EC-Net 4 - 5-Day Certification Course # 4001

Introduction

The #4001 course has been developed to complete the industry-standard EC-Net 4 Certification Program. This in-class training introduces and describes key concepts and knowledge about the Niagara4 framework and the EC-Net 4 software, and provides the hands-on opportunities needed to firmly establish the proficiency required in today's competitive marketplace. Features related to BACnet-based integrations are covered in an easy and convenient method to provide the needed requirements to complete the Certification Program with confidence.

As part of this course, the Certification Program also includes a pre-requisite e-Training #401 that validates a working understanding of the key concepts and ensures EC-Net 4 Certification. The precertification e-Training #401 is available online on the Tridium University website (www.tridiumuniversity.com) and should be completed prior to attending the #4001 classroom training.

Information

Course Duration	5 days
Certification Program	Niagara EC-Net 4 Certification
Required Equipment	Company or personal laptop with: • Wireless card • Windows 10, 8, or 7 • Ability to turn off Windows firewall and/or set firewall rules • Admin rights to download/install software
Pre-Requisites	• **Functional knowledge of Windows and PCs including navigating the Window architecture, copying/pasting files, basic Windows command prompt syntax, Windows Firewall issues, where to find desktop files, etc.** • e-Training #401 (online access is provided with #4001 registration) • Software (EC-Net 4) pre-installed • Latest Support Pack and Productivity Enhancement Tools pre-installed
Helpful Assets	BACnet Network Design knowledge

Audience

- Network and System integrators
- Operations and maintenance engineers
- Energy management specialists
- Building automation systems installers
- Application Engineers

Objectives

Participants will perform the following (and not necessarily in the order presented):

- Install specific files to and commission an EC-BOS-8 controller
- Explore the EC-Net 4 user interface
- Progressively build the control logic for and enhance the functionality of simulated applications to include staging, heating & boiler control, and lead/lag within the field bus controller's native programming environment (EC-*gfx*Program)
- Create a personalized and customizable palette (object library)
- Customize the menus used to create new component and widgets (graphics)
- Explore the Help system and exploit its capabilities
- Create several heating/boiler applications using a Tstat and PID control loop
- Establish connectivity with a second "supervisory" station through the Niagara Network
- Create and configure weekly and calendar schedules to control various types of loads
- Extend the functionality of Niagara objects to count runtime, collect histories and generate alarms
- Configure history and alarm properties
- Build plots and charts designed to view both real-time and historical trend data
- Export points, schedules, histories and alarms to a second "supervisory" station
- Create and configure a BACnet network using both BACnet IP and BACnet/MSTP
- Discover available devices and points on a BACnet IP/MSTP networks and capture those in the EC-Net 4 station database
- Create and configure a set of Px graphics, consisting of a variety of objects (e.g., fan, pump, heating coil, cooling coil, damper, space temperature, occupancy, etc.)
- Use dashboard panes to allow for persistent user data (i.e., users can save customized data) using web charts and circular gage widgets.
- Create a navigation scheme that allows various users/user types the ability to have a unique Home page and to easily navigate the architecture
- Establish user access and security protocols needed to safeguard the integrity of an EC-Net 4 station
- Tag objects in the station to allow for rapid searching and for building custom hierarchies.
- Establish relations between objects in a station for use in defining custom hierarchies
- Build custom hierarchies that allow for user-specific perspectives of floors, buildings, and sites
- Create and deploy station and device templates
- Use HTML5 views and widgets
- Troubleshoot various challenges that may arise when building applications

Course Topics

Day 1	• Welcome • Course Introduction • Licensing • Workbench User Interface Overview • Sending Data and Data Normalization • Hosts, Platforms and Stations • User Homes and Basic Security • EC-Net 4 Fundamentals • AX-to-N4 Differences

	• ECYLYPSE as a Stand-alone: BACnet IP • Support Pack • Configuring BACnet IP • Discovering Devices & Proxy Points • Building a Heating Project in EC-*gfx*Program • Creating Proxy Points in a Niagara Environment • Adding Extensions to Objects • Discrete Totalizers for capturing Runtime • Lead/Lag and Runtime (Totalization) • 16-Level Priority Array • Tagging - tag dictionaries, tag groups, tag rules • NEQL queries (searches) • PID Control Loops • Alarming
Day 2	• Collecting & Configuring Trend Data • Using Link Mark to Connect Objects in N4 • Building Px Graphics Using kitN4svg Palette and HTML5 Web Charts • Commissioning an EC-BOS-8 • Migrating an AX Station to N4
Day 3	• Customizing the Workbench Environment • Network Architecture/Field Bus Integration • Pre-Loaded VAV Applications • Building Relations Between Objects • Building & Using Hierarchies • Security & User Admin - secure vs. non-secure connection, the need for cybersecurity
Day 4	• Niagara Network Integration ○ Connection with Supervisor station ○ Exporting Proxy Points ○ Exporting Master Schedules ○ Routing Alarms ○ Archiving Histories • Creating Dashboards in Px • Building a Navigation File • Station Saving, Backup and Copying • Preparation for Certification Final Exam
Day 5	EC-Net 4 Technical Certification Program Final Exam (0800 - 1730)

Course Outline

DAY 1

Morning (0800 – 1200)

- Welcome
- Course Introduction (0.5 hr)
  - Logistics
  - Breaks
  - Course Structure
  - Materials – electronic comprehensive set of student files, N4 Terminology Guide, Student Lab Guide
- Sending Data and Data Normalization (0.25 hr)
  - The Big Picture – inputs to/outputs from controllers, types of data and actions
  - AX-to-N4
  - Between Devices
  - Between EC-BOS and Devices
  - Between Protocols
  - Data Normalization
- Workbench User Interface Overview (0.5 hr)
  - Menu bar, Tool bar, Locator bar, Side bars, Status bar
  - Nav tree
  - Palettes
  - Help
  - Graphics
- Hardware, Software and Licensing (0.25 hr)
  - Hardware
    - EC-BOS
    - Programmable controllers (ECY, ECB, ECL)
  - Software
    - EC-Net^{AX} / EC-Net 4
    - EC-*gfx*Program (programming tool)
    - ENVYSION (ECY graphics tool)
- Hosts, Platforms & Stations (1.0 hr)
  - Hosts – EC-BOS, On-site Server
  - Platforms
  - Stations
  - Ports – non-secure vs. secure
  - Review: Platform Services
  - Review: Platform Tools
  - What's a Platform Daemon?

  - Homes - Workbench User vs. Daemon User
  - Security issues – passphrases

- Review of N4 Fundamentals (L1 – 1.0 hrs)

  - Workbench GUI
  - Station architecture
  - Help database
  - Save/Backup
  - Ords
  - Niagara objects
  - Viewing & working with components
  - Default/standard views
  - Characteristics: Out property, Facets, Status flags, Priority levels
  - Right-click, Action and New menus
  - Palettes

  Lab #1 – Creating a New Station

  - New Station wizard
  - Platform/Station connections
  - Remote vs. Local Host
  - Running on Local Host until EC-BOS is commissioned

- AX-N4 differences (0.5 hr)

  - Architecture - locations
  - Security – TLS, passphrases
  - HTML5 views & widgets

- EC-*gfx*Program Emulator

- Building Program Code in a Field Bus Controller (L2 – 1.5 hrs)

  - Code Library – My gfxApplications, gfxApplications
  - Toolbox – searchable, drag & drop, customizable
  - Save/Autosave – Bcp folder in N4

  Lab #2 - Hot Water Pump Control Project

    - A - Thermostatic Control (using a Tstat)
    - B - Freeze Protection (prioritized inputs using a Schedule)
    - C - Simulating a Fluctuating Value (Ramping)

  Lab #3 - Controlling Equipment (Boiler) Using a PID Loop

    - Build code in EC-*gfx*Program
    - Different staging options
    - Use a Loop Point, Ramp and Digital Stages

- ECLYPSE as a Stand-Alone (L4 – 0.75 hr)

  - Brief discussion of small building architecture
  - Small integration without an EC-BOS
  - Support Pack
  - Wizard Service/Rest Service

- Adding a BACnet network (enabling IP)
- Launching EC-*gfx*Program on an ECY controller

Lab #4 - Configuring BACnet IP and Launching the Programming Wizard

- Creating Proxy Points in Niagara Environment (Local) (L5 – 0.5 hr)
  - Accomplished in the Local Host
  - Use of the Simulated BACnet Network with IP Port
  - Common Object Model
  - Views
  - Palettes
  - 16-Level Priority Array
  - Linking an N4 schedule directly to a proxy point
  - Using the N4 Scheduler interface
  - Device Manager / Point Manager

Lab #5 - Creating Proxy Points - Discovery vs. Create Points Action

Afternoon (1300 – 1730)

- HW Pump Control – Lead/Lag – Balancing Runtime (L5 – 1.2 hrs)
  - Elapsed Active Time (Runtime) – what is it?
  - Show how BACnet objects in GFX have ElapsedActiveTime built in
  - Lead/Lag concept with feedback loop (N4)
  - Extending object functionality (N4)
  - Discrete Totalizers – elapsedActiveTime - Runtime (N4)
  - Compositing (N4)

Lab #5 - Using Lead/Lag Runtime Niagara Object to Control Pump Runtime

- Tagging & Searching for Objects Using NEQL (L6, 7 – 1.5 hrs)
  - Custom Tag Dictionaries, Smart Tag dictionaries
  - Tag groups
  - Tag rules
  - Existing default tags and tag rules added from Niagara & Haystack tag dictionaries

Lab #6 - Creating a Smart Tag Dictionary

- Tag dictionaries - Niagara, Haystack
- Review of Niagara and Haystack dictionaries
- Creating a Custom Smart Tag Dictionary

- Tagging with the Batch Editor
- Allow creating of tag rules
- Tag types
- Tag dictionaries
- NEQL queries
- Searching for components using NEQL

Lab #7A - Working with Tags

- Adding tags to objects (HW Pumps and Boilers)
- Using Quick Search to find tagged objects

Lab #7B - Tagging with the Batch Editor

  - Points from ECY (from Lab 5)

- Configuring ECLYPSE as a Router for MSTP (L8 – 0.25 hrs)

Lab 8 – Configuring ECLYPSE as a Router for MSTP

- Discover/Add/Match MSTP Devices in EC-Net 4 (L9 – 0.5 hrs)

Lab 9 – Discover/Add/Match MSTP Devices in EC-Net 4

- Scheduling in EC-Net 4 (L10 – 1 hrs)

  - Schedule types
  - Functions of schedules

Lab #10 – Scheduling in EC-Net 4

- Alarm Notifications (L11 – 1.5 hrs)

  - Locations
  - Setting up alarms in ECLYPSE
  - Notification Classes in EC-*gfx*Program
  - Alarm Service, recipients and extensions
  - Escalating alarms
  - Alarm Portal
  - Importing alarms from ECLYPSE vs. adding alarm extensions in N4

Lab #11 - Alarm Notifications

  - Setting up recipient as N4 Supervisor vs. EC-BOS in EC-*gfx*Program and N4
  - Using multiple alarm classes
  - OPTIONAL: Emailing Alarm notifications

- Review/Questions for Day 1/Agenda for Day 2

DAY 2

Morning (0800 – 1200)

- Review/Questions for Day 1/Agenda for Day 2

- Collecting & Configuring Trend Data (L12 – 1.5 hrs)

  - Locations
  - *History Service*, views and extensions
  - Fault causes
  - Setting/importing trends from ECLYPSE vs. adding history extensions in N4

Lab #12 – History/Trend Data Collection

- Linking Objects Using Link Mark (L13 – 0.5 hrs)

  - Data links
  - Linking between wire sheets
  - Link Mark menu function – source, target

Lab #13 - Linking Proxy Points to Other Objects

- Building Px Graphics (L14 – 2.5 hrs)
  - What is Px?
  - Panes
  - Make Widget wizard - Ord, sources,
  - Px Includes
  - Hyperlinks
  - Relativizing Ords
  - kitPxN4svg palette – vector scaling

Lab #14 - Building Px Graphics

- ○ A - Creating a Header (as a Px Include)
- ○ B - Creating a Px View for HW Pump Control
- ○ C - Creating a Px View for Boiler Control
- ○ D - Creating a Px View for Timed Override
- ○ E - Optional - Hyperlink to a Search Result

Afternoon (1300 - 1730)

- Building Px Graphics (L14 – 2.5 hrs) – continued
- Cleaning an EC-BOS – Using clean.dist (Distribution File Installer)
- Commissioning an EC-BOS-8 and Station Copier (L15 – 1.0 hrs)
  - Module types - RT, UX, WB, SE, DOC
  - Commissioning Wizard
  - System Passphrase
  - Bog File Protection
  - Station copy of station running on Supervisor

Lab #15 - Commissioning an EC-BOS-8

- Migrating an AX Station to N4 (L16 – 1.5 hrs)
  - Reason for migrating stations
  - Obtaining a station backup
  - Migration tool, command and options
  - Hardware compatibility issues
  - Migration process output – destination station, errors/exceptions, and .miglog file (migration report)
  - Typical pre- and post-migration activities

Lab #16 - Migrating an AX station to N4 – 15 minutes

- ○ Demo or Group activity
- ○ Resulting migrated station will not be used in subsequent labs

- Review/Questions for Day 2/Agenda for Day 3

DAY 3

Morning (0800 – 1200)

- Review/Questions for Day 2/Agenda for Day 3
- Customizing the Workbench Environment (L17 – 1.0 hr)
  - Managing tabs in the view pane
  - Customizing the New Components and New Widgets menus
  - Creating a personal palette
  - Toolbar—Options
  - Workbench User folder (Local host – User home) – options, recent Ords, Px Editor, Nav tree, credentials, recent history, etc.

  Lab #17 – Customizing the Workbench Environment (Homework)

- Network Architecture/Field Bus Integration (L18/19 – 1.5 hrs)
  - Lonworks, Modbus, BACnet – discussion
  - Multi-protocol environment
  - BACnet requirements - license, modules, network access, enabled ports
  - *Distech Controls* palette
  - Driver Manager – network home, segregation of networks
  - *BACnet Quick Start Guide*
  - *Distech Network Guide:* BACnet MSTP installation requirements – # of devices, EOL terminations, cable length, network topology, BAUD rate, etc.
  - Batch tagging incoming devices/points in the Tag Mode of the Device/Point Manager
  - BACnet troubleshooting issues
  - Creating proxy points
  - *Device Manager / Point Manager*

  Lab #18 – BACnet MSTP Integration

  Lab #19 – Create BACnet Proxy Points

- Pre-Loaded VAV Applications (L20 – 1.0 hr)
  - Part of Productivity Enhancing Tools (PET)
  - PET benefits
  - PET User Guide
  - BACnet Pre-Engineered vs. Pre-Loaded Applications
  - gfxApplications PET library in EC-*gfx*Program Code Library

  Lab #20 – Pre-Loaded VAV Applications

  - A – Installing dcgfxApplications onto EC-BOS
  - B – Discover/Add/Match VAV controller
  - C – Configure Pre-Loaded Px graphic
  - D – Using the EC-Smart-Vue to make configuration changes

Afternoon (1300 – 1730)

- Building Relations Between Objects (L21 – 1.25 hr)
  - What's a relation?

  - How are relations useful?
  - *Relation Sheet* view
  - Relation links
  - Pre-existing relations between parent-child objects: Niagara/Haystack tag dictionaries – use *Spy* view to see all relations and whether Input or Output
  - Creating new relations/relation links

  Lab #21 – Building Relations Between Objects

- Building & Using Hierarchies (L22 – 1.5 hrs)

  - What's a hierarchy?
  - Begin with the end in mind > show the end result FIRST
  - SECOND, determine all tags have been added using the *Search Service*
  - *Hierarchy Service*
  - Hierarchy definitions
  - Hierarchy requirements – data (tagging) model applied, licensing, modules, assigned to a Role, Hierarchy Service
  - Hierarchy gotchas – NEQL syntax incorrect, incorrect hierarchy definition order, filter expressions absent or incorrect

  Lab #22 – Building Custom Navigational Hierarchies

    - Using GroupLevelDef, QueryLevelDef and RelationLevelDef
    - Using Filter Expressions
    - OPTIONAL: creating additional hierarchies, adding hierarchy to a palette

- Security & User Admin (L23 – 1.5 hrs)

  - Secure (TLS) vs. non-secure connections
  - Certificate management
  - Security categories
  - *Category Service/Category Manager*
  - *Authentication Service* – authentication schemes, global password configuration
  - *Role Service* – Purpose of roles, Viewable hierarchies

  Lab #23 – Security & User Admin

    - A – Creating and Assigning Categories
    - B – Configuring Authentication Schemes and password configs
    - C – Creating Roles and Assigning Permissions
    - D – Assigning Viewable Hierarchies to Roles
    - E – Creating User Accounts, defining default web profiles, assigning Roles

- Review/Questions for Day 3/Agenda for Day 4

DAY 4

<u>Morning (0800 – 1200)</u>

- Review/Questions for Day 3/Agenda for Day 4

- Niagara Network Integration (L24, 25, 26 – 1.5 hrs)

  - Create a new Supervisor station – based on a template

  - Connecting stations via the Niagara Network
  - *Driver Manager*
  - *Application Director*
  - Causes of Niagara Network connection errors – network Health – connection timed out, Authentication issues, Station Name mismatch, etc.
  - Connection types – client/server
  - Actions: Ping
  - Secure vs. Unsecure connections – Certificate Management, Allowed hosts, key store

  Lab #24 – Integrating with the Niagara Network: Configuring & Connecting

    - A – Creating a Supervisor station
    - B – Discover/Add stations
    - C – Enable/configure primary and reciprocal connections with the EC-BOS station
  - Bringing proxy points into a Supervisor station
  - *BQL Query Builder*
  - *Point Manager*

  Lab #25 – Integrating with the Niagara Network: Exporting Proxy Points

    - To a Supervisor station
  - Schedule Import/Export Managers
  - Execution time
  - Retry trigger

  Lab #26 – Integrating with the Niagara Network: Exporting Master Schedules

    - From a Supervisor station to an EC-BOS station

- Niagara Network Integration – (L27, 28 – 1.5 hrs) – Alarms & Histories

  - *Alarm Service* – Station Recipient
  - *Schedule Import/Export Manager*
  - Execution time
  - Retry trigger

  Lab #27 – Integrating With the Niagara Network: Routing Alarms

    - To a Supervisor station
    - Using the Alarm Portal
  - History Export/Import Manager

  Lab #28 – Integrating With the Niagara Network: Archiving Histories

    - To a Supervisor station

- Creating Dashboards in Px – (L29 – 0.5 hr)

  - Dashboard palette
  - *webChart* palette – Chart widget, Circular gauge widget
  - Dashboard pane
  - User-saved vs. not saved

  Lab #29 – Creating Dashboards in Px

- Navigation File – (L30 – 0.5 hr)

- Home node
- *Nav File Editor*
- Additional nodes
- Not replaced by hierarchies
- Assigning the Nav file to a specific user
- Testing the Nav file in the Workbench and in a web browser

Lab #30 – Creating a Nav File – Home Page

- Copying Stations – (L31 – 0.5 hr)
  - Station Save
  - Station Backup
  - Copying Training station – from EC-BOS to student's PC
  - Copying Training station – from student's PC to instructor's PC

Lab #31 – Station Saving, Backup and Copying

- Preparation for Certification Final Exam

DAY 5

- Niagara^{AX} Technical Certification Program Final Exam (0800 – 1730)
- Optional Topics & Labs

Topics:

- Weather Service
- Provisioning Service
- Web Service
- Time synchronization (NTP)

Labs:

- Using Advanced Facets for Schedule Overrides – max override duration
- Adding Hyperlinks (and/or) Pop-ups to a Px Graphic
- Emailing Alarm Notifications
- Modifying a Px Include (Header)
- Relativizing Ords in a Px Graphic
- Additional Hierarchy Exercises
- Adding a Hierarchy to a Palette
- Using Device Templates

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