

## FX Tools Software Package - FX Builder User's Guide

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# FX Tools Software Package – FX Builder User's Guide

## ***Introduction***

FX Builder is part of the FX Tool Pro software package. Use FX Builder to create applications for the Facility Explorer Series of Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR) controllers. FX Builder provides a graphical programming environment and features that help you generate programs quickly and accurately.

FX Builder includes a set of standard function blocks and control objects that you can use independently or nested in custom assemblies that you can reuse in other applications. FX Builder not only offers complete flexibility in the generation of applications but also includes features to save and reuse applications as standards where appropriate. See Figure 1.

FX Builder provides you with all the tools you need to:

- define and configure the target device and its physical inputs and outputs
- engineer the control algorithm
- identify the data points to be monitored and the format of the user interface
- enable and configure trends, schedules, and events
- configure the Short Message Service (SMS) or e-mail messaging services for monitoring data and events from remote locations
- design Web pages for the embedded Web server
- define the network profile for N2, LONWORKS®, or BACnet® protocols

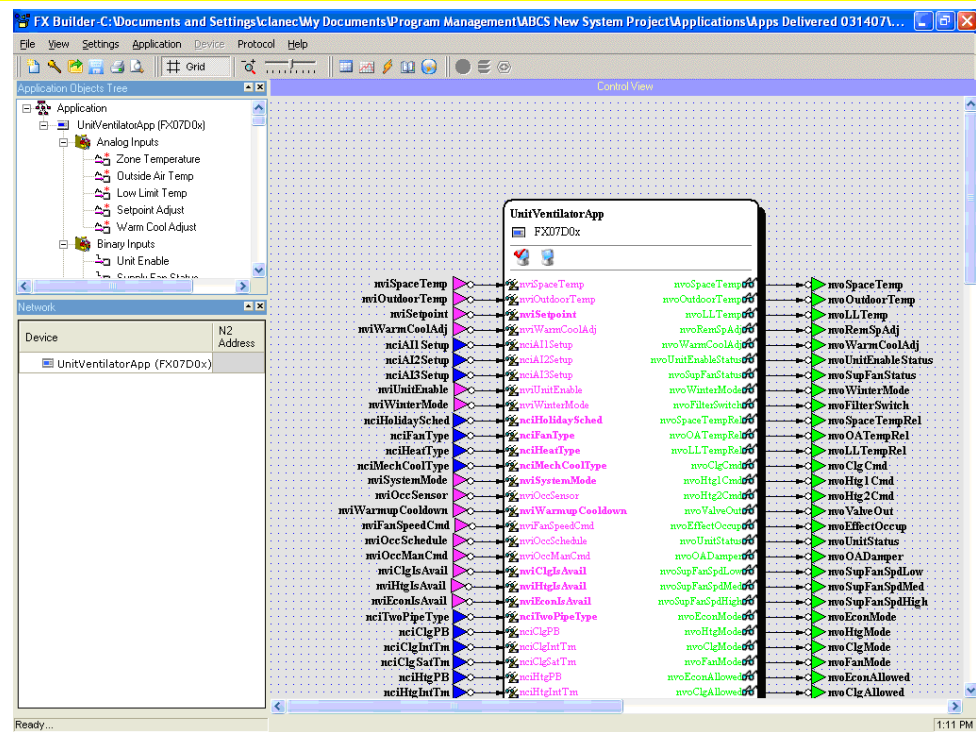


Figure 1: FX Builder

# Installation

## *Installing FX Builder*

### **Microsoft® Windows® Operating System (OS) Upgrade**

FX Builder includes a simulator plug-in based on the Microsoft .NET Framework; therefore, you need to install Microsoft .NET Framework Version 2.0 to run FX Builder.

Upgrade the Windows OS on your computer before proceeding with this installation.

#### ***The .NET Framework 2.0***

The .NET Framework is a component of the Windows operating system used to build and run Windows OS based applications.

#### ***Checking the .NET Framework Installation***

To check the .NET Framework installation:

1. From the Start menu, go to the Control Panel.
2. Double-click Add or Remove Programs. The Add or Remove Programs window appears.
3. Scroll down the list of applications. If Microsoft .NET Framework 2.0 appears, then the Windows OS upgrade is not necessary.

#### **Getting Microsoft .NET Framework 2.0**

To get Microsoft .NET Framework 2.0, go to the FX Tools Pro CD.

## Installing FX Builder

To install FX Builder:

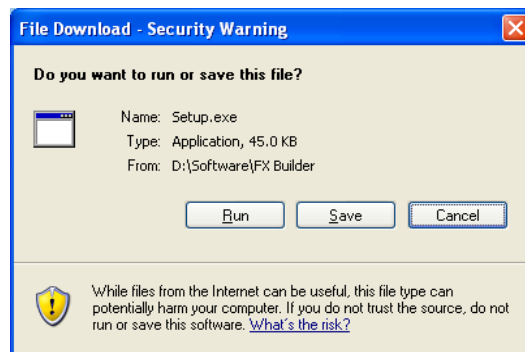
1. Close all open programs.
2. Insert the FX Tools Pro CD-ROM into the CD-ROM drive. The FX Tools Pro software menu appears (Figure 2).

**Note:** If the FX Tools Pro software menu does not appear, select Autorun.exe to start it manually.



**Figure 2: FX Tools Pro Software Menu**

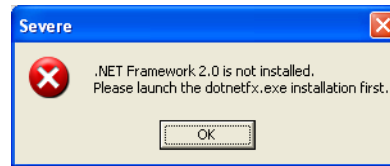
3. From the software menu, click FX Builder. The File Download-Security Warning window appears (Figure 3) and prompts you to run or save the file.
4. Click Run.



**Figure 3: File Download - Security Warning**

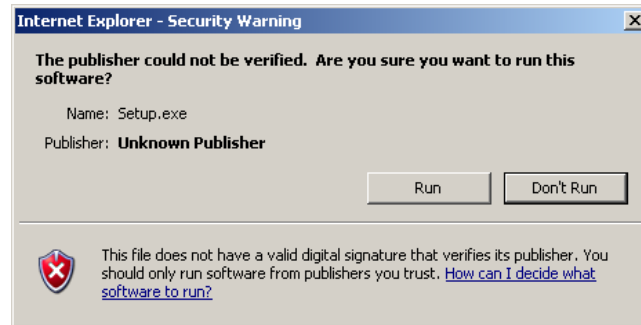
**Note:** If .NET Framework is not installed, an error message appears (Figure 4) and the installation process ends.



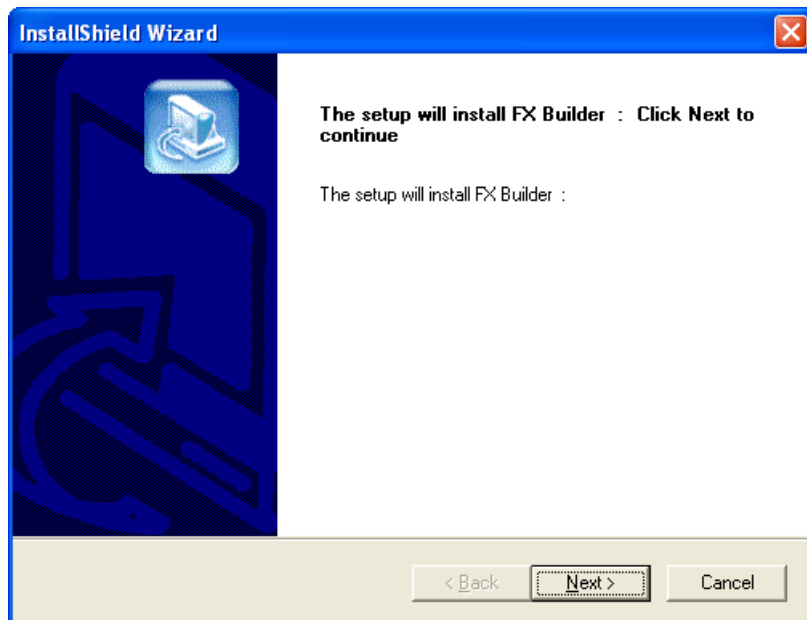


**Figure 4: NET Framework Not Installed Error**

**Note:** If this Security Warning appears, click Run to continue the installation (Figure 5).

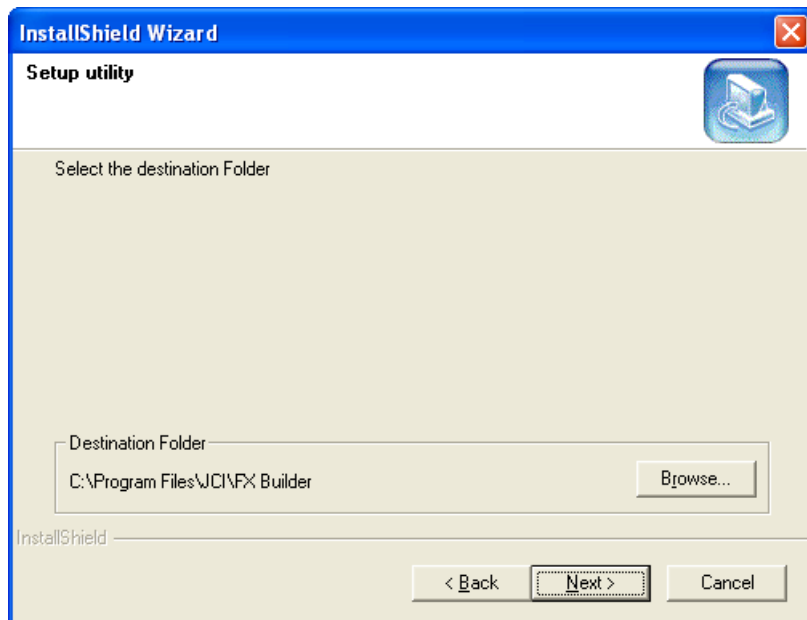


**Figure 5: Security Warning**



**Figure 6: FX Builder InstallShield® Wizard**

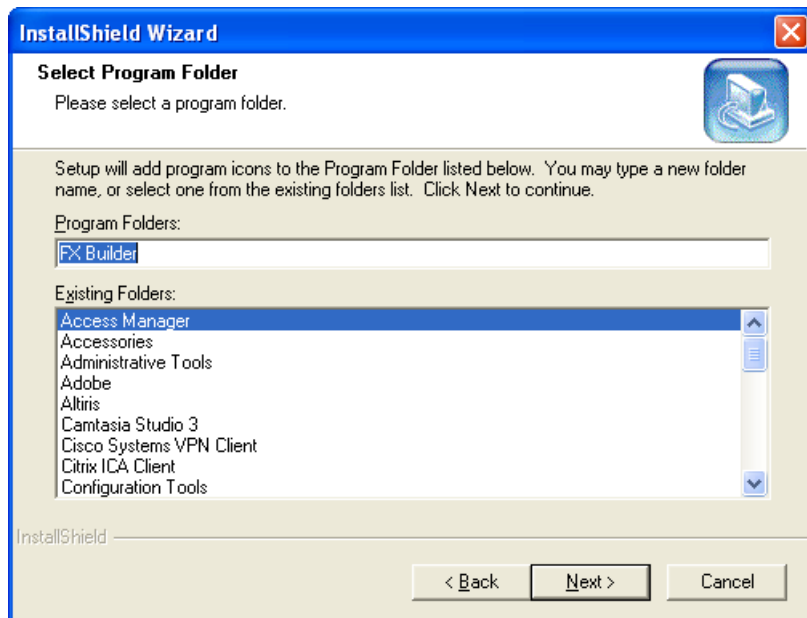
5. Click Next (Figure 6). The Destination Folder window appears (Figure 7).



**Figure 7: Destination Location**

**Note:** To install the program in a directory other than the default directory shown in the Destination Folder box, click Browse and select a different directory.

6. Click Next. The Select Program Folder window appears (Figure 8).



**Figure 8: Select Program Folder**

7. Click Next. The Setup Status and NodeBuilder Resource Editor windows appear (Figure 9 and Figure 10). When FX Builder installation finishes, the Installation Complete window appears (Figure 11).

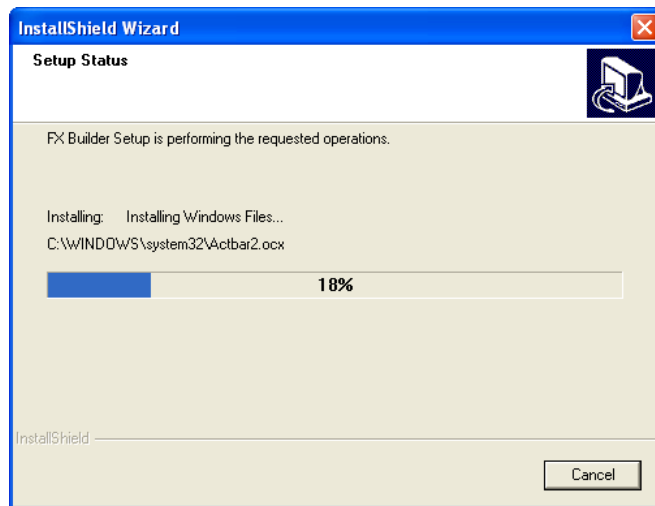


Figure 9: Setup Status

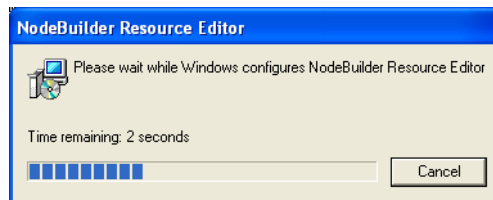


Figure 10: NodeBuilder Resource Editor

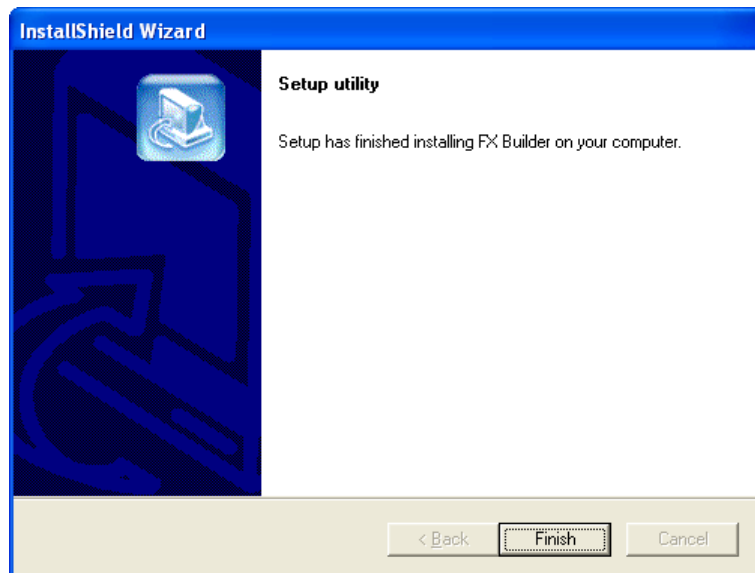


Figure 11: Installation Complete

8. Click Finish.

**Note:** Do not rename the program directory after you install the program.

### ***Installing FX Simulator***

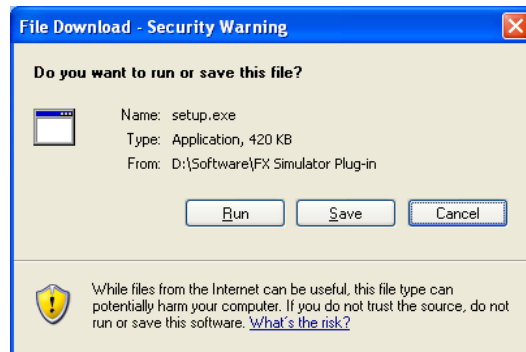
Once the FX Builder installation finishes, you need to install FX Simulator.

To install FX Simulator:

1. Close all open programs.
2. Insert the FX Tools Pro CD-ROM into the CD-ROM drive. The FX Tools Pro software menu appears.

**Note:** If the FX Tools Pro software menu does not appear, select Autorun.exe to start it manually.

3. From the software menu, click FX Simulator. The File Download - Security Warning window appears (Figure 12) and prompts you to run or save the file.
4. Click Run. The FX Simulator Setup Wizard appears (Figure 14).

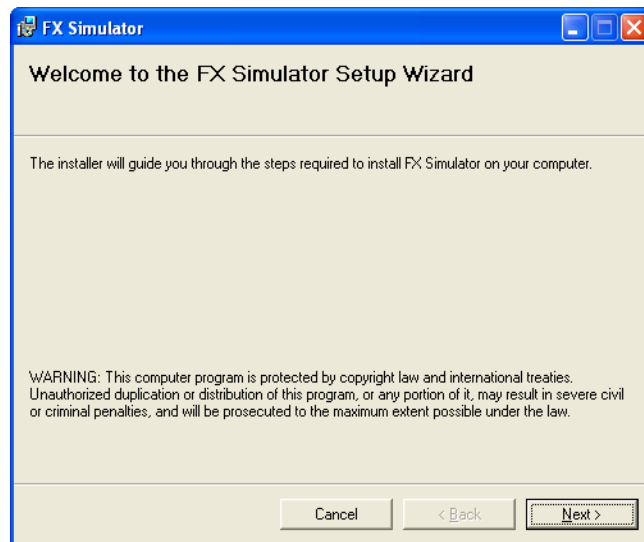


**Figure 12: File Download-Security Warning**

**Note:** If this Security Warning appears, click Run to continue the installation (Figure 13).

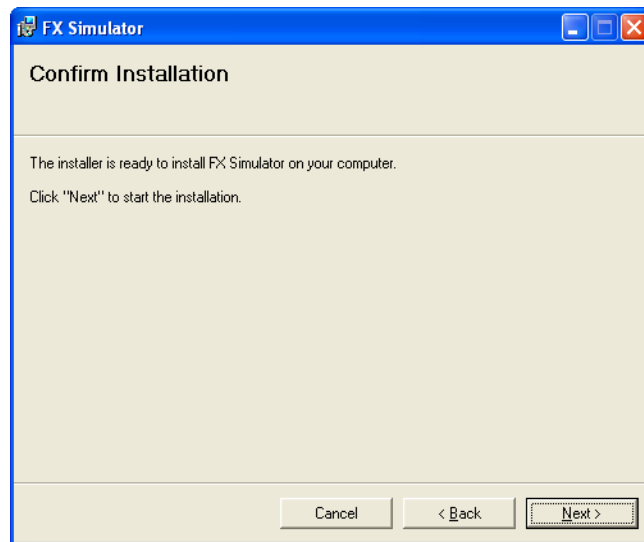


**Figure 13: Security Warning**



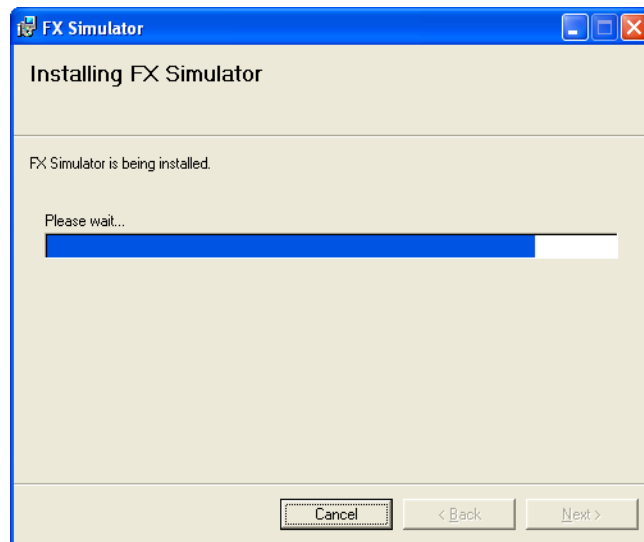
**Figure 14: FX Simulator Setup Wizard**

5. Click Next. The Confirm Installation window appears (Figure 15).



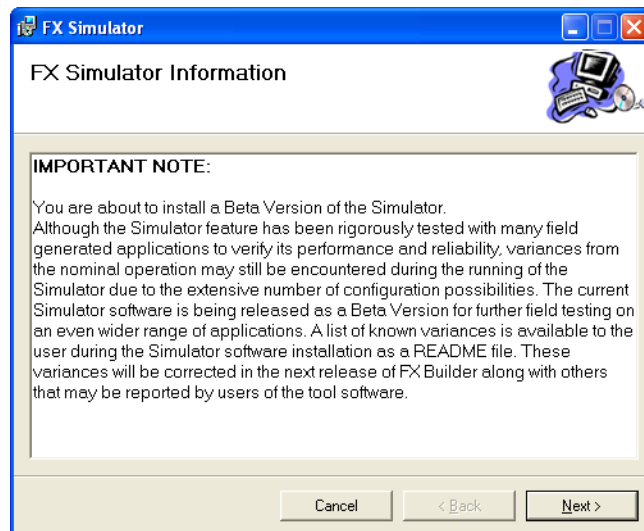
**Figure 15: Confirm Installation**

6. Click Next. The Installing FX Simulator status window appears (Figure 16).



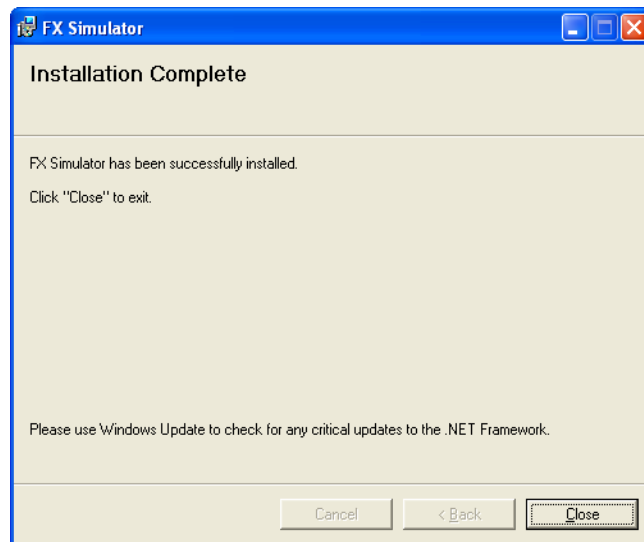
**Figure 16: Installing FX Simulator Status Window**

When the FX Simulator installation finishes, the FX Simulator Information window appears (Figure 17).



**Figure 17: FX Simulator Information Window**

7. Click Next. The Installation Complete window appears (Figure 18).



**Figure 18: Installation Complete**

8. Click Close and exit the software menu.

### ***Installing the Make Public Key***

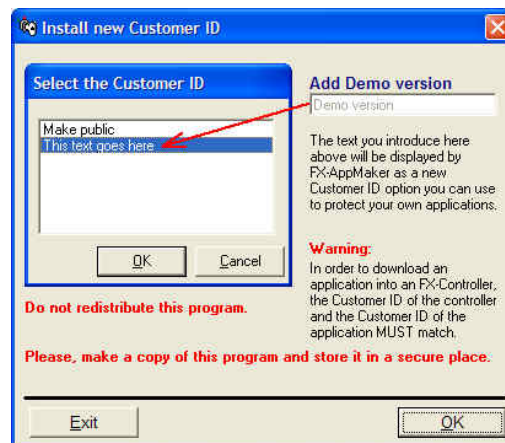
**Note:** The Make Public Key is automatically installed from FX Builder 5.x. See *FX Builder Security* for more information about the security provided by the Customer ID feature.

### ***Installing the Demo Version Key***

**Note:** The Demo Version customer ID is typically used for FX devices fitted to demonstration and simulation cases.

To install the Make Demo Key:

9. Close FX Builder.
10. On the FX Tools Pro CD-ROM, locate the file in **...\Software\Make Demo Key** and double-click on **DemoVersionInstaller.exe**.



**Figure 19: Make Demo ID Registration**

11. Click OK (Figure 19) and then click Yes to register the key.
12. Open FX Builder and select **Save and Export as** to view the Select the Customer ID window (Figure 20). You can now save demo applications.



**Figure 20: Save Demo Application**



# FX Builder Navigation

## FX Builder Entry Screen

The FX Builder entry screen (Figure 21) includes a main menu of commands allowing you to:

- create a standard application using an application wizard
- create a new application using a programming approach
- open an existing application
- change the units of measure
- adjust application wizard preferences
- determine the version of FX Builder

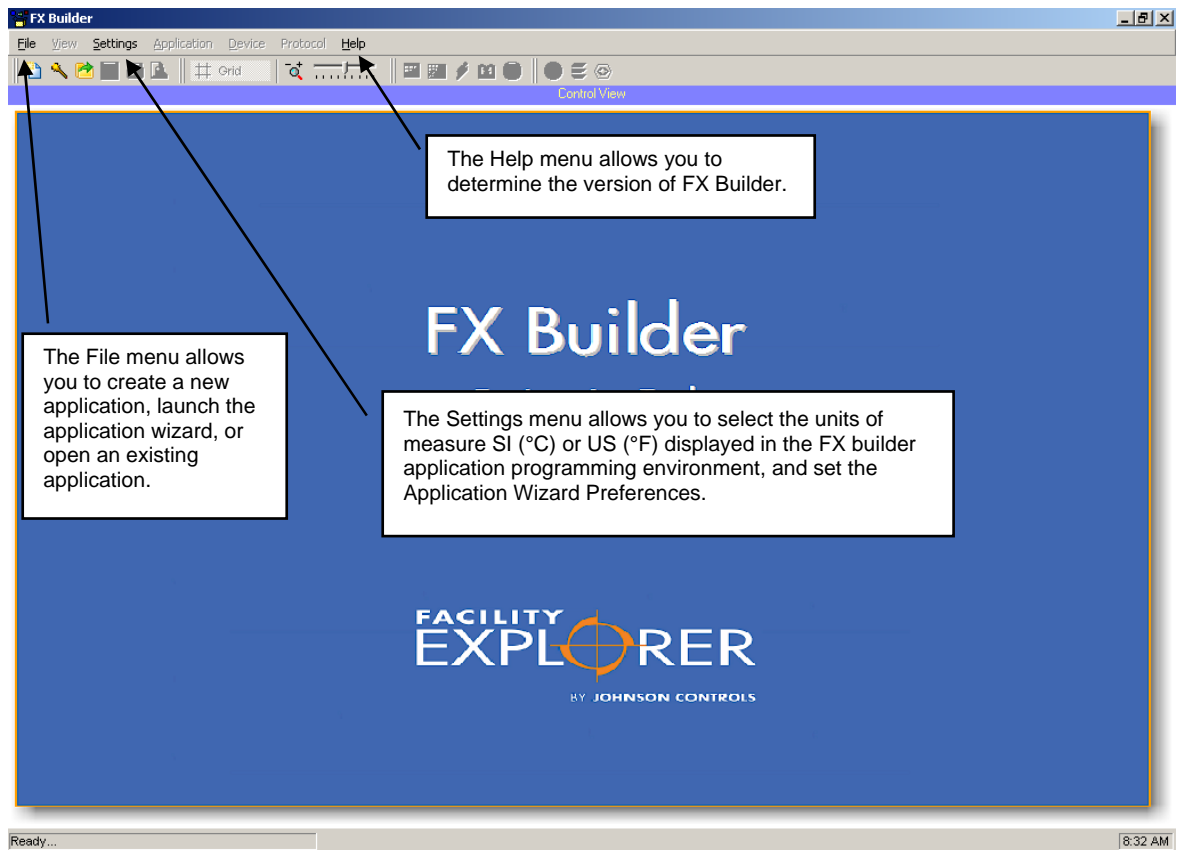
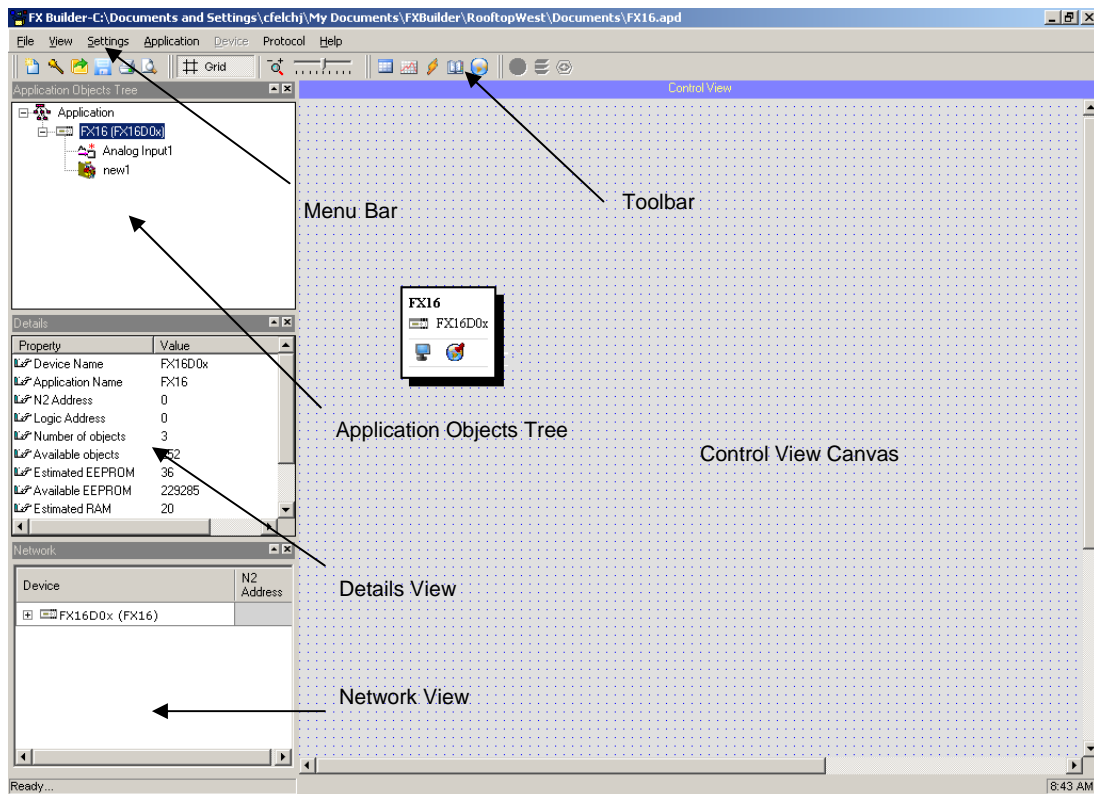


Figure 21: FX Builder Entry Screen

## Main Screen

FX Builder includes a single Integrated Development Environment (IDE) to program the application algorithm, simulate the application, and configure services for the application.



**Figure 22: FX Builder Main Screen**

On the FX Builder main screen (Figure 22), there are five sections:

- **Menu Bar and Toolbar** - offer an interface to the available actions allowed on the selected item.
- **Application Objects Tree** - shows the objects included in the application.
- **Details View** - shows the device and application name, address, number of objects, and available memory related to the selected element in the Control View canvas.
- **Network View** - lists the devices associated with the application.
- **Control View Canvas** - shows the application algorithm in a graphical way on the different application levels (devices, application, macros, and objects).

## Menu Bar

### ***File Menu***

The File menu provides the following options:

- **New Application** - creates a new application using a programming approach.
- **Application Wizard** – creates a standard application using a wizard approach.
- **Open** - opens an existing application.
- **Save** - saves the current application.
- **Save As** - saves the current application under another name.
- **Save Diagram As** - extracts the application architecture as an Enhanced MetaFile for Windows OS (.emf).
- **Print Preview** - previews the printout of the application architecture.
- **Print** - prints the application architecture.

### ***View Menu***

The View menu provides options to change the way the application appears on the computer screen. The View menu has the following options:

- **Application Object Tree** - shows or hides the Application Objects Tree.
- **Network** - shows or hides the Network window.
- **Details** - shows or hides the Details window.
- **Grid** - shows or hides canvas grid lines.
- **Zoom** - zooms in or out of the application architecture.

### ***Settings Menu***

- **Unit of Measure** - allows you to select the units of measure used to present data points on the screen. You can set the units of measure to either SI (°C) or US (°F).
- **Application Wizard Preferences** – allows you to select documentation to be generated and the file location where documentation is to be exported, install standard application packages, and view application package information.

### ***Application Menu***

The Application menu provides links to application-related plug-ins including:

- **Application Points** - allow you to view and edit application point details such as point name, data type, state names, units of measure, and default point values. The application point plug-in also allows you to assign events and trends to points.
- **Trends** - allows you to configure the trend sample time, start/stop conditions, and notification services.
- **Events** - allows you to configure event notification services.
- **Address Book** - allows you to define the contact information used by the controller for its notification services.
- **Web Site** - allows you to design the layout of the Web pages.
- **Notification Services** - allows you to configure the e-mail, SMS, and Web page service parameters.
- **Hardware Parameters** - allows you to configure the RS-232 and modem parameters.

The Application menu also provides links to:

- **Check Mandatory Inputs** - identifies any missing mandatory connections.
- **Check Consistency** - determines if the application falls within the memory and performance limits of the targeted device.
- **Show Documentation** - allows you to create a Microsoft Word document showing the application architecture.

### ***Device Menu***

The Device menu provides links to the following functions:

- **Edit Control Logic** - opens the Application Editor for the currently selected device.
- **Simulate Control Logic** - opens the FX Simulator for the currently selected device application.
- **Save Control Logic** - allows you to save an Application Assembly for future use.
- **Add Display** - allows you to build and configure a display module.
- **Add Slave** - allows you to create a new slave device or add a slave device from an existing application.
- **Device Info** - allows you to view and edit additional information related to the current Application Assembly associated with the device.
- **Wiring Diagram** - allows you to print out a Word document showing the target controller and the input/output channel assignments.

### ***Protocol Menu***

The Protocol menu provides plug-ins to create and edit the specific network profile associated to the application.

- **N2 Open** - opens the N2 Open plug-in to create and edit the N2 Open network profile.

The N2 Open plug-in allows you to determine which application points are included in the N2 network profile, define the N2 short and long names, change the N2 point type and address, and print out the .prn file.

- **LON** - opens the LON plug-in to create and edit the LON network profile.

The LON plug-in allows you to determine which application points to include in the LON network profile, define the LON variable name, change the Program ID, and generate the LON resource files.

- **BACnet** - opens the BACnet plug-in to create and edit the BACnet network profile.

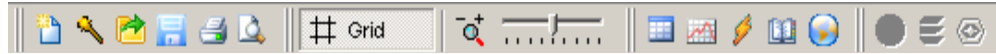
The BACnet plug-in allows you to determine which application points to include in the BACnet network profile, and define the BACnet object names and other configuration properties.

## Help Menu

The Help menu provides information about FX Builder, including the installed version number.

## Toolbar

The Toolbar provides an interface to the commands that are available for the selected item (See Figure 23 and Table 1).



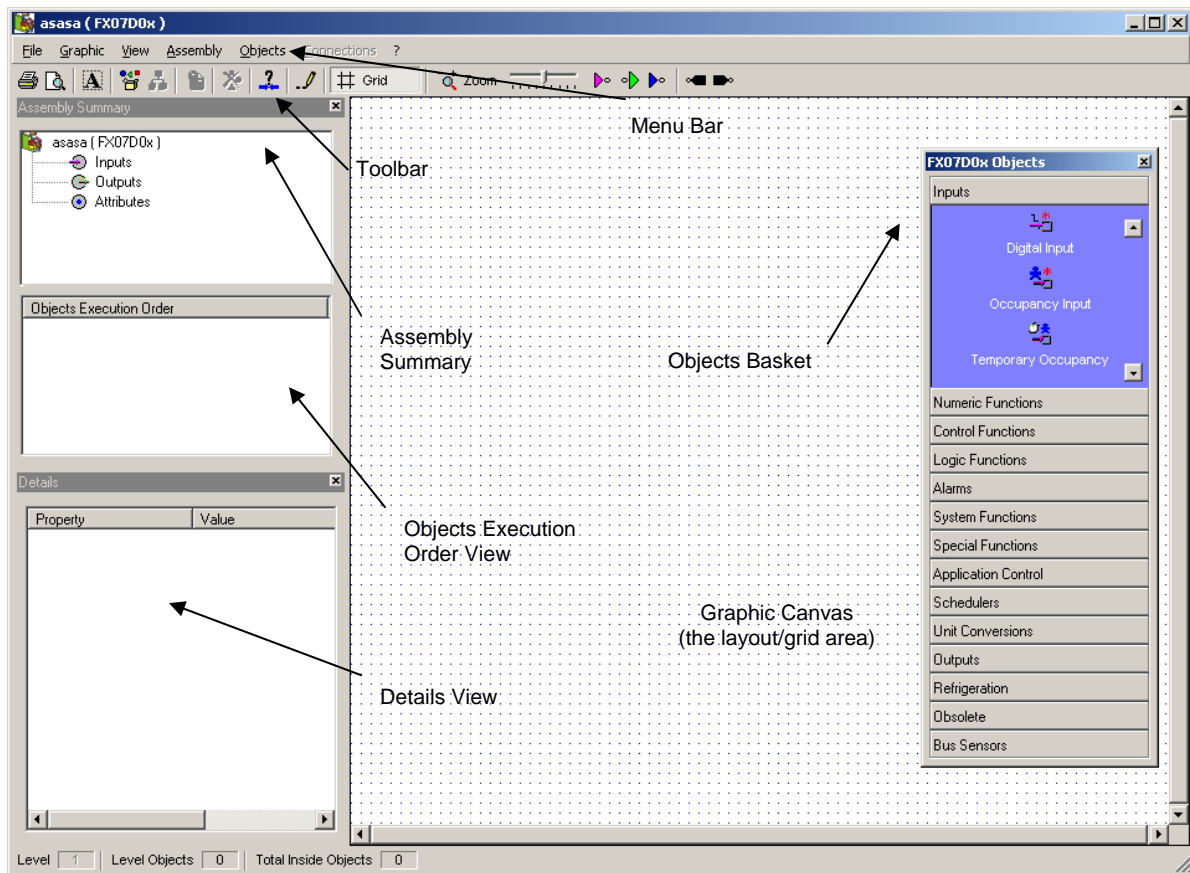
**Figure 23: FX Builder Toolbar**

**Table 1: FX Toolbar Icons**

Icon	Description
	Create application
	Create an application from an existing template
	Open an existing application
	Save current application
	Print diagram
	View diagram print preview
	Show or hide the grid
	Zoom
	Application points plug-in
	Trend plug-in
	Event plug-in
	Address book plug-in
	Web site plug-in
	N2 Open plug-in
	LON plug-in
	BACnet plug-in

# Application Editor

The FX Builder Application Editor uses layered screens to graphically represent the application programming structure.



**Figure 24: FX Builder Application Editor**

The FX Builder Application Editor (Figure 24) contains six sections:

- **Menu Bar and Tools Bars** - offer an interface to the available actions allowed for the selected item.
- **Assembly Summary** - shows the objects included in the current assembly.
- **Object Execution Order** - shows the objects in the currently assembly listed in order of execution.
- **Details View** - shows the current target device, number of objects, and available memory.
- **Network View** - lists the devices associated to the application.
- **Graphic Canvas** - shows the application algorithm in a graphical representation on the different application levels (devices, application, macros, and objects).

- **Objects Basket** - a library of objects used to create the application algorithms. Open the Objects Basket from the View menu.

## Menu Bar

### *File Menu*

The File menu provides the following options:

- **Page Setup** - allows you to set page formats.
- **Print Preview** - previews the printout of the application architecture.
- **Print** - prints the application architecture.
- **Exit** - closes the application editor.

### *Graphic Menu*

The Graphic menu provides the following options:

- **New Label** - allows you to apply a new label to a diagram.
- **Save diagram as EMF** - allows you to save a diagram as an Enhanced Metafile.

### *View Menu*

The View menu provides options to change the way the application appears on the computer screen.

- **Assembly Summary** - shows or hides the Assembly Summary window.
- **Details** - shows or hides the Details window.
- **Objects Basket** - shows or hides the Objects Basket.
- **IOM Object Basket** - shows or hides the IOM Object Basket.
- **Grid** - shows or hides the Grid.

### *Assembly Menu*

The Assembly menu provides options for creating and editing assembly attributes and data.

- **New** - creates a new assembly.
- **Load** - loads an existing assembly.
- **Rename** - enters a new macro name for the selected assembly.
- **Edit Info** - edits the selected assembly Prepared By and Description information.
- **All Attributes** - shows or hides attributes of the selected assembly.



- **Build Interface** - builds input, output, attribute, parent, and child interfaces.
- **Details and Dimensions** - updates the Details window.

### ***Objects Menu***

The Objects menu provides options for creating and editing object attributes and data.

- **Rename** - allows you to rename the selected object.
- **Remove** - allows you to remove the selected object.
- **Launch Plug In** - launches a plug-in for the selected object.
- **View Data Sheet** - opens the datasheet for the selected object.
- **Show Attributes** - shows attributes for the selected object.
- **Launch Simulator** - launches a simulator for the selected object.

### ***Connections Menu***

The Connections menu provides a means to check the mandatory connections.

- **Check Mandatory** - checks all mandatory connections.

### ***? Menu***

The Help menu provides options for viewing the online help and the version.

- **Help** - displays the online help for FX Builder.
- **About** - displays version information for Assembly generator.

















## Toolbar

The Toolbar provides an interface to the commands that are available for the selected item (See Figure 25 and Table 2).



**Figure 25: FX Builder Application Editor Toolbar**

**Table 2: FX Builder Application Editor Toolbar Icons**

Icon	Description
	Print the diagram
	Print Preview
	Insert a New Label
	Show Object basket
	Show IOM Object Basket
	Launch Plug-in of the selected object
	Remove the selected object
	Check Mandatory Connections
	Add Continuations
	Show or Hide the Grid
	Zoom
	Insert Input
	Insert Output
	Insert Attribute
	Insert Continuation Parent
	Insert Continuation Child

# Creating and Editing an Application

## ***FX Builder Key Topics***

Use FX Builder to program and configure the Facility Explorer series of HVACR controllers. You build the application on a graphical canvas by creating and connecting instances of the available **objects** in the object database of the controller.

### ***Application Object***

An application object is a functional block representing some interaction points called **Input References** and **Output References**. You can use the input/output references, via connections, to share values between objects. A connection always has the same direction (from a source to a target). Application objects also have **Attributes**, which are static values that you set only at design time. You typically use attributes to configure the behavior performed by the object or as backup values in case the output values are missing or invalid.

In the Facility Explorer Series of HVACR controllers, the control algorithm can also interact with various available plug-ins. For example, the logic can generate an event/alarm condition that requires an SMS text message notification to be sent.

There are over 80 different configurable application objects (depending on the target controller) to create the application algorithm.

### ***Application Algorithm***

The application algorithm is the function performed by a controller. Each device executes its own control algorithm depending on the configuration loaded. You create the application algorithm by selecting instances of the available application objects, configuring them, and then connecting them.

### ***Macro/Assembly***

A macro/assembly represents a group of application objects connected in subsets called Assemblies. You can isolate assemblies within a larger application, or you can export and save the assemblies as stand-alone files (.mcr). Assemblies allow you to reuse frequently used control sequences, reducing engineering time.

### ***Application Profile***

The application profile represents the interface between the device and the application points. Each device has its own application profile.

### ***Network Profile***

The network profile represents the interface between the application points and the network. The Protocol plug-in allows you to define how the desired application points are exposed to the N2, LONWORKS, or BACnet supervisory system.

### ***Plug-in***

A plug-in is an add-on piece of software that enhances and extends another application. The plug-in is typically used to configure an application with easy to use and intuitive data entry screens.

## **Application Types**

FX Builder allows you to develop three types of applications. See Table 3.

**Table 3: FX Toolbar Icons**

<b>Application</b>	<b>Description</b>
<b>Stand-Alone Applications</b>	FX05 Advanced, FX06, FX07, FX14, FX15, FX16, and FX10 Advanced
<b>Distributed Applications</b>	FX16 Master Controller or the MD20 Master Display can act as the master controller (maximum 16 slave devices in FX16 and maximum 8 slave devices in an MD20).
<b>Network Applications</b>	FX16 Master Controller or the MD20 Master Display supervises and monitors a network of N2 Open and N2 System 91 devices.

### ***Stand-Alone Application***

A stand-alone application is a control strategy that runs in a single controller as an independent entity. If necessary, you can establish a network communication to let the stand-alone application be monitored by a supervisory system (N2 Open, LON, or BACnet).

Stand-alone applications are used to control independent devices such as air handling units or zone temperature control equipment.

### ***Distributed Application***

A distributed application is a control strategy involving multiple controllers operating together to form a single control system. Distributed applications require the **MD20 Master Display** or the **FX16 Master Controller** (each hereafter referred to as master device) to manage the activities of the entire control system. A distributed application is executed concurrently in the master device and in up to **16** Facility Explorer field controllers connected to the Local Link Bus.

**Note:** The FX16 supports 16 slave controllers whereas the MD20 Master Display supports 8 slave controllers in a distributed application.

The communication between the master device and slave controllers is defined by network variables in the distributed application. The master device executes the communication in the most effective way to maintain the performance of the entire control system.

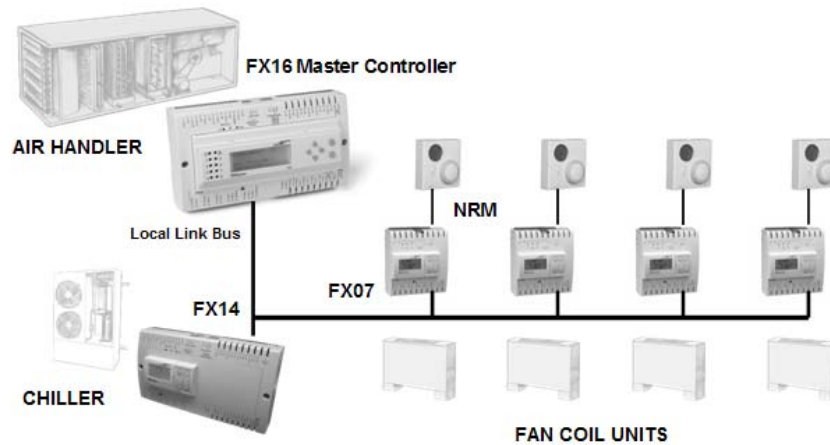
You use distributed applications for the coordinated control of a central plant and the remote equipment it serves. For example, you can apply a distributed application to an FX16 controlling an air handling unit and a number of FX07 controllers controlling zone terminal units. The distributed application can also combine FX Controllers to provide required inputs and outputs for the physical equipment interface. The distributed application is then automatically distributed and executed in the individual controllers as a single control system.

Each slave device works independently and provides its own information to the network through the application profile. The master device handles polling, refreshing, or forcing the network variables within the slave systems to synchronize the entire distributed application for proper operation.

The distributed application (.apd extension) is downloaded directly into the target MD20 Master Display or the FX16 Master Controller; then the relevant parts are subsequently downloaded by the controller into the connected slaves at first powerup.

The slave devices must have the N2 Open communication card installed. The connectable slave controllers are as follows:

- FX05 (Advanced) Field Controller
- FX06 Field Controller
- FX07 Field Controller
- FX10 (Advanced) Original Equipment Manufacturer (OEM) Controller
- FX14 Field Controller
- FX15 Field Controller
- FX15 Universal Field Controller



**Figure 26: FX16 Master Controller Performing a Distributed Application**

Before you connect the slave devices to the MD20 Master Display or the FX16 Master Controller, you need to set the devices with the correct address (that is, the address reserved for them in the application at design time). See Figure 26.

### ***Network Application***

A network application is a control strategy managed by a master device supervising a network of N2 Open and N2 System 91 controllers connected to its Local Link Bus.

The communication between the master controller and the controllers on the network is defined in the Gateway objects in the application of the master controller.

A network application in the MD20 Master Display is the ideal solution to monitor and control a small commercial HVAC plant, a refrigeration plant, or a number of devices in a small building. The MD20 can also be used to monitor a zone of a larger building to provide an overview of the operation from one location.

A network application in the FX16 Master Controller allows you to integrate N2 devices (such as variable speed drives) into the control strategy in the master controller. You can also run a distributed application with slave FX controllers.

You can use the master device and its network application as a system integrator of various control devices and networks or as a communication gateway into a small building from other buildings or remote operating centers.

Each slave device in a network application provides information to the master device through its N2 Open communication interface. See Figure 27.

See *Configuring the Gateway Object* for more information.

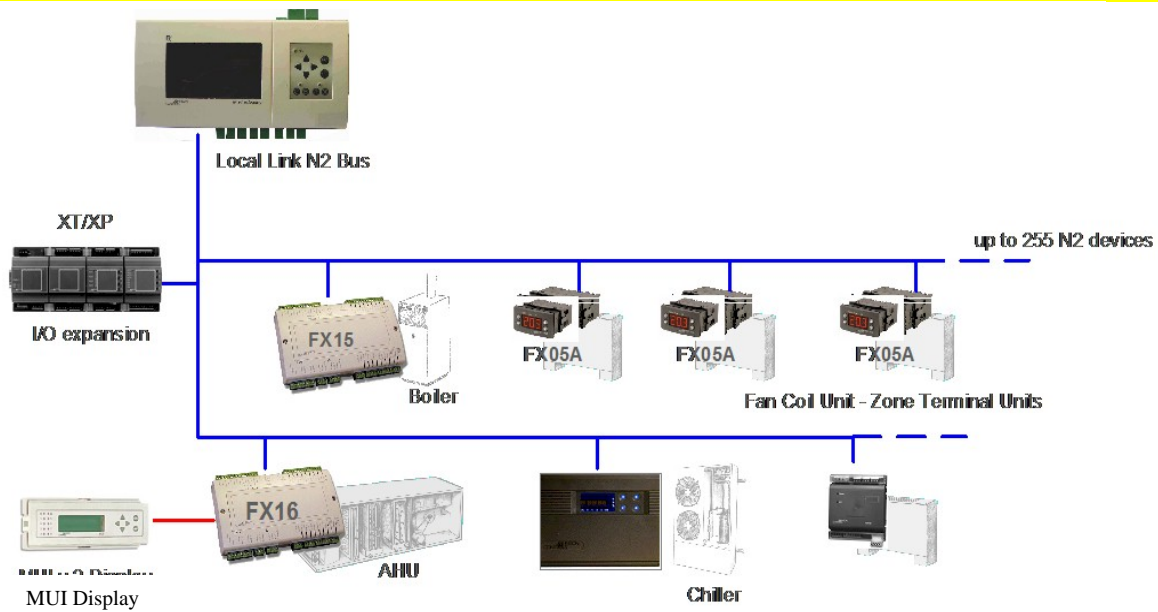


Figure 27: MD20 Master Display Supervising an N2 Network

## Generated Application and Documentation Files

The Application Wizard generates Application and documentation files. The type of files generated depends on the selections made in the Application Wizard Preferences dialog box (Figure 29) and Configuration Options plug-ins (Figure 36). See *Creating a Standard Application Using the Application Wizard*.

- **.apd** - the application file that gets downloaded to the controller
- **.prn** - N2 Print File (only if N2 was selected)
- **.txt** - application header data
- **\*appname\*HdwCfg.doc** - the Hardware Configuration Document (describes the input/output wiring assignments)
- **\*appname\*N2OpenProfile.doc** - the Network Profile Document (very similar to the .prn file except in a Word document format) if N2 was selected. Or **\*appname\*LONProfile.doc** if LON was selected, and **\*appname\*BACnetProfile.doc** if BACnet was selected.
- **\*appname\*AppCfg.doc** - the Application Configuration Document, which lists all the configuration options and settings the user selected during the configuration session.
- **\*appname\*.xif | .enu | .ftp | .typ | .fmt** - are the LON resource files (if LON network was selected)

**Note:** No specific BACnet resource files are exported (BACnet does not require resource files).

## ***FX Builder Detailed Procedures***

There are two methods for creating a new application.

- **Application Wizard Approach:** creates a standardized application based on the selected system and device pre-programmed options. See *Creating a Standard Application using the Application Wizard*.
- **Programming Approach:** creates a customized application based on system and device programming. See *Creating an Application (Programming Approach)*.

### **Creating a Standard Application (Application Wizard Approach)**

The Application Wizard contains the following features:

- intuitive menu selection and graphic configuration environment to create applications
- configuration procedures, which do not require programming skills, to make configuration easier
- a library of validated and proven standard applications to decrease the engineering, testing, and validation time
- inapplicable configuration options, which are disabled and are red-flagged, to prevent the user from making improper application choices
- plug-ins to configure commonly used features of the standard applications
- summary tabs to provide information about the selections made during the configuration session

#### ***Creating a Standard Application Using the Application Wizard***

To create a standard application using the Application Wizard:

1. Obtain and install the Application Packages.
2. Select a standard Application.
3. Select the configuration values for the plug-ins for the selected application.
4. Adjust the Exception Day and Occupancy calendars.
5. View the configuration summary report and I/O assignments.
6. Select the user interfaces, network protocol, and target devices.
7. Configure the hardware I/Os.
8. Generate the Application files and documents.
9. Export the application (.apd and commissioning files).



## Installing the Application Packages

FX Application Packages are obtained individually and then saved to a folder on the computer where FX Builder is installed.

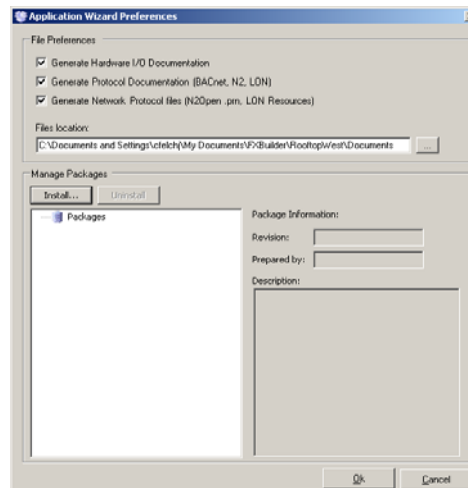
To install the application packages:

1. Obtain the desired Application Packages and save them to the TemplateApplications folder.
2. Launch FX Builder.
3. Click Settings > Application Wizard Preferences (Figure 28).



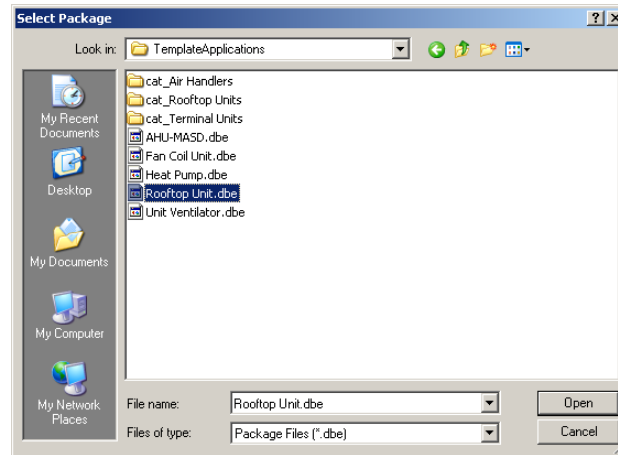
**Figure 28: Settings > Application Wizard Preferences Menu**

The Application Wizard Preferences dialog box appears (Figure 29).



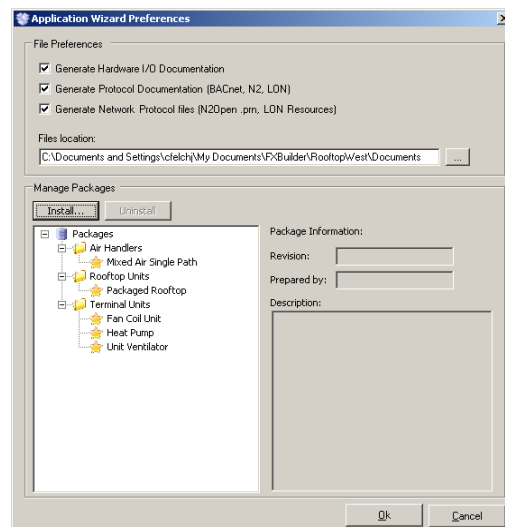
**Figure 29: Application Wizard Preferences Dialog Box without Packages Installed**

4. Under File Preferences, select the documents you want to generate. If desired, change the File Location to where the generated files are exported.
5. Click Install... and navigate to C:\ > Program Files > JCI > FX Builder > TemplateApplications.
6. Select the desired Application Package (.dbe file) and click Open (Figure 30).



**Figure 30: Select Package Dialog Box**

The Application Package is installed in the Application Wizard Preferences dialog box (Figure 31). Repeat step 5 and step 6 for each Application Package you wish to install.



**Figure 31: Application Wizard Preferences Dialog Box with Packages Installed**

7. Click Ok to exit the Application Wizard Preferences dialog box.

## Selecting a Standard Application

Standard applications are typically classified based on the following criteria: Air Handlers, Terminal Units, Central Plants, and Rooftop Units.

To select a standard application:

1. Open FX Builder.
2. Click File > Application Wizard (Figure 32). The Select an Application Template Window appears (Figure 33).



Figure 32: File > Application Wizard Menu

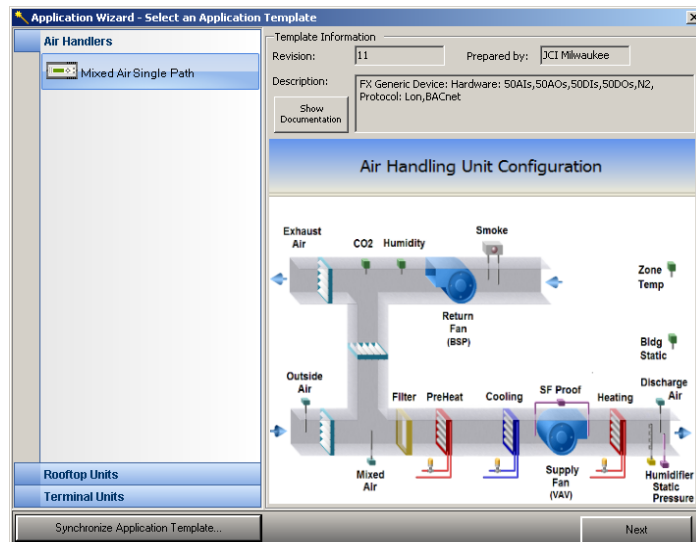
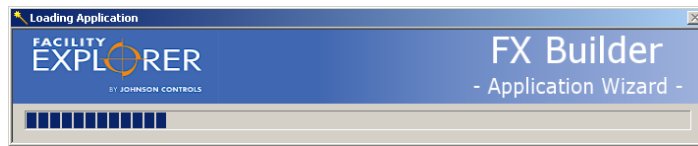


Figure 33: Select an Application Template Window

3. On the left side of the window, select the application category (for example, Air Handlers, Terminal Units, Central Plants, or Rooftop Units).

4. Select the desired application within the application category. The Template Information on the right side of the Select an Application Template Window (Figure 33) is populated with:
  - the Revision number
  - a Prepared by label
  - a Description of the application
  - a Show Documentation button that launches the Application Notes document for the selected application
  - a visual representation of the application
5. Click Next. A status bar appears while the selected application and plug-ins are loaded into FX Builder (Figure 34).



**Figure 34: Loading Application Status Bar**

The Configure plug-in appears when the application is loaded (Figure 35).

## Working with Plug-ins

Plug-ins contain categories, functions, and values (Figure 35). When you select a category, the relevant functions and values appear. Use these tips when working with functions and values.

- Some functions and values are dependent on previous selections. Work from the top of the list to the bottom of the list.
- If the function/value appears dimmed, it is not available. If you require that function, try changing some configuration options above.
- Double-click in the function field to cycle through the different values.
- Click in the value field to activate a drop-down arrow. Click the drop-down arrow to display a menu and select the desired value.

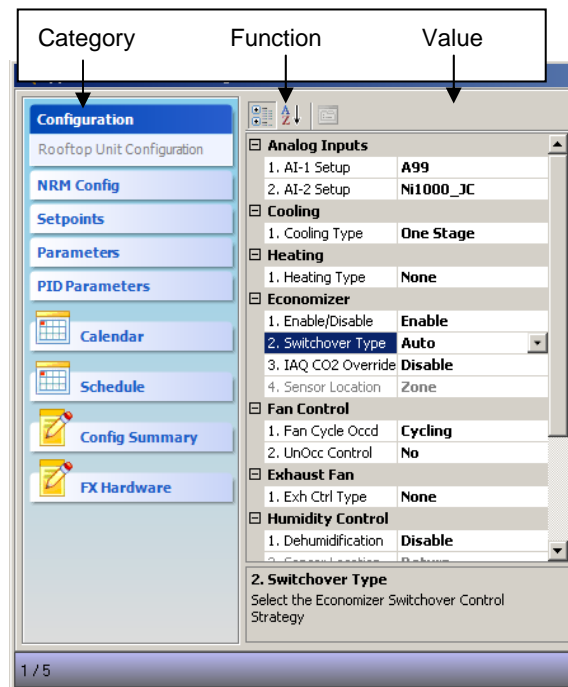


Figure 35: Application Wizard Plug-ins

## Selecting Configuration Options

The Configuration plug-in contains all the adjustable control logic functions within the selected application.

To select configuration options:

1. Click Configuration. The Configuration categories and values appear (Figure 36).

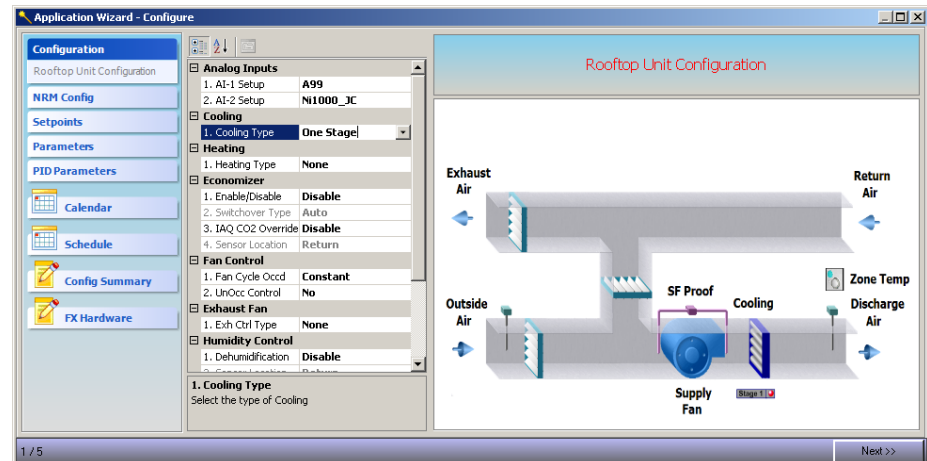


Figure 36: Configuration Plug-in

2. Modify the configuration settings as needed.

## Adjusting NRM Config

The NRM Config plug-in contains all adjustable NRM setpoints within the selected application. The NRM Config plug-in appears only when supported by the selected application.

To adjust NRM Config:

1. Click NRM Config. The NRM Config functions and values appear (Figure 37).

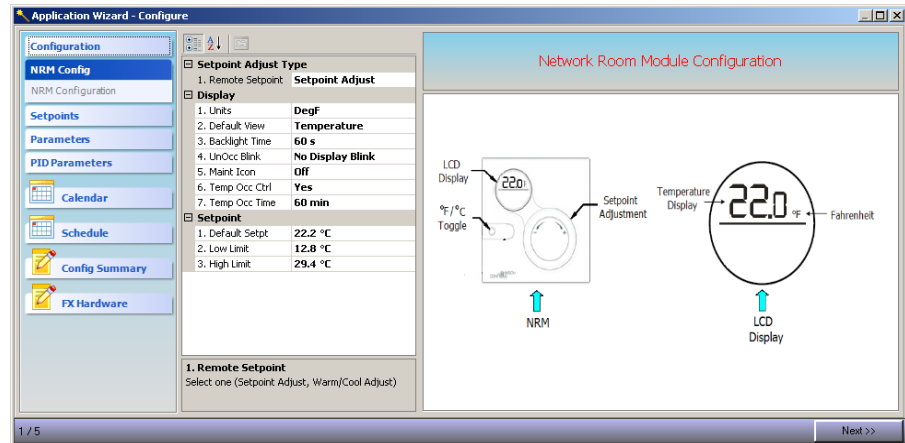


Figure 37: NRM Config Plug-in

2. Modify the NRM Config settings as needed.

## Adjusting Setpoints

The Setpoints plug-in contains all adjustable setpoints within the selected application.

To adjust setpoints:

1. Click Setpoints. The Setpoints functions and values appear (Figure 38).

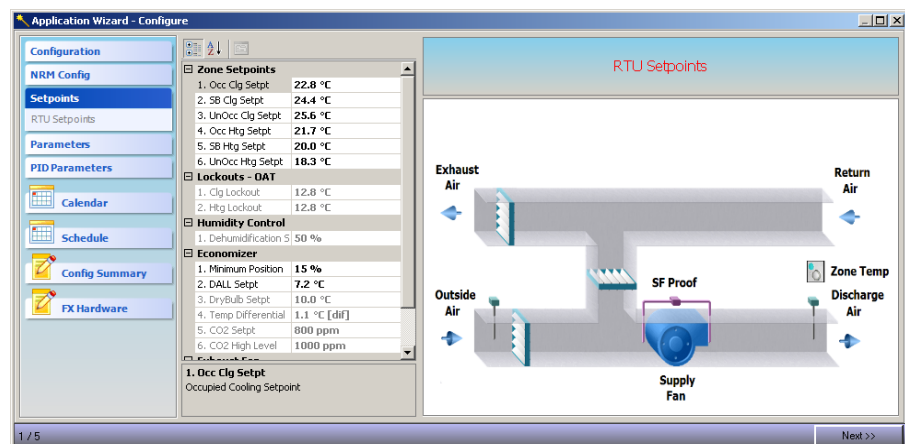


Figure 38: Setpoints Plug-in

2. Modify the Setpoint settings as needed.

## Adjusting Parameters

The Parameters plug-in contains all adjustable system parameters within the selected application.

To adjust parameters:

1. Click Parameters. The Parameters functions and values appear (Figure 39).

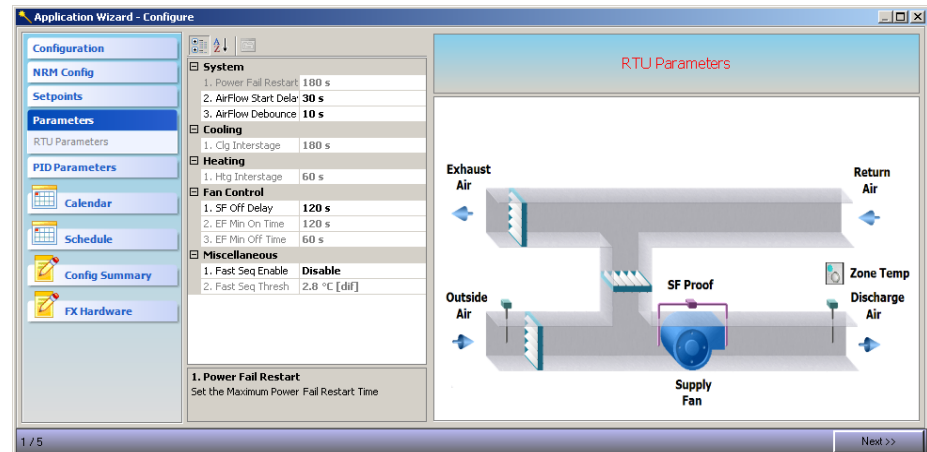


Figure 39: Parameters Plug-in

2. Modify the system parameters as needed.

## Adjusting Proportional plus Integral plus Derivative (PID) Parameters

The PID Parameters plug-in contains all adjustable tuning parameters (proportional bands, integration times, and saturation times) within the selected application.

To adjust PID parameters:

1. Click PID Parameters. The PID Parameters functions and values appear (Figure 40).

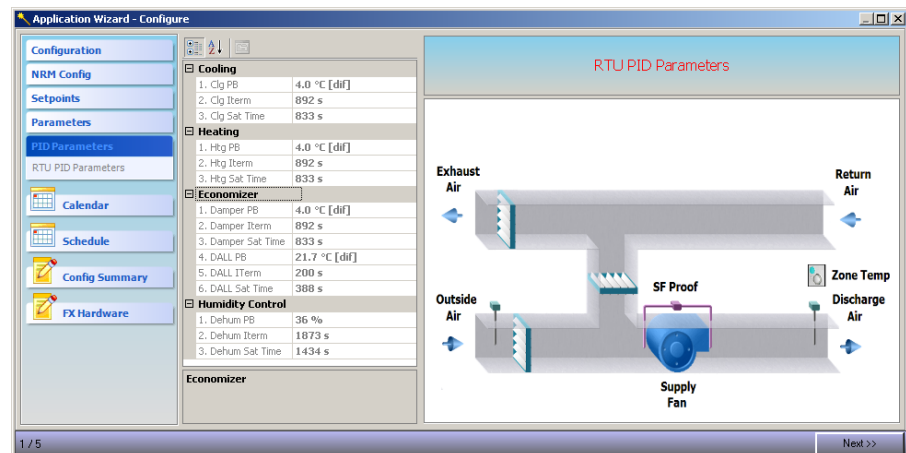


Figure 40: PID Parameters Plug-in

2. Modify the PID Parameters as needed.

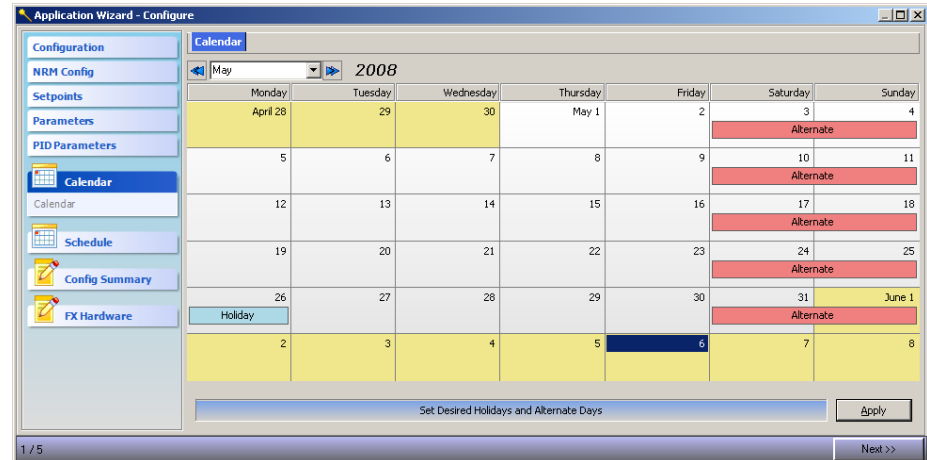


## Adjusting the Exception Day Calendar

The Calendar plug-in guides you in the definition of the exception day calendar.

To adjust the exception day calendar:

1. Click Calendar. The Calendar appears (Figure 41).



**Figure 41: Exception Day Calendar Plug-in**

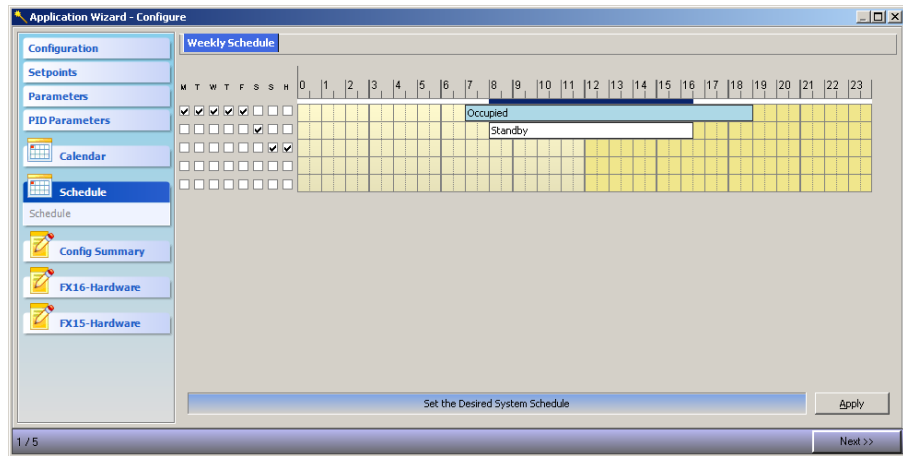
2. Modify the calendar as needed.
  - a. Click a day to highlight that day, or click and drag across the calendar to highlight a range of days.
  - b. Right-click on the highlighted day(s) and select the desired option from the menu.
  - c. To change a day's exception, right-click that day and select the desired option from the menu.
3. Click Apply.

## Adjusting the Weekly (Occupancy) Schedule

The Schedule plug-in guides you in the definition of the Weekly (Occupancy) Schedule.

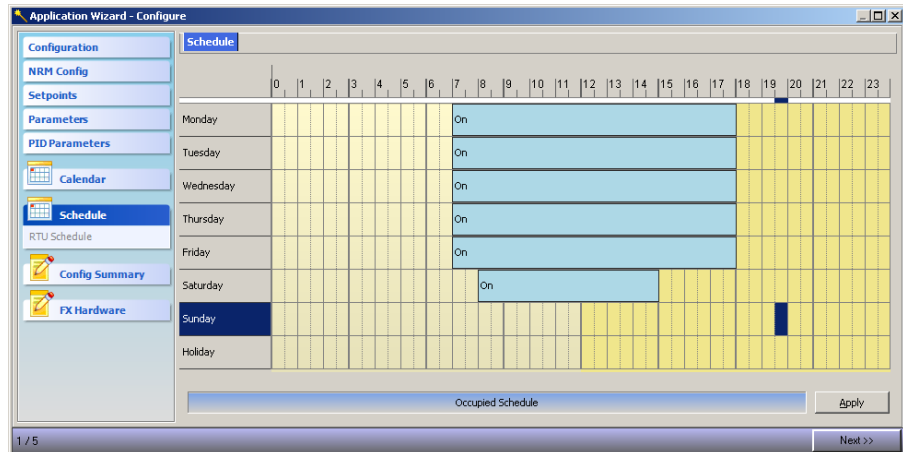
To adjust the weekly occupancy schedule:

1. Click Schedule. The Weekly Schedule plug-in appears (Figure 42).



**Figure 42: Weekly (Occupancy) Schedule Plug-in**

**Note:** The Roof Top Unit (RTU) application uses a different Occupied Schedule plug-in (Figure 43).



**Figure 43: Schedule Plug-in for use with RTUs**

2. Modify the schedule as needed.
  - a. Select the check boxes for the days that use the schedule configuration (Figure 42, only).
  - b. Double-click a day to display a Fine Tuning dialog box (Figure 43, only).
  - c. Click and drag across the schedule to highlight a time range for that day.
  - d. Right-click on the highlighted time range and select the desired option from the menu, or double-click a time range to display the Fine Tuning dialog box.
  - e. To change a time range's settings, click on the time range and drag it to the desired setting or double-click a time range to display the Fine Tuning dialog box.
3. Click Apply.

## Viewing the Configuration Summary

The Config Summary plug-in provides a summary for all configuration setting, setpoint, and parameter adjustments made during the configuration session. If you want to change anything, edit the appropriate configuration(s) you made prior to this step.

To view the configuration summary:

1. Click Config Summary. The Configuration Summary report appears (Figure 44).
2. View the summary here or to save the summary to a document, right-click on the summary information and select Copy to clipboard, then paste it into a document (a Notepad document retains better formatting than a Word document).

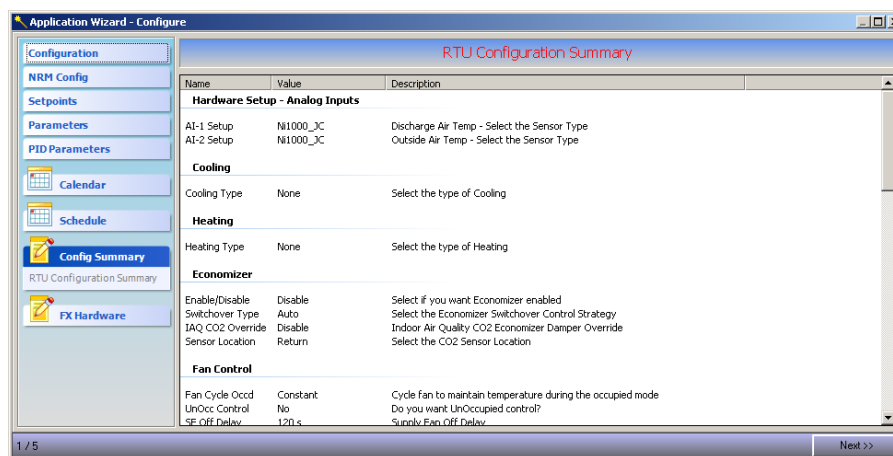


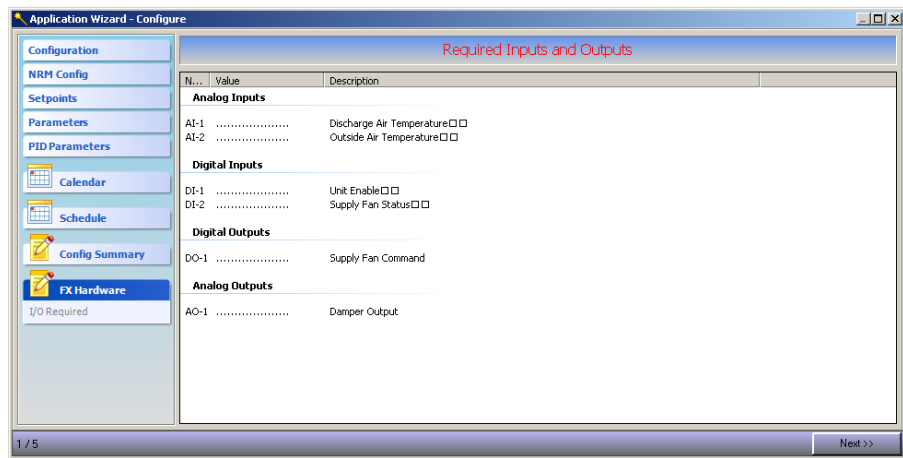
Figure 44: Configuration Summary Window

## Viewing Input and Output Assignments

The FX Hardware plug-in provides input and output assignment for the target controller based on the selected application and configuration. If you want to change anything, edit the appropriate configuration(s) you made prior to this step.

To view the Input and Output assignments:

1. Click FX Hardware. The Required Inputs and Outputs summary report appears (Figure 45).
2. View the summary here or, to save the summary to a document, right-click on the summary information and select Copy to clipboard then paste it into a document (a Notepad document retains better formatting than a Word document).



**Figure 45: Required Inputs and Outputs Window**

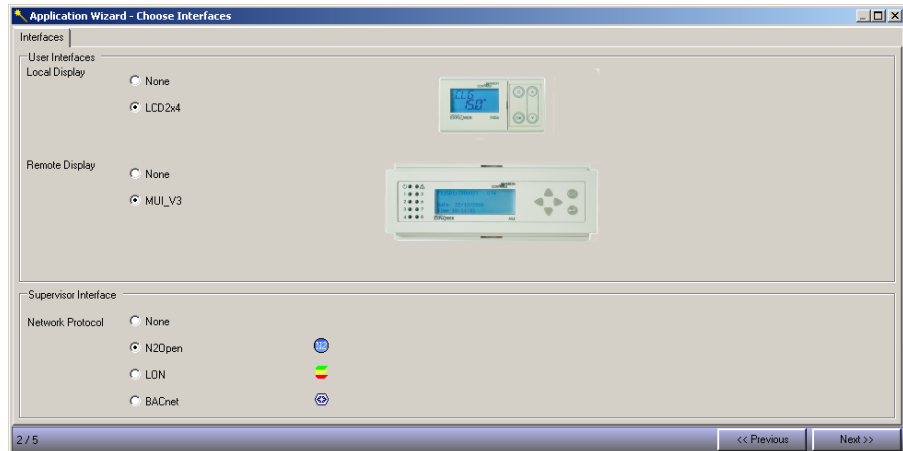
- Click Next to select the interface(s) and device I/Os (Figure 46).

### **Selecting the User Interface(s) and Network Protocol**

The Choose Interfaces (Figure 46) dialog box provides User Interface and Network Protocol options for the target controller based on the application and configuration settings you selected. If you do not see the options you want to use, click Previous to return to the configuration plug-ins and edit the appropriate configuration(s) you made prior to this step.

To select the user interface(s) and network protocol:

- Choose the desired User Interface(s).
- Choose the desired Network Protocol.

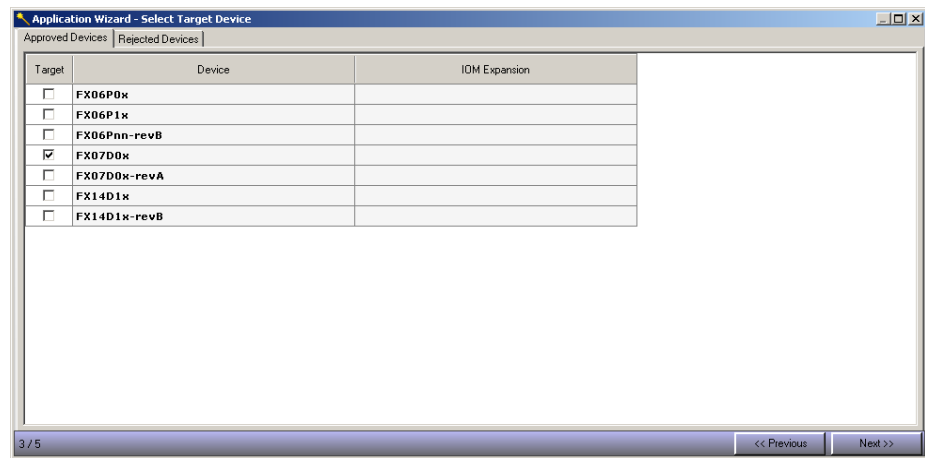


**Figure 46: Choose Interfaces Dialog Box**

- Click Next to select the FX controller. The Select Target Device dialog box appears (Figure 47).

### **Selecting the Target Device**


The Select Target Devices dialog box (Figure 47) provides FX controller options for the target controller based on the selected application and configuration.



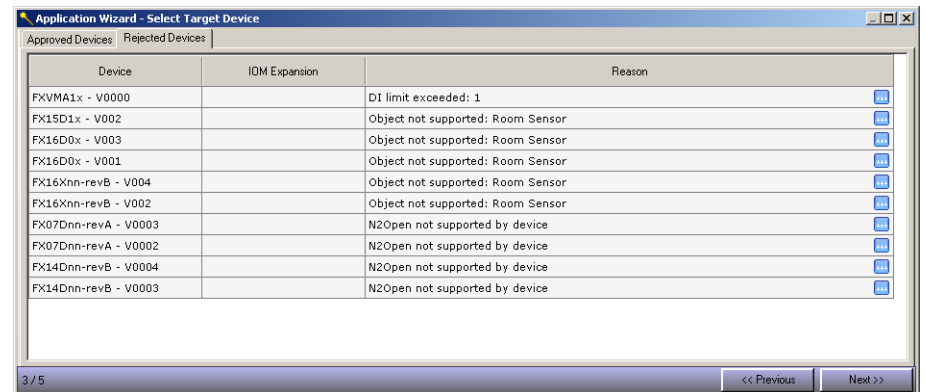
**Figure 47: Select Target Device Dialog Box**

To select the target device:

1. Select a device and click Next. The Configure Hardware I/O window appears (Figure 49).

**Note:** If the device you want to use does not appear in the list of the Approved Devices Tab (see Figure 47), click the Rejected Devices tab and view the Reason for the rejection (Figure 48). You can also click the Exclusion Details button  for more details.

Then, based on the rejection reasons, you can click Previous to return to the configuration plug-ins and edit the appropriate configuration(s) to configure the device so it is approved.



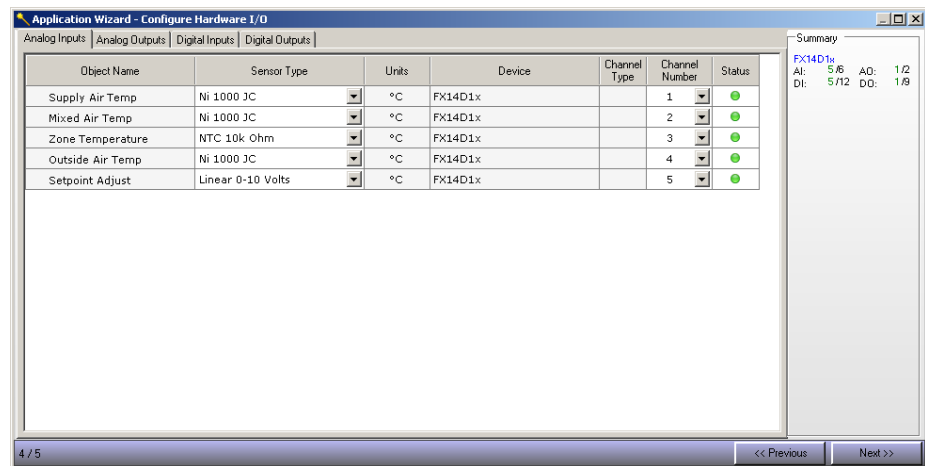
**Figure 48: Rejected Devices Tab**

## Configuring the Hardware I/Os

The Configure Hardware I/O dialog box is organized into tabs based on I/O type (Analog Inputs, Analog Outputs, Digital Inputs, and Digital Outputs).

To configure the hardware I/Os:

1. Change the Sensor Type and Channel Number for the desired objects (Figure 49).



**Figure 49: Configure Hardware I/O Window**

**Note:** Each Channel Number must be unique. The Status alerts you with a yellow alert symbol if multiple channels are assigned the same number. Correct the Channel Number so each channel has a unique number and all status symbols are green.

Channel Number	Status
1	●
2	⚠
3	●
2	⚠
5	●

**Figure 50: Channel Number Status Alert**

- Click Next. The Generate Application dialog box appears (Figure 51).

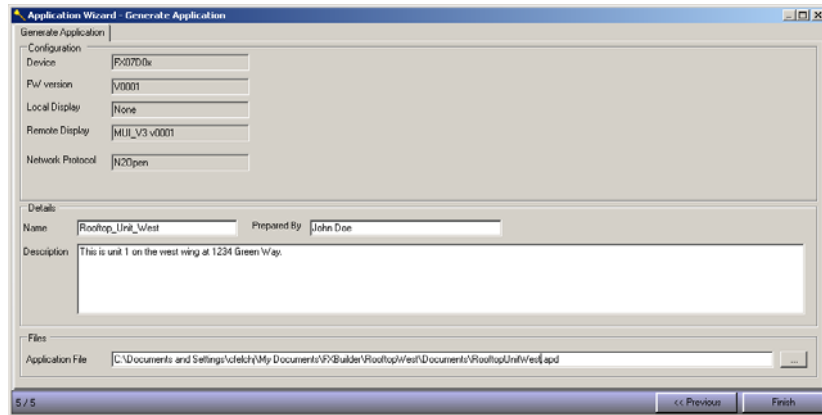
### ***Generating the Application Files and Documents***

This is the final step in creating and generating the Application files and documents (Figure 51).

To generate the application files and documents:

- Edit or enter a Name for the Application.
- Enter the name of the Application designer in the Prepared By field (or department name, employee ID, other relevant information to the preparer), if desired.
- Enter information relevant to the Application, design, notes for others who may use the Application in the future, or other information in the Description field, if desired.
- Navigate to the directory folder where you want the application files to be exported (if different than the Application File default location shown).

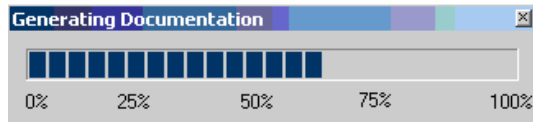
5. Change the name of the .apd file in the Application File field, if desired. But **do not** change the **.apd** extension.



**Figure 51: Generate Application Window**

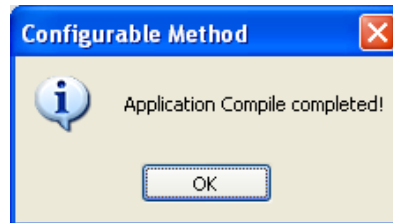
6. Click Finish.

The application files and documentation are generated, and the Application Wizard closes. The bottom of the FX Builder window displays a status for each application object loaded. When all application objects are loaded the Generating Documentation status bar displays in the middle of the screen (Figure 52).



**Figure 52: Generating Documentation Status Bar**

7. Click OK when the Application Compile completed! dialog box appears (Figure 53).

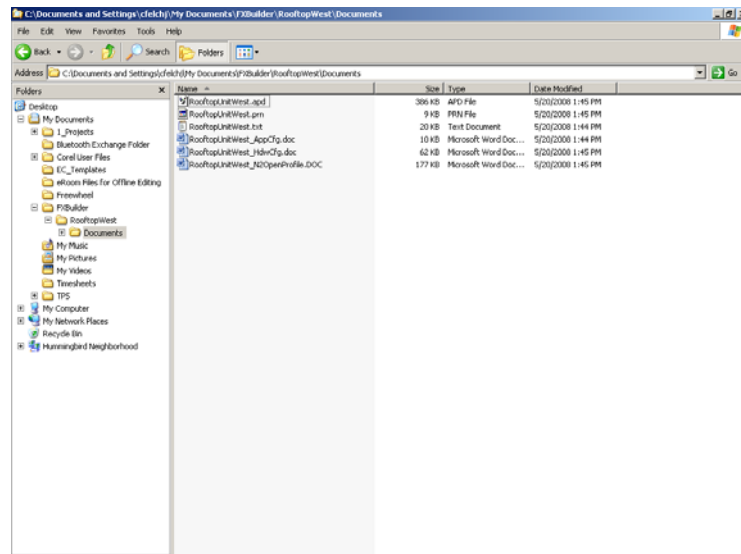


**Figure 53: Application Compile Completed! Dialog Box**

The Application and its corresponding files and documentation are now generated.

## Viewing Generated Application and Documentation Files

To view generated application and documentation files, go to the destination folder (Figure 54) that was designated in the Application File field (see Figure 51).



**Figure 54: Exported Application and Documentation Files**

The Application Wizard generates Application and documentation files. The type of generated files depends on the selections made in the Application Wizard Preferences dialog box (Figure 29) and Configuration Options plug-ins (Figure 36).

See *Generated Application and Documentation Files* for a description of the different types of files.

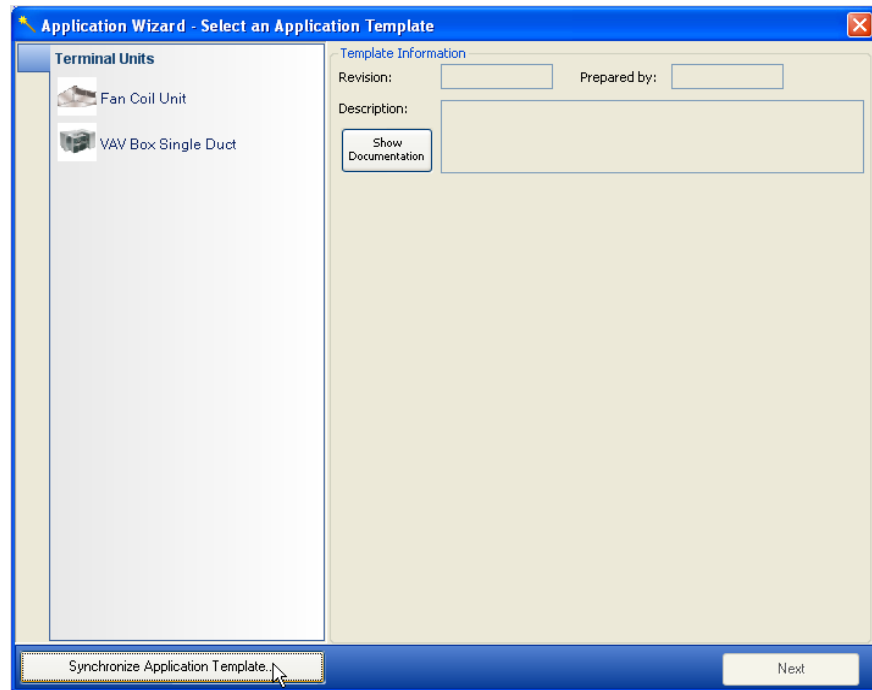
## Reviewing and Changing an Exported Application File

The Application Wizard includes a synchronization feature that allows you to match an exported application file (\*.apd) to its template. This feature allows you to use the Application Wizard screens to review and/or change any of the options, settings, or selections made to an exported application file.

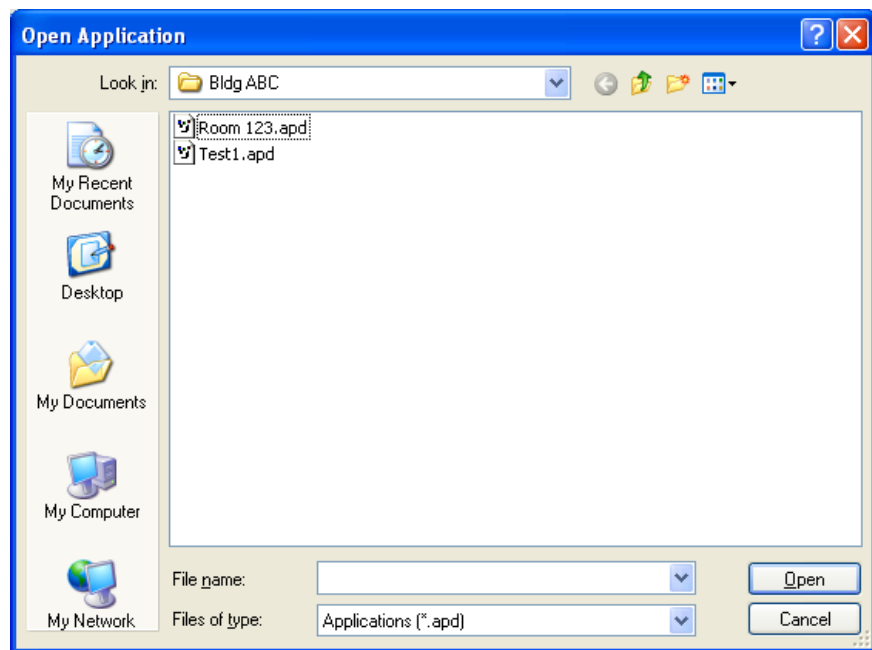
To use this feature:

1. Open the Application Wizard (File > Application Wizard).
2. Click on Synchronize Application Template . . . (see Figure 55).  
The Open Application dialog box appears (Figure 56).



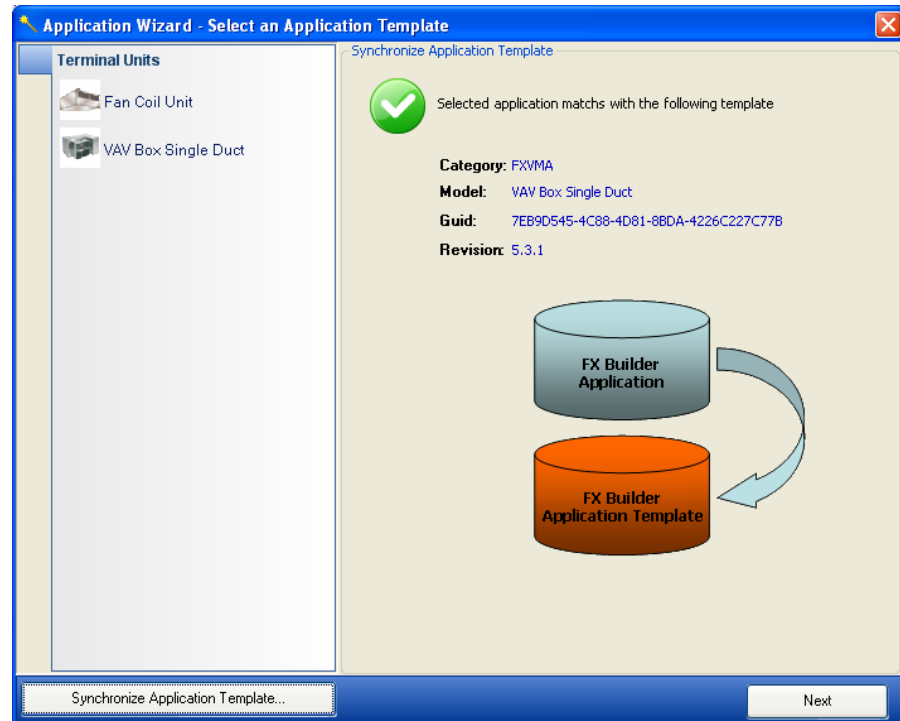


**Figure 55: Synchronize Application Template**



**Figure 56: Open Application Dialog Box**

3. Navigate to the location of your exported \*.apd file, select it and click Open. The Application Wizard reappears showing if the selected application matches an installed template (see Figure 57).



**Figure 57: Application Template Match**

4. Click Next. The Application Wizard appears, showing the actual configuration settings, setpoints, adjustment parameters, user interface selection, protocol choice, target controller selection, and I/O configurations that were originally made before the application file was exported. You can now use the Application Wizard to view and/or change these settings as desired.

## Creating an Application (Programming Approach)

### ***Creating an Application Using the Programming Approach***

This is a high-level overview of the steps used to create an application using the programming approach.

1. Select the target device.
2. Create the control algorithm with the Application Editor.
3. Expose the application object input/output references as either **volatile** or **permanent (nonvolatile)** application points.
4. Define application point details using the application points plug-in.
5. Enable trends and events (optional) using the application points plug-in.
6. Configure trends and events (optional) using their corresponding plug-ins.
7. Simulate the control algorithm with the Simulator plug-in.

8. Create and format the user interfaces (optional) using the Display plug-in.
9. Create and format the Web interface (optional) using the Web Site plug-in.
10. Create and format the network profile using the Protocol plug-in.

### ***Creating a New Application***

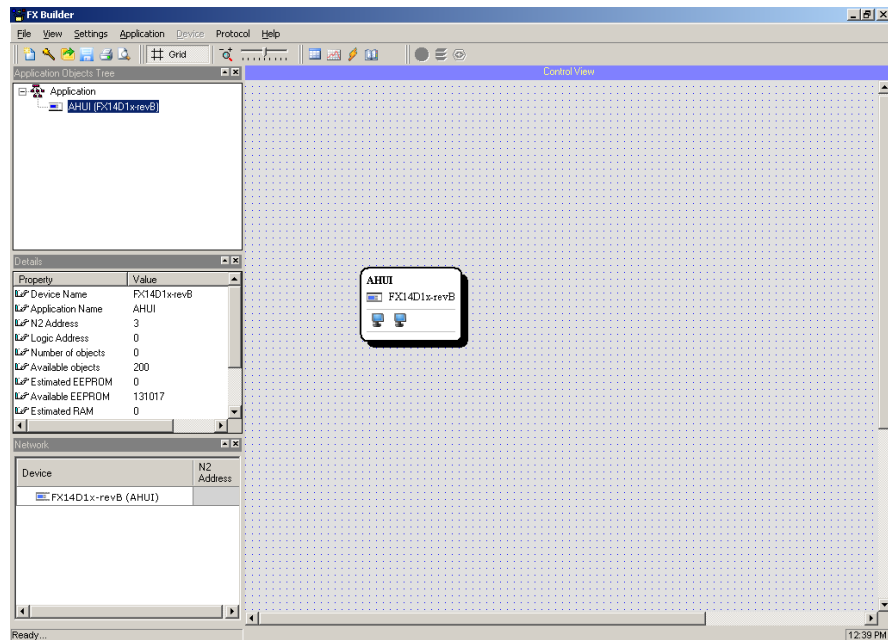
1. In FX Builder, select File > New Application. The New Application window appears (Figure 58).

**Figure 58: New Application**

2. From the list of devices, select the device that you want to create an application for.

When you highlight a target device, a brief description of the device appears on the bottom of the New Application window. For additional information, click on the Data Sheet button to access a copy of the technical bulletin of the device.

3. Enter the following information:
  - Name (required) – the name of the application
  - Category (optional)
  - Model (optional)
  - Prepared by (optional)
  - Description (optional)
  - Firmware (required) - the firmware version of the targeted device. This selection determines which objects and services are available in the application view. See Table 4 for details on the version numbers.
4. Click OK. FX Builder adds the device object to the Control View (Figure 59).



**Figure 59: Target Device Added to Control View**








At this point, you can create and edit the control algorithm using the Application Editor.





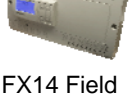


### ***Accessing the Application Editor for the Control View***






To access the Application Editor from the Control View:

1. Double-click on the device object.
2. Right-click the device object and select Edit Control Logic.
3. From the Device menu, select Edit Control Logic.

**Table 4: FX Controller Versions**

<b>Latest FX Tools Versions</b>	<b>FX Controller</b>	<b>Latest FW Version</b>	<b>Version in FX Builder</b>	<b>Date (Year, Week)</b>	<b>FX Applications Supported</b>
<b>FX Builder: 5.x</b> <b>FX CommPro N2: 5.x</b> <b>FX CommPro LON: 2.9.2</b> <b>FX CommPro BACnet: 5.x</b> <b>MDLON Loader: 1.2.0</b>	 MD20 Master Display N2 Models	3.30	V000	0843	Network Application using Gateway Object Distributed Application as Master Device (up to 8 FX Slaves)
	 MD20 Master Display LON Models	3.30	V000	0843	LONWORKS Interface Network Application using Gateway Object Distributed Application as Master Device (Up to 8 FX Slaves)
	 FX16x Master Controller Rev. B with FX IO Modules	7.1.5	V004	0913	Distributed Application as Master Device (up to 16 FX Slaves) Network Application using Gateway Object Stand-Alone Application Application Download/Upload BACnet Network Interface FX IO Modules
	 FX16x Master Controller Rev. B	6.30	V002	0752	Distributed Application as Master Device (up to 16 FX Slaves) Network Application using Gateway Object Stand-Alone Application Application Download/Upload BACnet Network Interface
	 FX16x Master Controller Rev. A with FX IO Modules	7.1.1	V003	0913	Distributed Application as Master Device (up to 16 FX Slaves) Network Application using Gateway Object Stand-Alone Application Application Download/Upload FX IO Modules
	 FX16x Master Controller Rev. A	5.20	V001	0752	Distributed Application as Master Device (up to 16 FX Slaves) Network Application using Gateway Object Stand-Alone Application Application Download/upload
	 FX16D and FX16X Master Controller	4.50	V000	0840	Distributed Application as Master Device (up to 16 FX Slaves) Stand-Alone Application
<b>Continued on next page . . .</b>					

Latest FX Tools Versions (Cont.)	FX Controller	Latest FW Version	Version in FX Builder	Date (Year, Week)	FX Applications Supported
<b>FX Builder: 5.x</b> <b>FX CommPro N2: 5.x</b> <b>FX CommPro LON: 2.9.2</b> <b>FX CommPro BACnet: 5.x</b>	 FX15 Field Controller Rev. A	4.40 4.00	V002 V001	0840 0644	Distributed Application as Slave Device Stand-Alone Application
	 FX15 Field Controller	2.05	V000	0518	Distributed Application as Slave Device Stand-Alone Application
	 FX15 Universal Controller Rev. A	4.40	V001	0840	Distributed Application as Slave Device Stand-Alone Application
	 FX15 Universal	2.05	V000	0518	Distributed Application as Slave Device Stand-Alone Application
	 FX14 Field Controller Rev. B	5.1.7	V0003	0913	Distributed Application as Slave Device Stand-Alone Application BACnet Network Interface
	 FX14 Field Controller Rev. A	3.21	V0002	0843	Distributed Application as Slave Device Stand-Alone Application
	 FX14 Field Controller	1.03	V0001	0622	Distributed Application as Slave Device Stand-Alone Application
	 FX07 Field Controller Rev. A	5.1.7	V0002	0913	Distributed Application as Slave Device Stand-Alone Application BACnet Network Interface
Continued on next page . . .					

Latest FX Tools Versions (Cont.)	FX Controller	Latest FW Version	Version in FX Builder	Date (Year, Week)	FX Applications Supported
	 FX07 Field Controller	3.21	V0001	0843	Distributed Application as Slave Device Stand-Alone Application
	 FX06 Controller Rev. A	3.21	V0002	0843	Distributed Application as Slave Device Stand-Alone Application
	 FX06 Controller	1.03	V0001	0622	Distributed Application as Slave Device Stand-Alone Application
	 FX05 Advanced	2.00	V0002	0524	Distributed Application as Slave Device Stand-Alone Application
	MUI Version 3 MUI Version 2 	3.40 2.43	V3 V2	0752 0545	Optional Display for FX16, FX15, FX14, FX07, FX06

## Creating the Control Algorithm

### *Working with the Application Editor*

To create an application algorithm, select the desired application objects, configure them, and connect them in the Application Editor.

### *Application Objects*






FX Builder includes a large set of configurable objects to create the control algorithm.

**IMPORTANT:** Not all application objects are supported by every device and firmware revision. The list of supported objects is unique to each device and firmware revision. Refer to the technical bulletin of the target device to ensure that the desired object is included.

### *IOM (Extension) Objects*

IOM Objects are used to add additional inputs and outputs to an application. Table 5 displays the I/O objects included in FX Builder.

**Table 5: IOM (Extension) Objects**









IOM Object Icon	Description
 IOM Analog Input (AI)	Reads the analog input from the device and makes it available to the application. The Analog Input object scales the AI value. This object then limits the value according to the channel type and the high and low range parameters. The object also has all the necessary filters to limit and suppress the effect of unstable measurement.
 IOM Digital Input (DI)	Reads the digital input from the device and makes it available for the application.
 IOM Input Counter	Reads the pulse input from the device and makes it available for the application.
 IOM Analog Output (AO)	Manages the analog outputs (0-10 V) of the device.
 IOM On/Off Output	Manages the On/Off hardware output. Use the output to control either Triac or Relay outputs.


















## Input/Output (I/O) Objects

Table 6 displays the I/O objects included in FX Builder.

**Table 6: Input/Output (I/O) Objects**

I/O Object Icon	Description
 <p>Analog Input</p>	<p>Reads the analog input from the device and makes it available to the application. The Analog Input object scales the AI value. This object then limits the value according to the channel type and the high and low range parameters. The object also has all the necessary filters to limit and suppress the effect of unstable measurement.</p> <p>Not BACnet compatible.</p>
 <p>Analog Input Ext</p>	<p>Enhanced AI object with additional exposed channels:</p> <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>
 <p>Fan Command</p>	<p>Based upon the Analog Input object. It converts a potentiometer input signal into various steps to describe the commanded speed of a fan.</p>
 <p>Occupancy Input</p>	<p>Reads the digital input from the occupancy device (typically an occupancy sensor or manual occupancy switch) and makes it available to the application.</p> <p>Not BACnet compatible.</p>
 <p>Occupancy Input Ext</p>	<p>Enhanced Occupancy Input object with additional exposed channels:</p> <ul style="list-style-type: none"> <li>• recommended for use with all Occupancy Input configurations</li> </ul>
 <p>Digital Input</p>	<p>Reads the digital input from the device and makes it available for the application.</p> <p>Not BACnet compatible.</p>
 <p>Digital Input Ext</p>	<p>Enhanced DI object with additional exposed channels:</p> <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>
 <p>Temporary Occupancy</p>	<p>Determines the effective occupancy based on an occupant override input.</p>
Continued on next page . . .	


I/O Object Icon (Cont.)	Description
 <b>On/Off Output</b>	Manages the On/Off hardware output. Use the output to control either Triac or Relay outputs. Not BACnet compatible.
 <b>On/Off Output Ext</b>	Enhanced On/Off Output object with additional exposed channels: <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>
 <b>Light-Emitting Diode (LED)</b>	Manages the LED next to the Occupant Override on the Room Command Module.
 <b>Position Adjusting Time (PAT) Output</b>	Manages two output channels (one for increasing and the other for decreasing) for PAT control (also known as incremental control). Use the PAT output to control only Triac outputs. Not BACnet compatible.
 <b>Position Adjusting Time Output Ext</b>	Enhanced PAT Output object with additional exposed channels: <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>
 <b>Fail-Safe Relay Output</b>	Manages the Fail-Safe Relay output. The Fail-Safe Relay is switched On or Off depending on the requested @VALUE. The physical status of the Fail-Safe Relay Output is periodically compared with the requested @VALUE. In case they differ, a FAILURE alarm is triggered.
 <b>Damper PAT Output</b>	Manages two output channels (one for increasing and the other for decreasing) for Damper PAT control (also known as incremental control). This object is very similar to the PAT Output object, except that the Damper PAT Output object does not include anti-sticking functions. Not BACnet compatible
 <b>Damper PAT Output Ext</b>	Enhanced Damper PAT Output object with additional exposed channels: <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>
Continued on next page . . .	

I/O Object Icon (Cont.)	Description
 Duration Adjusting Time (DAT) Output	<p>Generates an On signal proportional to a time base. Use the DAT Output object to control only Triac outputs.</p> <p>Not BACnet compatible.</p>
 Duration Adjusting Time Output Ext	<p>Enhanced DAT Output object with additional exposed channels:</p> <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>
 Hermetic Compressor	<p>Provides the logic, interlocking, and timing features required for operating a hermetic compressor.</p> <p>No mandatory connectable references.</p>
 Hermetic Compressor	<p>Provides the logic, interlocking, and timing features required for operating a hermetic compressor.</p> <p>The <b>HtgCommand</b> input is a mandatory connectable reference.</p>
 Hermetic Compressor	<p>Provides the logic, interlocking, and timing features required for operating a hermetic compressor.</p> <p>The <b>ClgCommand</b> is a mandatory connectable reference.</p>
 Analog Output	<p>Manages the analog outputs (0-10 V) of the device.</p> <p>Not BACnet compatible.</p>
 Analog Output Ext	<p>Enhanced AO object with additional exposed channels:</p> <ul style="list-style-type: none"> <li>• BACnet compatible</li> <li>• recommended for use with all available communication protocols</li> </ul>

### Input Function Objects

Table 7 displays the Input Function objects included in FX Builder.











Table 7: Input Function Objects











I/O Object Icon	Description
	<p>Provides a count of the Off to On logic transitions of the defined digital input channel. You can configure this object to count input pulses (having a maximum 50 Hz frequency).</p>





### Numeric Function Objects

Table 8 displays the Numeric Function objects included in FX Builder.

**Table 8: Numeric Function Objects**

<b>Numeric Function Object Icon</b>	<b>Description</b>
 <b>Average (2-Input)</b>	Calculates a weighted average between two values. To calculate the average among more values, use the 8-Input Average object.
 <b>Average (8-Input)</b>	Calculates a weighted average between eight values. To calculate the average among more values, apply the object in series with proper weight.
 <b>Extended Calculation</b>	Performs an addition, multiplication, or square root function between two values.
 <b>Compare</b>	Compares two variables and creates a binary logic output. You use this object to drive an On/Off output from a numeric value.
 <b>Event Counter</b>	Provides a way to count events based on logical transitions. A flag is set when full scale is reached.
 <b>Butterworth Filter</b>	Performs a low pass, second order Butterworth filter on the input. You typically used this filter to condition the input for Pattern Recognition Adaptive Control (PRAC).
 <b>Integrator</b>	Performs integration on the value of a numeric input. The integration rate is determined by a time constant. You can set the integrator to zero by a logic reference connected to a reset input. When the output reaches a programmable full-scale value, the integrator full-scale logic status is set and the output value remains at full scale until reset. Alternatively, the output value is set to zero and integrating restarts.
 <b>Maximum (2-Input)</b>	Calculates the maximum between two values. To calculate the maximum among more values, use the 8-Input Maximum object.
 <b>Maximum (8-Input)</b>	Calculates the maximum between eight values. To calculate the maximum among more values, apply the object in series.
 <b>Minimum (2-Input)</b>	This object calculates the minimum between two values. To calculate the minimum among more values, use the 8-Input Minimum object.
<b>Continued on next page . . .</b>	





Numeric Function Object Icon (Cont.)	Description
 <b>Minimum (8-Input)</b>	Calculates the minimum between eight values. To calculate the minimum among more values, apply the object in series.
 <b>Psychrometric 1</b>	Calculates the dew point temperature, the humidity ratio, and the enthalpy of a from temperature and Relative Humidity (RH) inputs. Dew point temperature is the temperature when the relative humidity is 100%. Enthalpy is the latent energy. Humidity ratio is also known as moisture content or mixing ratio. It is defined as $W = M_w/M_a$ where $M_w$ is the mass of water vapor in moist air sample and $M_a$ is the mass of dry air in moist air sample.
 <b>Psychrometric 2</b>	This object calculates the relative humidity, humidity ratio, and enthalpy from dry bulb temperature and wet bulb temperature inputs. Enthalpy is the latent energy. Humidity ratio is also known as moisture content or mixing ratio. It is defined as $W = M_w/M_a$ where $M_w$ is the mass of water vapor in moist air sample and $M_a$ is the mass of dry air in moist air sample.
 <b>Ramp</b>	Generates a linear rate ramp from an initial value to a setpoint. It is typically used to gradually start up equipment.
 <b>Selector (2-Input)</b>	Selects one of its two inputs based on the status of its pilot input.
 <b>Selector (8-Input)</b>	Selects one of its eight inputs based on the status of its selector input.
 <b>Segment</b>	Performs a nonlinear transform function on its input value. It allows up to 15 segments.
 <b>Span</b>	Linearly scales and biases an input value. This object differs from the Segment object in the way that the controller can dynamically adjust the transfer function rather than from a fixed configuration.
 <b>Timer</b>	Generates time-based function and activates its output accordingly. It features a random on-delay to use in applications to prevent high inductive loads from starting at the same time.
 <b>Timer with Reset</b>	Generates time-based function and activates its output accordingly. This object features a random on-delay that you can use in applications to prevent high-inductive loads from all starting at the same time. The Reset Input is mandatory.
Continued on next page . . .	

Numeric Function Object Icon (Cont.)	Description
 Time Counter	Counts the time its input is in the On position. A flag is set when full scale is reached. This object is typically used to determine runtime.
 Storage Element	Store a value in the permanent memory. The stored value is available after a reset action on the controller.
 Constant Value	Outputs a user-defined constant value. This object only has internal application purposes.
 Estimated Weighted Moving Average (EWMA)	Summarizes data into a single value similar to a mean, except that it places greater weight on more recent data. The EWMA object is useful for data analysis and diagnostics.

## Control Function Objects

Table 9 displays the Control Function objects included in FX Builder.

**Table 9: Control Function Objects**

Control Function Object Icon	Description
 On/Off Controller	Generates an On/Off output based on the difference between the variable being controlled (process variable) and the desired value (setpoint).
 Proportional plus Integral plus Derivative	Generates a PID output in response to the difference between the desired setpoint and the process variable.
 Automatic Economizer	<p>Provides a logical output based on the availability of free cooling. Free cooling is the use of outside air to lessen the load experienced by the cooling coil. This process reduces the need for mechanical cooling from the controlled equipment that provides energy savings. You can define the operating mode or strategy used by the object to determine free cooling availability, between one of the following:</p> <ul style="list-style-type: none"> <li>• automatic (depending on connected sensors)</li> <li>• differential enthalpy (difference between outdoor enthalpy and room/return enthalpy)</li> <li>• single enthalpy (outdoor enthalpy only)</li> <li>• differential temperature (difference between outdoor temperature and room/return temperature)</li> <li>• dry bulb (outdoor temperature only)</li> </ul> <p>You can override the Economizer object to adapt the damper position to the status of the equipment.</p>
 Fan Controller	Drives a multi-speed or variable-speed fan. This object provides all the logic and interlocking features required for such an application.












## Obsolete Objects

Use this folder to locate objects that have been substituted by new enhanced objects. The obsolete objects included still work but are now red-crossed.

## Logic Function Objects

Table 10 displays the Logic Function objects included in FX Builder.

Table 10: Logic Function Objects





Logic Function Object Icon	Description
 <b>Or (2-Input)</b>	Performs the Boolean <b>or</b> function on its 2 inputs. Each input can be negated.
 <b>Or (8-Input)</b>	Performs the Boolean <b>or</b> function on up to 8 inputs. Four inputs are negated.
 <b>And (2-Input)</b>	Performs the Boolean <b>and</b> function on its 2 inputs. Each input can be negated.
 <b>And (8-Input)</b>	Performs the Boolean <b>and</b> function on up to 8 inputs. Four inputs are negated.
 <b>XOR (2-Input)</b>	Performs the Boolean <b>xor</b> (Exclusive OR) function on its 2 inputs. The <b>xor</b> operation produces a result of 1 if exactly one of its inputs is 1; otherwise, it produces a result of 0 if its inputs are both 0 or both 1. Each input can be negated.
 <b>XOR (8-Input)</b>	Performs the Boolean <b>xor</b> (Exclusive <b>or</b> ) function on up to 8 inputs. The <b>xor</b> operation produces a result of 1 if exactly one of its inputs is 1; otherwise it produces a result of 0 if its inputs are all 0 or all 1. Each input can be negated.
 <b>Not</b>	Performs the Boolean <b>not</b> function (also known as negate or complement) on its four inputs.
 <b>Output Override Logic</b>	Coordinates overrides coming from different sources into the appropriate override format required to drive the output.
 <b>Enumeration Override</b>	Converts up to 16 states of an enumeration into some other enumerated states. Use this object for hvac_mode, occup, hvac_emerg, and/or UNVT_logic. For example, you can use this object to block some states that the controller receives from the network.
 <b>Enumeration Logic</b>	Prioritizes between two enumerated inputs. Use this object for hvac_mode, occup, hvac_emerg, UNVT_logic. For example, the priority between User Interface and Network mode can be done using this object.
 <b>Programmable Logic Controller (PLC)</b>	Performs the execution of a programmable logic control defined by a list of instructions. This object can perform any function built using ladder logic or state machine. It features all the basic instructions of a standard PLC.



## Alarms Objects

Table 11 displays the Alarm objects included in FX Builder.



Table 11: Alarms Objects









Alarms Object Icon	Description
 <b>Analog Alarm</b>	Generates an alarm status (high or low) from an analog value. The alarm can be a fixed value or referred to a setpoint. This alarm resets automatically with a differential.
 <b>Manual Reset Binary Alarm</b>	Allows you to define the number of automatic resets that can occur before a manual reset becomes mandatory. You can connect this alarm to a digital input object or to an automatic reset alarm object. This object locks its output when the Off to On input transition frequency exceeds a user-defined level and the output can be unlocked only by a manual reset. The reset is based on a digital reference that can be a digital input or a display key.
 <b>Compressor Envelope</b>	Allows you to define conditions not compatible with the usage of compressor operated systems. This object generates an alarm output if the user-defined conditions are not suitable for the compressor to run. It can be applied to air-to-air and water-to-air units.
 <b>Out of Range</b>	Imposes a user-defined limit range on its input value. If the input value is within the high and low limits, then the object passes the input value through to its output and the status is set to <b>off</b> . As soon as the input value goes outside the limits, the output is set to invalid and the status reports <b>on</b> until the input value returns within the limits.







## Special Functions Objects

Table 12 displays the Special Functions objects included in FX Builder.

Table 12: Special Functions Objects

Special Functions Object Icon	Description
 <b>Temperature Setpoint</b>	Calculates the heating and cooling temperature setpoints for the controller. The setpoints are derived from the configured setpoints, the absolute setpoint, the setpoint offset, the setpoint shift, and the occupancy mode. The setpoints are calculated using the Asymmetrical Method of Setpoint Calculation as defined in the Space Comfort Controller Template.
 <b>General Setpoint</b>	Calculates the working setpoint for the controller. The working setpoint is calculated depending on the action type and occupancy mode of the controller and is based on Local and Remote setpoint values. The working setpoint calculation can be altered by limits, biases, offsets, and ratio values.
Continued on next page . . .	




Special Functions Object Icon (Cont.)	Description
 <b>Emergency/Application Mode</b>	<p>Manages the heat/cool and emergency overrides for the application. This object is based on low ambient, OFF state, powerup, and various network commands. These can be Digital input or Network Variable inputs.</p>
 <b>Binary Sequencer</b>	<p>Provides control of 1-4 binary outputs (stages) as a function of a percentage of the input. The stages are controlled in sequence according to binary code. The sequencer always selects the appropriate stage combination for the requested output, with the possibility to add a stage delay between the changing of a state combination. The object automatically assigns load factors to all stages so when the selected output is equal to 100%, all stages are switched ON.</p>
 <b>Occupancy Mode</b>	<p>Generates the effective Occupancy Mode for the application depending on a manual command, an occupancy sensor, and occupancy schedules.</p>
 <b>Real-Time Clock</b>	<p>Sets the time of the hardware timekeeper chip and makes it available to the application and network. This object is meant to be used with Real-Time Clock plug-in card for the FX05 or FX10.</p>
 <b>Clock and Date Set</b>	<p>Sets the time and date of the hardware timekeeper chip and makes it available to the application. This object also manages automatic summer/winter time change over.</p>
 <b>Sensor Failure</b>	<p>Allows you to define the default operation of an output in case of sensor failure. The operation can be always ON, always OFF, or based on a weighted running average that represents the output function over time.</p>
 <b>Source Mode</b>	<p>Generates the appropriate application mode based on source temperature. For example, use this object to stop the fan when the coil is inefficient (to avoid blowing cold air on a heat request before the coil gets hot). You can also use this object in two-pipe applications, to allow switching between heating and cooling modes (either from a temperature sensor or from a switch).</p>
 <b>System Resources</b>	<p>Transfers important information on the status of the operating system to the application. Use this object to run the application in a default mode.</p>
Continued on next page . . .	

Special Functions Object Icon (Cont.)	Description
 <b>Sequencer</b>	<p>Provides the control of 1-4 outputs (stages) as a function of the value of the INPUT and the state of four logic (STAGENDISABLE) inputs. Use this object to control multi-stage equipment, maintaining minimum ON/OFF times, inter-stage delays, and sequencing loads. The output stages are controlled in sequence according to different strategies as Step Mode (First In Last Out [FILO]), Sequential Mode (First In First Out [FIFO]), Equal Runtime, or Equal Startup. Variations are also available for compressor circuit with Single Oil Pump or for Pump Down. This object can also perform Vernier Networks® control providing full adjustment.</p>
 <b>Array Sequencer</b>	<p>Operates as the Sequencer but controls up to 8 outputs (stages).</p>
 <b>Semi-hermetic Compressor</b>	<p>Provides the means for driving a semi-hermetic reciprocating compressor in refrigeration or air conditioning applications. This object is meant to take its input from a sequencer object.</p>
 <b>Summer/Winter Compensation</b>	<p>Calculates setpoint shifts based on the outdoor air temperature. The Setpoint Calculation object uses these shifts to calculate the effective occupancy setpoints.</p>
 <b>Load Manager</b>	<p>Calculates the load required by an installation and formats it for a sequencer. This object also manages lead/lag between two sequencers.</p>
 <b>Optimal Start/Stop</b>	<p>Calculates the minimum time to bring a controlled zone temperature to a desired condition at occupancy with a heating or cooling plant. This object also calculates the optimal stop time to maintain the desired conditions up to the end of the occupancy time.</p> <p>The Optimal Start/Stop object algorithm is adaptive. The heating and cooling thermal characteristics of the building are measured during the preheating or precooling cycles and are used in the operations.</p>

## Schedulers Objects

Table 13 displays the Schedulers objects included in FX Builder.



**Table 13: Schedulers Objects**



Schedulers Object Icon	Description
 On/Off Time Scheduler	Provides the control of a logic output as a function of a programmable event schedule, day of the week, calendar, time, and exception days condition. To define Start and Stop conditions, you need to configure events using a specific plug-in.
 Weekly Occupancy Scheduler	Provides Time Schedule capability to drive the occupancy status based on day of the week, calendar, and time information. Use this object to change occupancy status or to drive the Optimal Start/Stop object. To define Start and Stop conditions, you need to configure events using a specific plug-in.
 Exception Calendar	Generates exceptions for the days of the week. These exceptions are normally used to define holidays. The Exception Day object defines a period with a begin and end date. If the present date is within an exception day period, the day type is set to Alternate date.

## Refrigeration Objects

Table 14 displays the Refrigeration objects included in FX Builder.

**Table 14: Refrigeration Objects**






Refrigeration Object Icon	Description
 Accumulative Defrost	Defines the defrost cycle in applications with an outdoor air heat exchanger. Use this object in the air conditioning application heating mode to avoid and melt ice buildup on the heat exchanger. This object takes into account runtime to optimize the period of the cycle.
 Refrigeration Defrost Initiation	Allows you to define logic necessary to start up a defrost cycle. This object takes input from a network variable, a timer, a time scheduler, or a digital input object and organizes the priority. This object also features an adaptive defrost initiation mode.
Continued on next page . . .	




Refrigeration Object Icon (Cont.)	Description
 Refrigeration Defrost	Manages the defrost cycle for one evaporator that can be part of a line up. It is intended for refrigerated and frozen food temperature applications. You must use this object in conjunction with a Defrost Initiation object if used as a stand-alone device.
 Refrigeration Saturation Properties	Calculates thermodynamic properties for the specific refrigerant in use. Depending on the refrigerant type, pressure, and transformation type values, the object retrieves the temperature value of the isothermal curve that crosses the specified Saturated Points Line at the given pressure. Available saturated lines are the Saturated Liquid (Bubble) and Saturated Vapor (Dew). This object maps the Pressure-Enthalpy diagrams of the most common refrigerants.

### Unit Conversion Objects

Table 15 displays the Unit Conversion objects included in FX Builder.

**Table 15: Unit Conversion Objects**



Unit Conversion Object Icon	Description
 SNVT Hvac Status Generator	Creates the SNVT_hvac_status (required in the LONWORKS Space Comfort Controller Profile).
 UNVT_logic to SNVT_state	Converts UNVT_logic flags into a SNVT_state variable type (required in various LONMARK® Profiles).
 SNVT_state to UNVT_logic	Converts a SNVT_state variable type into UNVT_logic flags.
 Enumeration to UNVT_logic	Converts an enumeration value into UNVT_logic flags.
 SNVT_switch to UNVT_logic	Converts a SNVT_switch into UNVT_logic and reverse.
Continued on next page . . .	

Unit Conversion Object Icon (Cont.)	Description
 SNVT_lev_disc to SNVT_switch	Converts a SNVT_lev_disc (used mostly in Refrigeration Profiles) into SNVT_switch and reverse. Both conversions can be performed at the same time.
 Convert Format	Converts any value into a defined format.
 SNVT Chiller Status Generator	Creates the SNVT_chlr_status (required in the LONWORKS Chiller Profile).

### ***Extension Modules Objects***

Table 16 displays the Extensions objects included in FX Builder.


**Table 16: Extension Modules Objects**

Extension Modules Object Icon	Description
 XT9100	Configures the extension module XT91D00 and the expansion modules XP91D0x for interaction with the application.
 Gateway	Provides the supervisory interface between the FX16 Master Controller or MD20 Master Display and N2 Open devices. This object manages up to 255 inputs and 32 outputs. This object defines the network address, the data points to read and write to and from connected N2 devices. This object can also enable and disable the communication to the connected devices.

### ***Network Sensor Objects***

Table 17 displays the Bus Sensor objects included in FX Builder.

**Table 17: Network Sensor Objects**

Network Sensor Object Icon	Description
	Configures the Network Room Module (NRM) for interaction with the application.

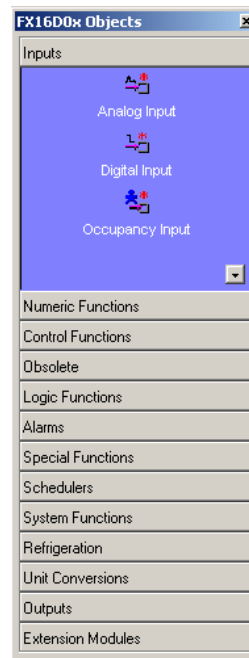
## Adding Application Objects

You can locate application objects in the Objects toolbar. The objects are organized in folders.

To add application objects:

1. In the FX Builder Application Editor, select View > Object Basket to display the Object choices (Figure 60).

**Note:** You can also click the Show Object Basket icon  on the toolbar.



**Figure 60: FX Builder Objects Toolbar**

2. Click the object you want.
3. Position the mouse on the Application Editor canvas where you want to position the object and click again. The object is added to the Application Editor canvas.

### Configuring Standard Application Objects

Each application object contains a data sheet describing its operation, connectable references, and attributes. To view the object data sheet, right-click the object and select View Data Sheet.

Most objects contain editable attributes that allow you to configure the exact operation of the object.

To configure a standard application object:

4. In the FX Builder Application Editor, click on the blue, right-facing arrow at the bottom of the object icon. An attribute editor window appears below the object block (Figure 61).
5. Click on the desired attribute field and edit as needed. You can close the window by clicking the arrow again.

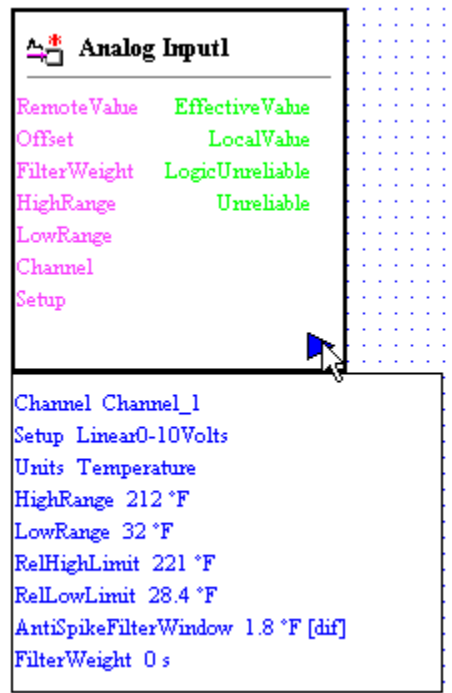


Figure 61: Editing Object Attributes

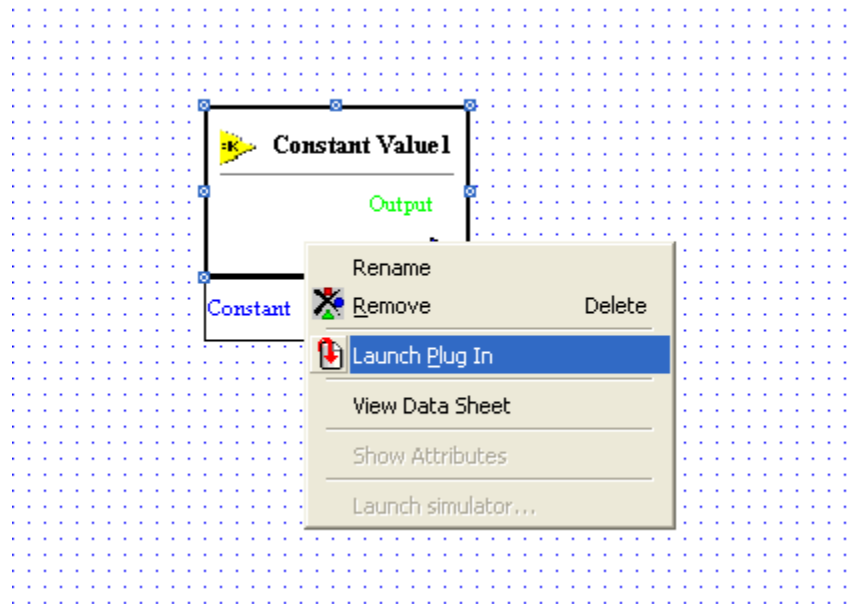
### Configuring the Constant Value Object

The Constant Value object is configured slightly differently than a standard object. You can expose the value attribute by clicking the blue, right-facing arrow at the bottom of the object; however, to set the data type of the constant value output, use the Constant Value object configuration plug-in.

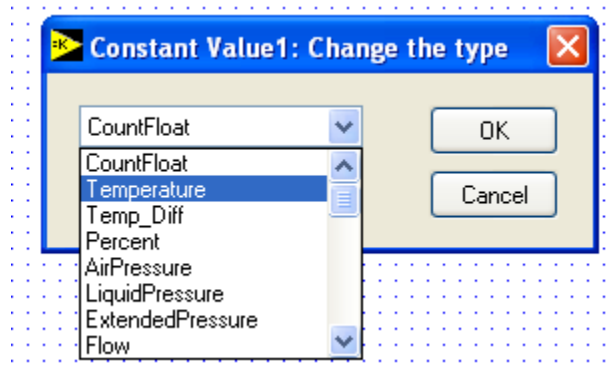
To configure the constant value object:

1. Right-click on the Constant Value object and select Launch Plug In (Figure 62). The Constant Value configuration plug-in appears (Figure 63).





**Figure 62: Launching Constant Value Configuration Plug-in**



**Figure 63: Changing the Constant Value Type**

2. Choose the desired data type and click OK.

### ***Configuring the Gateway Object***

The Gateway object allows the MD20 Master Display or FX16 Master Controller to supervise and monitor a network of N2 Open (including FX controllers with an N2 Open card) and N2 System 91 devices (DX-9100 and TC-910x). Through the gateway object, the master device reads, interprets, stores, and forwards the data points coming from N2 Open and N2 System 91 devices.

The read values are made available to the application running in the master device through the input and output references of the Gateway object.

The Gateway object can manage up to **255** inputs and **32** outputs and allows you to define the network address, the data points that the MD20 Master Display or an FX16 Master Controller has to read and write to and from connected N2 devices. The Gateway object can also enable or disable the communication toward the connected devices.

The maximum number of Gateway objects supported in an application is **32**. However, for an acceptable performance of the network, do not configure the Gateway objects in such a way that more than 350 inputs/outputs are polled or written in one poll cycle.

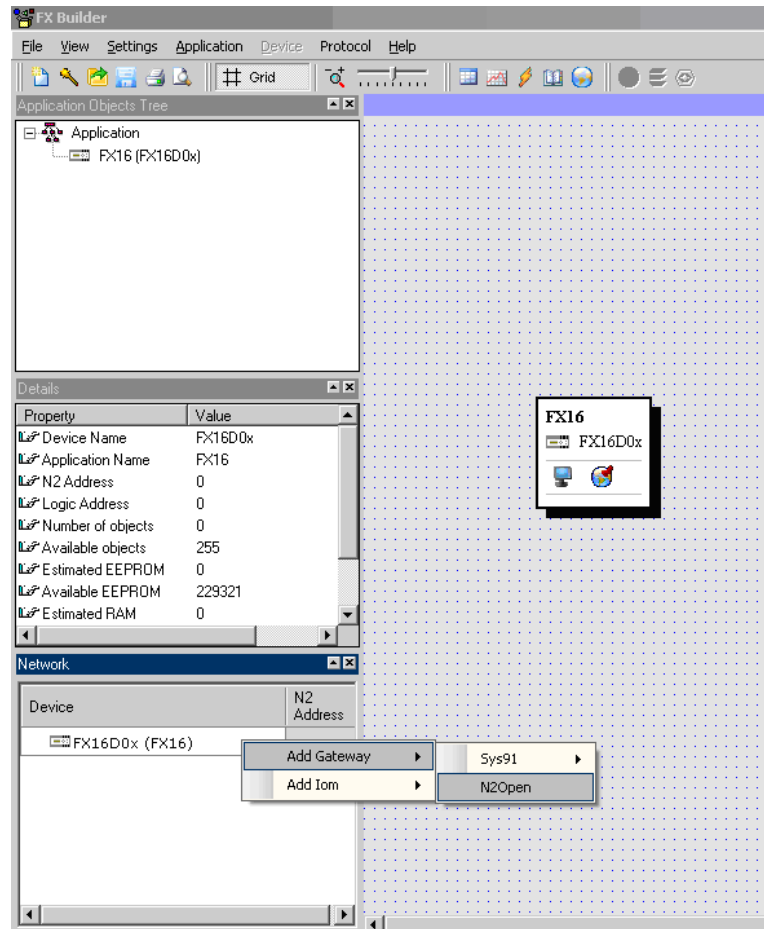
The Gateway object requires more involved configuration than standard application objects.

<p><b>IMPORTANT:</b> Avoid repeated writes on the Electrically Erasable Programmable Read-Only Memory (EEPROM). The FX05, FX06, FX07, and FX14 controllers and System 91 devices have EEPROM and repeated writes may disable the controller.</p>
--

## Configuring the Gateway Object for an N2 Open Device

To configure the Gateway object for an N2 Open device:

1. In the Network View, right-click the Device and select Add Gateway > N2 Open from the Add Gateway menu.

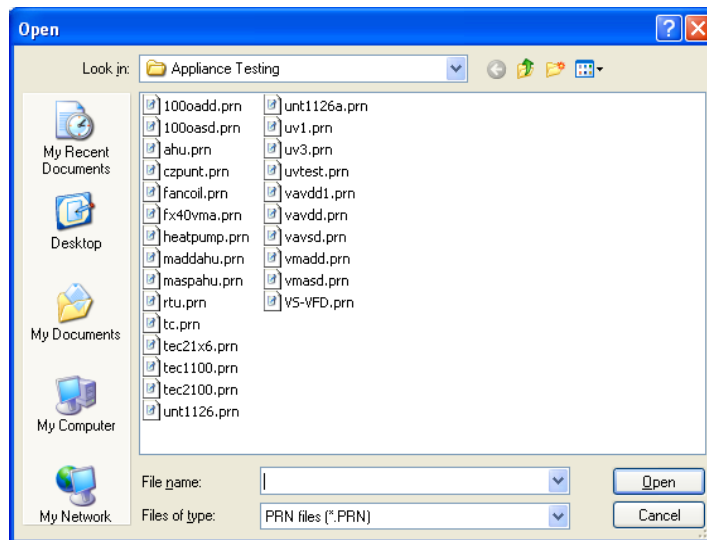


**Figure 64: Adding a Gateway for an N2 Open Device**

A file chooser window appears (Figure 65) allowing you to identify the N2 Print File associated to the N2 Open device. The N2 Print File lists all available analog inputs, analog data floats, analog data integers, binary inputs, and binary data points associated with the N2 Open device.

2. Select the N2 print file (\*.prn) for the N2 device you want to add to the Gateway and click Open.

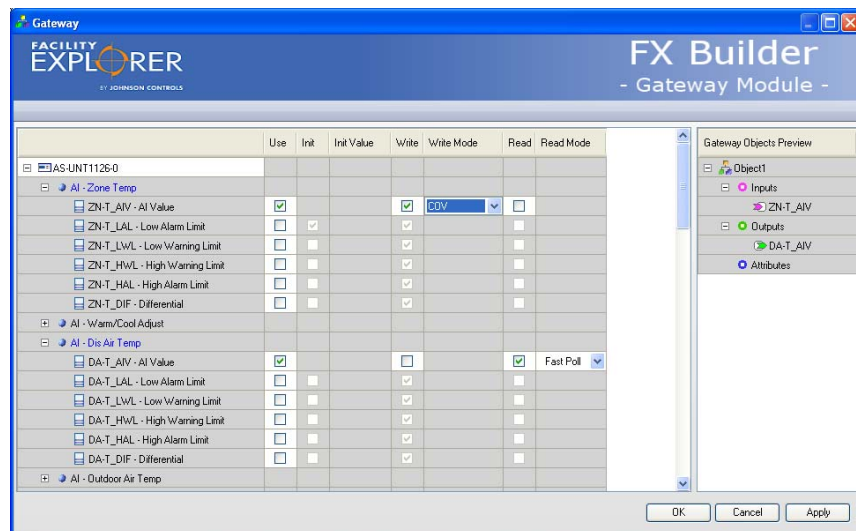
The Gateway configuration plug-in appears (Figure 66). The Gateway configuration plug-in is a table listing all of the N2 points discovered from the Print File.



**Figure 65: Selecting Print File**

- Expand the N2 points to expose their attributes.

Check boxes, data fields, and selector boxes appear, allowing you to configure how the point attributes are mapped to the application.



**Figure 66: Gateway Configuration Plug-In (N2 Open Device)**

- To expose an N2 point attribute to the application, click the check box in the Use column.
- To set an initial value for a point attribute, check the box in the Init column, and set the initial value in the Init Value column.
- To make an N2 point attribute writable (input reference) in the application, click the check box in the Write column, and set the Write Mode field to:
  - Change of Value (COV) - send write command when value changes (analog or binary)

- slow writing - send write command every 10 polls (volatile points only)
- fast writing - send write command on every poll (volatile points only)

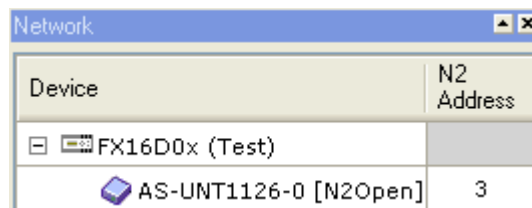
**Note:** The FX05, FX06, FX07, and FX14 devices use permanent parameters stored in the EEPROM of the device. The Gateway object interprets these parameters as inputs and allows you to choose a polling mode. We highly recommended that you choose the COV setting for those permanent parameters because continuous writing of the EEPROM memory causes permanent damage to the device.

7. To make an N2 point attribute readable (output reference) in the application, click the check box in the Read column and set the Read Mode field to:

- Change of State (COS) - use N2 Open COS poll to pick up changes (only works for N2 Open BI points)
- fast poll - read on every poll
- slow poll - read on every 10 polls

The Gateway Objects Preview window shows how the Gateway object appears in the Application Editor canvas once you exit the Gateway configuration plug-in. Use this feedback make sure you are configuring the Gateway Object according to your requirements.

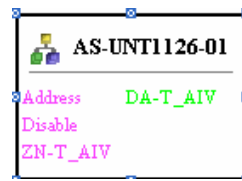
8. After you add and configure all desired N2 point attributes, click Apply and then click OK. The FX Builder main screen appears, and the N2 device you added via the Gateway object appears in the Network View.



**Figure 67: N2 Device in Network View**

9. If necessary, change the N2 address to match the actual N2 address of the slave N2 device.

The configured Gateway object appears in the first level of the Application Editor. The N2 point attributes you added are now exposed as connectable references of the Gateway object. You can connect inputs and outputs to them, expose them to the application point profile (allowing trends and events to be added), and add them to the user interface configuration of the master device.



**Figure 68: Gateway Object Interface (N2 Open Device)**

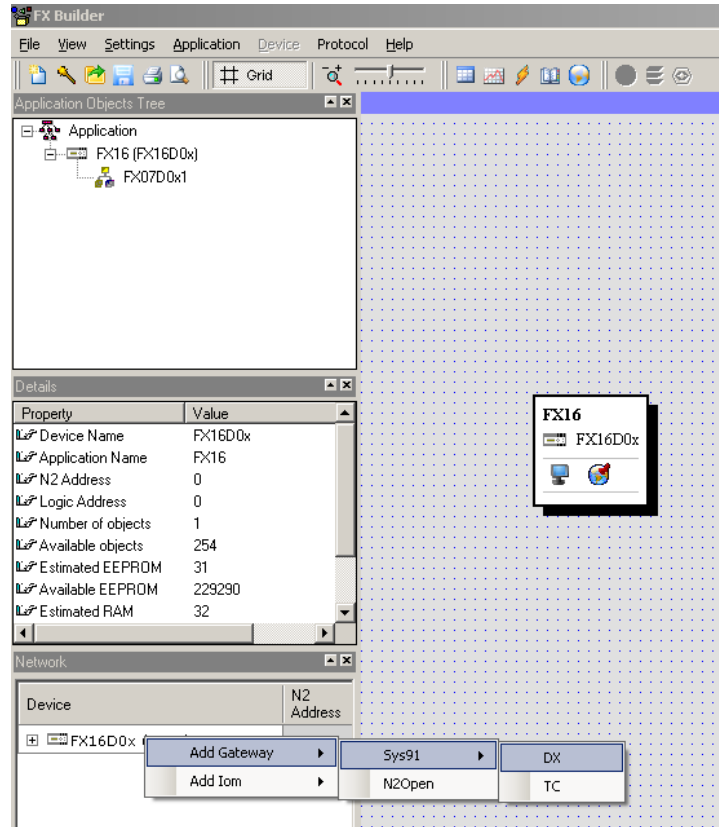
By default, the Gateway object adds two additional inputs:

- **Address** - used to modify the address via supervisory system.
- **Disable** - used to enable/disable the communication with the connected device.

## Configuring the Gateway Object for a System 91 Device

To configure the Gateway object for a System 91 device:

1. In the Network View, right-click the device.
2. From the Sys91 menu, select Add Gateway > Sys91 > DX or TC (Figure 69). The Gateway configuration plug-in appears. The Gateway configuration plug-in is a table that lists the System 91 programmable modules and points.



**Figure 69: Adding a Gateway for a System 91 N2 Device**

3. Expand the System 91 modules to expose their point attributes (Figure 70).

Check boxes, data fields, and selector boxes appear, allowing you to configure how the point attributes are mapped to the application.

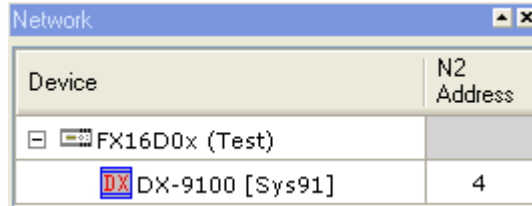




The Gateway Objects Preview window shows how the Gateway object appears in the Application Editor canvas once you exit the Gateway configuration plug-in. Use this feedback to make sure you are configuring the Gateway Object according to your requirements.

8. After you add and configure all desired System 91 point attributes, click Apply and then OK.

The FX Builder main screen appears, and the System 91 device you added via the Gateway object appears in the Network View.

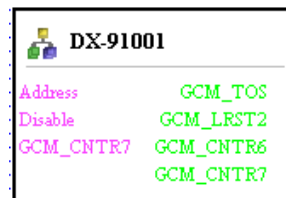


Device	N2 Address
FX16D0x (Test)	
DX-9100 [Sys91]	4

**Figure 71: System 91 Device in Network View**

9. If necessary, change the N2 address to match the actual N2 address of the slave System 91 device.

The configured Gateway object appears in the first level of the Application Editor. The System 91 point attributes you added are now exposed as connectable references of the Gateway object. You can connect inputs and outputs to them, expose them to the application point profile (allowing trends and events to be added), and add them to the user interface configuration of the master device.



DX-91001	
Address	GCM_TOS
Disable	GCM_LRST2
GCM_CNTR7	GCM_CNTR6
	GCM_CNTR7

**Figure 72: Gateway Object Interface (System 91 Device)**

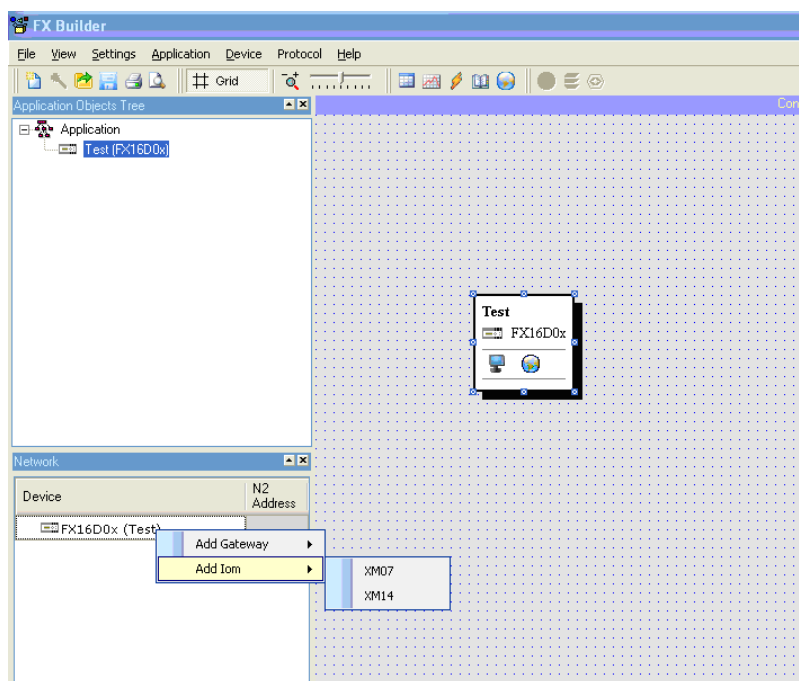
By default, the Gateway object adds two additional inputs:

- **Address Input** - used to modify the address via supervisory system.
- **Disable Input** - used to enable/disable the communication with the connected device.

## Configuring an IOM Object

To configure an IOM object:

1. In the Network view, right-click the device. The Add Iom menu appears (Figure 73).



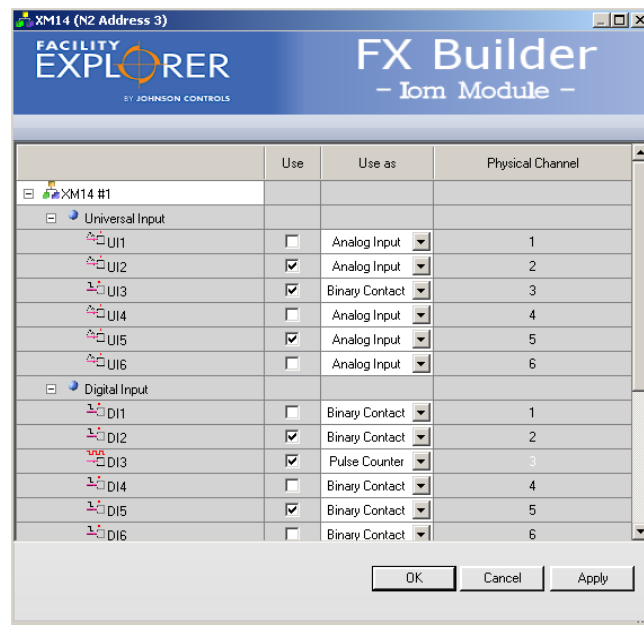
**Figure 73: Adding an IOM Device**

2. From the Add Iom menu, select the desired Extension Module (XMxx). The Iom Module configuration plug-in appears (Figure 74).



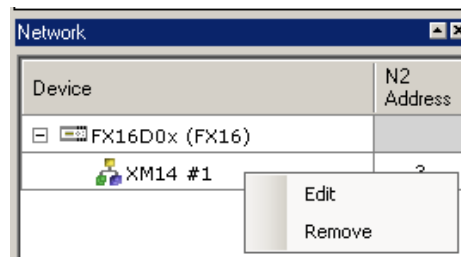
**Figure 74: IOM Module Configuration Plug-in**

3. Click the plus sign (+) to expand the Input and Output categories (Figure 75).




**Figure 75: IOM Module Configuration Plug-in with I/Os Expanded**

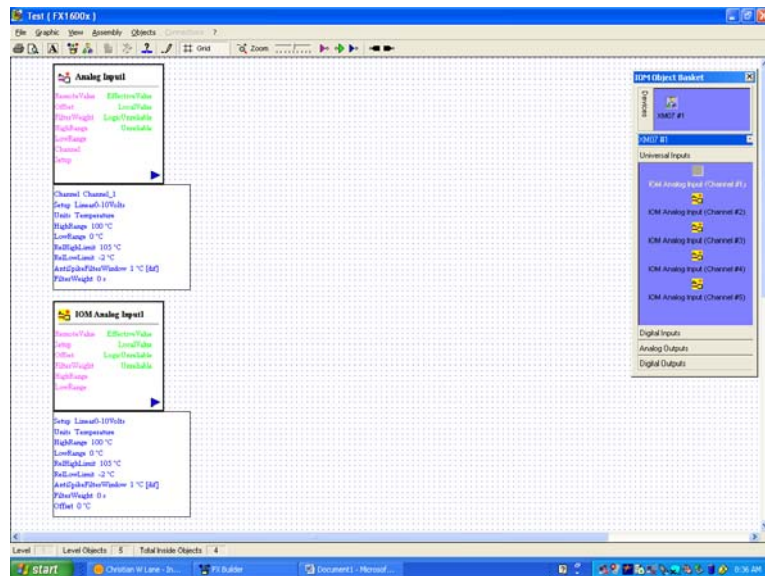
4. Select the check box in the **Use** column for each desired Input and Output Physical Channel (Figure 75). Use the scrollbar to view additional I/O Physical Channels.
5. Select the Universal Input type in the **Use as** column (either Analog Input or Binary Contact).
6. Select the Digital Input type in the **Use as** column (Binary Contact or Pulse Counter).
7. Click OK to save the selections and return to the FX Builder main screen.



**Figure 76: System 91 Device in Network View**

**Note:** In the Network area of the Main Screen, expand the plus sign next to the device to view the XMxx device(s). Right-click the XMxx device and select Edit to launch the IOM Module configuration plug-in, or Remove to delete the IOM module.

8. Double-click the FX device in the Control View. The configured IOM object appears in the first level of the Application Editor.
9. Click the Show IOM Object Basket icon on the toolbar . The IOM Object Basket appears (Figure 77).



**Figure 77: IOM Object Basket in Application Editor Window**

The IOM Object Basket contains the Input and Output objects created from the selections you made in the Iom Module configuration plug-in (see Figure 75). The IOM objects differ from other objects in the following important ways (Figure 78).

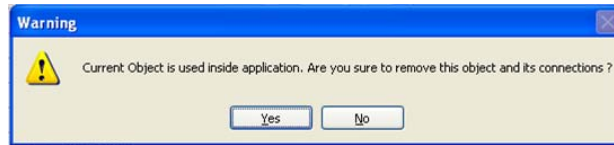
- The channel number of the IOM object is determined by the specific I/O object you bring to the canvas. Note the channel number in the description of each object in the IOM Object Basket. These channels were designated by the selections you made in the Iom Module plug-in (see Figure 75).
- You cannot use more than one instance of an XM object. Once used, the object appears dimmed in the XM object basket.
- Multiple XM devices can be created for a single object. Each XM device appears in the Devices field of the IOM Object Basket.



**Figure 78: IOM Object Basket**

10. Click the Device and the desired object.
11. Position the mouse on the Application Editor canvas where you want to position the object and click again. The object is added to the Application Editor canvas.

**Note:** If you exit the Iom Module configuration plug-in and attempt to deselect an object that is already connected in your application, you get a **Current Object is used inside application** warning (Figure 79).



**Figure 79: Current Object is used Inside Application Dialog Box**

### Configuring the XT9100 Object

The XT9100 object allows you to expand the input and output capabilities of the target controller by adding XT Extension and XP Expansion modules. The XT9100 object requires more involved configuration than standard application objects.

To configure an XT9100 object:

1. Right-click the Gateway object in the canvas and select Launch Plug In (Figure 80). The XT9100 window appears (Figure 81).

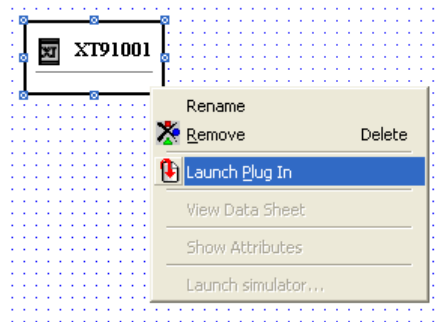


Figure 80: Launching XT/XP Configuration Plug-in

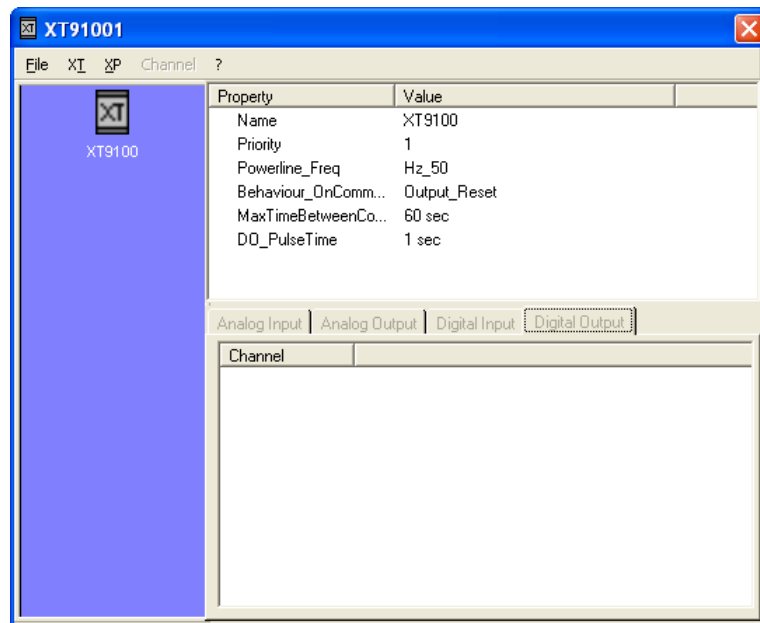
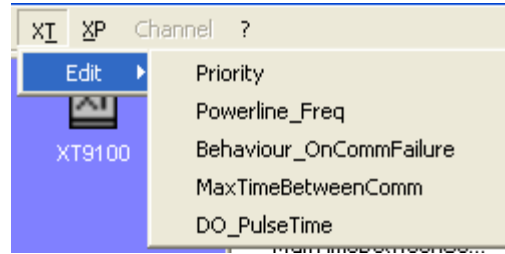


Figure 81: XT9100 Configuration Plug-in

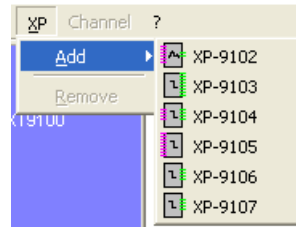
2. Select Edit from the XT menu.
3. Select the parameter to adjust. You can adjust the following communication parameters (Figure 82):
  - priority
  - powerline frequency
  - behaviour on communication failure
  - maximum time between communication

- Digital Output (DO) pulse time



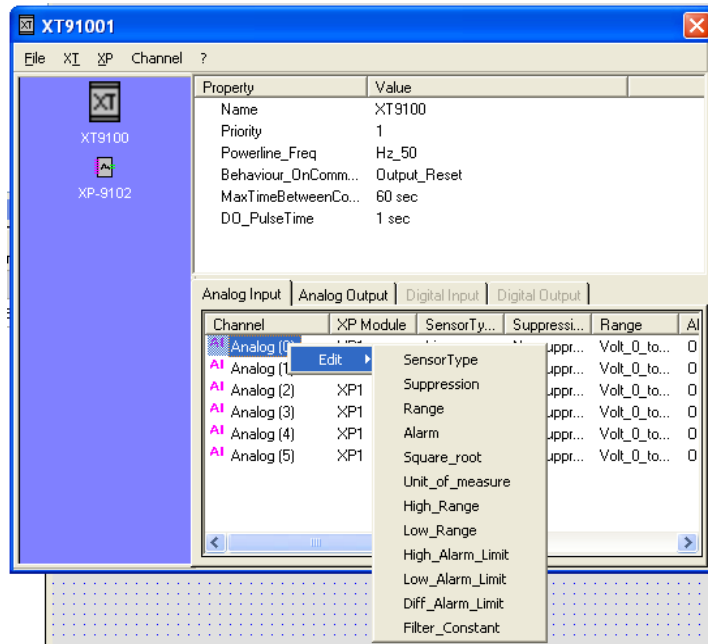
**Figure 82: Setting XT Parameters**

4. To add an XP module, select Add from the XP menu and select the desired XP module (Figure 83). The XP module appears on the window.



**Figure 83: Adding XP Modules**

5. To configure an XP input/output channel, right-click the channel and select Edit. A list of attributes appears (Figure 84).
6. Select the desired attribute. The XP attributes you can edit include:
  - Sensor Type
  - Suppression
  - Range
  - Alarm
  - Square Root
  - Unit of Measure
  - High Range
  - Low Range
  - High Alarm Limit
  - Low Alarm Limit
  - Differential Alarm Limit
  - Filter Constant
  - Type
  - Contact Type
  - Prescaler






**Figure 84: Editing Input/Output Channel Attributes**

### Connections

Every object has input and output references you connect to form the control algorithm. In addition, you can connect these object references to application inputs, outputs, and attributes, making them available for inclusion into the application point profile of the device.

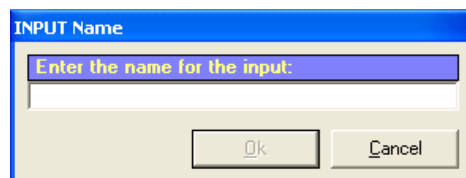
### Adding Inputs, Outputs, and Attributes to the Application Editor Canvas

You can connect object references to application inputs, outputs, and attributes, making them available for the application point profile of the device. These points include the following:

-  = Input
-  = Output
-  = Attribute

To add an input, output, or attribute to the Application Editor canvas:

1. Right-click the canvas and select Insert Input, Insert Output, or Insert Attribute. The Edit Name window appears allowing you to enter the name of the attribute (Figure 85).



**Figure 85: Entering Name of Input, Output, or Attribute**

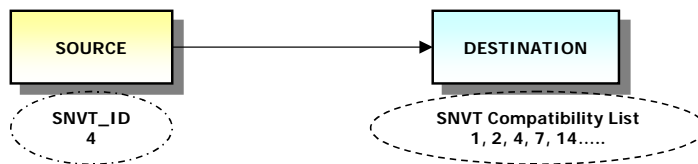


2. Enter the name and click OK.

**Note:** Alternatively, you can double-click on object reference. A corresponding input or output is automatically created and connected to the object reference.

### Connection Rules


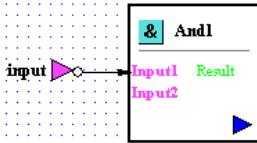
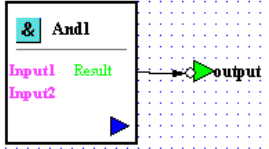

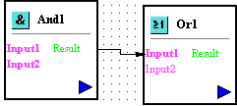
To ensure that object references are connected appropriately, each object reference contains a list of compatible data types. FX Builder uses the LONWORKS Standard Network Variable Types (SNVTs) to define its data types. For example, SNVT 105 temp\_p is used to define an absolute temperature. The exact data type of the application point is defined inside the application points plug-in. To make a connection from a source point to a destination point (or multiple destination points), the date types must be compatible. The SNVT Compatibility List of the destination must contain the SNVT ID of the source. See Figure 86.



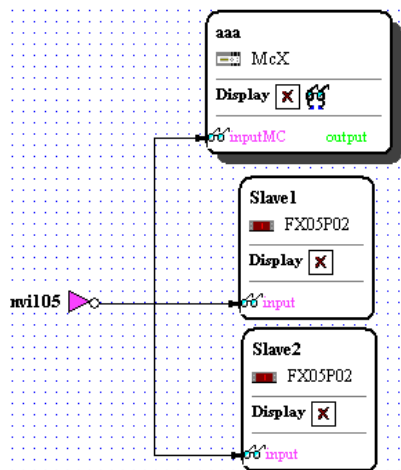
**Figure 86: Source and Destination Compatibility**

In addition to compatibility, Table 18 describes additional connection restrictions.

**Table 18: Application Points Connection Matrix**

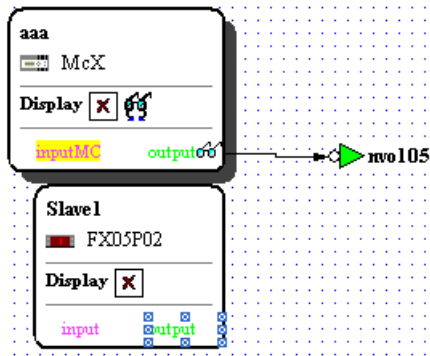
Destination Source	Application Output	Object Inputs	
Application Input	 No		
Object Output		Same Object 	Other Object 

**Note:** In some cases, you can connect a unique source to multiple destination points simultaneously. For example, you can connect an application point input to different object inputs (Figure 87).



**Figure 87: Source Point to Multiple Destination Points**

You can connect a destination point to only one source as shown in Figure 88. For example, you can connect an application output point to only one object output.



**Figure 88: Destination Point to Only a Source Point**

## Making Connections

You can use two methods to make connections.

To make a connection:

- Click on the source and drag it to the destination.

When you click on a source, all destinations with compatible data types are highlighted allowing you to easily identify potential destinations. When you click on input, output, or attribute icons, click on the small circle at the apex of the icon's triangle.

- Click on the source and drag it to an empty space on the canvas.

A Fast Link window appears. This window allows you to check all desired destinations. This Fast Link feature is helpful when you connect a source to multiple destinations, even in different assemblies. You also do not have to search for the destination points within a large complex application (Figure 89).

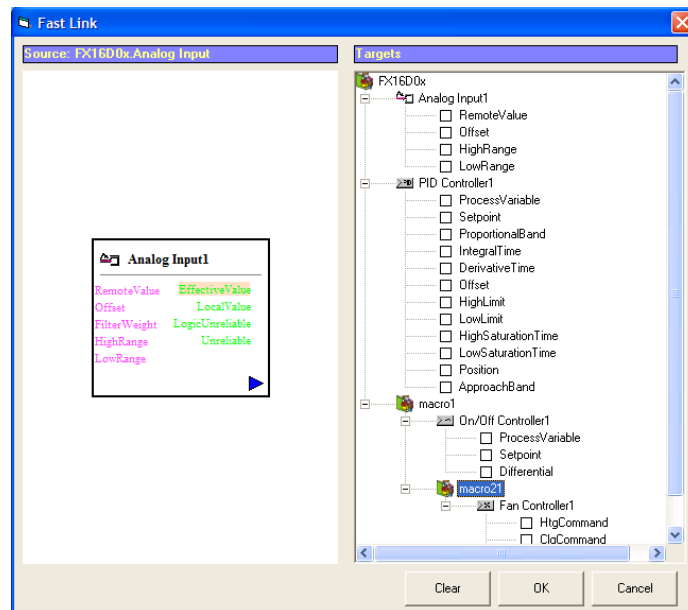


Figure 89: Fast Link Connection

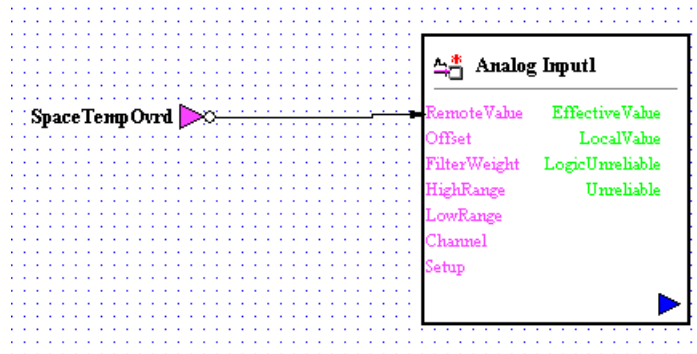


Figure 90: Successful Connection

## Continuations

As you add more objects and connections, your canvas may become cluttered with connection lines, making it difficult to visualize the application. Use a feature called Continuations to reduce the number of connection lines on your canvas.

Continuations involve a **parent** and a **child** directly connected, except that no connection line between them is visible. You can move the child continuation to various locations in the application canvas. A parent may have multiple child continuations associated to it.

### Creating a Continuation

To create a continuation:

3. To create a continuation parent, right-click on an empty space in the canvas and select Insert Continuation Parent (Figure 91). The New Continuation name window appears (Figure 92).

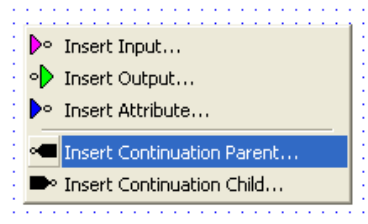


Figure 91: Insert Continuation Parent

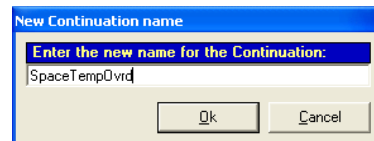


Figure 92: New Continuation Name

**Note:** To add a continuation parent, you can also select Insert Continuation Parent from the toolbar and drag it to the canvas.

4. Enter the name and click OK. You can now create the continuation child.
5. Right-click an empty space in the canvas and select Insert Continuation Child (Figure 93). The Connect Continuation window appears listing the available Parents (Figure 94).

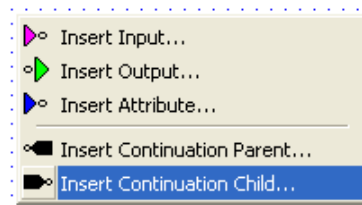
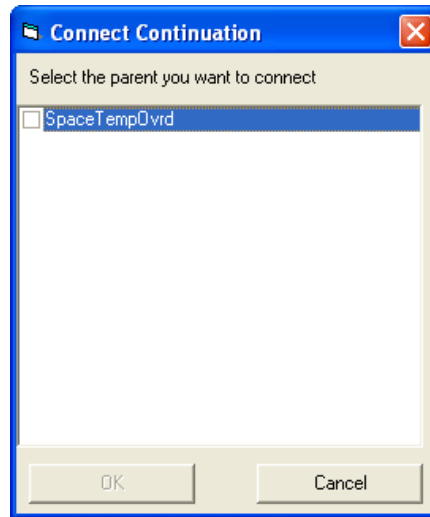


Figure 93: Insert Continuation Child

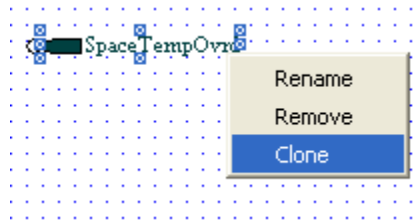


**Figure 94: Insert Continuation Child**

**Note:** To add a continuation child, you can also select Insert Continuation Child from the toolbar and drag it to the canvas.

6. Select the desired Parent you want to connect and click OK.


**Note:** To add a continuation child, you can also right-click the continuation parent you want and select Clone.



**Figure 95: Inserting a Continuation Child via Cloning**

### ***Displayable Point***

A displayable point is one that appears on the controller's user interface. Once a point is made displayable, the Display plug-in includes the point in the list of available points to add to the display. A

displayable point has the following icon: .

You can display all points to the device application profile.

## Making a Point Displayable

To make a point displayable:

- In the Application Editor, right-click the point and select Set Displayable On (Figure 96).

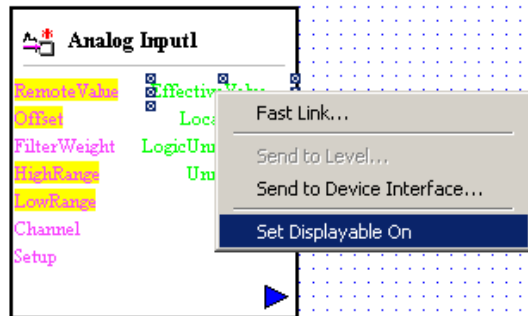


Figure 96: Setting Displayable On

## Assemblies

Assemblies (or Macros) are small sections of application code that you save in a separate file (.mcx). You can load predefined assemblies into applications, which provide the following benefits:

- You can reuse code from one application to another.
- Note:** You can load an assembly into an application **only** if it is targeted to the same device and firmware version.
- You can break down your applications into smaller, more manageable pieces. Using assemblies makes applications easier to create, change, test, and print.

## Creating Assemblies

To create an assembly:

1. From the Assembly menu, select New. The Assembly Info window appears.

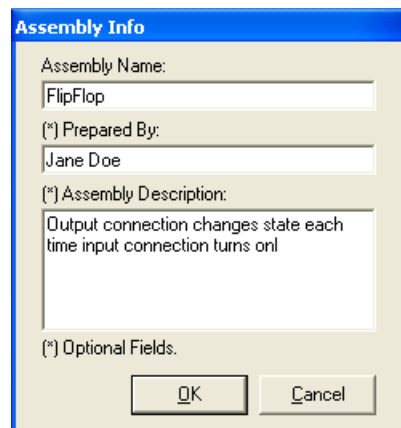


Figure 97: Assembly Info Window

2. Enter the following information and click OK.

- Assembly Name
- Prepared by (optional)
- Description (optional)

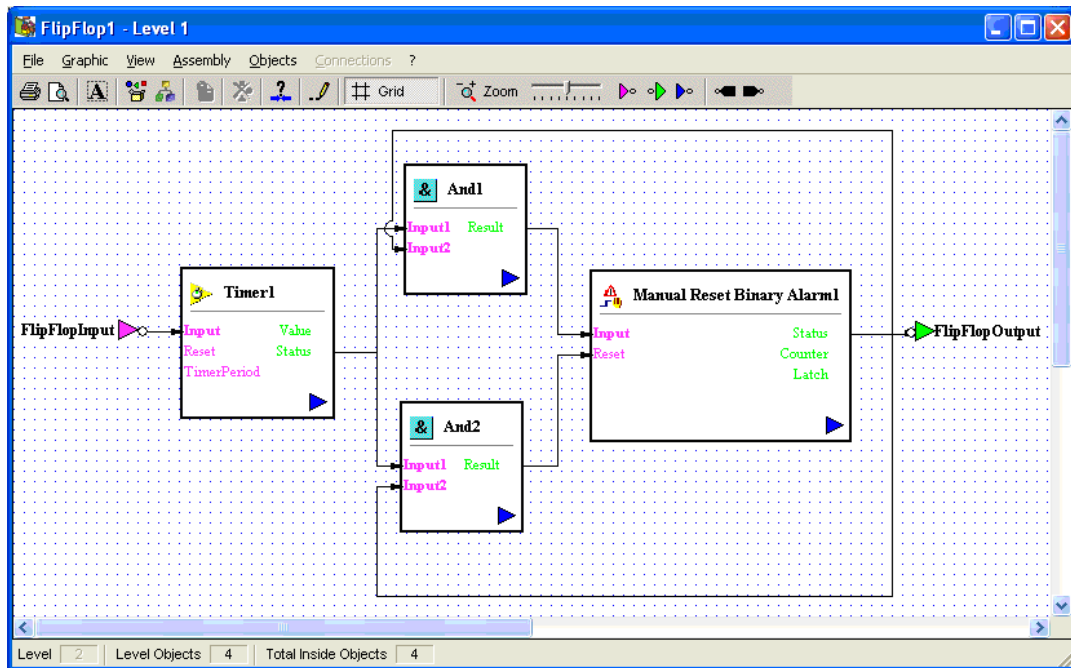
An empty Assembly module appears on the Application Editor canvas (Figure 98).




**Figure 98: Newly Added Assembly**

3. Double-click on the new assembly. Once inside the Assembly, you use the same techniques described in the following sections:
  - *Applying Application Objects*
  - *Configuring Standard Application Objects*
  - *Making Connections*
  - *Adding Inputs, Outputs, and Attributes to the Application Editor Canvas*

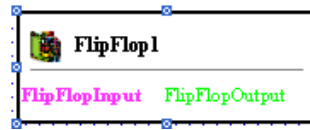
Figure 99 displays a finished assembly.



**Figure 99: Finished Assembly**

4. To save the assembly for future use, click Save As from the File menu.
5. Enter the file name and click OK.
6. Click  to exit the Assembly Application Editor.

The inputs and outputs of the assembly appear as connectable references on the assembly module (Figure 100). Now you can connect the assembly to other parts of your application (for example, to application objects, inputs, or outputs).



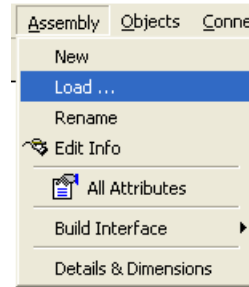
**Figure 100: Assembly Module**



## Loading Assemblies into an Application

To load an Assembly into an Application:

1. From the Assembly menu, select Load (Figure 101).



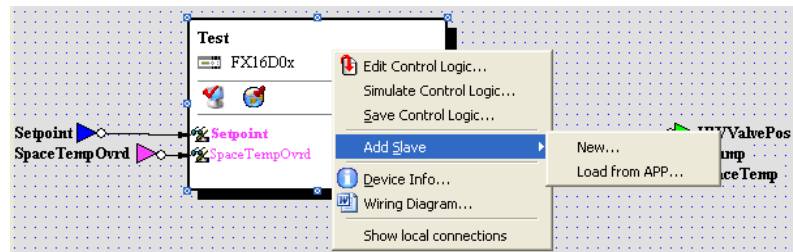
**Figure 101: Load Assembly**

2. Select the desired Assembly file and click OK.

## Creating a Distributed Application

To create a distributed application:

1. Right-click the device and select New from the Add Slave menu (Figure 102). The New Slave Device window appears (Figure 103).

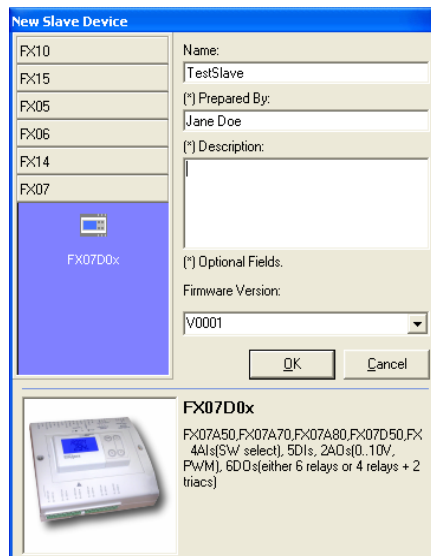


**Figure 102: Adding a Slave**

2. Select the target device. A brief description of the device appears on the bottom of the New Slave Device window (Figure 103).

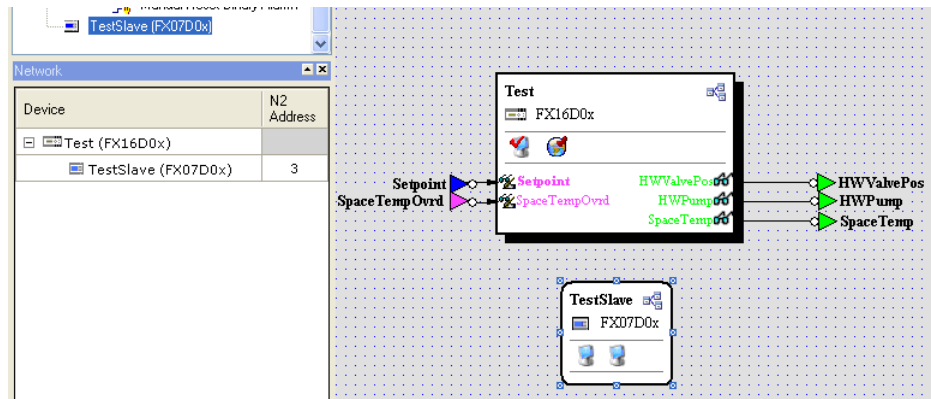
**Note:** For additional information, click the Data Sheet button to access a copy of the technical bulletin for the device.

3. Enter the following information:
  - Name (required) - the name of the slave application
  - Prepared by (optional)
  - Description (optional)
  - Firmware (required) - the firmware version of the targeted slave device. This information determines which objects and services are available in the application view.



**Figure 103: New Slave Device Window**

4. Click OK. The slave device object appears on the Control View canvas and on the Network view (Figure 104).



**Figure 104: Slave Device Added to Control View and Network View**

The slave device is automatically assigned a default N2 Address, which is identified in the Network view. This address is only applicable to slave devices and user interfaces wired to the master device's remote display and local link bus. Do not confuse this address with the supervisory N2 address of the master device, as the supervisory and local link buses are completely separate trunks.

**Note:** If desired, you can change the slave's N2 address (between 3 and 255). Click the N2 Address field and enter the new address.

At this point, you can create and edit the control algorithm for the slave device using the Application Editor.

## FX Builder Plug-ins

A plug-in is an add-on piece of software that enhances and extends FX Builder.

### ***Application Points Plug-in***

With the application points plug-in, you can do the following:

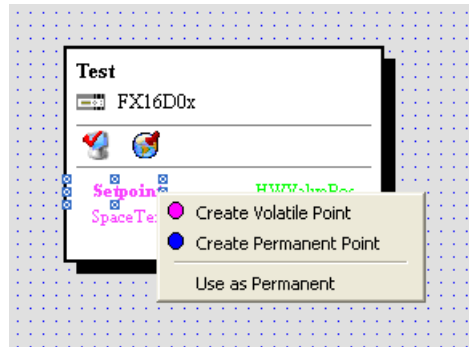
- edit application point details
- configure the default schedules
- enable events and trends

### Exposing the Application Object References to the Application Profile

Before using the application points plug-in, you must first expose your application object references to the application profile (create an associated application point).

To expose an application object reference as an application point in the application profile (Figure 105):




1. Right-click the object reference, and select the desired application point type.
  - **Create Volatile Point** - if selected, the application point loses its value on a power loss.
  - **Create Permanent Point** - if selected, the application point retains its value on a power loss.

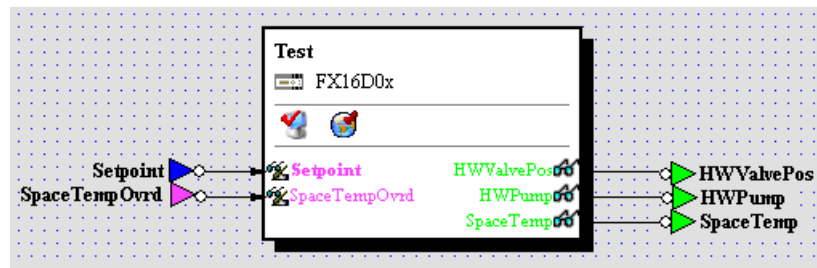


**Figure 105: Creating an Application Point**

2. Look at the colored arrows on the Control View canvas.

Once you select the appropriate application point type, the object reference appears in the Control View canvas with colored arrows:

-  = Permanent application point
-  = Volatile Input application point
-  = Volatile Output application point



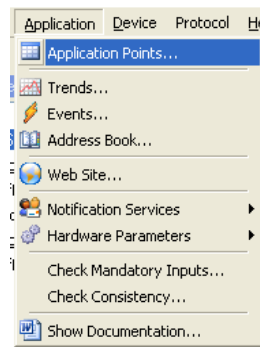
**Figure 106: Application Points Shown in Control View**

**Note:** You can also double-click the object reference. The volatile application point is automatically created and connected to the object reference. This method only creates a volatile point. To change the point to a permanent type, use the application point Plug-in.


### Launching the Application Points Plug-in

To launch the application points plug-in:

- From the Application menu, select application points (Figure 107).

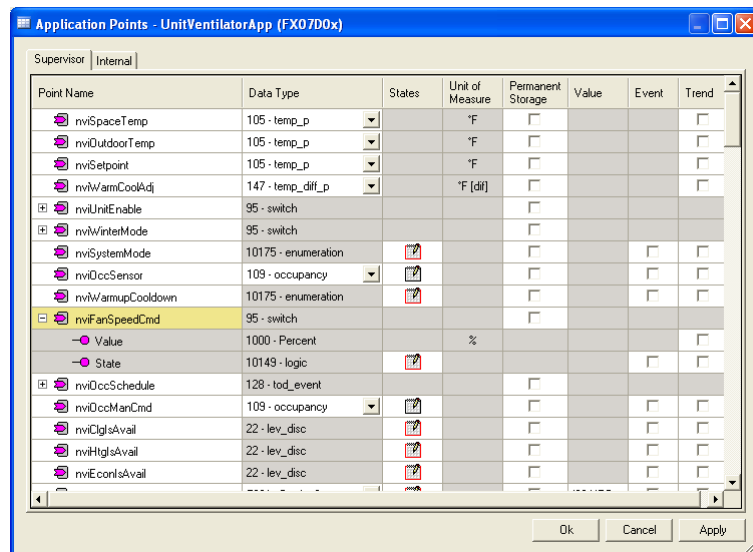


**Figure 107: Launching the Application Points Plug-in**

**Note:** You can also click the Application Points plug-in icon .

## Using the Application Points Plug-in

The application points plug-in lists all application points and allows you to configure application points, depending on the point type and the supported features. See Figure 108.

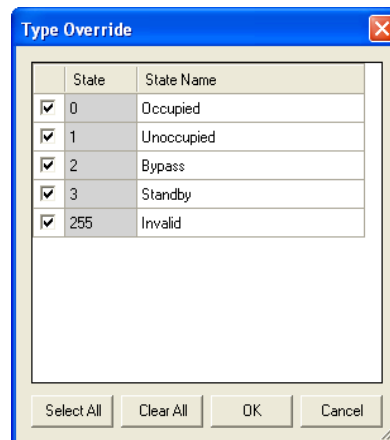


**Figure 108: Application Points Shown in Control View**

To use the application points plug-in:

1. In the Data Type column, select the data type from the list. Only compatible data types appear.
2. In the States column, select the desired enumerated point.

This allows you to define the state name that corresponds to the point's ordinal states. The Type Override window appears (Figure 109).



**Figure 109: Editing the State Name for an Enumerated Point**

3. Select one or more state names and click OK.
4. In the Permanent Storage column, select a check box for permanent and clear the check box for volatile.

5. If you selected Permanent Storage for a point, then you can enter a value for the point. Enter the default value for the point:

- On/Off Schedule
- Weekly Schedule
- Exception Schedule

For more information, see *Default Schedule*.

6. In the Event column, select the check box next to the points you want to enable events for.

7. In the Trend column, select the check box next to the points you want to enable trend logging for.

8. Click OK.

### Default Schedule

Use the application points plug-in to define the default Weekly Occupancy Scheduler, On-Off Time Scheduler, and Exceptions Day Calendar.

You can access the scheduler configuration plug-ins from the application points plug-in (Figure 110) in the **Value** column.

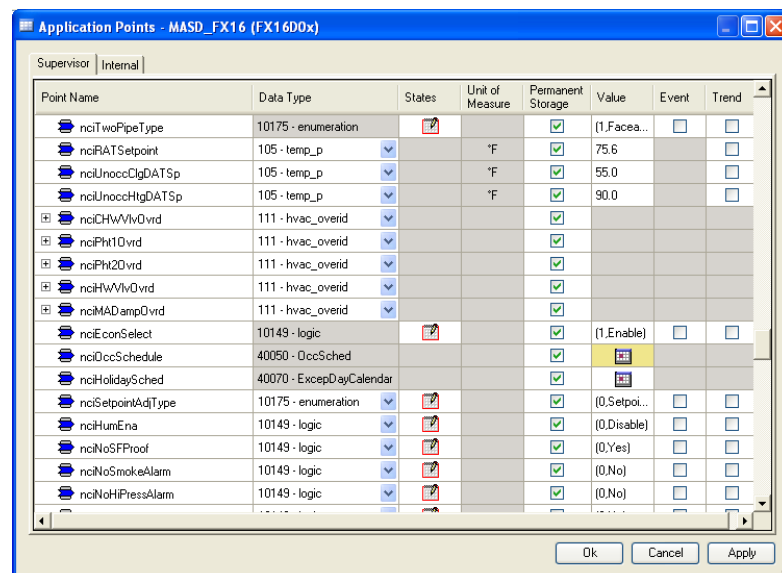



Figure 110: Location of Scheduler Configuration Plug-ins

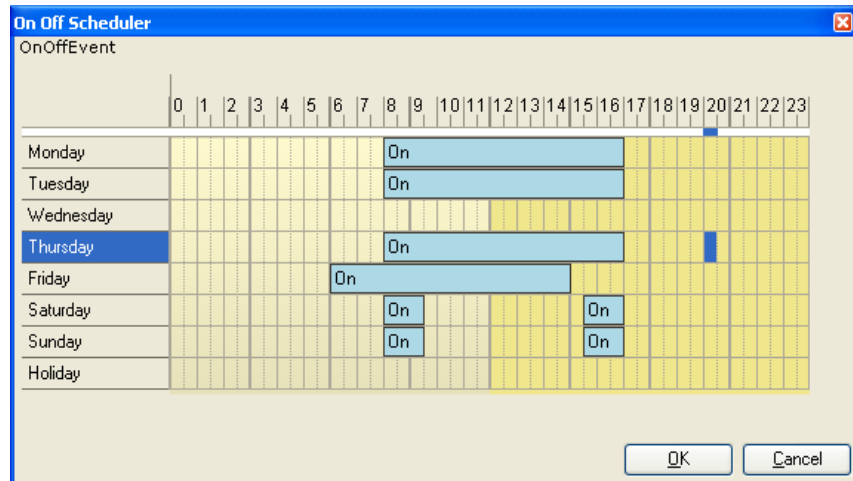
You can configure three types of schedulers in the application points plug-in:

- On/Off Scheduler
- Weekly Occupancy Scheduler
- Exception Days Calendar

### Defining the Default On/Off Scheduler

To define the default On/Off scheduler:

1. In the application points plug-in, click the  icon in the Value column. The On/Off Schedule window appears (Figure 111).




**Figure 111: On/Off Time Scheduler Configuration Plug-in**

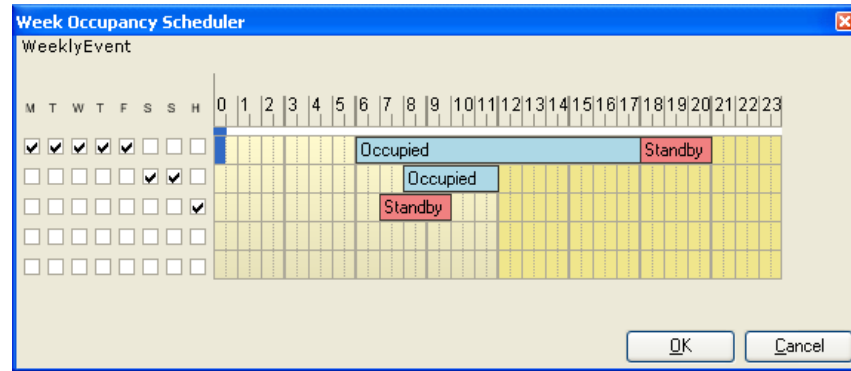
2. Drag the On times for each day of the week and the holiday (if used).

**Note:** The On/Off scheduler only allows 21 events per week, regardless if the week is normal or alternate.

## Defining the Default Weekly Occupancy Scheduler

To define the default weekly occupancy scheduler:

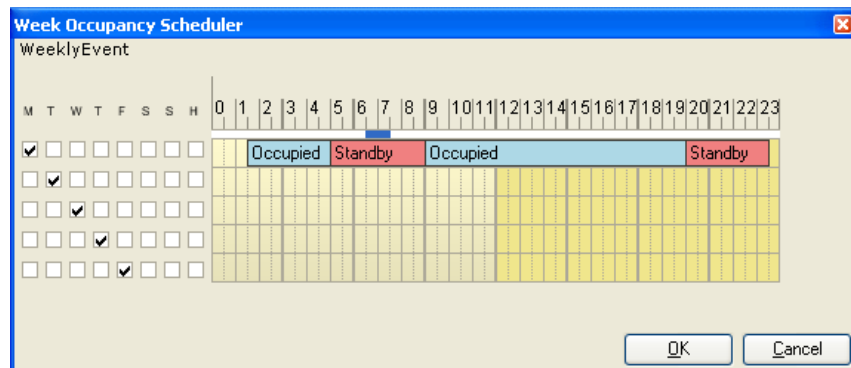
1. In the application points plug-in, click the  icon in the Value column. The Week Occupancy Schedule window appears (Figure 112).



**Figure 112: Weekly Occupancy Scheduler Configuration Plug-in**

2. Select the days of the week that have a common occupancy schedule.
3. Click the start time and drag the mouse to the end time for each day.
4. Right-click the highlighted time range and select the desired status (Occupied or Standby).

**Note:** The Weekly Occupancy Scheduler is limited to five groups with five events per group (for normal or alternate week). Each change of state (Figure 113) is considered an event:




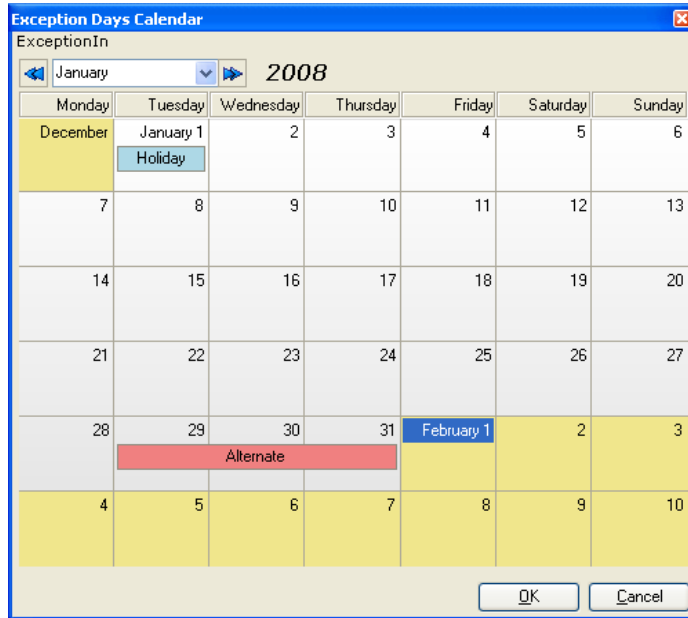
**Figure 113: Occupancy Scheduler Limitation**



## Defining the Default Exception Days Calendar

To define the default exception days calendar:

1. In the application points plug-in, click the  icon in the Value column. The Exception Day Calendar window appears (Figure 114).



**Figure 114: FX Builder Plug-ins to Configure ON-OFF Time Scheduler**

2. Go to the desired month.
3. Right-click the day you want, and select the desired status (Holiday or Alternate).

### ***FX Simulator***

FX Builder includes an application simulation feature called FX Simulator. FX Simulator recreates the same input and output behavior of the target hardware device and simulates the application.

The execution of the application in this environment is called **the simulation**. FX Simulator is application dependent because you can simulate the application in runtime before you download it to the target controller.

FX Simulator is also hardware dependent because, depending on the selected device, the simulator detects the input/output hardware channels.

## Launching FX Simulator

To launch FX Simulator, right-click the device block and select Simulate Control Logic (Figure 115).

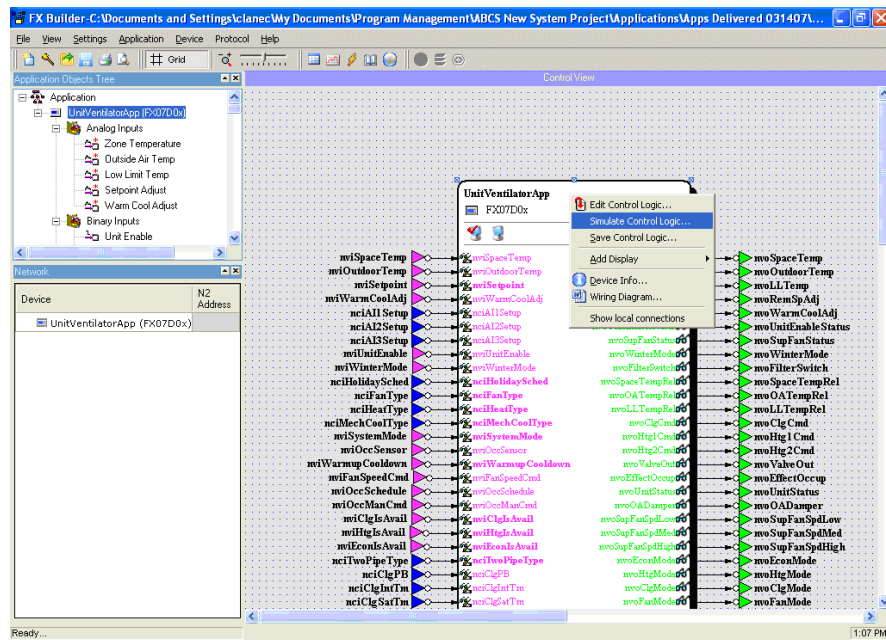


Figure 115: Launching FX Simulator

## FX Simulator Scope

FX Simulator allows you to simulate and test the following application components:

- device application
- macro assembly

**Note:** In case of a Distributed Application, FX Simulator does **not** simulate the entire application but only one device block at a time.

## FX Simulator Main Screen

The FX Simulator (Figure 116) consists of three sections:

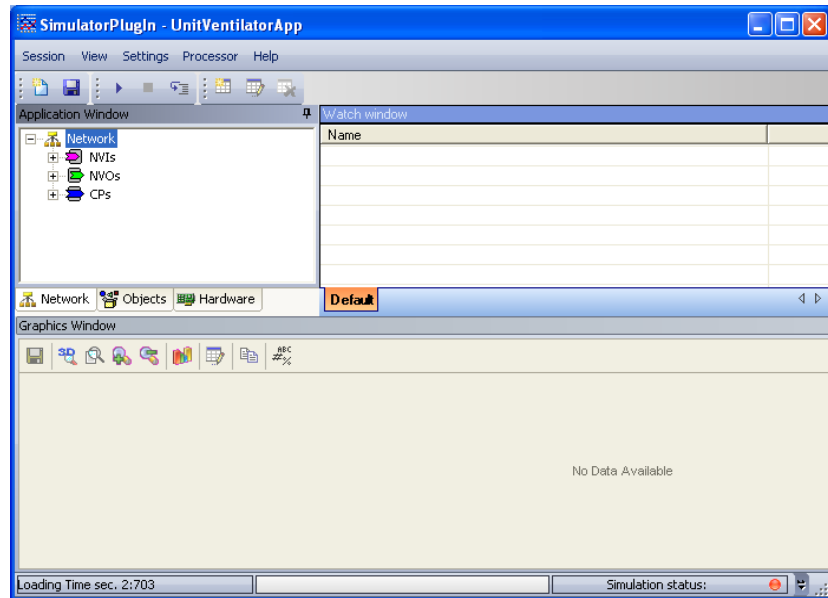


Figure 116: FX Simulator Main Screen

- **Application Window**

Use the Application Window to see the application in its three different sub-views:

- Network view (Figure 117)
- Objects view (Figure 118)
- Hardware view (Figure 119)

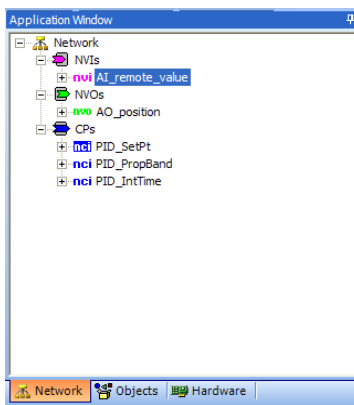


Figure 117: Network View

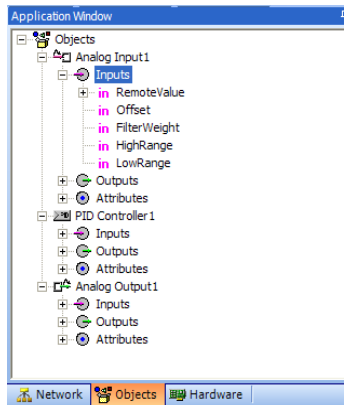


Figure 118: Objects View

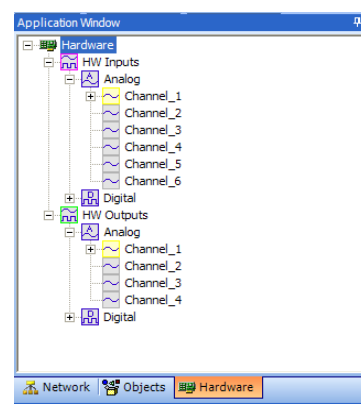


Figure 119: Hardware View

- **Watch Window**

Use the Watch Window to add the variables, points, and hardware channels to be viewed during simulation.

- **Graphics Window**

Use the Graphics Window to see a chart that shows the variables, points, and hardware channels defined in the Watch Window.

### Simulator Menus – Session Menu

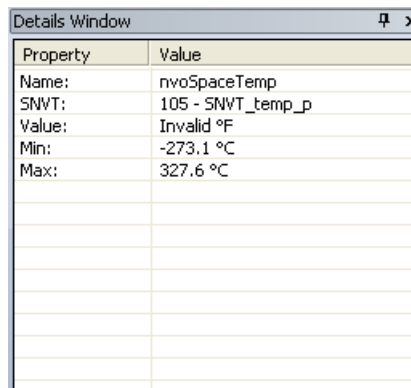
The Session menu contains the following:

- **New** - Starts a new simulation session.
- **Save** - Saves the current simulation to a file.
- **Exit** - Exits the FX Simulator.

### Simulator Menus – View Menu

The View menu contains the following:

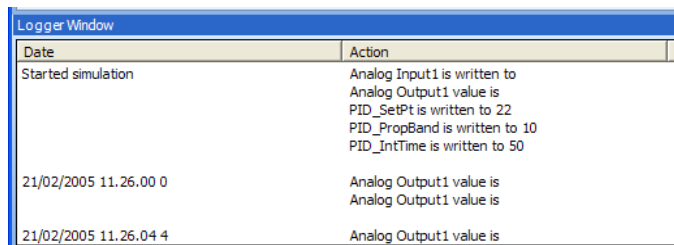
- **Details Window** - shows details of the selected component (Figure 120).



Property	Value
Name:	nvoSpaceTemp
SNWT:	105 - SNWT_temp_p
Value:	Invalid °F
Min:	-273.1 °C
Max:	327.6 °C

**Figure 120: Details Window**

- **Logger Window** - displays the simulation operations in a textual format (Figure 121).



Date	Action
Started simulation	Analog Input1 is written to Analog Output1 value is PID_SetPt is written to 22 PID_PropBand is written to 10 PID_IntTime is written to 50
21/02/2005 11.26.00 0	Analog Output1 value is Analog Output1 value is
21/02/2005 11.26.04 4	Analog Output1 value is

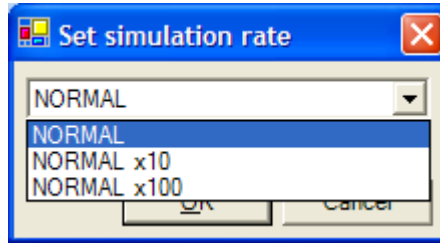
**Figure 121: Logger Window**

- **Bars** - enables or disables the selected toolbars.

## Simulator Menus – Settings Menu

The Settings menu contains the following:

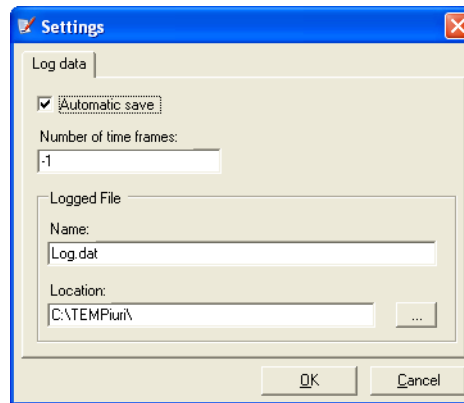
- **Simulation speed** - allows you to change the simulation speed from normal speed to 10 or 100 times faster (Figure 122).



**Figure 122: Set Simulation Speed Rate**

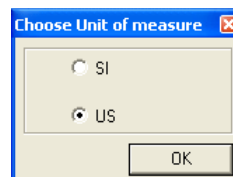
**Note:** Changing the simulation speed rate affects only the application iteration time (typically, one application iteration per 0.5 seconds).

- **Data logging** - allows you to automatically save the data logging to a file (Figure 123).



**Figure 123: Set Automatic Data Logging**

- **Units of Measure** - allows you to select the desired units of measure (SI [°C] or US [°F]) displayed in the simulator session (Figure 124).



**Figure 124: Units of Measure Setting**

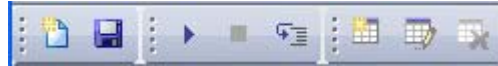
## Simulator Menus – Processor View

The Processor menu contains the following:

- **Run** - Starts the simulation.
- **Stop** - Stops the simulation.
- **Step** - Runs a step-by-step simulation.

## Simulator Main Toolbar

The Main Toolbar offers you shortcuts to most common commands (Figure 125).



**Figure 125: Simulator Toolbar**

Table 19 describes the buttons in the toolbar.

**Table 19: Simulator Toolbar**

Icon	Description
	Create a new Simulator session.
	Save the Simulator session.
	Start the simulation.
	Run a step-by-step simulation.
	Add a new sheet to the Watch Window.
	Rename the selected sheet in the Watch Window.
	Remove the selected sheet from the Watch Window.

## Adding Network Variables from the Application Window to the Watch Window

To add a network variable from the Application Window to the Watch Window:

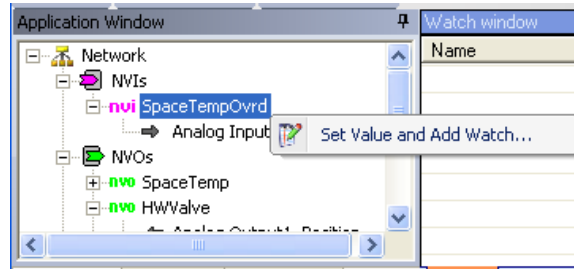
### For Network Variable Outputs (NVOs):

In the FX Simulator main screen, right-click the desired variable and select Add Item to Watch.

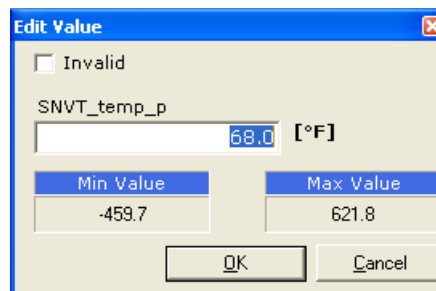
**Note:** You can also drag the variable from the Application Window to the Watch Window.

### For Network Variable Inputs (NVIs) or Configuration Property (CP):

1. In the FX Simulator main screen, right-click the desired variable and select Set Value and Add Watch. The Edit Value window appears (Figure 126).



**Figure 126: Adding an NVI to the Watch Window**

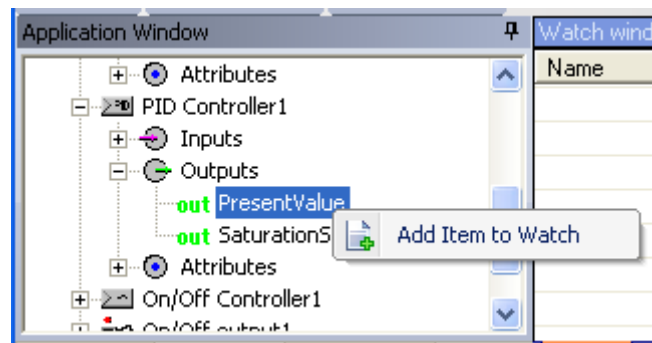


**Figure 127: Edit Value Window**

2. Enter the values of the NVI or CP to use only during the simulation.

### Adding an Object Point from the Application Window to the Watch Window

To add an object point from the Application Window to the Watch Window, right-click the desired object output and select Add Item to Watch.



**Figure 128: Adding an Object Point to the Watch Window**

**Note:** You can also drag the point to the Watch Window.

**Note:** You can only add the **Object Outputs** to the Watch Window because the Object Outputs represent the Outputs (read value) generated by the application algorithm running in the FX controller.

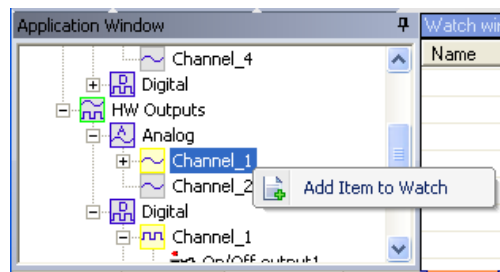
### Adding Hardware Channels from the Application Window to the Watch Window

Viewing hardware channels during simulation allows you to recreate the same input and output behavior of the FX controller. Depending on the type of the hardware channels, you can force or watch the status of the hardware inputs and outputs of the FX controller. For example, you can directly force a voltage value on a 0-10 V analog input.

To add hardware channels from the Application Window to the Watch Window:

#### For hardware outputs:

- Right-click the desired channel and select Add Item to Watch (Figure 129).

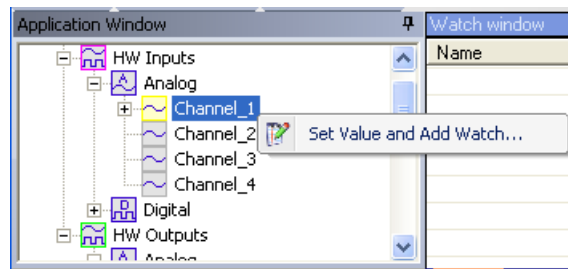


**Figure 129: Adding an Output to the Watch Window**

**Note:** You can also drag the variable from the Application Window to the Watch Window.

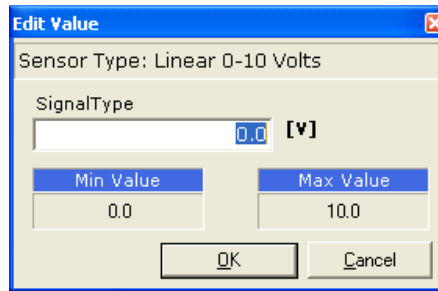
#### For hardware inputs:

1. Right-click the desired channel and select Set Value and Add Watch (Figure 130). The Edit Value window appears (Figure 131).



**Figure 130: Set Value on a HW Channel**





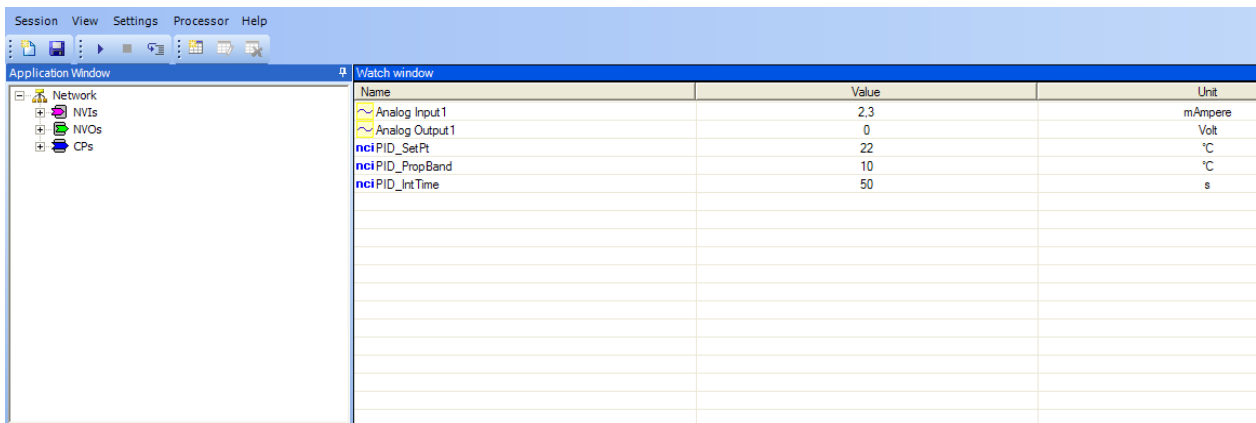
**Figure 131: Edit Value**

2. Enter a value to use on the input channel only during the simulation.

### Simulation Example

In Figure 129, a PID control loop has been defined in the application and includes a 4-20 mA Analog Input and a 0-10 V Analog Output. The variables/HW channels under watch are as follows:

- Analog Input1
- Analog Output1
- nciPID\_SetPt
- nciPID\_PropBand
- nciPID\_IntTime

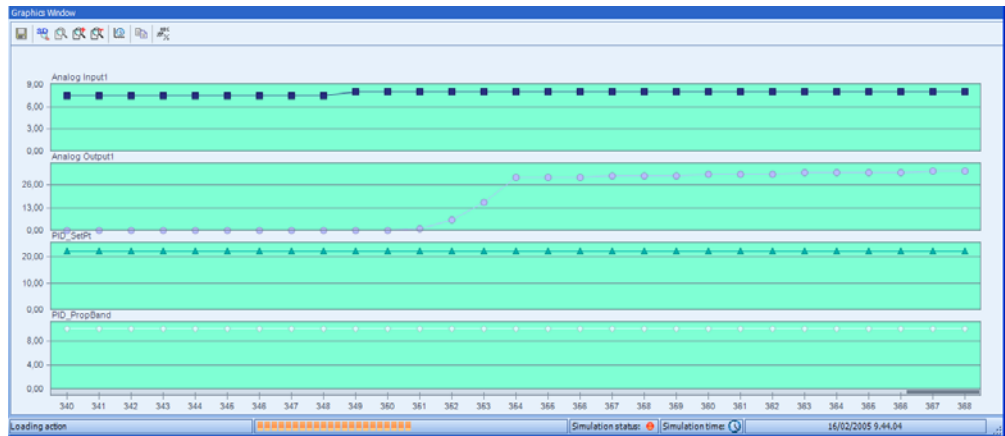


**Figure 132: Variables/Object Outputs/HW Channels on Watch Window**

## Starting a Simulation

Once you define the network variables, object points, and hardware channels that compose the simulation, you can start the simulation.

When you start the simulation, the **first four points** defined in the Watch Window automatically populate in the Graphics Window (Figure 133).



**Figure 133: Graphics Window**

On the **Y** axis, the simulator projects the current value of the points defined in the Watch Window. On the **X** axis, the simulator projects the application iteration/loop time.

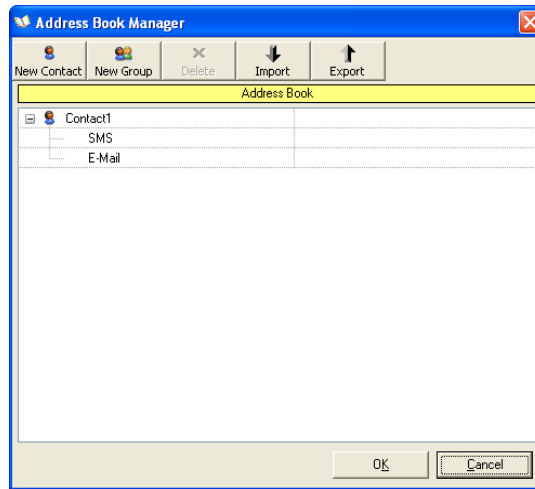
## Address Book Manager

The Address Book Manager stores contacts or groups of contacts used for the controller notification services (Figure 134).

**Note:** This feature applies only to controllers that support notification services.

When you create a new contact, you can include one of the following:

- **Mobile Phone Number** - used by the controller as destination for SMS Notification Services.
- **E-Mail Address** - used by the controller as destination for e-mail notification services.



**Figure 134: Address Book Manager**

**Note:** You use contact information only for supported services. For example, if only you use SMS notification, then only the mobile number is required. The same is valid for contacts that have only the e-mail address defined.

When you create a New Group of contacts, you first define the group and then copy or move the already defined contacts into the desired group.


The Address Book Manager allows you to perform the following commands:

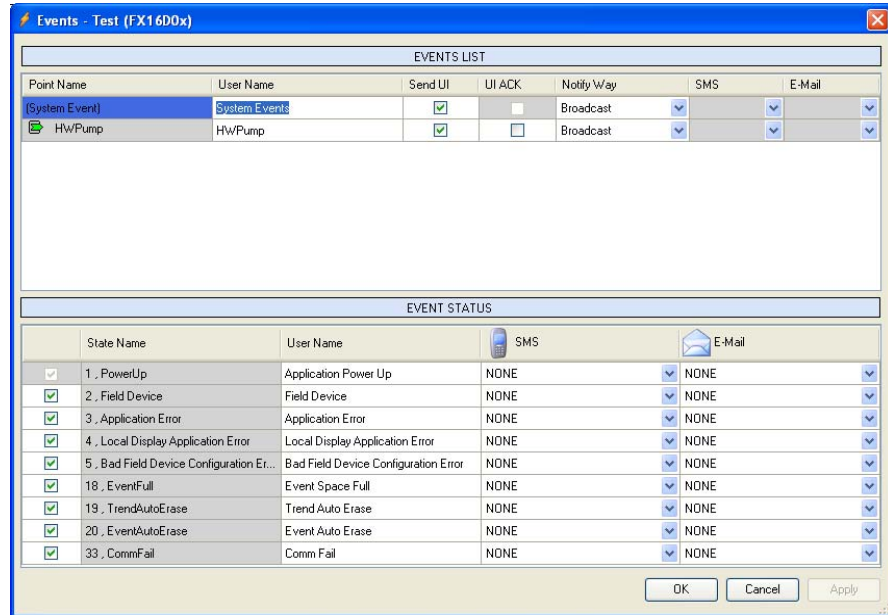
- **Move to Group** - removes the contact from the Single Contacts list and adds it into the desired group.
- **Copy to Group** - adds the selected contact into the desired group, leaving it also in the Single Contacts list. This feature is useful because the grouped contacts cannot be used as single contacts.

Move and Copy commands are available also to copy or move contacts from a Group to the Single Contacts list.

- **Rename** - allows you to rename a contact. This function is available for Contacts only by right-clicking on the Contact. Groups cannot be renamed.
- **Delete** - removes the selected element from the address book.
- **Import** - allows you to load and use an already-built Address Book (.xml).
- **Export** - allows you to save an Address Book (.xml) file for future use.

## Events

The Events plug-in allows you to configure the events of the application and their corresponding Messaging Service actions (notifications). The **Events Menu Item**  opens the Events plug-in (Figure 135).



**Figure 135: Events Plug-in**

Grayed columns indicate that the related Messaging Service is not available; this is because contacts are not available in the address book with the needed information to execute the related Messaging Service. For example, for SMS Messaging Service, the mobile phone number of the contact is required.

You can define events on binary (Boolean) or logic (enumerated) variables coming from the application points profile.

## System Events

Another group of events are defined as the System Events Group and consist of predefined event conditions related to the proper execution of the application. System events include:

- **Powerup** - triggered when FX controllers turn on.
- **Field Device** - triggered when field (slave) devices do not work properly (available only for master devices).
- **Application Error** - triggered when applications (.apd) become corrupt (available only for master devices).
- **Local Display Application Error** - triggered when display applications become corrupt (available only for master devices).

- **Bad Field Device Configuration Error** - triggered when a slave is not found at the predefined N2 address (available only for master devices).
- **Event Full** - triggered when Buffer Full threshold (user settable) is reached (available only for master devices).
- **Trend Auto-Erase** - triggered when the data trend buffer is full, and the controller is configured to automatically erase the buffer.
- **Event Auto-Erase** - triggered when the event buffer is full, and the controller is configured to automatically erase the buffer (available only for master devices).
- **Communication Failure** - triggered if the controller fails to send notifications (SMS or e-mail).

### Events – Notify Way

If more than one notification type (e-mail and SMS) is sent for the triggered event, you can prioritize which media to use first (Figure 136). The notification options include:

- **Broadcast** - Sends both e-mail and SMS notifications.
- **Prioritized** - Select which media to use first. In case the primary method fails, you can use a secondary media as a backup.

The screenshot shows the 'Events - Test (FX1600x)' window. It contains two main sections: 'EVENTS LIST' and 'EVENT STATUS'.

**EVENTS LIST**

Point Name	User Name	Send UI	UI ACK	Notify Way	SMS	E-Mail
(System Event)	System Events	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Prioritized	1 (High)	2
HWPump	HWPump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Broadcast		

**EVENT STATUS**

	State Name	User Name	SMS	E-Mail
<input checked="" type="checkbox"/>	1. PowerUp	Application Power Up	NONE	NONE
<input checked="" type="checkbox"/>	2. Field Device	Field Device	NONE	NONE
<input checked="" type="checkbox"/>	3. Application Error	Application Error	NONE	NONE
<input checked="" type="checkbox"/>	4. Local Display Application Error	Local Display Application Error	NONE	NONE
<input checked="" type="checkbox"/>	5. Bad Field Device Configuration Er...	Bad Field Device Configuration Error	NONE	NONE
<input checked="" type="checkbox"/>	18. EventFull	Event Space Full	NONE	NONE
<input checked="" type="checkbox"/>	19. TrendAutoErase	Trend Auto Erase	NONE	NONE
<input checked="" type="checkbox"/>	20. EventAutoErase	Event Auto Erase	NONE	NONE
<input checked="" type="checkbox"/>	33. CommFail	Comm Fail	NONE	NONE

Buttons: OK, Cancel, Apply

**Figure 136: Notify Way Set to Broadcast and Prioritized**

## Event Definitions

When you create an event, you define the following (Figure 137):

- **Event User Name** - Enter the name that appears on the user interface and Web page.
- **Send UI** - Select whether to send the event to the User Interface (UI).
- **UI ACK** - Select if acknowledgement is required.
- **Priority Management** - Select whether to broadcast or prioritize notification (only available for master devices).
- **Triggering Condition** - Select which event state triggers notification.
- **Event Status User Name** - Enter the Event Status name that appears.
- **Event Message** - Enter the message that is sent to SMS or e-mail.
- **Select and Configure the Notification Services** - Select the desired contact or group already defined in the address book.

The screenshot shows a software window titled "Events - Test (FX1600x)". It contains two main sections: "EVENTS LIST" and "EVENT STATUS".

**EVENTS LIST**

Point Name	User Name	Send UI	UI ACK	Notify Way	SMS	E-Mail
(System Event)	System Events	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Priorized	1 (High)	2
HwPump	HwPump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Broadcast		

**EVENT STATUS**

State Name	User Name	SMS	E-Mail
<input checked="" type="checkbox"/> 0 - Off	Off	Tony	Tony
<input checked="" type="checkbox"/> 1 - On	On	NONE	Tony

At the bottom of the window are buttons for "OK", "Cancel", and "Apply".

**Figure 137: Configuring the Notification Services**

## Customizing the Notification Service

To customize the notification service:

1. In the Events window, right-click the contact and select Edit Notification. The Notification window appears (Figure 138).

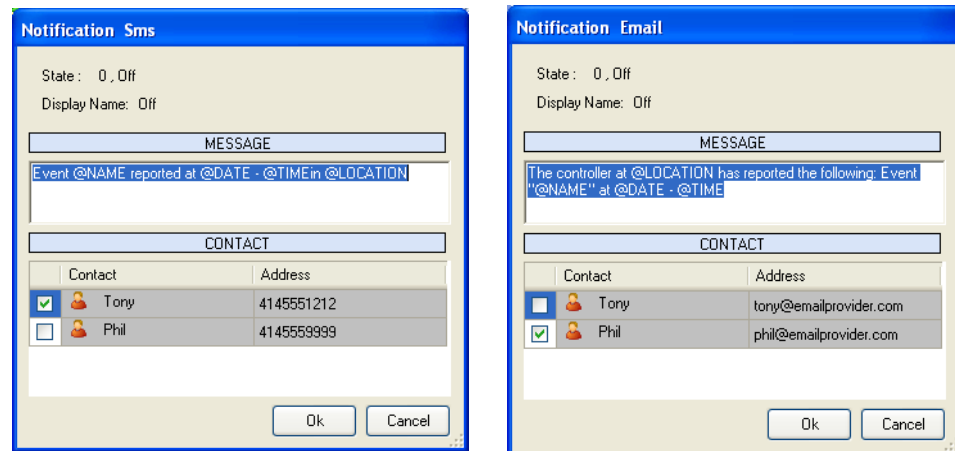


Figure 138: Editing the Treatment

2. Edit the notification message related to the selected event.

The event notification message is an alphanumeric string that can contain tagged elements. The tags report in the string the assigned value at the moment of the notification. For example, the @TIME tag is replaced by the current time value.

The available tagged information is as follows:

- **@LOCATION** of the Controller  
(for example, @LOCATION = Meeting Room 1st Floor)
- **@NAME** of the Event  
(for example, @NAME = Low Pressure Switch)
- **@DATE** of the Event  
(for example, @DATE = 31 Oct 2005)
- **@TIME** of the Event  
(for example, @TIME = 12.15)

3. Choose the destinations between the available contacts or groups already defined in the address book.

The available contacts and groups defined in the address book appear, allowing you to select the preferred destination for the selected event. The final destination must be **unique**. To send notification to more than one contact, define a group within the address book containing all the contacts you want to send a notification to at the same time.

4. Click OK.

## Event Maker Limits

The maximum number of collectable events depends on the specific FX field controller. Table 20 summarizes the current limit for each device:


**Table 20: Event Maker Limits**

Controller	Limitation
<b>MD20 Master Display</b>	Maximum 20 events
<b>FX16 Master Controller</b>	Non revision A: maximum 20 events Rev. A and B: maximum 250 events
<b>FX15 and FX15 Universal</b>	Maximum 12 events
<b>FX14</b>	Maximum 20 events
<b>FX10</b>	Maximum 10 events
<b>FX06 and FX07</b>	Maximum 20 events
<b>FX05 (Advanced)</b>	Maximum 16 events

## Trends

The Trends plug-in allows you to configure the trend logs of the application.

**Note:** Not all FX Controllers support trending. Check the appropriate technical bulletin of the target controller to ensure this feature is supported.

Before you configure trends, you must first select the variables for trending in the application points plug-in. Click on the **Trends Menu Item**  to open the Trends plug-in.

The Trend plug-in contains two tabs windows to set up the trend: **Configuration** and **Services**.

## Configuration Tab

On the Configuration tab, you define the following information:

- **User Name** - enter the name of the trend that appears on the user interface and the Web.
- **Trend Mode** - select between **Periodic sampling** or **On change** of value reporting (depends on trend type).
- **Sample Period** - if **Periodic sampling** mode was selected, enter the sample period, in minutes.
- **Trend Start and Stop Conditions** - use for logic or enumerated variables only.



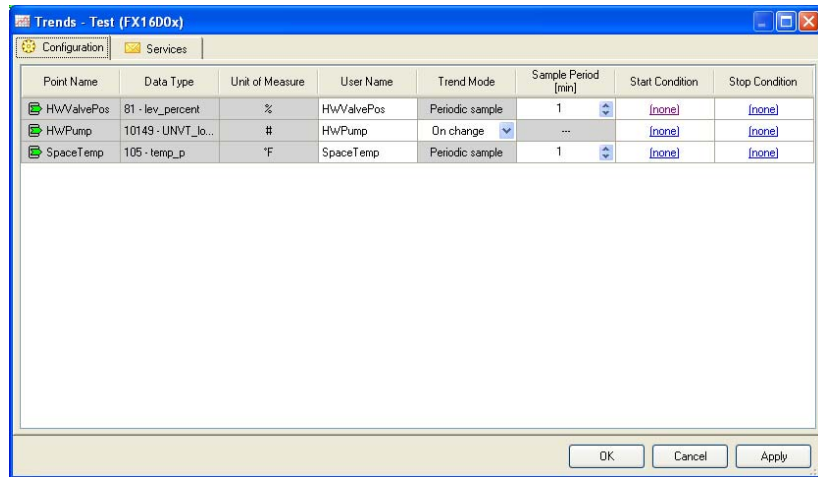


Figure 139: Configuration Tab of the Trends Plug-in

## Services Tab

The Services tab contains several sections including (Figure 140):

- Buffer management
- Periodic offload management
- Notification priority

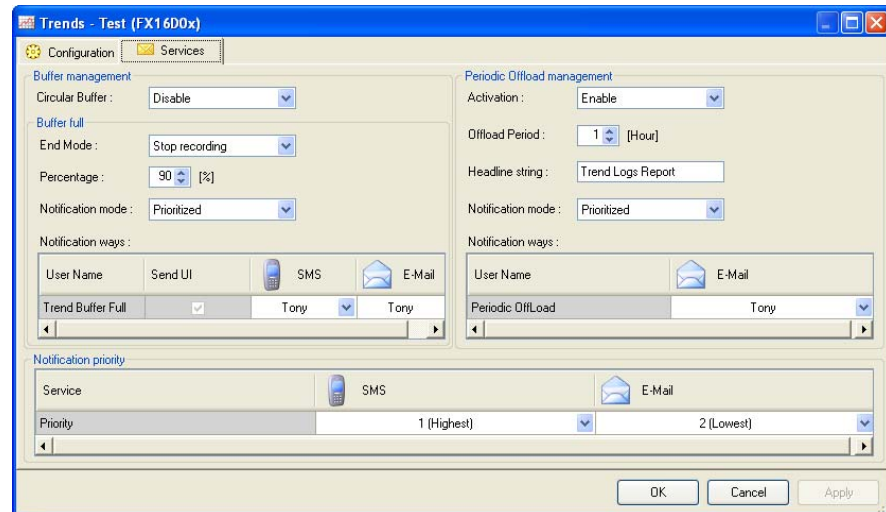


Figure 140: Services Tab of the Trends Plug-in

## Buffer Management

The Trends plug-in provides several options to deal with a full trend buffer.

You can enable circular buffering to replace the oldest trend records with new ones without any notification. If circular buffering is disabled, you can define a Buffer Full event with corresponding notification services.

In configuring the Buffer Full Event, you define the following:

- **Percentage** - the trend buffer full percentage that triggers the event
- **End Mode** - the action to take when trend buffer full percentage is reached. You can set the End Mode to **Stop recording** or **Erase and continue**.

### Buffer Management - Stop Recording

At the defined percentage, the controller notifies the user via the specified media that the memory full threshold has been reached. The controller then continues recording data until the buffer full condition is reached; at this point, the recording stops.

### Buffer Management - Erase and Continue

At the defined percentage, the controller notifies the user via the specified media that the memory full threshold has been reached. The controller then continues recording data up to the memory full condition. Once the memory full condition is reached, the controller (before erasing the buffer) automatically sends an e-mail with the trend records since the last offload and saves the last 60 events in a backup memory. The controller then erases the flash memory buffer, copies the 60 saved events, and restarts logging.

**Note:** During the last e-mail (for the entire length of the connection) and during the successive memory erase, the logging of new events and data is inhibited.

Buffer management contains the following functions:

- **Notification Mode** - Selects Broadcast (sends both SMS and e-mail notification) or Prioritized (sends to primary method first, then to secondary if primary fails).
- **Notification Ways** - Identifies the contact to receive the notification.

## Buffer Management - Periodic Off Load

The Trends plug-in allows you to enable or disable periodic offloading of trend records via e-mail using Space Separated Value format (Figure 141).

SpaceTemp		
22/10/2006	09:42:31	77.790
22/10/2006	09:42:32	77.780
22/10/2006	09:42:33	77.790
22/10/2006	09:42:34	77.790
22/10/2006	09:42:35	77.780
22/10/2006	09:42:36	77.780
22/10/2006	09:42:37	77.780

**Figure 141: Trended Value via E-mail**

When you configure the Periodic Offloading, you define the following information:

- **Offload Period** - Defines the frequency of the notifications (can be adjusted between 0 - 24 hours).
- **Headline String** - Defines the subject for the e-mail notification.
- **Notification Mode** - Sets the mode to Broadcast or Prioritized.
- **Notification Ways** - Defines the contact to receive the e-mail.

## Display

Use the Display plug-in to define and format the controller's user interface.

Table 21 displays user interface compatibility information.

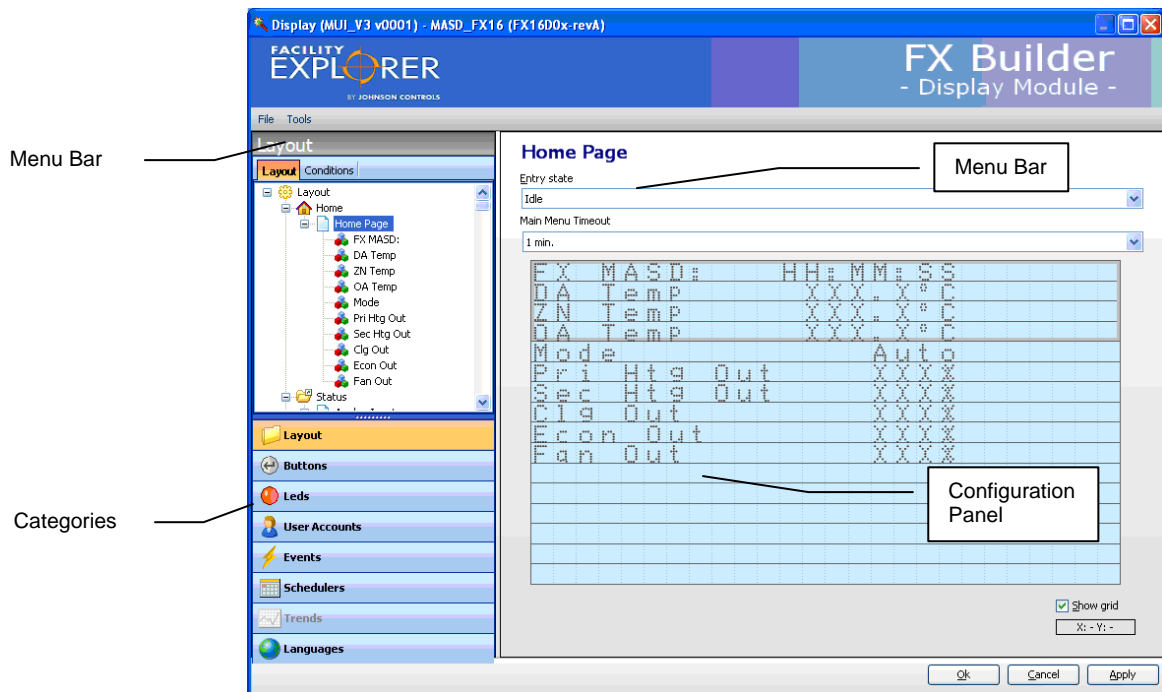
**Table 21: Display**

Display Type	Description	Supported Controller
INT7S	Three 7-segment LEDs with four push buttons, and three discrete LEDs	Integrated into FX05
LCD2x4	2 line x 4 character Liquid Crystal Display (LCD) with four push buttons, dynamic colored backlight, and graphical status icons	Integrated into FX06 and FX14 (option)
Continued on next page . . .		


Display Type (Cont.)	Description	Supported Controller
<b>MUI</b>	4 line x 20 character backlit LCD, six push buttons, and 10 discrete status LEDs	FX06 (remote) FX14 (remote) FX15 (integrated or remote) FX16 (remote)
<b>MUI_V3</b>	4 line x 26 character backlit LCD, six push buttons, and 10 discrete status LEDs	FX06 (remote) FX14 (remote) FX15 (remote) FX16 (integrated [Rev. A or Rev. B only] or remote)
<b>GUI</b>	240 x 148 pixel graphical LCD, 10 push buttons, and 3 discrete status LEDs	Integrated into MD20

### Launching the Display Plug-in

The Display plug-in consists of a menu bar, a list of configuration categories, a details panel, and a configuration panel (Figure 142).



**Figure 142: FX Builder Display Plug-in**

To launch the Display plug-in, right-click the  icon and select the target display (depending on the controller). The Display plug-in appears (Figure 143).

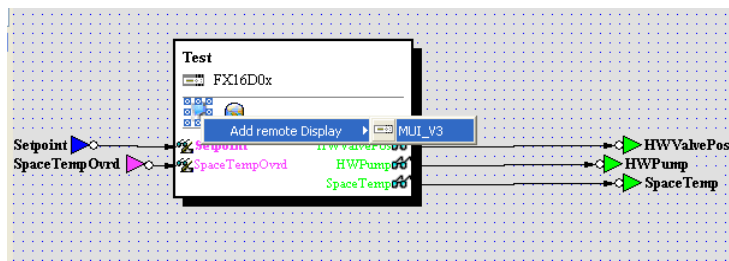


Figure 143: Launching Display Plug-in

### Menu Bar Details

The **File** menu of the Display plug-in menu bar includes:

- Load Template
- Save Template

The Tools menu of the Display plug-in menu bar includes the following:

- **Statistic Info** - allows you to check the memory usage allocated for the display configuration (Figure 144).

Name	Items	Max Items	Percentage
Accounts	1	8	12.50%
Enabling Conditions	0	5	0.00%
Events	1	20	5.00%
Folders	14	255	5.49%
Menu Items	10	16	62.50%
Languages	1	5	20.00%
User Texts	820	-	-
Pages	25	255	9.80%
Enum Points	80	255	31.37%
Float Points	6	255	2.35%
N1 Points	0	255	0.00%
N2 Points	125	255	49.02%
Trends	0	40	0.00%

Figure 144: Statistic Info

### Configuration Categories

The Display Plug-in features the following configuration categories:

- **Layout** - allows you to configure how information is organized and appears on the display.
- **Buttons** - allows you to assign actions to the push buttons.

- **LEDs** - allows you to assign discrete status information to each of the LEDs.
- **User Accounts** - allows you to define the user name, password, and access rights for each user account.
- **Events** - allows you to define which events are displayed and the allowed actions.
- **Schedulers** - allows you to define the interface to the schedules configured in the application.
- **Trends** - allows you to define which events are displayed and the allowed actions.
- **Languages** - allows you to set the language of select System Texts and User Texts.

### Configuring the Menu Based Navigation

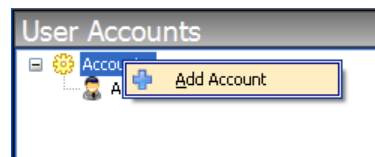
The LCD2x4 and Medium User Interface (MUI) user interfaces provides menu-based navigation. Each user interface includes a default Home folder and Home Page. Other default folders and pages include events, trends, and schedulers, depending on the capabilities of user interface type you added to the application. In addition, you can define customized folders and pages to provide operator access to application points and system information. You can link the default and user-defined pages and folders to a menu for the operator to easily access. Each folder and page has display attributes, which determine how they appear and are accessed in the user interface.

### Adding and Configuring a User Account

The LCD2x4 and MUI user interfaces allow you to restrict operator access to information based on user account and the defined access level.

To add and configure a user account:

1. Click User Accounts. The Details Panel shows a list of all defined User Accounts.
2. Click on Account and select Add Account (Figure 145).



**Figure 145: Adding a User Account**

The Configuration Panel appears showing the following configurable user account attributes:

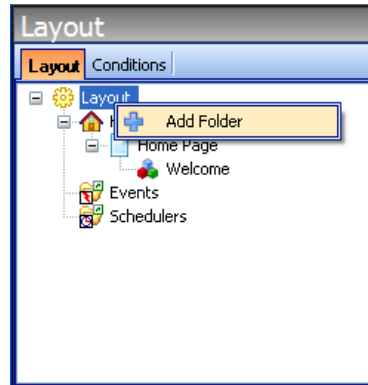
- **User Name** - allows you define the user name text as it appears in the display.

- **Password** - allows you to define the password for the selected user account.
- **Level** - allows you to define the access level for the selected user accounts.

## Adding Folders and Pages

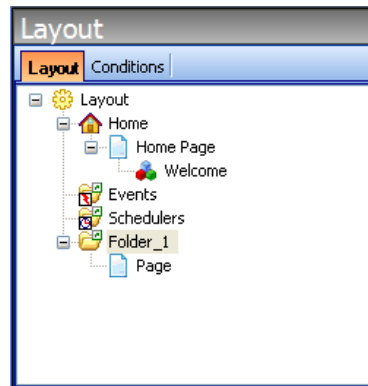
To add additional folders and pages:

1. Select the Layout tab. A Layout tree appears in the Details Panel and identifies the display folders and pages.
2. Right-click on Layout and select Add Folder (Figure 146).



**Figure 146: Adding a New Folder**

3. Enter the name of the folder and click OK. The Layout tree is populated with the new folder and an associated page (Figure 147).

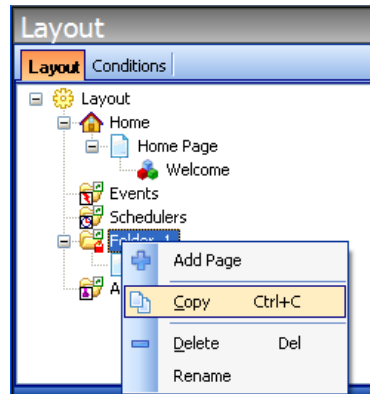


**Figure 147: New Display Folder Added**

After you add a display folder, you can right-click on it and select from the following actions:

- Add a page
- Copy
- Delete
- Rename

**Note:** You cannot add additional pages to the INT7S and LCD2x4 user interfaces. Both user interfaces only support one page per folder.



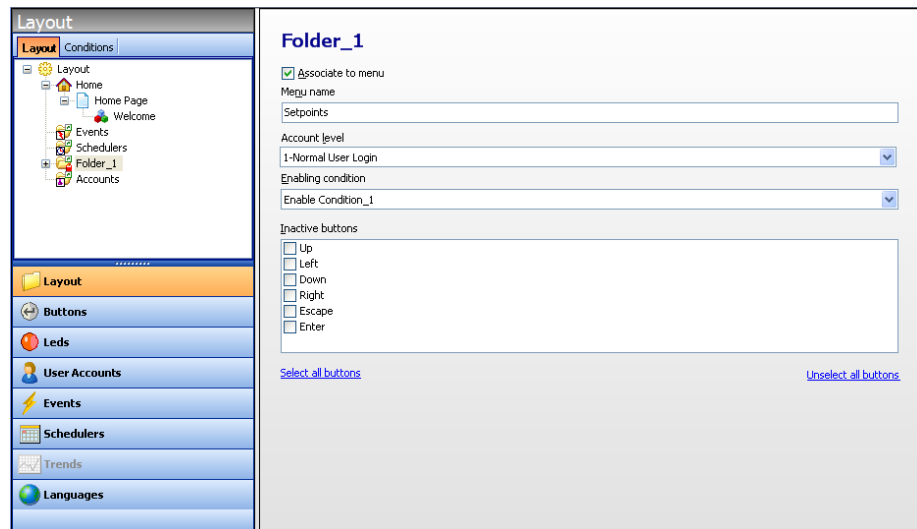
**Figure 148: Folder Actions**

### Editing Display Folder Attributes

When you select the display folder, the Configuration Panel appears and allows you to define the following display attributes for the selected folder:

- **Associate to menu** - when this box is checked, the display folder appears in the main menu.
- **Menu name** - allows you to define how the folder name appears in the main menu.
- **Account level** - allows you to identify the user access level required for the selected display folder.
- **Enabling Condition** - allows you to identify a special condition to enable the display folder (see *Defining Conditions*).
- **Inactive buttons** - allows you to select which buttons are inactive when the operator is using this display folder.





**Figure 149: Editing a Display Folder's Attributes**

### Editing Display Page Attributes

When you select a display page, the Configuration Panel populates with a What You See Is What You Get (WYSIWYG) display page editor and the following configurable page attributes:

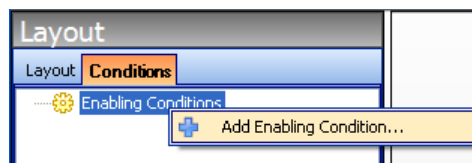
- **Entry State** - allows you to set the page entry state to Idle or Active. The Idle state requires operators to push the Enter button before they can edit a point. The Active state allows operators to edit a point immediately after they open the display page.
- **Timeout** - allows you to define the operator inactivity time before the user interface automatically reverts to the home page.

### Defining Conditions

You can enable or disable a display folder depending on certain conditions. The Conditions tab allows you to define a folder's enabling conditions.

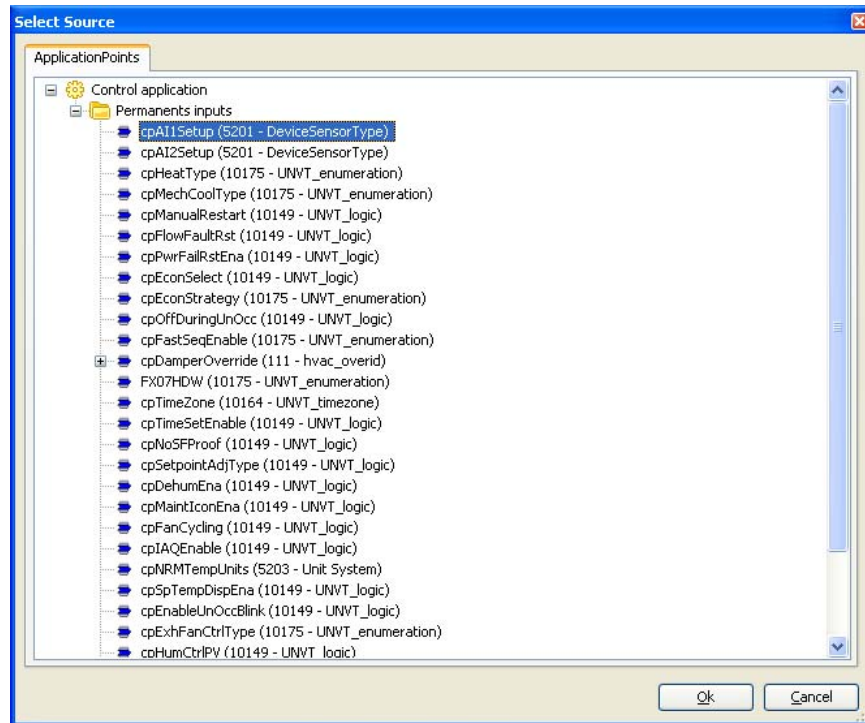
To define a condition:

1. Select the Conditions tab. A list of enabling conditions appears.
2. Right-click Enabling Conditions and select Add Enabling Conditions (Figure 150).



**Figure 150: Adding an Enabling Condition**

The Select Source window appears and shows a list of all permanent points defined in the application.



**Figure 151: Adding an Enabling Condition**

3. Select the desired application point to act as the source of the enabling condition and click OK.

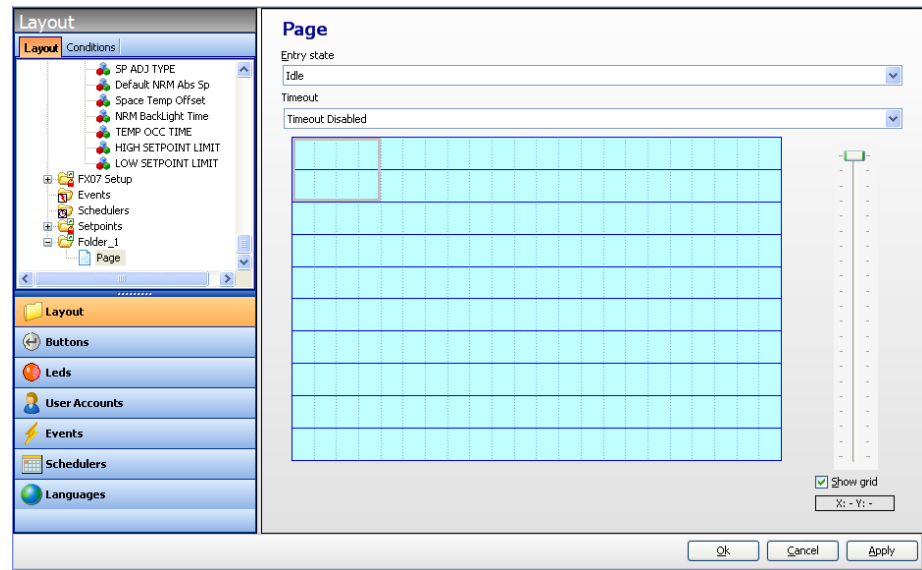
The Configuration Panel appears and shows the newly added enabling condition (the source point) and the available states.

4. Check all states to enable the display folder.
5. Go into the Layout tree, select the folder, and edit the folder attributes to identify the enabling condition. For more information, see *Editing Display Folder Attributes*.

## Adding Application Points to a Display Page

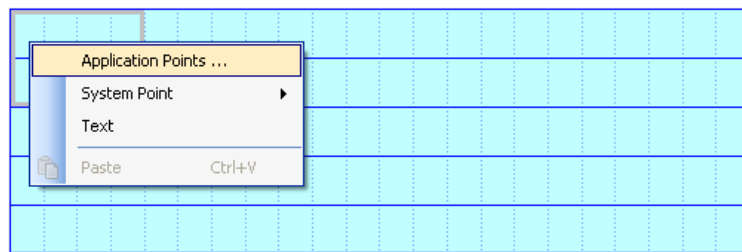
To add an application point to a display page:

1. Select the desired page in the Layout tree. The Configuration pane provides a display page editor (Figure 152).



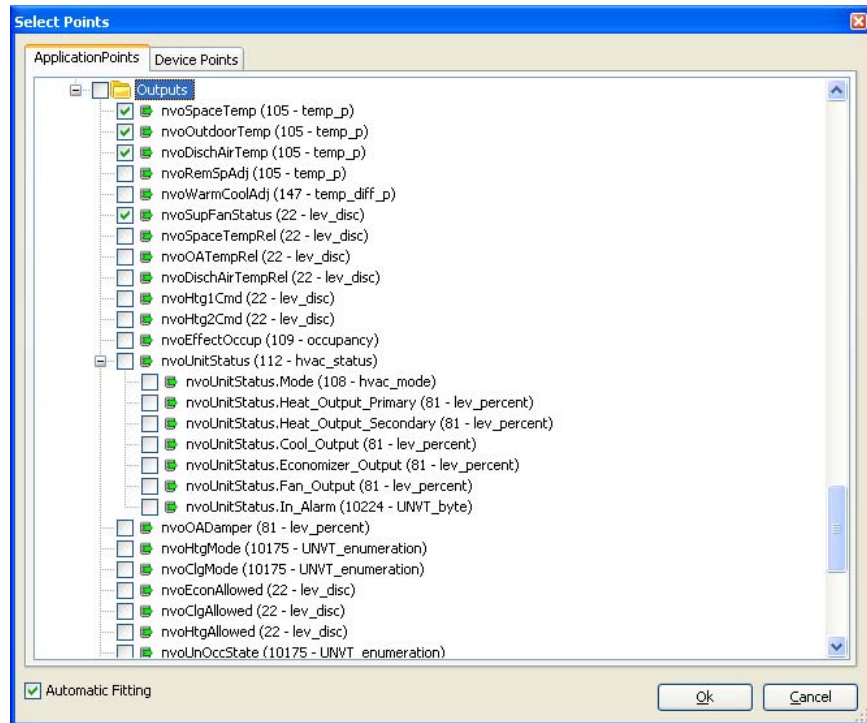
**Figure 152: Display Page Editor**

2. Position your cursor to where you want to insert the application point.
3. Right-click the area and select Application Points (Figure 153).



**Figure 153: Inserting Application Points on a Display Page**

A Select Points window appears and provides a list of all application points and displayable points defined in the application. Check the boxes for the points you wish to add to the display page.



**Figure 154: Adding an Enabling Condition**

4. Click OK. The Display Page Editor reappears and displays the application points you selected.
5. To change how the application point information appears on the display page, double-click the application point. The Edit Numeric Point (Figure 155) or Edit Enumerated Point (Figure 156) window appears and allows you to configure the following display point attributes:
  - **Point Name** - allows you to define the text used to display the point name.
  - **Account Level** - allows you to define the user access level required to view and edit the selected point.
  - **Read Only** - allows you to restrict operator access to read-only (write not allowed).
  - **Show Invalid** - allows you to define the point value when invalid.
  - **Invalid Label** - used in conjunction with Show Invalid to allow you to define the point value when invalid.
  - **Data size** - allows you to define the total number of characters to be displayed for the selected point's value.
  - **Number of decimals** - allows you to define the number of decimal places to be displayed for the selected point's value.
  - **Unit of measure** - allows you to define the units of measure for the selected point's value.

- **Unit of measure symbol** - allows you to define the unit of measure symbol for the selected unit of measure.
- **Validity range** - allows you to limit editing to within the specified range.
- **Is Selected** - allows you to remove or include specific enumerated point states from the display.
- **Displayed states text** - allows you to define the text displayed for each enumerated point state.

Figure 155: Edit Numeric Point

Is Selected	States	Displayed Text
<input checked="" type="checkbox"/>	0, Off	Off
<input checked="" type="checkbox"/>	1, On	On

Figure 156: Edit Enumerated

6. To optimally fit the application point name, value, and units of measure within the available display page row, select the application point, right-click, and select Fit.

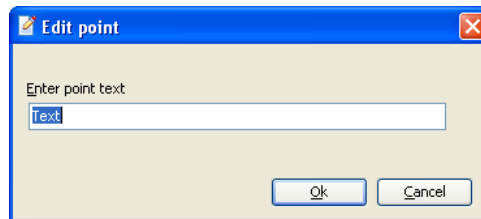
### Adding Text to a Display Page

To add text to a display page:

1. Select the desired page in the Layout tree. The display page editor appears in the Configuration Panel.
2. Position your cursor where you want to insert the text.
3. Right-click the area and select Text (Figure 157). The Edit Point window appears and prompts you to enter the desired text (Figure 158).



**Figure 157: Inserting Text on a Display Page**



**Figure 158: Edit Point Text Window**

4. Click OK. The display page editor reappears with the added text.
5. To change the position of the text on the display page, select the text and drag it to the desired location.

## Adding System Information to a Display Page

In addition to adding application points and text to a display page, you can also add various pieces of system information to a display page. The types of system information you can add depends on the type of user interface you select. This may include any of the following:

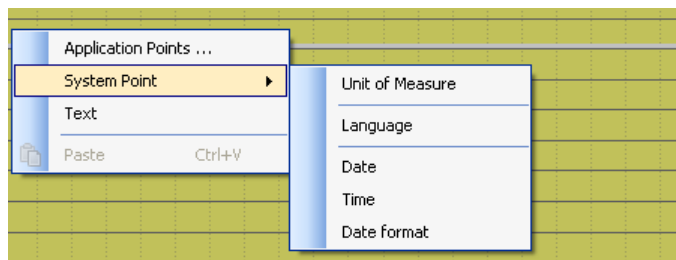
- time
- date
- date format
- unit of measure

**IMPORTANT:** The unit of measure setting affects not only the values of points shown on the display, but also the values of points transmitted on the N2 or BACnet network. If you plan to install the target controller on an N2 or BACnet network, you must add the unit of measure selector with the appropriate default setting in the display configuration, regardless of whether a display is actually used.

- language (see *Adding Multiple Language Support*)
- address (LCD2x4 only)
- LCD contrast (LCD2x4 only)
- backlight time (LCD2x4 only)
- default color (LCD2x4 only)
- alarm color (LCD2x4 only)
- baud rate (LCD2x4 only)

To add system information to a display page:

1. Select the desired page in the Layout tree. The display page editor appears in the Configuration Panel.
2. Position your cursor where you want to insert the system information.
3. Right-click in the area, select System Point, and then select the desired system information (Figure 159).



**Figure 159: Inserting System Information on a Display Page**

## Push Button Management

Each user interface type features a unique set of push buttons and default system capabilities (Table 22). In addition, you can assign user-defined functions to each push button (or to multiple push buttons).

Table 22: User Interface Push Buttons

User Interface Type	Push Buttons
INT7S	4 push buttons (Up, Down, Function, Enter)
MUI_V2 and MUI_V3	6 push buttons (Up, Down, Left, Right, Enter, Escape)
LCD2x4	4 push buttons (Up, Down, OK, Cancel)
GUI	10 push buttons (Up, Down, Left, Right, Enter, Escape, On/Off, Menu, Alarm, Alarm Ack [Acknowledge])

## Assigning User-Defined Functions to Push Buttons

To assign a user-defined function to a push button:

1. Select Buttons. The Details Pane displays the available push buttons for the target user interface (Figure 160 and Figure 161).

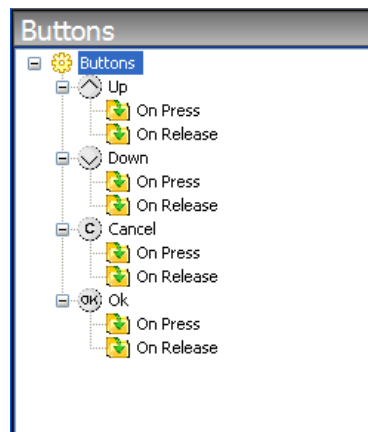
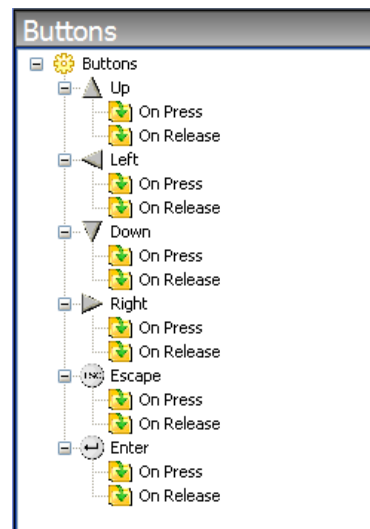


Figure 160: Available Buttons for LCD2x4



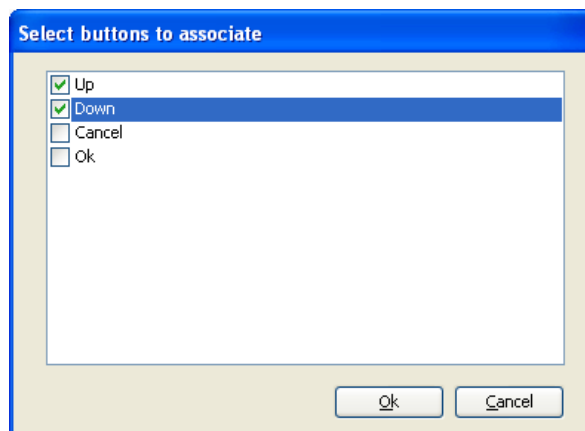


**Figure 161: Available Buttons for MUI**

2. To assign a function to more than one push button, right-click Buttons and select Add Multiple Button (Figure 162). The Select Buttons to Associate window appears (Figure 163).



**Figure 162: Adding a Multiple Button**



**Figure 163: Select Buttons to Associate**

3. Select the buttons you want to combine to associate a function and click OK. The multiple buttons appear in the Buttons tree (Figure 164).

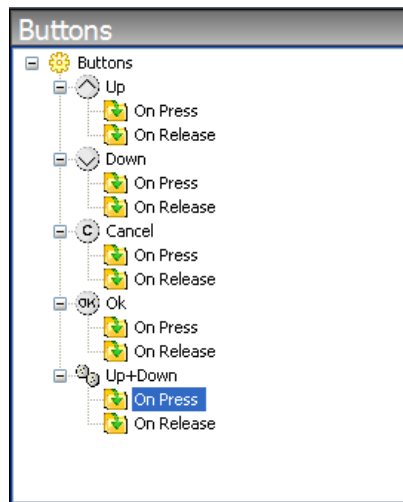


Figure 164: Add Multiple Button

4. Select the button or multiple buttons to assign a function.

The Configuration Panel allows you to assign functions to the selected button. The functions occur either when the button is pressed or released. You can configure the following task attributes for the selected button (or multiple buttons):

- **Task** - allows you to define the specific function assigned to the selected button (Table 23 and Figure 162).

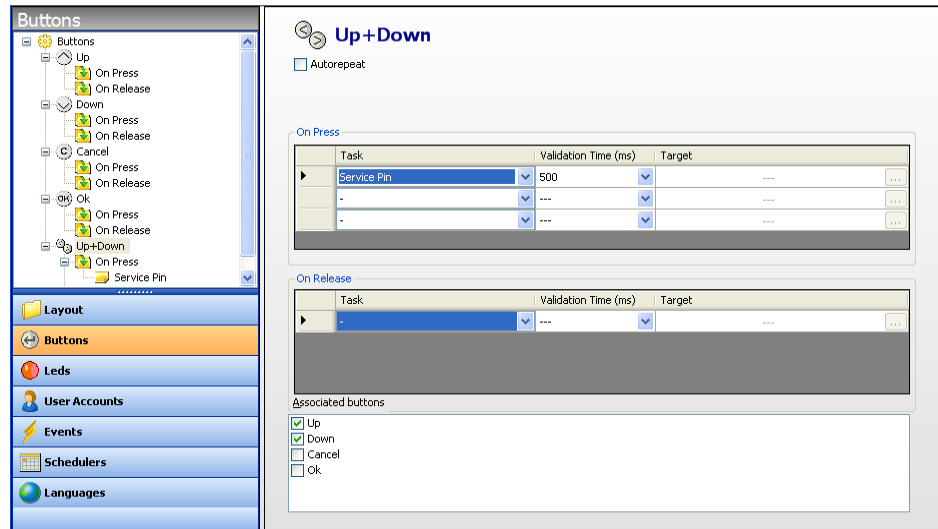
Table 23: User Interface Push Buttons

Task	Description	Applies to
<b>Set</b>	Commands a 1 to the target control point.	MUI_V2, MUI_V3, INT7S, LCD2x4, GUI
<b>Clear</b>	Commands a 0 to the target control point.	MUI_V2, MUI_V3, INT7S, LCD2x4, GUI
<b>Toggle</b>	Toggles command between 0 and 1 to the target control point.	MUI_V2, MUI_V3, INT7S, LCD2x4, GUI
<b>Shortcut To</b>	Jumps the operator to the target page.	MUI_V2, MUI_V3, INT7S, LCD2x4, GUI
<b>Alarm ACK</b>	Acknowledges alarm.	MUI_V2, MUI_V3
<b>Log OFF</b>	Logs off.	MUI_V2, MUI_V3, LCD2x4, GUI
<b>Keyboard Lock</b>	Locks out the keypad.	INT7S, LCD2x4
<b>Self Test</b>	Performs self test.	INT7S
<b>Service Pin</b>	Sends a Service Pin message to LON network.	INT7S, LCD2x4, GUI
<b>Menu</b>	Jumps to the Main Menu.	GUI
<b>Buzzer Off</b>	Turns the buzzer off.	GUI

- **Validation Time** - allows you to define the amount of time a user must press the button must before the associated task is performed.

- **Target** - identifies the control point for the Set, Clear, or Toggle task. Identifies the page for the Shortcut To task.
- **Autorepeat** - if selected, the push button automatically repeats its assigned function when continuously pressed. This feature uses the up and down arrows as a default to improve operator usability when editing values at the user interface.

You can also assign password protection to a push button function (except for Log OFF and Alarm ACK). When a push button function is password protected, the user must have the requested password level or higher; otherwise an Access Denied message appears.



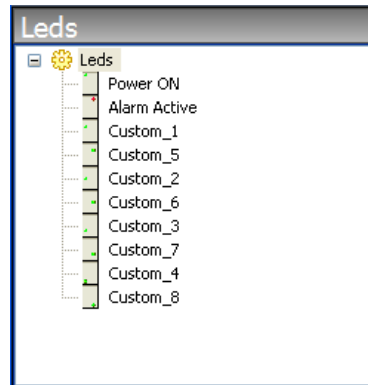
**Figure 165: Configuring the Push Button Function**

## Adding LED Association

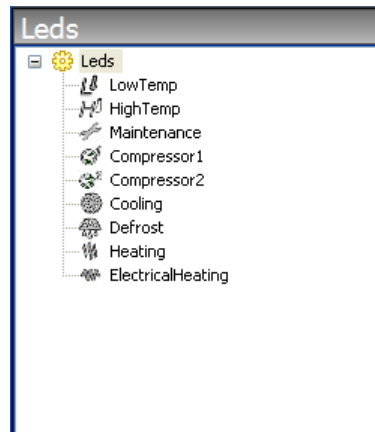
You can associate specific events and application point status to the discrete LEDs (MUI) or status icons (LCD2x6) on the target user interface. This provides the operator with a quick visualization of specific events and point status.

To add an LED association:

1. Select Leds. The Details Panel lists the available LEDs specific to each user interface type (Figure 166 and Figure 167).



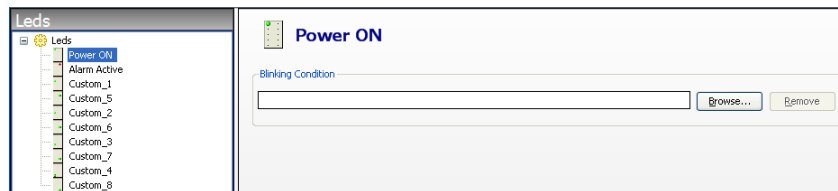
**Figure 166: LEDs for MUI**



**Figure 167: Status Icons for LCD2x4**

2. Select the LED to which you want to associate a status.

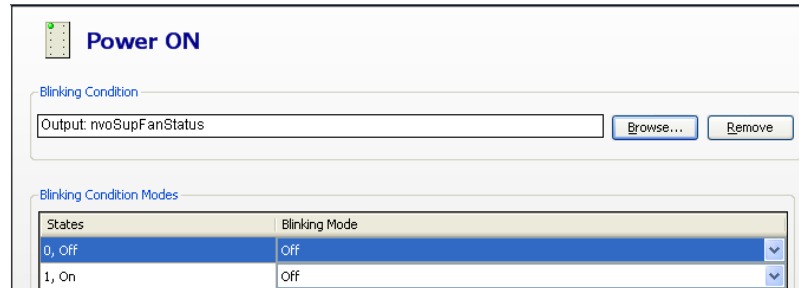
The Configuration Panel displays a picture that shows the selected LED or status icon and allows you to define the blinking condition (Figure 168).



**Figure 168: LED Configuration Panel**

- To select the LED association source, click Browse and select the control point from the list. (Figure 169).

The Configuration Panel then allows you to configure the operation of the LED. You can configure the LED to be On, Off, or blink (fast or slow) according to the different states of the source point.



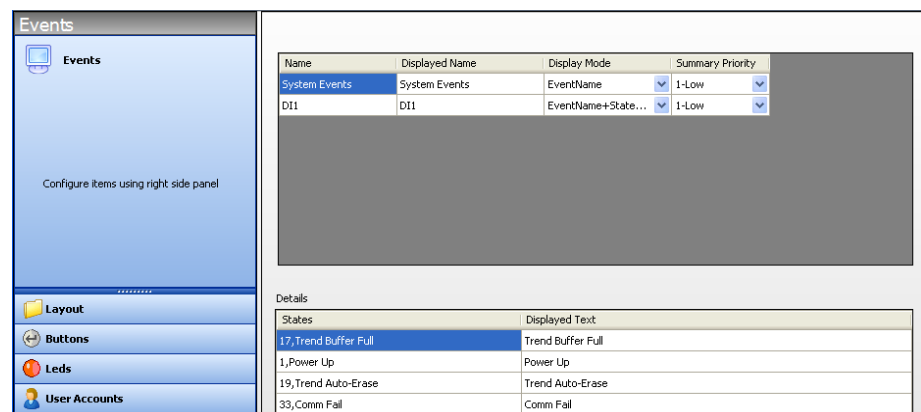
**Figure 169: Configuring Blinking Modes**

### Configuring Event Display Attributes

You can configure the user interface to display system events (for example, communication failure or trend buffer full) and any application events you have defined. The display plug-in allows you to define the display attribute for each event (for example, how events appear on the user interface).

To configure event display attributes:

- Select Events. The Configuration Panel prompts you to define how the system events and application events appear on the display (Figure 170).



**Figure 170: Configuring Event Display Attributes**

- Edit the attributes in the top section of the Configuration Panel.

The top section of the Configuration Panel displays a list of available system events and the following configurable display attributes:

- Displayed Name** - allows you to define the event name text as it appears in the display.

- **Display Mode** - allows you to define the event's appearance in the display. When an event occurs, you can configure the user interface to display the Event Name only, the State Name only, or the Event and State Name.

- **Summary Priority** - allows you to define the event's organization in the Event Summary log. You can set the Summary Priority to High, Intermediate, or Low.

**Note:** Set the Summary Priority to High (3) to activate the buzzer in the display.

- **Ack Password Level** - allows you to define the user access level required to acknowledge alarms (MUI only).

3. Edit the attributes in the bottom section of the Configuration Panel.

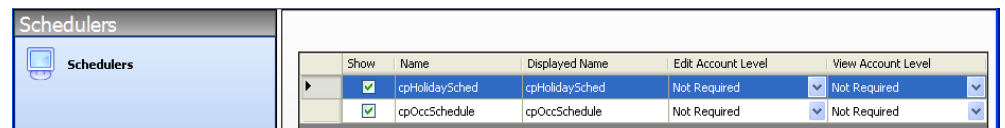
The bottom section of the Configuration Panel displays a detailed table that lists the states for each selected event. You can change the displayed states text for each event.

## Configuring Scheduler Display Attributes

You can configure the user interface to allow users to view and adjust schedules defined in the application. The display plug-in allows you to define each scheduler display attributes (for example, how the schedules are viewed and edited on the user interface).

To configure scheduler display attributes:

1. Click Schedulers. The Configuration Panel lists each scheduler defined in the application (Figure 171).
2. Edit the following configurable display attributes:
  - **Show** - allows you to show or hide the scheduler.
  - **Displayed Name** - allows you to define the scheduler name as it appears on the display.
  - **Edit Account Level** - allows you to define the user access level required to edit the schedule start and stop times.
  - **View Account Level** - allows you to define the user access level required to view the schedule.



**Figure 171: Configuring Schedulers Display Attributes**

## Adding Multiple Language Support

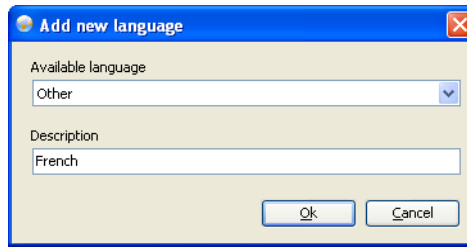
Certain controllers support up to five different languages that you can choose via the user interface at runtime.

**Note:** Check the technical bulletin of the target controller to determine if multiple language capability is supported.

The Display plug-in allows you to develop the main display application in the chosen primary language. You can then identify translations for the dates, states text, and point names used in the display configuration. The translation must not exceed the maximum string length.

To add multiple language support:

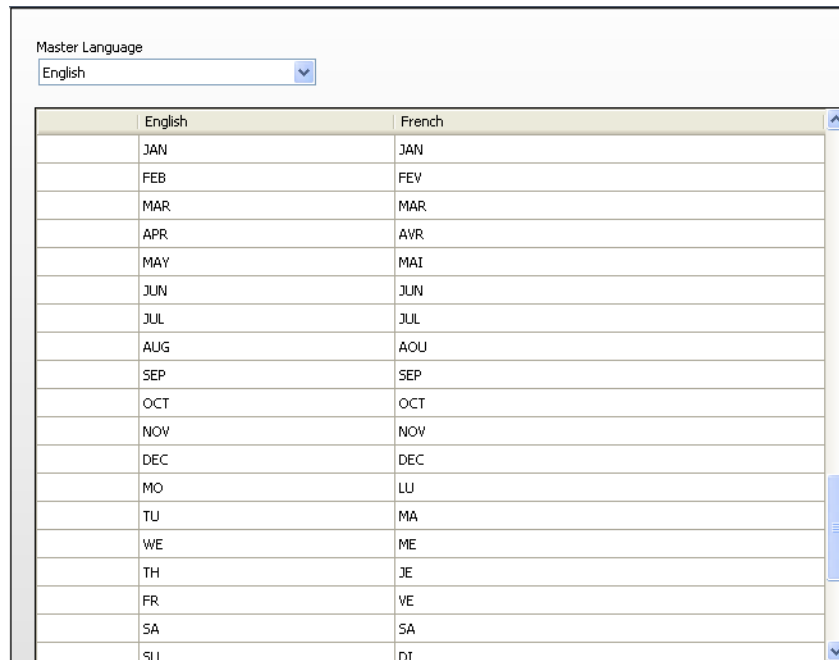
1. Select the Languages category. A list of Language translations appears in the Details Panel. The default language is **lang0**.
2. To add a language translation, right-click on Language and select Add Language. The Add New Language window appears (Figure 172).



**Figure 172: Adding a New Language**

3. In the Available Language list, select English or Other. If you select Other, you can define the language translation name in the Description field.
4. Click OK. If you want more languages translations, repeat Steps 2-3. The Configuration Panel displays the default language and all language translations that you added (Figure 173).

You can define translations for every piece of displayable text defined in the display configuration.



**Figure 173: Language Configuration Panel**

### Saving the User Interface Configuration

To save the user interface configuration, click OK.

### Web Site

The Web Site plug-in allows you to develop the Web pages served up by the controller.

**Note:** Not all controllers support the Web Site feature. Refer to the technical bulletin of the target controller to determine if this feature is supported (Table 24).



**Table 24: FX Controller Technical Bulletins**

Technical Bulletin	LIT Number
<i>FX05 (Advanced) Field Controller Technical Bulletin</i>	<i>LIT-12011155</i>
<i>FX06 Field Controller Technical Bulletin</i>	<i>LIT-12011166</i>
<i>FX07 Field Controller Technical Bulletin</i>	<i>LIT-12011269</i>
<i>FX14 Field Controller Technical Bulletin</i>	<i>LIT-12011164</i>
<i>FX15 Field Controller Technical Bulletin</i>	<i>LIT-12011107</i>
<i>FX16 Master Controller Technical Bulletin</i>	<i>LIT-12011108</i>

The navigation of the Web site is stored in the controller configuration, and you can restrict it with several levels of passwords to different users.

### Toolbar

The toolbar (Figure 174) includes commands to edit the Web Site, including:

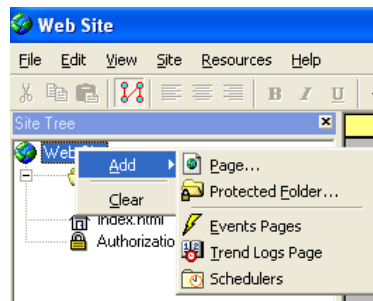
- Cut
- Copy
- Paste
- Shortcut to Site Map
- Text attributes (left/center/right justification, bold, italics, underline)
- Link to Home Page
- Refresh
- Edit Enumerated Texts

**Figure 174: Toolbar**

### Adding Content to the Web Site

To add content to the Web Site:

1. Right-click the Web Site Root in the Site Tree and select Add. Choose from the following:
  - Page
  - Protected Folder (adds a password protected folder)
  - Events Pages
  - Trend Logs Page
  - Schedulers



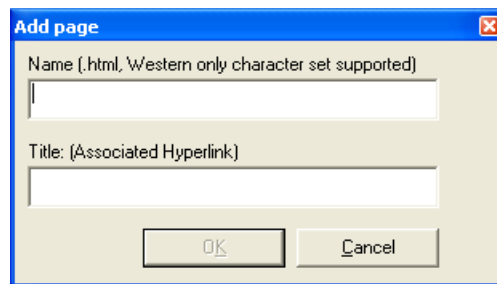
**Figure 175: Adding Content to Web Site**

### Adding a Web Page

The Web page you add allows you to add and format text, hyperlinks, tables, and application points (including volatile inputs and outputs and permanent points).

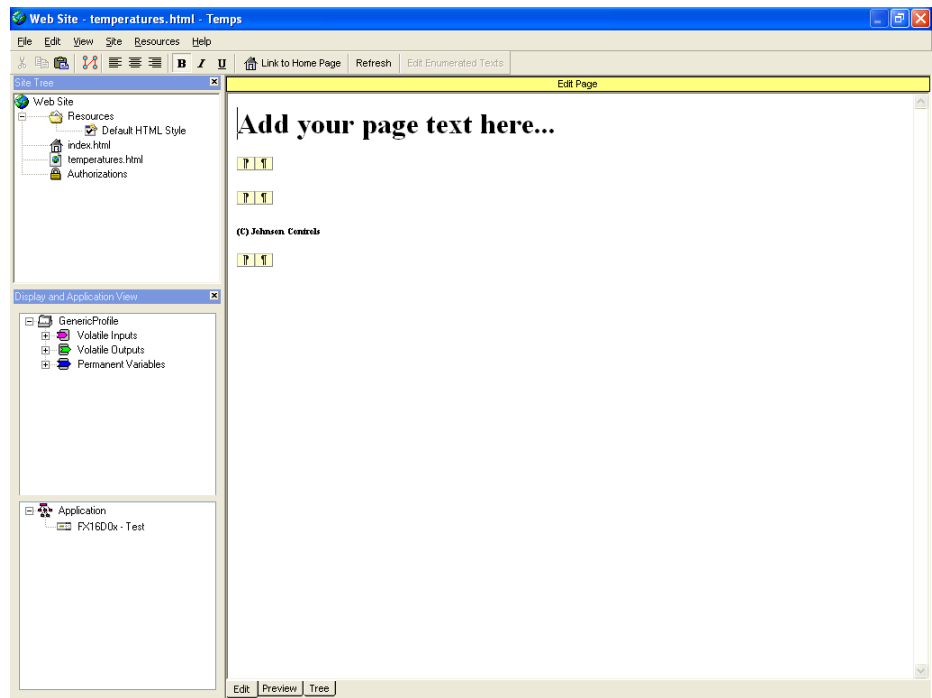
To add a Web page:

1. Right-click the Web Site Root in the Site Tree and select Add and then select Page. The Add Page window appears (Figure 176).



**Figure 176: Adding Content to Web Site**

2. Enter the page name and title and click OK. The Edit Page window appears (Figure 177).



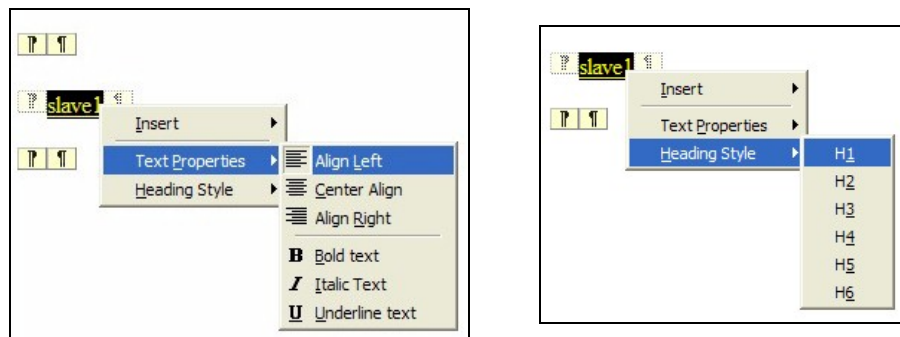
**Figure 177: Edit Page Window**

Tabs at the bottom of the Edit Page window allow you to preview the Web page and to jump back to the site map.

### Web Site Text

When adding text to a page (Figure 178), the plug-in provides commonly used text editing features, including:

- alignment
- text properties
- default header properties

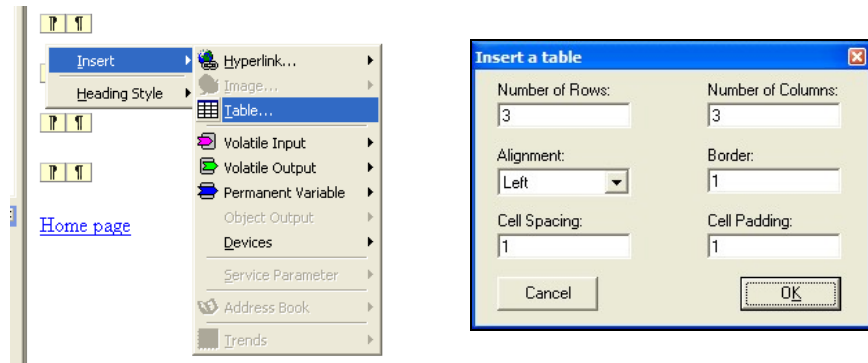


**Figure 178: Editing Text**

## Web Site Tables

When adding or editing a table, the plug-in provides commonly used table formatting features such as alignment, spacing, borders, and padding (Figure 179).

Once the table is added and formatted, you can insert text, hyperlinks, and application points into the table's cells.



**Figure 179: Adding Tables**

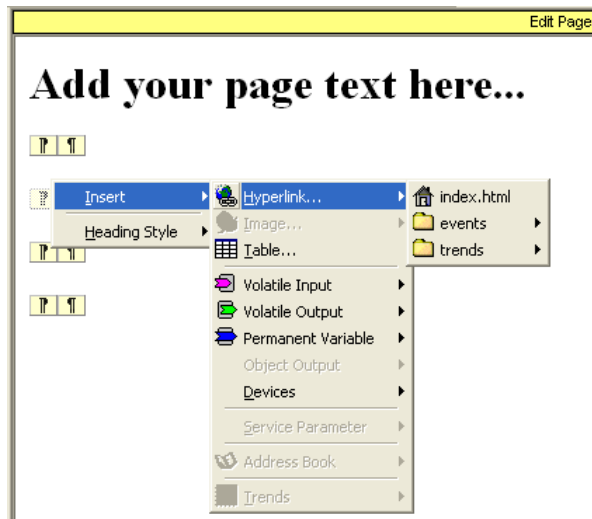
## Adding Hyperlinks

Hyperlinks provide you with the ability to jump to any of the available pages (Figure 180).

To add a hyperlink:

- Right-click in the Web page and select Hyperlink and then select the page to link to.

You can link to any page already predefined (including normal pages, the home page, the events page, the schedule page, and the trends page).

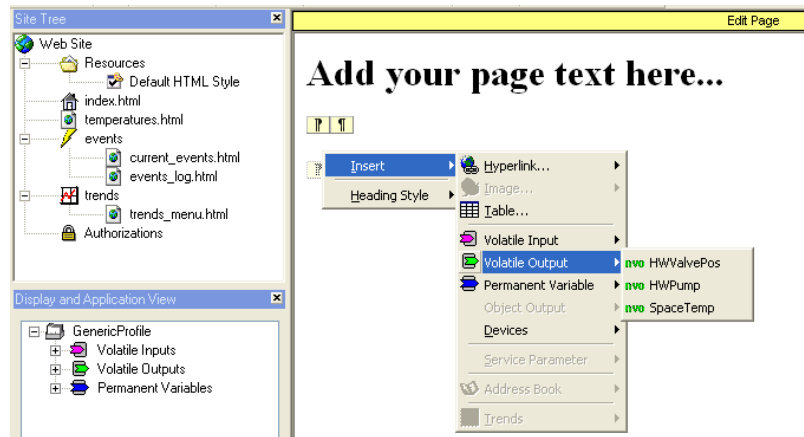


**Figure 180: Adding a Hyperlink**

## Adding Application Points

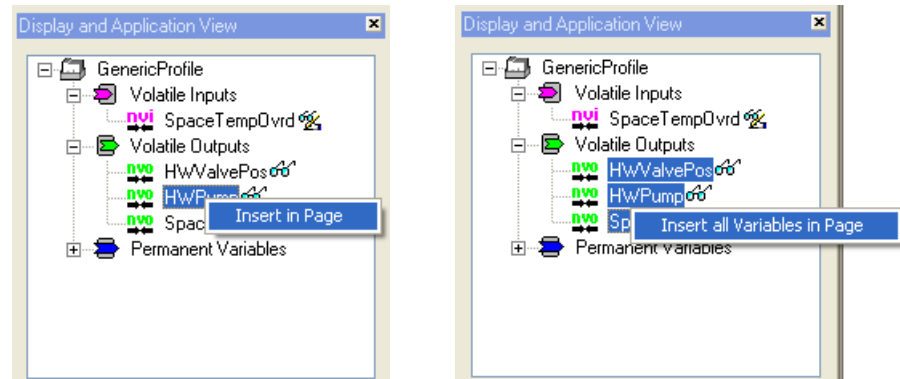
To add application points:

1. Right-click the Web page and select the desired volatile input, output, or permanent point (Figure 181).



**Figure 181: Adding an Application Point to a Web Page**

**Note:** You can also select one or more application points from the Display and Application View window (Figure 182).



**Figure 182: Adding Application Points from Display and Application View**

Multiple application point selection automatically creates a corresponding table with these default fields:

- **Variable** - the name of the application point. You can edit this name in the table, if desired.
- **Value** - the value of the application point
- **Unit** - the units of measure symbol

2. Edit the table as desired (Figure 183).

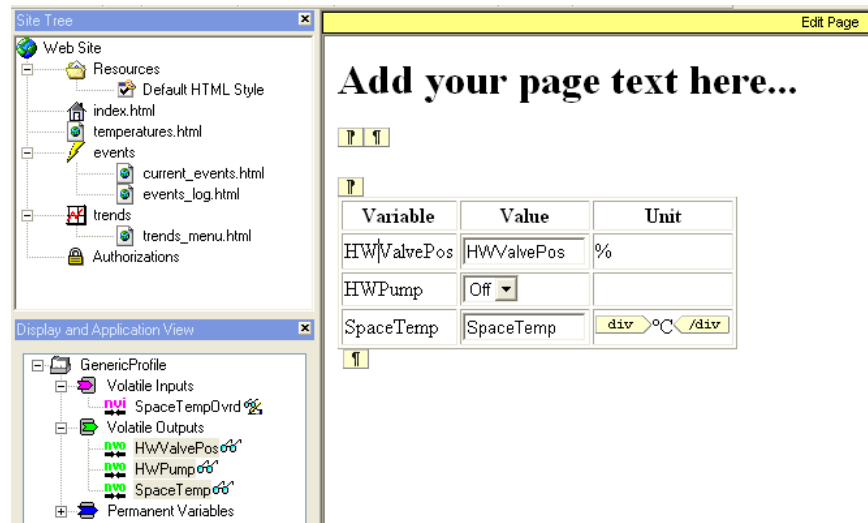


Figure 183: Inserting a Table from the Display View

### Editing Application Points in a Page

You can edit an application point in a Web page by right-clicking on its value (Figure 184) and selecting one of the following:

- **Details** - allows you to visualize the point details.
- **Delete** - removes the point entirely from the page.
- **Absolute** - removes the point from the table to be positioned elsewhere on the page.

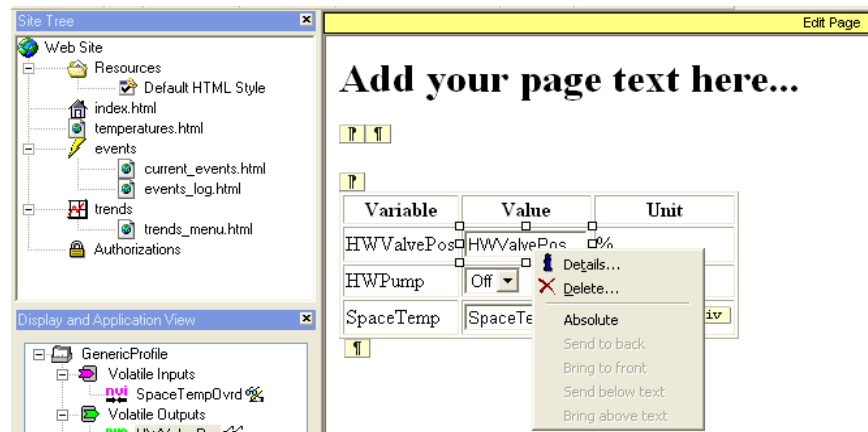


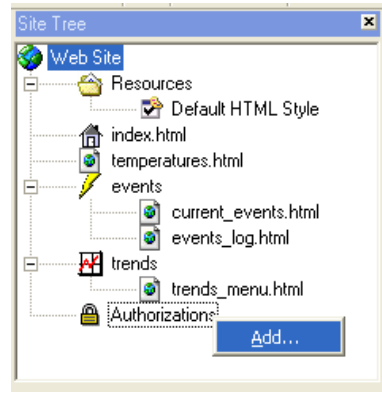
Figure 184: Editing an Application Point

### Adding Users and Restricting Access

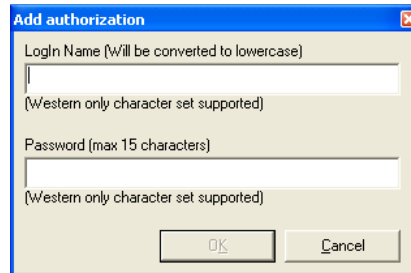
You can restrict access to certain data by setting up protected folders and defining authorized users and their corresponding passwords.

To add users and restrict access:

1. Right-click Authorizations and select Add (Figure 185). The Add Authorization window appears (Figure 186).

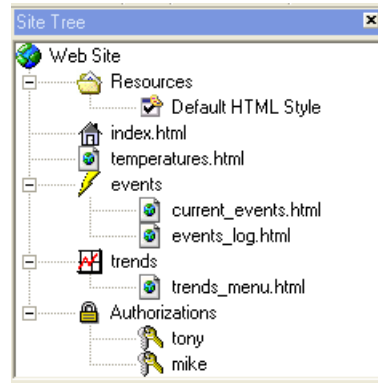


**Figure 185: Adding a User**



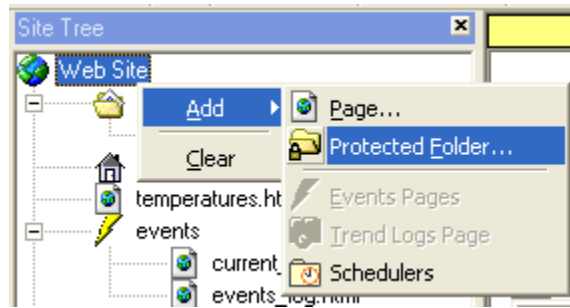
**Figure 186: Adding Login Name and Password**

2. Enter a LogIn Name and Password (fewer than 15 characters).
3. Repeat Steps 1 and 2 until you add all authorized users. The users appear in the Authorizations list in the Site Tree (Figure 187).

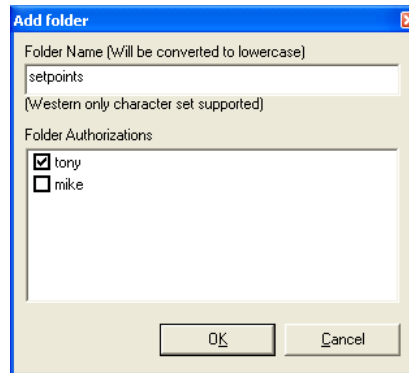


**Figure 187: Authorized Users in Site Tree**

4. Right-click Web Site and select Protected Folder from the Add Menu (Figure 188). The Add Folder window appears (Figure 189).



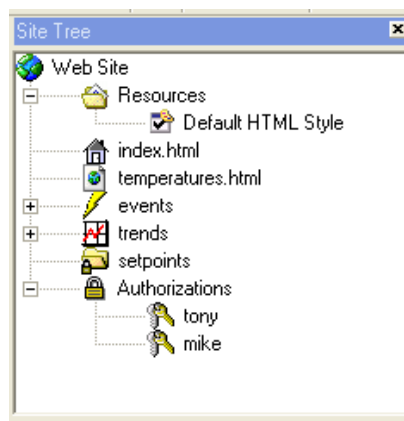
**Figure 188: Adding a Protected Folder**



**Figure 189: Adding Folder Authorizations**

5. Enter the folder name and identify the users authorized to access the pages in this folder.
6. Click OK.

Once added, the Protected Folder appears in the Site Tree with a folder and lock icon (Figure 190).



**Figure 190: Protected Folder Added**

7. To add a page to the protected folder, right-click the locked folder and select Add Page (Figure 191). You can now edit the page as a normal page.



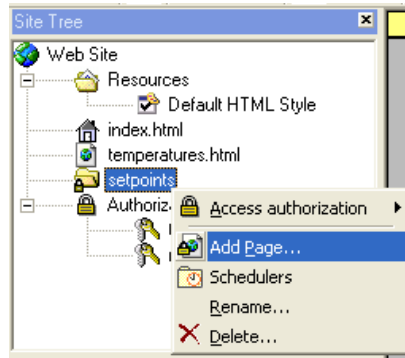


Figure 191: Adding a Protected Page

### Adding the Events Pages

To add Events Pages:

1. Right-click Web Site and select Events Pages from the Add menu. The Events folder appears in the Site Tree (Figure 192).

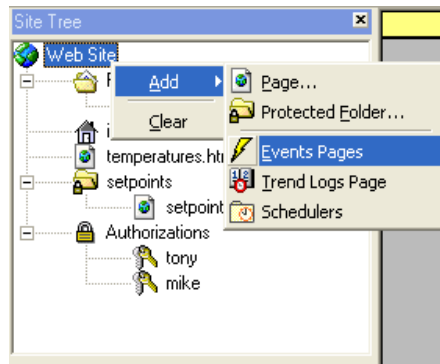


Figure 192: Adding Events Pages

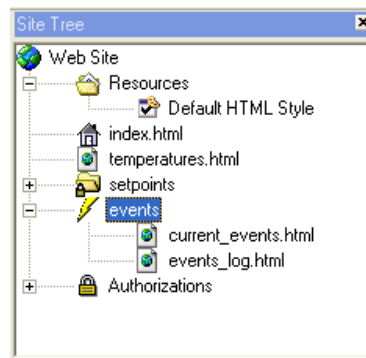


Figure 193: Adding Events Pages

Two default pages are automatically created. These pages collect and display the events identified in the application points plug-in and configured in the Events plug-in. You cannot edit these Events pages.

2. In the Site Tree, select **current\_events.html** to view the Current Events Page (Figure 194). This page can collect up to 20 active events.

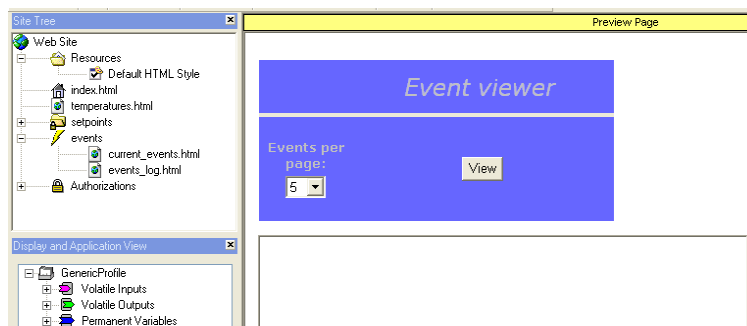


Figure 194: Current Events Page

3. In the Site Tree, select **events\_log.html** to view the Events Log Page. This page provides you with filter options like Application Events or System Events.

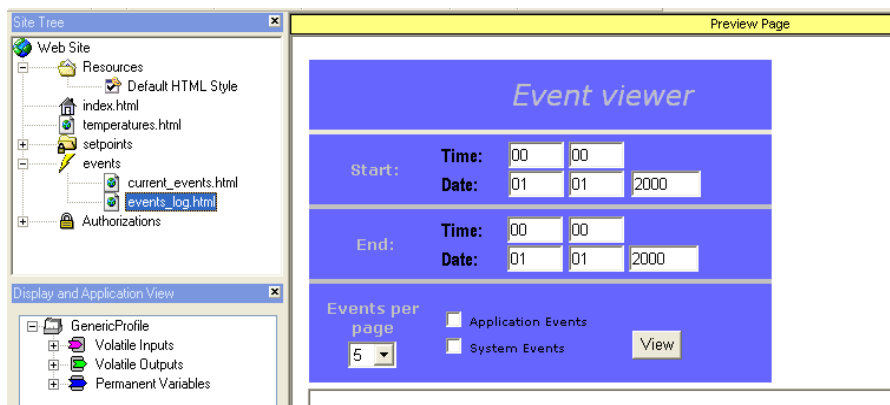


Figure 195: Events Log Page

## Adding Trend Pages

To add a trend page:

- Right-click the Web site root and select Add and then Trends Log Page (Figure 196). A default Trend Logs Page is automatically created and added to the Site Tree.

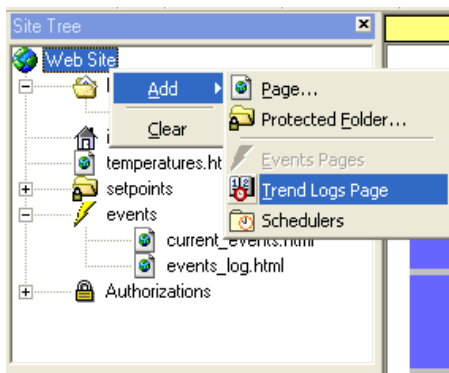


Figure 196: Adding the Trend Logs Page

The Trends Log Page collects and displays all the trended variables identified in the application points plug-in and configured in the Trends plug-in. The Trend Logs page is not editable.



Figure 197: Trend Logs Page

### Importing Trended Data into Microsoft Excel

Once the trended variable has been logged, you can access the trended data in two different ways:

- Wait for a periodic offload notification e-mail containing all the trended data logged during the offload period.
- Connect to the controller via modem (remote connection) or null modem (direct connection) and browse the available Trend Logs pages.

In either case, trended data appears in textual format, which is not effective for data analysis. The fastest way to convert the textual format into a more efficient one is to import data into Microsoft Excel.

To import trended data into Excel:

1. Copy the logged data from its original container, e-mail message, or Hypertext Markup Language (HTML) page. See Figure 198 and Figure 199.

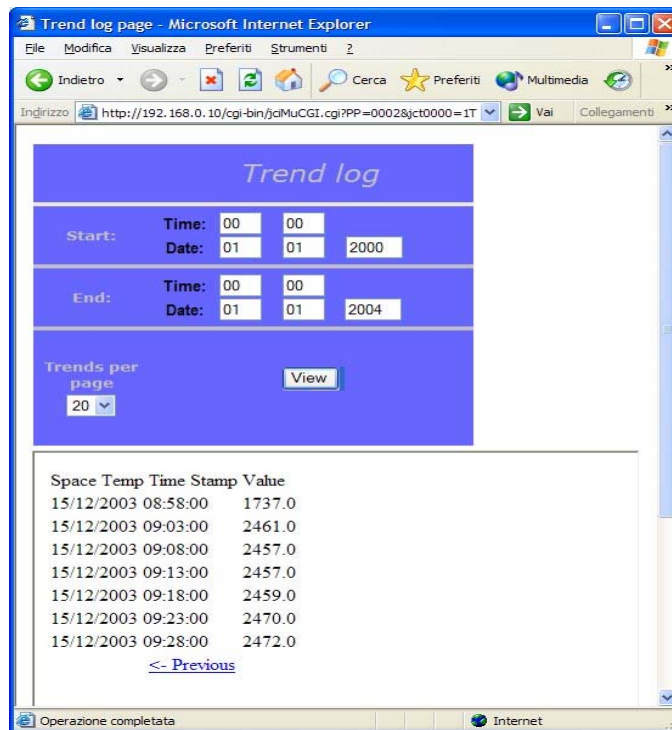


Figure 198: Trend Logs on Web

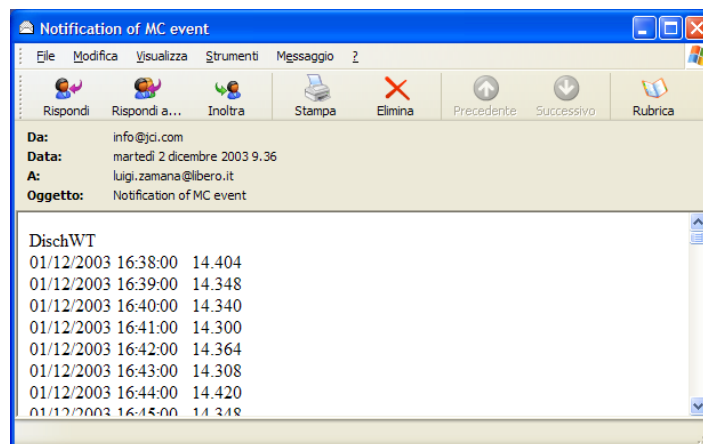


Figure 199: Trend Logs on E-Mail

2. Paste the data into a standard .txt file, using Notepad or another text editor (Figure 197).

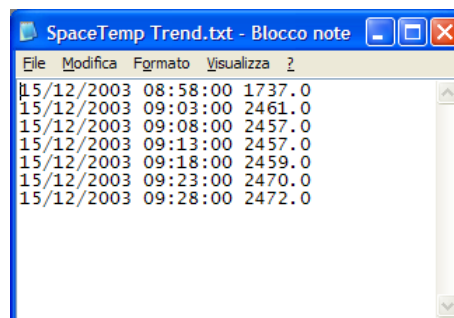


Figure 200: Trended Data to Notepad

3. Save the data in a .txt file.
4. Open the file in Microsoft Excel (Figure 201).

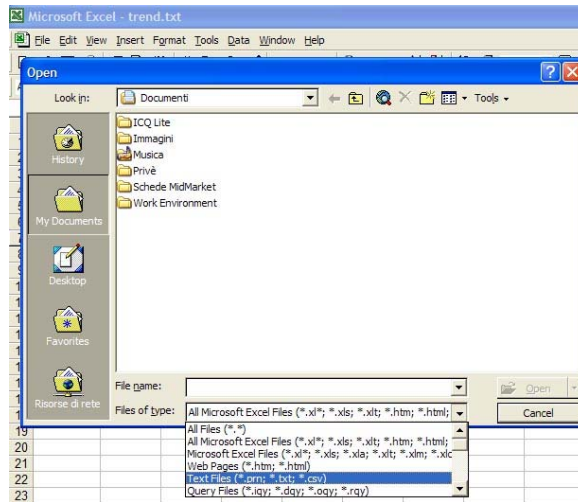


Figure 201: Importing .txt to Excel

5. Follow the Microsoft Excel prompts and click Finish once finished (Figure 202).

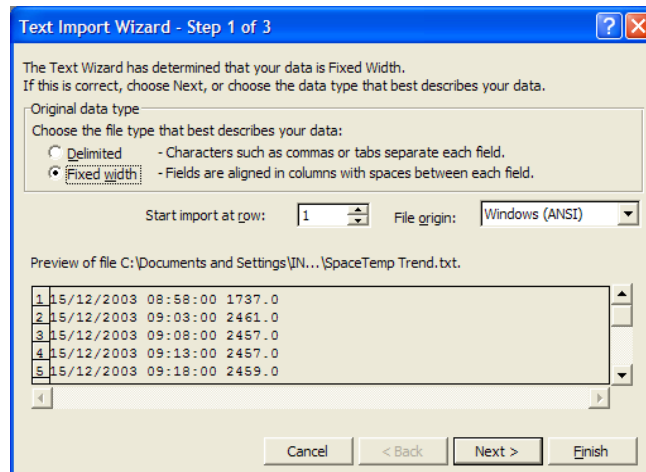


Figure 202: Text Import Wizard

The Excel import utility extracts the data contained in the text file and separates the values based on the **spaces** between columns (Figure 203).

	A	B	C	D
1	#####	8.58.00	1737	
2	#####	9.03.00	2461	
3	#####	9.08.00	2457	
4	#####	9.13.00	2457	
5	#####	9.18.00	2459	
6	#####	9.23.00	2470	
7	#####	9.28.00	2472	
8				

**Figure 203: Microsoft Excel Imported Trend**

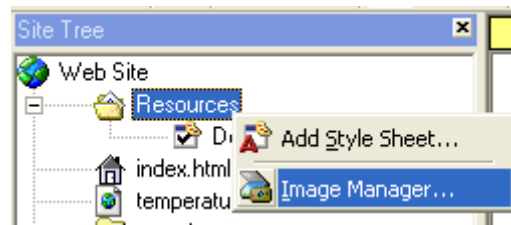
**Note:** The imported textual data may be longer than the Excel cell width. In this case, the data appears as in Figure 200 with # characters. To see the actual data, you need to resize the column width.

### Adding an Image to a Web Page

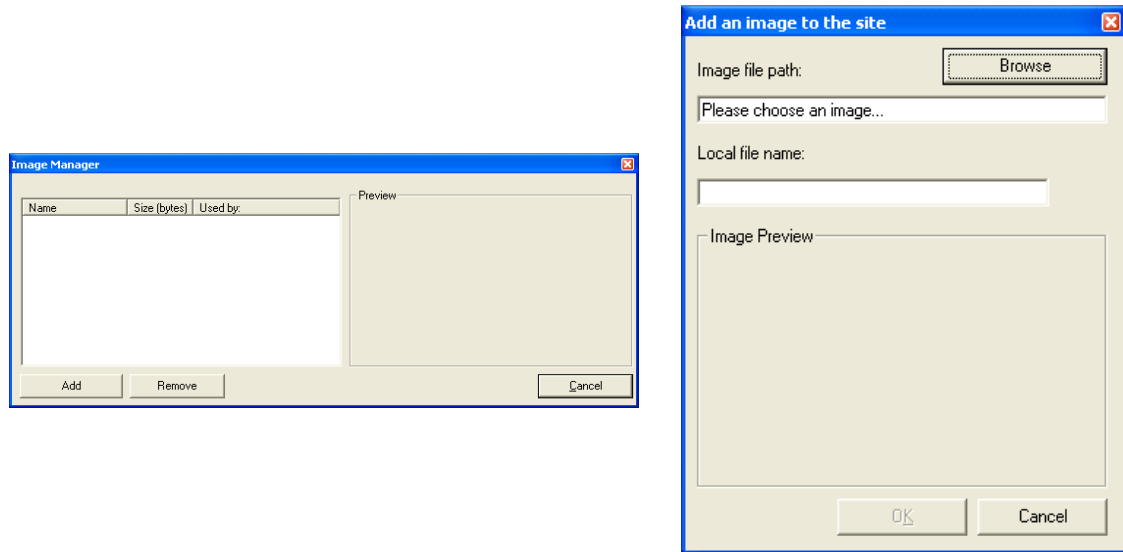
The Web Site plug-in allows you to add images to the Web pages. The images must be **.jpg** or **.gif** format and **less than 150 KB**.

To add an image to a Web page:

1. Right-click the Web Site root and select Image Manager (Figure 204). The Image Manager allows you to locate images by browsing your computer (Figure 205).

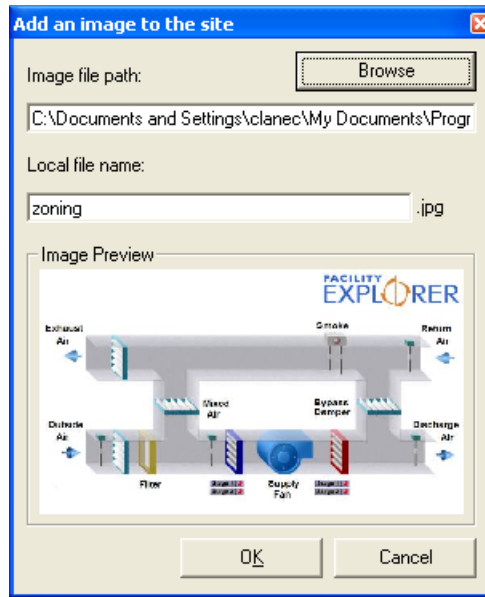


**Figure 204: Importing an Image (Part 1)**



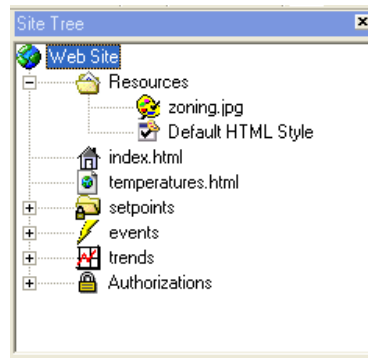
**Figure 205: Importing an Image (Part 2)**

2. Locate and select the image you want. A preview of the image appears along with the file details (Figure 206).



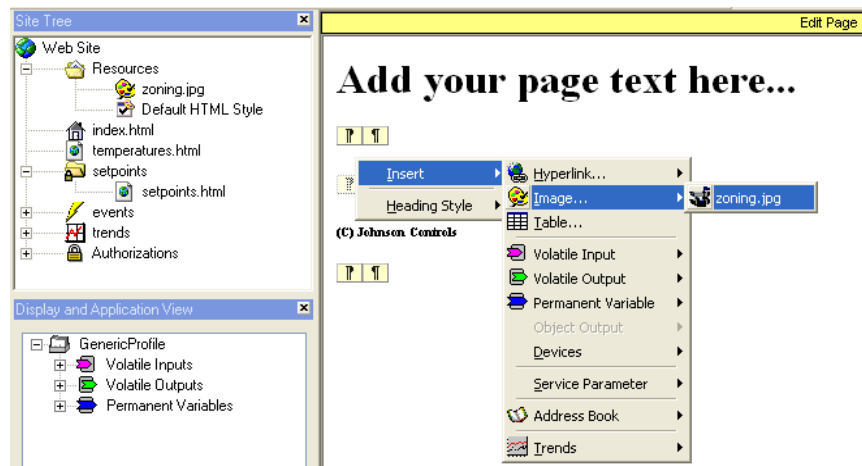
**Figure 206: Image Preview**

3. Click OK. The image appears in the Resources folder in the Site Tree (Figure 207).



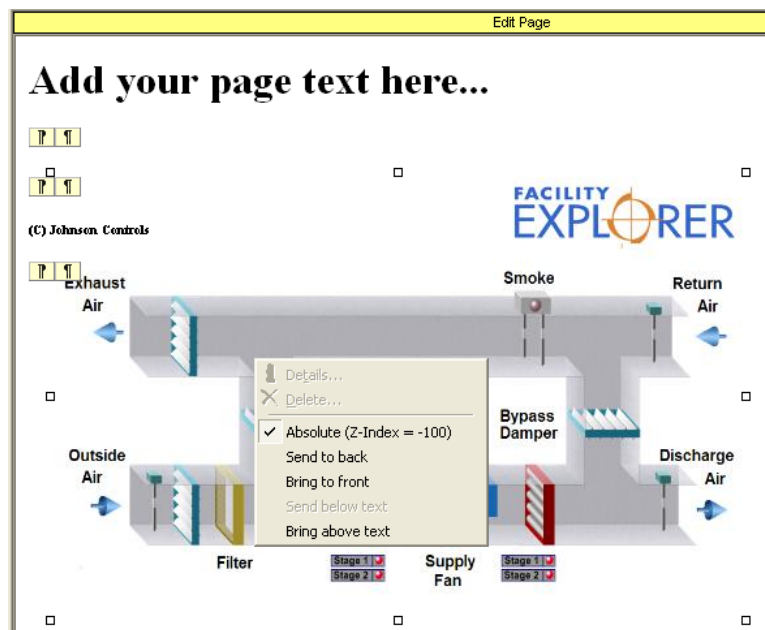
**Figure 207: Image Imported into the Resources**

4. To add the image to a Web page, right-click the empty Web page and select Image and then the desired image file (Figure 208).



**Figure 208: Add Image to a Web Page**

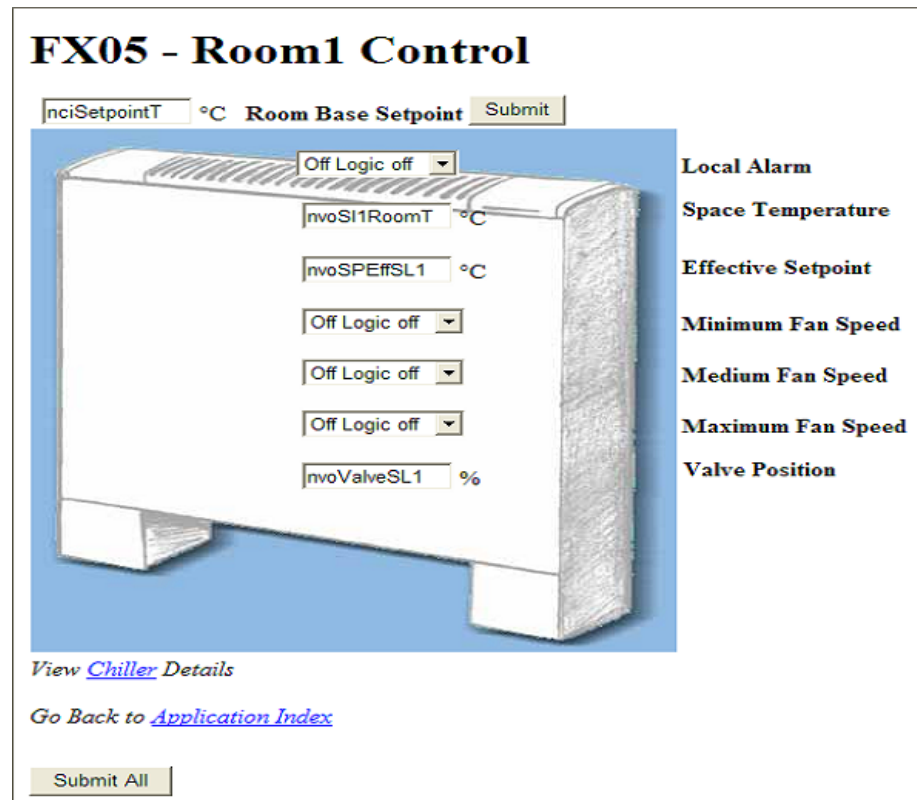
5. Once an image appears on the page, right-click the image to make it **Absolute**. This procedure allows you to move the image around the page (Figure 209).





**Figure 209: Image Options**

**Note:** You can also add hyperlinks or application points on top of the image to create a full summarized view of the application (Figure 210).

**Figure 210: Example of Web Page with Image, Hyperlinks, and Application Points**

### Saving the Web Site Configuration

To save the Web Site configuration:

- Click Exit from the File menu. The Web Site configuration automatically saves and compiles.

### Notification Services

The **Notification Services** menu item allows you to set up the SMS, e-mail, and Web connection service parameters of the controller.

**Note:** Notification Services are not available for every controller. Check the technical bulletin of the target controller to ensure these features are supported.

### Setting up the SMS Service Parameters

To set up the SMS service parameters:

1. Right-click the Application menu item and select Notification Services and then SMS (Figure 211). The Edit Service: SMS window appears (Figure 212).

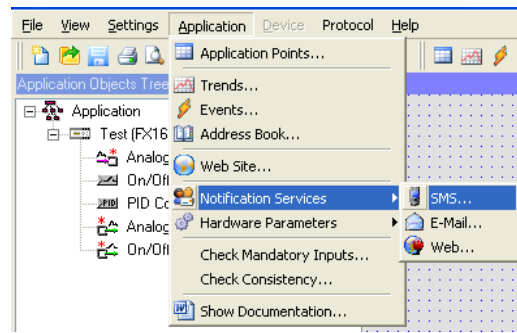


Figure 211: Accessing the SMS Service Parameters

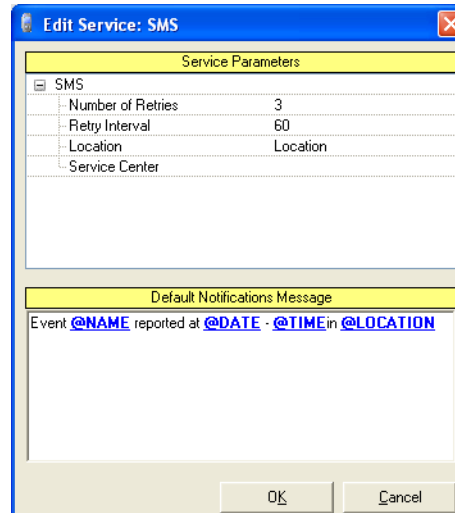


Figure 212: Editing SMS Service Parameters

2. Define the following information and click OK:

- **Number of Retries** - defines the number of failed attempts the controller must reach before triggering the **Communication Failure** event related to the SMS notifications.
- **Retry Interval** - defines the delay, in seconds, between two subsequent attempts.
- **Location** - defines the string that replaces the keyword @LOCATION in the SMS notification message.
- **Service Center** - defines the phone number the controller has to call to send an SMS (optional).

**Note:** The modem usually uses the service center number defined by default on the Global System for Mobile Communications (GSM) Subscriber Identity Module (SIM) card; however, you can force the modem to contact a different service center number with this setting.

- **Notification Message** - refers to an alphanumeric string that can contain tagged elements. In the string, the tags report their assigned value at the moment of the notification. For example,

the @TIME tag is replaced by the current time value. Available Tagged Information is as follows:

- @LOCATION of the Controller (for example, @LOCATION = Meeting Room 1st Floor)
- @NAME of the Event (for example, @NAME = Low Pressure Switch)
- @DATE of the Event (for example, @DATE = 31 Oct 2003)
- @TIME of the Event (for example, @TIME = 12.15)

### Setting up the E-mail Service Parameters

To set up the e-mail service parameters:

1. Right-click the Application menu item and select Notification Services and then E-Mail (Figure 213). The Edit Service: E-Mail window appears (Figure 214).

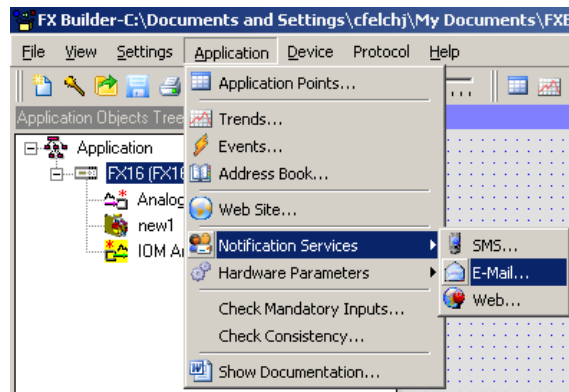


Figure 213: Accessing the E-Mail Service Parameters

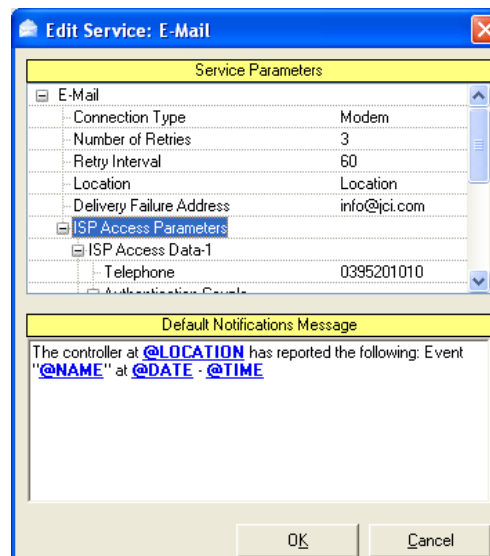


Figure 214: Editing E-Mail Service Parameters

2. Define the following information and click OK.

- **Connection Type** - defines the media the controller uses to send e-mail notifications.

**Note:** The Ethernet option is not yet implemented. Select only Modem.

- **Number of Retries** - defines the number of failed attempts the controller has to reach before triggering the **Communication Failure** event related to the e-mail notifications or before trying the other defined **Internet Service Provider (ISP) Access Data**.
- **Retry Interval** - defines the delay, in seconds, between two subsequent attempts.
- **Location** - defines the string that replaces the keyword **@LOCATION** in the e-mail notification message.
- **Delivery Failure Address** - If an e-mail message does not reach its destination, a Delivery Failure message is sent to the delivery failure address.
- **ISP Access Parameters** - defines information that the controller uses to connect to the ISP to send e-mail notification messages. You can define multiple **ISP Access Data** as backups for the primary destination in case of failures. The controller tries to connect to the first ISP defined. If the connection fails for the maximum number of retries defined, the controller tries the second one and so on. Right-click the ISP Access Parameters to Add or Remove an ISP Access Data (element).
- **ISP Access Data:**
  - **Telephone** - defines the ISP telephone number the controller calls to access a Simple Mail Transfer Protocol (SMTP) server to send e-mail notification messages.
  - **User Identification** - used by the controller to be authenticated from the e-mail server.
  - **Password** - used by the controller to be authenticated from the e-mail server.
- **SMTP Server** - represents the name of the e-mail server the controller accesses to send e-mail notification messages.

**Note:** This information is typically provided by the ISP.
- **Notification Message** - is an alphanumeric string that can **contain** tagged elements. These tags report in the string the assigned value at the moment of the notification. For example, the **@TIME** tag is replaced by the current time value. Available Tagged Information is as follows:

**@LOCATION** of the Controller (for example,  
@LOCATION = Meeting Room 1st Floor)

**@NAME** of the Event (for example, @NAME = Low  
Pressure Switch)

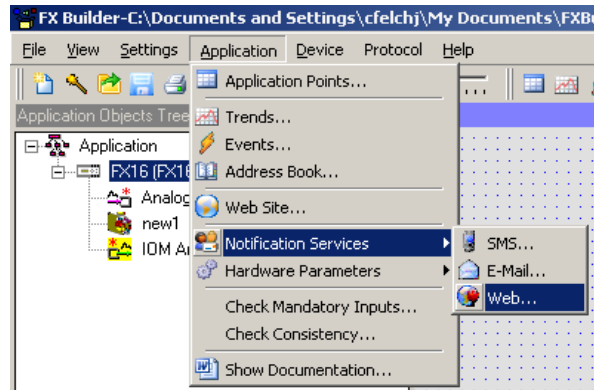
**@DATE** of the Event (for example, @DATE = 31 Oct  
2007)

**@TIME** of the Event (for example, @TIME = 12.15)

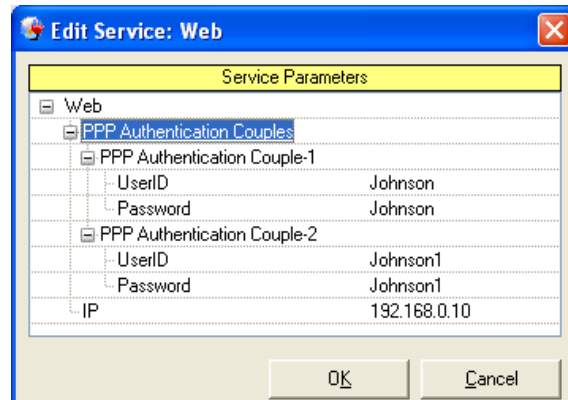
## Setting up the Web Connection Service Parameters

To set up the Web connection service parameters:

1. On the Application menu, select Notification Services and then Web (Figure 215). The Edit Service: Web window appears (Figure 216).



**Figure 215: Accessing the Web Connection Service Parameters**



**Figure 216: Editing the Web Service Parameters**

In configuring the Web connection service, you define the Authentication Couple, User Identification, and Password for each user that connects to the controller. Multiple users can establish a Point-to-Point Protocol (PPP) connection to the controller using the same authentication couple; however, you must make the connection one user at a time.

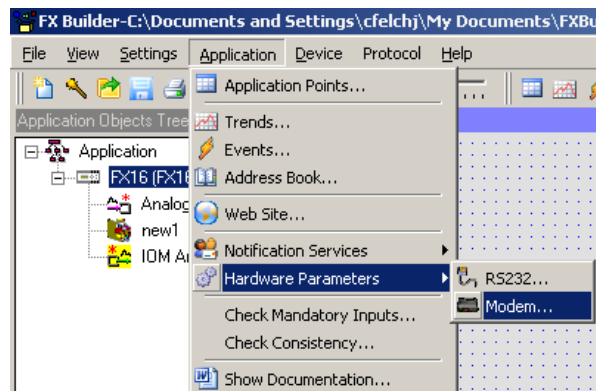
2. Define the following information and click OK.

- **Authentication Couple** - Add authentication couples by right-clicking on PPP Authentication Couples and selecting Add Element.
- **User ID** - The User ID String is limited to a maximum of 15 characters.
- **Password** - Each User ID must have its own unique password. Passwords are limited to a maximum of 15 characters.
- **IP Address** - This parameter defines the IP address users have to enter into the Web browser address bar once the PPP connection with the controller is established.

### ***Hardware Parameters***

The Hardware Parameters menu item allows you to configure the controller hardware used for the PPP (RS-232 and modem) connections (Figure 217).

**Note:** Notification Services are not available for every controller. Check the technical bulletin of the target controller to ensure these features are supported.



**Figure 217: Hardware Parameters**

## Configuring the RS-232 Port

When you configure the RS-232, you define the communication settings used by the controller during its PPP connections via null modem cable. This includes:

- **Baud Rate** - defines the communication speed the controller performs during RS-232 connections. The typical value is 9600 bits per second.
- **Flow Control** - defines the type of speed control the controller performs on the communication to synchronize the two speeds. The FX controllers do not implement the software flow control (Xon/Xoff), so you should set this to **None**.
- **Stop Bits** - defines the length of the stop bits present in the communication stream. The FX controllers use one stop bit, so you should set this to **1**.
- **Data Bits** - defines the length, in bits, of the data streams. The FX controllers use 8-bit data streams, so you should set this to **8**.
- **Parity** - defines the presence and the strategy to calculate the Parity bit (similar to a checksum). The FX controllers do not need any Parity bit, so you should set this to **None**.

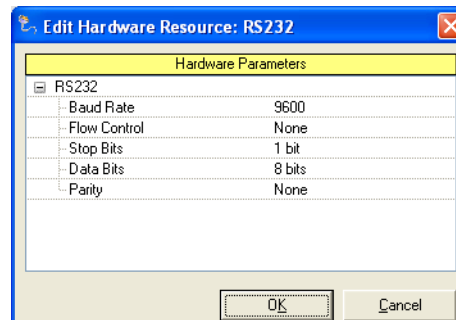


Figure 218: RS-232 Configuration Window

## Modem Configuration

When you configure the modem, you define the communication settings, which are used by the controller during its PPP connections via modem, including:

- **Modem Type** - defines the modem model the controller used to execute services. Public Switched Telecommunications Network (PSTN) means a landline modem and GSM is a modem type that uses the Global System for Mobile Communications (wireless).
- **Dial** - defines the dial mode (pulse or tone) the controller uses to connect to the SMS and e-mail service providers. The dial mode is strictly related to the phone line that the controller connects to. Typically, it is set to **Tone**.



- **Baud Rate** - represents the communication speed the controller performs during modem connections. Its typical value is **9600 Baud**.
- **Ring Numbers** - defines the number of rings the controller waits before taking an incoming call.
- **Number of Retries** - defines the number of retries.
- **Auto Baud** - indicates if the two modems involved in the communication have to automatically select the communication speed. Its typical value is **On**.
- **Init String** - defines the Command Initialization String the controller sends to the modem at powerup.
- **Card PIN** - represents the security code of the SIM card used by the GSM modem. You must disable the Personal Identification Number (PIN) on the SIM card.

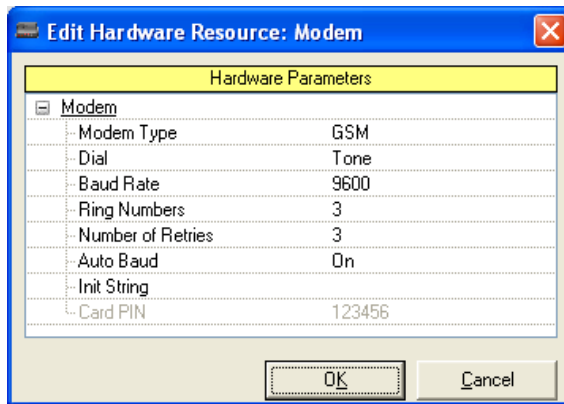


Figure 219: Modem Configuration Window

## Protocol Plug-in

The Protocol plug-in creates network profiles for the desired protocol. Using this plug-in, you can expose application points as N2 network points, as LONWORKS network variables and configuration properties, or as BACnet objects.

**IMPORTANT:** You must create the network profile **after** all application points have been fully defined and configured. If you make application changes, you must update the network profile accordingly because the network profile does not automatically update itself.

## N2 Network Profile Plug-in

### Configuring the N2 Network Profile

To configure the N2 Network Profile:

1. On the Protocol menu, select Add and then N2 Open. The N2 profile is automatically created. Every application point is exposed with a corresponding N2 network point (Figure 220).
2. If necessary, modify the N2 network profile as follows:
  - f. Remove application points from the N2 network profile by clearing its On the Network box.
  - g. Edit the N2 Short Name.
  - h. Edit the N2 Long Name.
  - i. Select a different point type (not recommended).
  - j. Change the N2 Point Address (not recommended).
3. Click Apply.

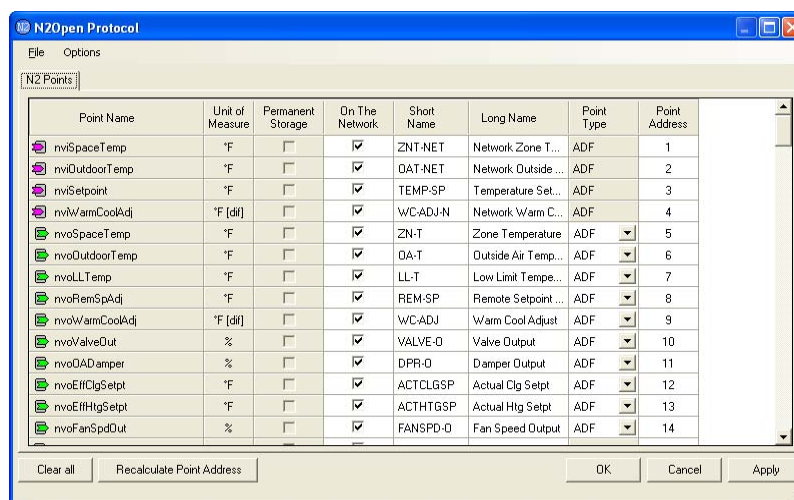


Figure 220: N2 Open Plug-in Window

### Exporting the N2 Print File

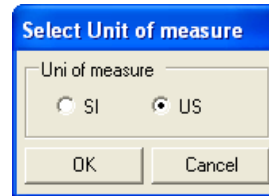
The N2 print file (.prn) contains a list of all N2 network points and their corresponding long name, short name, point type, point address,

and units of measure symbol. Use this file to assist the mapping of the controller's N2 network points into an N2 supervisory class controller (for example, Companion or N30).

**Note:** For integration into an FX40, use the .apd file.

To export the N2 print file:

1. From the File menu, select Generate PRN File. The Select Unit of Measure window appears (Figure 221).



**Figure 221: Selecting Desired Units of Measure**

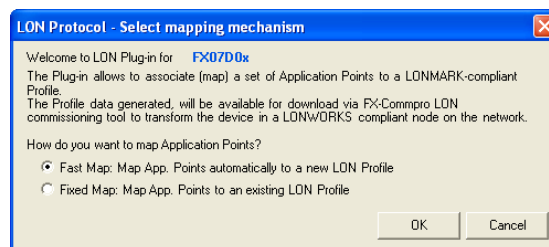
2. Select the desired unit of measure and click OK. The Save As window appears.
3. Enter the desired file name, select a location, and click Save.

### ***LONWORKS Network Profile Plug-in***

#### Configuring the LONWORKS Network Profile

To add a LONWORKS network profile:

1. From the Protocol menu, select Add and then LON. You can choose from the following methods to create the LONWORKS network profile:
  - **Fast Map** - This method automatically maps application points to a generic LONWORKS functional profile.



**Figure 222: Fast Map**

- **Fixed Map** - This method assists you in mapping application points to a specified LONWORKS functional profile. You can choose the desired LONWORKS functional profile from a predefined list in the plug-in (for example, Space Comfort Control profile).

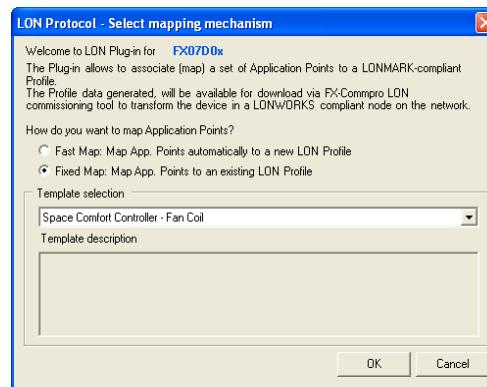


Figure 223: Fixed Map

2. For Fast Map configuration (Figure 224), modify the LONWORKS network profile as follows:

- Remove application points from the LONWORKS network profile by clearing its On the Network box.
- Edit the LON name.
- Enable the Receive Heartbeat feature (NVI only). If you enable this feature, the value of the NVI reverts to **invalid** when the **nciRecHrtBt** time expires. If you do not enable this feature, the value of the NVI is retained until power cycle.
- Change the LON index, Functional Block, and Member Index (not recommended).
- Change the Program ID.
- Change the Network Tuning Information (not yet implemented).

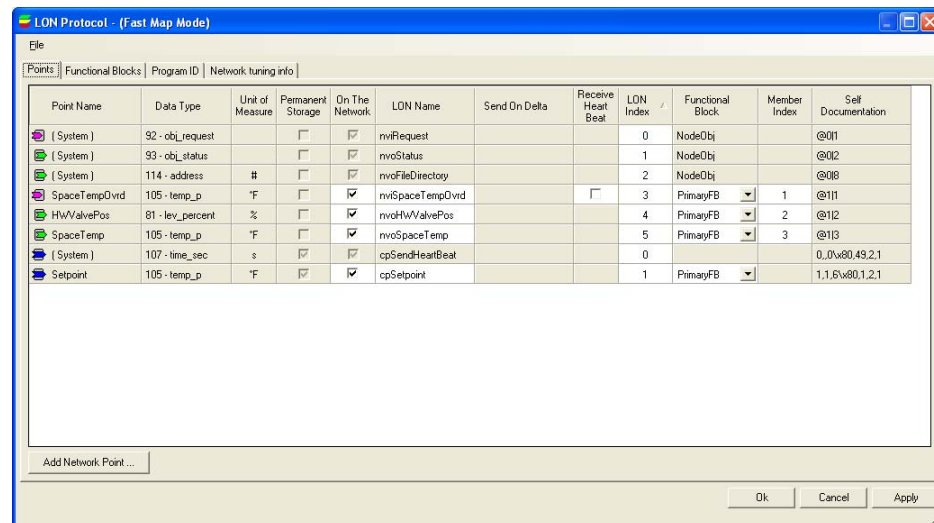
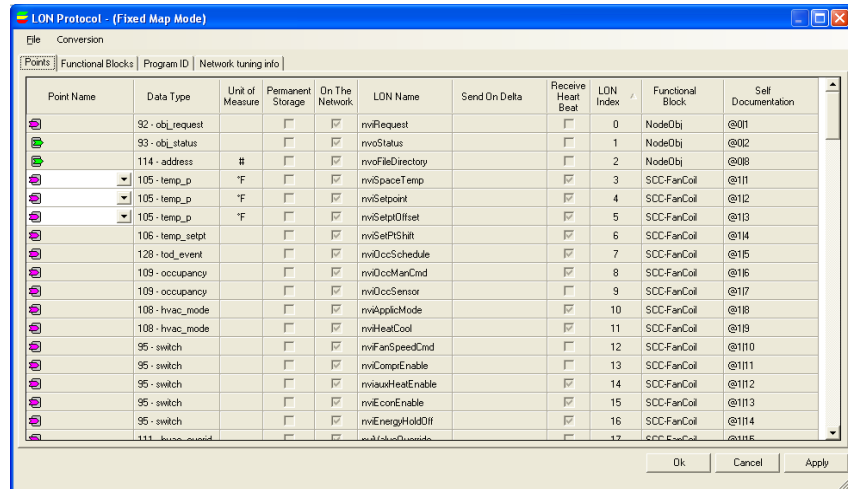


Figure 224: Adding a LONWORKS Network Profile via Fast Map

3. For Fixed Map configuration, a list of LONWORKS defined network variables for the selected functional profile appears. Identify which

application point should be mapped to the corresponding network variable in that list.

**Note:** If the selected functional profile is not suitable, you can switch to the Fast Map mode.



**Figure 225: Adding a LONWORKS Network Profile via Fixed Map**

4. Click Apply.

### Fast Map Configuration

If you use Fast Map configuration, the application points automatically map to a corresponding LONWORKS network variable.

The LON name automatically generates based on the following rules:

- Volatile application points of **in** direction receive an **NVI** prefix.
- Volatile application points of **out** direction receive an **NVO** prefix.
- All permanent application points receive a **CP** prefix.

### Fixed Map Configuration

If you use Fixed Map configuration, the plug-in assists you in mapping an application point to a LONWORKS network variable from the selected standard functional profile.

## Network Resource Files

The LONWORKS network resource files (.xif, .typ, .fmt, .ftp, .enu) include detailed information (data types, enumerations, and locations) about the Network Variables (NVs) and CPs defined in the application network profile. These resource files are used by a LONWORKS network management tool (for example, the LonMaker® tool) to interpret data flowing to and from the controller.

Resource files are grouped into resource file sets, where each set defines functional profiles, network variable types, configuration property types, enumeration types, strings, and formats for specified device types. File extensions include .xif, .enu, .typ, .fmt, .and .ftp.

The range of device types a resource file set applies to is called the **scope** of the resource file set. For example, the scope may specify that the resource file set applies to an individual device type or to all device types.

The scopes are:

- **Scope 5** - used for a user resource file set containing user resources for all devices with a specified Manufacturer ID and device class, usage, and channel. This scope value can be used by a manufacturer for a resource file set that applies to all of the manufacturer's devices of a specific device class, usage, and channel type.
- **Scope 6** - Used for a user resource file set containing user resources for all devices with a specified Standard Program Identifier (SPID). This scope value can be used by a manufacturer for a resource file set that applies to a single device type.

## Exporting the LONWORKS Network Resource Files

To export the LONWORKS network resource files:

1. From the File menu, select Generate Resources Files. The Save As window appears.
2. Enter the desired file name, select a location, and click OK.

### **BACnet Network Profile Plug-in**

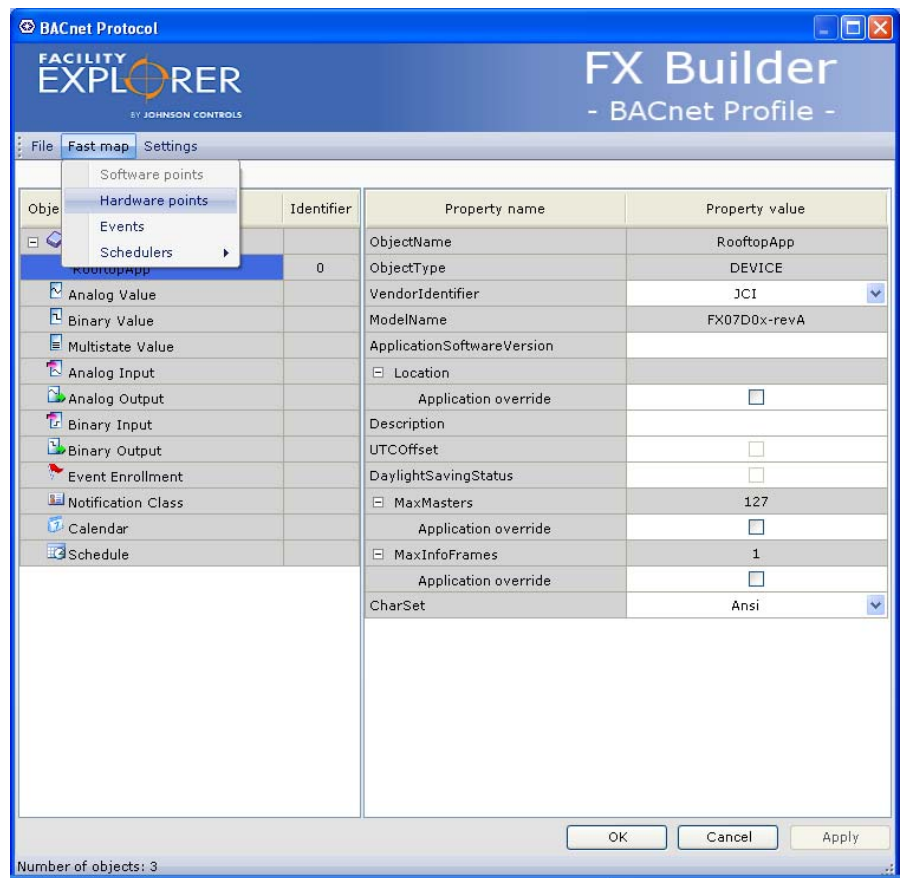
FX Builder allows you to add BACnet object instances to the network profile and to map the properties of each BACnet object instance to an application point, which is connected to an acceptable application object attribute.

You can use two methods to create the BACnet Network Profile: **Fast Map method** and **Manual Map method**.

#### **Configuring the BACnet Network Profile Using the Fast Map Method**

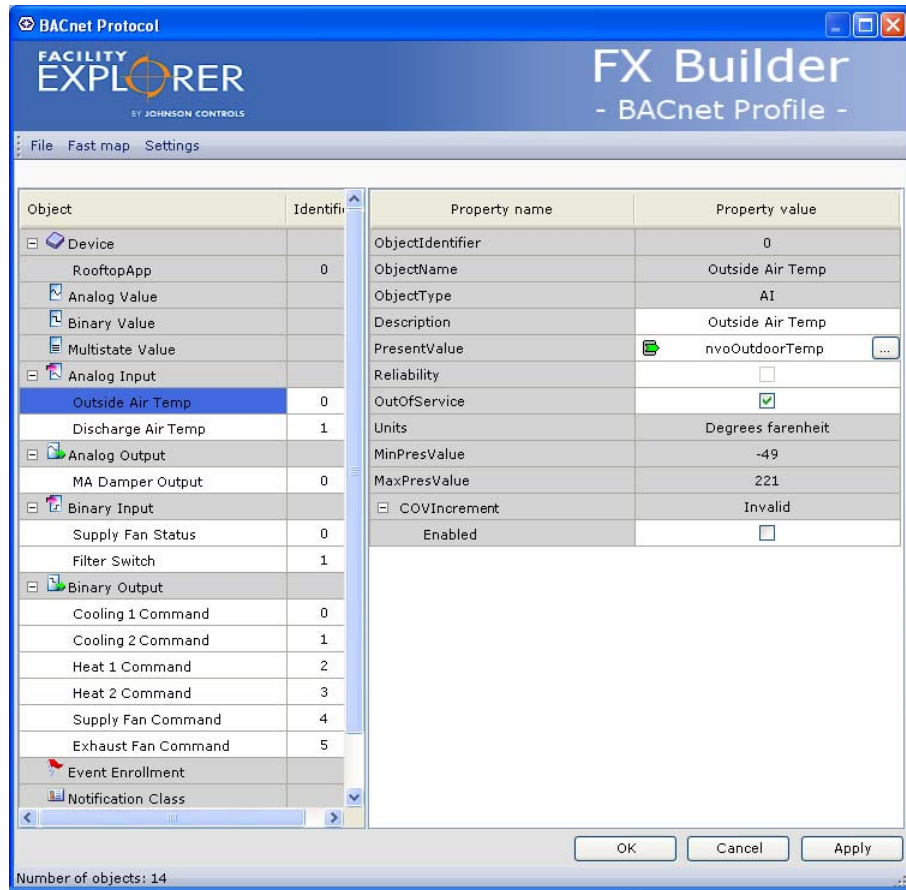
The Fast Map method creates a BACnet object for every type of application points. Currently, only hardware-type application points (for example, analog inputs, binary inputs, analog outputs, and binary outputs) are supported by the Fast Map method.

To use the fast map method, select Hardware Points from the Fast Map menu. The BACnet Protocol window appears (Figure 226).



**Figure 226: BACnet Protocol Window**

BACnet objects are automatically created for every hardware type application point (Figure 227). Each BACnet object instance name property automatically maps to the name of the corresponding application input/output object. Each BACnet present value property automatically maps to the corresponding effective output value of the application input/output object.



**Figure 227: BACnet Protocol Window (with BACnet Objects)**

### Configuring the BACnet Network Profile Using the Manual Map Method

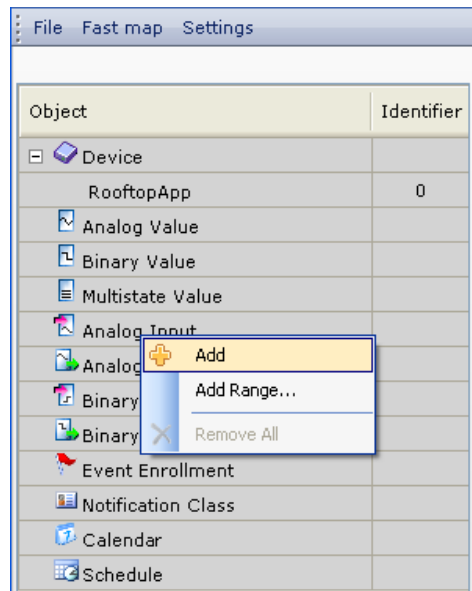
The Manual Map method allows you to manually add a desired BACnet object type to the network profile and then identify its source application point.

To configure the BACnet network profile using the manual map method:

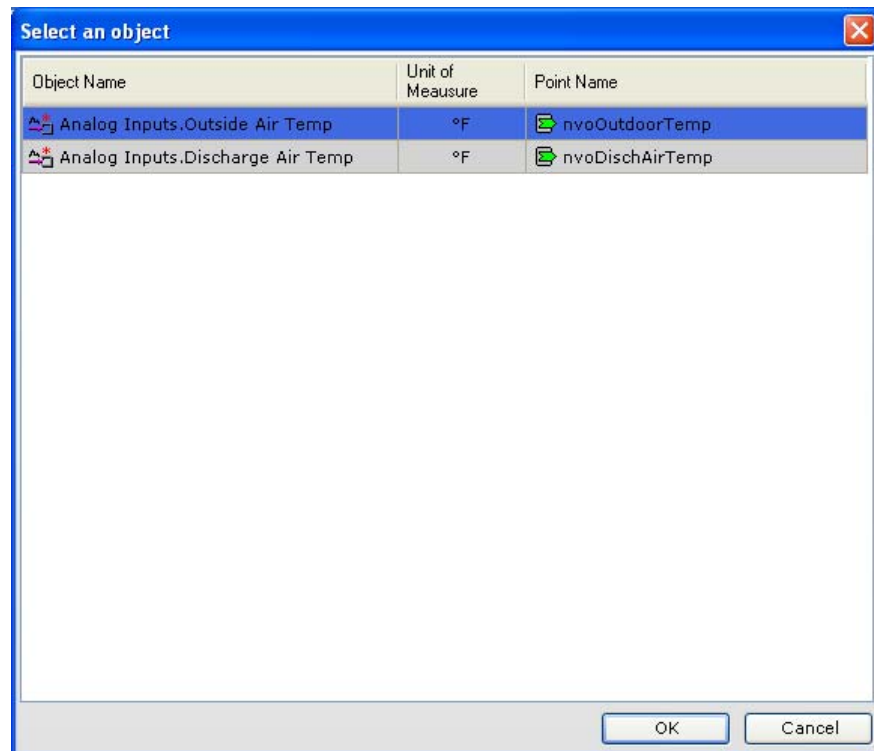
1. Right-click a BACnet object type and select Add or Add Range (Figure 228). The Select an Object window appears (Figure 229).

If you select Add, only one instance is created. If you select Add Range, multiple instances are created.






**Figure 228: Adding a BACnet Object Instance**



**Figure 229: Select an Object Window**

To map the BACnet object instance to a specific application object, click on the browse icon  next to the Present Value property and select the desired application object (Figure 229). Table 25 describes the maximum number of BACnet object instances supported by each FX controller type.

**Table 25: Maximum Number of Instances**

Object Type	FX06	FX07	FX14	FX16
Analog Input	4	4	6	46
Analog Output	4	4	4	48
Analog Value	50	50	60	130
Binary Input	5	5	12	68
Binary Output	6	6	9	69
Binary Value	10	10	10	52
Calendar	2	2	2	2
Device	1	1	1	1
Event Enrollment	16	16	16	40
File	3	3	3	3
Multistate Value	77	77	77	120
Notification Class	2	2	2	2
Schedule	4	4	4	8

- To enable COV notification, check the COV Increment Enabled box and identify the COV interval (Figure 230).

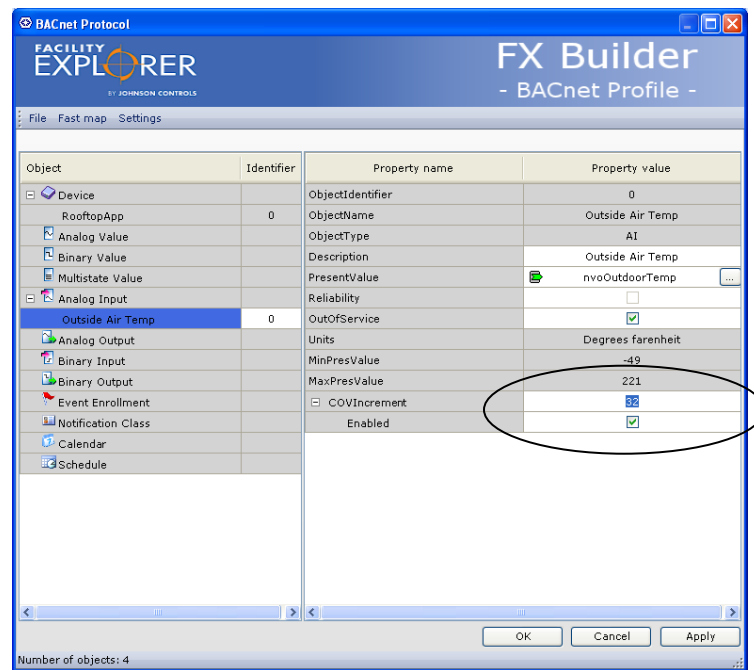
**Figure 230: Enable COV Notification**

Table 26 describes the maximum number of properties with COV notification supported.

**Table 26: Maximum Number of Properties with COV Notification Supported**

	<b>FX06</b>	<b>FX07</b>	<b>FX14</b>	<b>FX16</b>
<b>Maximum Number of Properties with COV Notification Supported</b>	20	20	20	50

Use the following reference information to understand how BACnet object properties are mapped to the application objects.

## Definition of BACnet Objects in Network Profile

### *Analog Input*

You can map the BACnet Analog Input object properties to the application points connected to the FX Extended Analog Input application object attributes.

The BACnet Analog Output object supports COV reporting on Present Value and Status Flag properties.

Table 27 lists the BACnet Analog Input object property information.

**Table 27: Analog Input**

Mandatory Property	Optional Property Supported	Network Read/Write	Notes
Object_Identifier		R	Set by FX Builder.
Object_Name		R	Default is the FX Analog Input object name. Edit in FX Builder. (20 char.)
Object_Type		R	BACnet standard
Present Value		W	Equal to EffectiveValue attribute of FX Analog Input object. Out_of_Service must be TRUE for write command.
	Description	W	Edit in FX Builder. (24 characters)
Status Flags		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = OOS
Event_State		R	FAULT if Reliability not equal to NO_FAULT_DETECTED, otherwise NORMAL
	Reliability		NO_FAULT_DETECTED OVER_RANGE (Unreliable High) UNDER_RANGE (Unreliable Low) UNRELIABLE_OTHER
Out_of_Service		W	Write enabled only if FX Object has Remote_Value input.
Units		R	Default is Units of FX Analog Input Object. You can select SI or US units, at design time, in FX Builder.
	Min_Pres_Value	R	Defaults are Rel_Limit attributes of FX Analog Input object.
	Max_Pres_Value	R	Edit in FX Builder.
	COV_Increment	W	Default is maximum float value. Edit in FX Builder. (When COV_Increment = max value, Change of Value [COV] is issued only when Status_Flags change.)

## BACnet Analog Input Object to FX Object Mapping

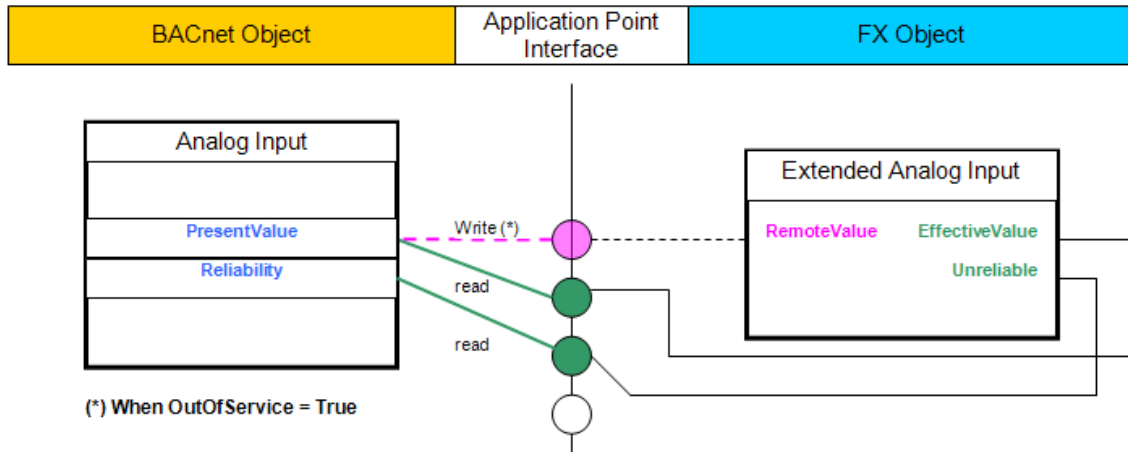


Figure 231: BACnet Analog Input Object to FX Object Mapping

### **Analog Output**

You can map the BACnet Analog Output object properties to the application points connected to the attributes of one of the following FX application object types:

- Extended Analog Output
- Extended DAT Output
- Extended PAT Output

The BACnet Analog Output object supports COV reporting on Present Value and Status Flag properties.

Table 28 lists the BACnet Analog Output object property information.

**Table 28: Analog Output**

<b>Mandatory Property</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Object_Identifier</b>		R	Set by FX Builder.
<b>Object_Name</b>		R	Default is the FX Analog Output object name. Edit in FX Builder. (20 characters)
<b>Object_Type</b>		R	BACnet standard
<b>Present_Value</b>		W	Equal to EffectiveValue or Position attribute of FX Object. Command uses Priority_Array.
	<b>Description</b>	W	Edit in FX Builder. (24 characters)
<b>Status_Flags</b>		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = OOS
<b>Event_State</b>		R	FAULT if Reliability not equal to NO_FAULT_DETECTED, otherwise NORMAL
	<b>Reliability</b>	R	NO_FAULT_DETECTED UNRELIABLE_OTHER
<b>Out_of_Service</b>		W	Disables FX Output object. (Physical output does not change.)
<b>Units</b>		R	%
	<b>Min_Pres_Value</b>	R	Default is 0%.
	<b>Max_Pres_Value</b>	R	Default is 100%.
<b>Priority_Array</b>		W	Default is all NULL.
Continued on next page . . .			

<b>Mandatory Property (Cont.)</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Relinquish_default</b>		R	Default is Invalid. (FX Object retakes control.)
	<b>COV_Increment</b>	W	Default is maximum float value. Edit in FX Builder. (When COV_Increment = max value, COV is issued only when Status_Flags change.)

### Out of Service Management

- Out Of Service = FALSE

Physical Channel coupled, Physical Channel value is equal to actual Present Value.

- Out Of Service = TRUE

Physical Channel decoupled, Physical Channel value is not influenced by Present Value.

### BACnet Analog Output Object to FX Object Mapping

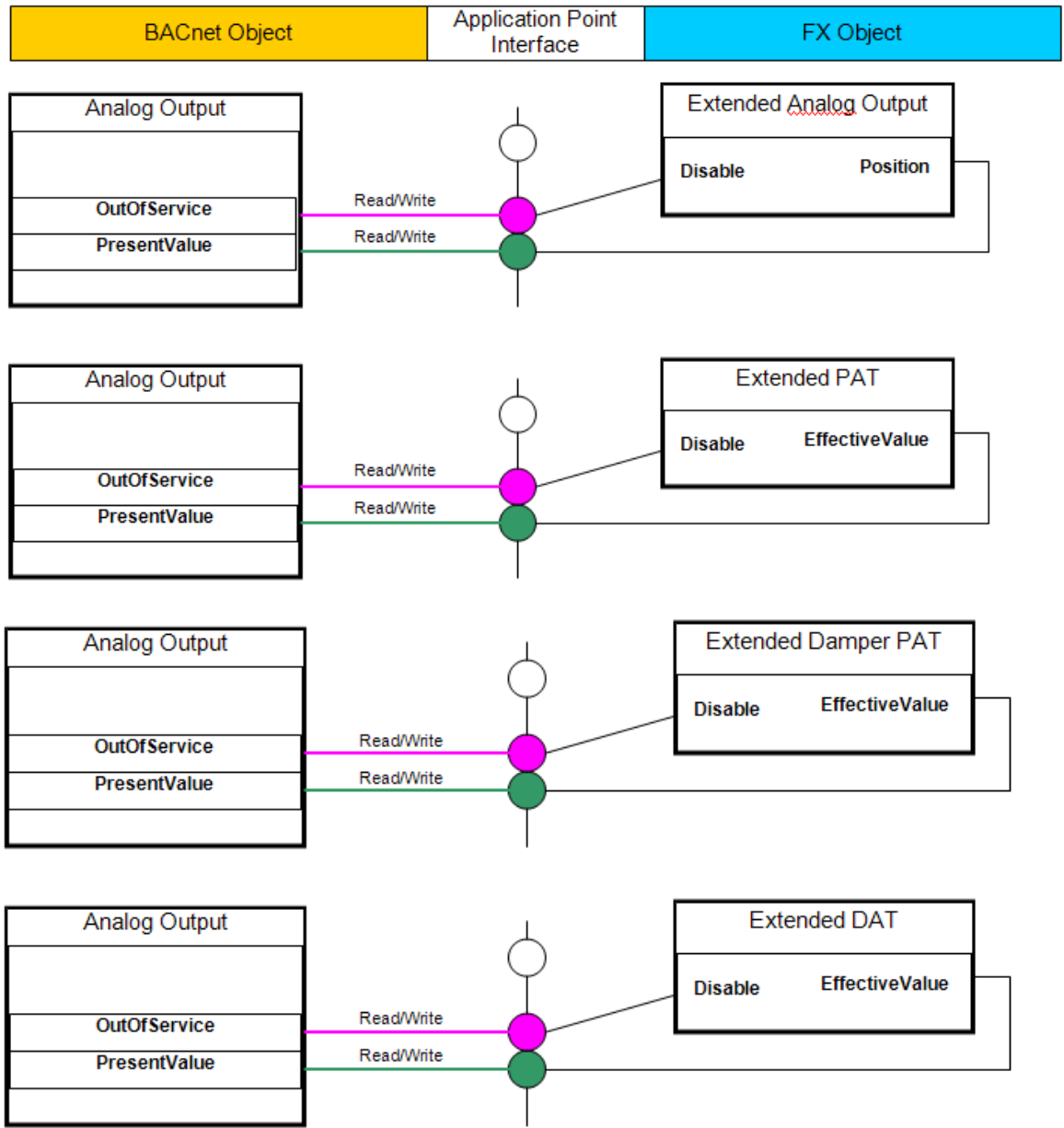


Figure 232: BACnet Analog Output Object to FX Object Mapping



### Analog Value

You can map BACnet Analog Value object properties to the application points connected to the numeric attributes (input, output, volatile, or permanent) of an FX application object.

The BACnet Analog Value object supports COV reporting on Present Value and Status Flag properties.

Table 29 lists the BACnet Analog Value object property information.

**Table 29: Analog Value**

Mandatory Property	Optional Property Supported	Network Read/Write	Notes
Object_Identifier		R	Set by FX Builder.
Object_Name		R	Default is the FX Application point name. Edit in FX Builder. (20 characters)
Object_Type		R	BACnet standard
Present_Value		W	Equal to value of the FX application point. Command uses Priority_Array.
	Description	W	Edit in FX Builder. (24 characters)
Status_Flags		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = False
Event_State		R	FAULT if Reliability not equal to NO_FAULT_DETECTED, otherwise NORMAL
	Reliability	R	NO_FAULT_DETECTED UNRELIABLE_OTHER
Out_of_Service		R	Always false
Units		R	Default is Units of FX application point. You can select SI or US units, at design time, in FX Builder.
Priority_Array		R	Default is all NULL.
Relinquish_default		R	Default is Initial Value.
	COV_Increment	W	Default is maximum float number. Edit in FX Builder. (When COV_Increment = max. value, COV is issued only when Status_Flags change.)

## BACnet Analog Value Object to FX Object Mapping

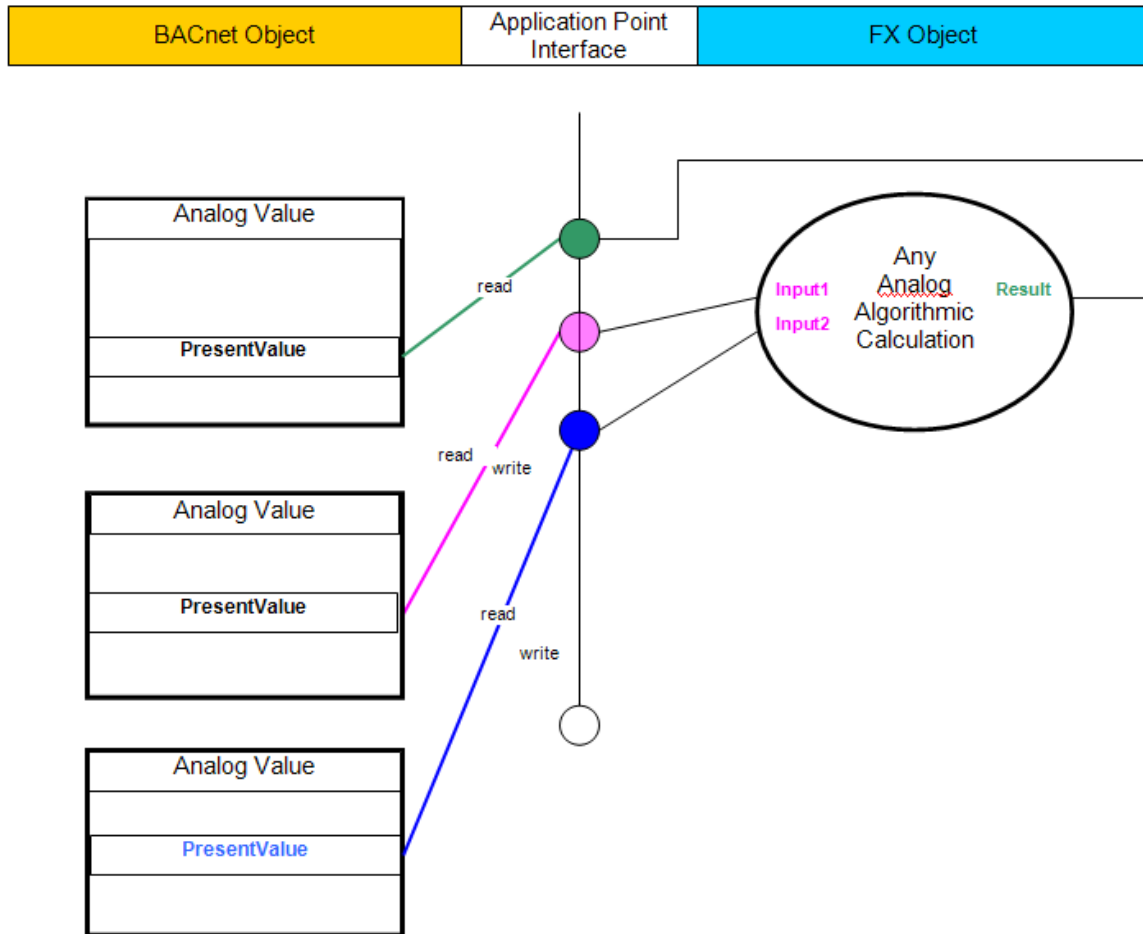


Figure 233: BACnet Analog Value Object to FX Object Mapping

**Note:** An input application point (either permanent or volatile) can be mapped in Write mode. An output application point can be mapped only in read mode.

## BACnet Analog Value Object Data Type Management

*Non Structured Data Type*

You can map all the numeric data types supported by the device firmware to the BACnet Multistate Value object. The data types are:

- SignedNumeric
- UnsignedNumeric

*Structured Data Type*

Table 30 shows the fields of the Structured Data Types in the FX application that can be mapped to the BACnet Analog Value object.

**Table 30: Structured Data Type**

<b>Data Type Name</b>	<b>LONMARK Name</b>	<b>State/Value Name</b>	<b>Mappable to Analog Value</b>
<b>Temperature Setpoints</b>	SNVT_temp_setpt	Occ_Cool	<input checked="" type="checkbox"/>
		StandBy_Cool	<input checked="" type="checkbox"/>
		UnOcc_Cool	<input checked="" type="checkbox"/>
		Occ_Heat	<input checked="" type="checkbox"/>
		StandBy_Heat	<input checked="" type="checkbox"/>
		UnOcc_Heat	<input checked="" type="checkbox"/>
<b>HVAC Override</b>	SNVT_hvac_overid	<b>State</b>	
		Percentage	<input checked="" type="checkbox"/>
		Flow	<input checked="" type="checkbox"/>
<b>Scene Control</b>	SNVT_scene	<b>Function</b>	
		Number	<input checked="" type="checkbox"/>
<b>Scene Configuration</b>	SNVT_scene_cfg	<b>Function</b>	
		Number	<input checked="" type="checkbox"/>
		Setting	<input checked="" type="checkbox"/>
		Rotation	<input checked="" type="checkbox"/>
		Fade_Time	<input checked="" type="checkbox"/>
		Delay_Time	<input checked="" type="checkbox"/>
<b>Lights and Sunblinds Setting</b>	SNVT_setting	Scene_Priority	<input checked="" type="checkbox"/>
		<b>Function</b>	
		Setting	<input checked="" type="checkbox"/>
<b>Time-of-Day Event</b>	SNVT_tod_event	Rotation	<input checked="" type="checkbox"/>
		<b>Current_State</b>	
		<b>Next_State</b>	
		Time_to_Next_State	<input checked="" type="checkbox"/>

### ***Binary Input***

You can map BACnet Binary Input object properties to the application points connected the FX Extended Digital Input application object attributes.

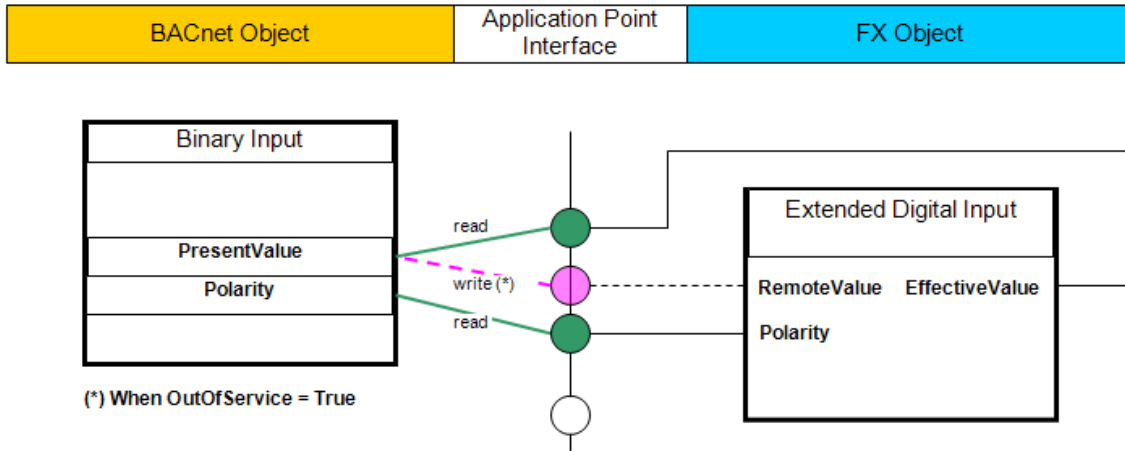
The BACnet Binary Input object supports COV reporting on the Present Value and Status Flag properties.

Table 31 lists the BACnet Input object property information.

**Table 31: Binary Input**

<b>Mandatory Property</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Object_Identifier</b>		R	Set by FX Builder.
<b>Object_Name</b>		R	Default is the FX Digital Input object name. Edit in FX Builder. (20 characters)
<b>Object_Type</b>		R	BACnet standard
<b>Present_Value</b>		W	Equal to EffectiveValue attribute of FX Digital Input object. Out_of_Service must be TRUE for write command.
	<b>Description</b>	W	Edit in FX Builder. (24 characters)
<b>Status_Flags</b>		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = OOS
<b>Event_State</b>		R	FAULT if Reliability not equal to NO_FAULT_DETECTED, otherwise NORMAL.
	<b>Reliability</b>	R	NO_FAULT_DETECTED UNRELIABLE_OTHER
<b>Out_of_Service</b>		W	Write enabled only if FX Object has Remote_Value input.
<b>Polarity</b>		R	Default is the Digital Input object Polarity attribute. Edit in FX Builder.
	<b>InactiveText</b>	R	Default is OFF. Edit in FX Builder.
	<b>ActiveText</b>	R	Default is ON. Edit in FX Builder.

## BACnet Binary Input Object to FX Object Mapping



**Figure 234: BACnet Binary Input Object to FX Object Mapping**

### **Binary Output**

You can map BACnet Binary Output properties to the application points connected to the FX Extended On/Off Output application object attributes.

The BACnet Binary Output object supports COV reporting on Present Value and Status Flag properties.

Table 32 lists the BACnet Binary Output object property information.

**Table 32: Binary Output**

<b>Mandatory Property</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Object_Identifier</b>		R	Set by FX Builder.
<b>Object_Name</b>		R	Default is the FX OnOff Output object name. Edit in FX Builder. (20 characters)
<b>Object_Type</b>		R	BACnet standard
<b>Present_Value</b>		W	Equal to LogicOutput attribute of FX OnOff Output object. Command uses Priority_Array.
	<b>Description</b>	W	Edit in FX Builder. (24 characters)
<b>Status_Flags</b>		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = OOS
<b>Event_State</b>		R	FAULT if Reliability not equal to NO_FAULT_DETECTED, otherwise NORMAL
	<b>Reliability</b>	R	NO_FAULT_DETECTED UNRELIABLE_OTHER
<b>Out_of_Service</b>		W	Disables FX Output object. Physical output does not change.
<b>Polarity</b>		R	Default is the FX OnOff object Polarity attribute. Edit in FX Builder.
	<b>InactiveText</b>	R	Default is OFF. Edit in FX Builder.
	<b>ActiveText</b>	R	Default is ON. Edit in FX Builder.
<b>Priority_Array</b>		R	Default is all NULL.
<b>Relinquish_default</b>		R	Default is Invalid. (FX Object retakes control.)

## Out of Service Management

- Out Of Service = FALSE

Physical Channel coupled, Physical Channel value is equal to actual Present Value.

- Out Of Service = TRUE

Physical Channel decoupled, Physical Channel value is not influenced by Present Value.

## BACnet Binary Output Object to FX Object Mapping

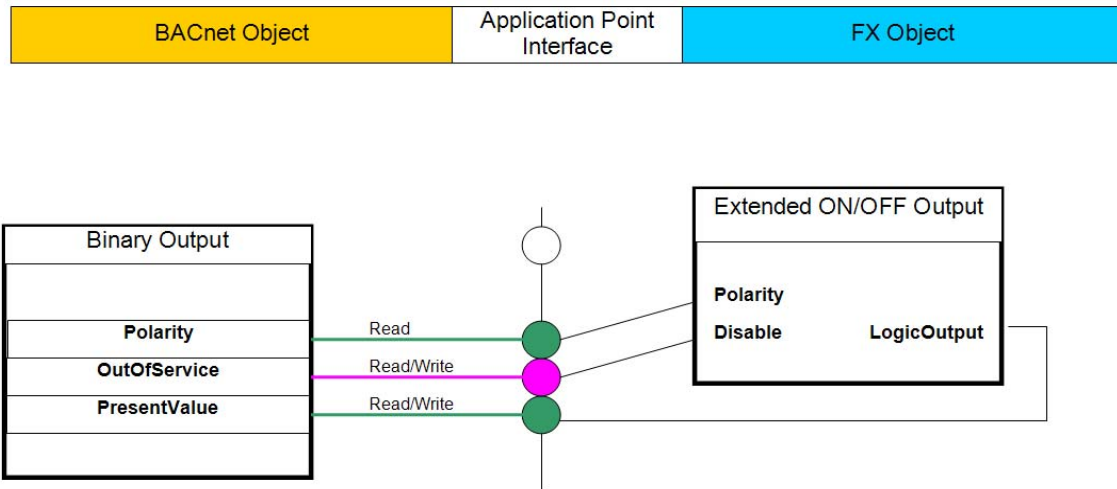


Figure 235: BACnet Binary Output Object to FX Object Mapping

### **Binary Value**

You can map Binary Value object properties to the application points connected to the binary (logic) attributes (input or output, volatile, or permanent) of an FX application object. This includes the State field of an attribute based on the LONMARK variable SNVT\_switch.

The BACnet Binary Value object supports COV reporting on Present Value and Status Flag properties.

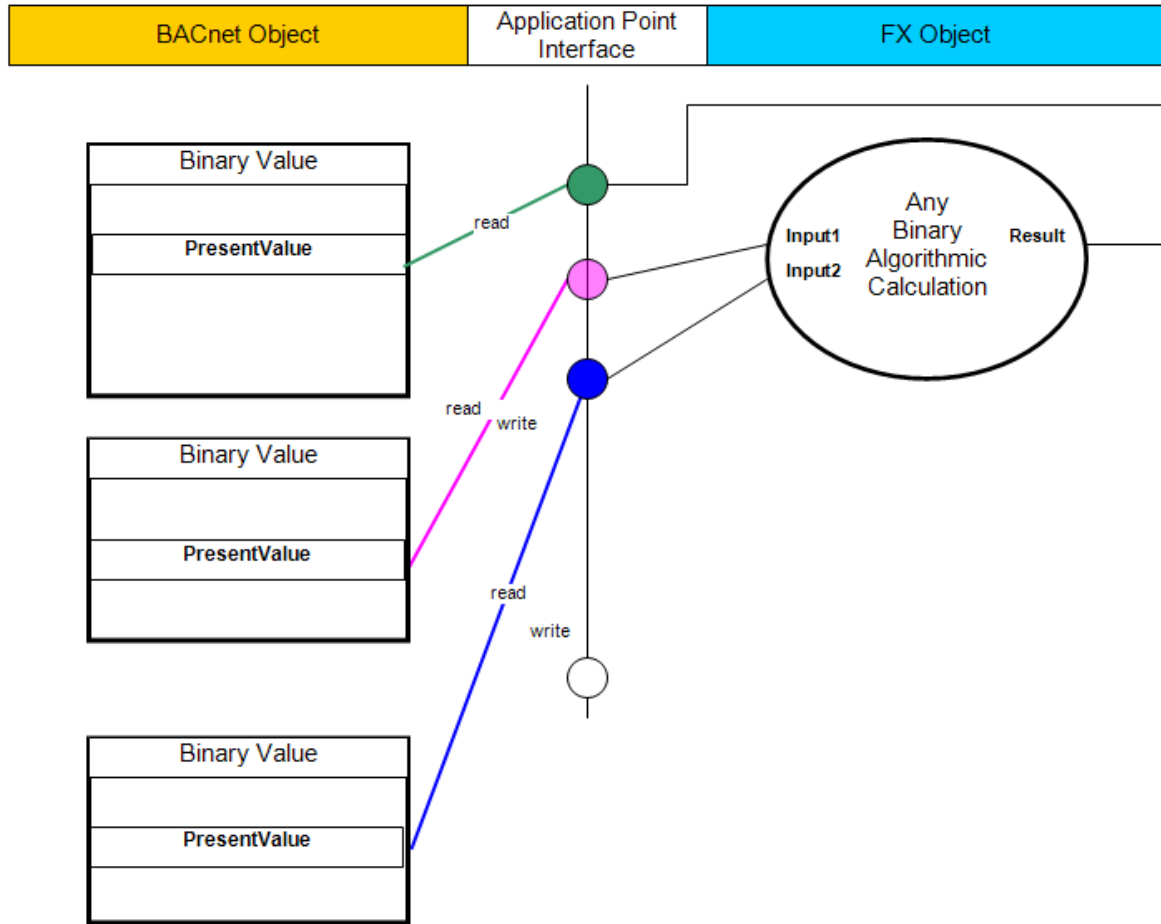
Table 33 lists the BACnet Binary Value object property information.

**Table 33: Binary Value**

<b>Mandatory Property</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Object_Identifier</b>		R	Set by FX Builder.
<b>Object_Name</b>		R	Default is the FX application point name. Edit in FX Builder. (20 characters)
<b>Object_Type</b>		R	BACnet standard
<b>Present_Value</b>		W	Equal to value of the FX application point.
	<b>Description</b>	W	Edit in FX Builder. (24 characters)
<b>Status_Flags</b>		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = False
<b>Event_State</b>		R	FAULT if Reliability not equal to NO_FAULT_DETECTED, otherwise NORMAL
	<b>Reliability</b>	R	NO_FAULT_DETECTED UNRELIABLE_OTHER
<b>Out_of_Service</b>		R	Always False
	<b>InactiveText</b>	R	Default is OFF. Edit in FX Builder.
	<b>ActiveText</b>	R	Default is ON. Edit in FX Builder.
<b>Priority_Array</b>		R	Default is all NULL.
<b>Relinquish_default</b>		R	Default is Initial Value.



## BACnet Binary Value Object to FX Object Mapping



**Figure 236: BACnet Binary Value Object to FX Object Mapping**

**Note:** An input application point (either permanent or volatile) can be mapped in write mode. An output application point can be mapped only in read mode.

### BACnet Binary Value Object Data Type Management

#### *Non Structured Data Type*

You can map the logic data type defined as **Logic Control: UNVT\_logic** to the BACnet Binary Value object.

#### *Structured Data Type*

Table 34 shows the fields of the Structured Data Types in the FX application that can be mapped to the BACnet Binary Value object.

**Table 34: Structured Data Type**

Data Type Name	LONMARK Name	State/Value Name	Mappable to Binary Value
Logic Control with Value	SNVT_switch	Value	
		State	<input checked="" type="checkbox"/>

### Calendar

A BACnet Calendar object is automatically mapped to the application points connected to the attributes of the FX Calendar application object.

FX Builder automatically manages the mapping for consistency and synchronization with the FX application. FX Builder:

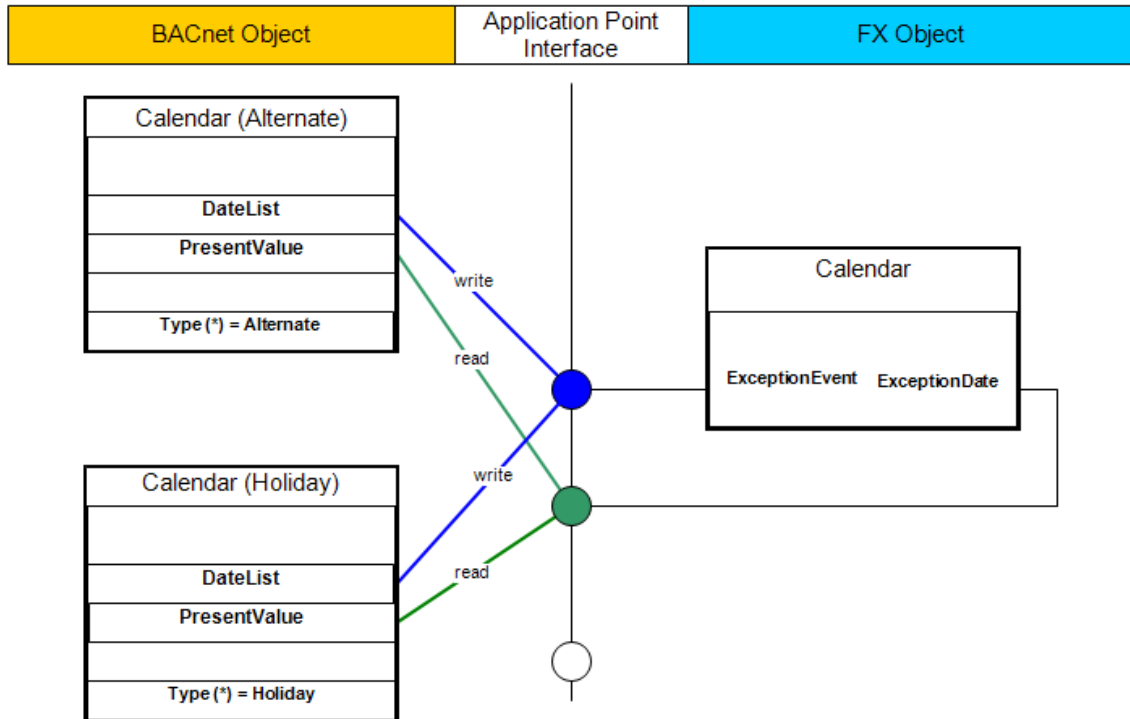
- creates a BACnet **Holiday** Calendar object. FX Builder then maps the object to the application points connected to the FX Calendar object for the definition of holidays.
- for an **Alternate** Schedule object, creates a BACnet Alternate Calendar object. FX Builder then maps the object to the application points connected to the FX Calendar object for the definition of alternate days.

Table 35 lists the BACnet Calendar object property information.

**Table 35: Calendar**

Mandatory Property	Optional Property Supported	Network Read/Write	Notes
Object_Identifier		R	Set by FX Builder.
Object_Name		R	Default is the FX Calendar object name. Edit in FX Builder. (20 characters) The suffix _ALT or _HOL is added to the name depending on the value of FX_Calendar_Type property.
Object_Type		R	BACnet standard
	Description	W	Edit in FX Builder. (24 characters)
Present_Value		R	Value of ExceptionDate attribute of FX Calendar object
DateList		W	Maps to the application point connected to the ExceptionEvent attribute of the FX Calendar object.
	FX_Calendar_Type	R	<b>Proprietary</b> DataType: UINT8: 1: HOLIDAY 2: ALTERNATE PropertyID: 9100

## BACnet Calendar Object to FX Object Mapping



(\*) Type:  
 User defined property that identifies the  
 Calendar object as:  
 - Holiday  
 - Alternate

**Figure 237: BACnet Calendar Object to FX Object Mapping**

## Device

A BACnet Device object defines the externally visible characteristics of the FX device. FX Builder automatically creates the BACnet Device object and maps its properties to the default initialization file details for the selected FX device.

Table 36 lists the BACnet Device object property information.

**Table 36: Device**

Mandatory Property	Optional Property Supported	Network Read/ Write	Notes
Object_Identifier		R	MS/TP network address in device.
Object_Name		R	Default is the FX Application name. Edit in FX Builder. (20 characters)
Object_Type		R	BACnet standard
System_Status		R	BACnet standard
Vendor_Name		R	Default is Johnson Controls.
Vendor_Identifier		R	Default is 5 (Johnson Controls).
Model_Name		R	FX device product order code
Firmware_Revision		R	FX firmware version
Application_Software_Version		R	Default is "". Edit in FX Builder.
	Location	W	Default is blank. Edit in FX Builder.
	Description	W	Default is blank. Edit in FX Builder.
Protocol_Version		R	1
Protocol_Revision		R	4
Protocol_Service_Supported		R	BACnet standard
Protocol_Object_Types_Supported		R	BACnet standard
Object_List		R	BACnet standard
Max_APDU_Length		R	480
Segmentation_Supported		R	Only in response mode
Max_Segments_Accepted		R	Device dependent: FX07, FX14: 6 FX16: 10
	Local_Time	R	Maps to the Real Time Clock (RTC) or FX Clock and Date Set object. Edit in FX Builder. <sup>1</sup>
	Local_Date	R	
	UTC_Offset	R	
	DayLight_Saving_Status	R	
Continued on next page . . .			

<b>Mandatory Property (Cont.)</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>APDU_Segment_Timeout</b>		R	BACnet default
<b>APDU_Timeout</b>		R	BACnet default
<b>Number_Of_APDU_Retries</b>		R	BACnet default
<b>Max_Masters</b>		W	Default is 127. Edit in FX Builder.
<b>Max_Info_frames</b>		W	Default is 1. Edit in FX Builder.
<b>Device_Address_Binding</b>		R	Empty
<b>Database_Revision</b>		R	1
<b>Active_COV_Subscriptions</b>			BACnet standard
	<b>FXStatus</b>	R	<b>Proprietary</b> 0: Idle 1: Busy 2: Initialization 3: Working 4: Test 5: Error 6: Stopping DataType: UINT8 PropertyID: 9007
	<b>Charset</b>	W	<b>Proprietary</b> ANSI X3.4 or ISO10646 UCS2 Default is ANSI X3.4 DataType: UINT8 PropertyID: 9005 Edit in FX Builder.
	<b>FamilyID</b>	R	<b>Proprietary</b> DataType: UINT16 PropertyID: 9000
	<b>CustomerID</b>	R	<b>Proprietary</b> DataType: UINT16 PropertyID: 9001
	<b>Application ID</b>	R	<b>Proprietary</b> DataType: UINT32 PropertyID: 9002
<b>Continued on next page . . .</b>			

Mandatory Property (Cont.)	Network Read/Write		Notes
	Unique Device Identifier	R	<b>Proprietary</b> DataType: ByteString[6] PropertyID: 9003
	FX Supported Services	R	<b>Proprietary</b> DataType: BitField[2 bytes] PropertyID: 9006

3. All FX Controller Platform devices support the service DM\_TS\_B.

- Local\_Time and Local\_Date are always supported.
- Local\_Time and Local\_Date are set to the **time** parameter in DM\_TS\_B service.

If the application includes the Clock and Date Set object, the FX devices also support the service DM\_UTC\_B.

- DST\_Status and UTC offset are then also supported.
- When receiving DM\_UTC\_B, Local\_Time, Local\_Date and DST\_Status are set with reference to **UTC time** parameter in DM\_UTC\_B and UTC offset.
- When receiving DM\_TS\_B, Local\_Time and Local\_Date are set to the **time** parameter of DM\_TS\_B service and DST\_Status is recalculated. UTC offset is not used.

### BACnet Device Object to FX Object Mapping

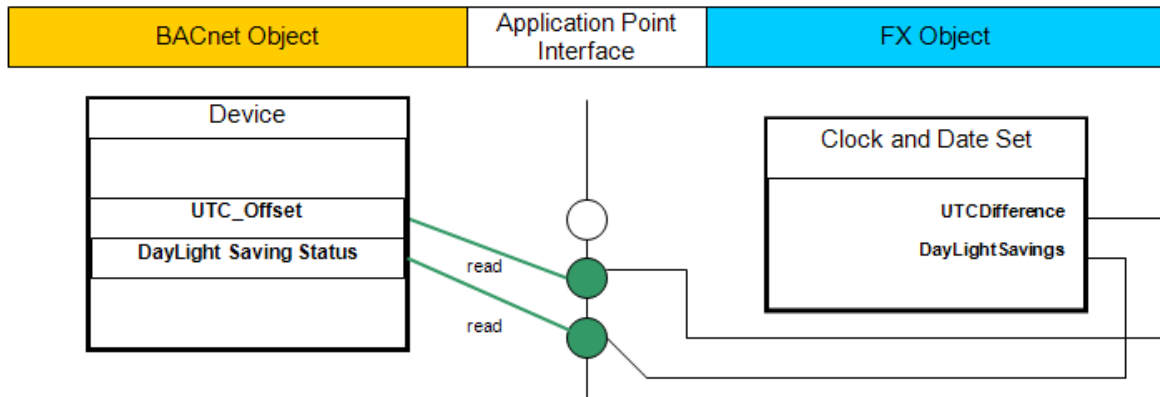


Figure 238: BACnet Device Object to FX Object Mapping

## Event Enrollment

The BACnet Event Enrollment object type contains the information required for managing events within the BACnet system. The primary purpose for the Event Enrollment object is to define an event and to provide a connection between the occurrence of the event and the transmission of a notification message to one or more recipients.

FX Builder creates the following:

- the required BACnet Multistate Value objects for event reporting, linking them to the application points defined as events in the FX application for notification to a UI device.
- the Event Enrollment objects for the events defined in the FX application, referencing both the Multistate Value objects and the Notification Class objects which have been created.

**Note:** Event Enrollment objects are only created for the application points defined as events for a user interface in the application and mapped using Multistate Value objects. This feature maintains the synchronization of events reported at a local user interface and reported over the BACnet network. You cannot create or delete Event Enrollment objects.

Table 37 lists the BACnet Event Enrollment object property information.

**Table 37: Event Enrollment**

Mandatory Property	Optional Property Supported	Network Read/Write	Notes
Object_Identifier		R	Set by FX Builder.
Object_Name		R	Event name. Edit in FX Builder. (20 characters)
Object_Type		R	BACnet standard
	Description	W	Edit in FX Builder. (24 characters)
Event_Type		R	CHANGE_OF_STATE
Notify_Type		R	EVENT ALARM Default is EVENT. Edit in FX Builder.
Event_Parameters		R	TimeDelay = 1s List_Of_Values (for OFFNORMAL) Defined in FX Builder Event window.
Continued on next page . . .			

Mandatory Property (Cont.)	Optional Property Supported	Network Read/Write	Notes
Object_Property_Reference		R	Reference to the Multistate Value object mapped to the FX application point generating the event.
Event_State		R	NORMAL OFFNORMAL
Event_Enable		R	Default = TO OFFNORMAL Edit in FX Builder.
Acked_Transitions		R	BACnet standard
Notification_Class		R	NC_AckRequired NC_AckNotRequired (Acknowledgement defined in FX Builder Event window.)
Event_Time_Stamp		R	BACnet standard

### BACnet Event Enrollment Object to FX Events/Application Points Mapping

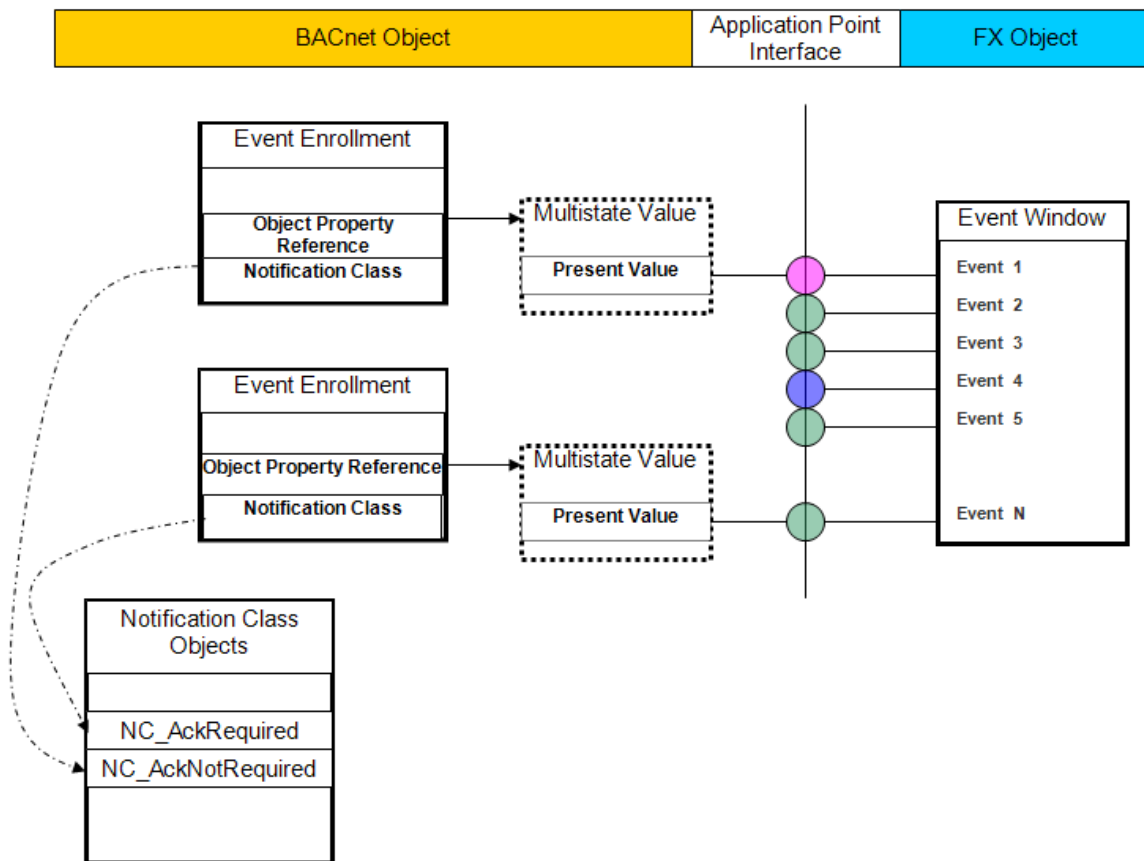


Figure 239: BACnet Event Enrollment Object to FX Object Mapping



## File

The BACnet File object describes properties of data files that are accessed using File Services. The files manage the proprietary information required by the FX devices. This includes both application software and firmware file management.

FX Builder automatically creates the following:

- an application file (executable code)
- a zipped application file (with full graphic user interface data)

The firmware file is loaded into the device at the factory.

FX controllers support the FX files described in Table 38.

**Table 38: File Descriptions**

File Name	Type	Description
Reserved_1	0x0	Reserved for future use
Firmware	0x1	Firmware of FX device
Application	0x2	Application code for FX device
Zipped Application	0x3	Complete user interface and all other information needed to download, upload, and synchronize the application data.
Reserved_2	0x4 to 0xFF	Reserved for future use
Reserved_3	0x100 to 0xFFFF	Reserved for future use

Table 39 lists the BACnet File object property information.

**Table 39: File**

Mandatory Property	Optional Property Supported	Network Read/Write	Notes
Object_Identifier		R	Set by FX Builder.
Object_Name		R	Set by FX Builder.
Object_Type		R	BACnet standard
File_Type		R	This is a string value representing a Hex number in the range 0x0 to 0xFFFFF. See Table 38.
File_Size		W	File size in bytes
Modification_Date		R	Date of file creation
Archive		W	Default to TRUE
Read_Only		R	TRUE
File_Access_Method		R	STREAM_ACCESS

### **Multistate Value**

You can map A BACnet Multistate Value to the application point connected to an enumerated attribute (input or output, volatile, or permanent) of an FX application object.

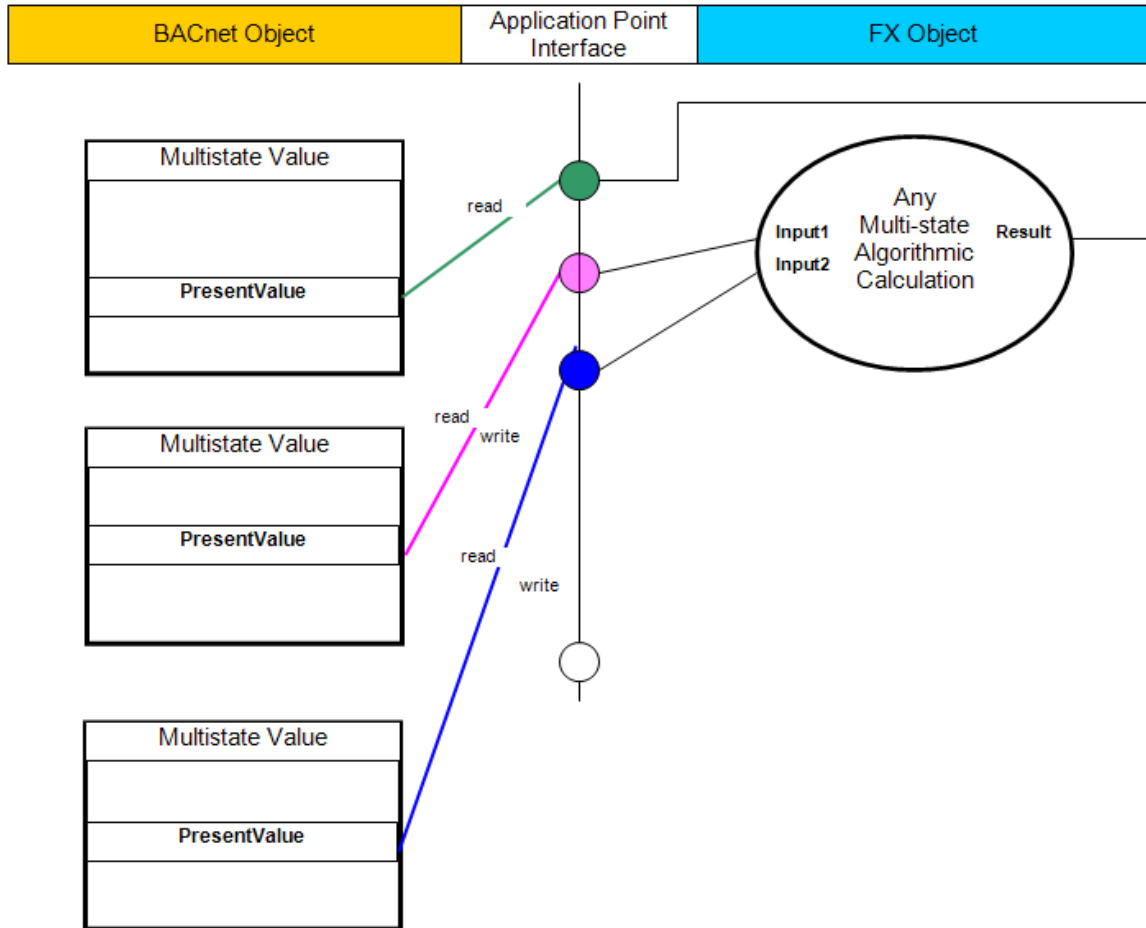
The BACnet Multistate Value object supports COV reporting on Present Value and Status Flag properties.

Table 40 lists the BACnet Multistate object property information.

**Table 40: Multistate Value**

<b>Mandatory Property</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Object_Identifier</b>		R	Set by FX Builder.
<b>Object_Name</b>		R	Default is the FX application point name. Edit in FX Builder. (20 characters)
<b>Object_Type</b>		R	BACnet standard
<b>Present_Value</b>		W	Equal to value of the FX application point.
	<b>Description</b>	W	Edit in FX Builder. (24 characters)
<b>Status_Flags</b>		R	IN_ALARM = Event_State FAULT = Reliability OVERRIDDEN = False OUT_OF_SERVICE = False
	<b>Reliability</b>	R	NO_FAULT_DETECTED UNRELIABLE_OTHER
<b>Event_State</b>		R	NO_FAULT_DETECTED UNRELIABLE_OTHER
<b>Out of Service</b>		R	Always false
<b>Number_Of_States</b>		R	Default is the number of states in enumerated data type of FX application point
	<b>StateText</b>	R	Default is the names of the states in enumerated data type of FX application point. Edit in FX Builder.
<b>Priority_Array</b>		R	Default is all NULL.
<b>Relinquish_default</b>		R	Default is Initial Value.

## BACnet Multistate Value Object to FX Object Mapping



**Figure 240: BACnet Multistate Value Object to FX Object Mapping**

**Note:** You can map an input application point (either permanent or volatile) in **write** mode; however, you only map an output application point in **read** mode.

## BACnet Multistate Value Object Data Type Management

### Non-Structured Data Type

You can map all the enumerated data types supported by the device firmware to the BACnet Multistate Value object.

### Structured Data Type

Table 41 shows the fields of the Structured Data Types in the FX application that can be mapped to the BACnet Multistate Value object.

**Table 41: Structured Data Type**

Data Type Name	LONMARK Name	State/Value Name	Mappable to Multistate Value
<b>HVAC Override</b>	SNVT_hvac_overid	<b>State</b>	<input checked="" type="checkbox"/>
		Percentage	
		Flow	
<b>Scene Control</b>	SNVT_scene	<b>Function</b>	<input checked="" type="checkbox"/>
		Number	
<b>Scene Configuration</b>	SNVT_scene_cfg	<b>Function</b>	<input checked="" type="checkbox"/>
		Number	
		Setting	
		Rotation	
		Fade_Time	
		Delay_Time	
		Scene_Priority	
<b>Lights and Sunblind Setting</b>	SNVT_setting	<b>Function</b>	<input checked="" type="checkbox"/>
		Setting	
		Rotation	
<b>Lights and Sunblind Setting</b>	SNVT_setting	<b>Function</b>	<input checked="" type="checkbox"/>
		Setting	
		Rotation	
<b>Time-of-Day Event</b>	SNVT_tod_event	<b>Current_State</b>	<input checked="" type="checkbox"/>
		<b>Next_State</b>	<input checked="" type="checkbox"/>
		Time_to_Next_State	
<b>Pilot</b>		<b>State</b>	<input checked="" type="checkbox"/>

### **Notification Class**

The BACnet Notification Class object represents and contains information required to distribute event notification within BACnet systems. Use notification classes to event-initiate objects with identical needs in terms of how their notification is handled, the desired notification destinations, and the preferred way to acknowledge the notification.

FX Builder:

- detects if events are defined in the application. FX Builder the creates one Notification Class object to manage the events that requires acknowledgement and another Notification Class object to manage the events that do not require acknowledgement.
- sets up the default attributes of the Notification Class objects

**Note:** You cannot create or delete Notification Class objects.

Table 42 lists the BACnet Notification Class object property information.

**Table 42: Notification Class (NC)**

<b>Mandatory Property</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Object_Identifier</b>		R	Set by FX Builder.
<b>Object_Name</b>		R	Defaults are: 1 = NC_AckRequired 2 = NC_AckNotRequired
<b>Object_Type</b>		R	BACnet standard
	<b>Description</b>	W	Edit in FX Builder.
<b>Notification_Class</b>		R	BACnet standard
<b>Priority</b>		W	Default is: 128,128,128 Edit in FX Builder.
<b>Ack_Required</b>		R	Default is: 1 = 1,0,0 for object with Ack 2 = 0,0,0 for object without Ack
<b>Recipient_List</b>		W	BACnet standard

## Schedule

The BACnet Schedule object properties map to the application points connected to the attributes of an FX On-Off or Weekly Occupancy Schedule application object.

FX Builder automatically manages the mapping for consistency and synchronization with the FX application. FX Builder:

- creates a normal BACnet Schedule object and maps the Weekly\_Schedule property to the application point connected to the Event input attribute of the FX On-Off or Weekly Occupancy Schedule application object.
- if the ExceptionDay input connects to the FX On-Off or Weekly Occupancy Schedule application object, maps the Exception\_Schedule property of the normal Schedule object to the application point connected to the Event input attribute of the On-Off or Weekly Schedule application object. This is for the definition of holiday events.
- if the AlternateEvent and the ExceptionDay inputs connect to the FX On-Off or Weekly Occupancy Schedule application object, creates an alternate Schedule object and maps the Weekly\_Schedule property to the application point connected to the AlternateEvent input attribute. This is for the definition of alternate events. The Exception\_Schedule property is not used.

**Table 43: Schedule**

Mandatory Property	Optional Property Supported	Network Read/Write	Notes
Object_Identifier		R	Set by FX Builder
Object_Name		R	Default is the Schedule object name. Edit in FX Builder. (20 characters)
Object_Type		R	BACnet standard
Present_Value		R	On-Off Schedule: Equal to value of Output attribute of On-Off Schedule object. Weekly Occupancy Schedule: Equal to value of Output.Current_state field of Output attribute of Weekly Occupancy Schedule object.
	Description	W	Edit in FX Builder. (24 characters)
Continued on next page . . .			

<b>Mandatory Property (Cont.)</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
<b>Effective_Period</b>		R	1st January to 31st December of any year
<b>Weekly_Schedule</b>		W	Schedule (Normal): maps to the application point connected to the Event input attribute of an On-Off or Weekly Occupancy Schedule object. Schedule (Alternate) - optional: maps to the application point connected to the AlternateEvent input attribute of an On-Off or Weekly Occupancy Schedule object.
<b>Exception_Schedule</b>		R	Schedule (Normal): maps to the holiday (exception) events of the application point with an event data type and connected to the Event input attribute of the On-Off or Weekly Occupancy Schedule object. Schedule (Alternate) - optional: not used.
<b>Schedule_Default</b>		R	Off
<b>List_Of_Obj_Property_Ref</b>		R	On-Off or Weekly Occupancy Schedule Output (Fixed)
<b>Priority_for_Writing</b>		W	Default is 16. (Not used in FX application)
<b>Status_Flag</b>		R	IN_ALARM: Always false FAULT: Always false OVERRIDDEN: Always false OUT_OF_SERVICE: Out_Of_Service status
<b>Reliability</b>		R	Always False
<b>Out_Of_Service</b>		R	Schedule (Normal): TRUE when day is Alternate FALSE when day is Normal Schedule (Alternate): TRUE when day is Normal FALSE when day is Alternate
<b>Continued on next page . . .</b>			

<b>Mandatory Property (Cont.)</b>	<b>Optional Property Supported</b>	<b>Network Read/Write</b>	<b>Notes</b>
	<b>Schedule_FX_Out</b>	R	Proprietary Maps to the FX On-Off or FX Weekly Occupancy Schedule - Output.Current_State. DataType: UINT8: PropertyID: 9101
	<b>Type</b>	R	Proprietary DataType: UINT8 0 = On-Off Schedule (Default) 1 = WeeklyOccupancy Schedule



## BACnet Schedule Object to FX On-Off Schedule Object Mapping

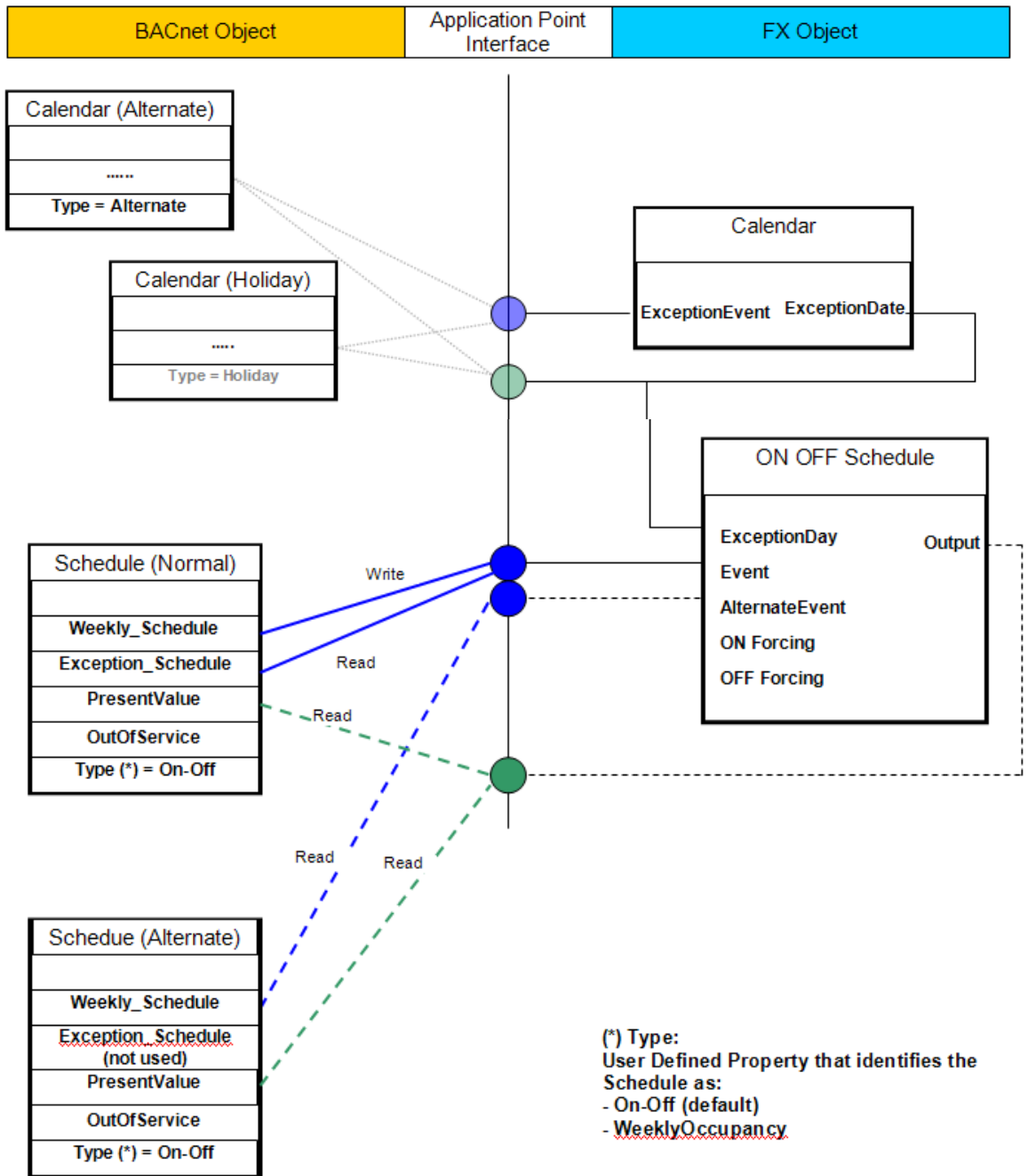


Figure 241: BACnet Schedule Object to FX On-Off Schedule Object Mapping

## BACnet Schedule Object to FX Weekly Occupancy Schedule Object Mapping

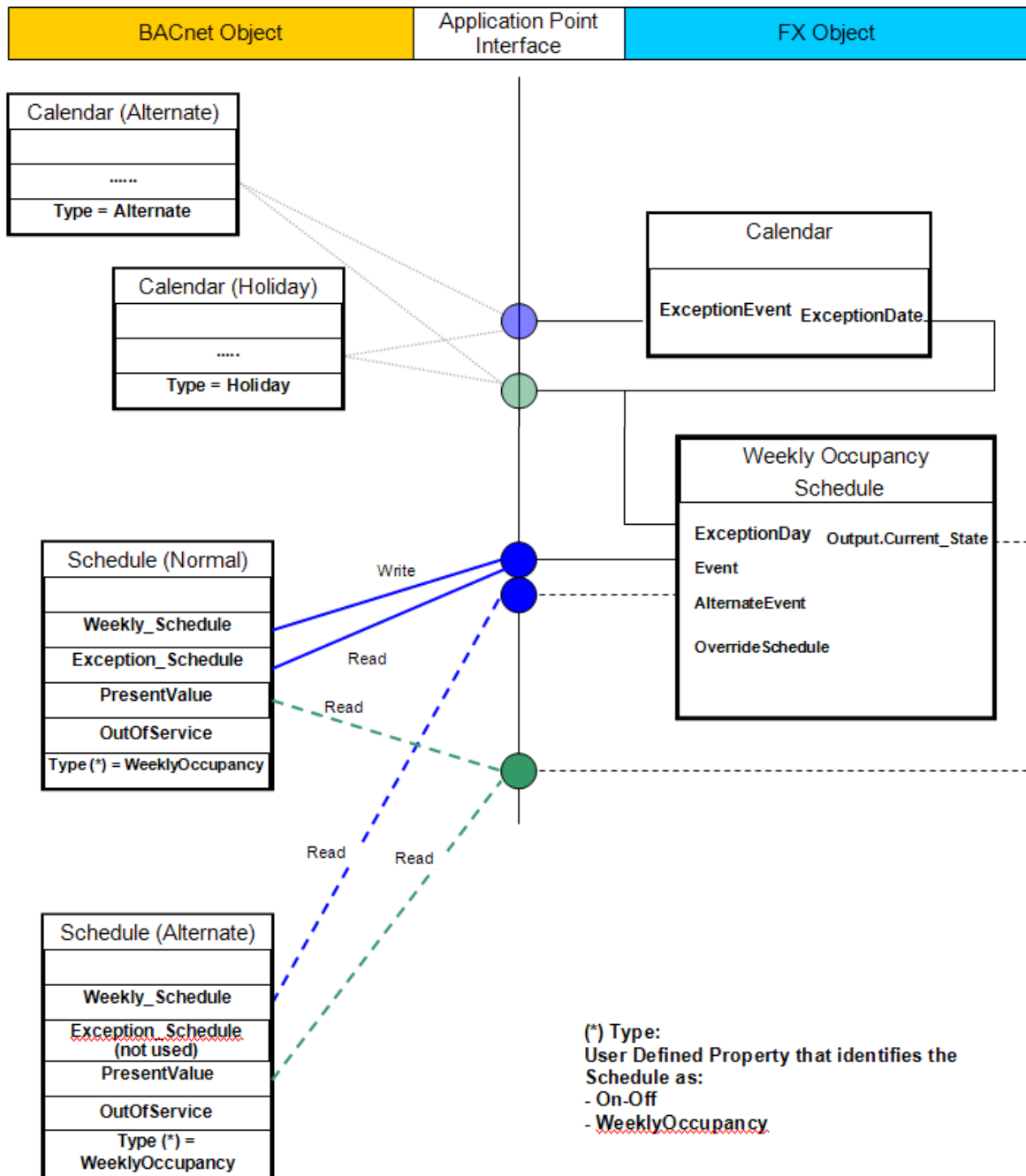


Figure 242: BACnet Schedule Object to FX Weekly Occupancy Schedule Object Mapping

## FX Builder Security

FX Builder and the FX controllers use an embedded security feature based on the use of identifiers: the **Family ID** and the **Customer ID**.

### *Family ID*

The Family ID is used to distinguish between different hardware types and to avoid downloading an application to the wrong controller.

**Table 44: Family IDs**

Facility Explorer Controller	FX Builder Code	Family ID
FX05 (Advanced) Controller	FX05P11-02	0218
	FX05P11-12	0210
	FX05P11-22	0211
	FX05P12-02	0212
	FX05P12-12	0214
	FX05P12-22	0215
	FX05P13-02	0213
	FX05P13-12	0216
	FX05P13-22	0217
FX06 Compact Controller (Models FX06P0x, FX06P2x, and FX06P3x) Original and Rev. A	FX06P0x	0701
FX06 Compact Controller (Models FX06Px4, Rev. B (BACnet)	FX06Pnn Rev. B	0705
FX06 Compact Controller (Models FX06P1x) Original and Rev. A	FX06P1x	0700
FX07 Field Controller (Models FX07Dxx and FX07Axx) Original	FX07D0x	0900
FX07 Field Controller (Models FX07Dx4 and FX07Ax4) Rev. A (BACnet)	FX07Dnn Rev. A	0904
FX14 Field Controller (Models FX14Dxx) Original and Rev. A	FX14D1x	0801
FX14 Field Controller (Models FX14Dx4) Rev. B (BACnet)	FX14Dnn Rev. B	0804
FX15 Field Controller (Models FX15D1x, FX15D2x, FX15D6x, FX15D7x, FX15X1x, FX15X2x, FX15X6x, FX15X7x) Original and Rev. A	FX15D1x	0402
FX15 Universal Controller (All models FX15D0x, FX15D5x) Original and Rev. A	FX15D0x	0401
Continued on next page . . .		

Facility Explorer Controller (Cont.)	FX Builder Code	Family ID
FX16 Master Controller (All Models FX16Dxx and FX16Xxx) Original and Rev. A	FX16D0x	0501
FX16 Master Controller (All Models FX16Xx4) Rev. B (BACnet)	FX16Xnn Rev. B	0504
Master Display	MD20D00	0600
	MD20D01	0601
	MD20D02	0602
	MD20D03	0603
	MD20D04	0604
	MD20D05	0605

### **Customer ID**

Customer ID is used to distinguish between the:

- generic user (MAKE PUBLIC ID)
- Demo ID
- Customer/Private Specific ID

The Customer ID protects the controller downloaded with a custom-developed application. The Customer ID also protects the application source code from being edited by unauthorized users.

The **Make Public ID** allows you to:

- Read all public application source files (saved with the very same Public ID).
- Download these applications to standard Facility Explorer controllers, which remain downloadable from whoever has the same Public ID.

The **Demo ID** allows you to:

- Read demo applications only (for example, applications that have been saved with the Demo ID).
- Download the demo applications to demo cases or demo controllers.

The **Customer/Private Specific ID** allows you to:

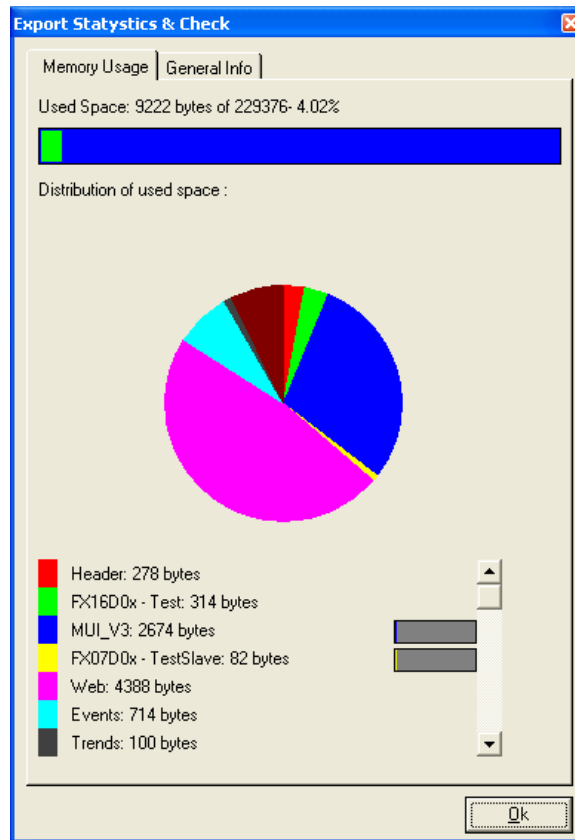
- Make the application source files readable only by users who have the same Specific ID installed on their computer.
- Download the applications to standard Facility Explorer controllers, which then become customer specific and downloadable only with applications saved with the same customer specific ID. To receive a Customer Specific ID, contact your local Johnson Controls® representative.

## Checking Application Point Limits

Each FX controller has its own unique memory and application point limitations. FX Builder compares the application memory and application point usage to the device memory and application point usage.

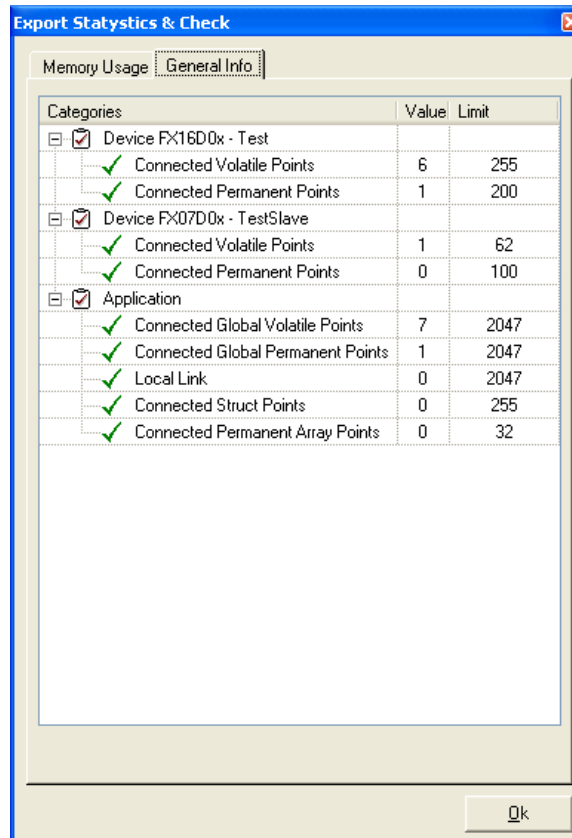
To check application point limits:

1. From the Application menu, select Check Consistency. The Export Statistics & Check window appears (Figure 243). This window contains two tabs:
  - **Memory Usage** - identifies the used and available memory and the distribution of the used memory (Figure 243).



**Figure 243: Export Statistics and Check Memory Tab**

- **General Info** - identifies the current application point usage, the maximum limits of the target device, and any missing mandatory connections (Figure 244).



**Figure 244: Export Statistics and Check General Info Tab**

Exceeding the limits or missing mandatory connections results in error during the Save operation. FX Builder automatically opens the Export Statistics and Check window, reports the error location, and allows only the Save without Export action (Figure 245).

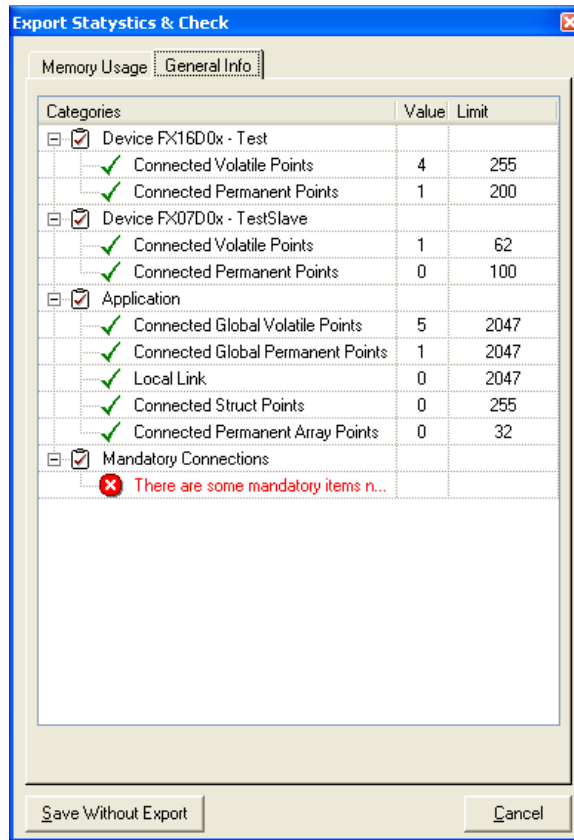


Figure 245: Error Reported When Missing Mandatory Connections

### Checking Mandatory Inputs

You can view more detailed information on missing mandatory connections if you check for mandatory inputs.

To check mandatory inputs:

- On the Application menu, click Check Mandatory Inputs. The Missing Mandatory Connections window appears.

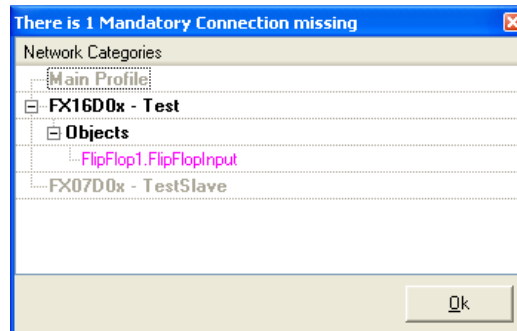


Figure 246: Missing Mandatory Connections Window

## Compiling and Saving Applications

To compile and save your application:

1. On the File menu, click Save or Save As.
2. If you selected Save As, enter the new file name and location for the application.

During the Save operation, FX Builder exports the application file with an .apd file extension. This file contains the complete application, including the control algorithm, application point definitions, event and trend configurations, Web site, display configuration, and network profile.

**Note:** An application file can contain only one network profile (N2 Open, LON, or BACnet).



# Specifications and Technical Data

## Ordering Codes

Table 45: Software

Product Code	Product Description
LP-FXTPRO-0	FX Tools Pro CD ROM (FX Builder, FX CommPro N2, FX CommPro LON, FX CommPro BACnet, FX Loader, and MD LON Loader) – New User
LP-FXTPRO-6	FX Tools Pro CD ROM (FX Builder, FX CommPro N2, FX CommPro LON, FX CommPro BACnet, FX Loader, and MD LON Loader) – Upgrade

## Technical Specifications

Table 46: FX Builder

Product Code		Product Description
Operating System		Microsoft Windows 2000 (with Service Pack 4 or later) Microsoft Windows XP® (with Service Pack 1 or later)
Hardware Requirements	Processor	Intel® Pentium® Processor, 500 MHz or higher
	RAM	Minimum 512 MB RAM (1 GB recommended)
	Hard Disk	60 MB for storage of FX Tools 2.5 MB (typical) to 6 MB (maximum) for storage of each application file
	Display	Display resolution 800 x 600 16-bit (32,768) color minimum
Software Requirements		Microsoft Internet Explorer® Version 5.0 or later Microsoft .NET Framework Version 2.0

*The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.*



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