

FDDWorX

Training Manual

Version 10.7

Rev. C

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Introduction to FDDWorX

1

Welcome to the training for ICONICS' FDDWorX™, a predictive building automation solution that uses an advanced Fault Detection and Diagnostics Engine. It incorporates algorithms that weigh the probability of faults and advise management, operators and maintenance personnel of actions to prevent equipment failures or excessive use of energy. When equipment failures occur, advanced software technology provides automatic guidance to a list of causes sorted by probability, resulting in reduced downtime and lower costs to diagnose and repair. You can use it inside the Workbench Silverlight within the GENESIS64 HMI/SCADA suite.

FDDWorX collects building equipment process data (such as HVAC and DDC system data) using industry-standard data collection mechanisms. It can automatically generate alert notifications and reports. Operators can use real-time integrated Silverlight viewers or SharePoint displays to analyze relevant data such as the status of equipment operating outside rules parameters. Fault Detection and Diagnostics (FDD) Analysis technology takes into account several National Institute of Standards and Technology (NIST) concepts.

This course will take you through the process for configuring and using FDDWorX. This training manual includes hands-on exercises that provide opportunities for you to work with and learn FDDWorX on your own.

1.1. Objectives

After completing this chapter, you should be able to:

- Understand what FDDWorX does
- Understand how FDDWorX works as a companion to ICONICS products

1.1.1. Before You Begin

The material in this course assumes that you are familiar with or have experience with the following:

- Microsoft Internet Explorer
- 64-bit Microsoft Windows operating systems such as Windows 7, Windows 8, or Windows Server 2012 (should be able to launch and close applications)

- The ICONICS GENESIS64 and/or AnalytiX suites of software applications, including a basic familiarity with Silverlight-based tools

Note: Demo mode for FDDWorX allows for up to 24 enabled assets and 2 client connections for 12 hours of runtime. In order to run FDDWorX in a production environment, please contact ICONICS for a full license.

1.2. *Environment*

FDDWorX, as part of ICONICS' AnalytiX suite, has the following minimum system requirements. Your system must meet the minimum requirement before you can install AnalytiX.

CPU:

Dual Core 64-bit processors
(e.g. AMD Athlon 64 X2, Intel Xeon, or AMD Phenom)

Memory:

Minimum: 4 GB of RAM
Recommended: 6 GB of RAM

Hard Disk:

Recommended: At least 50 GB free hard disk space is recommended – for installation and to allow for SQL Server database growth.

Drive:

DVD Drive for installation

Operating System:

Any Windows 64-bit operating system, including:

- Windows 8 x64 (Professional or Ultimate Edition)
- Windows 7 x64 (Professional or Ultimate Edition)
- Windows Server 2008 R2 x64
- Windows Server 2008 x64
- Windows Server 2012

.NET Framework:

Microsoft .NET Framework 4.0

Web Server:

Microsoft Internet Information Services (IIS) 7.0 [IIS with FTP is a prerequisite. This can be installed from the Start menu → Control Panel → Programs and Features → Turn Windows Features On and Off.

Additional Software:

- Microsoft SQL Server 2008 R2 SP1 or higher
- Microsoft SharePoint Server 2010 or SharePoint Foundation 2010 (required for PortalWorX-SP only, can be installed on a separate server if desired)
- Microsoft Office Excel 2003 or above (32 bit only required for ReportWorX)

Web Access: Via Silverlight Publishing: Internet Explorer 7 or later, Firefox 3 or later, Safari, Chrome.

Note: It is recommended that the system's page file size be a minimum of four (4) times the size of installed (physical) RAM.

Note: The connection to a SQL Server data source may be either local or remote.

Optional Hardware:

Ethernet adapter (for remote PC connections or Ethernet I/O)

USB port (for hardware or software license or license transfer)

Serial COM ports or other adapters (for data I/O)

Note: The requirements described above are based on typical applications. Depending on your specific application, the minimum requirements may vary. These system requirements assume that the OPC server(s) are installed locally on the system and that the following ICONICS components are all installed and running: Energy AnalytiX, Facility AnalytiX and ReportWorX. For AnalytiX application servers that will also utilize portions of the ICONICS GENESIS64 HMI/SCADA suite, including tools within the Platform Services, note that those requirements are separate, but must also be taken into consideration.

1.3. Introduction to FDDWorX

About Fault Detection and Diagnostics (FDD)

In modern automation and in most control systems, in general, a great deal of attention is devoted to the problems of Fault Detection and Diagnostics. One part of FDD methodology deals with the ability of a control system to detect and report (or, in some cases, predict) equipment failures or abnormal operating conditions while another part focuses on problem analysis and failure cause diagnostics.

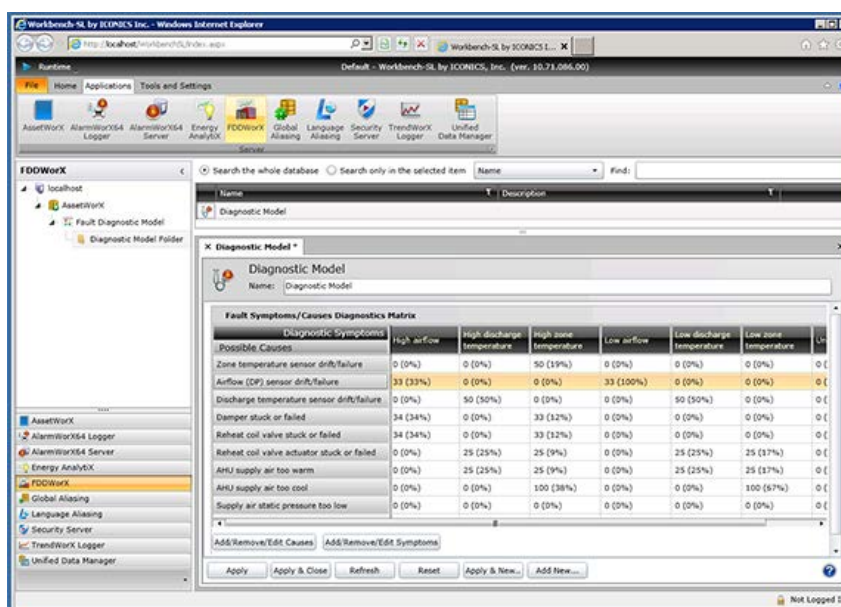


Figure 1.1 - Utilizing Fault Detection and Diagnostics

In the world of OPC-enabled SCADA systems, the concept of fault detection unambiguously falls into the area of Alarms and Events management. OPC Alarms and Events specifications define how OPC A&E-enabled servers generate events to notify operators about various occurrences in the system. ICONICS' AlarmWorX32 and AlarmWorX64 Alarm Servers are both fully OPC A&E-compliant event servers. They provide a mechanism to scan data point values (e.g. signals from sensors, PLC registers, expressions or external Rules engine boolean variables) and evaluate logical conditions generating Alarms (in OPC A&E language) or Faults (in general, non-OPC process control literature).

FDDWorX' FDD technology addresses the need for a set of tools to perform alarm analysis and diagnostics, with a goal to determine a root cause or a limited set of possible reasons that lead to the appearance of specific Alarms (Faults). Both ideal simulation and historical pattern search approaches to fault diagnostics require very specific detailed knowledge of the equipment types being diagnosed.

Traditionally, ICONICS' SCADA applications were developed to target the most generic types of devices without regards to specific details about particular pieces of equipment like boilers, air handler units, VAV boxes, etc. An alarm pattern recognition technique allows formal generalization to any equipment type.

ICONICS FDDWorX utilizes a number of Fault Detection and Diagnostics technologies, including:

- AssetWorX
- Fault Detection
 - Integrating ICONICS AlarmWorX64 Server
 - Probable Cause Configuration
 - Fault Database
 - Rules Engine
- Fault Diagnostics
 - Diagnostic Models
 - SQL Server Stored Procedures
- Fault Visualization
 - Integrating GraphWorX64 and AlarmWorX64
 - New Charts and Grids
- Fault Reporting
 - Integrating ICONICS ReportWorX

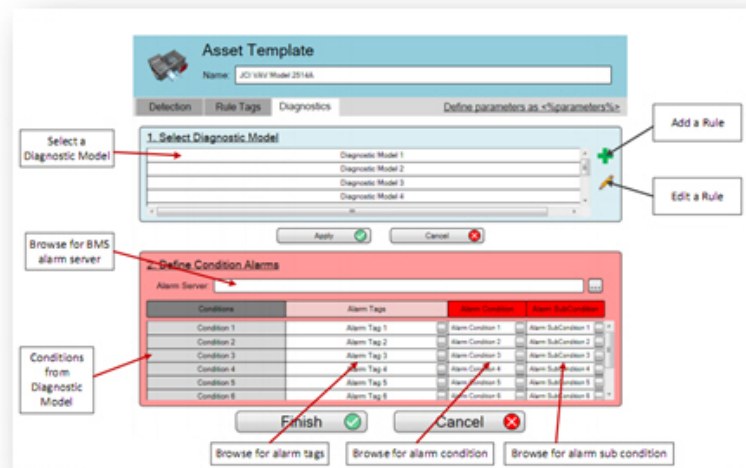


Figure 1.2 - Asset Template Example

1.4. The Structure of this Course

In this course, we will be providing basic training on some specific, underlying tools and technology that are not unique to FDDWorX, but are part of the platform on which FDDWorX is built.

We will provide an overview of AssetWorX. AssetWorX is an ICONICS product that utilizes ISA95 Intelligent Asset Technology to create models and organization of all assets within a system. Monitored equipment or buildings can be considered assets. Understanding how to organize assets is necessary to properly configure the FDDWorX Fault Detection and Diagnostics Function.

In Chapter 2, we discuss the FDDWorX Configurator, a 'Provider' application within the Workbench-SL Silverlight-integrated, Web-based configuration utility. You will learn about diagnostic models and how to add the causes, symptoms and percentages that help to determine the desired fault diagnostics. You'll see how this data combines to provide diagnostic matrices and will also learn how to connect this information to selected assets.

Chapter 3 specifically covers the FDDWorX Viewer provider within PortalWorX-SL. You'll find out how to add charts, grids, tabs containers, panels and details, as well as how to configure commands through the viewer. Although this training will be mostly focused on the Silverlight-based tools, we also cover how to add the FDDWorX Web Part in SharePoint 2010.

Lab: Training Setup

L1

With this lab, we will leverage features in both the WorkBench, to import the training .csv data, and in WorkBench-SL to import the AssetWorX .csv data. We will also leverage Workbench-SL to verify the FDD solution is enabled. Let's proceed.

1.1. Task Checklist

In this lab, you will complete the following tasks:

- Learn how to operate the FDD Simulator
- Prepare the platform for training
- Review the general function of Expressions

1.2. Support Files

You will need the following file(s) to complete each of the labs:

- icTonicsAssetWorX.csv
- icTonicsAlarmLoggerConfig.csv
- icTonicsAlarmServerConfig.csv
- icTonicsUDMConfig.csv
- fddworx_header.png
- FDD_icTonics_HVAC.gdxf
- icTonics.opf

1.2.1. Create the AnalytiX Database

Important: Pay particular attention to sections in the GENESIS64 Additional Features Training Manual labs that pertain to the icTonicsAssetWorX database.

FYI, the icTonicsAssetWorX configuration database is used for all AnalytiX providers in the Workbench-SL including the AnalytiX Catalog, Energy AnalytiX, and FDDWorX.

1.2.2. Import Training Data

When we created the IcTonicsAssetWorX database, we elected not to include the sample data. The following procedure, importing training data, populates the appropriate databases with information to support the FDDWorX labs. Let's get started.

Note: The following import procedure will need to be performed on each of the .csv files in the tables below. Be sure to select the correct **Provider** for the **Import File**. The AssetWorX provider import is described below as an example.

Workbench-SL		
<i>Database</i>	<i>Import File</i>	<i>Provider</i>
icTonicsAssetWorX	icTonicsAssetWorX.csv	AssetWorX
icTonicsAlarmServerConfig	icTonicsAlarmServerConfig.csv	AlarmWorX64 Server
icTonicsAlarmLoggerConfig	icTonicsAlarmLoggerConfig.csv	AlarmWorX64 Logger
icTonicsUDMConfig	icTonicsUDMConfig.csv	Unified Data Manager

1. If closed, open Workbench-SL. From the Windows Start button select **Start → All Programs → ICONICS → Workbench-SL**.
2. Select the **AssetWorX** (or appropriate) provider.

Note: After selecting the provider, if the database in the above table does not exist then right click on the localhost (reminder, after selecting the appropriate provider) and select **New Database**. For example, select the AlarmWorX64 Server provider, right click on the localhost, select new database and name the database icTonicsAlarmServerConfig. Do not include sample data. See Chapter 1 for more details on creating a database.

3. Right-click on the **icTonicsAssetWorX** database and select **Import**.

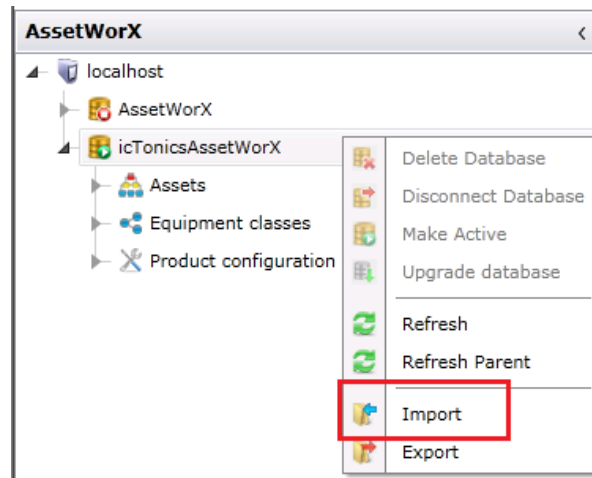


Figure L1.1– Importing the Energy AnalytiX Training Data

4. From the “**Import a file into the database**” dialog, click on the browse button. Browse to the **C:\Training** folder and select the **icTonicsAssetWorX.csv** file. Leave the remaining fields as default and click on the **Upload** button.

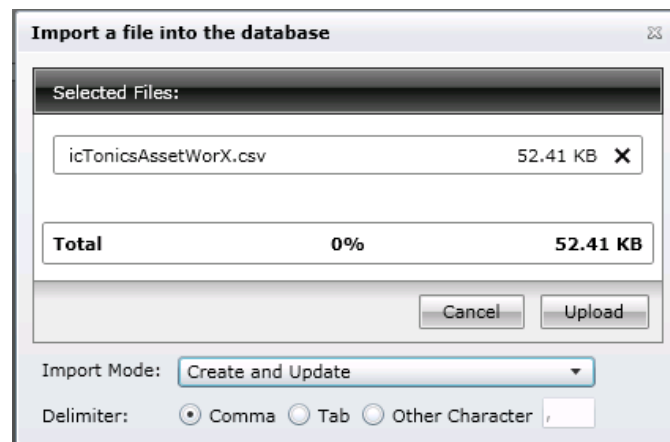


Figure L1.2– Importing the icTonicsAssetWorX Data

5. The results of your import should look similar to the following figure. If you have errors please let your instructor know.

Note: If **Energy AnalytiX** is not installed you will see errors during the import process that reference **EAConfigurationRoot**. It is okay to proceed with the FDD labs.

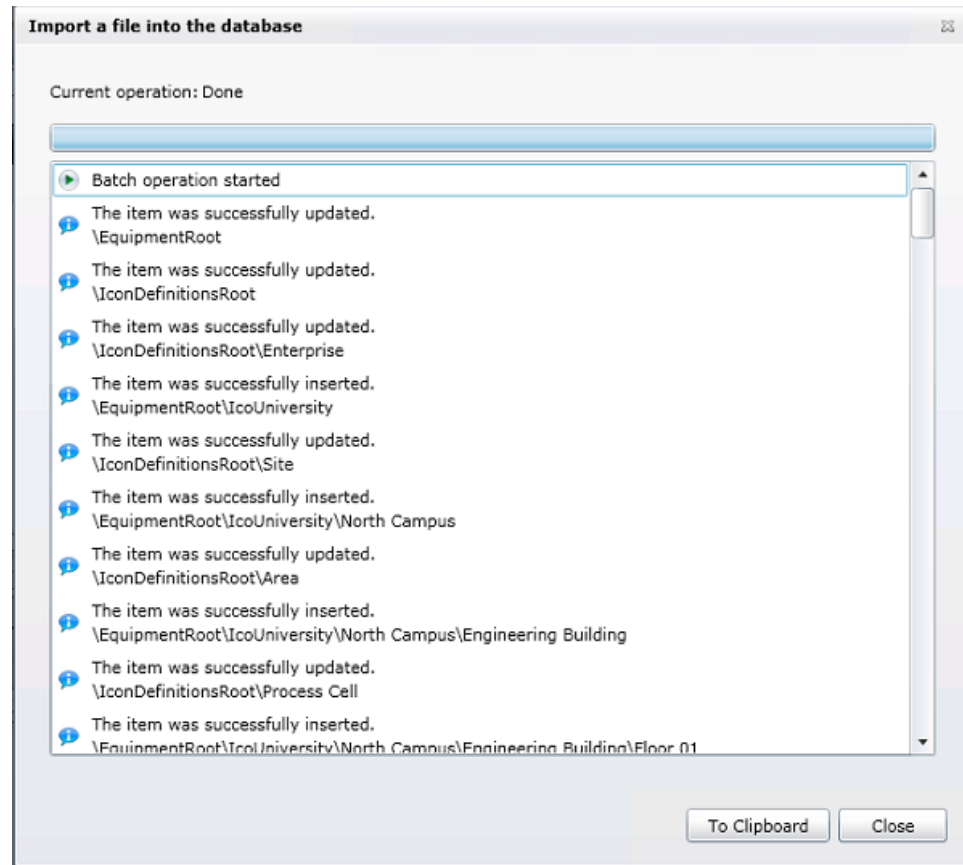


Figure L1.3 – The icTonicsFDDAssetWorX Data Import Results

6. Click the **Close** button.
7. Right click on **icTonicsAssetWorX** database in the AssetWorX navigation tree and select **Make Active**. A notification about AnalytiX may appear. Click **OK**.
8. Right click on localhost in the AssetWorX navigation tree and select **Refresh**.

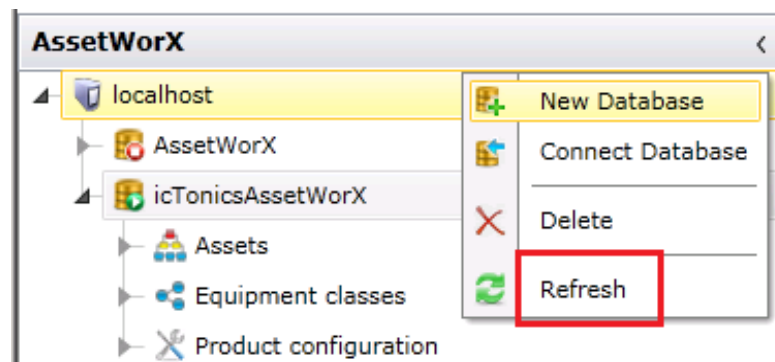


Figure L1.4 – Refresh the Provider Tree

9. At this time, all **four** of the support files should have been successfully imported and **each icTonics database should be active**. Please check to make sure the imports are complete and the four (AssetWorX, Unified Data Manager, Alarm Server and Alarm Logger) icTonics databases are **Active**.
10. Select the **AlarmWorX64 Server** provider.
11. Expand the **icTonicsAlarmServerConfig** → **Configurations** → **icTonics_FDD_Alarms** tree.
12. Double click on the **icTonics_FDD_Alarms** tree node and be sure the **Default (Active) Configuration** (in the lower right hand window) **checkbox is selected**.
13. In the following steps, if the simulator is not working properly you may have to reboot the machine.

1.3. Alarm Logger Setup and Testing

In a later lab we will be creating a report that will retrieve alarm information from the alarm logger. Completing the steps in this section will ensure we have alarm data being logged to the alarm SQL Server database.

1.3.1 Creating the Alarm Database

1. Open the SQL Server Management Studio by going to **Start** → **All Programs** → **Microsoft SQL Server 2008 R2** → **SQL Server Management Studio**.
2. Once the Management Studio opens, you will receive a dialog box that asks you to connect to a SQL Server. If this is the first time you are using the SQL Management Studio, you may receive a **welcome** and **setup** dialog box prior to the **connection** dialog box. You can use the default credentials that are already filled in the dialog box. Take note of these credentials. Click on **“Connect”** to connect to the server.

Note: If the server name field is blank, enter: **“(local)\SQLEXPRESS”** (without quotes) into it.

3. Once you are connected, expand your server instance → **Databases** in the Object Explorer on the left-hand side.
4. **Right-click** on **Database** in the Object Explorer and select **“New Database”**.

5. In the New Database dialog box, type in “**icTonicsAlarmData**” in the Database name field.

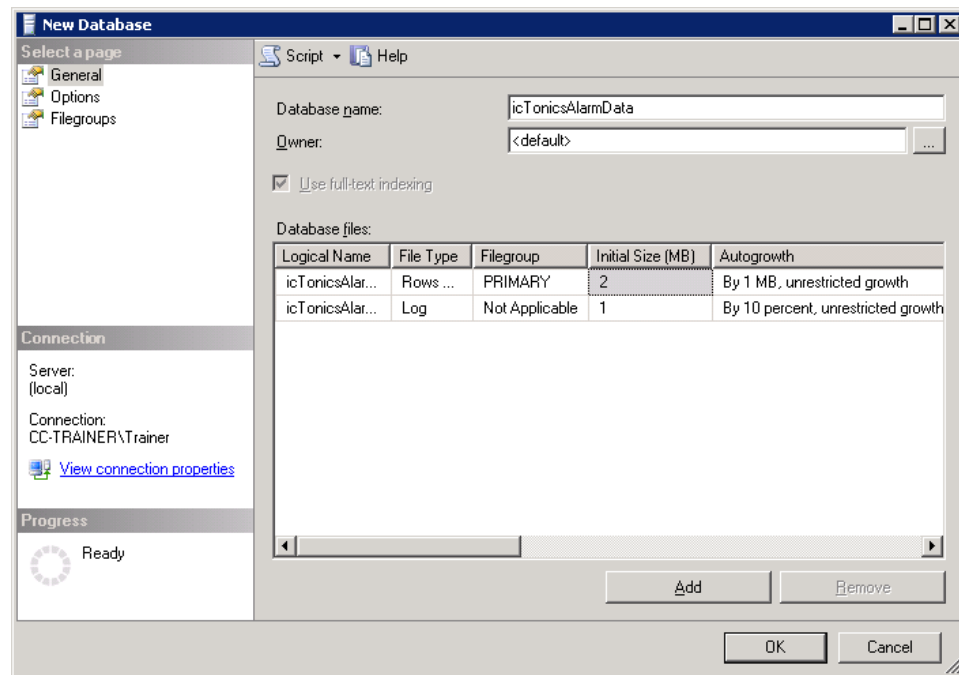


Figure L1.5 - Creating a New SQL Database

6. Click on “**OK**” at the bottom of the dialog box to create the database. This may take a few seconds.
7. Leave the SQL Server Management Studio open.

1.3.2 Alarm Logger Node Definition

1. If closed, open Workbench-SL. From the Windows Start button select **Start → All Programs → ICONICS → Workbench-SL**.
2. Select the **Alarm Logger** provider.
3. If the Logger is started, using the traffic light in the ribbon, **stop** the **logger**.
4. Expand the **icTonicsAlarmLoggerConfig** tree on the left. This should be the Active Database.
Note: If not, right click on icTonicsAlarmLoggerConfig and select Make Active.
5. Right click on **Nodes** and select **Add Node**.
6. From the **Node Name** drop down list, select your node name (computer name).

7. Click **Apply**.
8. Right click on your node name entry under Nodes, and select **Add Link to Configuration**.
9. From the **Configuration Name** drop down list, select **icTonicsAlarms**.
10. Click **Apply**.
11. Using the traffic light in the ribbon, **Restart** the **Alarm Logger**.

1.3.3 Verify the Alarm Logger Tables are Created

1. Return to the **SQL Server Management Studio**.
2. Expand the Databases Tree.
3. Expand **icTonicsAlarmData** → **Tables**.
4. As seen in the following figure, you should see a series of blue icons including **dbo.AlarmLog**.

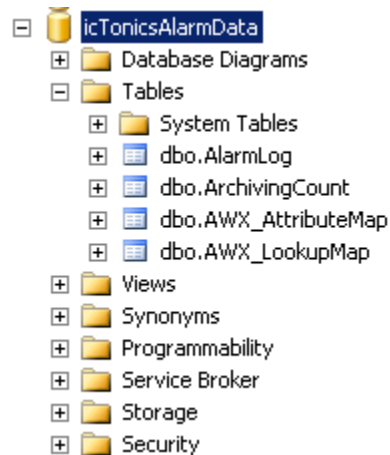


Figure L1.6 – Alarm Logger Tables

5. If the Alarm Logger tables do not exist, verify each of the above steps have been completed successfully.

1.4. Using the FDD Simulator

We will proceed by verifying that the support files are correctly deployed and that the simulator is functioning properly. The simulator was created with the intent of simulating an HVAC system. Its design is a combination of simulated OPC Tags, Expressions and Registers. From the perspective of learning how FDD works, here's a few pointers on how to manipulate the simulator to generate system faults.

1.4.1 The GraphWorX Display

1. Using the Windows File Explorer, navigate to the **C:\Training** folder and double-click on the **FDD_icTonics_HVAC.gdpx** file. This will launch the GraphWorX editor.
2. Click on the **Runtime** selection in the upper right. Your display should resemble the following figure. Wait until the display initializes.

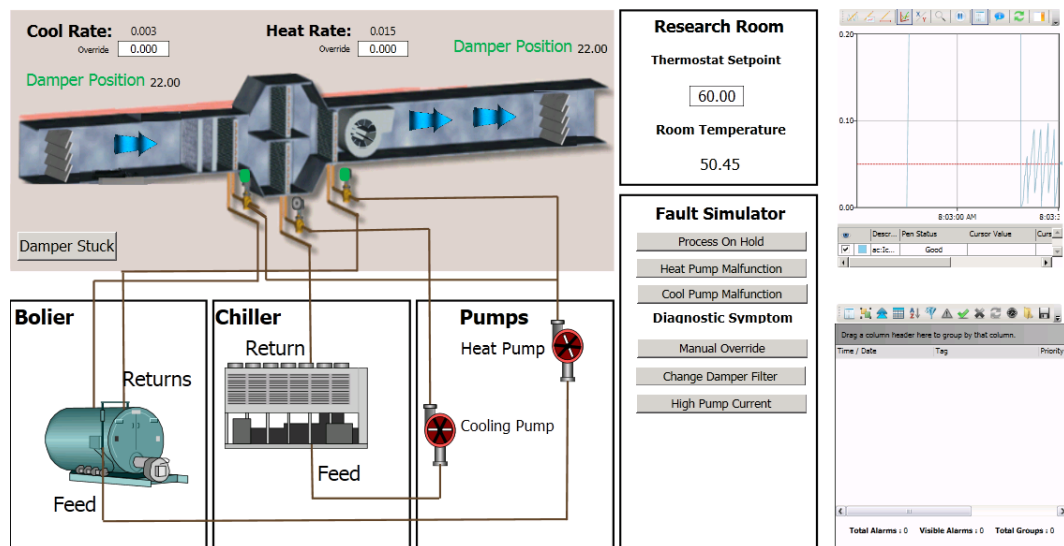


Figure L1.7 – The Simulator Front End

Note: If the display is not functioning properly, reboot the machine so all the changes we made will take effect.

3. If there are buttons with **Yellow** text, click on these buttons. The text color should change to 'Normal' and any fault and/or alarm indication should disappear.
4. Enter a value into the **Thermostat Setpoint** field that is **10** degrees higher than the current room temperature and hit the **Enter** key.

5. Animation will start, **Dampers** will open and your **Room Temperature** should adjust to try to match the **Thermostat Setpoint**.
6. The **trend viewer** in the upper right will start to display data and the **alarm viewer** in the lower right should remain empty. This procedure should not have generated any alarms.
7. Click on the '**Heat Pump Malfunction**' button. You should see a '**HeatPumpStatus**' alarm. Notice the **color scheme** of the alarm (red text with a white background). This will be significant when we distinguish between process and fault related alarm entries.
8. Notice the **Heat Rate** changes to **0.003** and the rate of room temperature change has slowed down considerably.
9. As long as the process remains in the heat pump malfunction state, the trend viewer data should remain below the low **threshold**. The low threshold is designated by the dotted **red line** within the trend viewer. Your trend viewer should resemble the following figure.

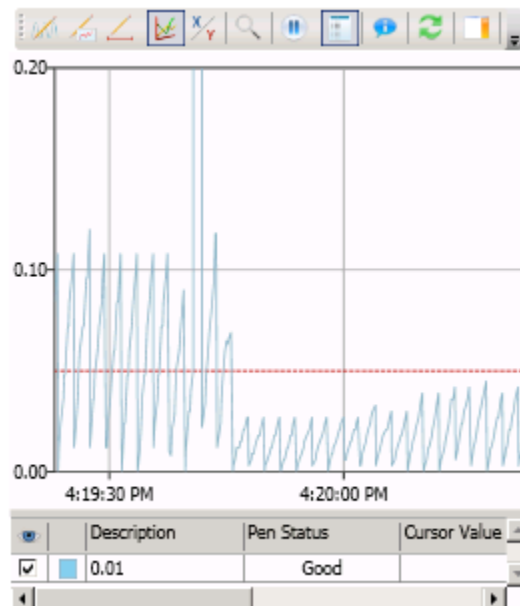


Figure L1.8 – Simulated Heat Pump Malfunction

10. Click on the '**Heat Pump Malfunction**' button again. The **Heat Rate** should change to **0.015**. The **Room Temperature** should eventually reach the **Thermostat Setpoint** and remain very close to, or hover at, the Thermostat Setpoint.

Note: The **Override** data entry fields are used to manually adjust the rate at which the Room Temperature aligns with the Thermostat Setpoint. Entering a value of 2 in the override will cause a very rapid temperature change. For automated operation each override value should be set to 0 (zero).

11. Also notice the **alarm is cleared** from the viewer.
12. Once the **Room Temperature is within 0.2 of the Thermostat Setpoint** the animation will stop.
13. The **Cool Pump Malfunction** works in a similar fashion while the room temperature is decreasing.
14. Any button under the **Fault Simulator** section with **yellow text** will have a corresponding alarm.
15. **Process On Hold** will pause all automated activity and the dampers will close.
16. The **Thermostat Setpoint** value has a range of **50** to **90** and will not accept input outside these limits.

This concludes this lab.

FDDWorX Configurator

2

FDDWorX consists of a configuration tool within ICONICS Workbench-SL utility as well as a viewer element within PortalWorX-SL (or a viewer within ICONICS' GraphWorX64 or within a Web Part within Microsoft SharePoint).

In this chapter, we will review the configuration aspects of ICONICS Fault Detection and Diagnosis tool, FDDWorX.

2.1. Objectives

After completing this chapter, you should know how to:

- Launch the FDDWorX provider in Workbench-SL
- Create a Diagnostic Model Folder
- Create a Diagnostic Model
- Add a Cause
- Add a Symptom
- Add Number of Instances/Percentages
- Use Diagnostic Matrices in the AssetWorX Provider
- Add a FDDWorX Diagnostic Model to a Selected Asset

2.2. Introduction to FDDWorX Configurator

ICONICS FDDWorX is run as a provider within ICONICS' Workbench SL, which, in turn, is the centralized, Web-based environment for GENESIS64 configuration. The Workbench acts as an advanced operator interface for service management, with built-in project management functionality.

Users can manage licenses, redundancy and databases through the Workbench while retaining the ability to use secure logins to lock down configuration. With Workbench-SL, users can configure alarms, trends, security and even GraphWorX64 displays, to unleash the full centralization of configuration.

2.2.1. Launch FDDWorX

FDDWorX can be launched within Workbench-SL in several ways. Workbench-SL can be accessed from **Start -> All Programs -> ICONICS GENESIS64 -> Workbench-SL**. Once opened, the Workbench will look like the following figure.

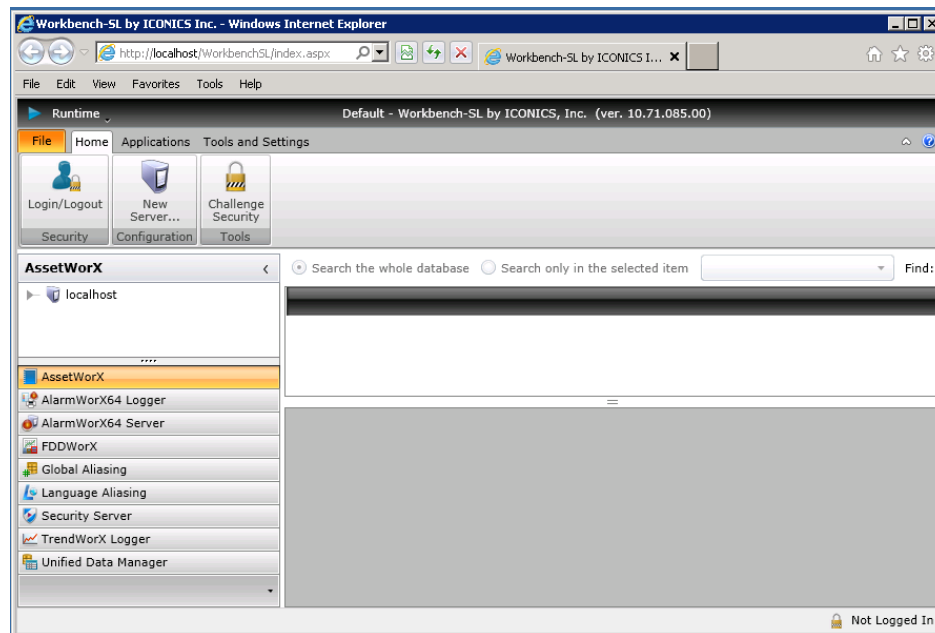


Figure 2.1 - Workbench-SL

You can then select the **Facility AnalytiX** provider from the list in the left-side pane of the Project Explorer within Workbench-SL, as shown below:

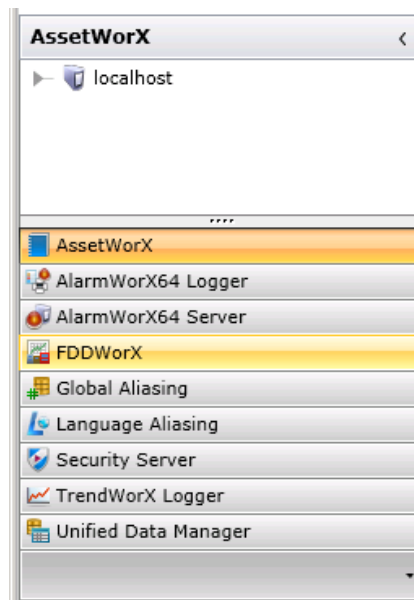


Figure 2.2 - Selecting FDDWorX Via the Project Explorer

If the left pane of the Project Explorer is collapsed, you can still select FDDWorX via its icon  from those in the tray beneath the collapsed window, as shown below.



Figure 2.3 - Provider Icons Beneath Collapsed Project Explorer Window

You can also open FDDWorX by clicking the **Applications** tab of the ribbon, and then clicking on the **FDDWorX** button, as shown below:

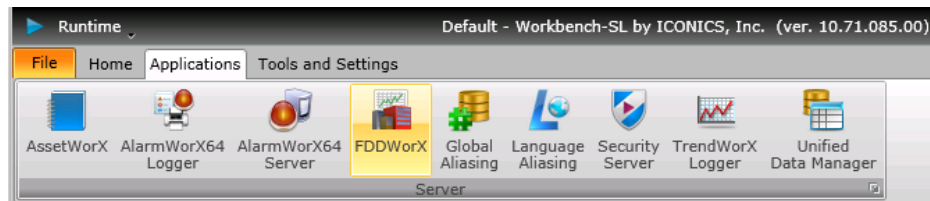


Figure 2.4 - Selecting FDDWorX from the Ribbon

2.2.2. Importing/Exporting

2.2.2.1. Importing Into FDDWorX

You can import data into the database or Diagnostic Model branches within FDDWorX' Project Explorer.

1. Right-click on your selected branch, then select "Import", as shown below:

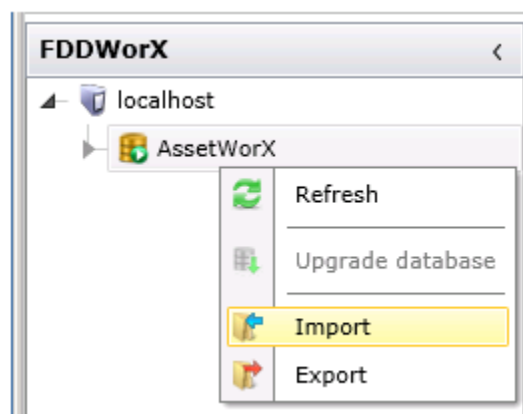


Figure 2.5 - Importing into FDDWorX' Project Explorer

- The "Import a file into the database" window will open. Click on "**Browse**" to navigate to your selected .csv (or other exported format) file. You can set the Import Mode via the pulldown menu. Options include "Only Create new items", "Only Update old items" and "Create and Update". You can also set the Delimiter for the imported data (Comma, Tab or Other Character).



Figure 2.6 - Import a file into the database Window

Once you have selected the data file you wish to import and made your mode and delimiter settings, the window will update to look similar to below:

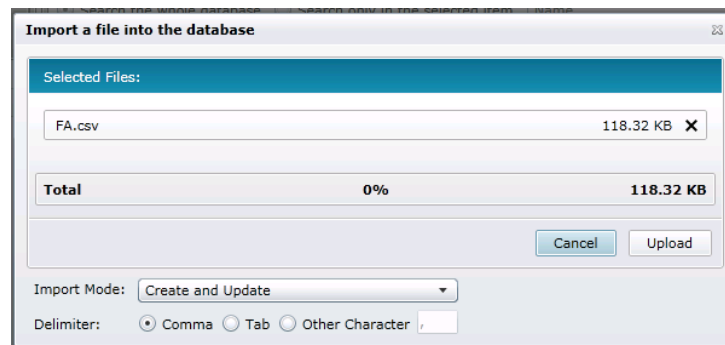


Figure 2.7 - Updated Import Window

- Click "**Upload**" to proceed. The following status window will appear. You can Pause the data import at this time, if you so choose, else the import will proceed.

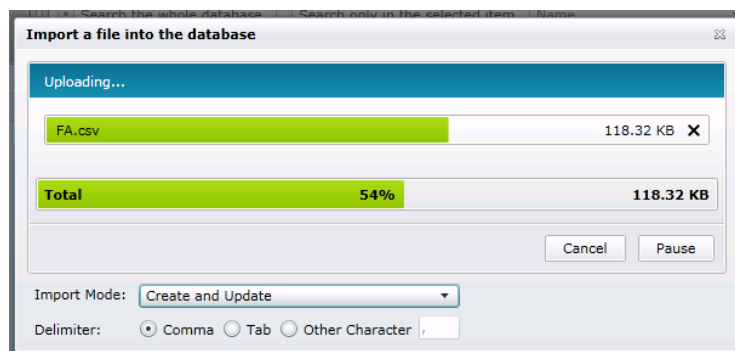


Figure 2.8 - Import Upload Status

Once the file has been imported, depending on your selected Import Mode, FDDWorX in Workbench for Silverlight will perform additional import-related tasks, listed in the window as shown below. Once the import process has completed, you have the option of copying the status notices (by clicking on **"To Clipboard"**) to paste into another application [Word, Notepad, etc.] for record-keeping.

- Click on "Next" to return to the "Import a file into the database", where you can import additional data files. Click on **"Close"** to return directly to FDDWorX in Workbench-SL to utilize your imported data.

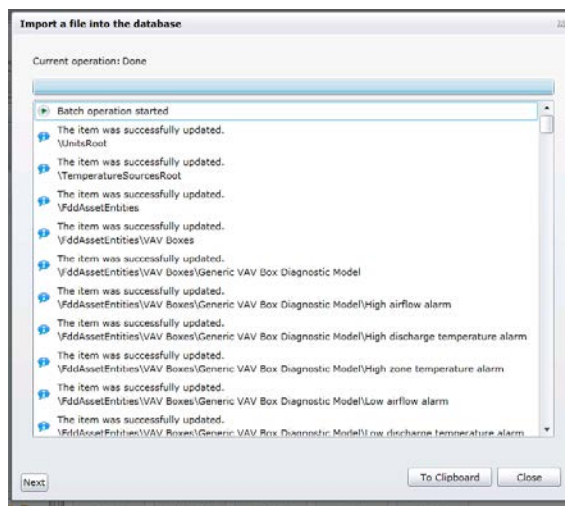


Figure 2.9 - Import Current Operations

2.2.2.2. Exporting From FDDWorX

You can export data from the database or Diagnostic Model branches within FDDWorX' Project Explorer.

- Right-click on your selected branch, then select **"Export"**, as shown below:

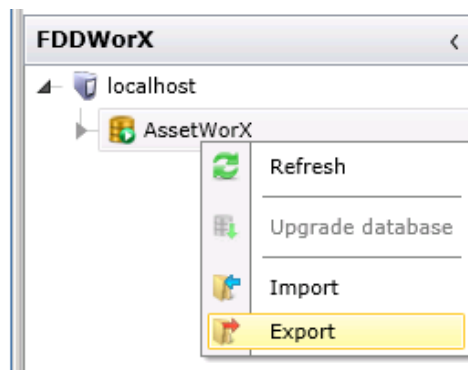


Figure 2.10 - Exporting from FDDWorX' Project Explorer

- The Export Options window will open. You can select in which format the data should be exported (e.g., CSV). Under the "Settings" header, you can select what type of Delimiter you wish to use (Comma, Tab, or Other character). You can also decide whether or not to generate relative paths for the exported data (via check box).

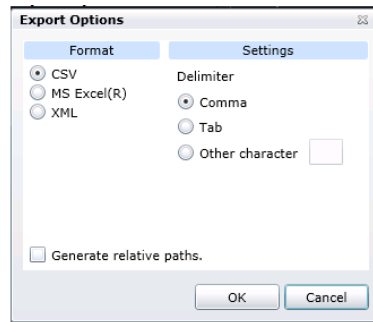


Figure 2.11 - Export Options Box

- You'll then see the next window (as shown below), providing the status of the data export. Once the export process has completed, you have the option of copying the status notices (by clicking on "To Clipboard") to paste into another application [Word, Notepad, etc.] for record-keeping). Click on "Close" to continue.

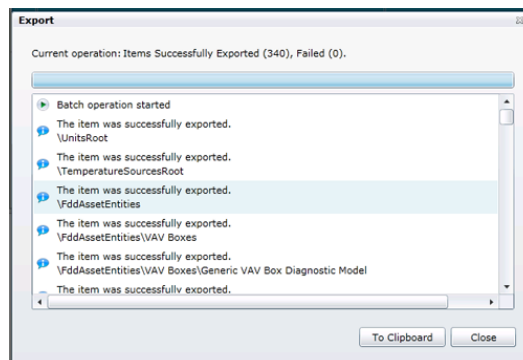


Figure 2.12 - Export Progress Window

The following notice will then appear, to provide the location of the exported data. You can click on the hyperlink to open the file containing the exported data.

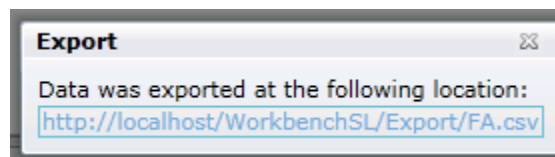


Figure 2.13 - Exported Data Location Notice

- Click on the "X" to close this box and return to FDDWorX.

2.3. Fault Diagnostic Models

After you verified your asset database (set through the AssetWorX provider) and/or imported any desired elements into your project via FDDWorX' Project Explorer in ICONICS' Workbench-SL, you can expand the database branch to show the Fault Diagnostic Model, as shown below:

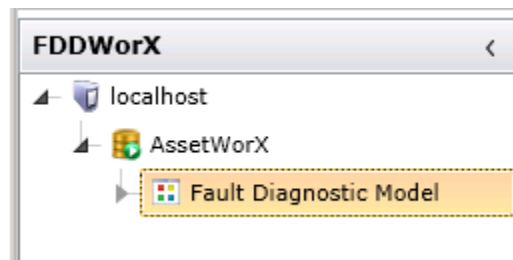


Figure 2.14 - Fault Diagnostic Model in FDDWorX' Project Explorer

In this node you can:

1. Create Diagnostic Model Folders and Add Diagnostic Models to them.
2. In a diagnostic model, you can Add Causes.
3. Then you can Add Symptoms for each cause.
4. Then you can Enter Numbered Instances/Percentages for each symptom.

2.3.1. Create a Diagnostic Model Folder

The Fault Diagnostic Model that appears under any newly created database in FDDWorX' Project Explorer is initially empty. You can create Diagnostic Model Folders that can contain equipment-specific diagnostic models that, themselves, allow you to set Diagnostic Symptoms and Possible Causes within a Fault Symptoms/Causes Diagnostic Matrix.

There are two ways that you can create a diagnostic model folder.

To Create a Diagnostic Model Folder

1. Right-click on the Fault Diagnostic Model branch under your selected database in the Project Explorer, then click on "**Add Diagnostic Model Folder**", as shown below:

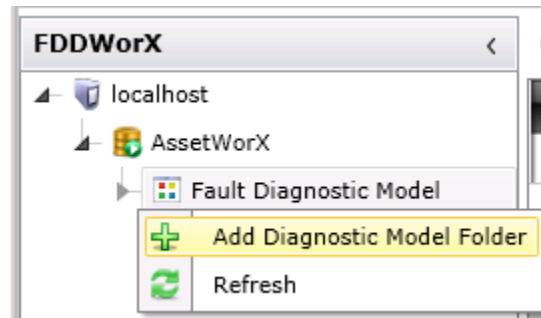


Figure 2.15 - Adding a Diagnostic Model Folder in the Project Explorer

OR, you can select the Fault Diagnostic Model in the Project Explorer, then click on the "**Add Diagnostic Model Folder**" button in the Workbench Ribbon, as shown below.

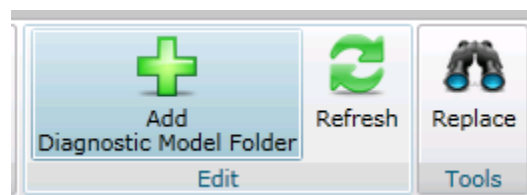


Figure 2.16 - Adding a Diagnostic Model Folder from the Ribbon

2. You'll notice that a placeholder branch now appears in the left-side panel of the Project Explorer, reading "[NewDiagnosticModelFolder]". Also, see that the settings for the as-yet-unnamed folder appear in the lower right panel, as shown in the following figure. In this example, we have named the new Diagnostic Model Folder "VAV Boxes". Enter your own name here, then either click on "**Apply**" and proceed to make additional changes to the same Diagnostic Model Folder OR click on "**Apply & Close**" to save your settings and return to the Project Explorer OR click on "**Add New...**" to change the settings for an additional new Diagnostic Model Folder.

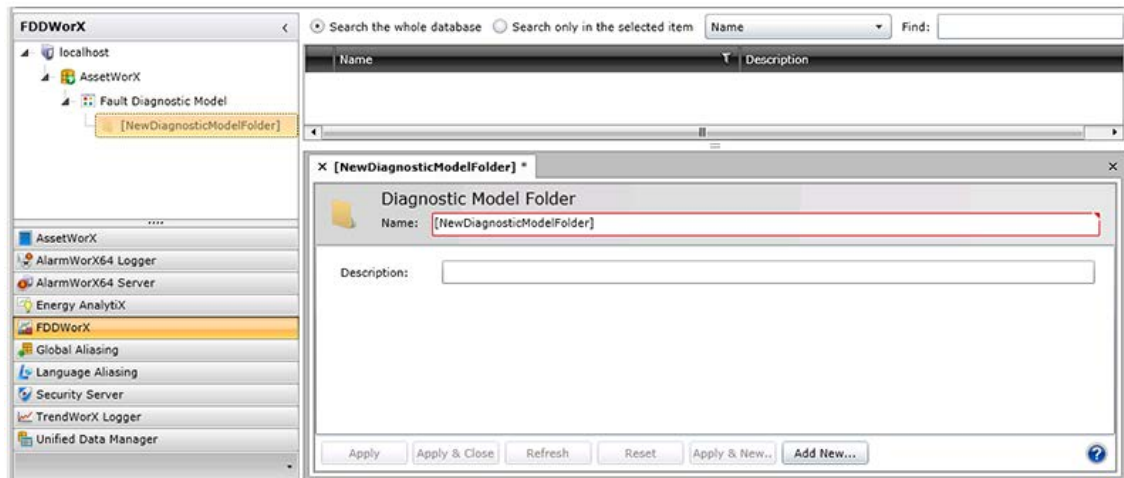


Figure 2.17 - Diagnostic Model Folder Settings

Once you have named the Diagnostic Model Folder, it will overwrite the placeholder [NewDiagnosticModelFolder] in the left pane of the Project Explorer, as shown below (with our example, "VAV Boxes". You will now be able to add Diagnostic Models with this folder.

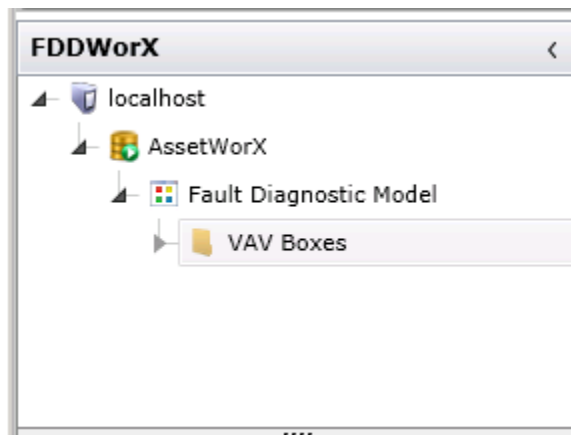


Figure 2.18 - Newly Named Diagnostic Model Folder Appears

2.3.1.1. Create a Diagnostic Model

Once you have created a Diagnostic Model Folder, you can then populate it with Diagnostic Models that will allow you to set Diagnostic Symptoms and Possible Causes within a Fault Symptoms/Causes Diagnostic Matrix.

There are two ways that you can create a Diagnostic Model.

To Create a Diagnostic Model

1. Right click on a Diagnostic Model Folder in the Project Explorer, then click on **"Add Diagnostic Model"** as shown in the image below.

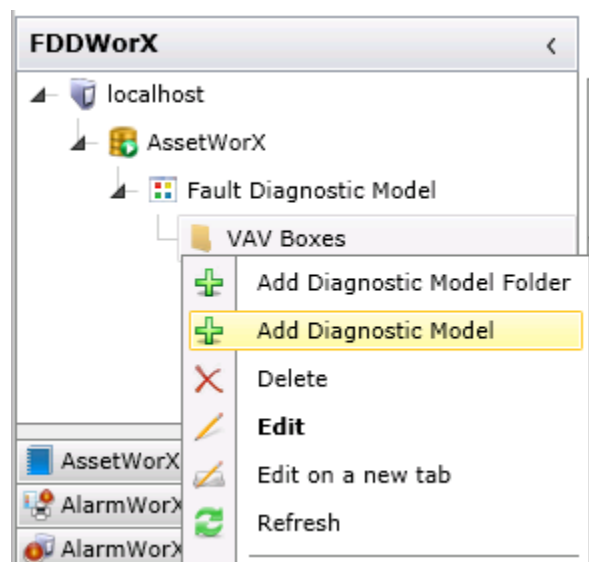


Figure 2.19 - Adding a Diagnostic Model in the Project Explorer

OR, you can select the Diagnostic Model Folder in the Project Explorer, then click on the **"Add Diagnostic Model"** button in the Workbench Ribbon, as shown below.

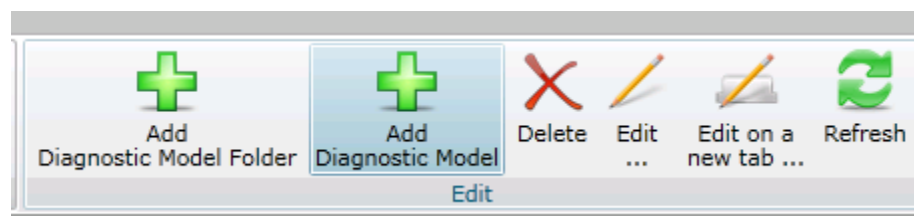


Figure 2.20 - Adding a Diagnostic Model from the Ribbon

- The top and bottom panels on the right side of the Project Explorer will reflect the newly created Diagnostic Model. In the top panel, you'll notice a "[NewDiagnosticModel]" placeholder. In the bottom, you'll see the tab for the [NewDiagnosticModel] settings. In this example, we have named the new Diagnostic Model "Generic VAV Box Diagnostic Model". Enter your own name here, then either click on "**Apply**" and proceed to make additional changes to the same Diagnostic Model OR click on "**Apply & Close**" to save your settings and return to the Project Explorer OR click on "**Add New...**" to change the settings for an additional new Diagnostic Model.

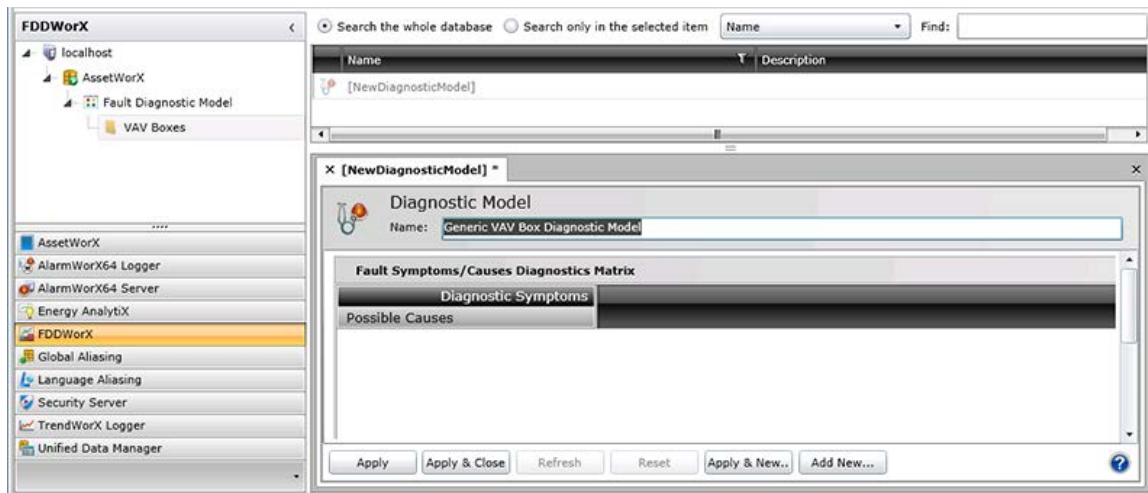


Figure 2.21- Initial Diagnostic Model Settings

2.4. *Fault Symptoms/Causes Diagnostics Matrix*

The Fault Symptoms/Causes Diagnostics Matrix is accessed through the bottom-right panel of the Project Explorer when editing settings within a Diagnostic Model in FDDWorX.

The Matrix is empty upon initial creation of a Diagnostic Model, as shown below.

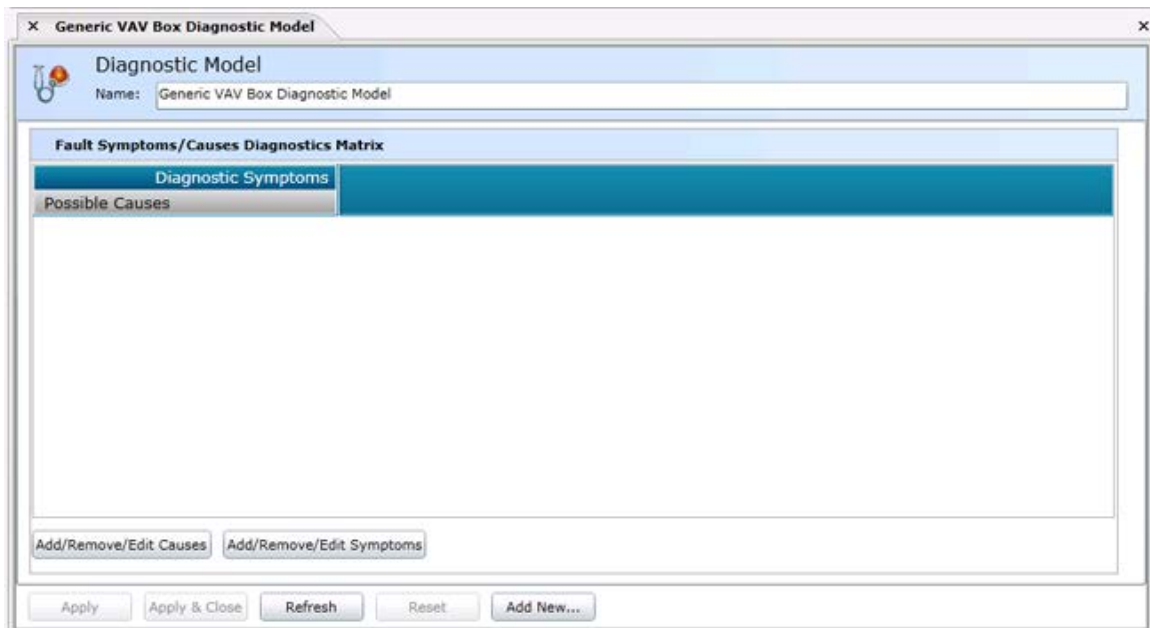


Figure 2.22 - Empty Fault Symptoms/Causes Diagnostics Matrix

The Fault Symptoms/Causes Diagnostics Matrix allows you to enter a list of Diagnostic Symptoms of equipment failures or abnormal operating conditions in a left-to-right column-header format as well as Possible Causes in top-to-bottom row format.

These tools help in performing alarm analysis and diagnostics with a goal to determine a root cause (or a limited set of possible reasons) that lead to the appearance of specific alarms (faults). Both ideal simulation and historical pattern search approaches to fault diagnostics require very specific detailed knowledge of the equipment types being diagnosed. FDDWorX allows ICONICS' SCADA applications to target specific device types with specific details (particular pieces of equipment like boilers, air handler units, VAV boxes, etc). An alarm pattern recognition technique allows formal generalization to any equipment type.

Diagnostic Symptoms	High airflow alarm	High discharge temperature alarm	High zone temperature alarm	Low airflow alarm	Low discharge temperature alarm	Low zone temperature alarm	Unlabeled
Zone temperature sensor drift/failure	0 (0%)	0 (0%)	50 (10%)	0 (0%)	0 (0%)	50 (10%)	0 (0%)
Airflow (DP) sensor drift/failure	33 (20%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)	33 (10%)
Discharge temperature sensor drift/failure	0 (0%)	50 (50%)	0 (0%)	0 (0%)	50 (50%)	0 (0%)	0 (0%)
Damper stuck or failed	34 (21%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)	33 (10%)
Damper actuator stuck or failed	34 (21%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)	33 (10%)
Reheat coil valve stuck or failed	0 (0%)	25 (25%)	25 (5%)	0 (0%)	25 (25%)	25 (5%)	0 (0%)
Reheat coil valve actuator stuck or failed	0 (0%)	25 (25%)	25 (5%)	0 (0%)	25 (25%)	25 (5%)	0 (0%)
AHU supply air too warm	0 (0%)	0 (0%)	100 (21%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
AHU supply air too cool	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	100 (21%)	0 (0%)

Figure 2.23 - Completed Diagnostic Model Example

To create this matrix, you add causes and their symptoms and enter instances and percentages.

2.5. Causes and Symptoms

2.5.1. Add a Cause

What is a Cause?

A cause, in the case of FDDWorX, is a reason for a resulting symptom that would create concern or "alarm". The causes to be added to the Fault Symptoms/Causes Diagnostics Matrix will, of course, vary by connected equipment. For instance, using our example of a VAV Box (a Variable Air Volume unit or zone-level flow control in a heating, ventilating, and/or air-conditioning [HVAC] system), there could be multiple causes of multiple symptoms that could cause specific alarms, including (but not limited to) Zone temperature sensor drift/failure, Airflow (DP) sensor drift/failure, Discharge temperature sensor drift/failure, Damper stuck or failed, Reheat coil valve stuck or failed, Reheat coil valve actuator stuck or failed, AHU supply air too warm, AHU supply air too cool, Supply air static pressure too low, Scheduling conflict with AHU, Undersized VAV box, Tuning problem with airflow feedback control loop, Tuning problem with zone temperature feedback control loop, Inappropriate zone temperature set point, Minimum airflow set point too low, Minimum airflow set point too high, Maximum airflow set point too high, Maximum airflow set point too low, and/or Sequencing logic error.

To Add Causes

1. To add causes to the Fault Symptoms/Causes Diagnostics Matrix, click on the **"Add/Remove/Edit Causes"** button at the bottom left of the window, highlighted in the image below. [Note: If you are not able to see these buttons, use the vertical scrollbar at the far right of the Workbench-SL window. If you still cannot see the buttons, maximize the window as much as possible, then use the scrollbar.]

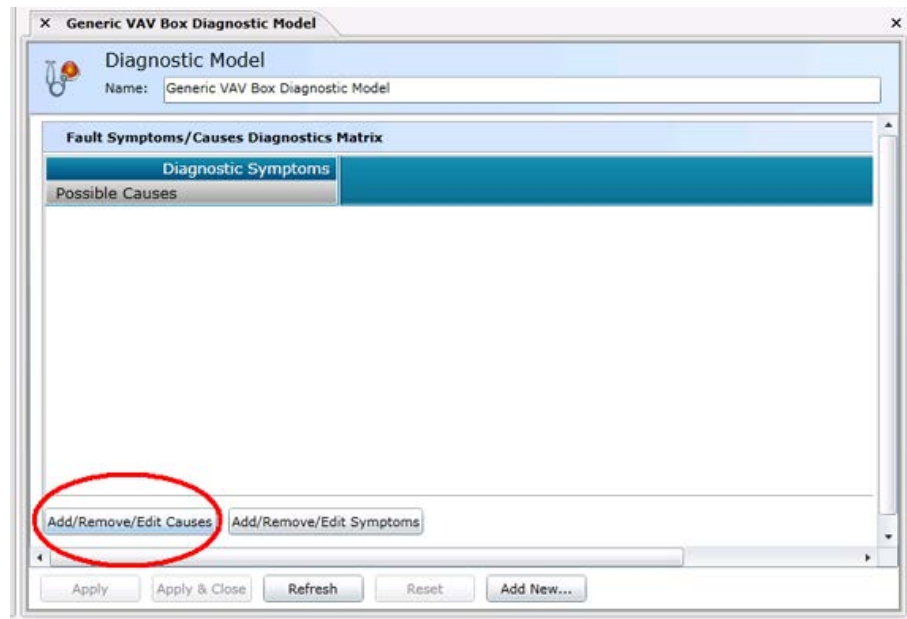


Figure 2.24 - Adding Causes to the Fault Symptoms/Causes Diagnostic Model

2. The following "Add, Remove or Edit Causes" window will appear. Click on the  icon or on the words "Click here to add new item".

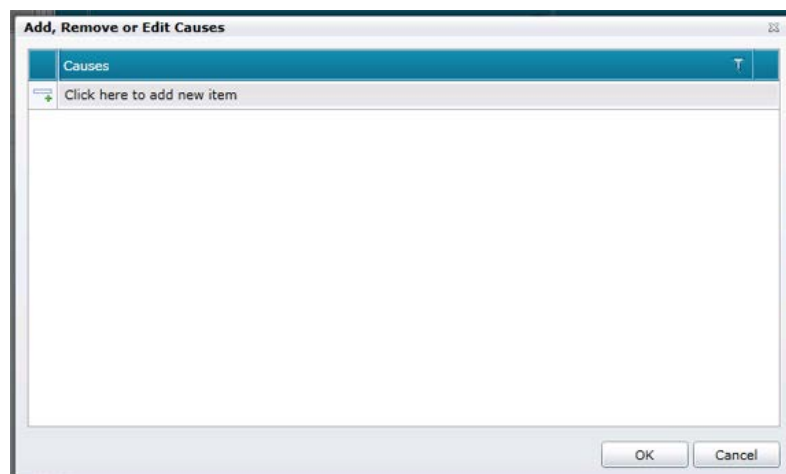


Figure 2.25 - Adding a New Cause

You will then be able to name the Cause, as shown below. In our example, we used a VAV Box' possible cause of "Zone temperature sensor drift/failure".

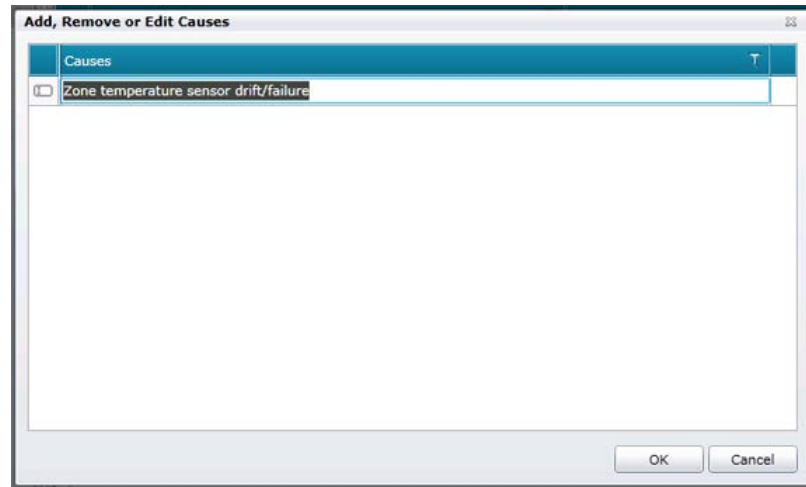


Figure 2.26 - Name the Cause

3. Should you wish to enter additional causes at this time, press the Enter key and repeat the procedure from Step 2 above. To return to the Fault Symptoms/Causes Diagnostic Matrix, click on the "OK" button. You'll see your newly added Cause(s) in the left column of the Matrix, as shown below.

Fault Symptoms/Causes Diagnostics Matrix	
Diagnostic Symptoms	
Possible Causes	
Zone temperature sensor drift/failure	

Figure 2.27 - A Newly Added Cause to the Fault Symptoms/Causes Diagnostics Matrix

4. In order to save your newly added cause(s), you must then either click on the "Apply" button at the bottom of the Diagnostic Model panel within the Project Explorer, as shown below (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on "Apply & Close" to save your settings and return to the main Project Explorer **OR** click on "Refresh" to update the Matrix itself **OR** click on "Reset" to return the state of the Matrix to the last saved settings **OR** click on "Add New..." to change the settings for an additional new Diagnostic Model.

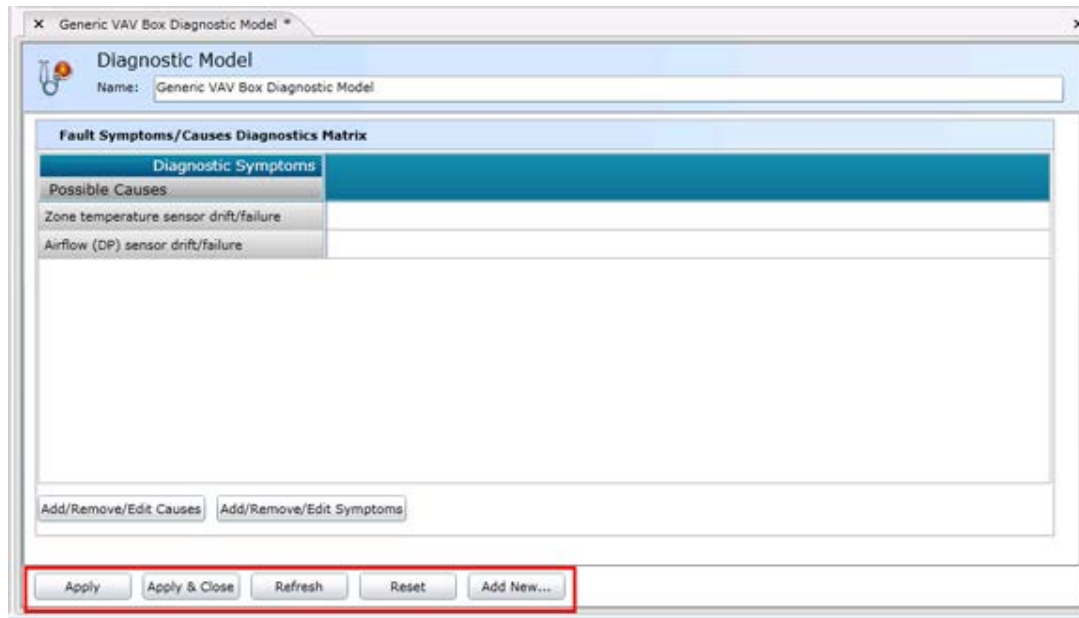


Figure 2.28 - Highlighted Possible Actions Following Fault Symptoms/Causes Diagnostic Model Settings

2.5.2. Add a Symptom

What is a Symptom?

A symptom, in the case of FDDWorX, is any state or condition related to specific equipment that the user/manager would consider cause for concern or "alarm". The symptoms to be added to the Fault Symptoms/Causes Diagnostics Matrix will, of course, vary by connected equipment. For instance, using our example of a VAV Box (a Variable Air Volume unit or zone-level flow control in a heating, ventilating, and/or air-conditioning [HVAC] system), there could multiple symptoms that could cause specific alarms, including (but not limited to) high airflow, high discharge temperature, high zone temperature, low airflow, low discharge temperature, low zone temperature, and/or unstable airflow.

To Add Symptoms

1. To add symptoms to the Fault Symptoms/Causes Diagnostics Matrix, click on the "**Add/Remove/Edit Symptoms**" button at the bottom left of the window, highlighted in the following figure. [Note: If you are not able to see these buttons, use the vertical scrollbar at the far right of the Workbench-SL window. If you still cannot see the buttons, maximize the window as much as possible, then use the scrollbar.]

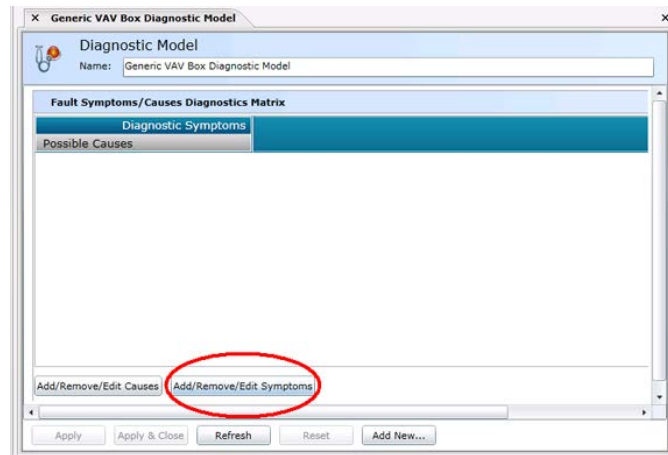


Figure 2.29 - Adding Symptoms to the Fault Symptoms/Causes Diagnostic Model

2. The following "Add, Remove or Edit Symptoms" window will appear. Click on the  icon or on the words "Click here to add new item".

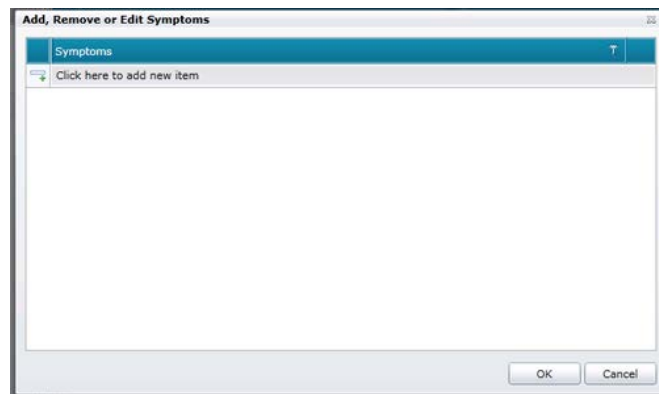


Figure 2.30 - Adding a New Symptom

You will then be able to name the Symptom, as shown below. In our example, we used a VAV Box' possible symptom of "High zone temperature alarm".

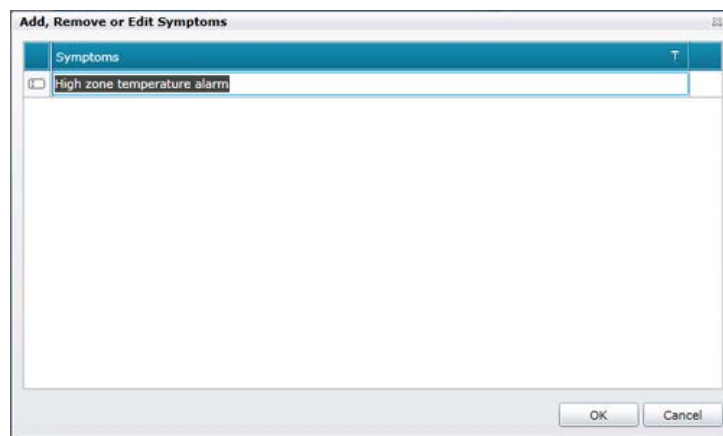


Figure 2.31 - Name the Symptom

3. Should you wish to enter additional symptoms at this time, press the Enter key and repeat the procedure from Step 2 above. To return to the Fault Symptoms/Causes Diagnostic Matrix, click on the "OK" button. You'll see your newly added Symptom(s) in the top row of the Matrix, as shown below.

Fault Symptoms/Causes Diagnostics Matrix		
Diagnostic Symptoms	High zone temperature alarm	
Possible Causes		

Figure 2.32 - A Newly Added Symptom to the Fault Symptoms/Causes Diagnostics Matrix

4. When you have added all symptoms, you can enter numbered instances/percentages for each symptom.
5. In order to save your newly added symptom(s), you must then either click on the "**Apply**" button at the bottom of the Diagnostic Model panel within the Project Explorer, as shown in the following figure (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on "**Apply & Close**" to save your settings and return to the main Project Explorer **OR** click on "**Refresh**" to update the Matrix itself **OR** click on "**Reset**" to return the state of the Matrix to the last saved settings **OR** click on "**Add New...**" to change the settings for an additional new Diagnostic Model.

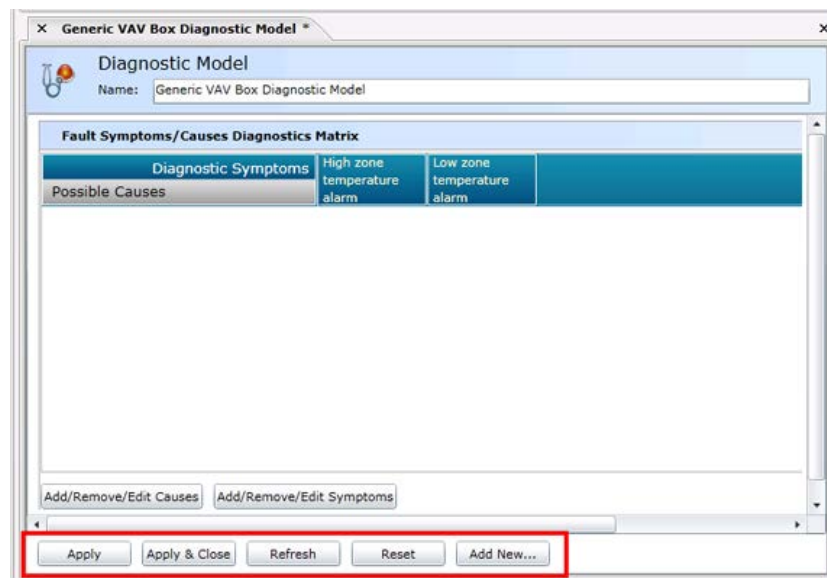


Figure 2.33 - Highlighted Possible Actions Following Fault Symptoms/Causes Diagnostic Model Settings

2.5.3. Entering Number of Instances/Percentages

After you have completed entering Symptoms and Causes into the Fault Symptoms/Causes Diagnostics Matrix, you can then enter the number of instances into each cell (corresponding between a selected symptom and a selected cause).

The numbers that users can enter here can come from multiple sources. Some may wish to use listed probabilities from equipment manufacturers' users manuals or specifications. Some may wish to use historical numbers recorded since equipment installation. Some may wish to use probabilities taken from maintenance employees with multiple years' experience working with specific equipment. Ultimately, the source of, and the responsibility for the maintenance and updating of, these numbers lies with the users themselves.

Generic VAV Box Diagnostic Model

Diagnostic Model
Name: Generic VAV Box Diagnostic Model

Fault Symptoms/Causes Diagnostics Matrix

Diagnostic Symptoms	High airflow alarm	High discharge temperature alarm	High zone temperature alarm	Low airflow alarm	Low discharge temperature alarm	Low zone temperature alarm
Possible Causes						
Zone temperature sensor drift/failure	0 (0%)	0 (0%)	50 (10%)	0 (0%)	0 (0%)	50 (10%)
Airflow (DP) sensor drift/failure	33 (10%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)
Discharge temperature sensor drift/failure	0 (0%)	50 (50%)	0 (0%)	0 (0%)	50 (50%)	0 (0%)
Damper stuck or failed	34 (21%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)
Damper actuator stuck or failed	34 (21%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)
Reheat coil valve stuck or failed	0 (0%)	25 (25%)	25 (5%)	0 (0%)	25 (25%)	25 (5%)
Reheat coil valve actuator stuck or failed	0 (0%)	25 (25%)	25 (5%)	0 (0%)	25 (25%)	25 (5%)
AHU supply air too warm	0 (0%)	0 (0%)	100 (21%)	0 (0%)	0 (0%)	0 (0%)
AHU supply air too cool	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	100 (21%)

Add/Remove/Edit Causes Add/Remove/Edit Symptoms

Apply Apply & Close Refresh Reset Add New...

Figure 2.34 - Entering Numbers in the Fault Symptoms/Causes Diagnostics Matrix

As you continue to enter numbers into the cells beneath Symptom columns, you'll notice how FDDWorX automatically calculates the percentage that the Cause (in that row) is the most likely reason for the "fault" or Symptom (in that column). In the above and below example, entering "33" into the cell corresponding between the Symptom of "High airflow alarm" and the Cause of "Airflow (DP) sensor drift/failure" results in the calculation of 20% probability (of the selected Cause being the reason for the selected Symptom).

Fault Symptoms/Causes Diagnostics Matrix						
Diagnostic Symptoms	High airflow alarm	High discharge temperature alarm	High zone temperature alarm	Low airflow alarm	Low discharge temperature alarm	Low zone temperature alarm
Possible Causes						
Zone temperature sensor drift/failure	0 (0%)	0 (0%)	50 (10%)	0 (0%)	0 (0%)	50 (10%)
Airflow (DP) sensor drift/failure	33 (20%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)

Figure 2.35 - Percentage Calculation of Causes of Symptoms

Once you have completed entering numbers in the matrix, you can sort individual columns by percentage by clicking on the column header itself (highest to lowest [with the red arrow facing down ▼] or lowest to highest [with the red arrow facing up ▲]) OR click again to return to the previously unsorted column).

X Generic VAV Box Diagnostic Model X						
Diagnostic Model						
Name: Generic VAV Box Diagnostic Model						
Fault Symptoms/Causes Diagnostics Matrix						
Diagnostic Symptoms	High airflow alarm	High discharge temperature alarm	High zone temperature alarm	Low airflow alarm	Low discharge temperature alarm	Low zone temperature alarm
Possible Causes						
Damper stuck or failed	34 (21%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)
Damper actuator stuck or failed	34 (21%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)
Airflow (DP) sensor drift/failure	33 (20%)	0 (0%)	0 (0%)	33 (10%)	0 (0%)	0 (0%)
Scheduling conflict with AHU	20 (12%)	0 (0%)	20 (4%)	20 (6%)	0 (0%)	20 (4%)
Tuning problem with airflow feedback control loop	20 (12%)	0 (0%)	20 (4%)	20 (6%)	0 (0%)	20 (4%)
Sequencing logic error	20 (12%)	0 (0%)	20 (4%)	20 (6%)	0 (0%)	20 (4%)
Zone temperature sensor drift/failure	0 (0%)	0 (0%)	50 (10%)	0 (0%)	0 (0%)	50 (10%)
Discharge temperature sensor drift/failure	0 (0%)	50 (50%)	0 (0%)	0 (0%)	50 (50%)	0 (0%)
Reheat coil valve stuck or failed	0 (0%)	25 (25%)	25 (5%)	0 (0%)	25 (25%)	25 (5%)
Add/Remove/Edit Causes Add/Remove/Edit Symptoms						
Apply Apply & Close Refresh Reset Add New...						

Figure 2.36 - Symptom Column Sorted by Highest to Lowest Probability of Causes

In order to save the changed status of the Fault Symptoms/Causes Diagnostics Matrix (with the newly entered numbered instances and calculated percentages), you must then either click on the **"Apply"** button at the bottom of the Diagnostic Model panel within the Project Explorer (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on **"Apply & Close"** to save your settings and return to the main Project Explorer **OR** click on **"Refresh"** to update the Matrix itself **OR** click on **"Reset"** to return the state of the Matrix to the last saved settings **OR** click on **"Add New..."** to change the settings for an additional new Diagnostic Model.

2.5.4. Remove a Cause

To Remove Causes

1. To remove causes from the Fault Symptoms/Causes Diagnostics Matrix, click on the **"Add/Remove/Edit Causes"** button at the bottom left of the window, highlighted in the image below. [Note: If you are not able to see these buttons, use the vertical scrollbar at the far right of the Workbench-SL window. If you still cannot see the buttons, maximize the window as much as possible, then use the scrollbar.]

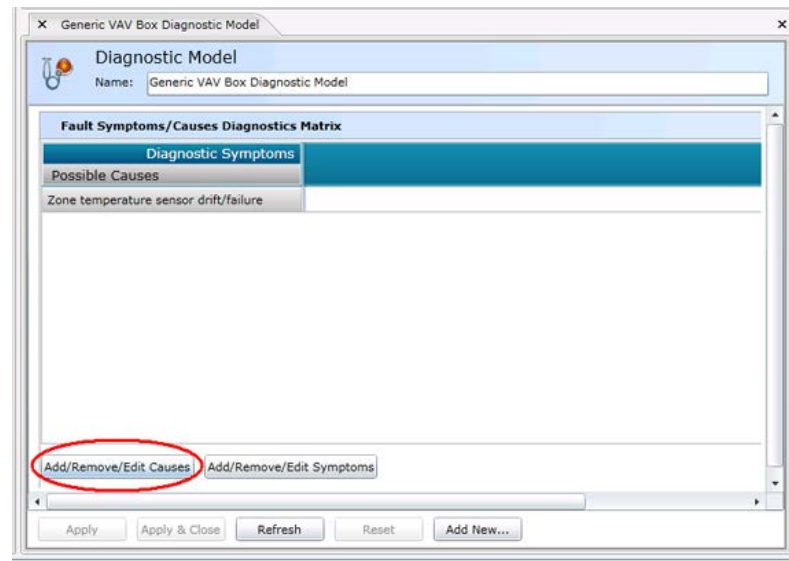


Figure 2.37 - Removing Causes from the Fault Symptoms/Causes Diagnostic Model

2. The "Add, Remove or Edit Causes" window, shown in the following figure, will appear. Your existing cause(s) will appear under the "Click here to add new item" selection at the top of the screen.

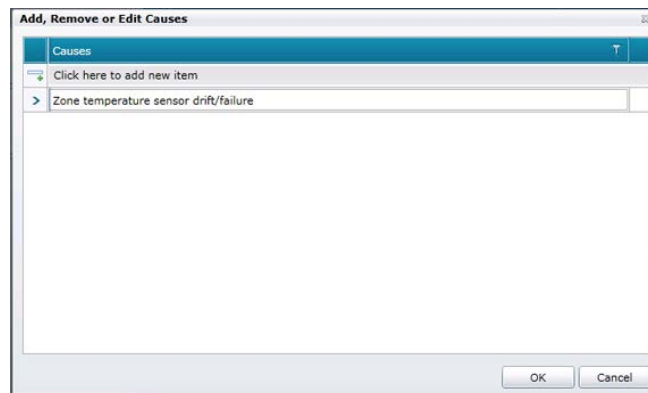


Figure 2.38 - Removing a Cause

3. In order to remove a cause, you must first select it, as shown below, then press the Delete key. **NOTE:** There is a difference in selecting a cause for deletion (where the character in the box to the left of the cause name is the ">" symbol) and selecting for renaming (where the character to the left of the cause name is the "i" symbol). Be sure that you have selected the entire cause (the entire row of cells) for deletion rather than just deleting the cause name. You'll be able to tell by whether the row of cells remains after clicking on the "Delete" key or not.

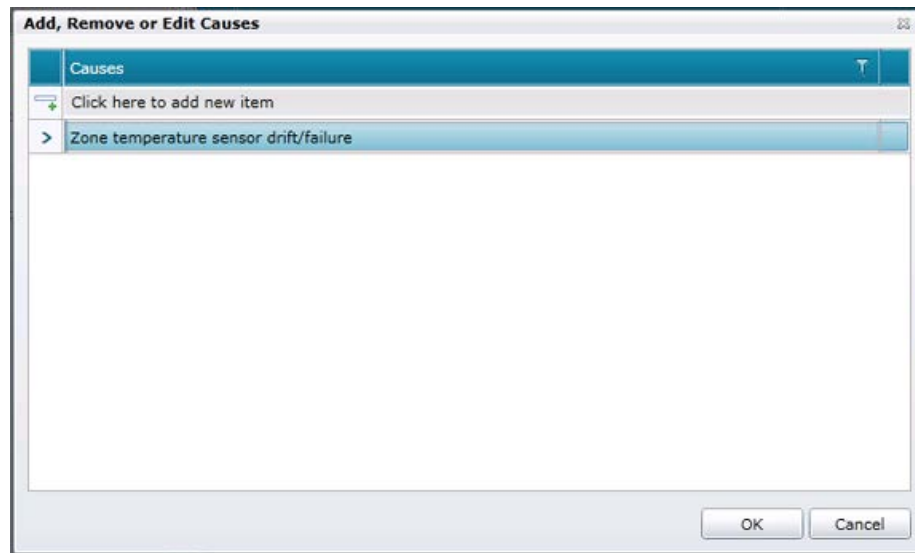


Figure 2.39 - Highlighting a Cause Prior to Deletion

4. Once you have completed the deletion of the selected cause(s), click "OK" to proceed. You will return to the Fault Symptoms/Causes Diagnostics Matrix. You'll see that your selected Cause(s) has/have been removed from the left column of the Matrix.
5. In order to save the changed status of the Fault Symptoms/Causes Diagnostics Matrix (with the newly removed cause[s]), you must then either click on the "Apply" button at the bottom of the Diagnostic Model panel within the Project Explorer, as shown in the following figure (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on "Apply & Close" to save your settings and return to the main Project Explorer **OR** click on "Refresh" to update the Matrix itself **OR** click on "Reset" to return the state of the Matrix to the last saved settings **OR** click on "Add New..." to change the settings for an additional new Diagnostic Model.

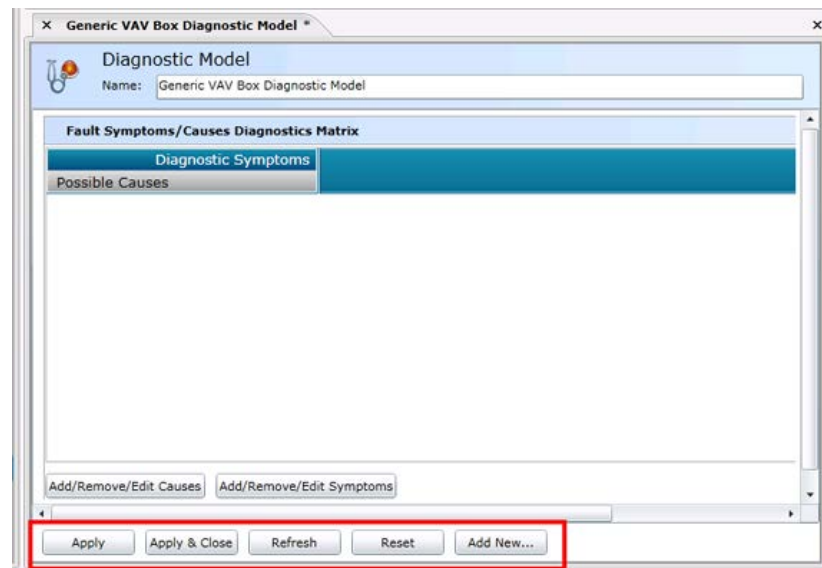


Figure 2.40 - Highlighted Possible Actions Following Fault Symptoms/Causes Diagnostic Model Settings

2.5.5. Edit a Cause

To Remove Symptoms

1. To edit causes from the Fault Symptoms/Causes Diagnostics Matrix, click on the "Add/Remove/Edit Causes" button at the bottom left of the window, highlighted in the image below. [Note: If you are not able to see these buttons, use the vertical scrollbar at the far right of the Workbench-SL window. If you still cannot see the buttons, maximize the window as much as possible, then use the scrollbar.]

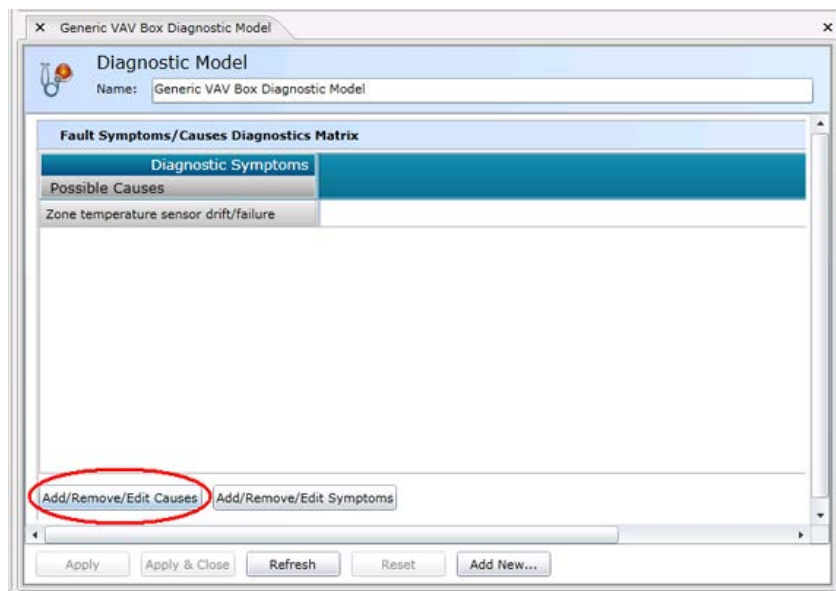


Figure 2.41 - Editing Causes from the Fault Symptoms/Causes Diagnostic Model

- The following "Add, Remove or Edit Causes" window will appear. Your existing cause(s) will appear under the "Click here to add new item" selection at the top of the screen.

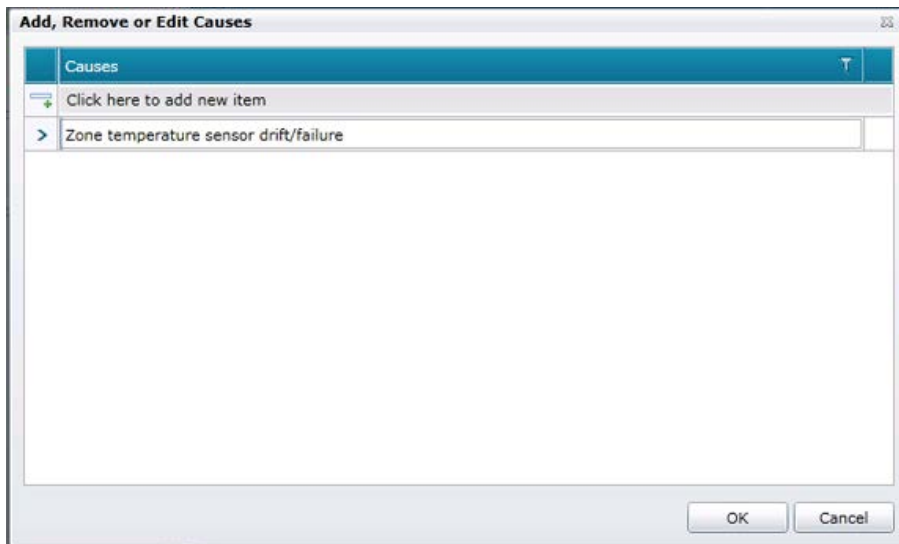


Figure 2.42 - Editing a Cause

- In order to edit a cause, click on the Cause name (text) inside the row's cell, as shown below.

NOTE: There is a difference in selecting a cause for editing (where the character to the left of the symptom name is the " " symbol) and selecting a cause for deletion (where the character in the box to the left of the cause name is the ">" symbol). For instructions on deleting a cause, view Remove a Cause.

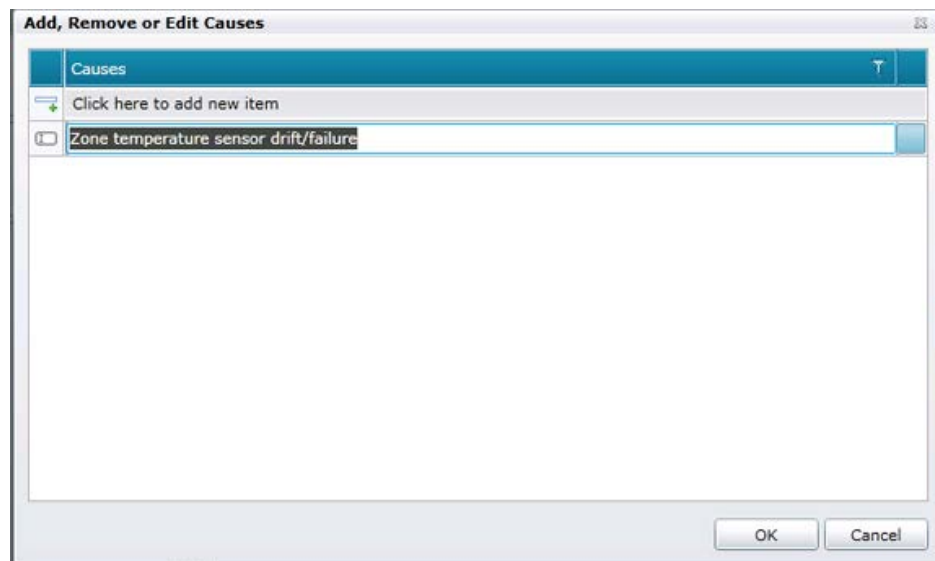


Figure 2.43 - Highlighting a Cause Prior to Editing

Once you have finished editing your selected cause(s), as shown below, click "OK" to proceed. You will return to the Fault Symptoms/Causes Diagnostics Matrix. You'll see the edits you have made to your selected Cause(s) in the left column of the Matrix.

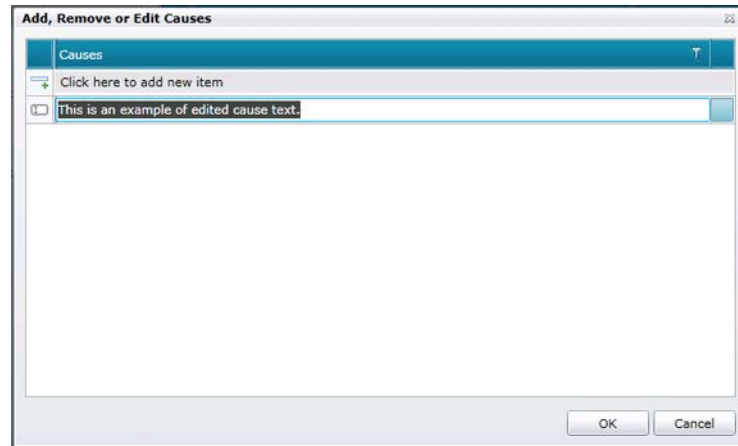


Figure 2.44 - An Example of Edited Cause Text

4. In order to save the changed status of the Fault Symptoms/Causes Diagnostics Matrix (with the newly edited cause[s]), you must then either click on the **"Apply"** button at the bottom of the Diagnostic Model panel within the Project Explorer, as shown below (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on **"Apply & Close"** to save your settings and return to the main Project Explorer **OR** click on **"Refresh"** to update the Matrix itself **OR** click on **"Reset"** to return the state of the Matrix to the last saved settings **OR** click on **"Add New..."** to change the settings for an additional new Diagnostic Model.

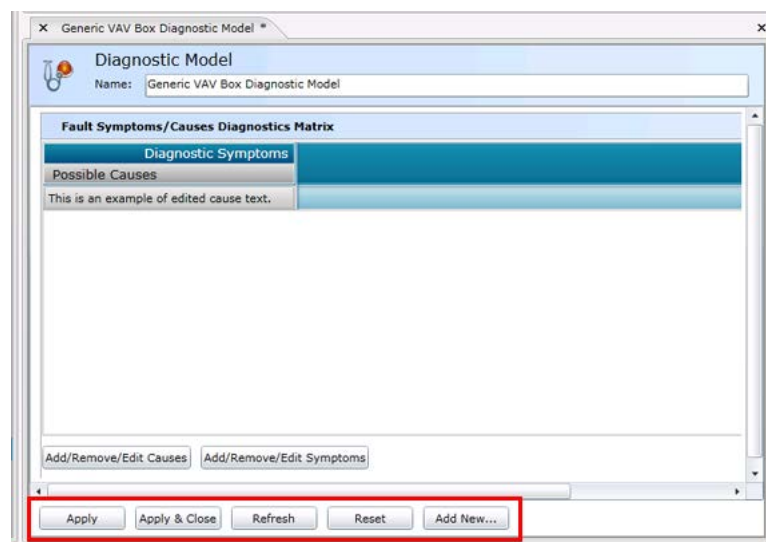


Figure 2.45 - Highlighted Possible Actions Following Fault Symptoms/Causes Diagnostic Model Settings

2.5.6. Remove a Symptom

To Remove Symptoms

1. To remove symptoms from the Fault Symptoms/Causes Diagnostics Matrix, click on the **"Add/Remove/Edit Symptoms"** button at the bottom left of the window, highlighted in the image below. [Note: If you are not able to see these buttons, use the vertical scrollbar at the far right of the Workbench-SL window. If you still cannot see the buttons, maximize the window as much as possible, then use the scrollbar.]

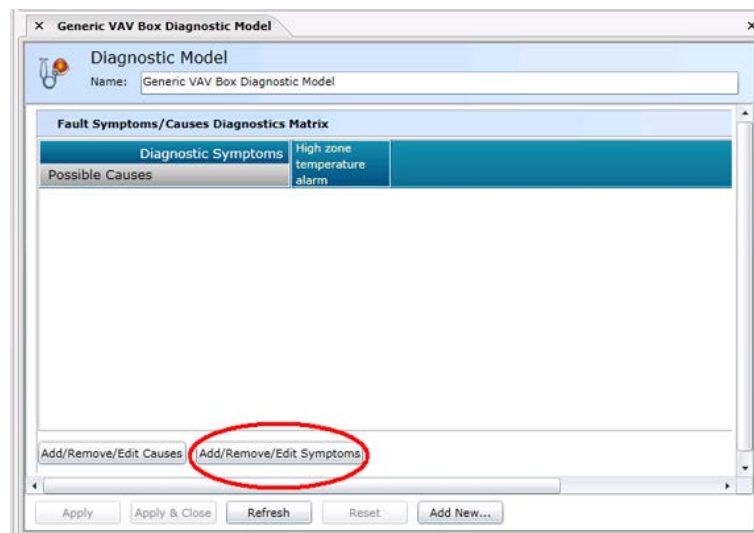


Figure 2.46 - Removing Symptoms from the Fault Symptoms/Causes Diagnostic Model

2. The following "Add, Remove or Edit Symptoms" window will appear. Your existing symptom(s) will appear under the "Click here to add new item" selection at the top of the screen.

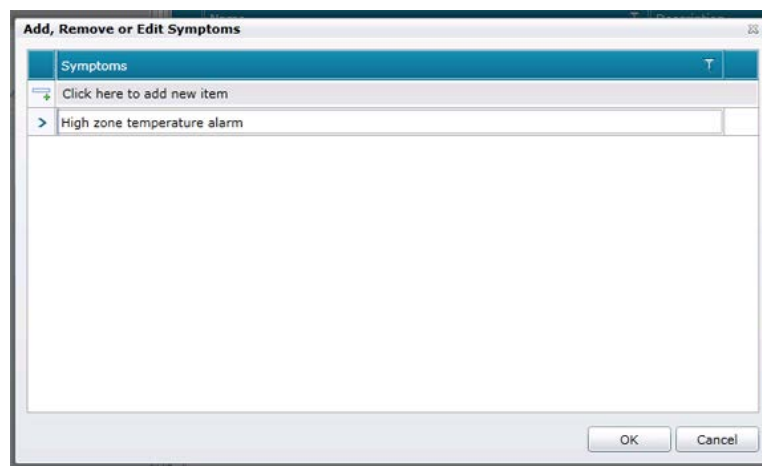


Figure 2.47 - Removing a Symptom

3. In order to remove a symptom, you must first select it, as shown below, then press the Delete key. **NOTE:** There is a difference in selecting a symptom for deletion (where the character in the box to the left of the symptom name is the ">" symbol) and selecting for renaming (where the character to the left of the symptom name is the " " symbol). For instructions on renaming a symptom, view Edit a Symptom. Be sure that you have selected the entire symptom (the entire row of cells) for deletion rather than just deleting the symptom name. You'll be able to tell by whether the row of cells remains after clicking on the "Delete" key or not.

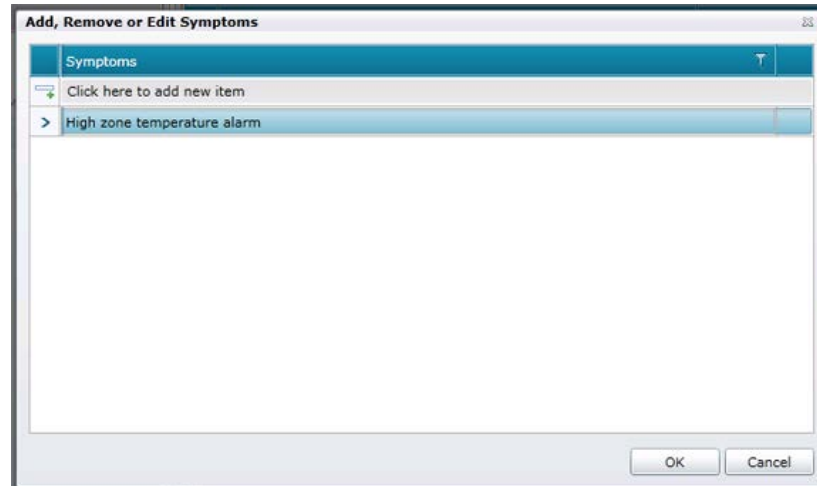


Figure 2.48 - Highlighting a Symptom Prior to Deletion

4. Once you have completed the deletion of the selected symptom(s), click "OK" to proceed. You will return to the Fault Symptoms/Causes Diagnostics Matrix. You'll see that your selected Symptom(s) has/have been removed from the top row of the Matrix.
5. In order to save the changed status of the Fault Symptoms/Causes Diagnostics Matrix (with the newly removed symptom[s]), you must then either click on the "Apply" button at the bottom of the Diagnostic Model panel within the Project Explorer, as shown in the following figure (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on "Apply & Close" to save your settings and return to the main Project Explorer **OR** click on "Refresh" to update the Matrix itself **OR** click on "Reset" to return the state of the Matrix to the last saved settings **OR** click on "Add New..." to change the settings for an additional new Diagnostic Model.

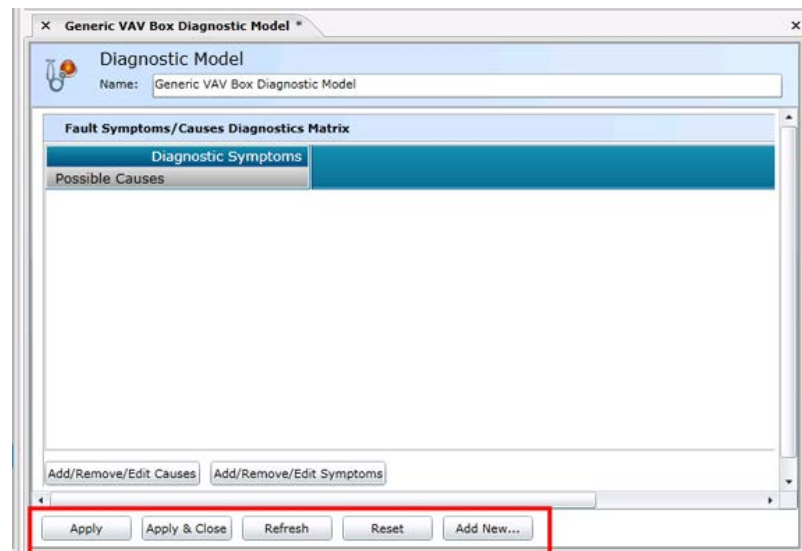


Figure 2.49 - Highlighted Possible Actions Following Fault Symptoms/Causes Diagnostic Model Settings

2.5.7. Edit a Symptom

To Edit Symptoms:

1. To edit symptoms from the Fault Symptoms/Causes Diagnostics Matrix, click on the "Add/Remove/Edit Symptoms" button at the bottom left of the window, highlighted in the image below. [Note: If you are not able to see these buttons, use the vertical scrollbar at the far right of the Workbench-SL window. If you still cannot see the buttons, maximize the window as much as possible, then use the scrollbar.]

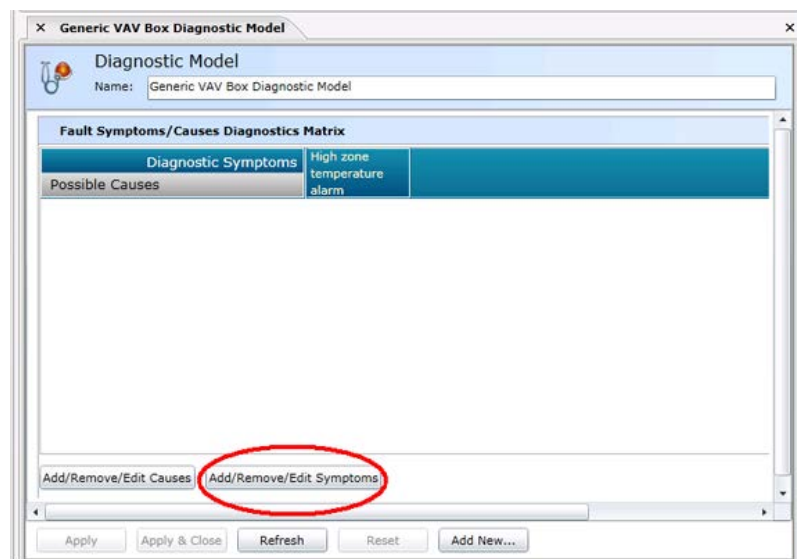


Figure 2.50 - Editing Symptoms from the Fault Symptoms/Causes Diagnostic Model

- The following "Add, Remove or Edit Symptoms" window will appear. Your existing symptom(s) will appear under the "Click here to add new item" selection at the top of the screen.

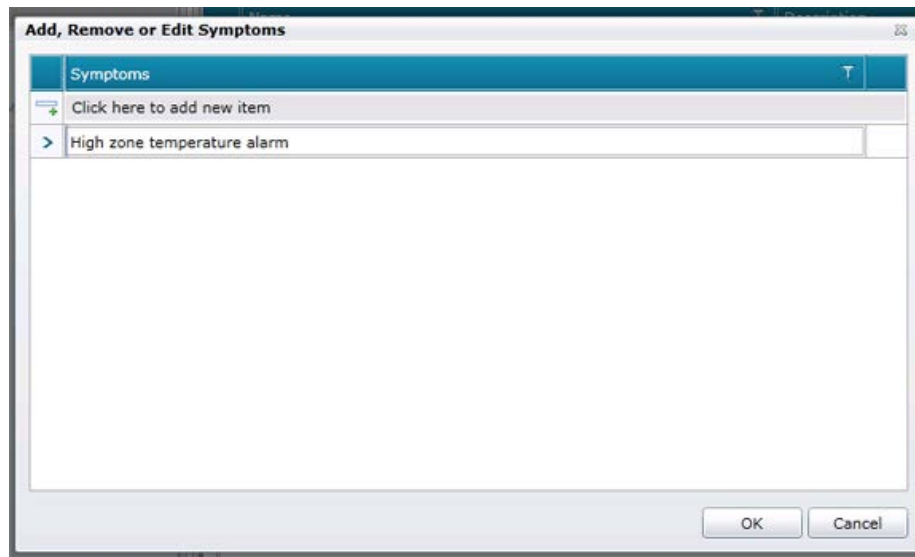


Figure 2.51 - Editing a Symptom

- In order to edit a symptom, click on the Symptom name (text) inside the row's cell, as shown below. **NOTE:** There is a difference in selecting a symptom for editing (where the character to the left of the symptom name is the "i" symbol) and selecting a symptom for deletion (where the character in the box to the left of the symptom name is the ">" symbol). For instructions on deleting a symptom, view Remove a Symptom.

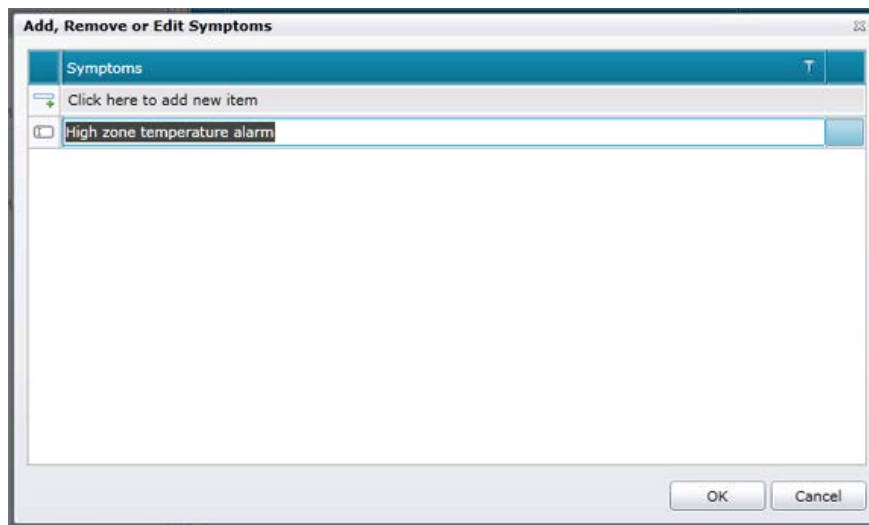


Figure 2.52 - Highlighting a Symptom Prior to Editing

Once you have finished editing your selected symptom(s), as shown below, click "OK" to proceed. You will return to the Fault Symptoms/Causes Diagnostics Matrix. You'll see the edits you have made to your selected Symptom(s) in the top row of the Matrix.

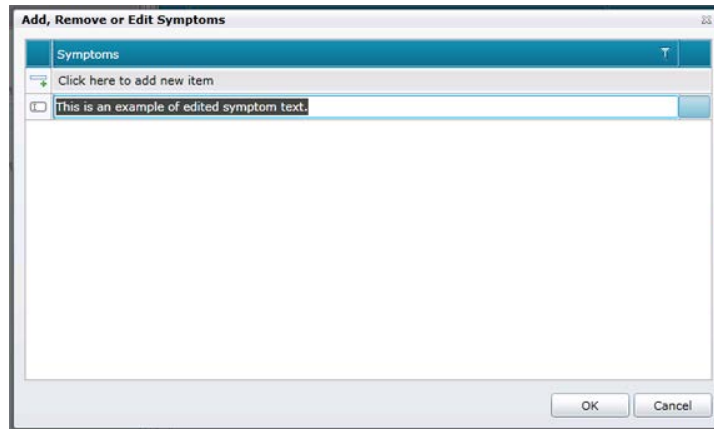


Figure 2.53 - An Example of Edited Symptom Text

4. In order to save the changed status of the Fault Symptoms/Causes Diagnostics Matrix (with the newly edited symptom[s]), you must then either click on the "Apply" button at the bottom of the Diagnostic Model panel within the Project Explorer, as shown below (and can then proceed to make additional changes to the same Diagnostic Model) **OR** click on "Apply & Close" to save your settings and return to the main Project Explorer **OR** click on "Refresh" to update the Matrix itself **OR** click on "Reset" to return the state of the Matrix to the last saved settings **OR** click on "Add New..." to change the settings for an additional new Diagnostic Model.

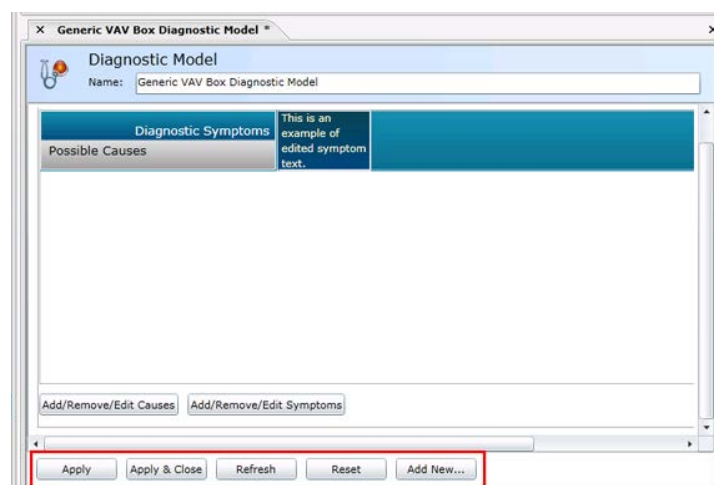


Figure 2.54 - Highlighted Possible Actions Following Fault Symptoms/Causes Diagnostic Model Settings

2.6. Using Diagnostic Matrices in the AssetWorX Provider

Once you have created a Diagnostic Model, complete with a Fault Symptoms/Causes Diagnostic Matrix, within the FDDWorX provider in ICONICS' Workbench-SL online configuration tool, you can link it to an Asset within the AssetWorX provider.



Note: For more information about the AssetWorX provider, look for the related topic(s) in the Help Documentation for GENESIS64 V10.6 Workbench-SL.

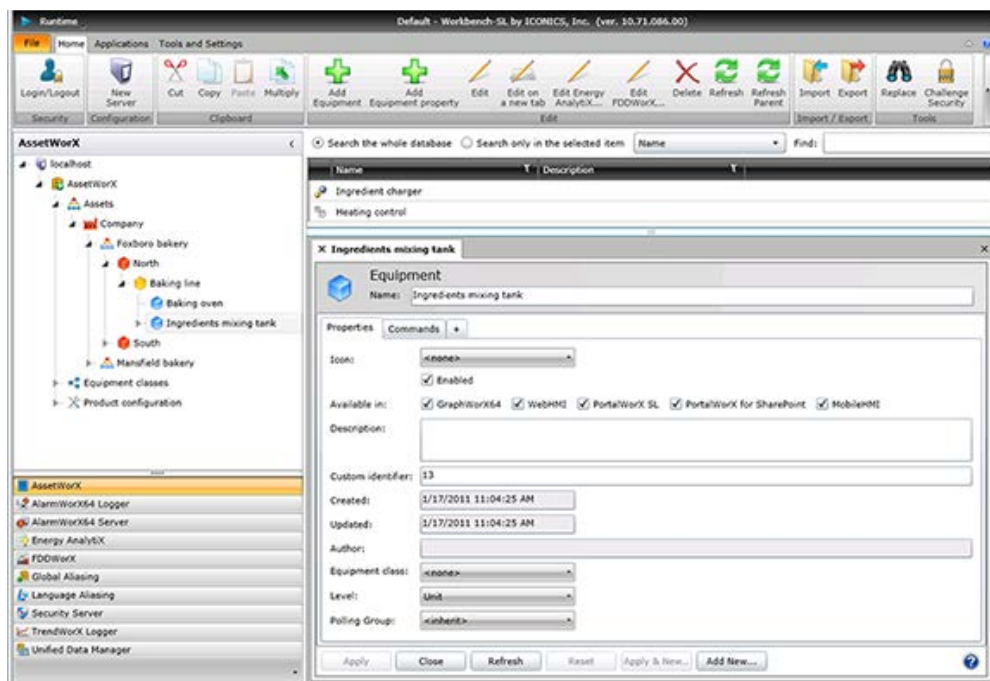


Figure 2.55 - A Selected Asset in the AssetWorX Provider in Workbench-SL

The **Assets** branch of the AssetWorX's Project Explorer is where users can configure equipment (also called "assets") and house a hierarchical asset tree. Users could enter many assets, such as for a large enterprise-sized corporation or a few, for a smaller single-site company. Universities and colleges could benefit from listing numerous assets spread over one or more campuses. The AssetWorX was designed to handle the wide possibilities of the size of users' asset collections.

In the example above, the Assets branch has been expanded to reveal "Company", which contains "Foxboro bakery", which contains a "North" location, which contains "Baking line" which contains an "Ingredients Mixing Tank".

You might use "Ingredients Mixing Tank" as an Asset to which you connect a Diagnostic Model that was created in the FDDWorX provider.

There are multiple ways to add a FDDWorX Diagnostic Model to a selected asset in AssetWorX.

To Add a FDDWorX Diagnostic Model to a Selected Asset

1. Right-click on your selected Asset in the AssetWorX Project Explorer, then click on **"Edit FDDWorX..."** as shown in the image below.

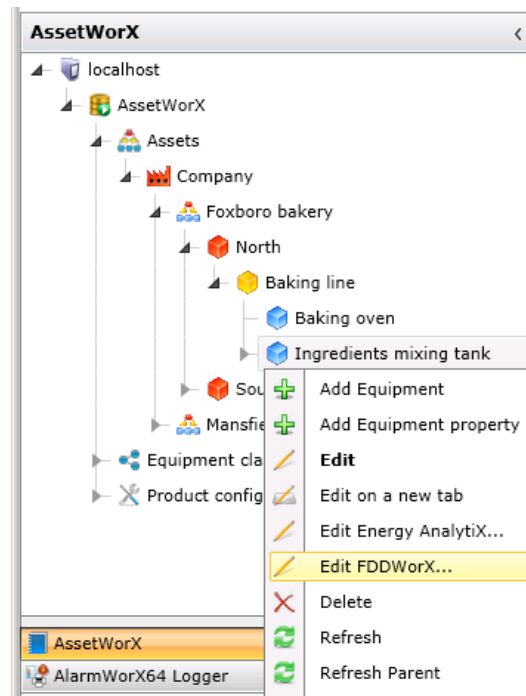


Figure 2.56 - Edit FDDWorX... from Project Explorer

OR, you can select the Asset in the Project Explorer, then click on **"Edit FDDWorX..."** button in the Workbench Ribbon, as shown below.

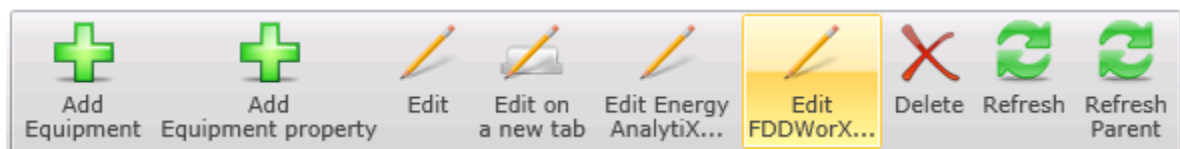


Figure 2.57 - Edit FDDWorX... from the Ribbon

OR, you can right-click on the Asset in the Project Explorer, then click on "Edit..." (or double-click on the Asset) to bring up its properties in the right pane of the Project Explorer, as shown below.

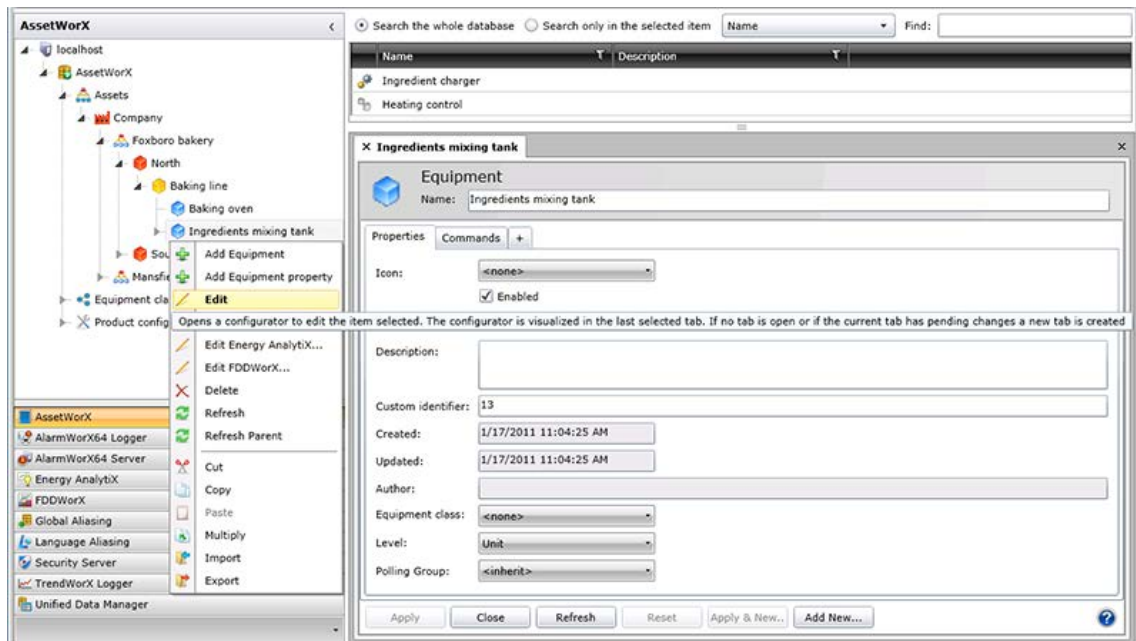


Figure 2.58 - Asset Properties Window in Right Pane of AssetWorX Project Explorer

Click on the [+] tab and then select "FDDWorX" from the pulldown menu, as shown below.

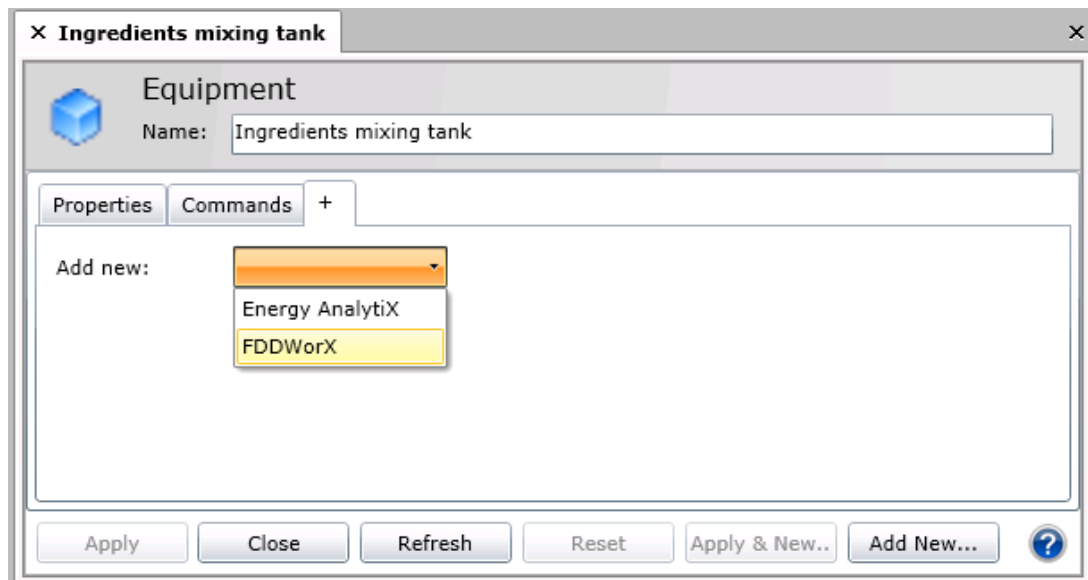


Figure 2.59 - [+] Tab in Asset Properties in AssetWorX

- The FDDWorX tab will then appear within the asset properties window in the Project Explorer, as shown below.

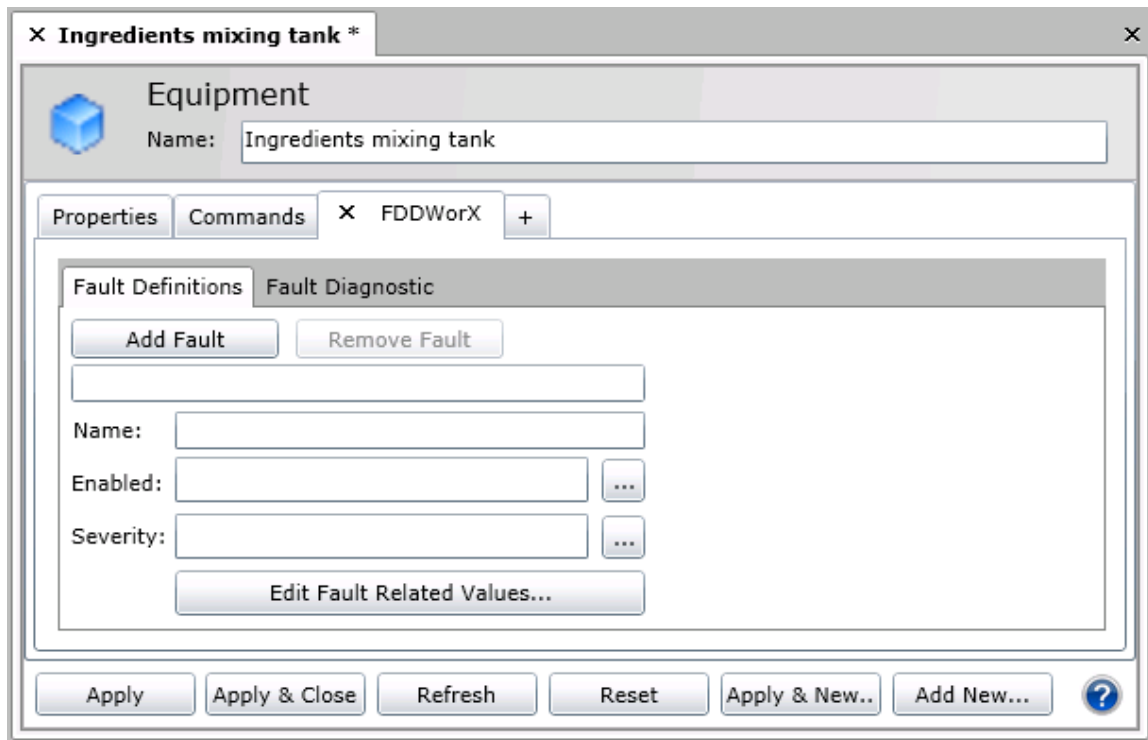


Figure 2.60 - Newly Added FDDWorX Tab in the Asset Properties Window

- Continue to make your edits.

2.7. Add a FDDWorX Diagnostic Model to a Selected Asset

2.7.1. Define a Fault

In FDDWorX, a fault is a rule or expression that is based on time, a change of state, and a combination of any parameters related to a particular piece of equipment, that defines the circumstances under which the equipment is not operating to specification. For example, if a chiller is supposed to be able to cool a room by 1 degree every 5 minutes, it could be considered in a “faulted” state if after 30 minutes it has cooled the room by only 2 degrees. The chiller in this case is not necessarily broken, but something preventing it from operating at ideal efficiency. This can be quantified as a “fault”, and users can be notified when such conditions occur. You to add your own equipment faults and diagnostic models as they relate to your particular industry or application.

Faults are defined in the Workbench-SL using the Rules Editor, which integrates with the Expression Editor to offer a variety of functions in different categories including arithmetic, relational, logical, bitwise, string and date/time.

When you define a fault for use with FDDWorX:

- Each fault is associated to a rule that drives/triggers this fault.
- If each rule is associated to an output register, the configurator needs to either be able to get that output register from the rules engine when selecting it, or be able to derive the output register address from the rule name.

To define a fault, follow these steps:

1. In the Workbench-SL, open **AssetWorX** by clicking its Project Explorer provider button.
2. Expand **localhost > AnalytiX > Assets** to show the asset tree.
3. Expand the asset tree until you reach the equipment to which you want to add a fault.
4. Click on the tab that has the **plus sign (+)** on it. From the **Add New** drop-down list, select **FDDWorX**. This adds the FDDWorX tab, with the Fault Definitions sub-tab on top.
5. Click the **Add Fault** button to add a fault. The sub-tab looks something like the following:

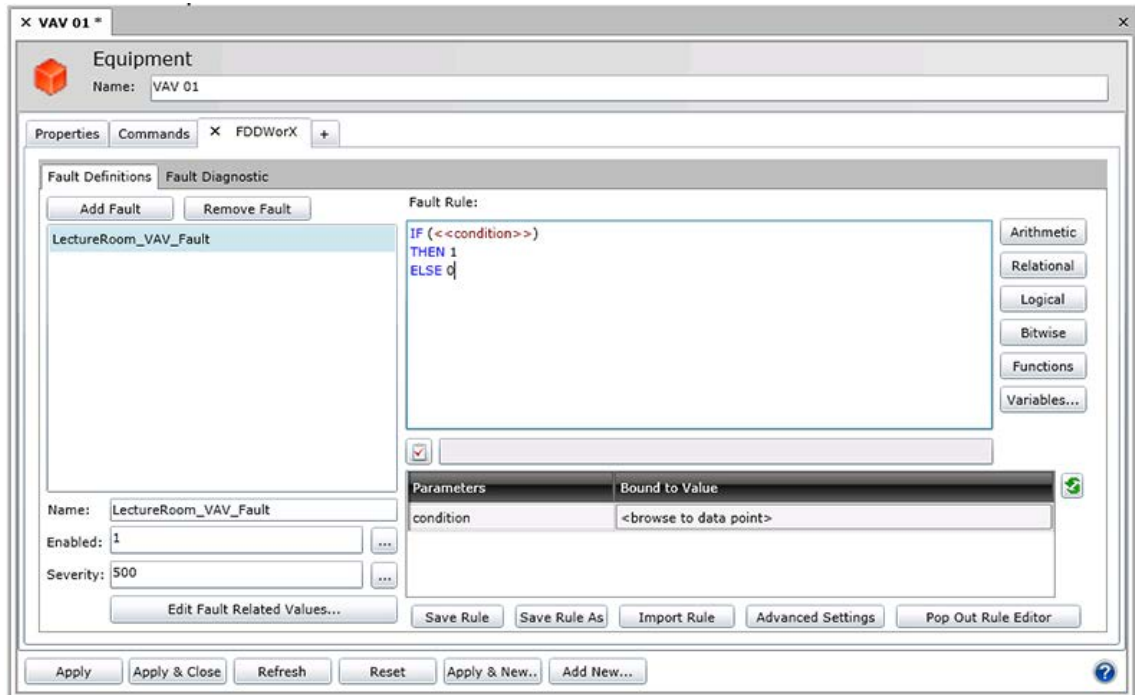


Figure 2.61 - Fault Definition Example

Define faults as described in the Fault Definitions Tab topic.

Then map the equipment faults to a diagnostic model as described in the Fault Diagnostic Tab topic. Note that your diagnostic models must be created before you can complete this step.

2.7.2. Fault Definitions Tab

Once you have added the FDDWorX tab to the asset's Equipment form in the AssetWorX provider in Workbench-SL, you'll be able to add (and then eventually select) from a list of added Faults. The image below shows the initial state of the Fault Definitions tab within the FDDWorX tab within the selected asset's properties.



Info

Note: This tab is also available for equipment classes. All equipment classes are defined in AssetWorX in the **Equipment Classes** node. In AssetWorX, you can define and use equipment classes as templates for creating nodes in the asset tree. You can also use aliases in your equipment classes; these aliases will prompt you for actual properties for equipment as you use the equipment classes to define nodes in the asset tree.

To Set a Fault

1. Click on Add Fault button. In the Name field, enter a name for the fault.

NOTE: The fault name can be any description attributed to any state of operation for the asset to which the user wishes to be alerted. It does not necessarily have to correlate to specific alarms or conditions. In our example, we have set a fault for "Machine 1 Malfunction" that does not specify any cause or symptom.

You may need to click on the fault's name again in order to further edit the fault's details in the right side of the window, as shown below.

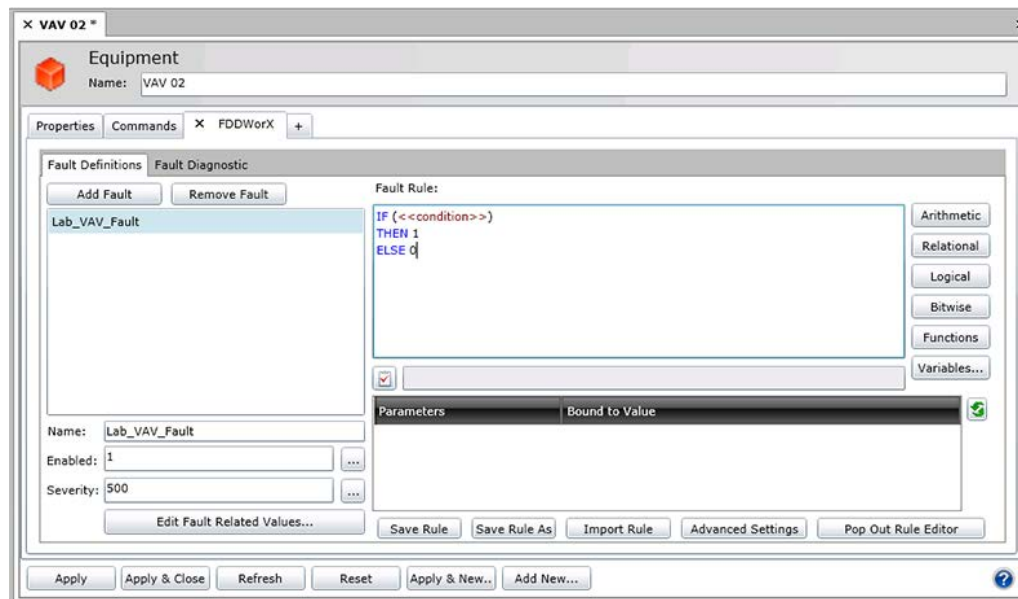


Figure 2.62 - Fault Details

2. You can now make changes to the **Enabled** and **Severity** options. Both of these entries allow you to click on the ellipsis [...] button to use the ICONICS Expression Editor (with options for Arithmetic, Relational, Logical, Bitwise, Functions or Variables in your expression).
3. Select the **Edit Fault Related Values...** to open the *Related Values Editor* dialog box. For each related value that you wish to create, either type in a static value in provided text box or click on the ellipsis [...] button to browse for an OPC tag. You can add up to 20 values that you wish to capture as part of the fault whenever the fault condition occurs. You can view these related values when you examine faults in the FDDWorX Viewer.

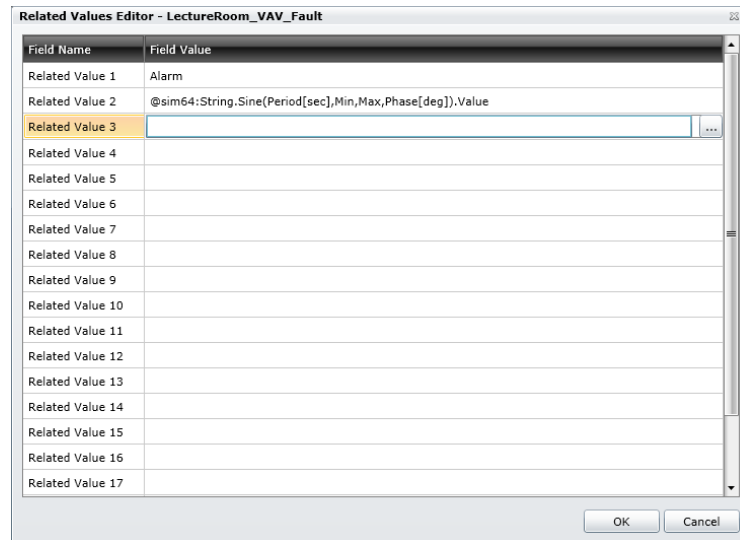


Figure 2.63 - Configuring Supplementary Fault Information with the Related Values Editor

- Next, in the **Fault Rule** area of the tab, you can enter the rule to associate with the fault. You have the option of creating a new rule, editing an existing rule, importing a rule or setting additional rule parameters. If you would like more screen space to type a complex fault rule expression, you can click the **Pop Out Rule Editor** button to open a *pop-up window* with an expanded fault rule editing area. Any changes that you make to the fault rule expression in the pop-up window are reflected in the original Fault Definitions Tab, and vice versa.



Figure 2.64 - Pop-Up Window with Expanded Fault Rules Editing Area

Similar to the Expression Editor, the Rules Editor allows you to use Arithmetic, Relational, Logical or Bitwise expressions, as well as Functions or Variables. Clicking on the **Variables** button opens the Data Browser, as shown below, allowing you to search for the data source relative to your Fault.

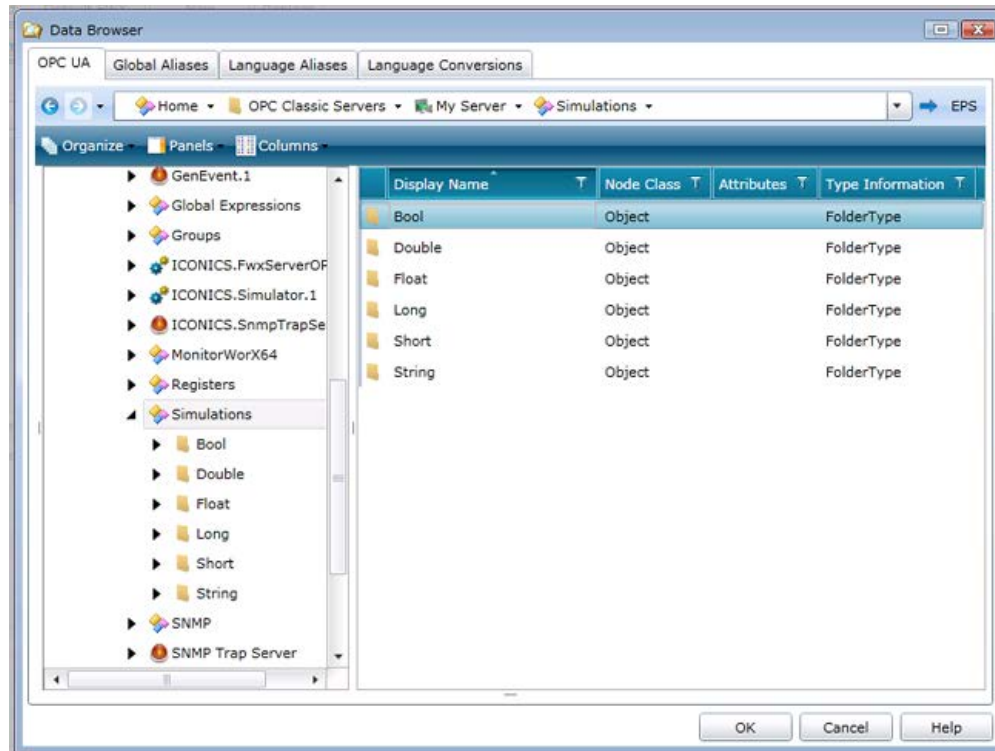


Figure 2.65 - Data Browser Launched from the Variables... Button

- Click the **Save Rule** button to save the asset's fault rule, overwriting the previous version of the fault rule for the asset. If you would like to choose a location to save the asset's new fault rule, click the **Save Rule As** button. The **Save UDM Rule** window appears, as shown in the following figure. You can select the default folder or click the **Create New Folder** button. You can also change the expression name at this time, if you prefer. Click **OK** again to save the fault rule in the selected location and return to the Fault Definitions tab.

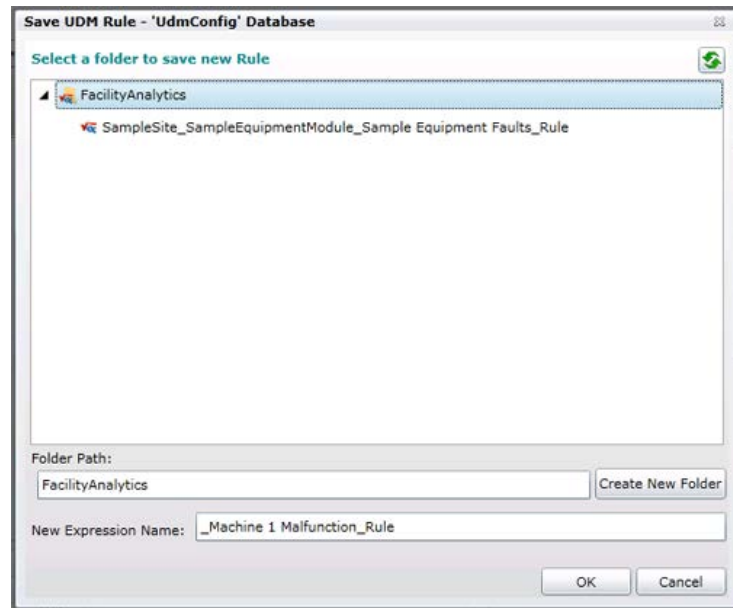


Figure 2.66 - Save UDM Rule Window



Note: The **Save UDM Rule** window opens automatically when you click the **Save Rule** button or the **Save Rule As** button to save an asset's fault rule for the first time.

- Once you return to the Fault Definitions tab, you'll notice that the Fault Rule section of the Fault Definitions tab has been updated, as highlighted below.

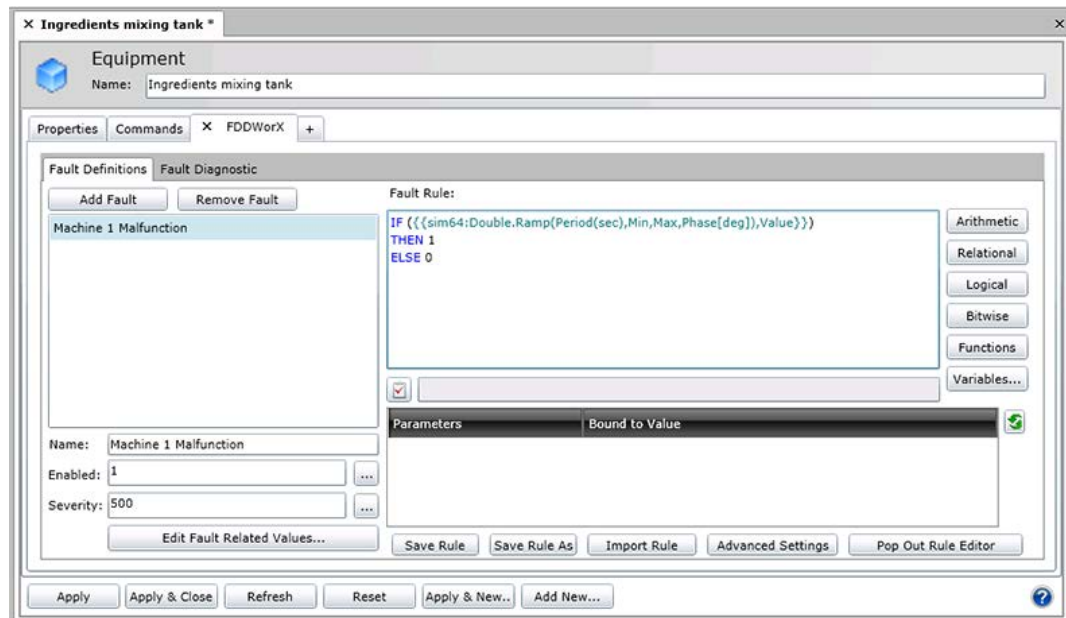


Figure 2.67 - Updated Fault Rule in the Fault Definitions Tab

7. In order to save the changed status of the Fault Definitions Tab (with the newly added Fault Rule), you must then either click on the **Apply** button at the bottom of the tab window within the Project Explorer (and can then proceed to make additional changes to the same Fault Definition) **OR** click on **Apply & Close** to save your settings and then return to the main Project Explorer by closing the tab **OR** click on **Refresh** to update the Fault Definitions tab itself **OR** click on **Reset** to return the state of the Fault Definitions tab to the last saved settings **OR** click on **Add New...** to change the settings for an additional asset.

2.7.3. Fault Diagnostic Tab

Once you have added the FDDWorX tab to the asset's Equipment form in the AssetWorX (and then added faults through the Fault Definitions tab) you can add Diagnostic Symptoms Mappings. The image below shows the initial state of the Fault Diagnostic tab within the Facility AnalytiX tab within the selected asset's properties.



Note: This tab is also available for equipment classes. All equipment classes are defined in AssetWorX in the **Equipment Classes** node. In AssetWorX, you can define and use equipment classes as templates for creating nodes in the asset tree. You can also use aliases in your equipment classes; these aliases will prompt you for actual properties for equipment as you use the equipment classes to define nodes in the asset tree.

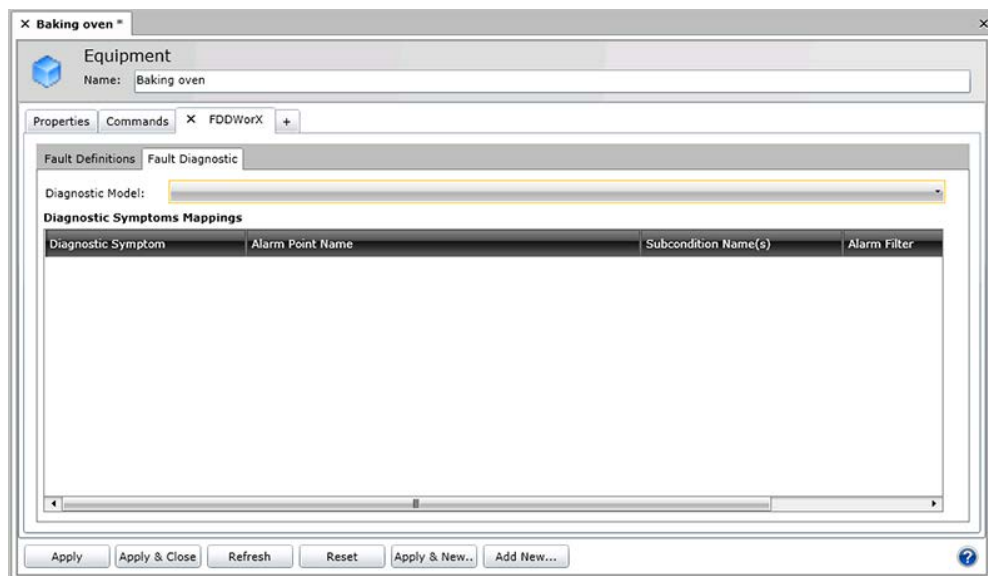


Figure 2.68 - Fault Diagnostic Tab in the FDDWorX Tab in the Equipment Form in AssetWorX

To Select a Diagnostic Model

1. You can select a Diagnostic Model by clicking on the pulldown menu at the top of the tab window, as shown below.
2. You'll notice that the Symptoms from the Diagnostic Model created in Facility AnalytiX now populate the Diagnostic Symptoms Mappings grid within the Fault Diagnostic tab, as highlighted below. You can now associate Alarm Point Names to each Diagnostic Symptom.

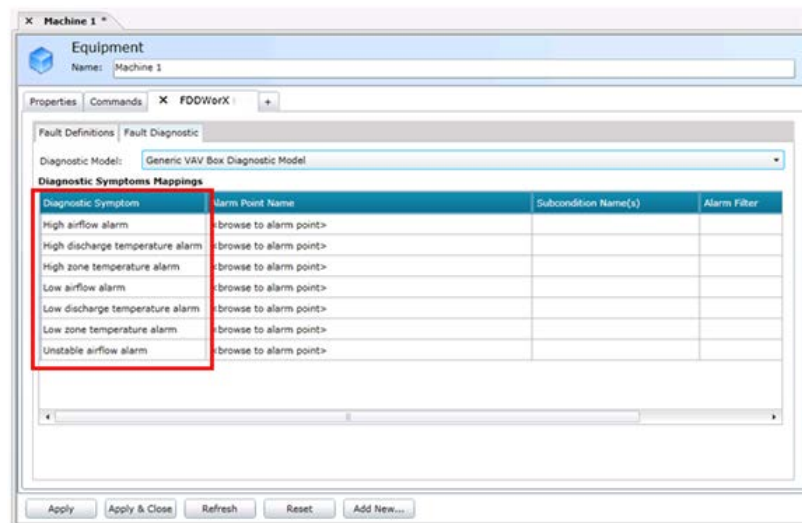


Figure 2.69 - Populated Diagnostic Symptoms in the Fault Diagnostic Tab

3. To associate Alarm Points to Diagnostic Symptoms, click on "<browse to alarm point>" to the right of your selected Diagnostic Symptom, in the **Alarm Point Name** column, as shown below. Next, click on the ellipsis button [...] to access the Data Browser and find your desired alarm point.

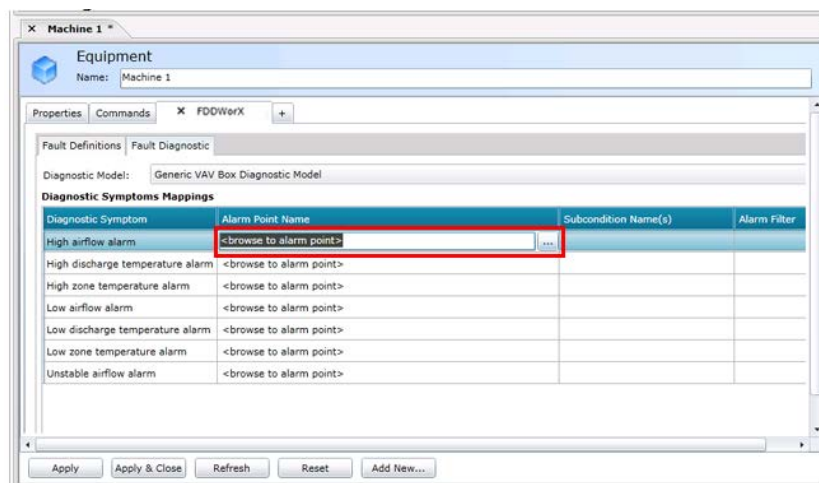


Figure 2.70 - Selecting an Alarm Point

- Clicking on the ellipsis button [...] opens the Data Browser, as shown below, which allows you to navigate to an alarm to associate with the selected Diagnostic Symptom. Once you have selected an alarm, click "OK" to proceed and return to the Fault Diagnostic Tab.

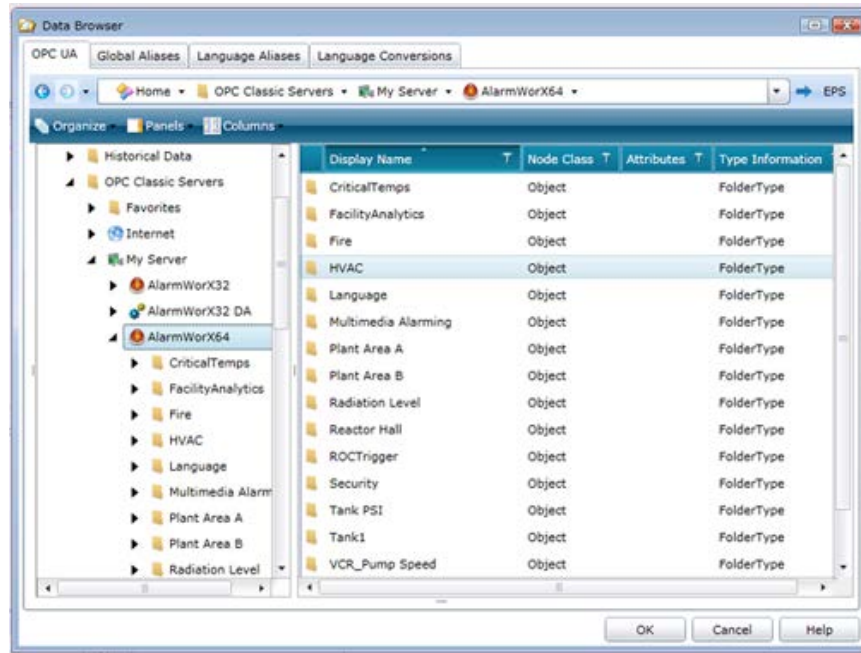


Figure 2.71 - Selecting an Alarm from the Data Browser

- Your selected Alarm Point will now appear in the Diagnostic Symptoms Mappings grid, as shown below. At this time, you can set subconditions in the **Subcondition Name(s)** column by clicking on the ellipsis [...] button.

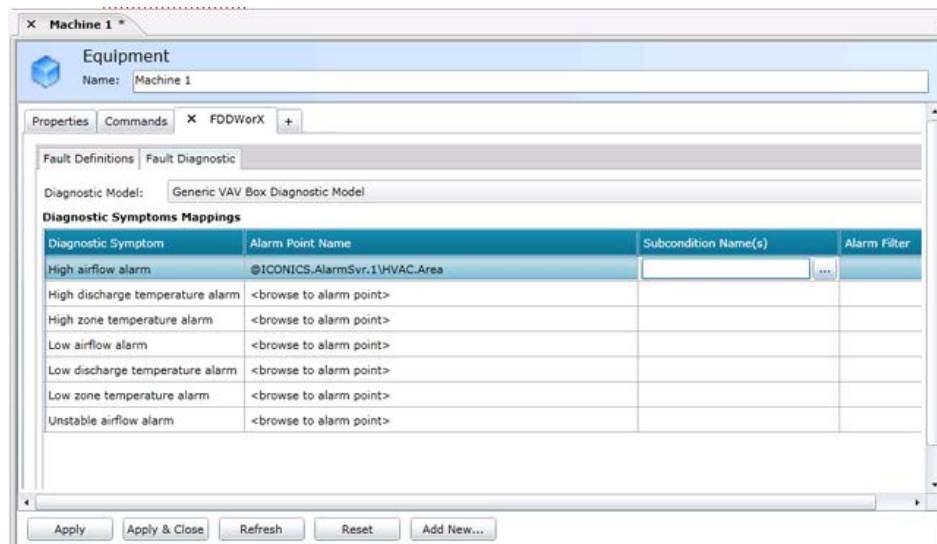


Figure 2.72 - Entering Subconditions

- Clicking on the ellipsis button opens the Device Subcondition Name window, as shown below. Make your selections, then click "OK" to return to the Fault Diagnostic tab.

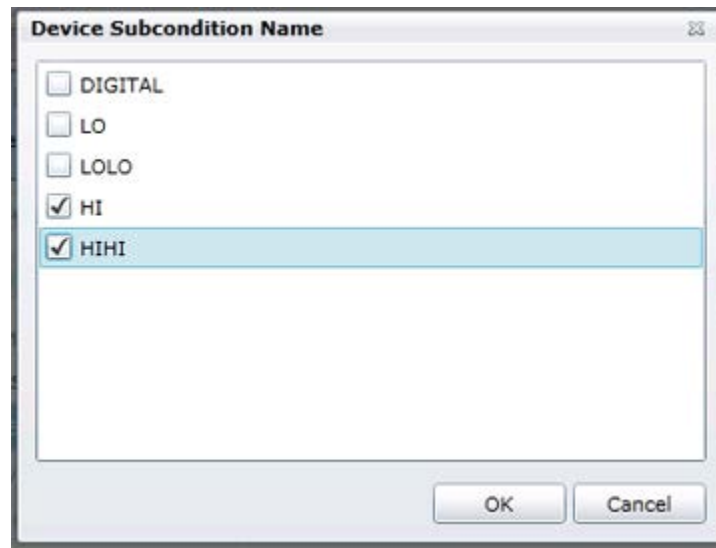


Figure 2.73 - Device Subcondition Name

- Once you have entered your subconditions, you'll see them appear under the Subcondition Name(s) column of the Diagnostic Symptoms Mappings grid. You can now enter an Alarm Filter in the far right column, as shown below.

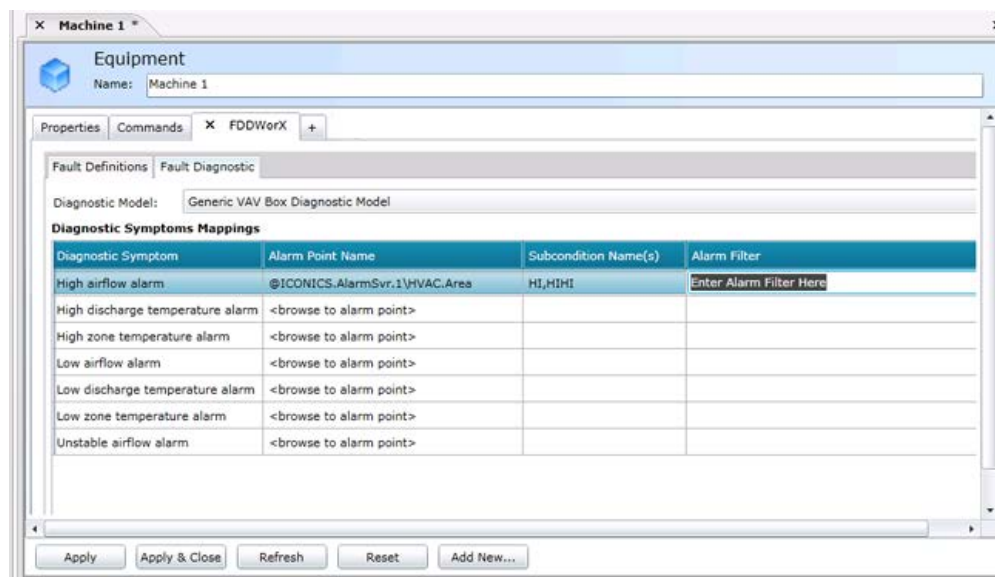


Figure 2.74 - Entering an Alarm Filter in the Diagnostic Symptoms Mappings Grid

8. In order to save the changed status of the Fault Diagnostic Tab (with the newly completed Diagnostic Symptoms Mappings), you must then either click on the **"Apply"** button at the bottom of the tab window within the Project Explorer (and can then proceed to make additional changes to the same Fault Diagnostic) **OR** click on **"Apply & Close"** to save your settings and then return to the main Project Explorer by closing the tab **OR** click on **"Refresh"** to update the Fault Diagnostic tab itself **OR** click on **"Reset"** to return the state of the Fault Diagnostic tab to the last saved settings **OR** click on **"Add New..."** to change the settings for an additional asset.

Lab: FDDWorX

L2

From within Workbench-SL, you will be leveraging a variety of tools found in the FDD configuration. Review the Task Checklist below for more details.

2.1. Task Checklist

In this lab, you will complete the following tasks:

- Create a Diagnostic Model in the FDD Configurator,.
- Start the FDD Service
- Add an asset to the asset tree
- Add the FDD extension to the aforementioned asset
- Configure a Fault Rule
- Connect the asset to the Diagnostic Model
- Test FDD functionality

2.2. Support Files

You do not need any additional support files to complete this lab.

2.3. Expressions Overview

An expression is a function that takes input, performs a specified calculation, and returns an output. The calculation is executed periodically, at a user-configured rate. In expressions, you can use parameters and make the expressions writable. Such expressions can be accessed from a large variety of ICONICS products as single tags.

As with the Windows operating system itself, there is a variety of ways to perform selected tasks. GENESIS64 is no different. Here are some of the ways you can access the Expression Editor.

- Through the Expression section of the Unified Data Manager in either the Workbench Classic or the Workbench Silverlight.
- Through the FDD Rule editor
- Through the Data Browser

FDDWorX uses the Expression Editor to create fault rules. The GENESIS64 integrated Help system includes a lot of useful information about the different elements of expressions.

2.4. *Creating a Diagnostic Model*

A **Diagnostic Model** will allow you to set **Diagnostic Symptoms** (a symptom, in the case of FDDWorX, is any state or condition related to specific equipment that the user/manager would consider cause for concern or "alarm") and **Possible Causes** (a cause, in the case of FDDWorX, is a reason for a resulting symptom that would create concern or "alarm") within a Fault Symptoms/Causes **Diagnostic Matrix**.

2.5. *Creating a Diagnostic Model Folder*

1. From within the Workbench-SL select the **FDD provider**.
2. Expand the **icTonicsAssetWorX** tree.
3. Right click on the **Fault Diagnostic Model** tree node and select **Add Diagnostic Model Folder**.
4. Name the folder **HVAC** and click **Apply**.
5. Right click on the **HVAC** folder and create another diagnostic model folder called **Zone1** and click **Apply**.
6. Your configuration should resemble the following figure.

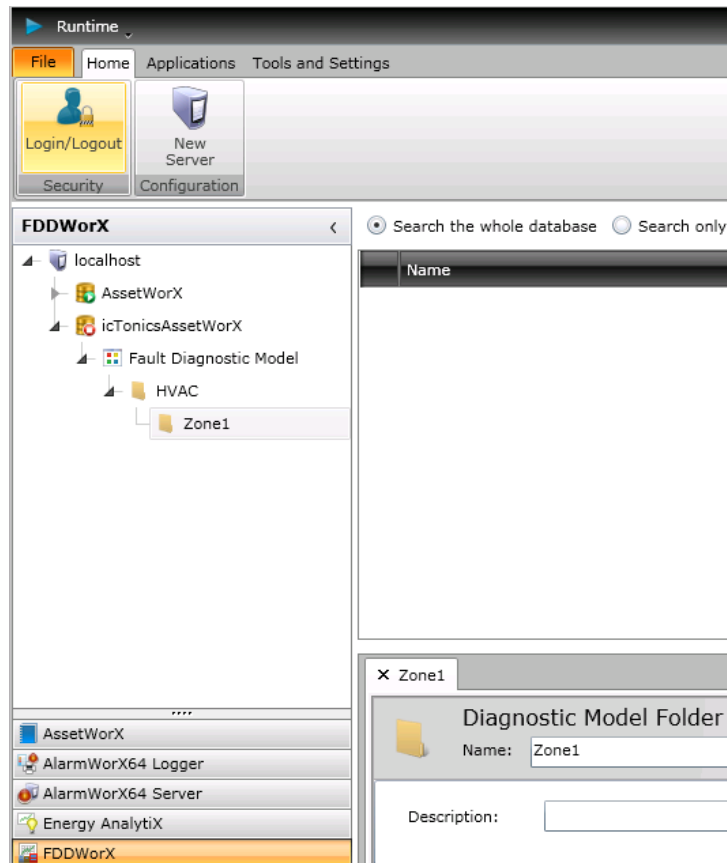


Figure L2.1 - Creating a Diagnostic Model Folder Tree

2.6. Creating a Diagnostic Model

1. Right click on the **Zone1** diagnostic model folder and select **Add Diagnostic Model**.
2. Name the diagnostic model '**DM_Maintenance Mode**'.
3. Using the **handle** (as is highlighted with a circle in the following figure) to expand the content window, expose the FDD **Causes** and **Symptoms** configurator **buttons**.

Note: You can also gain workspace by double clicking on the Home tab in the ribbon. This hides (collapses) the home ribbon. Double clicking on the Home tab again will re-expose the ribbon.

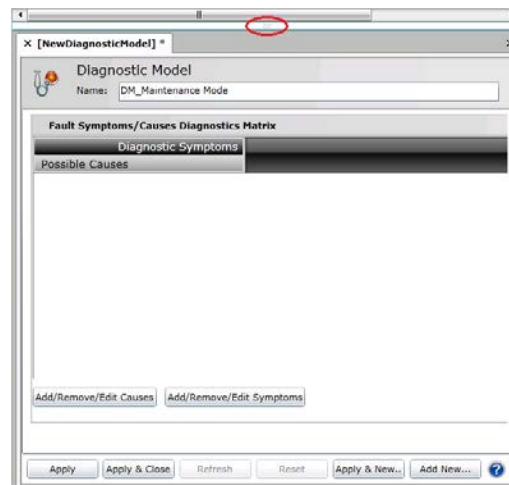


Figure L2.2 - Creating a Diagnostic Model

4. Now that you have access to the **Causes** and **Symptoms** buttons, let's proceed to add causes.
5. Click on the **Add/Remove/Edit Causes** button.
6. From within the Add, Remove or Edit Causes dialog box, select the '**Click here to add new item**' field.
7. Enter the term '**Maintenance Mode Off**' and hit the **Enter** key.
8. Type the term '**Maintenance Mode On**' and click the **OK** button.
9. Click on the **Add/Remove/Edit Symptoms** button.
10. From within the Add, Remove or Edit Symptoms dialog box, select the '**Click here to add new item**' field.
11. Enter the term '**Process Running**' and hit the **Enter** key.
12. Type the term '**Process Stopped**' and click the **OK** button.
13. Cross reference to the **Symptom** column **Process Running** and the **Maintenance Mode Off** row. Enter a value of **100**.
14. Cross reference to the **Symptom** column **Process Stopped** and the **Maintenance Mode On** row. Enter a value of **100**.
15. Your completed diagnostic matrix should resemble the following figure.

Fault Symptoms/Causes Diagnostics Matrix		
Diagnostic Symptoms	Process Running	Process Stopped
Possible Causes		
Maintenance Mode Off	100 (100%)	0 (0%)
Maintenance Mode On	0 (0%)	100 (100%)

Figure L2.3 - Maintenance Mode Diagnostic Matrix

16. Click **Apply**.
17. This completes the configuration of a simple diagnostic matrix.

2.7. Starting the FDDWorX Service

1. With the **FDDWorX provider** selected, you should see an icon that resembles a traffic light on the ribbon.
2. If the traffic light is **Green**, the FDDWorX service is already **running**.
3. If the traffic light **Red, stopped**, then click on it. The color should turn to green as the FDDWorX starts. Wait a moment for the service to start.

Note: If for some reason you do not see the traffic light, be sure that the FDDWorX localhost asset tree is expanded. Also, there have been instances where hitting F5 to refresh the browser session will expose the Service icon.

2.8. Creating an FDDWorX Asset

Any asset added to the asset tree through AssetWorX can be configured as an FDD asset by associating the asset with an FDD extension. This section will help you understand how to create an FDDWorX asset.

2.8.1. Adding the FDDWorX Extension

1. From within the Workbench-SL select the **AssetWorX** provider.
2. Expand the **icTonicsAssetWorX → Assets → IcoUniversity → North Campus** tree to expose the **Engineering Building** asset as seen in the following figure.

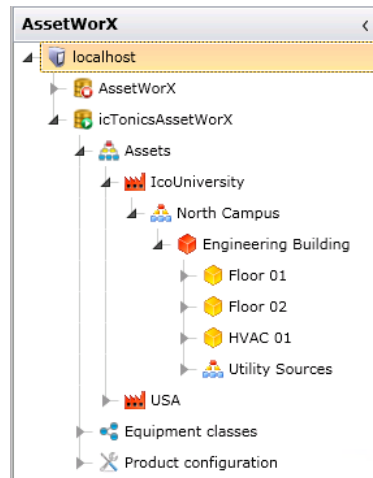


Figure L2.4 - Expanded icTonicsAssetWorX Asset Tree

3. Right click on the **Engineering Building** asset and select **Add Equipment**.
4. Enter the Name: '**HVAC 02**'.
5. From the Icon: drop down select '**Process Cell**'.

Note: When you click Apply a refresh will occur and a third tab with a label of a **Plus Sign** will appear to the right of the **Commands** tab.

6. Click **Apply**.

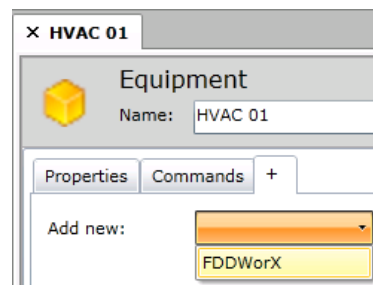


Figure L2.5 - Adding the FDDWorX Extension

7. Click on the **Plus Sign** to the right of the **Commands** tab.
8. From the **Add New:** drop down list select **FDDWorX**.

Note: By performing the above steps you have added the **FDDWorX extension** to the **HVAC 02** asset.

2.9. Defining the Fault Diagnostic

1. With the **FDDWorX** tab selected, click on the **Fault Diagnostic** sub-tab.
2. From the **Diagnostic Model** drop down list select **DM_Maintenance Mode**.
3. Click in the field at the cross section of the **Alarm Point Name** column and the **Process Stopped** row, click on **<browse to alarm point>**.
4. Click on the **ellipsis** to launch the **Data Browser**.
5. Select the tag **Home → OPC Classic Server → My Server → AlarmWorX64 → Manual Override** (do not traverse any further in the tree) and click **OK**.
6. The **Process Stopped / Alarm Point Name** should be defined as **@ICONICS.AlarmSvr.1\Manual Override.Source**.
7. Click **OK**.
8. For each entry, click on the **Subcondition Name(s)** field.
9. Click on the **ellipsis** to launch the **Device Subcondition Name** dialog.
10. Place a checkmark in the **Digital** selection and click **OK**.
11. Your configuration should resemble the figure below. Click **Apply**.

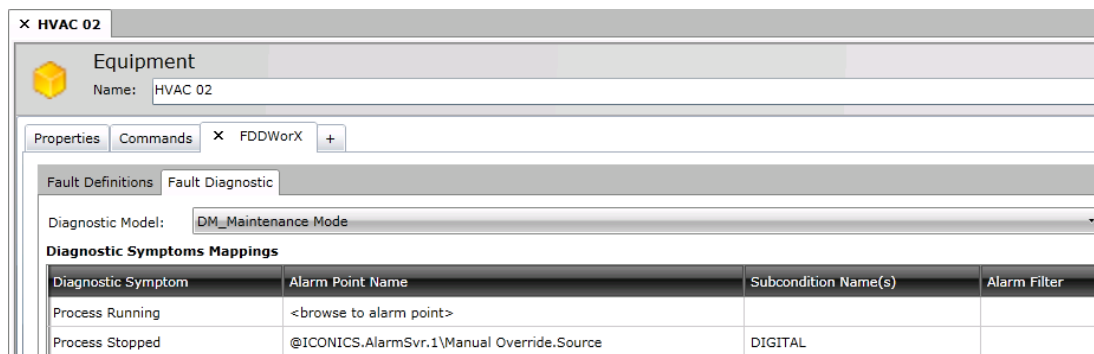


Figure L2.6 - Fault Diagnostic Configuration

2.10. Defining the Fault Definitions

1. Click on the **Fault Definitions** tab.
2. Click on the **Add Fault** button.

3. Select the text **<<condition>>** (including the << and >> signs) and click on the **Variables...** button. This launches the Data Browser.

Note: At this point, the tag you select in the data browser will replace the <<condition>> text you selected.

4. Select the tag **Home → AssetWorX → IcoUniversity → North Campus → Engineering Building → HVAC 01 → ManualOverride_opc**. Click OK.
5. Add **==1** to the end of the equation.
6. Your IF statement should look like this.

IF ({{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/ManualOverride_opc}}) ==1

Note: You can copy and paste your entire expression into **Notepad** for viewing and/or editing.

7. Once again, use the **handle** to expand the content window. Replace **Fault1** and enter the **Name: Maintenance Mode**.
8. Your configuration at this point should resemble the figure below.

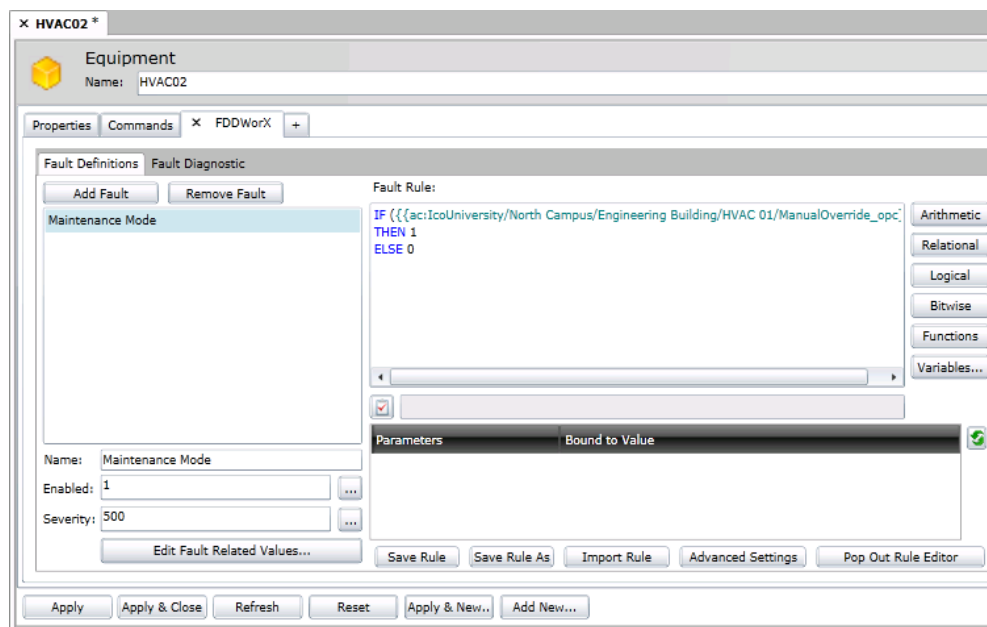


Figure L2.7 - Fault Definition/Fault Rule Editor

9. Click on the **Save Rule** button
10. Click on the **FacilityAnalytiX** folder.

11. Remove the text **IcoUniversity_NorthCampus_EngineeringBuilding_** from the New Expression Name:
12. Your **New Expression Name:** should be **HVAC02_Maintenance Mode_Rule**.
13. When the information in the **Save UDM Rule** dialog resembles the figure below, Click **OK**.

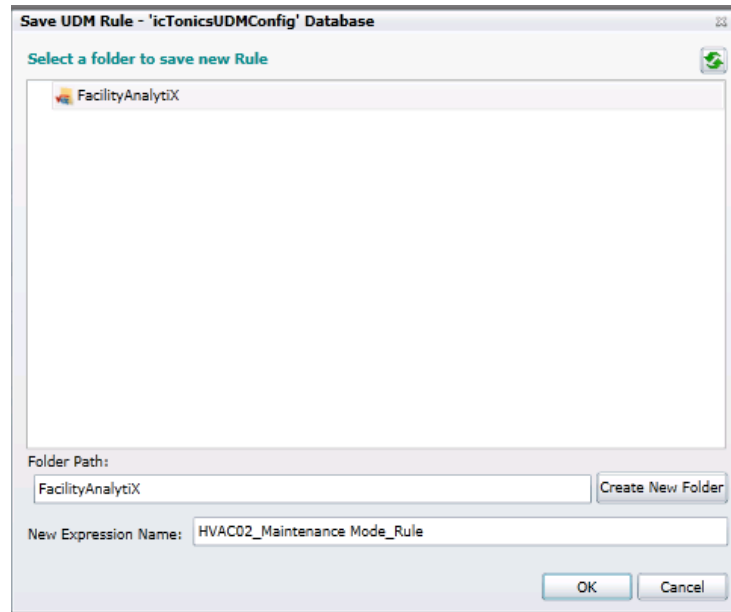


Figure L2.8 - Save UDM Rule Dialog

Note: As we proceed it's worth mentioning that some of the procedures we will perform during these labs require some time to process. For instance, notice when you click Apply in the next step that after about 2 seconds a refresh occurs. The refresh is the indicator that processing is complete. Watch for other notes in other labs indicating to wait for a refresh.

14. Click **Apply**. Wait for the refresh.

2.11. Confirming Faults through SQL Server

This section of lab has been included as a helpful suggestion and a quick guide to assist you during rule development and testing. This section is brief as it is anticipated that you have some SQL Server knowledge and can fill in the blanks.

1. Launch the **SQL Server Management Studio** by making the appropriate selection under **Start → All Programs**.
2. After authenticating, expand the **Databases → icTonicsAssetWorX → Tables** tree.
3. Right click on the **dbo.FDD_Fault_Incidents** table and click on ‘**Select Top 1000 Rows**’ to view the rows in the table.
4. The table is empty if you see **0 rows** displayed in the lower right hand corner.

Note: The ‘Select Top 1000 Rows’ selection will vary depending on the version of SQL server you’re running. You may have to use an alternative method to view the rows of the table.

2.12. Generating and Analyzing a Simple Fault

Our lab environment is setup and ready for testing. During this section you will generate a fault, verify the fault is posted as an alarm and review the fault data that was written to the SQL Server database table **[dbo].[FDD_FAULT_INCIDENTS]** (AKA the faults table) where the faults are stored.

2.13. Generating a Fault

As we proceed to execute the following steps, monitor the alarm viewer in the lower right section of the GraphWorX64 display. The alarms with red text and white background simulate alarms coming from your process while the alarms with the yellow/orange background are generated by a fault rule. Let’s get started.

1. Load the **FDD_icTonics_HVAC.gdpx** display in **Runtime**.
2. In the **Fault Simulator** section of the display, click on the **Manual Override** button. The text on the button should turn yellow.

3. An alarm with the **yellow/orange background** is generated by a **fault rule** and an alarm with **red text and white background** is generated by the **process**. Two alarms should be visible in the alarm viewer.
4. As we did previously, launch the **SQL Server Management Studio**.
5. Expand the **Databases → icTonicsAssetWorX → Tables** tree.
6. Right click on the **dbo.FDD_Fault_Incidents** table and click on ‘**Select Top 1000 Rows**’ to view the rows in the table.
7. You should see 1 row in the table. Notice the **ActiveConditions** field.
8. Return to the **FDD_icTonics_HVAC.gdpx** display and click on the **Manual Override** button again.
9. The **button** text **color** should return to **normal**, the **manual override alarm** will **disappear** and the **fault alarm background color** will change to **white** but remain in the **alarm viewer**.
10. The white alarm indicates that there was an alarm but the alarm state has cleared. This alarm will be removed from the alarm viewer once the alarm is acknowledged.
11. Return to the **SQL Server Management Studio** and click on the **Execute** button. This will rerun the ‘**Select Top 1000 Rows**’ script and refresh the view of the rows in the table.
12. As shown in the following figure, you should see 2 rows in the table. Note that the contents of the **ActiveConditions** field. The second entry has “**All Symptoms Inactive**”. This indicates that **none** of the **Symptom alarms** were **active** when the fault occurred.

	IncidentID	FaultID	FaultName	AssetID	AssetName	FaultDiagnosticTime	FaultActiveTime	ActiveConditions
1	1	1	Maintenance Mode	17	IcoUniversity.North Campus.Engineering Building,...	2013-09-05 19:23:36.673	2013-09-05 19:23:36.387	Process Stopped;
2	2	1	Maintenance Mode	17	IcoUniversity.North Campus.Engineering Building,...	2013-09-05 19:40:53.050	2013-09-05 19:23:36.387	All Symptoms are inactive;

Figure L2.11 - Two Rows in the dbo.FDD_Fault_Incidents Table

2.14. Clearing the dbo.FDD_Fault_Incidents Table

Starting a fresh round of testing with an empty dbo.FDD_Fault_Incidents can be helpful. The script below will clear the dbo.FDD_Fault_Incidents table. We will be using this script during class so you can see how it applies to testing.

1. From within the **SQL Server Management Studio**, click on the 'New Query' button.
2. Enter the following **script syntax** into the empty dialog.

```
USE icTonicsAssetWorX
GO
DISABLE TRIGGER [dbo].[FddFaultIncidentOnDelete] ON
[dbo].[FDD_FAULT_INCIDENTS]
DELETE FROM [dbo].[FDD_FAULT_INCIDENTS];
ENABLE TRIGGER [dbo].[FddFaultIncidentOnDelete] ON
[dbo].[FDD_FAULT_INCIDENTS]
```

3. Click on the **Execute** button. From within the split window you should see on the **Messages** tab in the lower window, information depicting how many row(s) were affected. Because we generated two faults you should see the message **(2 row(s) affected)**. Your output should resemble the following figure.

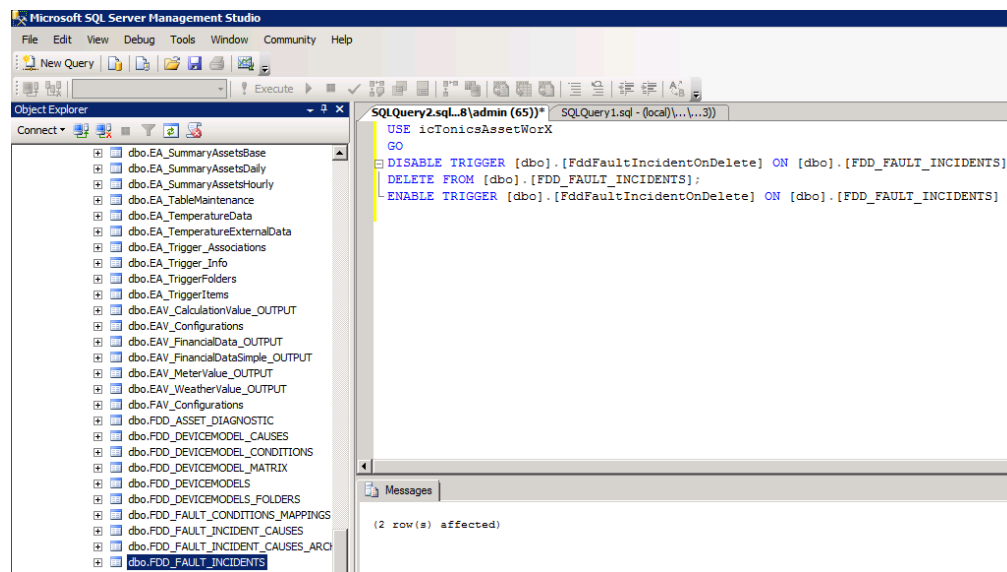


Figure L2.9 - Clear Fault Table Script

4. Click on **File → Save SQLQuery.sql As** and enter the name **ClearFaults.sql**. See the figure below as a reference.

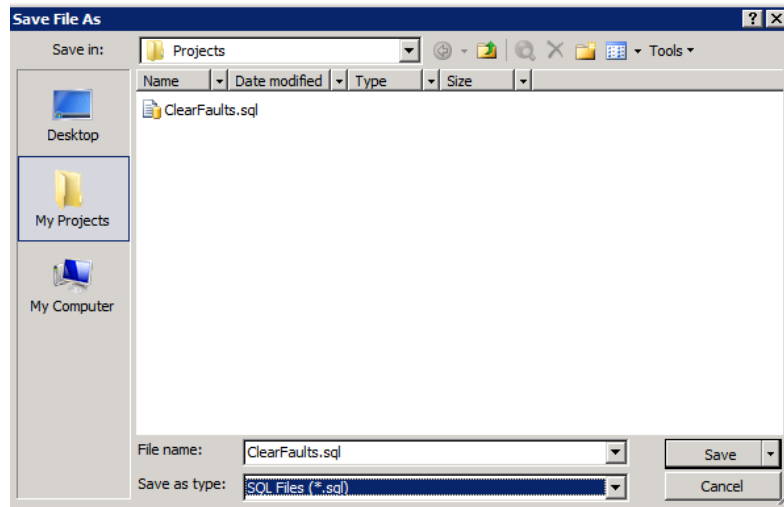


Figure L2.10 - Saving the ClearFaults Script

5. Click **Save**.
6. As we proceed with testing, you will execute either the **Select Top 100 Rows** or the **ClearFaults.sql** query. Practice selecting the appropriate tab and clicking on the **Execute** button.
7. Take some time to experiment with generating faults and clearing the table. Also spend some time thinking about what is happening in this process.

2.15. Leaving Faults in the FDD_Fault_Incidents Table

In the next lab we will create a view in PortalWorX to view the fdd_fault_incidents data. If you cleared the records from the table, execute the following steps to add fault records.

1. Now you know that clicking on the **Manual Override** button generates an alarm and a fault.
2. Return to the **FDD_icTonics_HVAC.gdxf** display.
3. Click on the **Manual Override** button. The text should turn yellow and two alarms (one process and one fault) should appear in the alarm viewer.
4. **Pause** (wait) a few seconds.
5. Click on the **Manual Override** button again. Note the alarm viewer changes.
6. Return to **SQL Server Management Studio**, and execute the Top 1000 rows query to confirm you have records in the table.

7. Here's a little more detail if you need it. Expand the **Databases** → **icTonicsAssetWorX** → **Tables** tree, right click on the **dbo.FDD_Fault_Incidents** table and click on '**Select Top 1000 Rows**'.

This concludes this lab.

FDDWorX Viewer

3

The FDDWorX Viewer is a Silverlight control that is used to visualize the data collected by the FDDWorX server, including Faults, Fault Summaries, Asset Summaries and Diagnostic causes. There is a FDDWorX Viewer that can be used within PortalWorX-SL, another within GraphWorX64, and a Web Part that can be used in PortalWorX SP (utilizing SharePoint).

3.1. Objectives

After completing this chapter, you should know how to:

- Quickly Create a Grid to Display Faults
- Configure Commands through the FDDWorX Viewer
- Add a Chart
- Add a Grid
- Add a Tabs Container
- Add a Panel
- Add Details
- Add the FDDWorX Web Part in SharePoint 2010

3.2. Configuring the FDDWorX Viewer

This chapter will initially demonstrate how to configure a FDDWorX viewer to display a grid with faults. We will add a Row Detail to the grid so that when we expand the fault, we can display more information including a list of causes, a chart showing the current week's distribution of faults, and asset details.

3.2.1. Creating a Grid to Display Faults

1. In your FDDWorX Viewer, right-click on "Viewer" and select "Add Grid", as shown below.

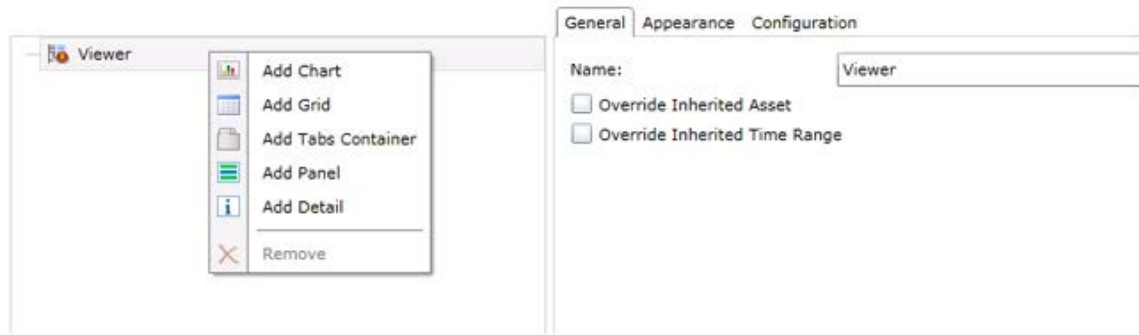


Figure 3.1 – Adding a Grid

2. Click your Grid in the tree and select the Data tab. Select "Faults" from the Data Query drop down menu

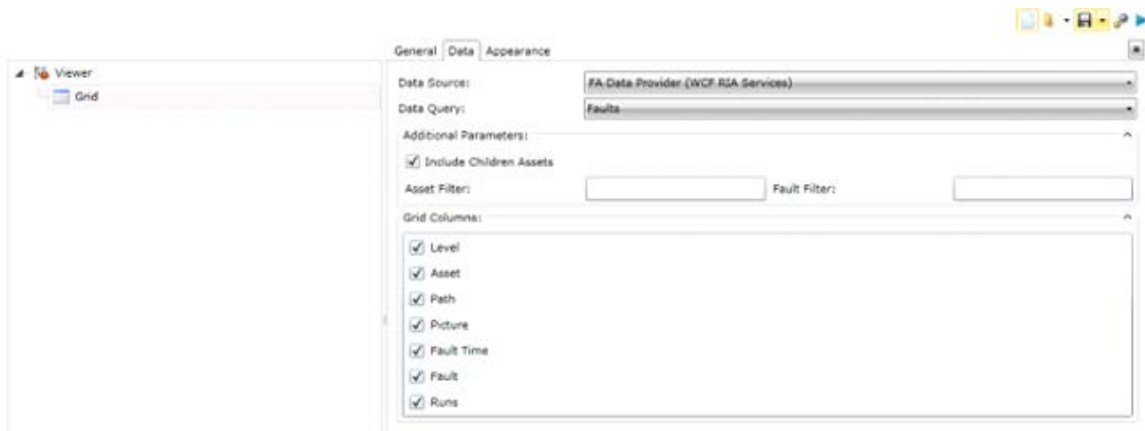


Figure 3.2 – Data Tab for Grid

3.2.2. Creating a Row Detail and Panel

1. Right-click the Grid in the tree and select "Add Row Detail". This will allow you to expand a row in your grid to retrieve more information.
2. Next, right-click the new Row Detail and select "Add Panel".
3. Click the Panel in the tree and make sure that the Layout Orientation specified on the Appearance tab is "Horizontal". This will ensure that if you add multiple features to this panel, they will be displayed side-by-side. If you prefer that features added to the panel be displayed top-to-bottom, you can select "Vertical" orientation.



Figure 3.3 – Panel Appearance Tab

3.2.3. Creating a Tabs Container and Tabs

1. Right-click on the new Panel and select "Add Tabs Container".

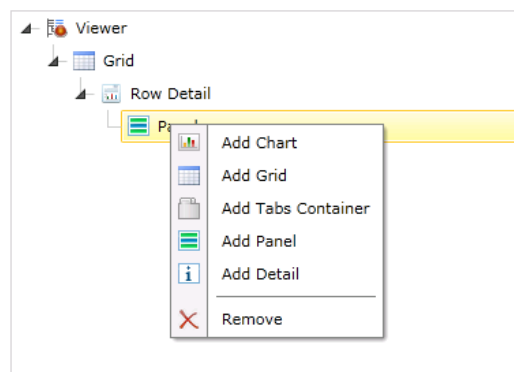


Figure 3.4 – Adding a Tabs Container

2. Right-click on the new Tabs Container and select "Add Tab".
3. Select the tab in the tree. On the Appearance Tab, enter "Distribution" for the Title text.

3.2.4. Creating a Chart and Series

1. Right-click the Tab and select "Add Chart". Select a Bar chart for Chart Type.
2. Next, right-click the chart and select "Add Series".
3. Click on the series in the tree. For this series, we will only want to look at the faults that have occurred this week, so first, check the Override Inherited Time Range check box. In the Start section, change the start to "Preset" and "First Day of Current Week".

The screenshot shows the 'Appearance' tab of a configuration window. Under the 'Time Range' section, the 'Start' dropdown is set to 'Preset' and 'First Day Current Week'. The 'End' dropdown is set to 'Now'. The 'Offset' section shows 'Years: 0', 'Months: 0', 'Days: 0', and 'Hours: 0'. The 'Auto Update' checkbox is unchecked.

Figure 3.5 – Overriding the Time Range

4. On the Data tab, select "Distribution by asset" for the Data Query. Select "Day" as the Interval Type in the Additional Parameters section.
5. Check the "Format" check box and change the Format to MMM-dd.
6. Next, try creating another Tab for inclusion in the Tab Container. Name it "Causes" and add a Grid to it that uses the latest Causes data query.

3.2.5. Creating an Asset Detail

1. Next, we will add an Asset Detail to our panel to be shown next to our Tabs Container. Right-click on "Panel" and select "Add Asset Detail".
2. Select the Asset Detail in the tree and on the Data tab, choose the "Summary by asset Data" Query.

When you are finished, your tree should look similar to the one in the figure below.

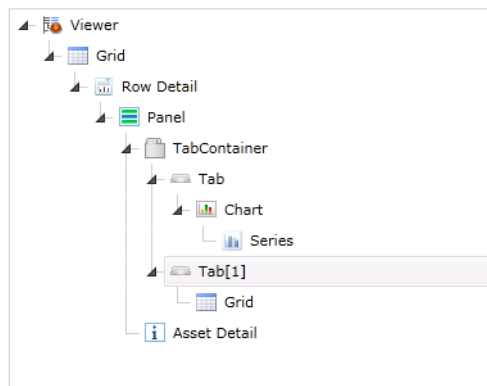


Figure 3.6 – Final Configuration

Make sure to click the "Save" button at the top of the viewer to save this configuration. Clicking the blue play button at the top right of the viewer will switch the viewer to Runtime mode. You won't see any results there now because the viewer is configured to use an Inherited Asset. This means the asset that is passed to the queries in the viewer is determined when you select an asset in the tree that has a **Load FDDWorX Data** command that was defined for it in the Workbench-SL.

To verify that your configuration is working correctly, you can click the Viewer in the tree and check the "Override Inherited Asset" check box and select some specific asset for which faults have occurred. If you switch to runtime, you will see a grid of these faults. If you click the plus sign [+] at the beginning of any row, you will see the panel that we defined.

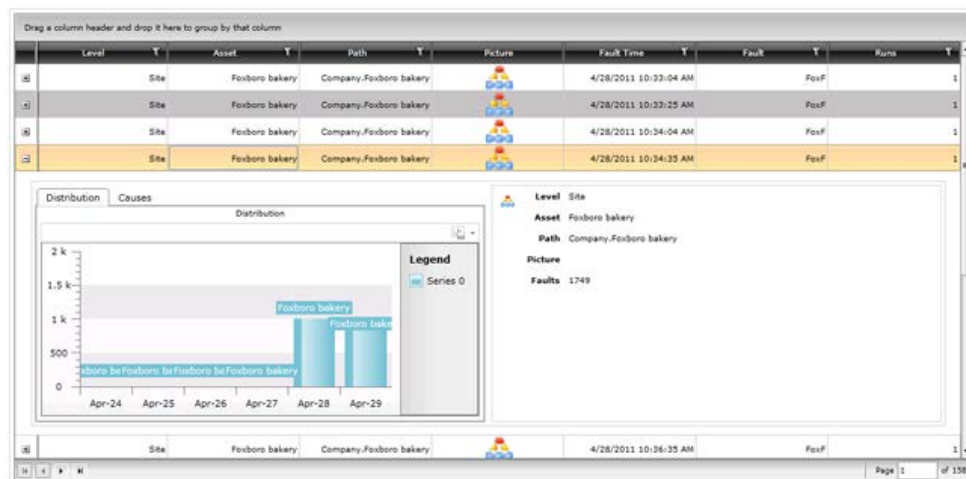


Figure 3.7 – FDDWorX in Runtime Mode

3.3. *Configuring Commands for an FDDWorX Viewer*

You can apply some of the commands that you have added to your assets in AssetWorX to an FDDWorX Viewer control in PortalWorX-SL.

To Apply an Existing Command from an Asset to an FDDWorX Viewer:

1. In the AssetWorX Navigator on the left-hand panel, navigate to the asset that contains the command that you wish to apply to the viewer.
2. Right-click the asset and select the command you wish to apply.
3. Choose the viewer to which you would like to apply the command. You can also apply the command to a **New Control**, which will open a new FDDWorX viewer with the default settings.

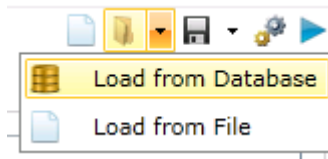
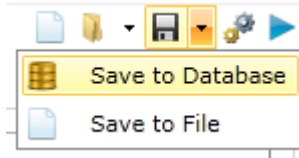
3.3.1. *Commands Supported by FDDWorX Viewer Controls*

An FDDWorX Viewer control in PortalWorX-SL supports the following commands:

- **Export Image**
- **Load Facility Data**
- **Navigate** - FDDWorX viewers support only the **Back**, **Forward**, **Home**, and **End** navigation types for this command.
- **Save Configuration**
- **Select Asset**
- **Select Element** - FDDWorX viewers support only the **Row** element type for this command.
- **Set Visibility** - FDDWorX viewers support only the **Column** object type for this command.

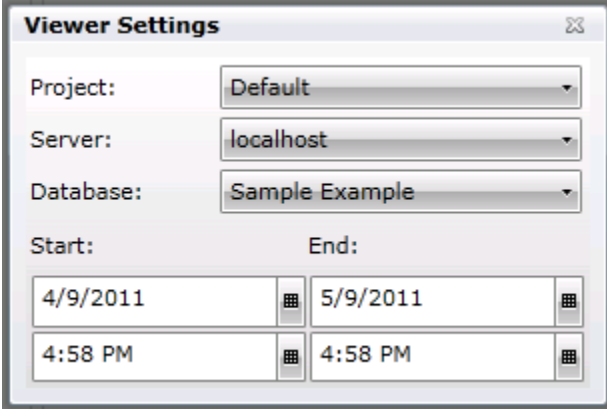
3.4. Viewer/Web Part Main Page Options for FDDWorX

The icons in the top right of the FDDWorX Silverlight Web Part (    ) perform different functions, as listed below.

	Return to Main Settings - Click on this to return to the main page options screen from any other location while using the FDDWorX Silverlight Web Part.
	Load From - Clicking on this button provides you with two options for loading configuration data -- Load from Database or Load from File -- as shown below.  Figure 3.8 - "Load As" Options Clicking on Load from Database allows you to select the connected database from a pulldown menu. Clicking on Load from File launches a file explorer allowing you to browse to your selected saved FDDWorX Configuration (.fav) File.
	Save To - Clicking on this button provides you with two options for saving configuration data; Save to Database or Save to File; as shown below.  Figure 3.9 - "Save To" Options Clicking on Save to Database allows you to enter the name of the configuration to be saved, as well as set it as a Default Configuration, if you so desire. Clicking on Save to File launches a file explorer, allowing you to save the present configuration as a FDDWorX Configuration (.fav) File in your preferred location.
	Viewer Settings - Clicking on this button brings up the Viewer Settings window. For details, see the section called "Viewer Settings" at the end of this table.

	Switch to Runtime Mode - Clicking this button from any page within the FDDWorX Silverlight Web Part switches the Viewer to Runtime Mode. (This icon appears only if AssetWorX's Show Mode Switch button is selected.)
	Switch to Configuration Mode - Clicking this button switches the Viewer from Runtime Mode to Configuration Mode, allowing users to make further changes to the Viewer. (This icon appears only if AssetWorX's Show Mode Switch button is selected.)

 **Viewer Settings** - Clicking on this button brings up the Viewer Settings window, shown below, allowing you to select the configuration Project, Server, Database, Start Date and Time; and End Date and Time.



The Viewer Settings window is a dialog box with a title bar that says "Viewer Settings" and a close button. It contains several configuration fields:

- Project:** A dropdown menu with "Default" selected.
- Server:** A dropdown menu with "localhost" selected.
- Database:** A dropdown menu with "Sample Example" selected.
- Start:** Two input fields for date and time. The date field shows "4/9/2011" and the time field shows "4:58 PM". Each field has a small calendar icon to its right.
- End:** Two input fields for date and time. The date field shows "5/9/2011" and the time field shows "4:58 PM". Each field has a small calendar icon to its right.

Figure 3.10 - Viewer Settings Window

Clicking on the [] button to the right of either the Start or End date brings up a monthly calendar for date selection, as shown below.



The image shows a monthly calendar for July 2012. The title bar says "July - 2012" with left and right navigation arrows. The days of the week are listed at the top: Sun, Mon, Tue, Wed, Thu, Fri, Sat. The dates are arranged in a grid. The date "1" is highlighted in a yellow box, and the date "11" is also highlighted in a yellow box.

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.11 - Monthly Calendar

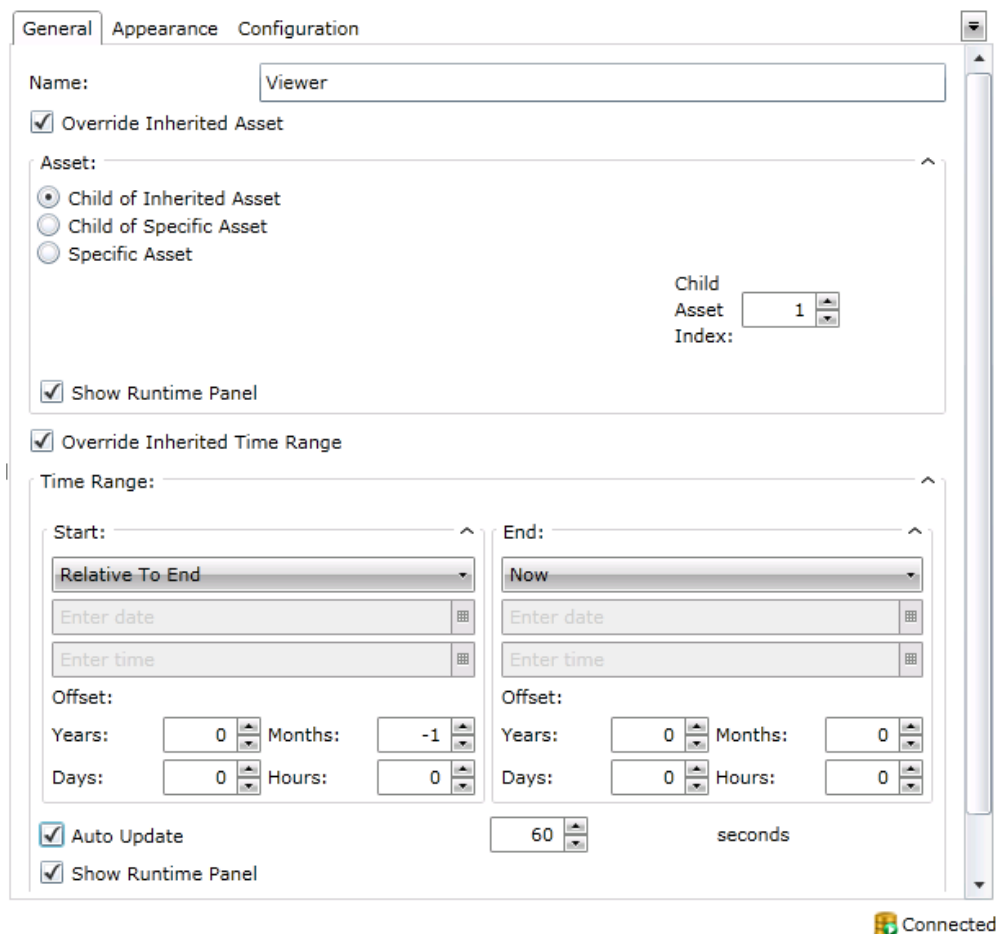
Clicking on the [] button to the right of either the Start or End time brings up a clock window for time selection, as shown below.

Clock			
12:00 AM	1:00 AM	2:00 AM	3:00 AM
4:00 AM	5:00 AM	6:00 AM	7:00 AM
8:00 AM	9:00 AM	10:00 AM	11:00 AM
12:00 PM	1:00 PM	2:00 PM	3:00 PM
4:00 PM	5:00 PM	6:00 PM	7:00 PM
8:00 PM	9:00 PM	10:00 PM	11:00 PM

Figure 3.12 - Clock Window

3.4.1. General Tab in the FDDWorX Web Part

The following is a description of the settings that can be changed in the General tab of the FDDWorX Web Part in Silverlight, shown below.



General Appearance Configuration

Name:

☒ Override Inherited Asset

Asset:

☒ Child of Inherited Asset
☐ Child of Specific Asset
☐ Specific Asset

Child Asset Index:

☒ Show Runtime Panel

☒ Override Inherited Time Range

Time Range:

Start:

End:

Offset:

Years: Months:
Days: Hours:

Offset:

Years: Months:
Days: Hours:

☒ Auto Update seconds

☒ Show Runtime Panel

Connected

Figure 3.13 - General Tab in the FDDWorX Web Part

- **Name** - Enter a name for the Viewer in the left-side navigation window in the FDDWorX Web Part.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.

Figure 3.14 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.

Figure 3.15 - Specific Asset Settings

- o *Show Runtime Panel*
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset** and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the  buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown in the following figure.

July - 2012							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.16 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

Clock			
12:00 AM	1:00 AM	2:00 AM	3:00 AM
4:00 AM	5:00 AM	6:00 AM	7:00 AM
8:00 AM	9:00 AM	10:00 AM	11:00 AM
12:00 PM	1:00 PM	2:00 PM	3:00 PM
4:00 PM	5:00 PM	6:00 PM	7:00 PM
8:00 PM	9:00 PM	10:00 PM	11:00 PM

Figure 3.17 - Clock Window

- o *Offsets* - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o *Show Runtime Panel* - Clicking this check box allows you to edit the Header Format setting below.
- o *Header Format* - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

Figure 3.18 - Header Format Settings

3.4.2. Appearance Tab in the FDDWorX Web Part

The following is a description of the settings that can be changed in the Appearance tab of the FDDWorX Web Part in Silverlight, shown below.

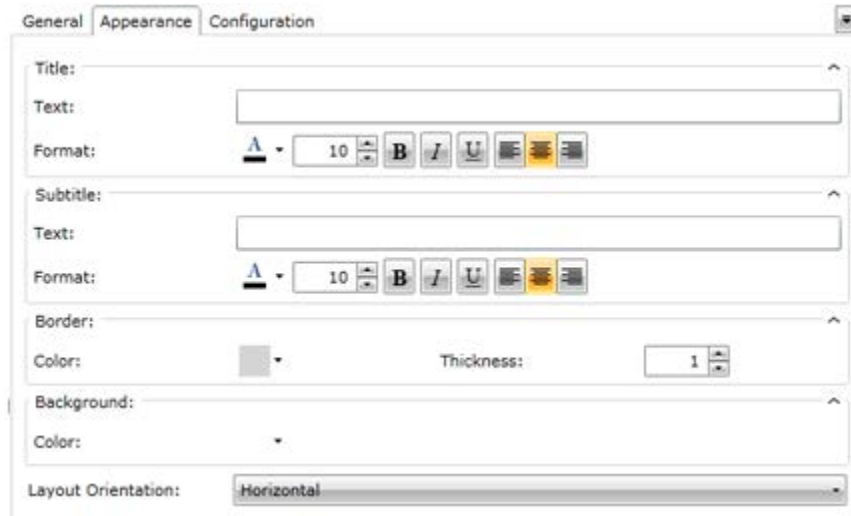
The image shows a configuration window for the FDDWorX Web Part, specifically the 'Appearance' tab. The window has three tabs: 'General', 'Appearance', and 'Configuration'. The 'Appearance' tab is selected. It contains several sections for configuring the web part's look. The 'Title' section has a text input field, a 'Format' dropdown menu, and a set of formatting buttons (font color, size, bold, italic, underline, bulleted list, numbered list). The 'Subtitle' section has a similar text input field and formatting options. The 'Border' section includes a 'Color' dropdown menu and a 'Thickness' spinner set to 1. The 'Background' section has a 'Color' dropdown menu. At the bottom, there is a 'Layout Orientation' dropdown menu set to 'Horizontal'.

Figure 3.19 - Appearance Tab in the FDDWorX Web Part

Title:

- **Text** - Enter a main title for the area where your visualized data will appear during runtime. This text will appear at the top of the section that will include your viewer runtime elements (charts, grids, tabs containers, panels, details, etc.).
- **Format** - You can change the text color, size, style (bold, italics or underline) and justification of the Title Text here.

Subtitle:

- **Text** - Enter a subtitle for the area where your visualized data will appear during runtime. This text will appear beneath the Title and above the section that will include your viewer elements (charts, grids, tabs containers, panels, details, etc.).
- **Format** - You can change the text color, size, style (bold, italics or underline) and justification of the Subtitle Text here.

Border:

- **Color** - Select a color for the border containing your visualized data in runtime mode.
- **Thickness** - Set the thickness of the border containing the runtime elements.

Background:

- **Color** - Select a color for the background of the section containing your visualized data in runtime mode.

Layout Orientation - Use the pulldown menu to select either Horizontal or Vertical orientation of multiple runtime elements (charts, grids, tabs containers, panels, details, etc.).

3.4.3. Configuration Tab in the FDDWorX Web Part

The following is a description of the settings that can be changed in the Configuration tab of the FDDWorX Web Part in Silverlight, shown below.

Figure 3.20 - Configuration Tab in the FDDWorX Web Part

- **Configuration Title** - Enter a title for the configuration you will view during runtime.
- **Default Configuration** - Click this to set the current configuration as the default.
- **Created By** - You can enter information for the creator of the configuration here.
- **Date** - Enter the date into the text entry field or click on the button. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below. You may do the same for the "Modified By" field, as well.

July - 2012						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6
28	8	9	10	11	12	13
29	15	16	17	18	19	20
30	22	23	24	25	26	27
31	29	30	31	1	2	3
32	5	6	7	8	9	10

Figure 3.21 - Monthly Calendar

- **Modified By** - Should an existing configuration require any changes, you can keep track of who made changes by entering a name here. For "Date" description, see above.
- **Description** - Enter a description of the configuration you will view through the FDDWorX Silverlight Web Part.

3.5. Adding Viewer Elements

Either before or after setting the Web Part Main Page Options, you can begin to add Viewer elements within the FDDWorX Silverlight Web Part.

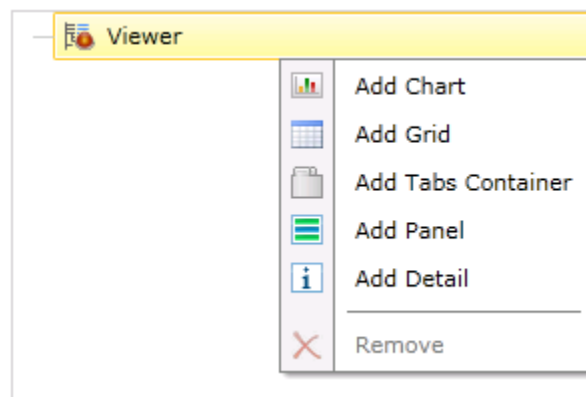


Figure 3.22 - Adding Viewer Elements to the FDDWorX Silverlight Web Part

Right-click on the Viewer in the left-side navigation pane of the Web Part to make your selection.

Among the elements you can add are:

- Chart (or Series)
- Grid (or Row Detail)
- Tabs Container (or Tab)
- Panel
- Detail

3.6. Add Chart (or Series)

To Add a Chart:

1. Right-click on your selected Viewer in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "Add Chart", as shown below.

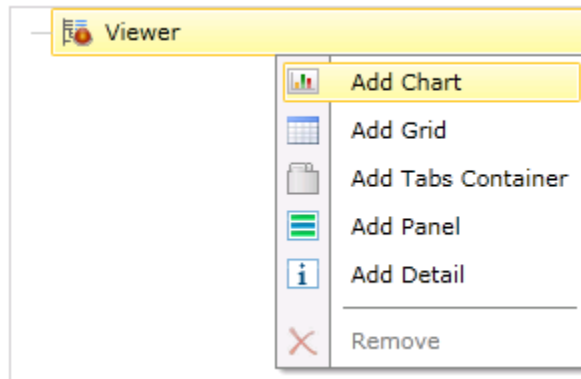


Figure 3.23 - Add Chart

2. This adds a "Chart" branch to the project explorer as well as opens the chart properties in the right side of the FDDWorX Silverlight Web Part. These properties are split between the General and Appearance tabs.

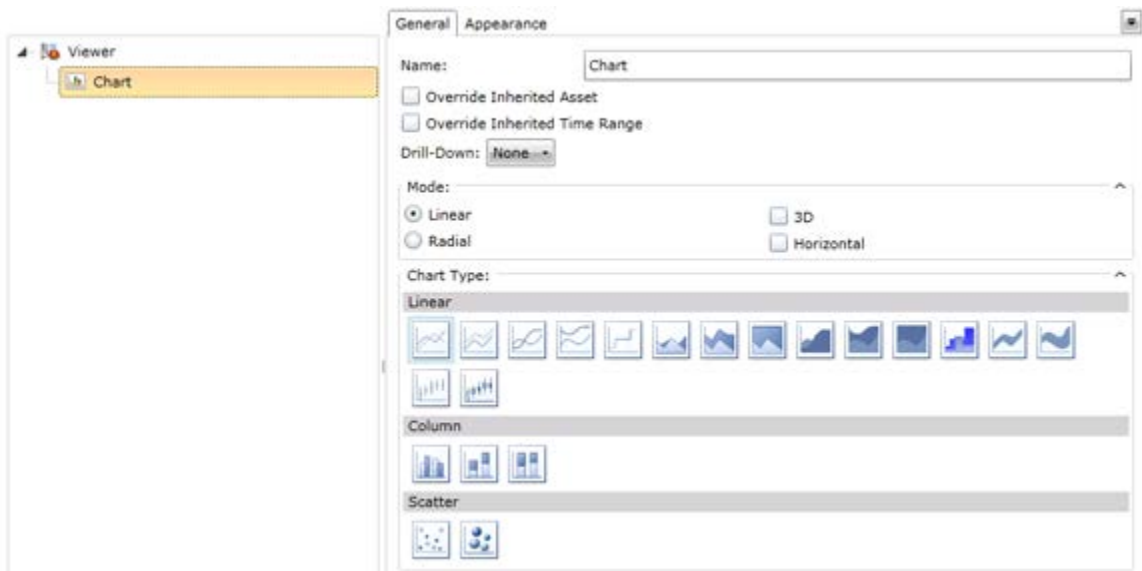


Figure 3.24 - Chart Properties

3.6.1.1. Chart - General Tab

The following is a description of the settings that can be changed in the General Tab of the Chart properties.

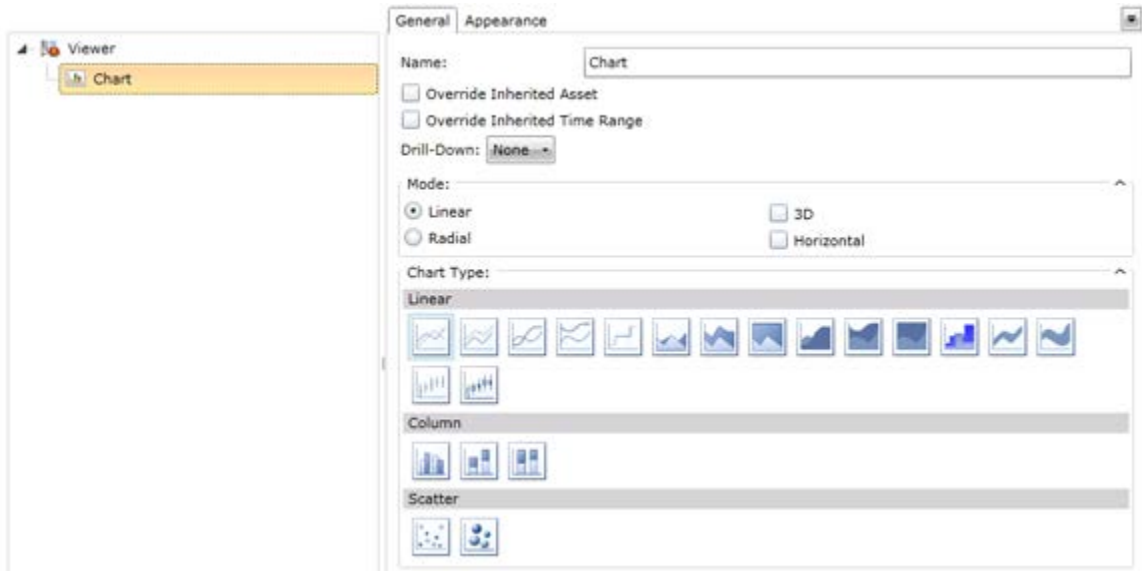


Figure 3.25 - Chart - General Tab Properties

- **Name** - You can enter the name of the chart here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.



Figure 3.26 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.



Figure 3.27 - Specific Asset Settings

- o *Show Runtime Panel*
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset** and **Custom**. Depending on the pulldown selection, you can also enter in new date/time in  buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below.



Figure 3.28 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

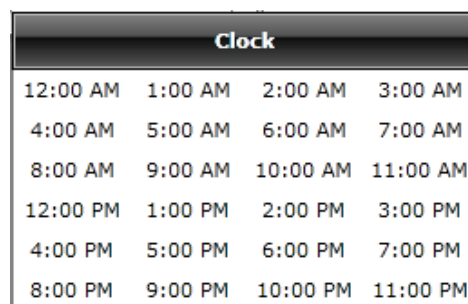


Figure 3.29 - Clock Window

- o *Offsets* - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o *Show Runtime Panel* - Clicking this check box allows you to edit the Header Format setting below.
- o *Header Format* - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

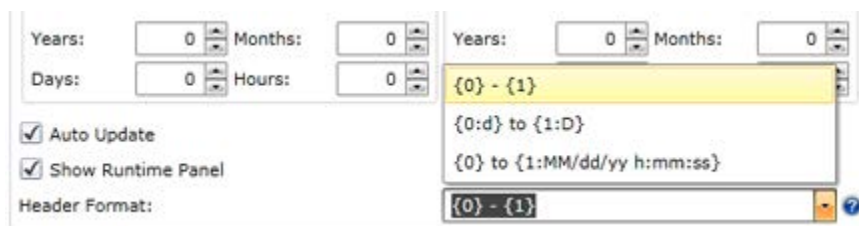


Figure 3.30 - Header Format Settings

- **Drill Down** - Should you wish to be able to access an additional chart from a primary one (i.e., "drill down" to additional data on a separate chart), click on this pulldown menu. Options include "None" (to clear this selection), "Asset" or "Custom". Selecting "Custom" adds a "Drill-Down" branch to the Chart branch in the project explorer. You can then click on the Drill-Down branch to edit its own chart properties. You could then, in turn, create a Drill Down in that level and so on, to create multiple levels of chart data, if so desired.



Figure 3.31 - One Drill-Down Level for a Selected Chart

- **Mode** - Decide on whether your chart will be Linear or Radial. Based on which radio button you click, you'll have further options. For Linear Mode, you can make the chart either 3D (or leave as 2D) or Horizontal (or leave as Vertical). For Radial Mode, you can decide whether or not you want the chart in 3D. Your Mode selection will affect which Chart Type you can choose.

- **Chart Type** - Depending on the Mode you selected, you can choose from multiple options for your chart type. Listed below are the Mode/Chart Type Options:

LINEAR MODE

Linear



Line - Standard line series



Stacked Line - Stacked line series



Spline - Standard spline series



Stacked Spline - Stacked spline series



Step Line - Step line chart series



Area - Line area series



Stacked Area (x2) - Stacked area line series



Spline Area - Spline area series



Stacked Spline Area - Stacked spline area series



100% Stacked Spline Area - Stacked spline area series, filling 100% of the output range



Step Line Area - Step line area series



Range - Line range series



Spline Range - Spline range series



Stick - Stick chart series



Candle - Candle stick chart series

Column



Bar - Standard bar series



Stacked Bar - Stacked bar series



100% Stacked Bar - Stacked bar series, filling 100% of the output range

Scatter



Scatter - Scatter (point) chart series



Bubble - Bubble chart series

LINEAR MODE - 3D

Linear



Line 3D - 3D chart line series



Stacked Line 3D - 3D chart stacked line series



Area 3D - 3D chart area series



Stacked Area 3D - 3D chart stacked area series



100% Stacked Area 3D - 3D chart 100% stacked area series

Column



Bar 3D - 3D chart bar series



Stacked Bar 3D - 3D chart stacked bar series



100% Stacked Bar 3D - 3D chart 100% stacked bar series

LINEAR MODE - HORIZONTAL

Bar



Horizontal Bar - Horizontal bar series



Stacked Horizontal Bar - Stacked horizontal bar series



100% Stacked Horizontal Bar - Stacked horizontal bar series, filling 100% of the output range

RADIAL MODE

Radial



Pie - Pie chart series



Doughnut - Doughnut chart series

RADIAL MODE - 3D

Radial



Pie 3D - 3D pie chart series



Doughnut 3D - 3D doughnut chart series

3.6.2. Chart - Appearance Tab

The following is a description of the settings that can be changed in the Appearance Tab of the Chart properties.

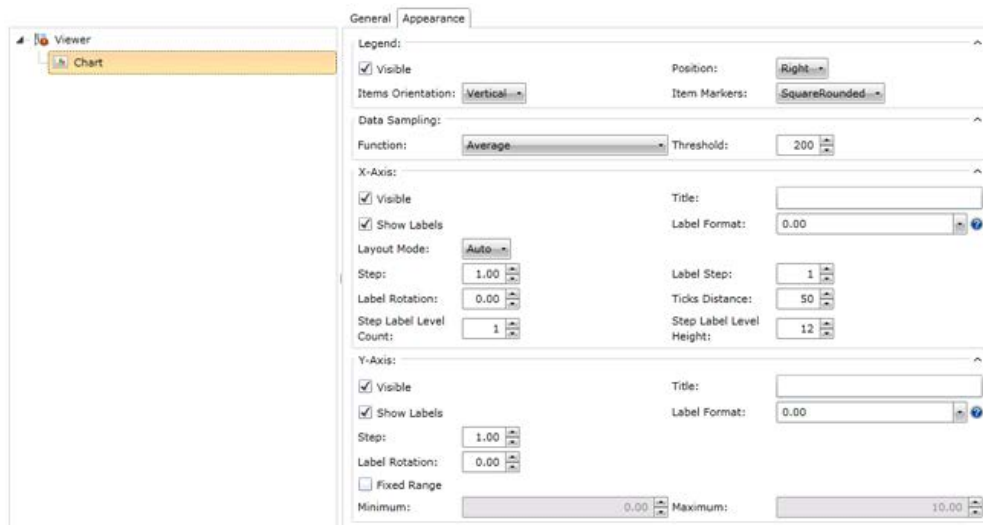


Figure 3.32 - Chart - Appearance Tab

- **Title - Text and Format** - Enter a name for the Chart that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Subtitle - Text and Format** - Enter a subtitle for the Chart that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the chart. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the chart.

Legend

- **Visible** - Click this box to include a Legend with your chart to provide additional information as to its elements.
- **Items Orientation** - Use the pulldown menu to set whether the Legend items will be horizontal or vertical. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Position** - Use the pulldown to set where the Legend will be positioned (Left, Top, Right, or Bottom). Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Item Markers** - Use the pulldown to set which item markers will be used within the Legend: Circle; Diamond; Hexagon; Square; SquareRounded; StarEightRay; StarFiveRay; or Triangle. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.

Data Sampling

- **Function** - Use the pulldown menu to set the data sampling function: Average; First, KeepExtremes; Last; Max; Min; or Sum.
- **Threshold** - Enter, or use the up and down arrows to set, the data sampling threshold here.

X-Axis

- **Visible** - Click this box to include an X-Axis with your chart.
- **Show Labels** - Click this box to show labels for the X-Axis elements of the chart.
- **Title** - You can enter a name for the X-Axis information here.
- **Label Format** - You can decide upon how you wish the X-Axis labels to be viewed: Standard Numeric Format Strings; Custom Numeric Format Strings; Standard Date and Time Format Strings; or Custom Date and Time Format Strings. Options include: 0.00; #,##; ##.0%; ### 'degrees'; d; D; f; F; g; G; M; and Y.
- **Layout Mode** - Use the pulldown menu to select the layout mode for the chart's X-Axis info: Auto; Between; Inside; or Normal. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Step** - Enter, or use the up and down arrows to set, the Step for the X-Axis information here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.

- **Label Step** - Enter, or use the up and down arrows to set, the Label Step here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Label Rotation** - Enter, or use the up and down arrows to set, the Label Rotation here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Ticks Distance** - Enter, or use the up and down arrows to set, the Ticks Distance here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Steps Label Level Count** - Enter, or use the up and down arrows to set, the Steps Label Level Count here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Steps Label Level Height** - Enter, or use the up and down arrows to set, the Steps Label Level Height here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.

Y-Axis

- **Visible** - Click this box to include an Y-Axis with your chart.
- **Show Labels** - Click this box to show labels for the Y-Axis elements of the chart.
- **Title** - You can enter a name for the Y-Axis information here.
- **Label Format** - You can decide upon how you wish the Y-Axis labels to be viewed: Standard Numeric Format Strings; Custom Numeric Format Strings; Standard Date and Time Format Strings; or Custom Date and Time Format Strings. Options include: 0.00; #,##; ##.0%; #.## 'degrees'; d; D; f; F; g; G; M; and Y.
- **Layout Mode** - Use the pulldown menu to select the layout mode for the chart's Y-Axis info: Auto; Between; Inside; or Normal. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Step** - Enter, or use the up and down arrows to set, the Step for the Y-Axis information here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Label Rotation** - Enter, or use the up and down arrows to set, the Label Rotation here. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.

- Fixed Range - Click here if you want the Y-Axis of your chart to have a fixed range. Selecting this option enables you to enter, or use the up and down buttons to set, a Minimum and Maximum value for the range.

3.6.3. Add a Series

To Add a Chart Series:

1. Right-click on your selected Chart in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "Add Series", as shown below.

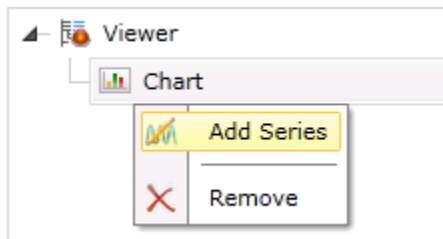


Figure 3.33 - Add Series

2. This adds a "Series" branch to the project explorer (beneath the chart) as well as opens the series properties in the right side of the FDDWorX Silverlight Web Part. These properties are split between the General, Data and Settings tabs.

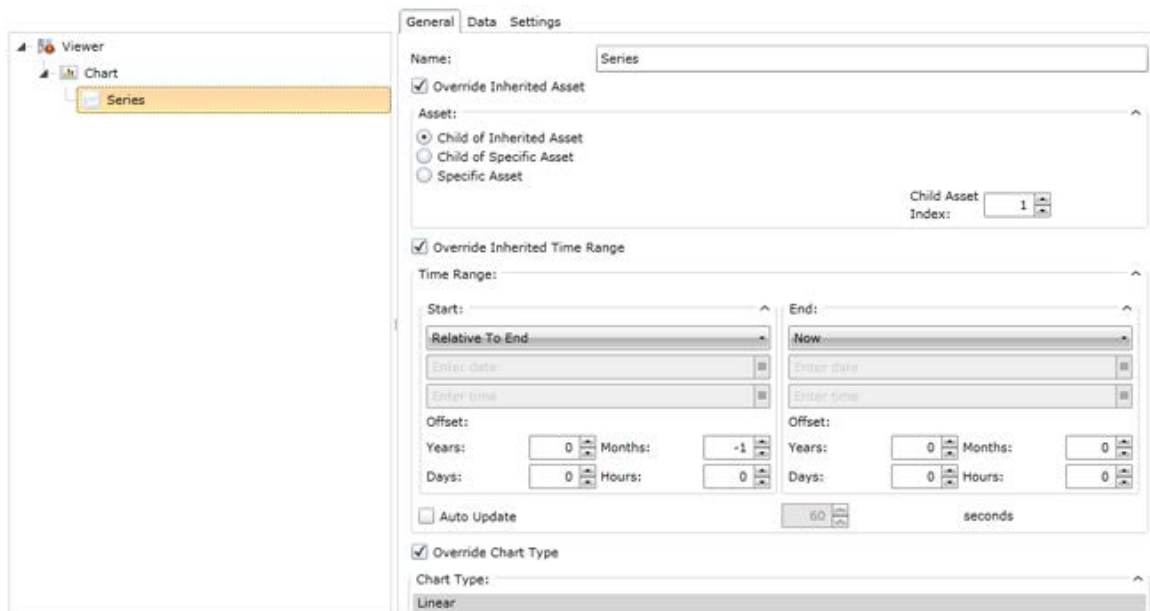


Figure 3.34 - Series Properties

3.6.3.1. Series - General Tab

The following is a description of the settings that can be changed in the General Tab of the Series properties.

Figure 3.35 - Series - General Tab Properties

- **Name** - You can enter the name of the series here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.

Figure 3.36 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.



Figure 3.37 - Specific Asset Settings

- o *Show Runtime Panel*
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including "Now, Inherited, Relative to End, Preset and Custom". Depending on the pulldown selection, you can also enter in new date/time information or use the [] buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below.



Figure 3.38 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

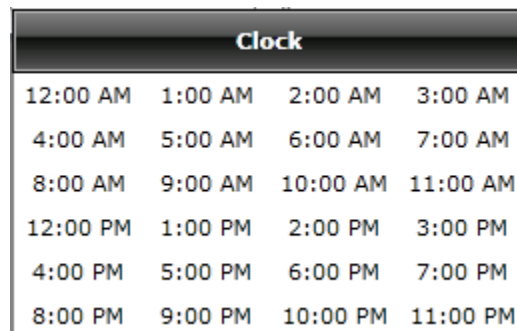


Figure 3.39 - Clock Window

- o *Offsets* - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- **Override Chart Type** - See the Chart Type description for selecting a replacement for the initially selected chart type.

3.6.3.2. Series - Data Tab

The following is a description of the settings that can be changed in the Data Tab of the Series properties.

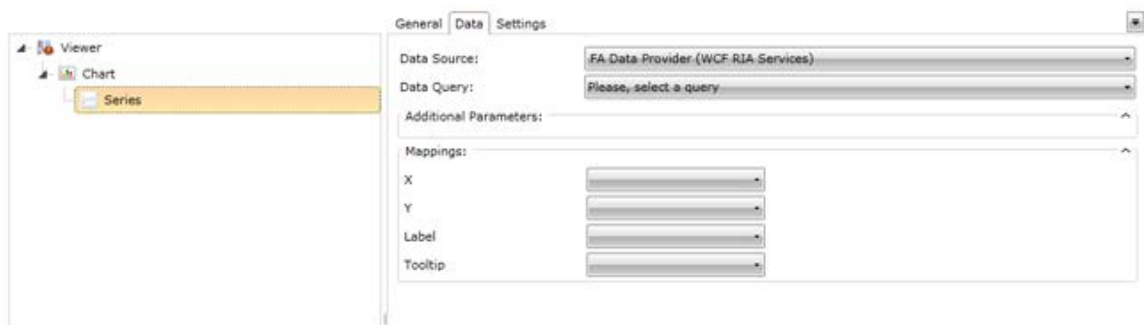


Figure 3.40 - Series - Data Tab

- **Data Source** - Use this pulldown to select the data source for what will populate the chart/series.
- **Data Query** - Use this pulldown to select your query. For instance, in the FDDWorX Silverlight Web Part viewer, you may wish to see Faults; Summary by asset; Summary by asset and fault; Distribution by asset; Distribution by fault for given asset; Distribution by asset and fault; or Latest causes.
- **Additional Parameters** - Depending on your selected Data Query, you can set additional parameters here by clicking on the downward facing arrow (⌵) at the right edge of this section.

For Faults; Summary by asset; Summary by asset and fault; Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you can decide whether or not you wish to **Include Children Assets** (by clicking on the check box).

For Faults; Summary by asset; Summary by asset and fault; Distribution by asset; and Distribution by fault for given asset data queries, you can also enter an **Asset Filter** and/or **Fault Filter** in their respective text entry fields.

For Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you also have the option of setting an **Interval Type** (Hour, Day, Week, Month, Year) via the pulldown menu.

- **Mappings** - Depending on your selected Data Query, you can set the mapping for the X-Axis, Y-Axis, Label and Tooltip.

For Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you also have the option of setting the Format for the Mappings. Click the check box to the left of "Format" to enable the pulldown menu. You can decide upon how you wish the mappings to be viewed: Standard Numeric Format Strings; Custom Numeric Format Strings; Standard Date and Time Format Strings; or Custom Date and Time Format Strings. Options include: 0.00; #,###; ##.0%; #.## 'degrees'; d; D; f; F; g; G; M; and Y.

3.6.3.3. Series - Settings Tab

The following is a description of the settings that can be changed in the Settings Tab of the Series properties.

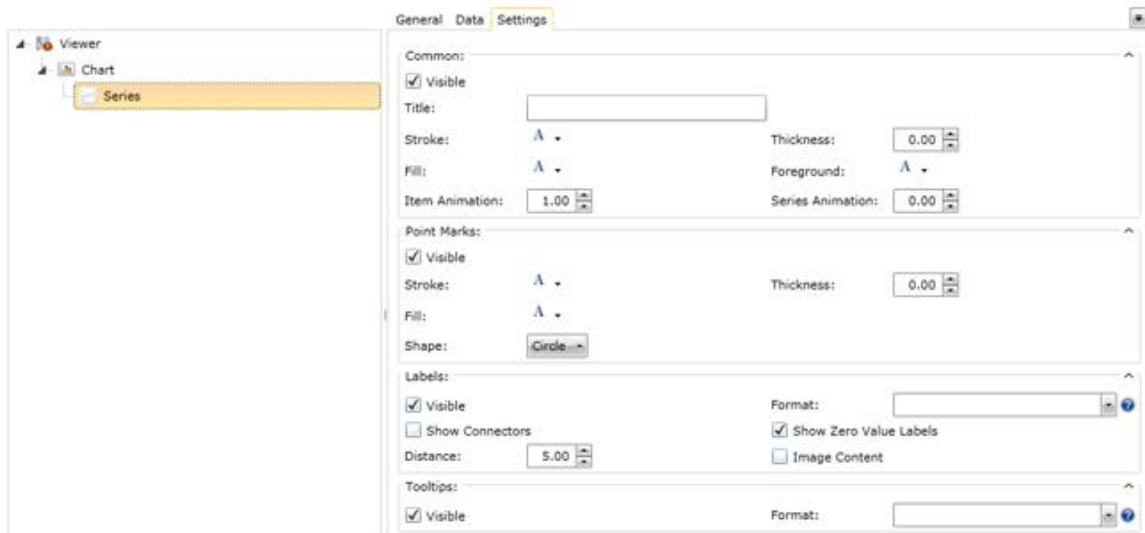


Figure 3.41 - Series - Settings Tab

Common

- **Visible** - Click this box if you want the common elements within the series to be visible.
- **Title** - Enter a title for the common elements of the series.
- **Stroke** - Click on the pulldown handle to select a color for the line included with common elements within the series. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Thickness** - Enter, or use the up and down arrows to set, the thickness of the line. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Fill** - Click on the pulldown handle to select a color for the fill included with common elements within the series. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Foreground** - Click on the pulldown handle to select a color for the foreground included with common elements within the series. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Item Animation** - Enter , or use the up and down arrows to set, the item animation rate for common items within the series.
- **Series Animation** - Enter , or use the up and down arrows to set, the item animation rate for the series itself.

Point Marks

- **Visible** - Click this box if you want point marks within the series to be visible.
- **Stroke** - Click on the pulldown handle to select a color for the point marks within the series. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Thickness** - Enter, or use the up and down arrows to set, the thickness. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Fill** - Click on the pulldown handle to select a color for the fill. Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.
- **Shape** - Use the pulldown menu to set the Point Mark shape (Circle, Diamond, Hexagon, Square, SquareRounded, StarEightRay, StarFiveRay, Triangle). Hovering the mouse over the pulldown will trigger the blue "Default" text, allowing you to make this change a default property.

Labels

- **Visible** - Click this box if you want the labels within the series to be visible.
- **Format** - You can decide upon how you wish the labels to be viewed: Standard Numeric Format Strings; Custom Numeric Format Strings; Standard Date and Time Format Strings; or Custom Date and Time Format Strings. Options include: 0.00; #,###; ###.0%; #.### 'degrees'; d; D; f; F; g; G; M; and Y.
- **Show Connectors** - Click this box to show connectors between labels.
- **Distance** - Enter, or use the up and down arrows to set, the distance for connection between labels. Hovering the mouse over the text entry field will trigger the blue "Default" text, allowing you to make this change a default property.
- **Show Zero Value Labels** - Check this box if you wish to label zero values in the series.
- **Image Content** - Check this box if you wish to include an associated image with any labels in the series.

Tooltips

- **Visible** - Click this box if you want the tooltips within the series to be visible.
- **Format** - You can decide upon how you wish the tooltips to be viewed: Standard Numeric Format Strings; Custom Numeric Format Strings; Standard Date and Time Format Strings; or Custom Date and Time Format Strings. Options include: 0.00; #,###; ###.0%; #.### 'degrees'; d; D; f; F; g; G; M; and Y.

3.7. Add a Grid

To Add a Grid:

1. Right-click on your selected Viewer in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "Add Grid", as shown below.

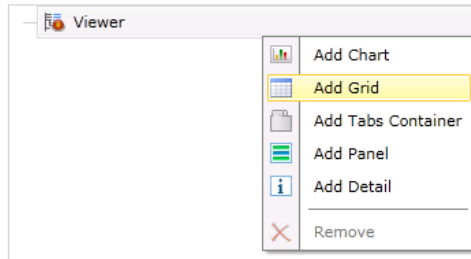


Figure 3.42 - Add Grid

2. This adds a "Grid" branch to the project explorer as well as opens the grid properties in the right side of the FDDWorX Silverlight Web Part. These properties are split between the General, Data and Appearance tabs.



Figure 3.43 - Grid Properties

3.7.1. Grid - General Tab

The following is a description of the settings that can be changed in the General Tab of the Grid properties.

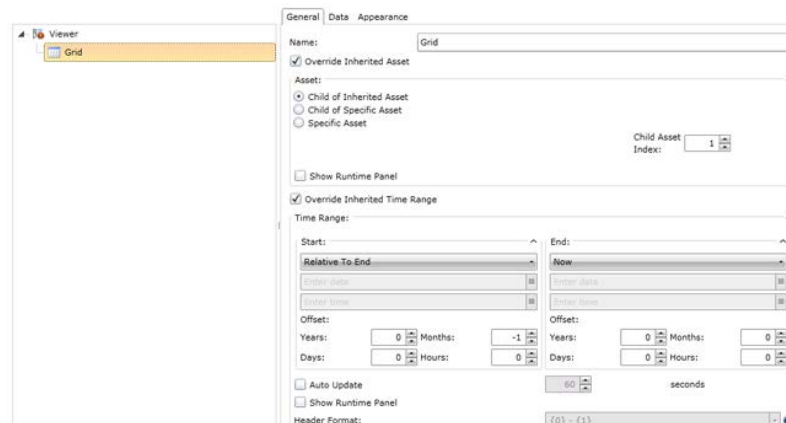


Figure 3.44 - Grid - General Tab Properties

- **Name** - You can enter the name of the grid here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.



Figure 3.45 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.



Figure 3.46 - Specific Asset Settings

- o *Show Runtime Panel* -
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset** and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the  buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown in the following figure.



Figure 3.47 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

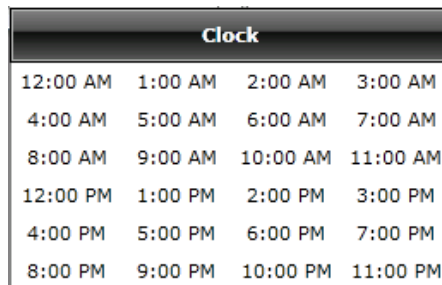


Figure 3.48 - Clock Window

- o *Offsets* - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o *Show Runtime Panel* - Clicking this check box allows you to edit the Header Format setting below.
- o *Header Format* - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

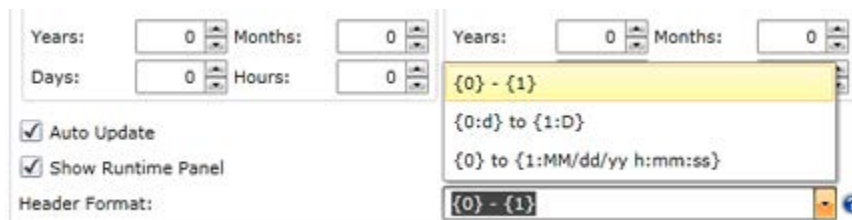


Figure 3.49 - Header Format Settings

3.7.2. Grid - Data Tab

The following is a description of the settings that can be changed in the Data Tab of the Grid properties.

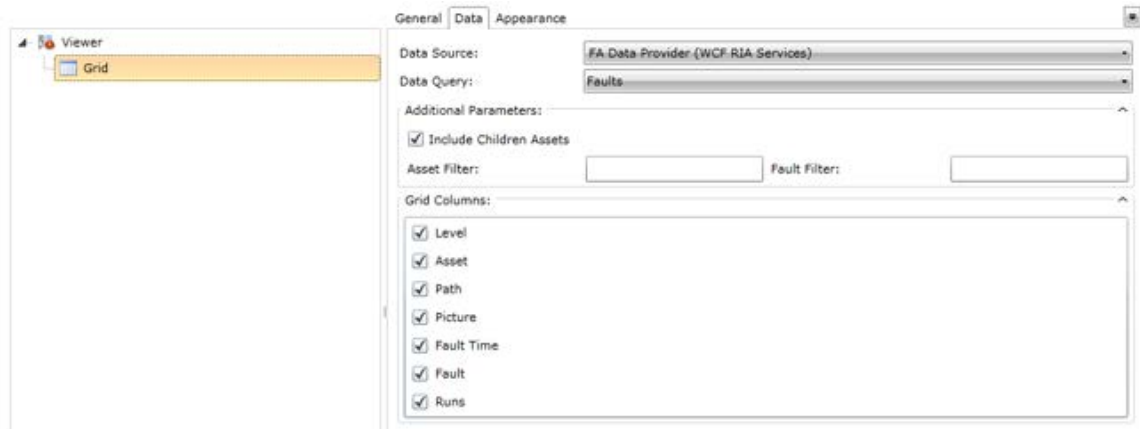


Figure 3.50 - Grid - Data Tab Properties

- **Data Source** - Use this pulldown to select the data source for what will populate the grid.
- **Data Query** - Use this pulldown to select your query. For instance, in the FDDWorX Silverlight Web Part viewer, you may wish to see Faults; Summary by asset; Summary by asset and fault; Distribution by asset; Distribution by fault for given asset; Distribution by asset and fault; or Latest causes.
- **Additional Parameters** - Depending on your selected Data Query, you can set additional parameters here by clicking on the downward facing arrow (▼) at the right edge of this section.

For Faults; Summary by asset; Summary by asset and fault; Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you can decide whether or not you wish to **Include Children Assets** (by clicking on the check box).

For Faults; Summary by asset; Summary by asset and fault; Distribution by asset; and Distribution by fault for given asset data queries, you can also enter an **Asset Filter** and/or **Fault Filter** in their respective text entry fields.

For Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you also have the option of setting an **Interval Type** (Hour, Day, Week, Month, Year) via the pulldown menu.

- **Grid Columns** - Depending on your selected Data Query, you will be able to select which grid columns you wish to display. For instance, should you select a "Distribution by fault for given asset" data query, you can select from Level, Asset, Path, Picture, Fault, Start, End, Interval or Faults as potential Grid Columns, while, in contrast, for the "Latest causes" query, you can only select whether to use Rank or Text.

3.7.3. Grid - Appearance Tab

The following is a description of the settings that can be changed in the Appearance Tab of the Grid properties.

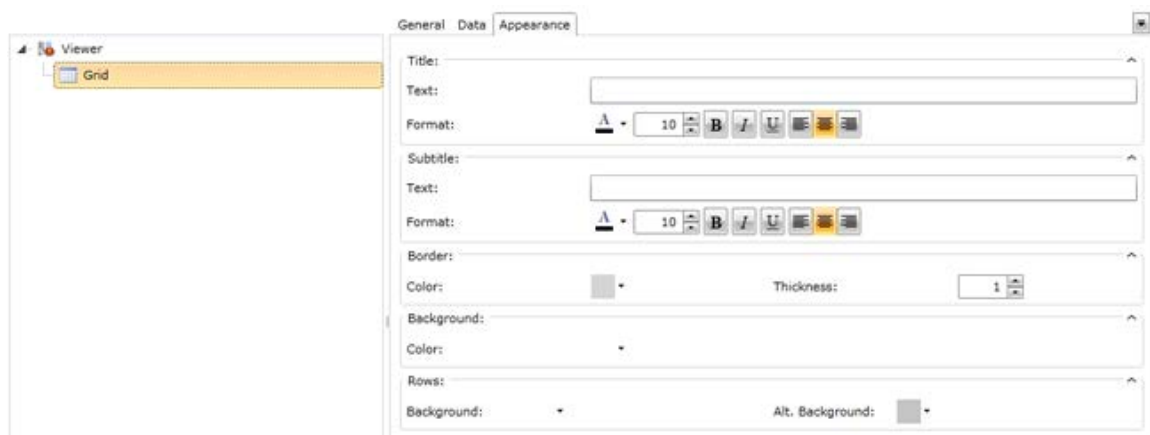


Figure 3.51 - Grid - Appearance Tab Properties

- **Title - Text and Format** - Enter a name for the Grid that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Subtitle - Text and Format** - Enter a subtitle for the Grid that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the grid. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the grid.
- **Rows** - Click on the "Background" pulldown handle to select a color for the background of rows in the grid. Click on the "Alt. Background" pulldown handle to select the color for the background of alternating rows within the grid.

3.8. Add Row Detail

To Add a Row Detail:

1. Right-click on your selected Grid in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "Add Row Detail", as shown below.

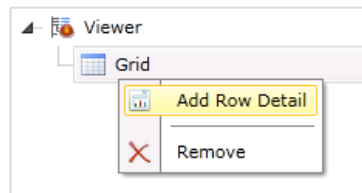


Figure 3.52 - Add Row Detail

2. This adds a "Row Detail" branch to the project explorer (beneath the grid) as well as opens the row detail properties in the right side of the Facility AnalytiX Silverlight Web Part. These properties are split between the General and Appearance tabs.

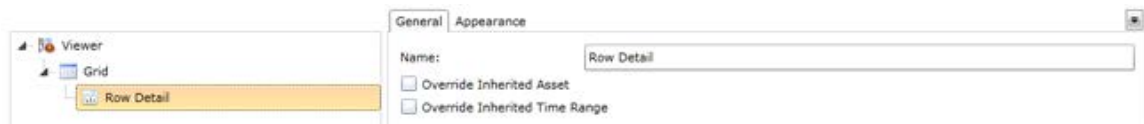


Figure 3.53 - Row Detail Properties

3.8.1. Row Detail - General Tab

The following is a description of the settings that can be changed in the General Tab of the Row Detail properties.

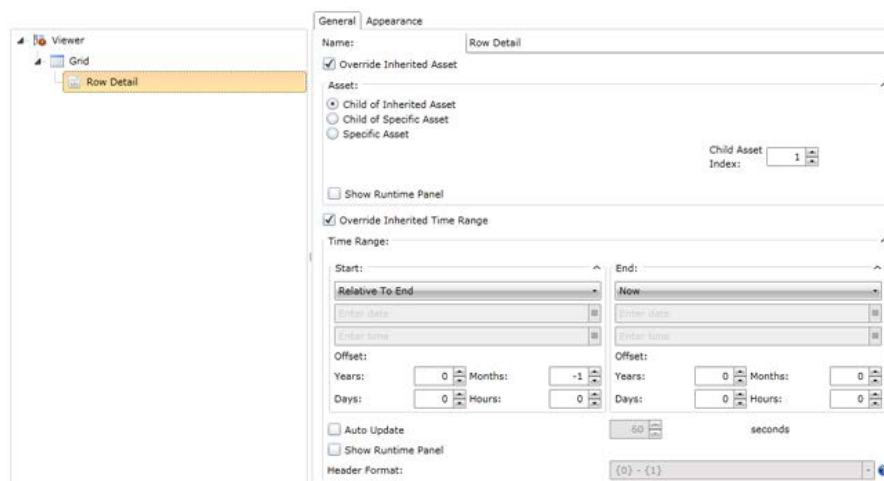


Figure 3.54 - Row Detail - General Tab Properties

- **Name** - You can enter the name of the row detail here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.



Figure 3.55 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.



Figure 3.56 - Specific Asset Settings

- o Show Runtime Panel
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset** and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the  buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown in the following image.

July - 2012							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.57 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

Clock			
12:00 AM	1:00 AM	2:00 AM	3:00 AM
4:00 AM	5:00 AM	6:00 AM	7:00 AM
8:00 AM	9:00 AM	10:00 AM	11:00 AM
12:00 PM	1:00 PM	2:00 PM	3:00 PM
4:00 PM	5:00 PM	6:00 PM	7:00 PM
8:00 PM	9:00 PM	10:00 PM	11:00 PM

Figure 3.58 - Clock Window

- o *Offsets* - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o *Show Runtime Panel* - Clicking this check box allows you to edit the Header Format setting below.
- o *Header Format* - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

Figure 3.59 - Header Format Settings

3.8.2. Row Detail - Appearance Tab

The following is a description of the settings that can be changed in the Appearance Tab of the Row Detail properties.

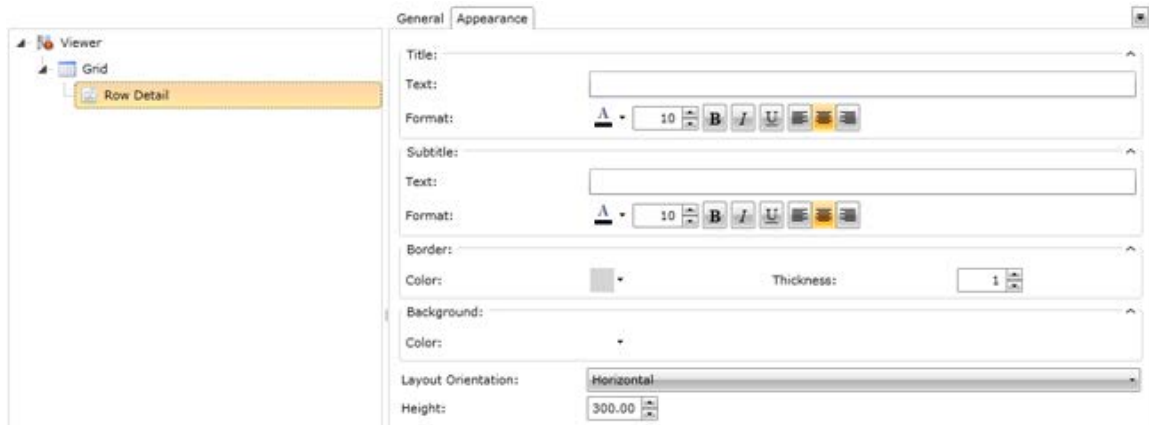


Figure 3.60 - Row Detail - Appearance Tab Properties

- **Title - Text and Format** - Enter a name for the Row Detail that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Subtitle - Text and Format** - Enter a subtitle for the Row Detail that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the Row Detail. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the Row Detail.
- **Layout Orientation** - Use the pulldown menu to select either a Horizontal or Vertical orientation for the Row Detail.
- **Height** - Enter, or use the up and down arrows to set, a height for the Row Detail.

3.9. Add Viewer Elements to a Row Detail

To Add Viewer Elements to a Row Detail:

1. Right-click on your selected Row Detail in the left-sided pane of the FDDWorX Silverlight Web Part, then click on:

"Add Chart" or

"Add Grid" or

"Add Tabs Container" or

"Add Panel" or

"Add Detail", as shown below.

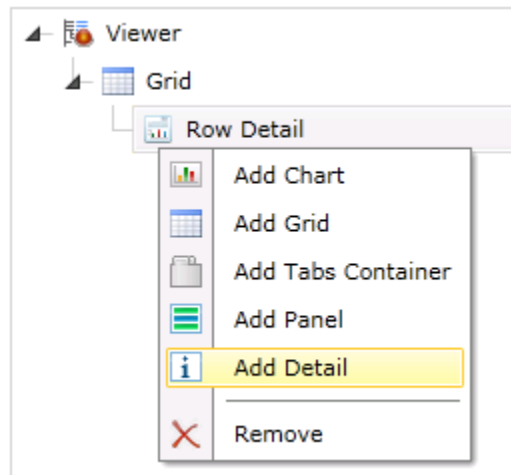


Figure 3.61 - Add Viewer Elements to a Row Detail

3.10. Add Tabs Container and Tabs

You can add tabs to a viewer. Before you can add tabs, you must first add a tabs container, as described here.

To Add a Tabs Container:

1. Right-click on your selected Viewer in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "Add Tabs Container", as shown below.

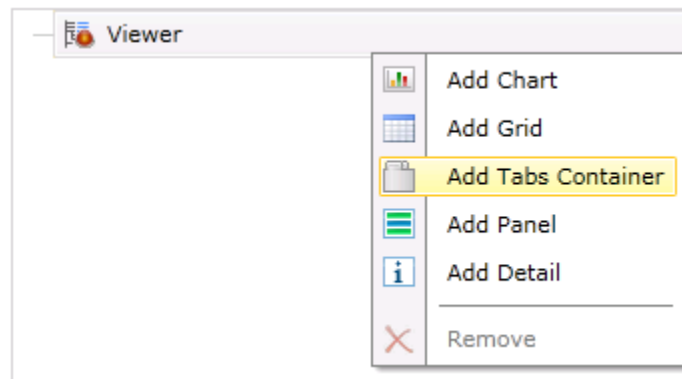


Figure 3.62 - Add Tabs Container

2. This adds a "TabContainer" branch to the project explorer as well as opens the tabs container properties in the right side of the FDDWorX Silverlight Web Part. These properties are split between the General and Appearance tabs.



Figure 3.63 - TabContainer Properties

3.10.1. TabContainer - General Tab

The following is a description of the settings that can be changed in the General Tab of the TabContainer properties.

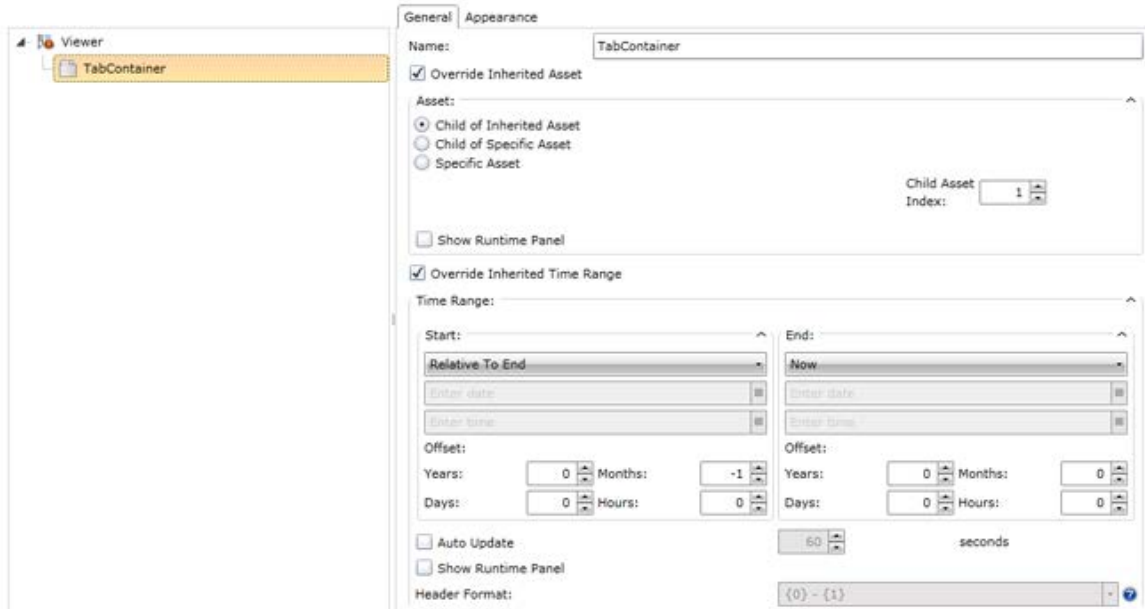


Figure 3.64 - TabContainer - General Tab Properties

- **Name** - You can enter the name of the tabs container here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.



Figure 3.65 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.

Figure 3.66 - Specific Asset Settings

- o *Show Runtime Panel* -
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset** and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below.

July - 2012							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.67 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

Clock			
12:00 AM	1:00 AM	2:00 AM	3:00 AM
4:00 AM	5:00 AM	6:00 AM	7:00 AM
8:00 AM	9:00 AM	10:00 AM	11:00 AM
12:00 PM	1:00 PM	2:00 PM	3:00 PM
4:00 PM	5:00 PM	6:00 PM	7:00 PM
8:00 PM	9:00 PM	10:00 PM	11:00 PM

Figure 3.68 - Clock Window

- o **Offsets** - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o **Auto Update** - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o **Show Runtime Panel** - Clicking this check box allows you to edit the Header Format setting below.
- o **Header Format** - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

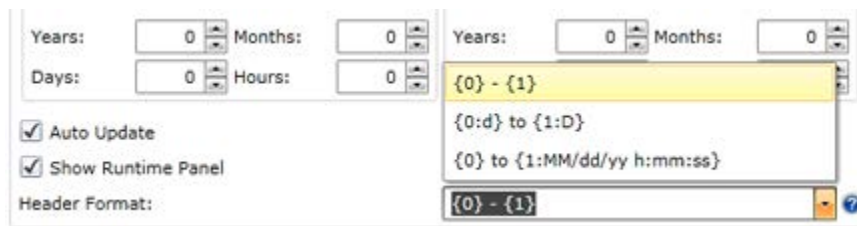


Figure 3.69 - Header Format Settings

3.10.2. TabContainer - Appearance Tab

The following is a description of the settings that can be changed in the Appearance Tab of the TabContainer properties.



Figure 3.70 - TabContainer - Appearance Tab Properties

- **Title - Text and Format** - Enter a name for the TabContainer that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Subtitle - Text and Format** - Enter a subtitle for the TabContainer that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.

- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the tab container. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the tab container.

3.11. Add a Tab

You can add tabs to a tab container in the viewer.

To Add a Tab:

1. Right-click on your selected TabContainer in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "**Add Tab**", as shown below.

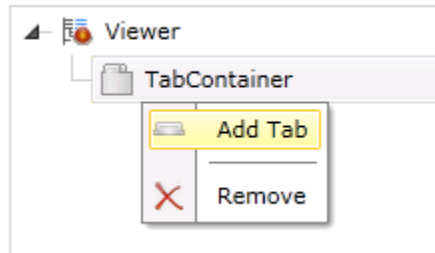


Figure 3.71 - Add Tab

2. This adds a "Tab" branch to the project explorer (beneath the tab container) as well as opens the tab properties in the right side of the FDDWorX Silverlight Web Part. These properties are split between the General and Appearance tabs.



Figure 3.72 - Tab Properties

3.11.1. Tab - General Tab

The following is a description of the settings that can be changed in the General Tab of the Tab properties.

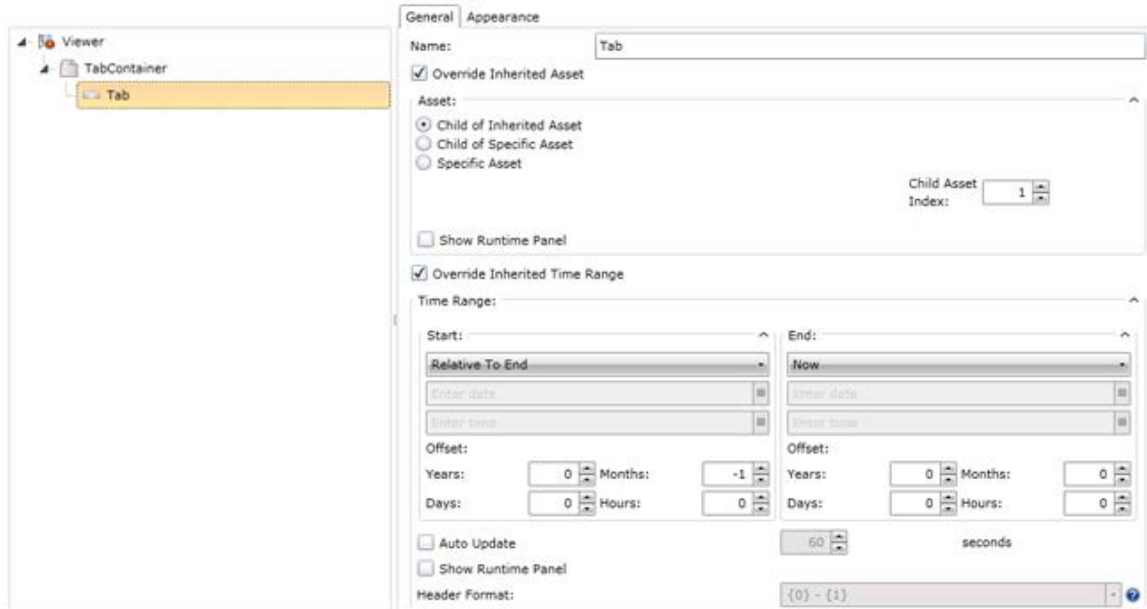


Figure 3.73 - Tab - General Tab Properties

- **Name** - You can enter the name of the tab here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown below.



Figure 3.74 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.

Figure 3.75 - Specific Asset Settings

- o *Show Runtime Panel*
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset** and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the  buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below.

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.76 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

Clock	
12:00 AM	1:00 AM
4:00 AM	5:00 AM
8:00 AM	9:00 AM
12:00 PM	1:00 PM
4:00 PM	5:00 PM
8:00 PM	9:00 PM
	10:00 PM
	11:00 PM

Figure 3.77 - Clock Window

- o Offsets - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o *Show Runtime Panel* - Clicking this check box allows you to edit the Header Format setting below.
- o *Header Format* - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

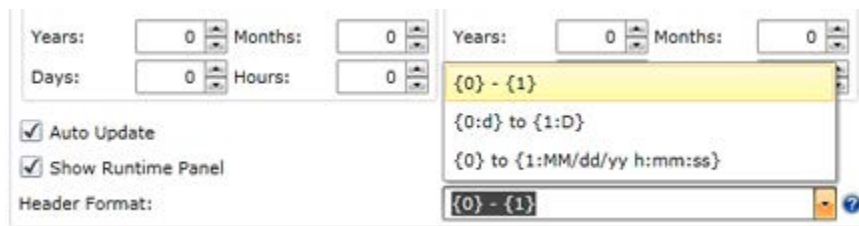


Figure 3.78 - Header Format Settings

3.11.2. Tab - Appearance Tab

The following is a description of the settings that can be changed in the Appearance Tab of the Tab properties.

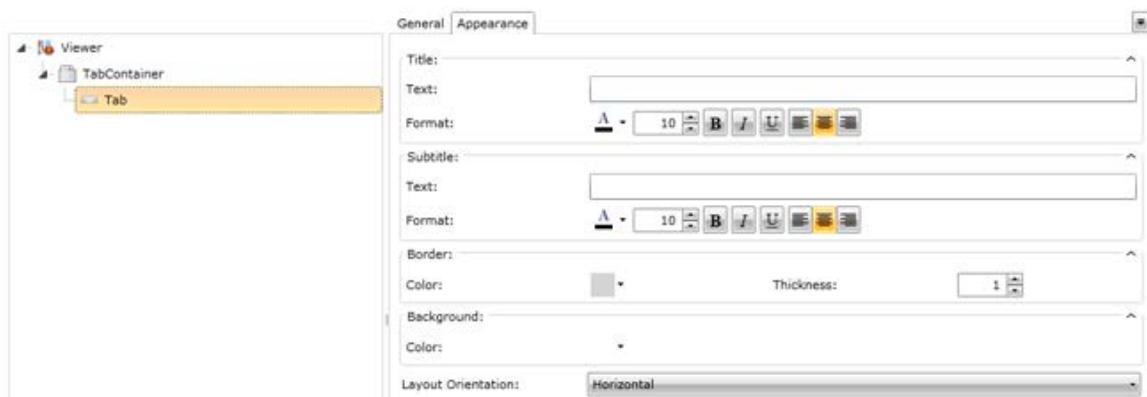


Figure 3.79 - Tab - Appearance Tab Properties

- **Title - Text and Format** - Enter a name for the Tab that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.

- **Subtitle - Text and Format** - Enter a subtitle for the Tab that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the Tab. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the Tab.
- **Layout Orientation** - Use the pulldown menu to select either a Horizontal or Vertical orientation for the Tab.

3.12. Add Viewer Elements to a Tab

To Add Viewer Elements to a Tab:

1. Right-click on your selected Panel in the left-sided pane of the FDDWorX Silverlight Web Part, then click on:

"Add Chart" or

"Add Grid" or

"Add Tabs Container" or

"Add Panel" or

"Add Detail", as shown below.

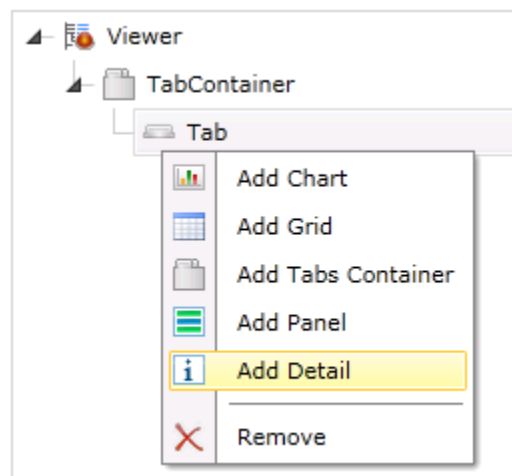


Figure 3.80 - Add Viewer Elements to a Tab

3.13. Add Panel

To Add a Panel:

1. Right-click on your selected Viewer in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "**Add Panel**", as shown below.

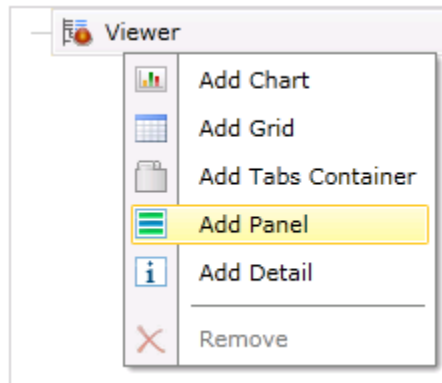


Figure 3.81 - Add Panel

2. This adds a "Panel" branch to the project explorer as well as opens the panel properties in the right side of the FDDWorX Silverlight Web Part. These properties are split between the **General** and **Appearance** tabs.



Figure 3.82 - Panel Properties

3.13.1. Panel - General Tab

The following is a description of the settings that can be changed in the General Tab of the Panel properties.

Figure 3.83 - Panel - General Tab Properties

- **Name** - You can enter the name of the panel here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown in the following figure.

Figure 3.84 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.

Figure 3.85 - Specific Asset Settings

- o *Show Runtime Panel*
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
 - o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset**, and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the [] buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below.

July - 2012							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.86 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown in the following figure.

Clock			
12:00 AM	1:00 AM	2:00 AM	3:00 AM
4:00 AM	5:00 AM	6:00 AM	7:00 AM
8:00 AM	9:00 AM	10:00 AM	11:00 AM
12:00 PM	1:00 PM	2:00 PM	3:00 PM
4:00 PM	5:00 PM	6:00 PM	7:00 PM
8:00 PM	9:00 PM	10:00 PM	11:00 PM

Figure 3.87 - Clock Window

- o **Offsets** - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o **Auto Update** - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o **Show Runtime Panel** - Clicking this check box allows you to edit the Header Format setting below.
- o **Header Format** - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

Figure 3.88 - Header Format Settings

3.13.2. Panel - Appearance Tab

The following is a description of the settings that can be changed in the Appearance Tab of the Panel properties.

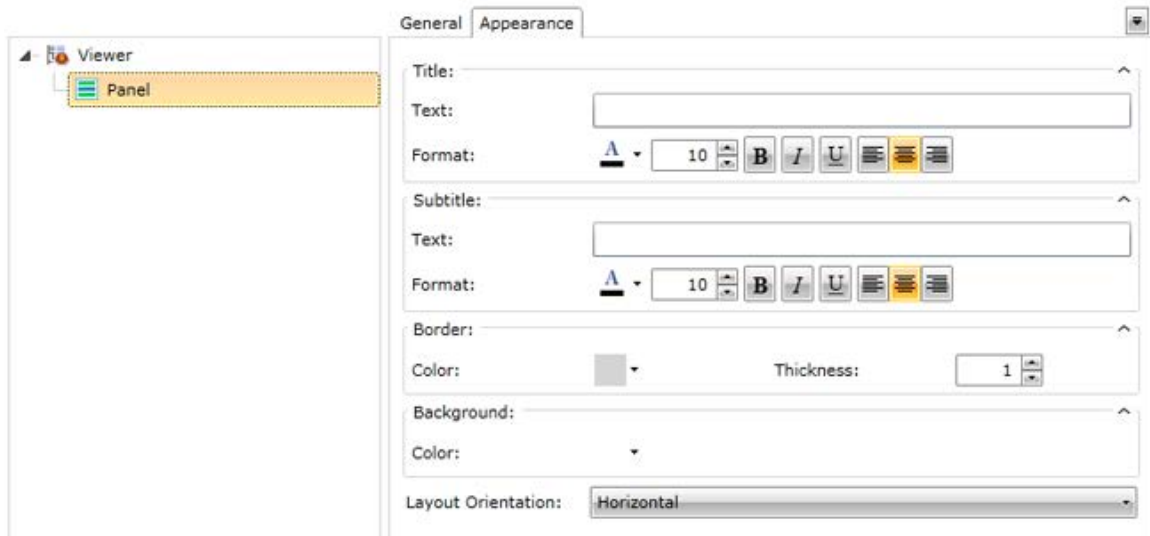


Figure 3.89 - Panel - Appearance Tab Properties

- **Title - Text and Format** - Enter a name for the Panel that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Subtitle - Text and Format** - Enter a subtitle for the Panel that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the Panel. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the Panel.
- **Layout Orientation** - Use the pulldown menu to select either a Horizontal or Vertical orientation for the Panel.

3.13.3. *Add Viewer Elements to a Panel*

To Add Viewer Elements to a Panel:

1. Right-click on your selected Panel in the left-sided pane of the FDDWorX Silverlight Web Part, then click on:

"Add Chart" or

"Add Grid" or

"Add Tabs Container" or

"Add Panel" or

"Add Detail", as shown below.

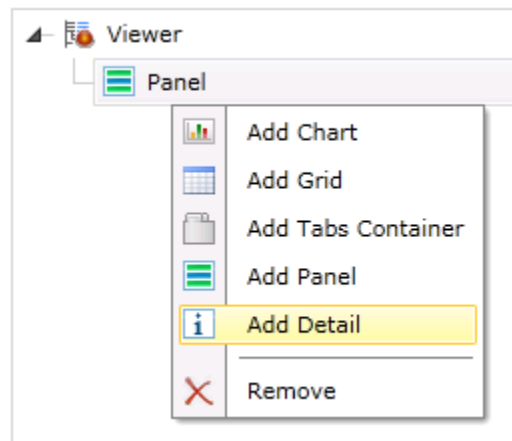


Figure 3.90 - Add Viewer Elements to a Panel

3.14. Add Detail

To Add a Detail:

1. Right-click on your selected Viewer in the left-sided pane of the FDDWorX Silverlight Web Part, then click on "**Add Detail**", as shown below. You can also add Details to Row Details, Tabs and Panels.

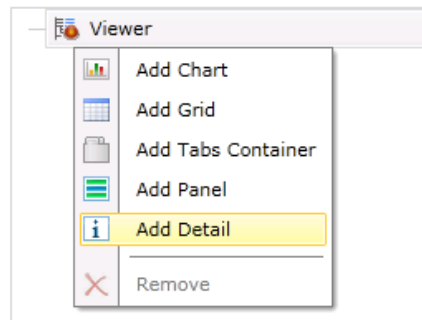


Figure 3.91 - Add Detail

2. This adds an "Asset Detail" branch to the project explorer as well as opens the detail properties in the right side of the Facility AnalytiX Silverlight Web Part. These properties are split between the General, Data, and Appearance tabs.



Figure 3.92 - Detail Properties

3.14.1. Detail - General Tab

The following is a description of the settings that can be changed in the General Tab of the Detail properties.

Figure 3.93 - Detail - General Tab Properties

- **Name** - You can enter the name of the detail here.
- **Override Inherited Asset** - Click this check box to override inherited assets from your designated data source. You will then have the option of overriding with a:
 - o *Child of Inherited Asset* - If selected, you will be able to set the Child Asset Index, located at the right side of the window (as shown in the image above), to select the branch level of the asset child that you would like to override the inherited asset.
 - o *Child of Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset whose child you wish to use to override the inherited asset, while also setting the Child Asset Index, as shown in the following figure.

Figure 3.94 - 'Child of Specific Asset' Settings

- o *Specific Asset* - If selected, you will be able to use a pulldown menu to select the specific asset to override the inherited asset.

Figure 3.95 - Specific Asset Settings

- o *Show Runtime Panel*
- **Override Inherited Time Range** - Click this check box to override inherited time/date ranges from your designated data source. You will then have the option of overriding with new time and date info.
- o *Start and End* - Using the pulldown menus, you're able to select options including **Now**, **Inherited**, **Relative to End**, **Preset**, and **Custom**. Depending on the pulldown selection, you can also enter in new date/time information or use the [] buttons. The button to the right of the date entry field brings up a monthly calendar for date selection, as shown below.

July - 2012							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	1	2	3	4	5	6	7
28	8	9	10	11	12	13	14
29	15	16	17	18	19	20	21
30	22	23	24	25	26	27	28
31	29	30	31	1	2	3	4
32	5	6	7	8	9	10	11

Figure 3.96 - Monthly Calendar

The button to the right of the time entry field brings up a clock window for time selection, as shown below.

Clock			
12:00 AM	1:00 AM	2:00 AM	3:00 AM
4:00 AM	5:00 AM	6:00 AM	7:00 AM
8:00 AM	9:00 AM	10:00 AM	11:00 AM
12:00 PM	1:00 PM	2:00 PM	3:00 PM
4:00 PM	5:00 PM	6:00 PM	7:00 PM
8:00 PM	9:00 PM	10:00 PM	11:00 PM

Figure 3.97 - Clock Window

- o Offsets - Beneath the Start and End date and time fields, you can offset the entered info by Years, Months, Days or Hours.
- o *Auto Update* - Clicking this check box allows you to set the time to automatically update the date/time-related data.
- o *Show Runtime Panel* - Clicking this check box allows you to edit the Header Format setting below.
- o *Header Format* - The pulldown menu, as shown below, allows you to set the header format to include date and time information as one of the following:
 - {0} - {1}
 - {0:d} to {1:D}
 - {0} to {1:MM/dd/yy h:mm:ss}

Figure 3.98 - Header Format Settings

3.14.2. Detail - Data Tab

The following is a description of the settings that can be changed in the Data Tab of the Detail properties.

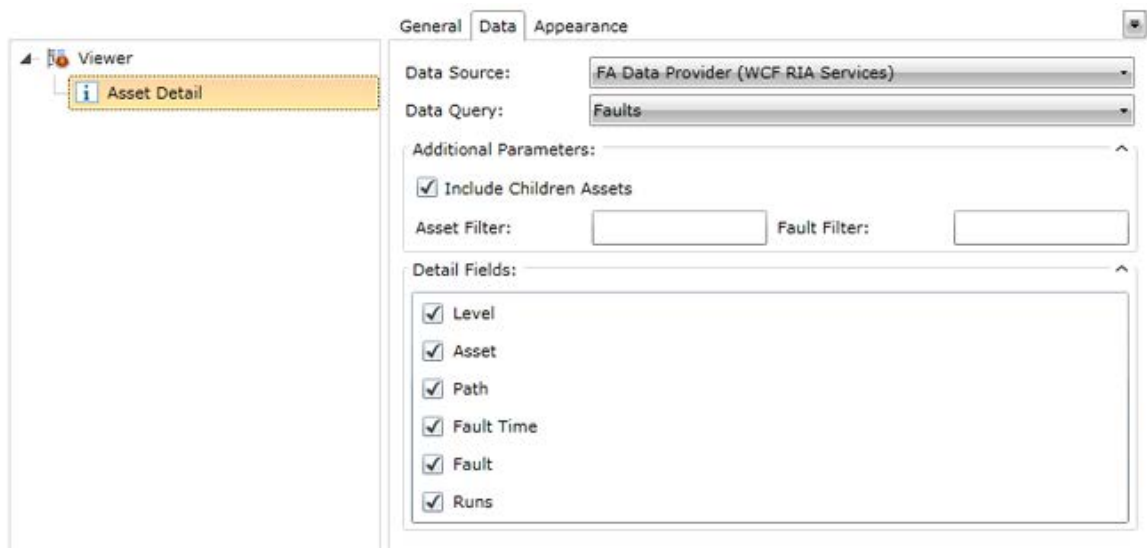


Figure 3.99 - Detail - Data Tab Properties

- **Data Source** - Use this pulldown to select the data source for what will populate the detail.
- **Data Query** - Use this pulldown to select your query. For instance, in the FDDWorX Silverlight Web Part viewer, you may wish to see Faults; Summary by asset; Summary by asset and fault; Distribution by asset; Distribution by fault for given asset; Distribution by asset and fault; or Latest causes.
- **Additional Parameters** - Depending on your selected Data Query, you can set additional parameters here by clicking on the downward facing arrow (⌵) at the right edge of this section.

For Faults; Summary by asset; Summary by asset and fault; Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you can decide whether or not you wish to **Include Children Assets** (by clicking on the check box).

For Faults; Summary by asset; Summary by asset and fault; Distribution by asset; and Distribution by fault for given asset data queries, you can also enter an **Asset Filter** and/or **Fault Filter** in their respective text entry fields.

For Distribution by asset; Distribution by fault for given asset; and Distribution by asset and fault data queries, you also have the option of setting an **Interval Type** (Hour, Day, Week, Month, Year) via the pulldown menu.

3.14.3. *Detail - Appearance Tab*

The following is a description of the settings that can be changed in the Appearance Tab of the Detail properties.

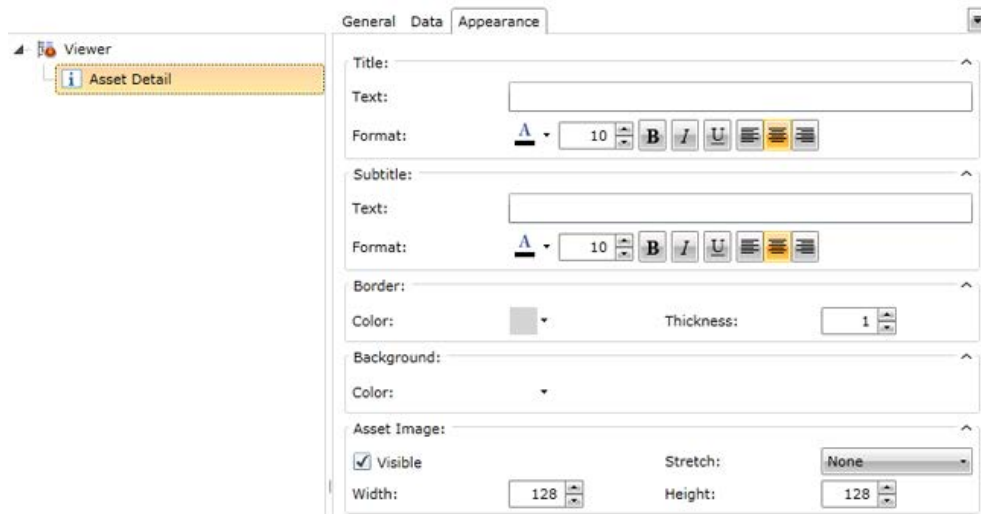


Figure 3.100 - Detail -Appearance Tab Properties

- **Title - Text and Format** - Enter a name for the Detail that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Subtitle - Text and Format** - Enter a subtitle for the Detail that will appear in runtime. You can also set the color, font size, style and justification of your entered text here.
- **Border - Color and Thickness** - Click on the pulldown handle to select a color for the border that will surround the detail. Enter (or use the up and down arrows) to set its thickness.
- **Background** - Click on the pulldown handle to select a color for the background to be used behind the detail.
- **Asset Image**
 - o **Visible** - Click the check box if you wish to show a related image to the Detail in runtime.
 - o **Stretch** - Use the pulldown to select how you would like the asset image to appear: Fill, Uniform or Uniform to Fill.
 - o **Width** - Enter, or use the up and down arrows to set, a desired width for the asset image.
 - o **Height** - Enter, or use the up and down arrows to set, a desired width for the asset image.

3.15. Adding the FDDWorX Web Part in SharePoint 2010

The following are initial steps to add ICONICS' Facility AnalytiX Web Part within Microsoft SharePoint 2010. There may also be a script to perform these actions automatically. Please review the additional documentation (ReadMes, Application Notes, etc.) accompanying this product for further info.

To Add the FDDWorX Web Part in SharePoint 2010

1. Open a SharePoint 2010 Central Administration page. Create a new site by clicking on "**Manage web applications**" as highlighted below.

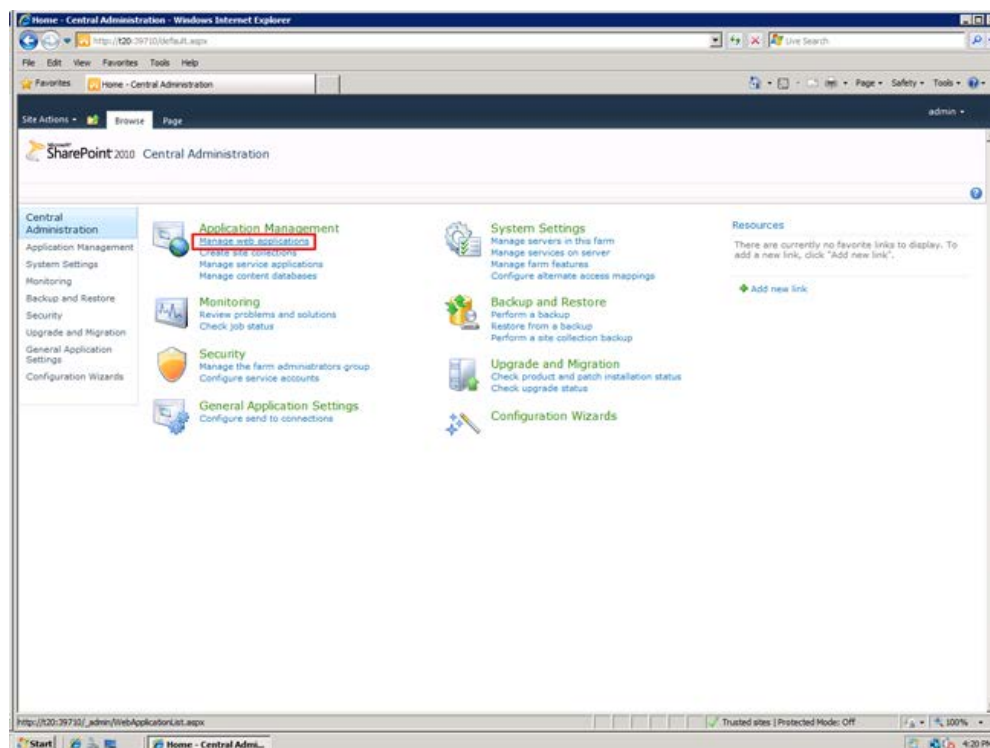


Figure 3.101 - Creating a New Site in SharePoint 2010

Next, click on the "New" button within the Web Applications ribbon (as shown in the following image).

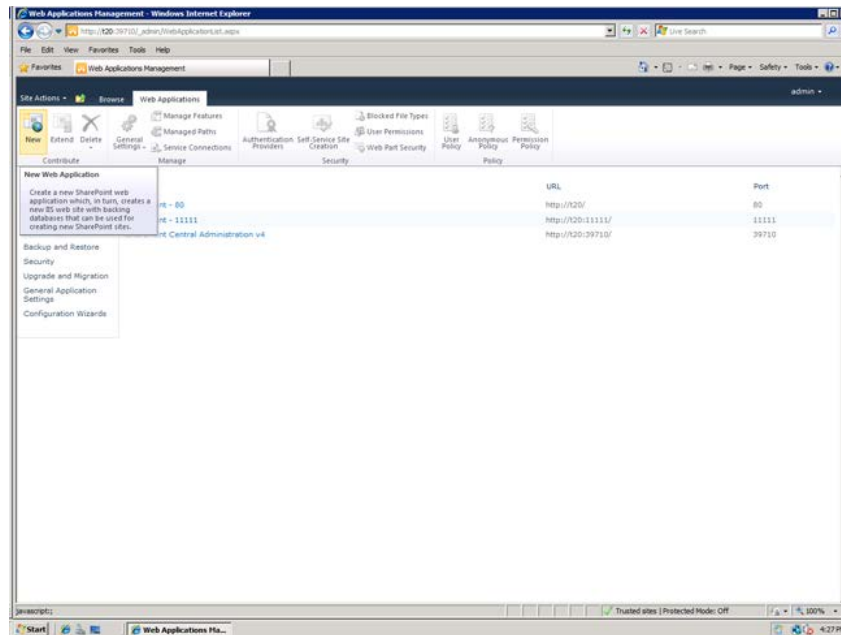


Figure 3.102 - Clicking on the 'New' Button within the Web Applications Ribbon

NOTE: Once you have completed the settings for the new site, be sure you also click on Create Site Collections (Click on "**Central Administration**", then "**Create site collections**").

2. Start SharePoint 2010 Administration Service from the Services console (Start Menu > Administrative Tools > Services).

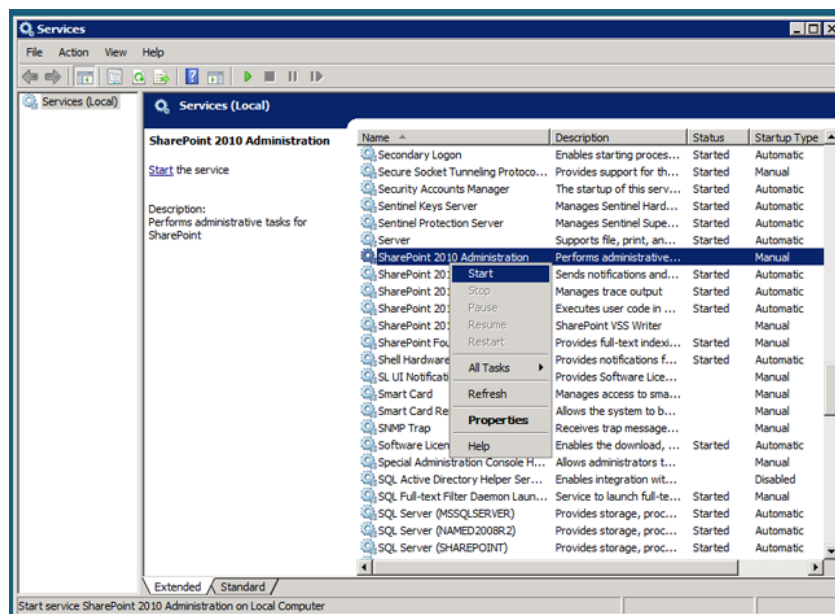


Figure 3.103 - Starting SharePoint 2010 Administration Service

3. Run **SharePoint 2010 Management Shell** (C:\ProgramData\Microsoft\Windows\Start Menu\Programs\Microsoft SharePoint 2010 Products\SharePoint 2010 Management Shell) as Administrator.

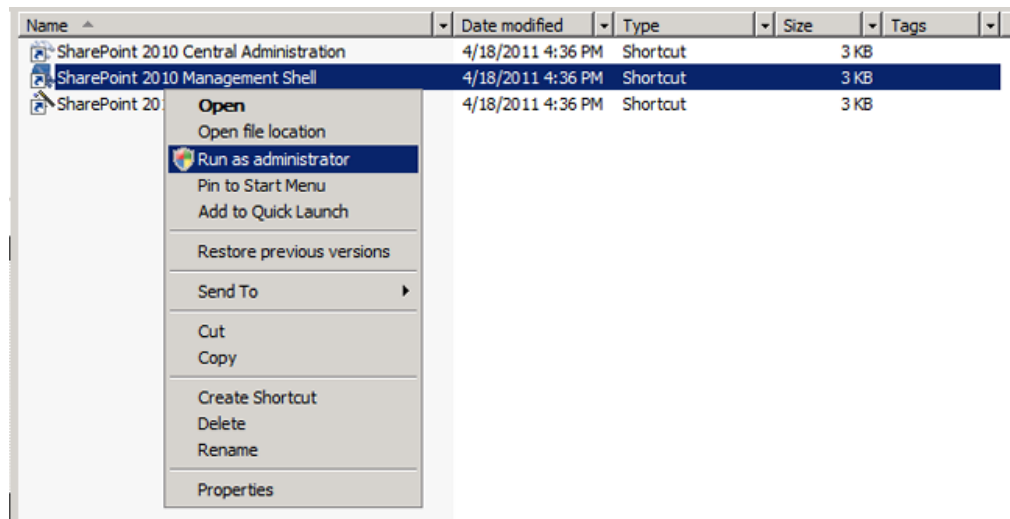


Figure 3.104 - Running SharePoint 2010 Management Shell as Administrator

4. In the SharePoint 2010 Management Shell (that you are running as administrator), type the following:
stsadm -o addsolution -filename "C:\Program Files\ICONICS\GENESIS64\WorkbenchSL\IcoWebParts.wsp"

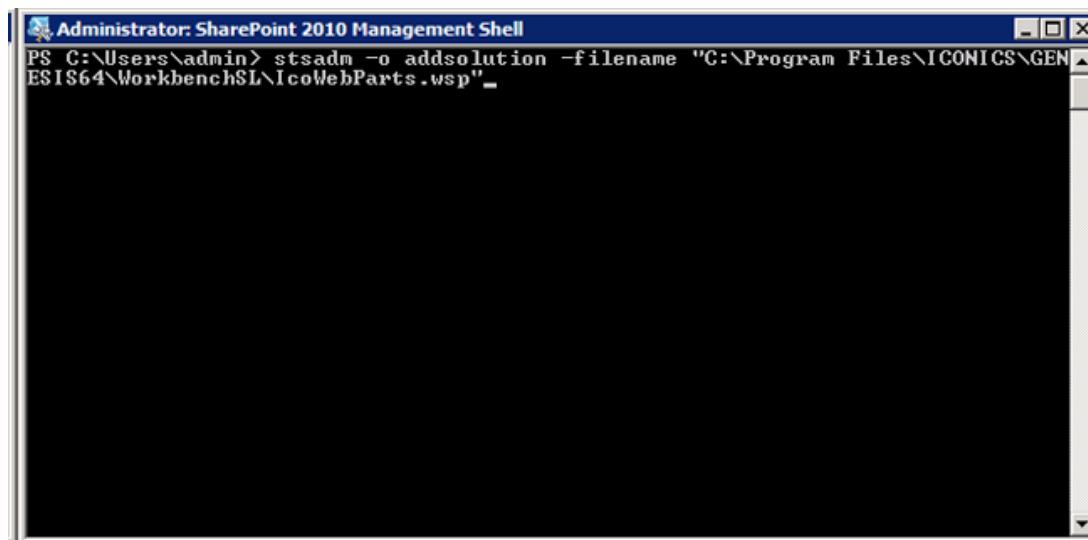


Figure 3.105 - Typing in the SharePoint 2010 Management Shell

- Returning to the SharePoint 2010 Central Administration page, click on "**System Settings**". This will open a new window. Next, click on "**Manage farm solutions**", as highlighted below.

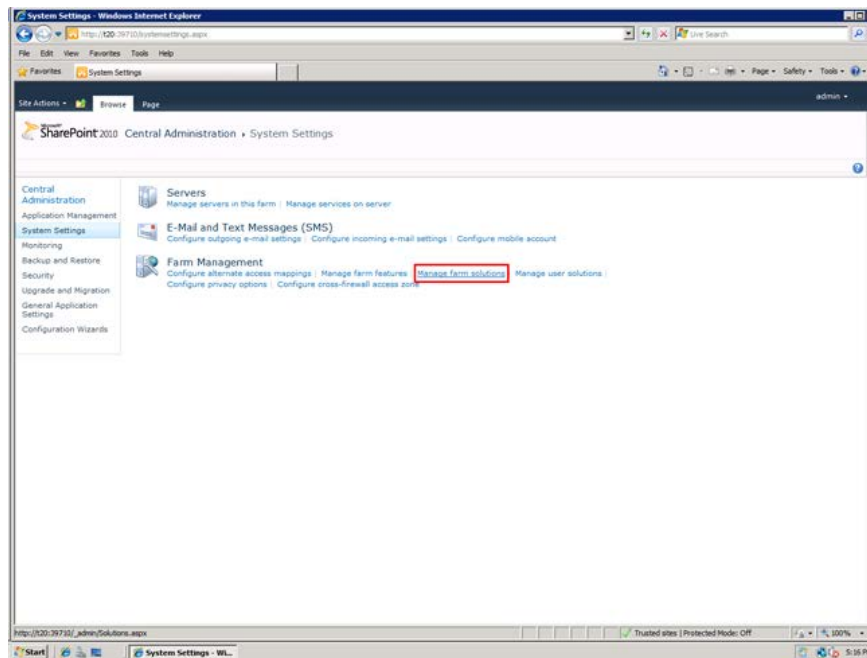


Figure 3.106 - Selecting 'Managing Farm Solutions' within SharePoint 2010 Central Administration

- Click on the solution and then on "**Deploy solution**", as highlighted below. The remaining settings should be kept as default. Exit SharePoint 2010 Central Administration normally.

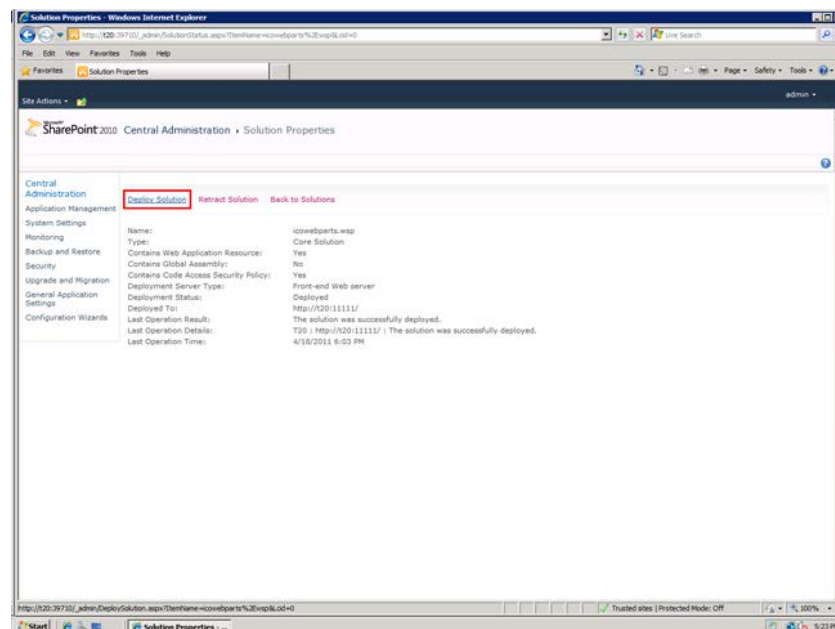


Figure 3.107 - Deploying the icowebsparts.wsp Solution in SharePoint 2010 Central Administration

7. Launch your selected browser, then open the created portal. In the example we've been using, that would be http://t20:11111.
8. Once your main portal page is open, click on "**Site Actions**" in the top left corner and then on "**Site Settings**". A new page will open. Click on "**Site Collection Features**" under the "Site Collection Administration" section, as highlighted below. This will open another new page.

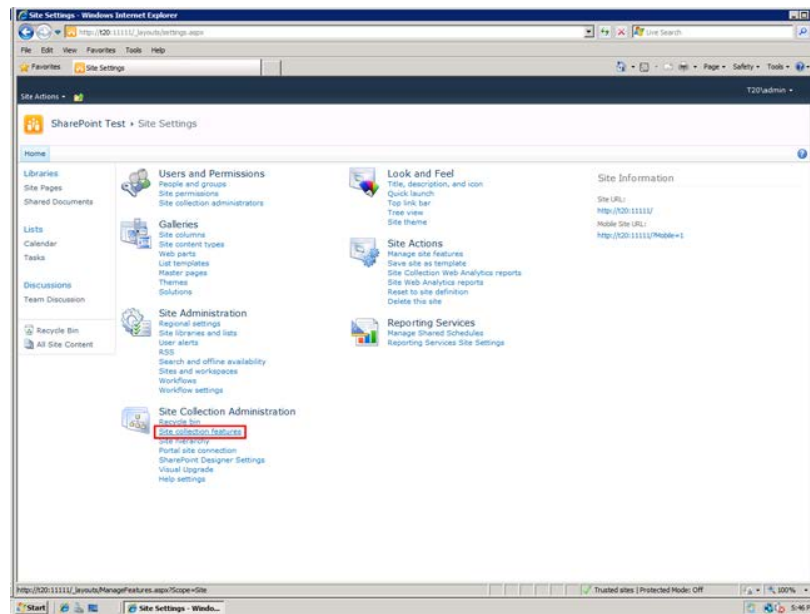


Figure 3.108 - Site Collection Features in Site Settings

9. Click on the "**Activate**" button to the right of "ICONICS Silverlight Web Parts", as highlighted below.

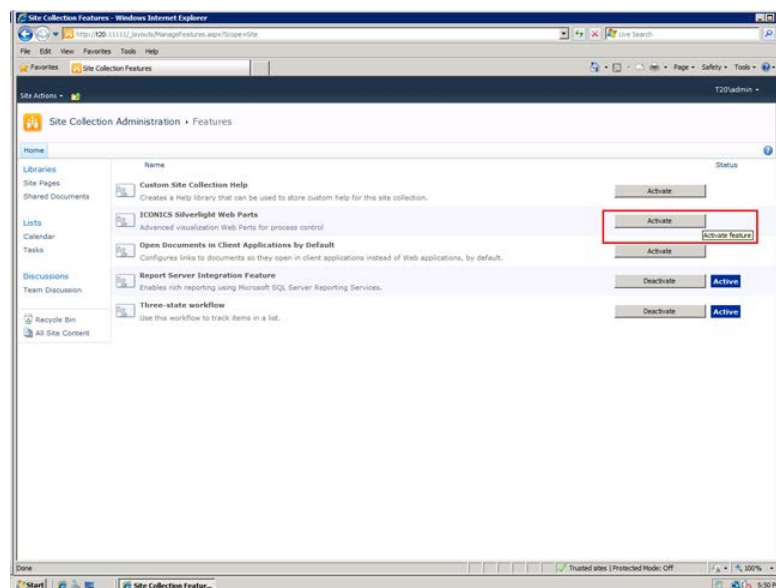


Figure 3.109 - Activating ICONICS Silverlight Web Parts

10. Add a Web Part to your site. From your site's Home page, click on "**Page**" in the top left navigation tools, then click on the "**Edit**" button in the top ribbon, then on the yellow "**Insert**" tab (under the newly appeared orange "Editing Tools" section in the top left navigation tools), then on "**Web Part**".

NOTE: It may take a few minutes for the Web Part button to be functional (no longer greyed out) in the ribbon at the top of the page. If this does not occur, be sure to make sure you have correctly performed the above steps up to this point.

Click on "**ICONICS**" in the Categories list in the left-side navigation pane, then on "**FDDWorX Silverlight Web Part**" in the Web Parts list, then click on the "**Add**" button on the right side of the screen.

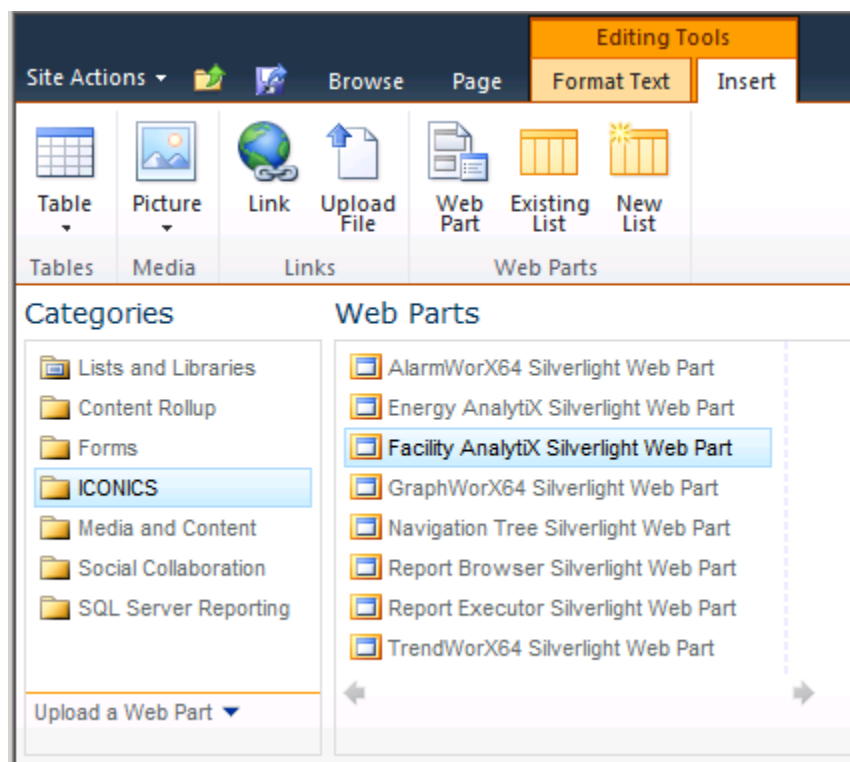


Figure 3.110 - Adding the FDDWorX Silverlight Web Part

Lab: Viewing FDDWorX Logged Data In PortalWorX-SL

L3

Now that we have FDD data, we will proceed to present the data to the user by configuring the **FDDWorX Viewer** in **PortalWorX-SL**.

Estimated time to complete this lab: 30 minutes

3.1. Task Checklist

In this lab the goal is to complete these tasks:

- Add an FDDWorX viewer to a PortalWorX-SL layout.
- Add a Chart to view the logged data (Configure the FDDWorX Viewer)
- Add a Grid to view the logged data (Configure the FDDWorX Viewer)

3.2. Support Files

You do not need any supporting files to complete this lab.

3.3. Runtime Mode

Workbench-SL is the configuration dashboard where we created and configured our asset tree and started logging data.

Now we'll utilize the FDDWorX Viewer web part in PortalWorX-SL to view the logged data.

Note: As with many Windows applications, there is more than one way to perform a specific function. The technique we will use in this lab is **to launch PortalWorX-SL from within the Workbench-SL**. You could also launch PortalWorX-SL from the Windows Start menu. **Start → All Programs → ICONICS → PortalWorX-SL**.

- 1) To enter **PortalWorX-SL from Workbench-SL**, click on the **Runtime** button on the top left of the Workbench-SL dashboard.

Lab: Viewing
FDDWorX Logged
Data Using
PortalWorX-SL

Note: If you do not see the **Runtime** selection, from within the Workbench-SL select the Tools and Settings tab and select the “**Show the Ribbon Title**” checkbox.

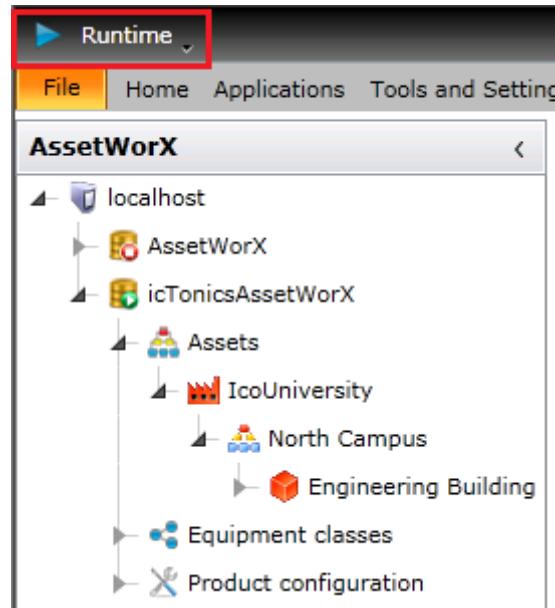


Figure L3.1 - Workbench-SL Runtime Button to Launch PortalWorX-SL

- 2) A new Web browser session will open. On the left will be the **AssetWorX Navigator** which depicts the **Active Database** and **Asset Tree** that was created in Workbench-SL. Your current configuration should resemble the figure below. There may or may not be a USA asset also.

Note: You may see the Windows Security login prior to connecting to PortalWorX-SL. Enter the User Name and Password used to install ICONICS products and click **OK** to proceed.

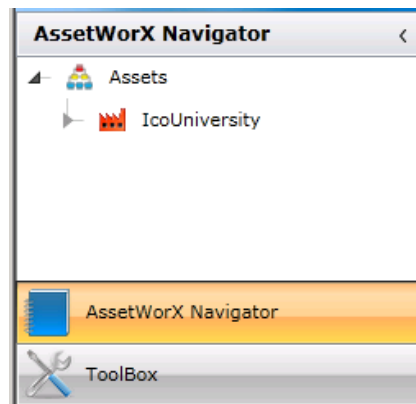


Figure L3.2 - PortalWorX SL Asset Navigator, Asset Tree and Toolbox

3.4. The FDDWorX Viewer Web Part in PortalWorX

A **Web Part** is an ASP.NET server control which is added to a **Web Part Zone** on **Web Part Pages** by users at run time. The controls enable end users to modify the content, appearance, and behavior of Web pages directly from a browser.

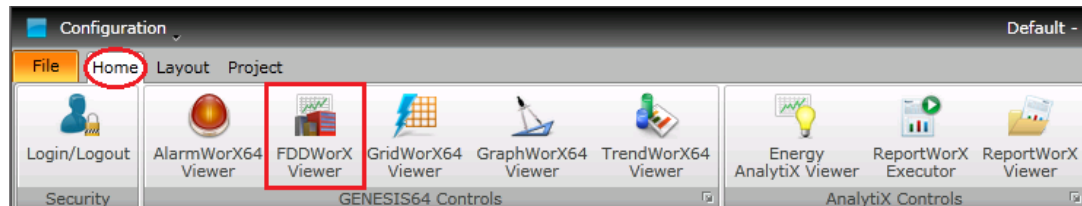


Figure L3.3 - The FDDWorX Viewer is Available within PortalWorX-SL

1. From within **PortalWorX-SL** with the **Home** tab selected, we will select the **FDDWorX Viewer** control in the **GENESIS Controls** section of the **Home Ribbon** to launch the configurator.

Note: You can launch an FDDWorX AnalytiX Viewer in multiple ways. You can select it within the AnalytiX Controls in the Home Ribbon OR you can select it within the main window in the lower right of the PortalWorX-SL browser window OR you can select it from the list within the Toolbox in the left navigation box.

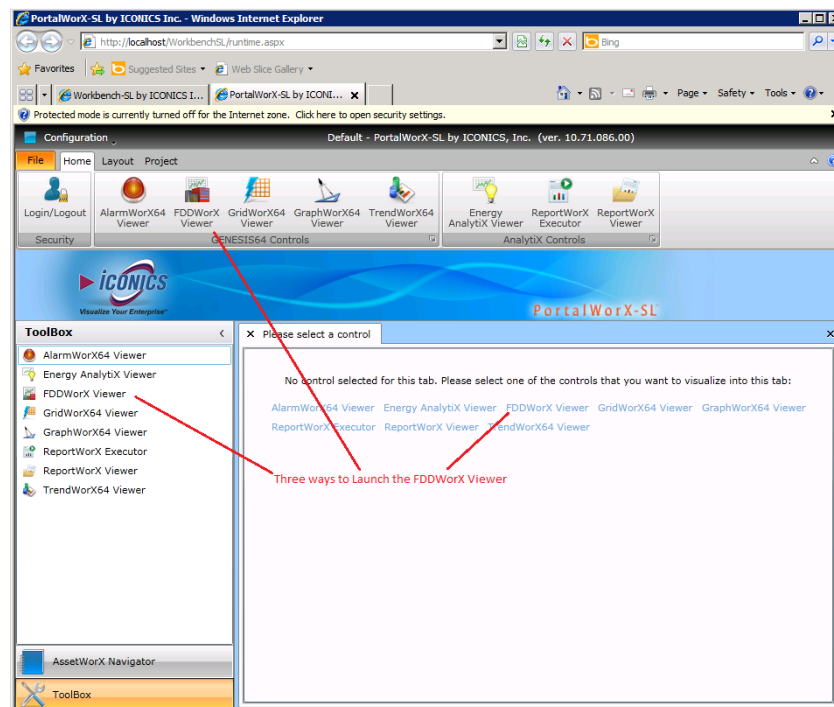


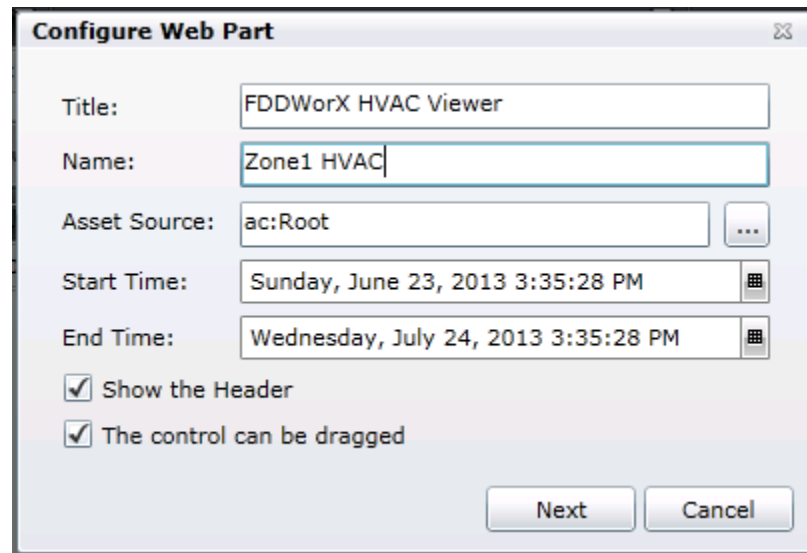
Figure L416.4 - Three Ways to Launch the FDDWorX Configurator

Lab: Viewing
FDDWorX Logged
Data Using
PortalWorX-SL

3.4.1. Configuring the FDDWorX Viewer Web Part

1. Now we will begin to configure how the logged data to be presented.

Note: You can gain workspace by double clicking on the Home tab in the ribbon. This hides (collapses) the home ribbon. Double clicking on the Home tab again will re-expose the ribbon.



The screenshot shows the 'Configure Web Part' dialog box with the following values:

- Title: FDDWorX HVAC Viewer
- Name: Zone1 HVAC
- Asset Source: ac:Root
- Start Time: Sunday, June 23, 2013 3:35:28 PM
- End Time: Wednesday, July 24, 2013 3:35:28 PM
- ☒ Show the Header
- ☒ The control can be dragged

Figure L3.5 - Configure Web Part

2. For the Title enter **FDDWorX HVAC Viewer**
3. For the Name enter **Zone1 HVAC**

Note(s):

- *Show the Header:* If unchecked, the header tab for the web-part would be hidden.
- *The control can be dragged:* If unchecked, the web-part cannot be dragged and docked.

4. Leave the remaining field selections as default and click **Next**.
5. Within the **Configure Web Part** dialog is where you will add Grids, Charts (Series) and Row Details.

Note: Currently there are three tabs **General**, **Appearance** and **Configuration**, in the Configure Web Part dialog.

6. With the **General tab** selected enter the **Name: FDDWorX Training**.

7. Select the **Override Inherited Asset** checkbox.
8. From within the **Asset:** section click on the **Specific Asset** radio button.
9. From the **Specific Asset:** drop down list, drill down until you can select **HVAC02** under IcoUniversity.
10. Your General tab configuration should resemble the figure below.

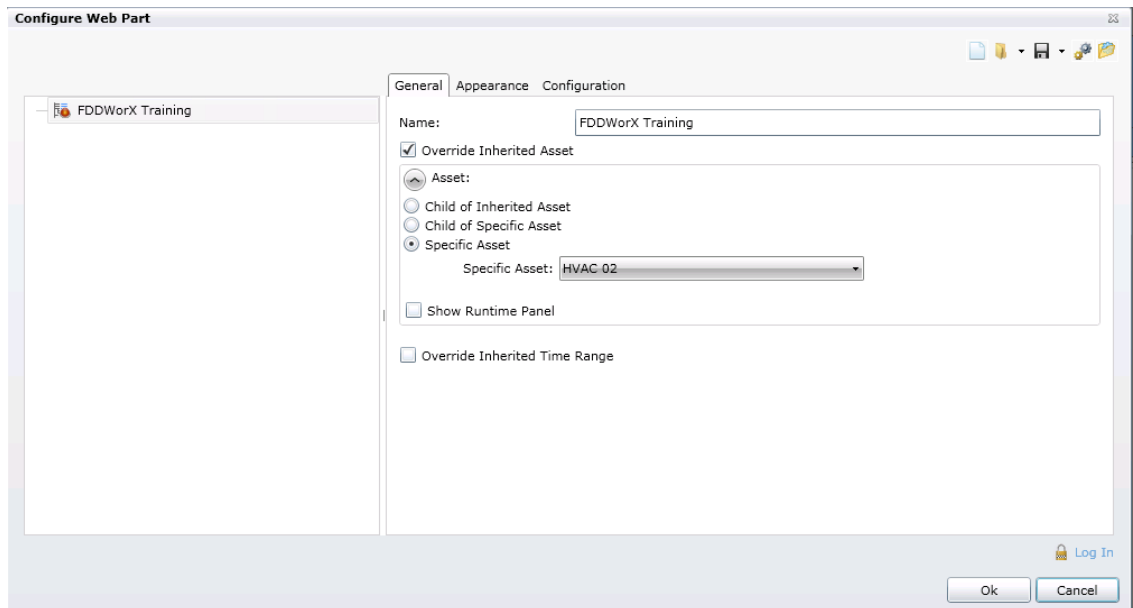


Figure L3.6 - General Tab of Configure Web Part

11. Select the **Configuration** tab and enter the following information:

- Configuration Title: **FDD_HVAC_02**
- Default Configuration: **select this checkbox**

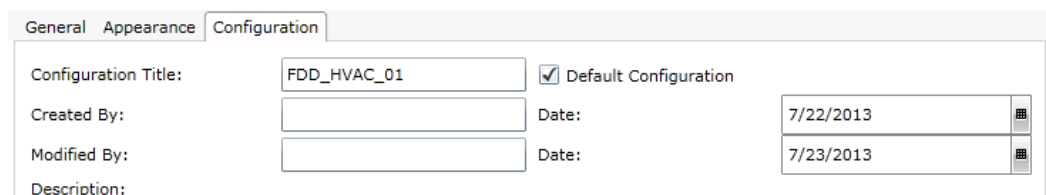


Figure L3.7 - Configuration Tab on Configure Web Part

12. Leave the remaining fields as they are and continue with the following configuration steps.

3.4.2. FDDWorX Viewer Web Part Grid

1. In this section we will select the type of Grid.
2. On the left side of the Configure Web Part dialog, **right click on FDDWorX Training** and select **Add Grid**.

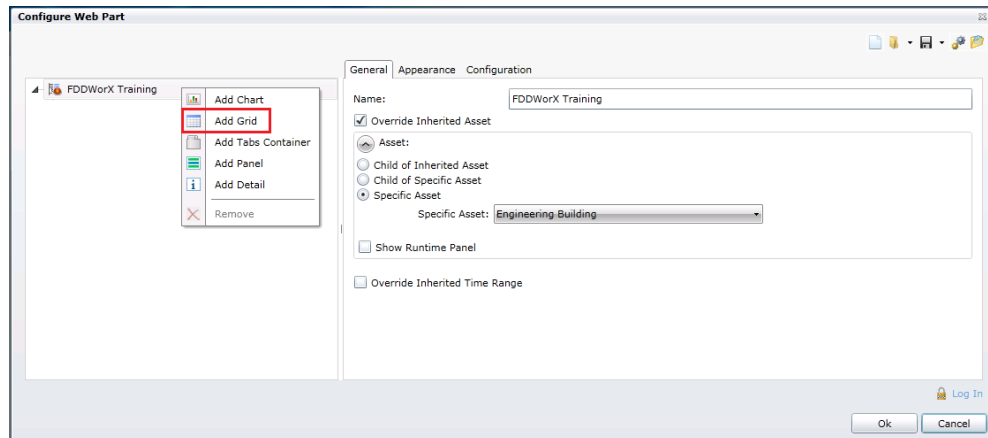


Figure L3.8 - Adding a Chart

3. With the **Grid selected**, click on the **General tab**. We can leave these fields as default.
4. Click on the **Data tab**.
5. Set the fields in this form as follows.
 - Data Source: **FDD Data Provider (Platform Services)**
 - Data Query: **Faults** (expand the Faults branch)
 - Additional Parameters: **Include Children Assets**
 - Grid Columns: **Asset, Fault Time, Fault and Runs** (De-Select all other fields).
6. Your current configuration should resemble the following figure.

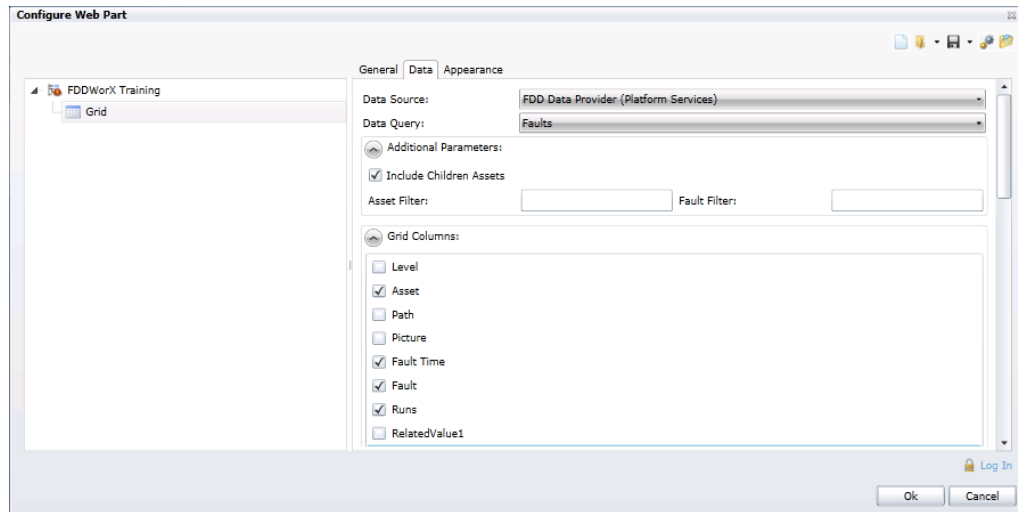


Figure L3.9 - Grid – Data Tab Configuration

7. We will leave the **Appearance** tab as **default**.
8. Right click on the **Grid** you just added and select **Add Row Detail**.
9. We will leave both the **General** and **Appearance** tabs as **default**. There are no changes required on this form.
10. Right click on the **Row Detail** branch and select **Add Grid**.
11. Under **Row Detail**, select the **Grid – Data** tab and set the fields in this form as follows.
 - Data Source: **FDD Data Provider (Platform Services)**
 - Data Query: **Latest Causes**
 - Grid Columns: select both **Rank** and **Text**.
12. We will leave both the **General** and **Appearance** tabs on this **Grid** as **default**. There are no further changes required on this form.
13. Right click on the **Row Detail** branch again and select **Add Chart**.
14. Select the **Chart** and set the fields in this form as follows.
 - Column: **Select the Left Most Column chart**.
 - o See the following figure for more information.

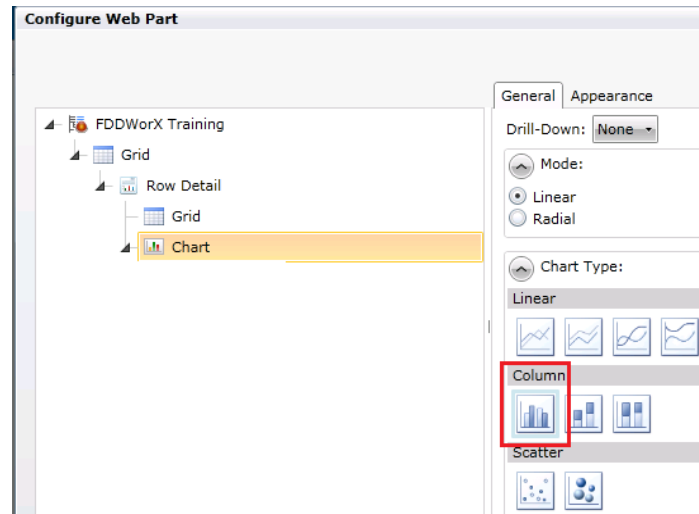


Figure L3.10 – Define a Column Type Chart

15. We will leave both the **General** and **Appearance** tabs on this **Chart** as **default**. There are no further changes required on this form.
16. Right click on the **Chart** and select **Add Series**.
17. Under **Chart**, select the **Series – Data** tab and set the fields in this form as follows.
 - Data Source: **FDD Data Provider (Platform Services)**
 - Data Query: **Latest Causes**
18. We will leave the remaining fields on the **Data**, **General** and **Appearance** tabs on this **Series** as **default**. There are no further changes required on this form. Your **Series – Data** tab configuration should resemble the figure below.

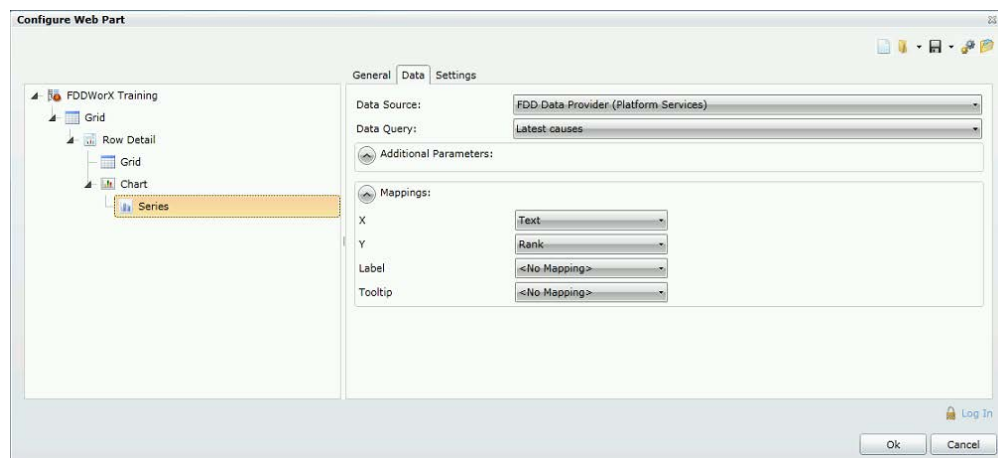
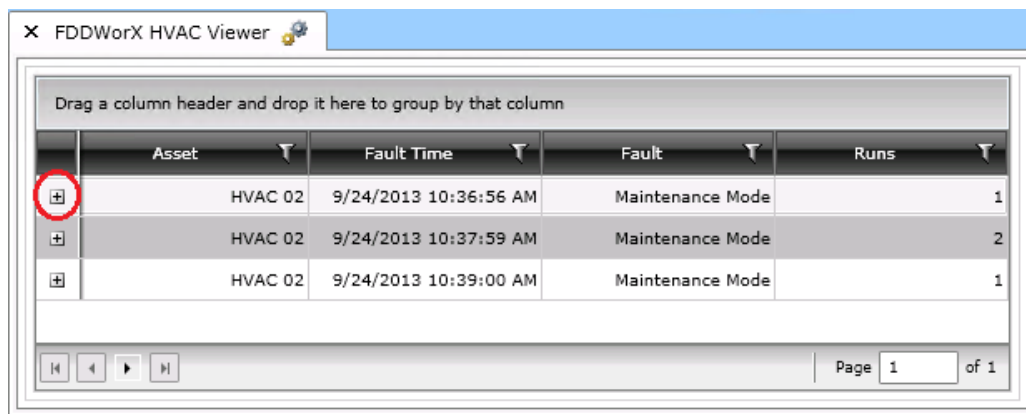


Figure L3.11 - Define a Chart Series

3.4.3. FDDWorX Viewer Data Presentation

1. When the FDDWorX Viewer configuration is complete, click on drop down arrow next to the **Floppy Disk** icon in the upper right and select “**Save to Database**”.
2. In the ‘**Save Configuration to Database**’ dialog, enter the **Title: FDD_HVAC_02**. Leave the Default Configuration check box selected and click on the **Save** button.
3. From the ‘**Configure Web Part**’ dialog, clicking on the **OK** initiates data retrieval.
4. You should see some records in the viewer with criteria similar to the what is displayed below.
 - Asset: **HVAC 02**
 - Fault Time: **Relative to the date the previous lab was performed**
 - Fault: **Maintenance Mode**
 - Runs: 2



Drag a column header and drop it here to group by that column

	Asset	Fault Time	Fault	Runs
+	HVAC 02	9/24/2013 10:36:56 AM	Maintenance Mode	1
+	HVAC 02	9/24/2013 10:37:59 AM	Maintenance Mode	2
+	HVAC 02	9/24/2013 10:39:00 AM	Maintenance Mode	1

Page 1 of 1

Figure L3.12 - Simple Data Presentation

5. As represented by the circle in the previous figure, click on the **Plus Sign** to the left of a **HVAC 02** asset.
6. This displays more detail which includes the **Rank** of the **Causes**. Since we only have one **Symptom** defined in our **Diagnostic Matrix**, the **Rank** of **Maintenance Mode On** is **100**. How this all works will become more understandable as we proceed.

Note: At this point, since we have minimal data, don't be concerned if you do not see any causes.

This concludes this Lab.

Lab: FDDWorX Additional Tools

L4

From within Workbench-SL, you will leverage a variety of tools found in the FDD provider. Review the Task Checklist below for more details.

4.1. Task Checklist

In this lab the goal is to complete the following tasks:

- Create a more sophisticated Diagnostic Model.
- Create a more sophisticated Fault Rule
- View the result in PortalWorX-SL

4.2. Support Files

You do not need any additional support files to complete this lab.

Note: This lab makes references to SQL Server actions that are explained in detail in chapter 15.

4.3. Creating a Diagnostic Model

We will create a diagnostic model that will react to a Room Temperature taking an extensive amount of time reaching a Thermostat Setpoint.

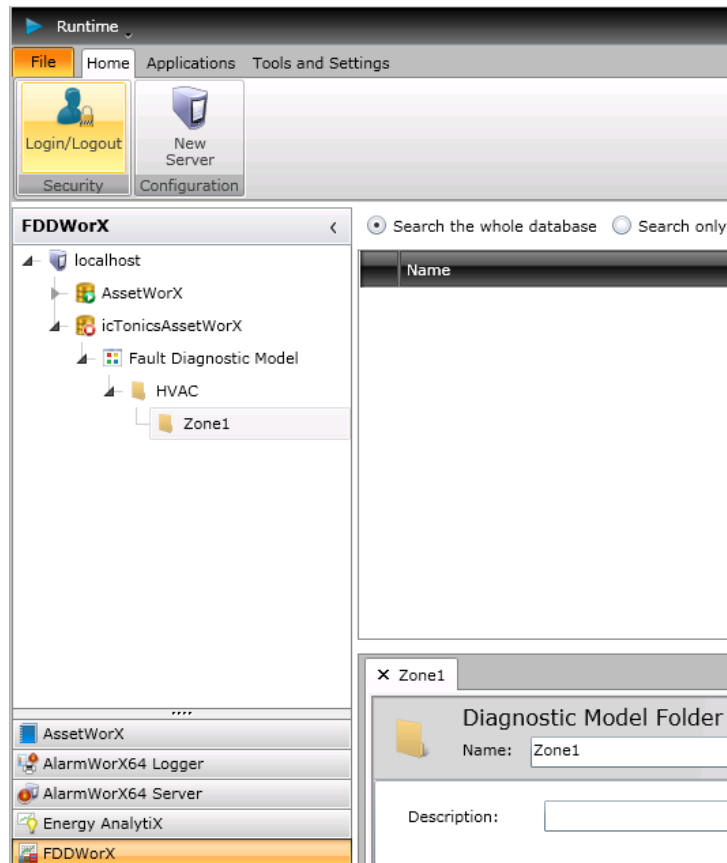


Figure L4.1 - Creating a Diagnostic Model Folder Tree

1. From within the Workbench-SL, select the **FDDWorX** provider.
2. Right click on the **Zone1** diagnostic model folder and select **Add Diagnostic Model**.
3. Name the diagnostic model '**DM_SlowToSetpoint**'.
4. Using the **handle** (as is highlighted with a circle in the following figure) expand the content window to **expose** all of the FDD configurator **buttons**.

Note: You can also gain workspace by double clicking on the Home tab in the ribbon. This hides (collapses) the home ribbon. Double clicking on the Home tab again will re-expose the ribbon.

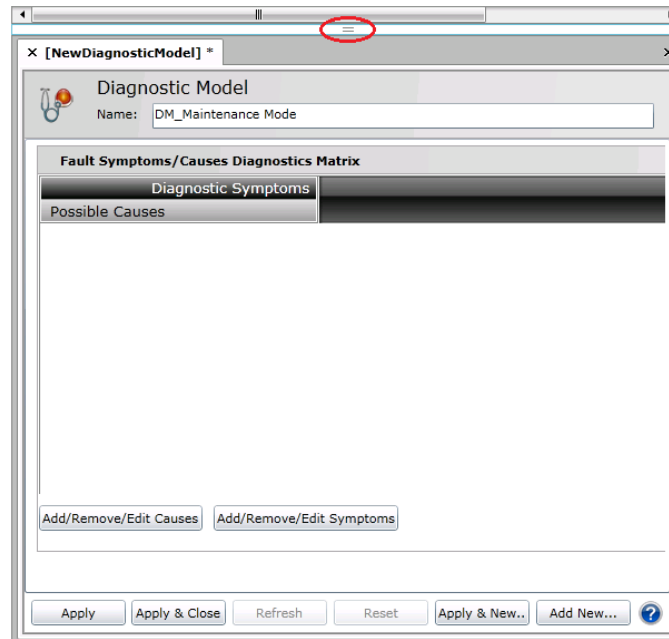


Figure L4.2 - Creating a Diagnostic Model

5. Now that you have access to the **Causes** and **Symptoms** buttons, let's proceed to add causes.
6. Click on the **Add/Remove/Edit Causes** button.
7. From within the Add, Remove or Edit Causes dialog box, select the '**Click here to add new item**' field.
8. Enter the term '**Air Flow Low**' and hit the **Enter** key.
9. Enter the term '**Pump Obstruction**' and hit the **Enter** key.
10. Enter the term '**User Intervention**' and hit the **Enter** key.
11. Type the term '**Valve Partially Closed**' and click the **OK** button.
12. Click on the **Add/Remove/Edit Symptoms** button.
13. From within the Add, Remove or Edit Symptoms dialog box, select the '**Click here to add new item**' field.
14. Enter the term '**Change Damper Filter**' and hit the **Enter** key.
15. Enter the term '**High Pump Current**' and hit the **Enter** key.
16. Type the term '**Manual Override**' and click the **OK** button.
17. Click on the 0 (0%) fields and add percentages as seen in the matrix below.

18. Your completed chart should resemble the figure below.

Fault Symptoms/Causes Diagnostics Matrix			
Diagnostic Symptoms	Change Damper	High Pump	
Possible Causes	Filter	Current	Manual Override
User Intervention	0 (0%)	0 (0%)	100 (71%)
Air Flow Low	80 (100%)	0 (0%)	20 (14%)
Valve Partially Closed	0 (0%)	0 (0%)	0 (0%)
Pump Obstruction	0 (0%)	40 (100%)	20 (14%)

Figure L4.3 - SlowToSetpoint Diagnostic Matrix

19. Click **Apply**.

20. This completes the configuration of this diagnostic matrix.

4.4. Re-Starting the FDDWorX Service

1. With the **FDDWorX** provider selected you should see an icon that resembles a traffic light on the ribbon.
2. Clicking on the traffic light will cause the FDD Service to change state. Started to Stopped and vice versa.
3. **Restart the FDD Service.**

Note: If for some reason you do not see the traffic light, be sure that the FDDWorX localhost asset tree is expanded. Also, there may be some instances where hitting F5 is required to refresh the browser session and expose the services icon.

4.5. Creating an FDDWorX Asset

Any asset added to the asset tree through AssetWorX can become an FDD asset by associating the asset with an FDD extension. This section will help you understand how to add the FDDWorX extension to an existing asset.

4.6. Adding the FDDWorX Extension

1. From within the Workbench-SL select the **AssetWorX** provider.
2. Expand the **icTonicsAssetWorX** tree to expose the **Engineering Building** asset as seen in the figure below.

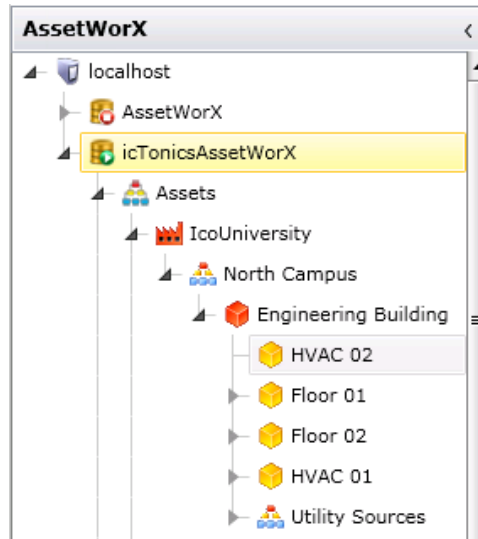


Figure L4.4 - Expanded icTonicsAssetWorX Asset Tree

3. Right click on the **Engineering Building** asset and select **Add Equipment**.
4. Enter the Name: '**HVAC 03**'.
5. From the Icon: drop down select '**Process Cell**'.

Note: When you click Apply a refresh will occur and a third tab with a label of a **Plus Sign (+)** will appear to the right of the **Commands** tab.

6. Click **Apply**.

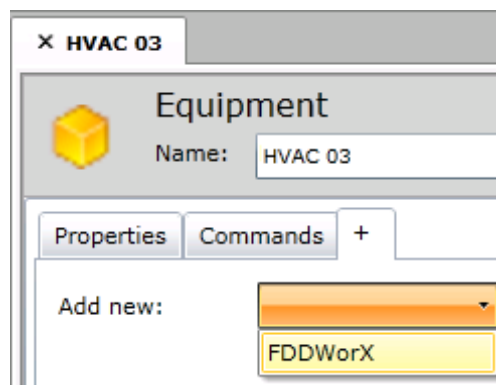


Figure L4.5 - Adding the FDDWorX Extension

7. Click on the **Plus Sign** to the right of the Commands tab.
8. From the **Add New:** drop down list select **FDDWorX**.

Note: By performing the above steps you have added the **FDDWorX extension** to the **HVAC 03** asset.

4.7. Defining the Fault Diagnostic

1. With the **FDDWorX** tab selected, click on the **Fault Diagnostic** sub-tab.
2. From the **Fault Diagnostic** drop down list select **DM_SlowToSetpoint**.
3. Configure the **Diagnostic Symptoms Mappings** as seen in the table below.
4. **Note:** Here's an example of where to locate the tags. Select the tag **Home → OPC Classic Server → My Server → AlarmWorX64 → Change Damper Filter** (do not traverse any further in the tree).

Diagnostic Symptom	Alarm Point Name	Subcondition Name(s)	Alarm Filter
Change Damper Filter	@ICONICS.AlarmSvr.1\Change Damper Filter.Source	Digital	
High Pump Current	@ICONICS.AlarmSvr.1\High Pump Current.Source	Digital	
Manual Override	@ICONICS.AlarmSvr.1\Manual Override.Source	Digital	

Figure L4.6 - Diagnostic Symptoms Mappings

5. Your completed configuration should resemble the figure below.

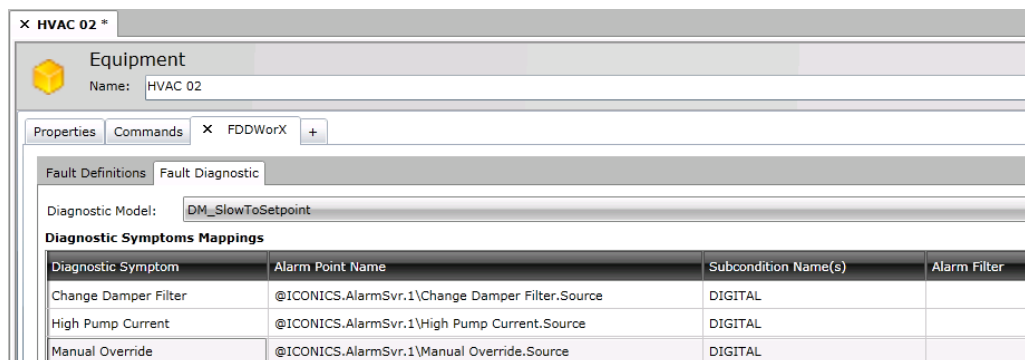


Figure L4.7 - Completed Fault Diagnostics

4.8. Defining the Fault Definition

1. Click on the **Fault Definitions** tab.
2. Click on the **Add Fault** button.
3. Name the fault **SlowToSetpoint**.
4. Expand the display to expose all the **Rule Editing** buttons as seen in the following figure.

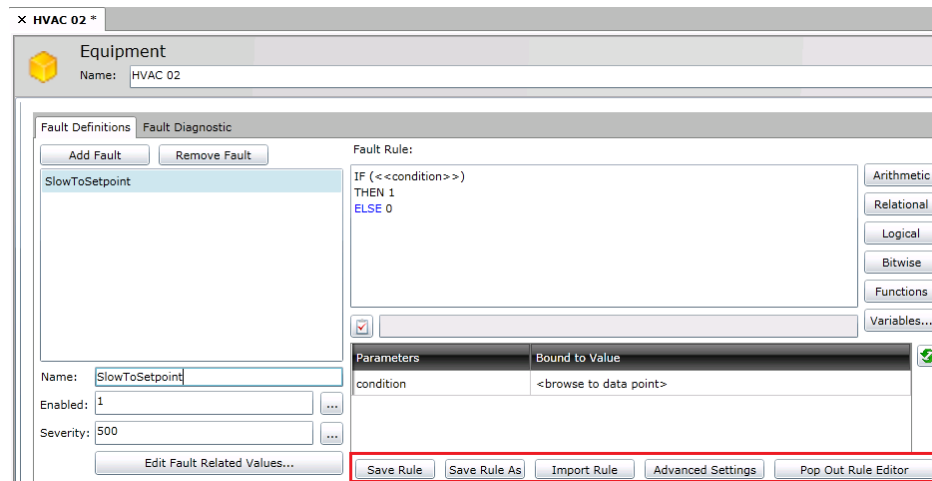


Figure L4.8 - The Rule Editing Buttons

5. In the following steps we will replace the default rule **IF (<condition>>) THEN 1 ELSE 0** with the **SlowToSetpoint Rule** syntax below.
6. Although you could just type the syntax below into the Fault Rule: dialog manually, from the perspective of training the expectation is that you will know how to create the rule using the buttons on the right of the Expression Editor. The following steps will offer some assistance.

Note: As you get more versed in how rules are written you may consider creating the rules in another editor such as Notepad.

Completed SlowToSetpoint Rule Syntax

IF *abs({{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/ThermostatSetPoint_opc}} - {{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/RoomTemperature_opc}}) > 0.02 && trueforduration({{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/Rate_2Sec_Calc_exp}} < 0.04, 3000)*

THEN 1

ELSE 0

7. After the IF statement select (<<**condition**>>) and click on the **Arithmetic** button.
8. As you hover over each of the Functions accessible in the Expression Editor you will notice tooltips describing the syntax for the function. As a matter of convenience I've included the tooltip information for the **abs** and **trueforduration** functions below.

abs Function

Description:

Returns the absolute value of a specified number

Parameters:

Parameter1: A number

Returns:

A number that is greater than or equal to zero

trueforduration Function

Description:

Returns true if a boolean condition has been true for a specified amount of time (or longer)

Parameters:

Parameter1: a sub-expression that evaluates to a boolean condition

Parameter2: a TimeSpan duration that specifies how long Parameter1 must be true before this function will return true

Returns:

A Boolean. True if Parameter1 has been true for the amount of time specified in Parameter2 (or longer), false otherwise.

Example usage:

trueforduration({{tagname}} > 100, 5000)

or

```
trueforduration({{tagname}} > 100, "0:00:05")
```

or

```
trueforduration({{tagname}} > 100, fromseconds(5))
```

9. Click on the **abs** function. The selected (<<condition>>) syntax will be replaced with abs(number).
10. Select the word **number** (red text only) and click on the **Variables...** button.
11. Select the tag **Home → AssetWorX → icoUniversity → North Campus → Engineering Building → HVAC 01 → ThermostatSetPoint_opc** and click **OK**.
12. The syntax should look like this: **IF abs({{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/ThermostatSetPoint_opc}})**
13. Between the right had set of }} and the)) place a space – space and leave the cursor in front of)). You should recognize that when you use the buttons to select elements the selected element gets inserted into the expression at the location of the cursor. See the figure below for more information.

/Engineering Building/HVAC 01/ThermostatSetPoint_opc}} -)

Place Cursor Here ↑

Figure L4.9 - Selected syntax gets inserted at the cursor position

14. Click on the **Variables...** button again.
15. Select the tag **Home → AssetWorX → icoUniversity → North Campus → Engineering Building → HVAC 01 → RoomTemperature_opc** and click **OK**.
16. The syntax should look like this **IF abs({{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/ThermostatSetPoint_opc}} - {{ac:IcoUniversity/North Campus/Engineering Building/HVAC 01/RoomTemperature_opc}})**

17. We're getting there. To prevent you from having to flip through pages, here is the completed rule syntax as a reference.

SlowToSetpoint Rule Syntax

```
IF abs({{ac:IcoUniversity/North Campus/Engineering Building/HVAC
01/ThermostatSetPoint_opc}} - {{ac:IcoUniversity/North Campus/Engineering
Building/HVAC 01/RoomTemperature_opc}}) > 0.02 &&
trueforduration({{ac:IcoUniversity/North Campus/Engineering
Building/HVAC 01/Rate_2Sec_Calc_exp}} < 0.04, 3000)
```

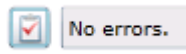
THEN 1

ELSE 0

18. Place the cursor after the **parentheses** on the **right**.
19. Hit the **space bar** and enter this syntax:
20. > **0.02 &&**
21. Enter a **space** after previous line and click on the **Functions** button and hover over **Date and Time Functions** and select **trueforduration**.
22. Select the **booleanCondition** (red text only) and click on the **Variables...** button.
- Note:** You may find it easier to **select text** using the **Shift** and **Left / Right Arrow** keys.
23. Select **Home** → **AssetWorX** → **icoUniversity** → **North Campus** → **Engineering Building** → **HVAC 01** → **Rate_2Sec_Calc_exp** tag and click **OK**.
24. Place the cursor at the end of **ac:Zone1_Rate_2Sec_Calc_exp}}** enter a space and enter < **0.04**.
25. Select the **timespanDuration** (red text only) and enter the number **3000**.

Your rule should be complete. Check your syntax against the **SlowToSetpoint Rule Syntax**.

26. Check your syntax by clicking on the check mark icon at the bottom of the editor window.



27. Click on the **Save Rule** button.

28. Click on the **FacilityAnalytix** selection. The **Folder Path:** should be populated with the word FacilityAnalytiX.
29. From the **New Expression Name:** field, remove this text 'IcoUniversity_NorthCampus_EngineeringBuilding_' to set the New Expression Name: **HVAC03_SlowToSetpoint_Rule**.
30. Your **Save UDM Rule** dialog should resemble the figure below.

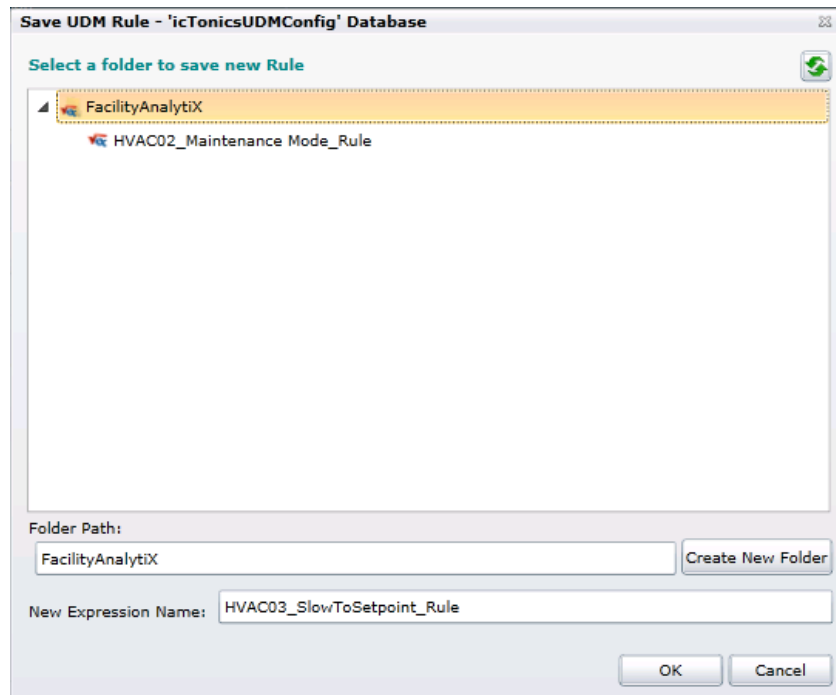


Figure L4.10 - Saving the SlowToSetpoint Rule

31. Click **OK**.
32. Click **Apply**.

Note: Notice there is a pause as the rule is committed to the database then the screen will refresh and the Apply button is grayed out. This is another delay we spoke of in the earlier labs.

4.9. *Testing the SlowToSetpoint Rule*

To proceed, please be confident you understand the following sections in **chapter 15**:

- **Confirming Faults through the SQL Server**
- **Clearing the dbo.FDD_Fault_Incidents Table**

Utilizing the procedures in the aforementioned sections will help you precisely analyze what is happening when you generate faults with various characteristics.

1. **Clear** the **dbo.FDD_Fault_Incidents** Table.
2. **Restart** the **FDD Service**. Remember? WB-SL, FDD provider, Stop Light.
3. **Restart** the **Alarm Server** by selecting the AlarmWorX64 Server provider in WB-SL and clicking on the AlarmWorX64 stop light to toggle the state of the service.
4. Return to the **FDD_icTonics_HVAC** display in Runtime.
5. Reset all the **Fault Simulator** buttons to the '**Normal**' state. (**no Yellow buttons**).
6. **Acknowledge all alarms** that are displayed in the AlarmWorX viewer.
7. Enter a new **Setpoint** of at least **10 degrees above** the current setpoint and hit the **Enter** key.
8. Click on the **Heat Pump Malfunction** button.
9. You should immediately see a **HeatPumpStatus alarm** with **Red Text**.
10. **After three seconds** (3000ms as we configured in the SlowToSetpoint Rule) expires, you should see a **second alarm**, with a **yellow/orange background**. This is the **Fault alarm**.
11. Return the **SQL Server Management Studio** and analyze the entry in the **dbo.FDD_Fault_Incidents** table. Especially note the entry in the **ActiveConditions** field. "**All Symptoms are inactive;**" indicates that none of the **Fault Diagnostic / Diagnostic Symptoms Mappings / Alarm Point Names**, as seen highlighted in the figure below, were in alarm when the fault occurred. We will generate these alarms manually in the next steps.

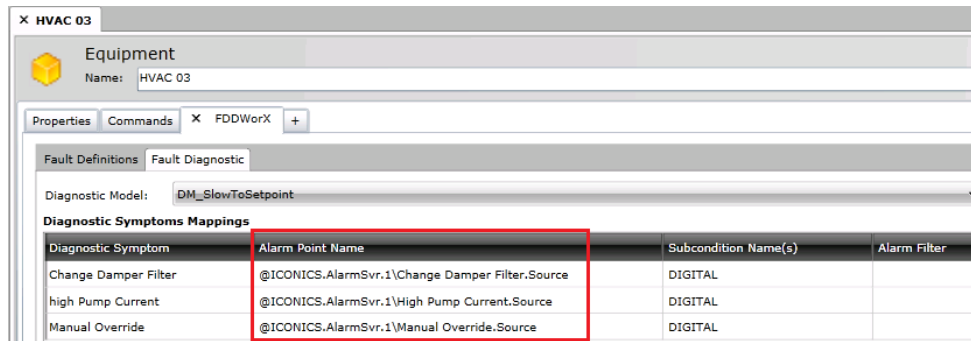


Figure L4.11 – Alarm Point Names

12. Reference the figure below for more information. With the Heat Pump Malfunction selected, click on the **Diagnostic Symptom / Change Damper Filter** button.

Note: The SlowToSetpoint fault will not be generated if the Thermostat Setpoint and Room Temperature are equal.

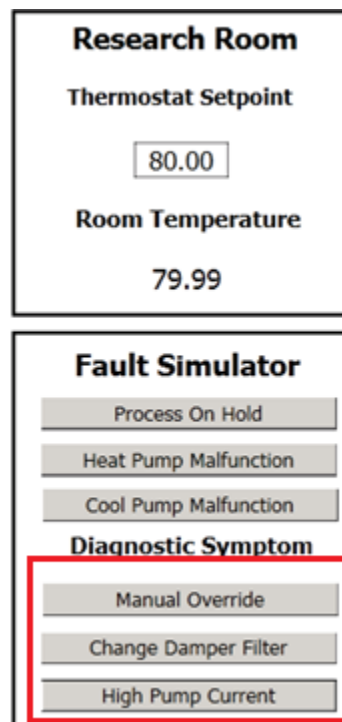
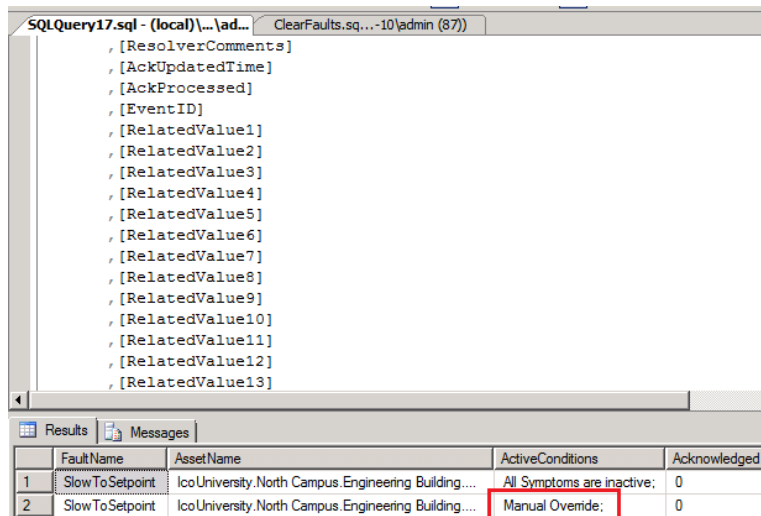


Figure L4.12 – Diagnostic Symptoms Buttons

13. Return to the **SQL Server Management Studio** and click on the **Execute** button to refresh table listing.
14. Note again the contents of the **ActiveConditions** field. You should have “**Change Damper Filter**” in this field. You may see a second entry with the value ‘Manual Override’ in the ActiveConditions field.



SQLQuery17.sql - (local)\... \ad... ClearFaults.sql...-10\admin (87)

```

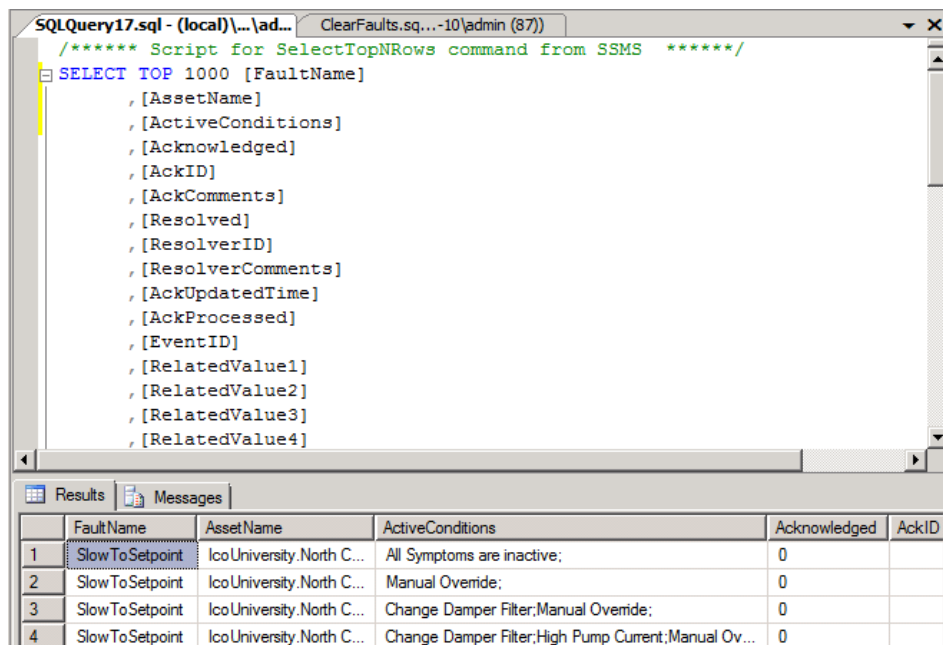
, [ResolverComments]
, [AckUpdatedTime]
, [AckProcessed]
, [EventID]
, [RelatedValue1]
, [RelatedValue2]
, [RelatedValue3]
, [RelatedValue4]
, [RelatedValue5]
, [RelatedValue6]
, [RelatedValue7]
, [RelatedValue8]
, [RelatedValue9]
, [RelatedValue10]
, [RelatedValue11]
, [RelatedValue12]
, [RelatedValue13]

```

	FaultName	AssetName	ActiveConditions	Acknowledged
1	Slow To Setpoint	IcoUniversity.North Campus.Engineering Building...	All Symptoms are inactive;	0
2	Slow To Setpoint	IcoUniversity.North Campus.Engineering Building...	Manual Override;	0

Figure L4.13 – Manual Override Active Condition

15. Continue by clicking on the **High Pump Current** Diagnostic Symptom buttons. Monitor the **alarm viewer** to see the alarm is generated.
16. Return to **SQL Server Management Studio** and execute the query to refresh the FDD_FAULT_INCIDENTS data.
17. Your results should resemble, but will not be identical to, the figure below.



SQLQuery17.sql - (local)\... \ad... ClearFaults.sql...-10\admin (87)

```

/***** Script for SelectTopNRows command from SSMS *****/
SELECT TOP 1000 [FaultName]
, [AssetName]
, [ActiveConditions]
, [Acknowledged]
, [AckID]
, [AckComments]
, [Resolved]
, [ResolverID]
, [ResolverComments]
, [AckUpdatedTime]
, [AckProcessed]
, [EventID]
, [RelatedValue1]
, [RelatedValue2]
, [RelatedValue3]
, [RelatedValue4]

```

	FaultName	AssetName	ActiveConditions	Acknowledged	AckID
1	Slow To Setpoint	IcoUniversity.North C...	All Symptoms are inactive;	0	
2	Slow To Setpoint	IcoUniversity.North C...	Manual Override;	0	
3	Slow To Setpoint	IcoUniversity.North C...	Change Damper Filter;Manual Override;	0	
4	Slow To Setpoint	IcoUniversity.North C...	Change Damper Filter;High Pump Current;Manual Ov...	0	

Figure L4.14 – dbo.FDD_Fault_Incidents table listing

This concludes this lab.

Lab: FDDWorX/ReportWorX Reporting

L5

In this lab, we will explore the benefits and rich reporting capabilities of the ICONICS ReportWorX add-on. In this section, there is a brief reference to the use of stored procedures and ReportWorX. For more information about reporting using stored procedures, refer to the ICONICS Energy AnalytiX Training Manual, where using stored procedures with ReportWorX is explained in detail. In this lab, you will create a query that directly retrieves data from the `dbo.FDD_FAULT_INCIDENTS` table.

Estimated time to complete this lab: 30 minutes

5.1. Task Checklist

In this lab, you will complete the following tasks:

Note: If you had already completed the Energy AnalytiX reporting lab, some of the tasks in this lab will have already been completed.

- Create a ReportWorX configuration database
- Create a ReportWorX Template
- Use ReportWorX add-ons in Excel
- Use the PortalWorX-SL Report Executor and Report Viewer controls

5.2. Support Files

You do not need any supporting files to complete this lab.

5.3. Creating a Report Template

In order for the SQL Server query to return data you should have completed each of the previous FDDWORX labs sequentially. This will ensure you have data in the `dbo.FDD_FAULT_INCIDENTS` table. We also anticipate you have at least some familiarity with the ICONICS ReportWorX reporting tool from the BizViz suite.

5.4. Creating the ReportWorX Training Configuration Database

1. Start the ReportWorX Configurator by clicking on **Start → Programs → ICONICS BizViz → ReportWorX → ReportWorX Configurator**.
2. Click on **File → New Configuration Database**.
3. The Configuration Database Wizard will appear, as shown below.



Figure L5.1 - Configuration Database Wizard

4. Click **Next** to begin the wizard.
5. Leave **Use this Computer** selected to create the SQL Server Configuration Database locally as shown in the figure below. Click **Next** to continue.

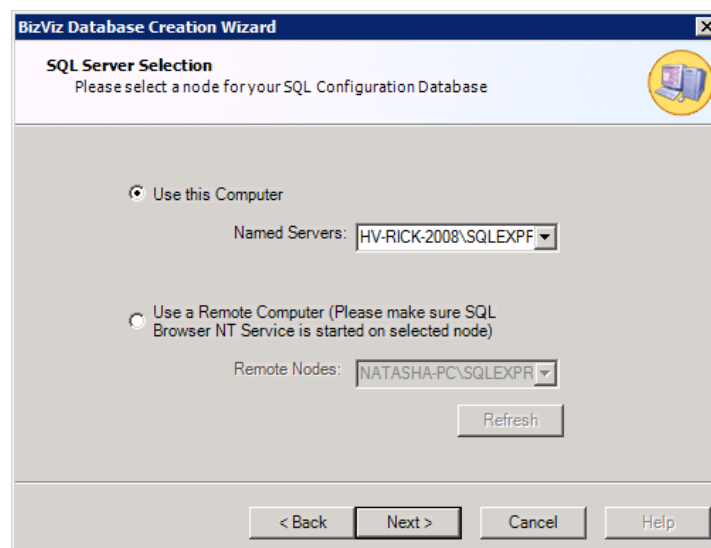


Figure L5.2 - SQL Server Selection

6. Since we are connecting to the local SQL Server, we can use **Windows Integrated Security**. Click **Next** to continue.

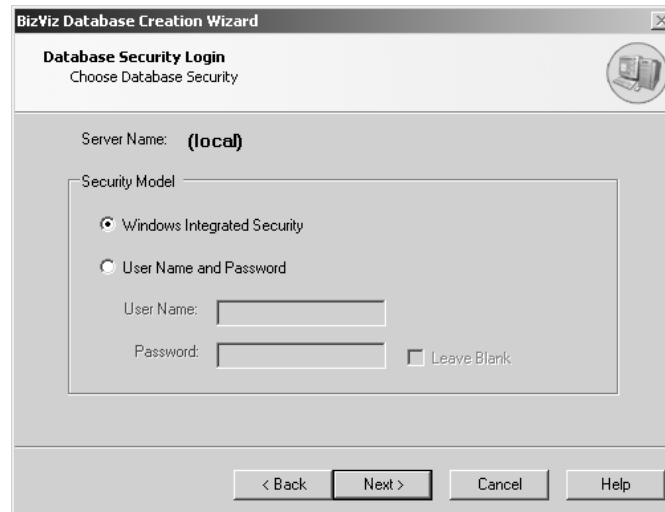


Figure L5.3 - Database Security Login

7. In the next dialog, as shown by a circle in the figure below, **deselect 'Include samples in configuration database'**. Leave the remaining fields as default and click **Next** to continue.

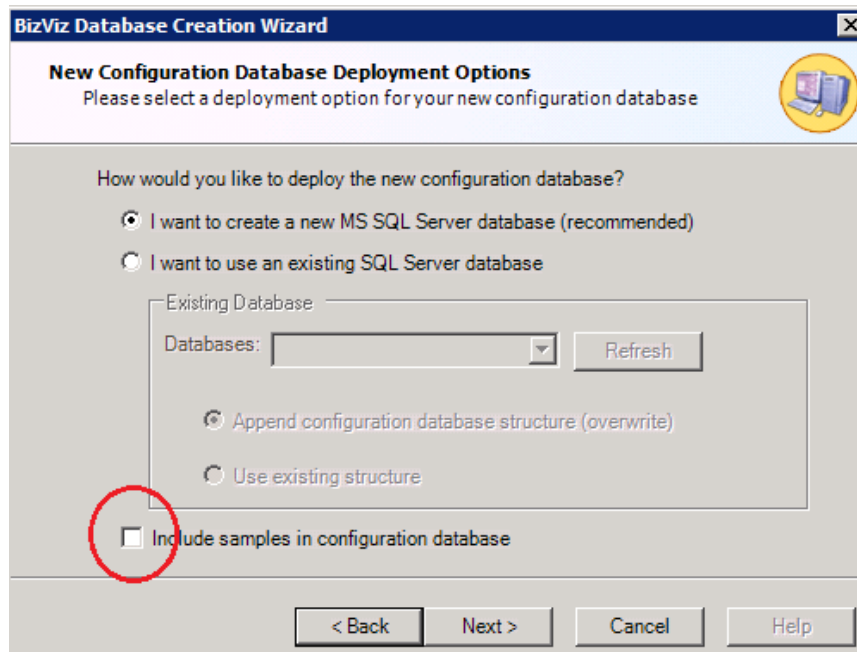
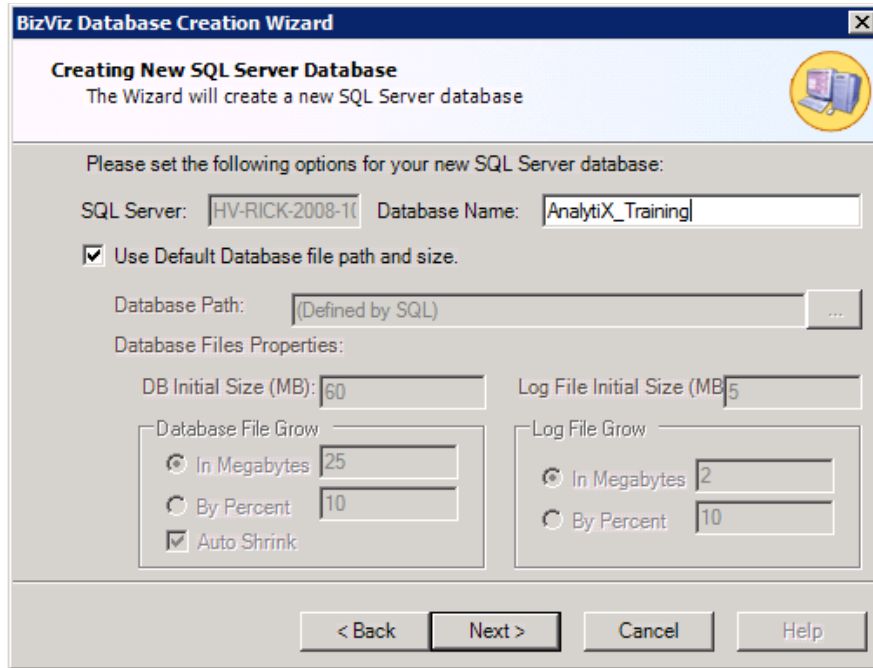


Figure L5.4 - Configuring Database Deployment Options

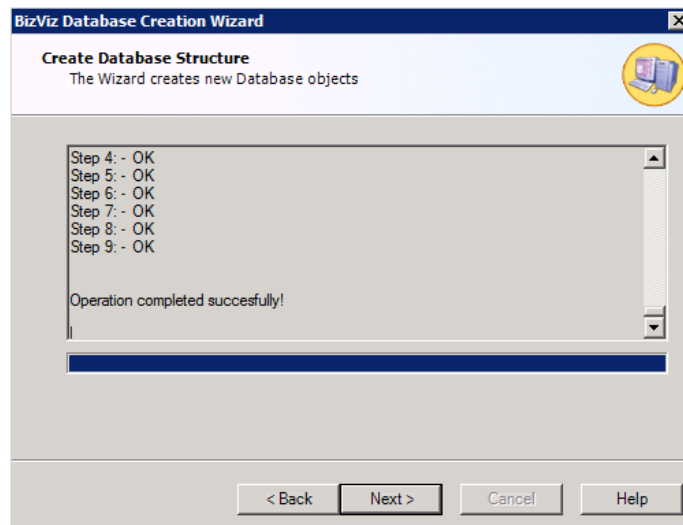
8. Name the database **AnalytiX_Training** and leave all other options default as shown, as they are the ideal settings for most configuration databases. Click **Next** to create the database.



The screenshot shows the 'BizViz Database Creation Wizard' window. The title bar reads 'BizViz Database Creation Wizard'. The main heading is 'Creating New SQL Server Database' with a subtext 'The Wizard will create a new SQL Server database'. Below this, it says 'Please set the following options for your new SQL Server database:'. The 'SQL Server' field contains 'HV-RICK-2008-10' and the 'Database Name' field contains 'AnalytiX_Training'. A checkbox labeled 'Use Default Database file path and size.' is checked. The 'Database Path' field shows '(Defined by SQL)'. Under 'Database Files Properties', 'DB Initial Size (MB)' is set to 60 and 'Log File Initial Size (MB)' is set to 5. For 'Database File Grow', 'In Megabytes' is selected with a value of 25, 'By Percent' is 10, and 'Auto Shrink' is checked. For 'Log File Grow', 'In Megabytes' is selected with a value of 2, and 'By Percent' is 10. At the bottom are buttons for '< Back', 'Next >', 'Cancel', and 'Help'.

Figure L5.5 – Naming the Database

9. The next dialog will show the steps being executed while creating the new database, as all the predefined examples and structures are added to the new database. When the steps are finished, you should be informed that the operation was successful. Click **Next** to continue.



The screenshot shows the 'BizViz Database Creation Wizard' window at the 'Create Database Structure' step. The title bar reads 'BizViz Database Creation Wizard'. The main heading is 'Create Database Structure' with a subtext 'The Wizard creates new Database objects'. A list box shows the progress of the wizard: 'Step 4: - OK', 'Step 5: - OK', 'Step 6: - OK', 'Step 7: - OK', 'Step 8: - OK', and 'Step 9: - OK'. Below the list box, it says 'Operation completed successfully!'. At the bottom are buttons for '< Back', 'Next >', 'Cancel', and 'Help'.

Figure L5.6 - Database Creation Status

10. Finally, accept the default name and location for the .udl file. Be sure the **Make Database Active** check box is checked.
11. Click **Next** to continue.

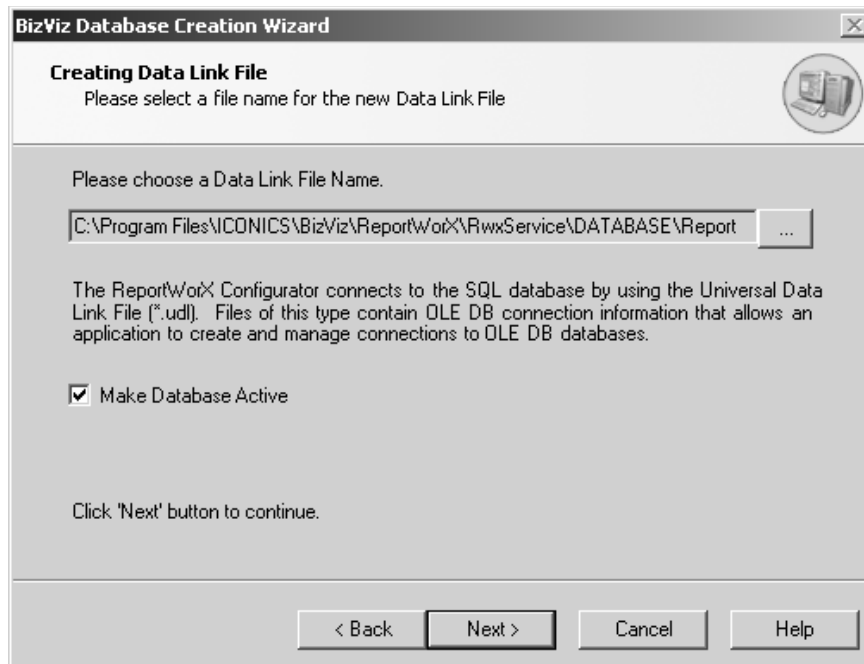


Figure L5.7 - Creating the .udl File

12. Click **Finish** to close the wizard after viewing the report.

Creating a Report Template Folder

1. Launch the **ReportWorX Configurator** by selecting **Start → All Programs → ICONICS BizViz → ReportWorX → ReportWorX Configurator**.
2. Expand the **Report Tools** branch and right click on **Report Templates**
3. Select **New → Template Folder**. Name the folder **AnalytiX_Templates**.
4. Click **Apply**. You will see the AnalytiX Templates entry under the Report Templates branch.

Creating a Report Configuration

5. Right click on the **Configurations** branch and select **New → Report Configuration**. Name the configuration **AnalytiX_Configuration**. Click **Apply**.
6. As highlighted in the figure below, note the **Red X** in the AnalytiX_Configuration folder. This indicates this new configuration is not Active.
7. Click on the **'Set As Active Configuration'** button. The Red X should disappear.

8. Lastly, click on the **Stop Light** icon to **Start** or **Restart** (requires clicking on the stop light icon 2 times).

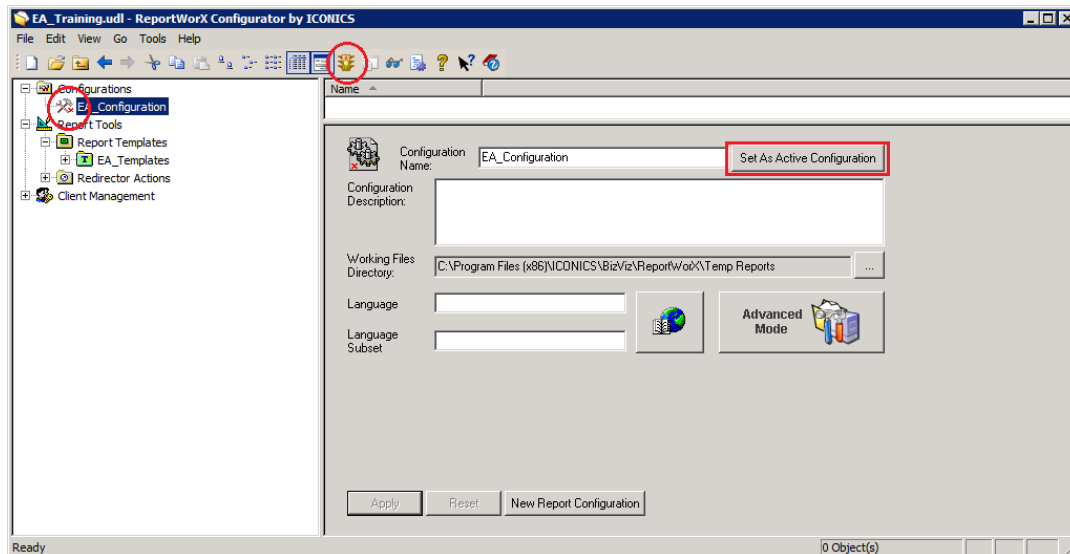


Figure L5.8 – Making the AnalytiX_Configuration Active

Creating a Report Folder

1. Create a new Report Folder by right-clicking on **AnalytiX_Configuration** and selecting **New** → **Report Folder**. Name the folder **AnalytiX_Reports** and click **Apply**.
2. You should have two AnalytiX folders, in the left hand pane, as shown in the figure below.

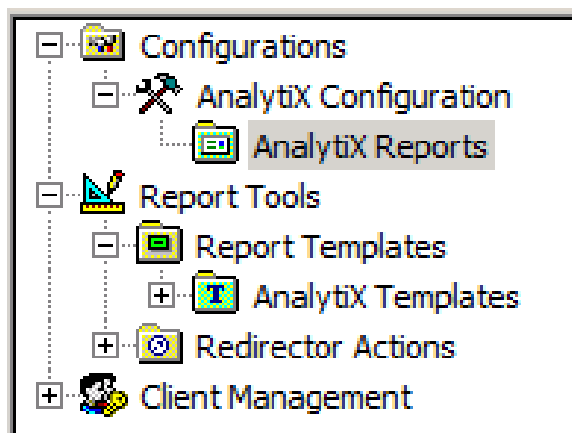


Figure L5.9 - Creating Report Folders in ReportWorX V9.22

5.5. FDDWorX – Creating a Report Template

Creating a new FDDWorX AnalytiX Report Template

1. Right click on the **AnalytiX_Reports** folder and select **New** → **Report**. Name the report **rpt_FDD_Fault_Statistics** and click **Apply**.
2. If you receive a '**Report scheduling has been changed**' notification click **Yes**.
3. On the far right click on the **Enabled** field.
4. Launch the **Report Template Wizard** by clicking on the wizard icon to the far right of the Report Template field. The icon is circled in the figure below.

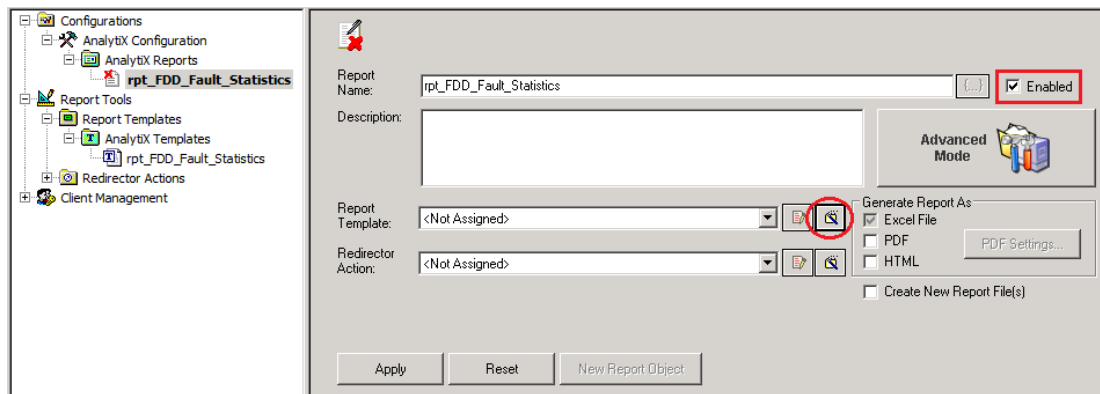


Figure L5.10 – Launching the Report Template Wizard

5. In the Report Template Wizard splash screen, Click **Next**.

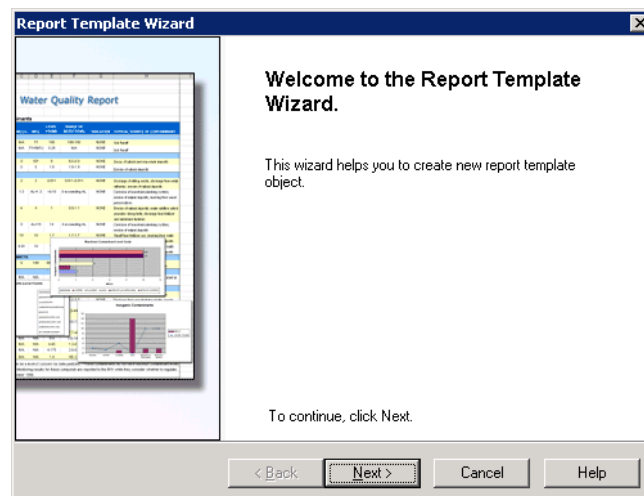
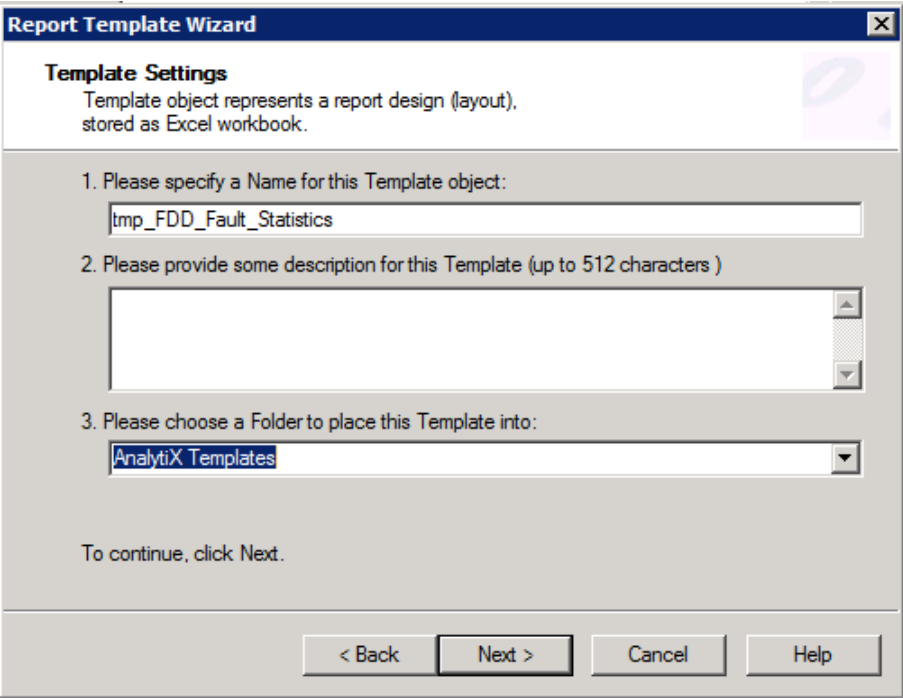


Figure L5.11 - Report Template Wizard

6. Name the template **tmp_FDD_Fault_Statistics**. Adding a description is optional.

7. Replace the **WizardGenerated** entry in line 3. by selecting the **AnalytiX_Templates** entry from the drop down list. Your finished configuration should resemble the figure below. Click **Next**.



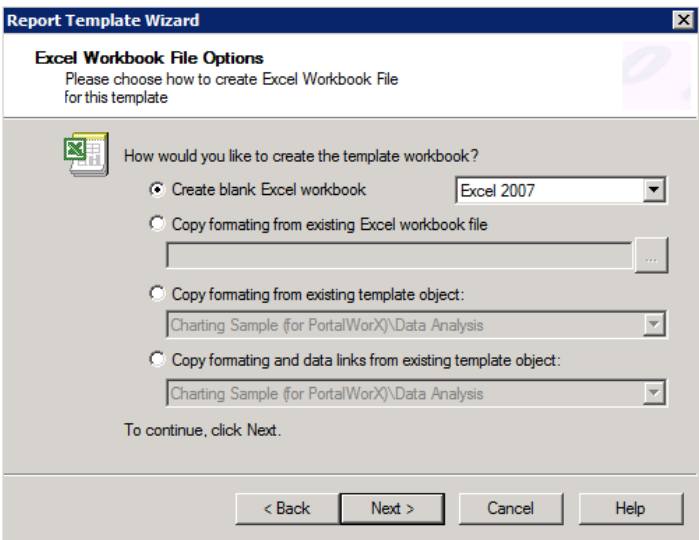
The dialog box is titled "Report Template Wizard" and has a close button (X) in the top right corner. The main heading is "Template Settings" with a subtext: "Template object represents a report design (layout), stored as Excel workbook." Below this, there are three numbered steps:

1. Please specify a Name for this Template object:
A text box contains "tmp_FDD_Fault_Statistics".
2. Please provide some description for this Template (up to 512 characters)
A large empty text area with a vertical scrollbar.
3. Please choose a Folder to place this Template into:
A dropdown menu shows "AnalytiX Templates".

Below the steps, it says "To continue, click Next." At the bottom, there are four buttons: "< Back", "Next >", "Cancel", and "Help".

Figure L5.12 – Report Template Wizard – Name and Folder Definitions

8. The only entry to change on the following page is the version of Excel.
9. Select **Excel 2007** from the drop down list and click. Your configuration should resemble the following figure. Click **Next**.



The dialog box is titled "Report Template Wizard" and has a close button (X) in the top right corner. The main heading is "Excel Workbook File Options" with a subtext: "Please choose how to create Excel Workbook File for this template". Below this, there is an Excel icon and the question "How would you like to create the template workbook?". There are four radio button options:

- ☒ Create blank: Excel workbook. A dropdown menu next to it shows "Excel 2007".
- ☐ Copy formatting from existing Excel workbook file. A text box with a browse button (...).
- ☐ Copy formatting from existing template object: A dropdown menu showing "Charting Sample (for PortalWorX)\Data Analysis".
- ☐ Copy formatting and data links from existing template object: A dropdown menu showing "Charting Sample (for PortalWorX)\Data Analysis".

Below the options, it says "To continue, click Next." At the bottom, there are four buttons: "< Back", "Next >", "Cancel", and "Help".

Figure L5.13 – Report Template Wizard – Specify Excel Version

10. On the following display, leave the fields at default and click **Finish**.

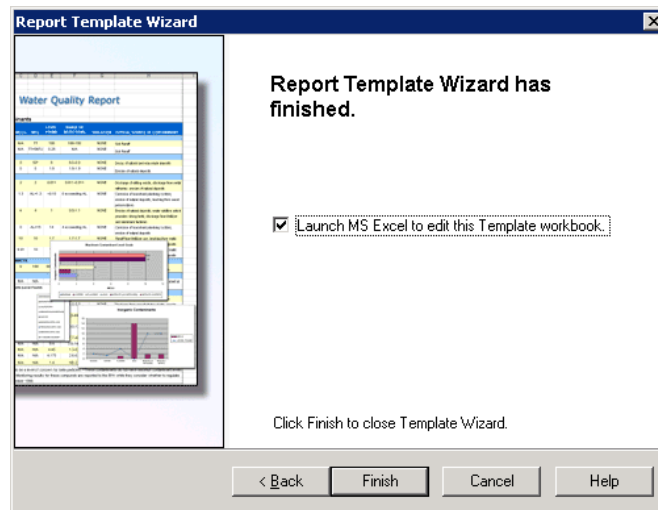


Figure L5.14 – Report Wizard has Finished

11. Click **OK** to the notification, as shown in the figure below.

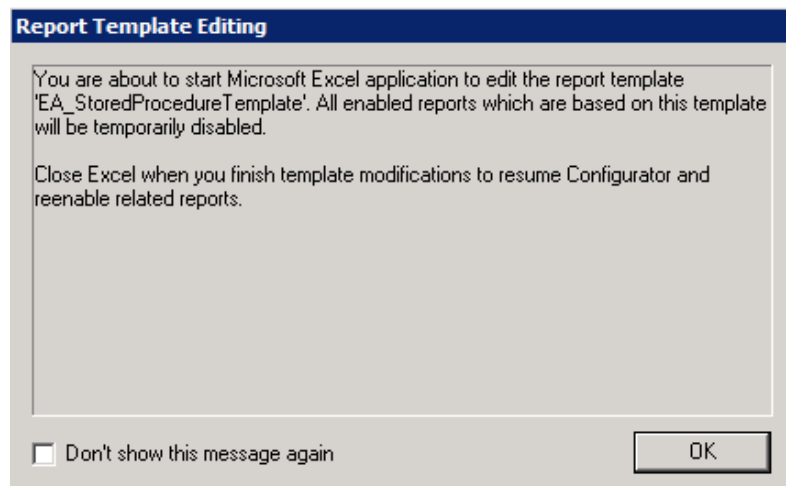


Figure L5.15 – Warning While Editing Report Templates

12. Excel will launch with an empty worksheet.

Creating database connections in Excel

1. We're going to connect to the **icTonicsAlarmData** database.
2. Once Microsoft Excel opens, select cell **A1** in the upper left.
3. In the top of the Excel screen, in the **ribbon**, select the **Insert** tab.
4. In the **Illustrations** section of the Excel ribbon select **Picture**.

5. Navigate to **C:\Training**, select the **fddworx_header.png** file and click on the **Insert** button. This inserts the Energy AnalytiX header into the Excel report.
6. We will adjust the size of the banner later when we have our columns defined and sized.

Creating a database connection in Excel

7. Select cells **A9 through E10** as seen in the figure below.

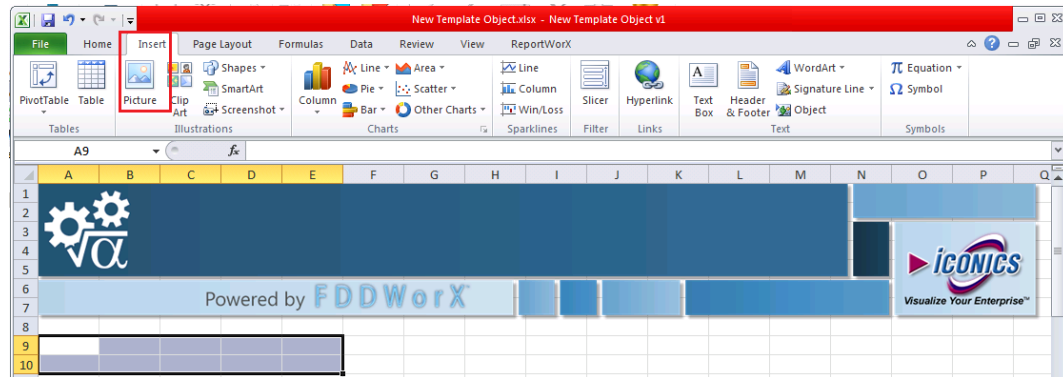


Figure L5.16 – Cell Selection in Excel

8. Right-click on cell **A9** and select **Connect to new Data Source → Open Database**.

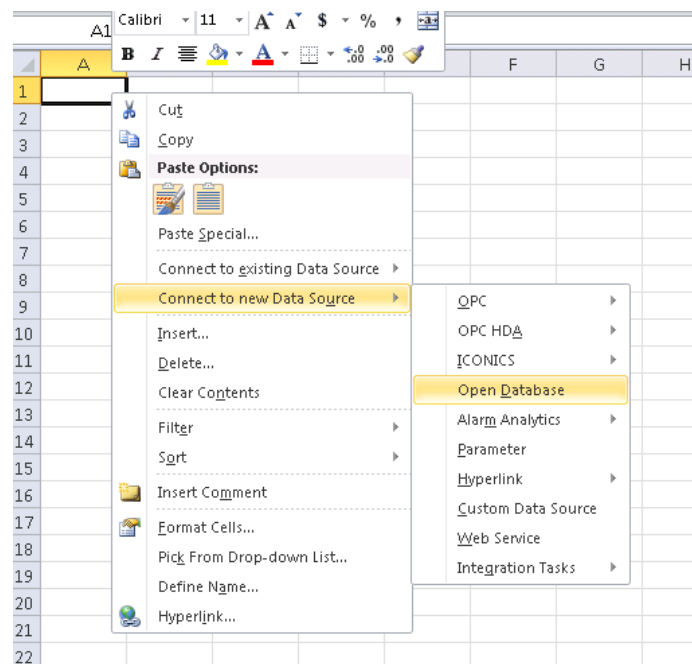


Figure L5.17 - Connecting to a Data Source in Excel

9. The **Database Connection Configuration Wizard** appears. Click on **Browse**.

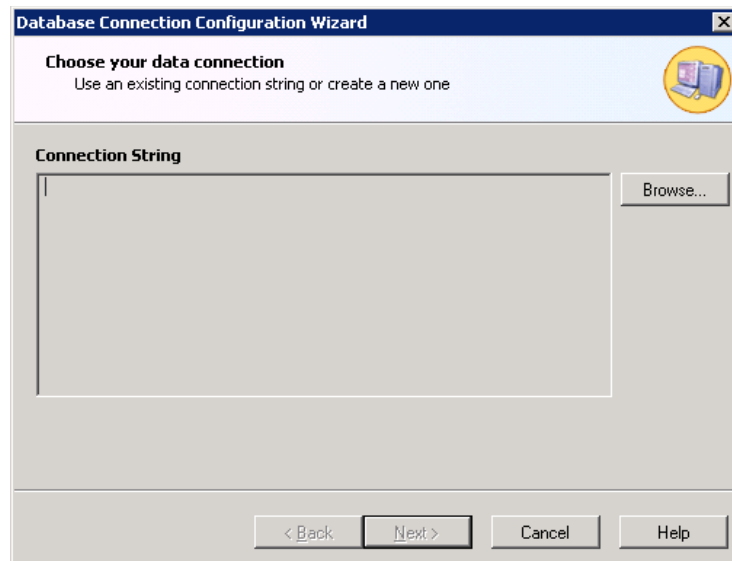


Figure L5.18 - Database Connection Configuration Wizard

10. The **Database Connections Browser** will appear. Right click in the right pane window (beneath 'Connection Name') and select **Insert New Connection**.

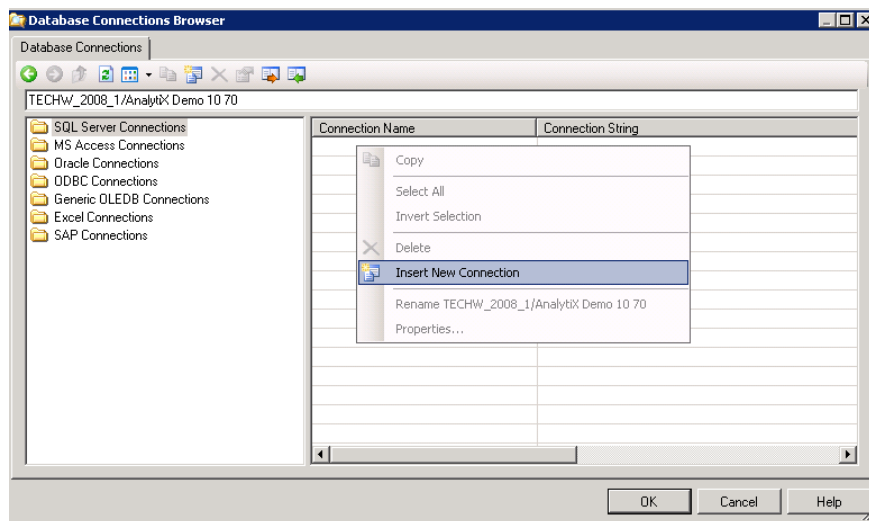


Figure L5.19 - Database Connections Browser

11. The Data Link Properties window will appear. Enter your SQL Server name. Typically in training the server name is **(local)\SQLEXPRESS**.

Note: A dot in the server name, **.\SQLEXPRESS**, indicates that the database is on the local machine.

12. In line 2. select **Use Windows NT Integrated Security**.

13. In line 3. Select the **icTonicsAlarmData** database from the drop down list. Feel free to click the **Test Connection** button if you want. When your completed configuration resembles the figure below click **OK**.

Note: The following example defined the server name as (local)\SQLexpress. Please consult with your instructor in the event you do not see the database name 'icTonicsAlarmData' in the drop down list.

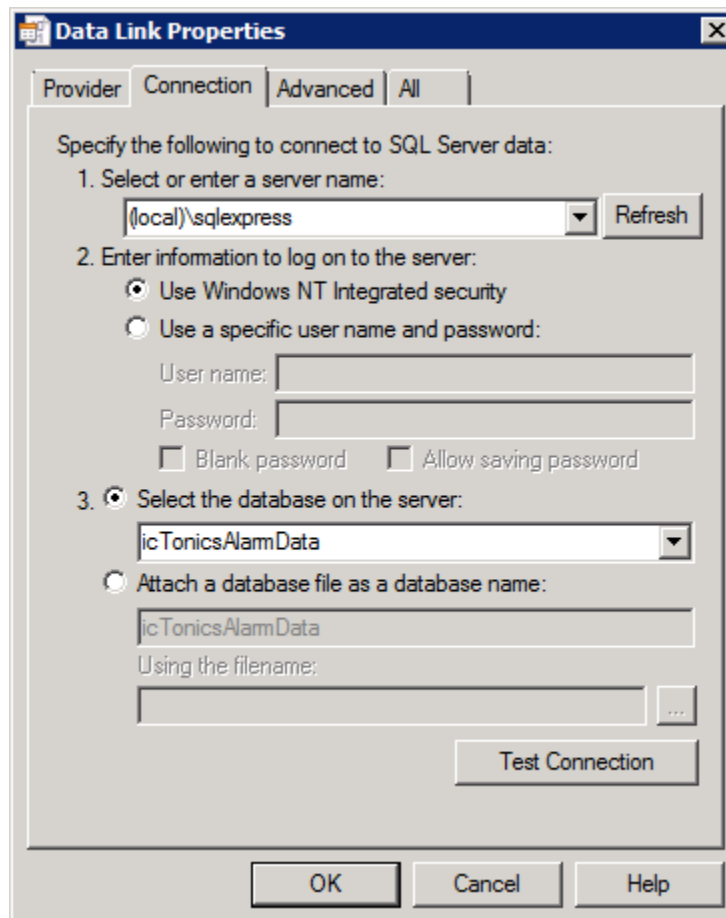


Figure L5.20 - Data Link Properties Window

14. Select the newly created **Connection String** and click **OK**.

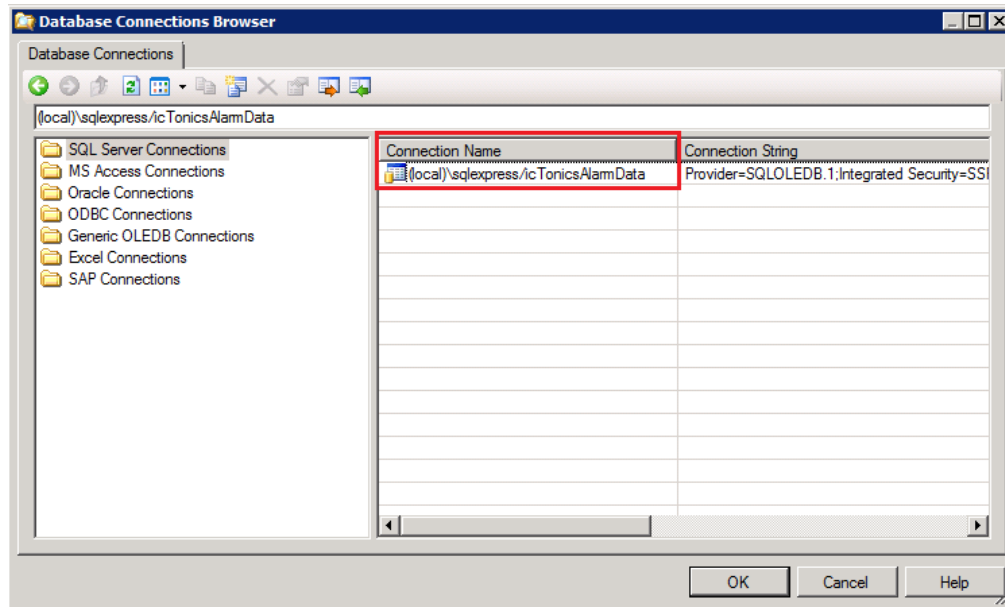


Figure L5.21 - Data Connection Browser

15. Your **Connection String** should resemble the contents of the figure below. Click **Next** to continue.

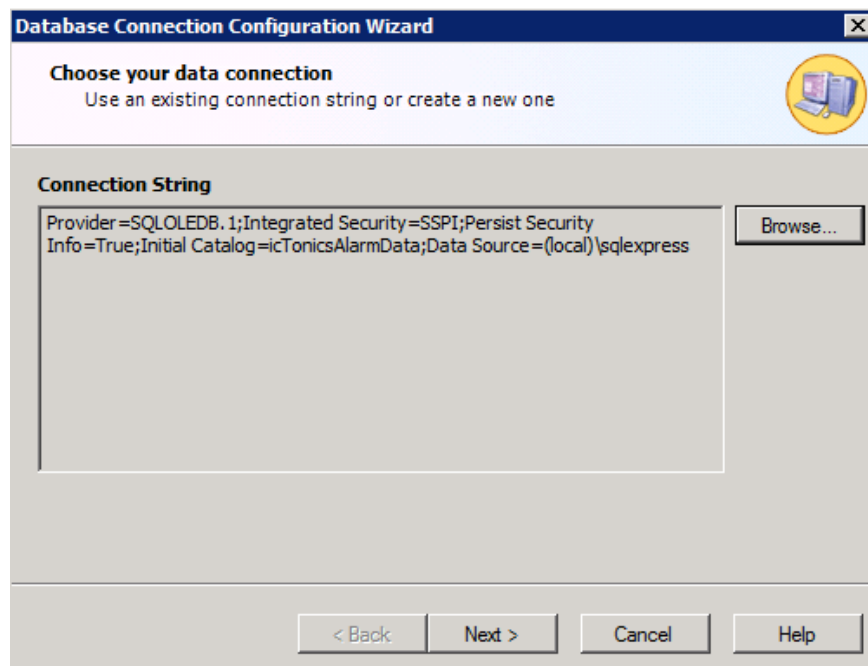


Figure L5.22 - Database Connection String

Creating a Simple Query

1. You will now be able to create your **Database Query**. Click on the **Edit** button and select **Simple Query**.

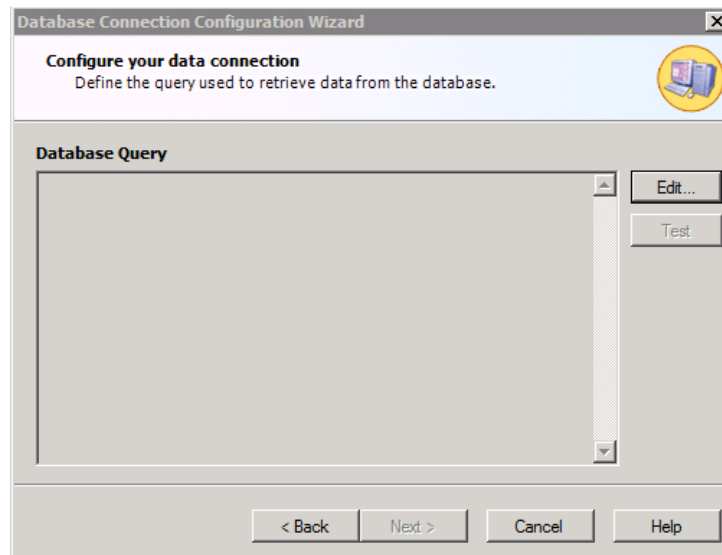


Figure L5.23 - Database Query Selection

2. This opens the **SQL Command Designer** window. Click on the ellipsis [...] button as indicated by the circle in the figure below.

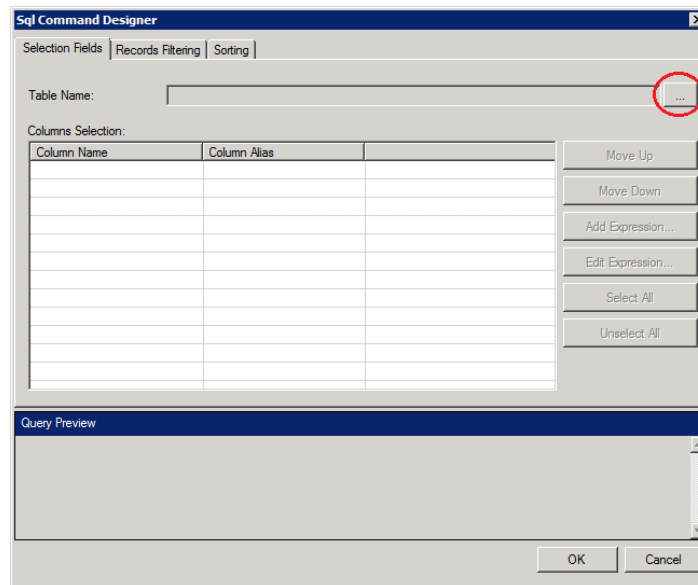


Figure L5.24 - SQL Command Designer

3. This opens the **Select Table** window.
4. Expand the **TABLE → dbo** branch.

5. Select the **AlarmLog** table. By clicking on AlarmLog the name will appear in the **Table:** field in the bottom of the dialog.
6. Click **OK**.

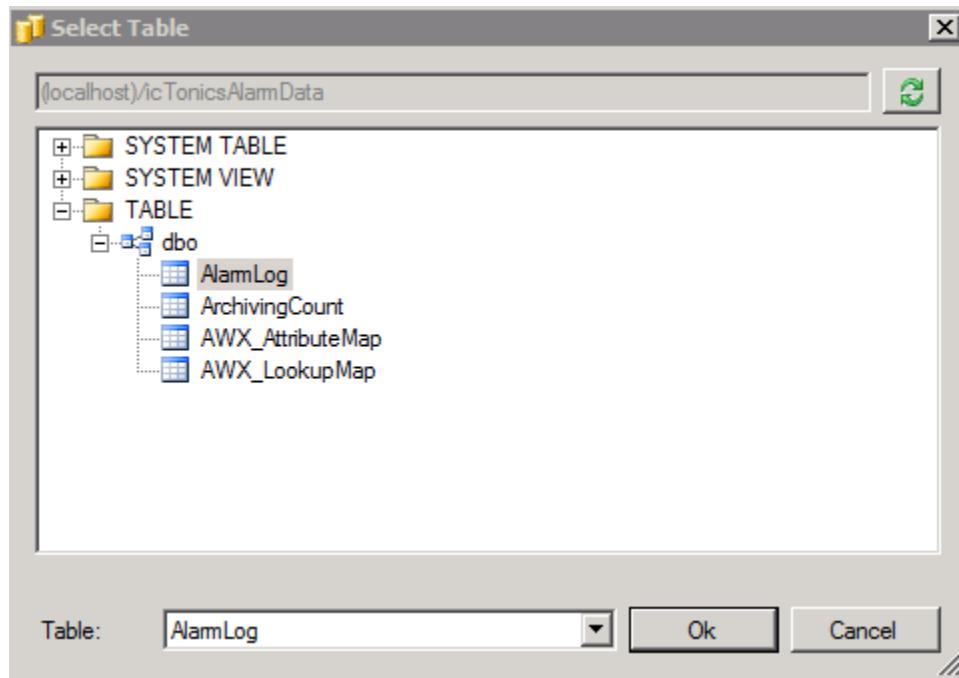


Figure L5.25 - Select Table Dialog

5.6. Selecting Table Fields

After selecting your table and clicking OK, this launches the **SQL Command Designer** dialog.

Select the columns for your report.

1. Place a check mark in the following fields: **EventTime**, **Source**, **Severity**, **ServerNode** and **Message**.

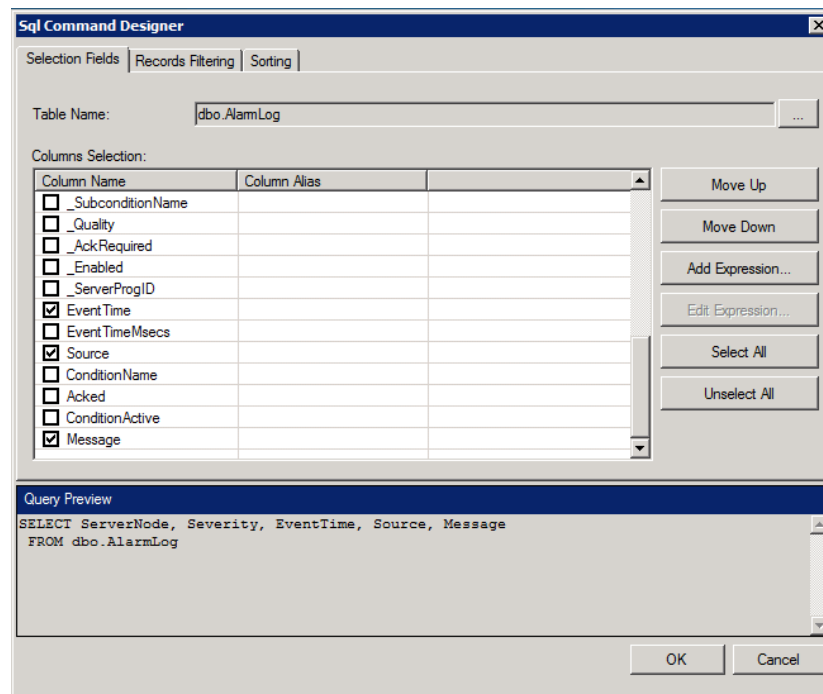


Figure L5.26 – Defining the Columns for your Report

2. Click **OK**.
3. Click **Next**.
4. In the **Data Source Name** field enter **icTonicsAlarmData_DatabaseSource**.
5. Click **Finish**.
6. By inserting and selecting each field from the drop down from within the **Layout Manager** dialog, define columns **A through E** as follows **EventTime**, **Source**, **Severity**, **ServerNode** and **Message**.

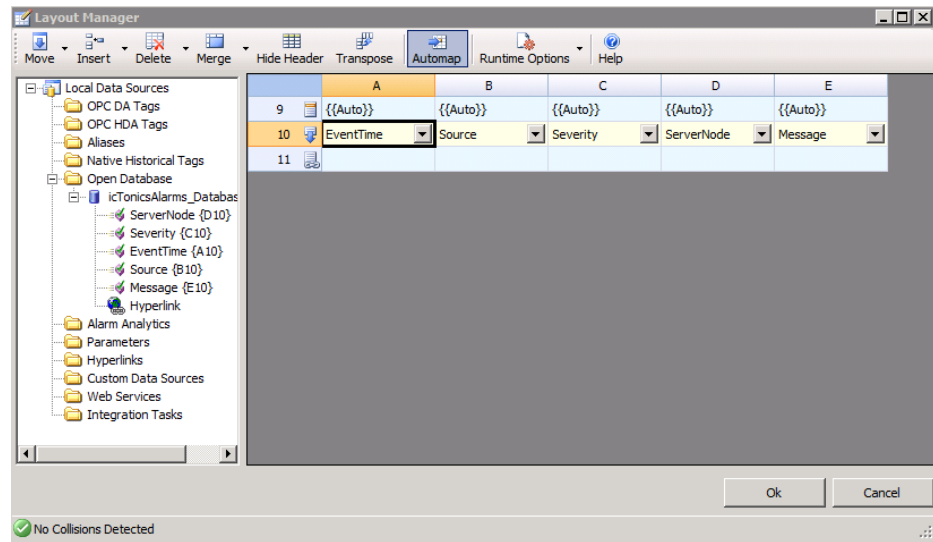


Figure L5.27 – Defined Column Layout

7. When complete, click **OK**.
8. We will proceed by defining each field's **Column Width**.
9. Click on the **A** in **column A**. The intent is to select the entire column. See the circled selection in the figure below.

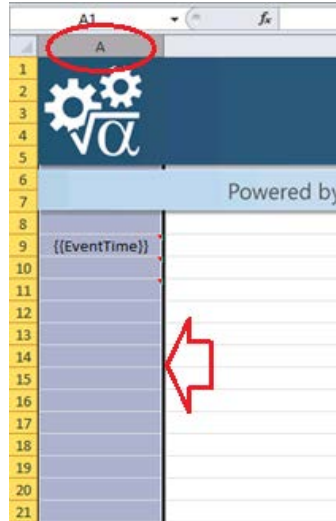


Figure L5.28 – Selecting a Column to Define Column Width.

10. Right click in the selected area (see the arrow in the previous figure) and select Column Width from the drop down list.

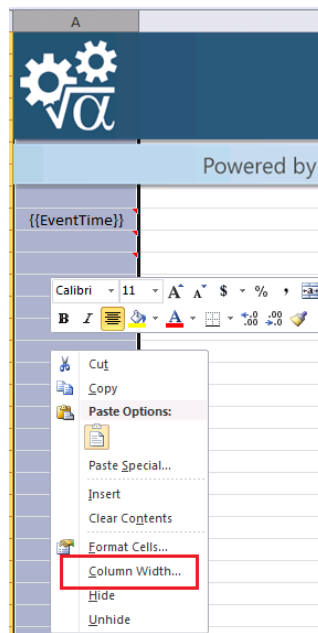


Figure L5.29 – Define the Column Width

11. Enter the value **15.57** and click **OK**.

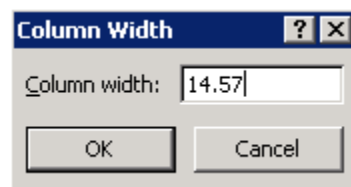


Figure L5.30 – Column A Width = 15.57

12. Proceed to select the columns **B** through **E** and adjust the column widths according to the chart below.

<i>Columns</i>				
	B	C	D	E
<i>Widths</i>	70.43	9.71	16	85.86

13. Once again, select **Column A**.

14. Once again, right click on the selected cells and select **Format Cells**.

15. From the **Format Cells** dialog box, click the **Number** tab.

16. Select the **Date** format as seen in the following figure.

17. Click **OK**.

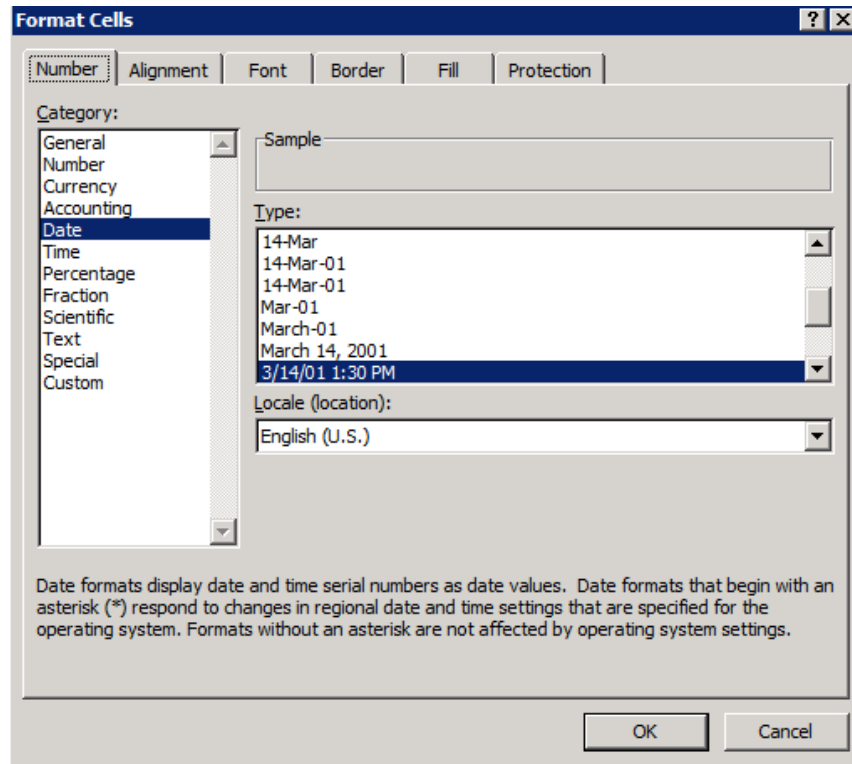


Figure L5.31 – Format Column A as Date

18. Lastly, select cells **A9** through **E10** again.
19. Click on the Excel **Data** tab.
20. In the **Sort and Filter** section, click on the **Filter** icon.
21. The result should resemble the figure below.

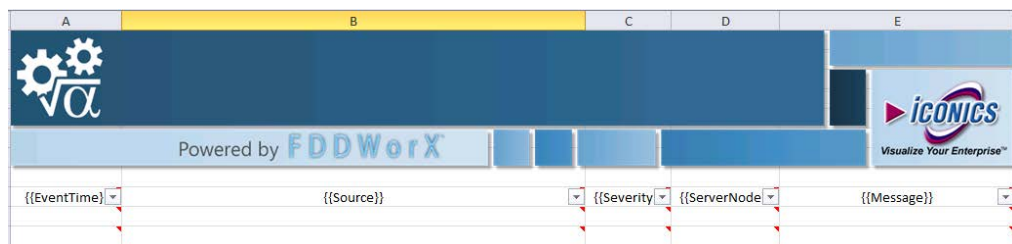


Figure L5.32 – Column Widths defined and Filter applied.

22. **Select the banner.** Using one of the handles, adjust the size of the banner to accommodate the width of the report.
23. The report is built but we may be making adjustments later on.
24. In order to return to the ReportWorX configurator, **Close Excel by clicking on the Close Window X** in the far upper right hand corner of the Excel window.

Important: Do Not use File → Exit to close Excel.

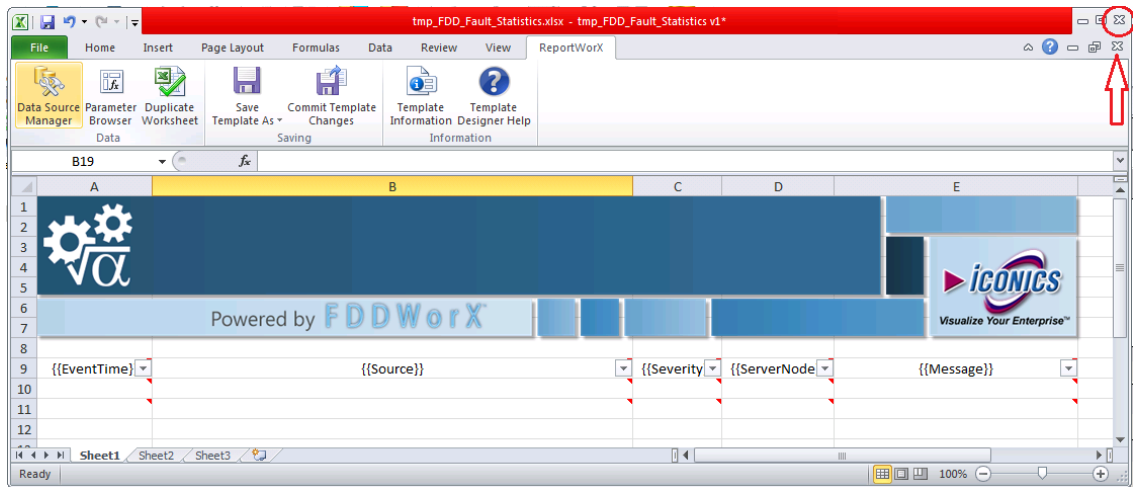


Figure L5.33 – Closing Excel

25. Click the **Commit Changes** button.

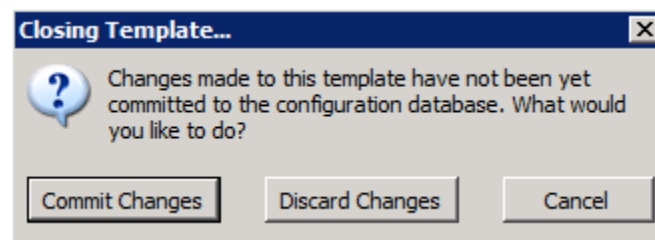


Figure L5.34– Committing Report Changes

26. Click **OK** in the **Comment Template Changes** dialog.

27. This returns you to the **ReportWorX configurator**. Your report is ready to be executed.

28. If the traffic light in the ribbon is not green, click on the traffic light to **start** the **ReportWorX Service**.

5.7. ReportWorX Executor in PortalWorX-SL

You have the option to execute configured reports through the ReportWorX Executor in PortalWorX-SL.

There are some setup steps that need to be performed prior to being able to execute a report in the viewer. The steps are described below.

PortalWorX-SL and the ReportWorX Executor

1. Launch PortalWorX-SL by selecting **Start** → **All Programs** → **ICONICS** → **PortalWorX-SL**.

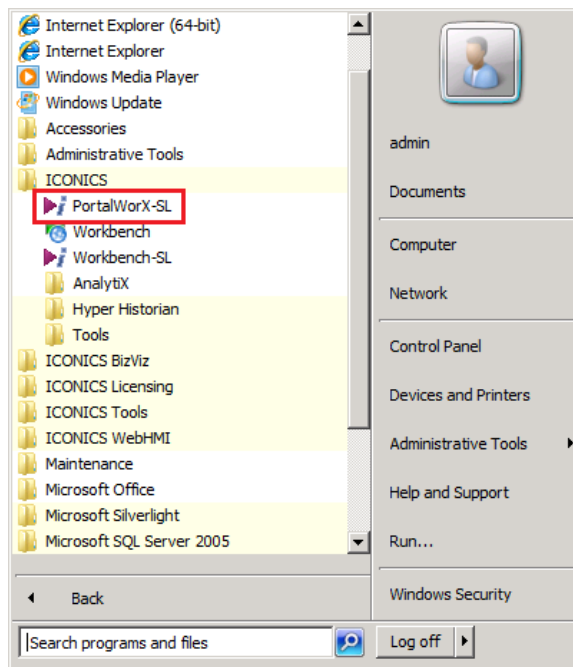


Figure L5.35 – Launching PortalWorX

2. From the **Home** tab from within the **AnalytiX Controls**, select the **ReportWorX Executor** as indicated in the following figure.

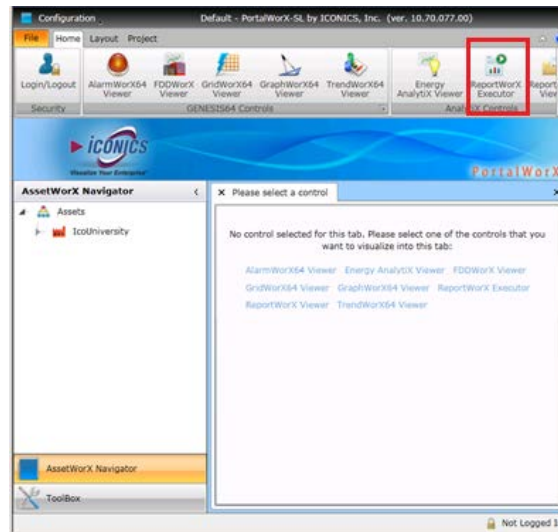


Figure L5.36 – The ReportWorX Executor in PortalWorX-SL

3. As indicated in the figure below, from the **Report Name:** drop down list, select the **rpt_FDD_Fault_Statistics** report we created earlier. Leave the remaining fields as default.
4. Click **OK**.

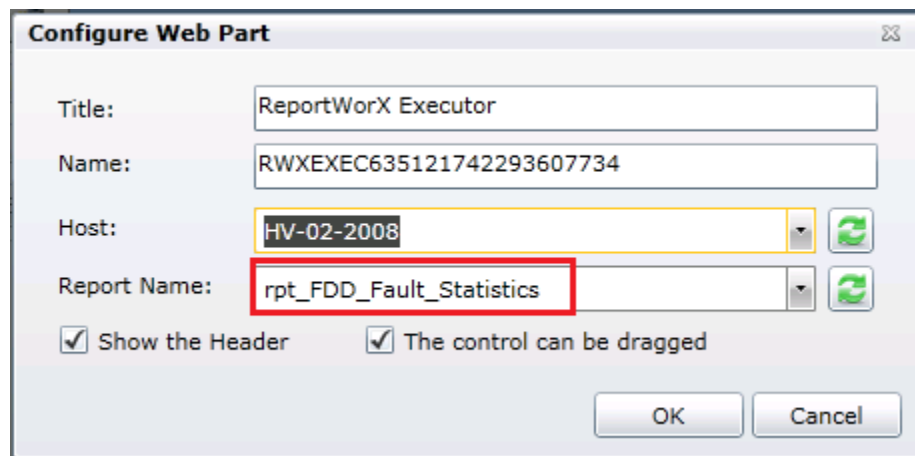


Figure L5.37 – Selecting the Report Name

5. The content area in PortalWorX-SL should resemble the figure below.

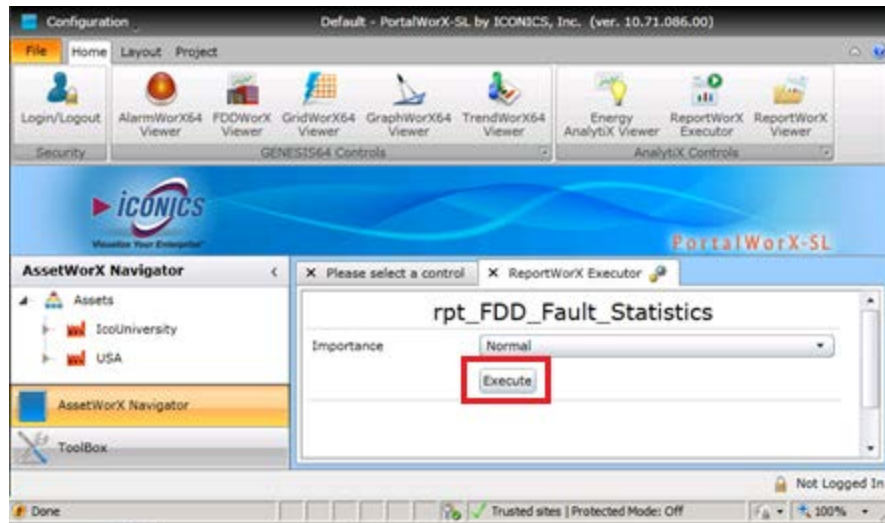


Figure L5.38 – Selecting the Report to Execute

6. As highlighted with a rectangle in the previous figure, click on the **Execute** button.
7. The result should resemble the figure below. Click on the link labeled '**Click here to view the report.**'



Figure L5.39 – Viewing the Report

8. The selection will launch Excel. In the **File Download** dialog click **Open**.
9. If necessary, enter the **User name and Password** delivered by your instructor. This will be the credentials to log into the SQL Server Database. Note: The login dialog may be under another window. If there is a highlighted icon on your taskbar, click on it. Or you may have to do Alt-Tab to select the login dialog.

EventTime	Source	Severity	ServerNode	Message
8/15/13 10:30 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 is in normal state
8/15/13 11:22 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 Fault state 'SlowToSetpoint.'
8/15/13 11:22 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 is in normal state
8/15/13 11:22 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 Fault state 'SlowToSetpoint.'
8/15/13 11:35 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 is in normal state

Figure L5.40 – Completed Report – Example

5.8. Using the PortalWorX-SL ReportWorX Viewer

You also have the option to select and view configured and executed reports through the ReportWorX Viewer in PortalWorX-SL. This is similar to how reports can be selected to be viewed via the ReportWorX Configurator or Unified Web Interface.

In PortalWorX-SL, when you select a **ReportWorX Viewer**, you are able to configure that specific Web Part including selecting a report from a configured Report Server and report folder. In the example below, we are selecting the AnalytiX_Reports folder that was previously created in ReportWorX Configurator.

1. From within PortalWorX-SL select the ReportWorX Viewer.

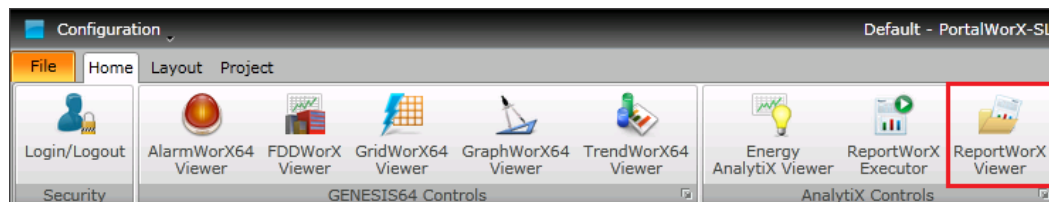
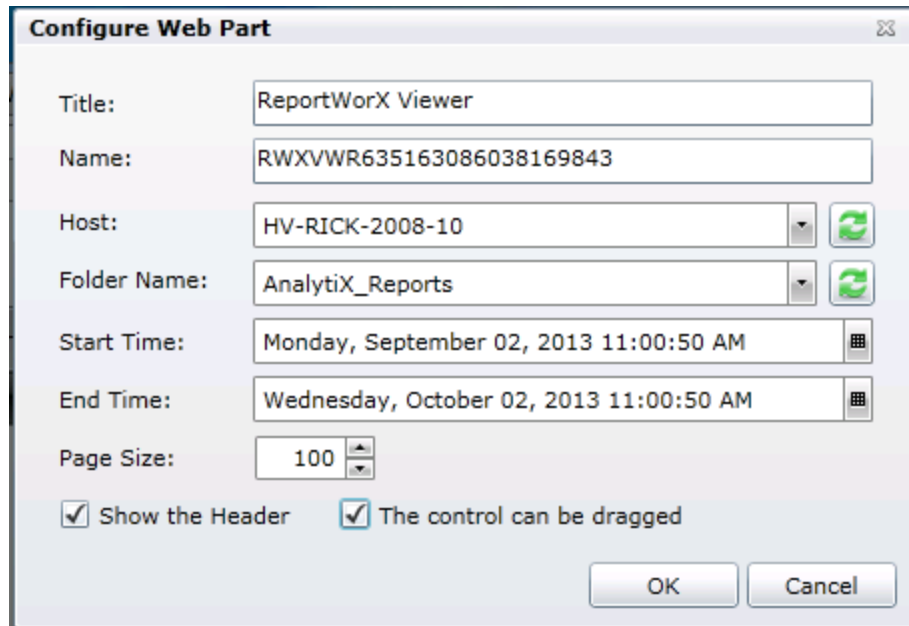


Figure L5.41 – AnalytiX Controls ReportWorX Viewer

2. Within the **Configure Web Part** dialog you only need to select the **Folder Name** from the drop down list. However you can also configure optional information such as the Title.
3. Click **OK**.



Configure Web Part

Title: ReportWorX Viewer

Name: RWXVWR635163086038169843

Host: HV-RICK-2008-10

Folder Name: AnalytiX_Reports

Start Time: Monday, September 02, 2013 11:00:50 AM

End Time: Wednesday, October 02, 2013 11:00:50 AM

Page Size: 100

☒ Show the Header ☒ The control can be dragged

OK Cancel

Figure L5.42 – Configuring the Web Part

4. A new window will appear in the content area of PortalWorX-SL, showing your selected report folder's name, as shown in the following image. You can change the dates as to when your selected report may have been executed, as well as apply an additional filter. Your configured and executed reports will be listed below. In our example, we wish to view the rpt_FDD_Fault_Statistics report shown below.
5. To open the report, click on the Excel icon () to the left of the Report Name and click on the **Open** button.

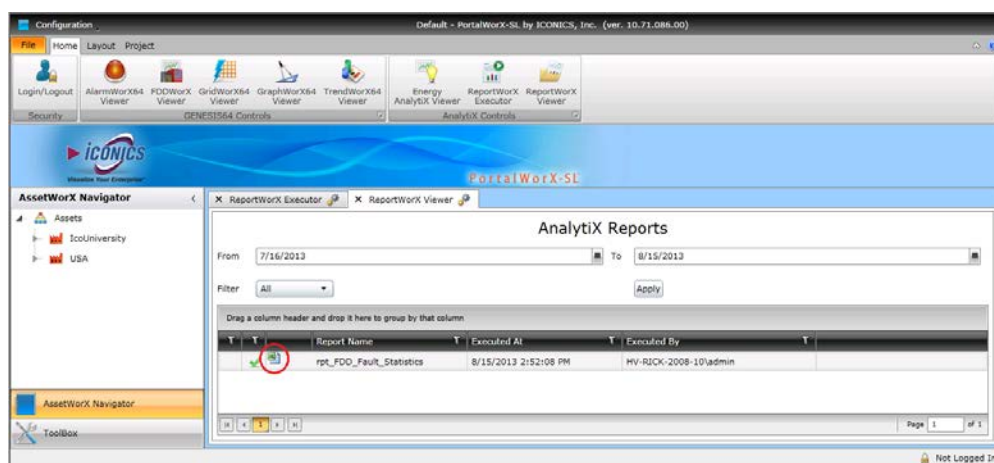


Figure L5.43 – Selecting a Report to View

- This will open the Excel file that shows the configured data from your selected data sources.

EventTime	Source	Severity	ServerNode	Message
8/15/13 10:30 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 is in normal state
8/15/13 11:22 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 Fault state 'SlowToSetpoint.'
8/15/13 11:22 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 is in normal state
8/15/13 11:22 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 Fault state 'SlowToSetpoint.'
8/15/13 11:35 AM	IcoUniversity.NorthCampus.EngineeringBuilding.HVAC02.SlowToSetpoint	500	HV-RICK-2008-10	HVAC02 is in normal state

Figure L5.44- Executed Report in Microsoft Excel

This concludes this Lab.



Visualize Your Enterprise™

100 Foxborough Blvd., Foxborough, MA 02035
508.543.8600 • FAX: 508.543.1503
www.iconics.com • E-mail: info@iconics.com

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