



FDDWorX Quick Start



APPLICATION NOTE

October 2015

Description: A quick start guide to configuring FDDWorX.

Introduction

FDDWorX is a predictive building automation solution that uses an advanced Fault Detection and Diagnostics Engine. It incorporates algorithms that weigh the probability of faults and advises management, operators and maintenance personnel of actions to prevent equipment failures or excessive use of energy. Commanding provides users with a simple way to monitor their asset structures with minimum development effort.

In this Application Note you will learn about Fault definition, creating Fault Diagnostic Model, and applying that model for Fault diagnostics. The example used is based on a Variable Air Volume (VAV) device commonly found in Building Automation Systems.

Fault Detection

Configuring an Equipment

To configure Fault Detection and Diagnostics, we will want to add this support to one of our AssetWorX equipment. To start, we will quickly create a structure in AssetWorX that will contain a single VAV device.

1. Open Workbench Desktop from **Start → All Programs → ICONICS → Workbench Desktop**
2. Expand the **AssetWorX** provider to show the **Equipment** option.
3. While there is already a sample equipment structure in the default configuration database, we will create one for our VAV. Right click on Equipment, and select **Add Equipment**.
4. Enter a name of "**BuildingA**" and click **Apply**.
5. Continue to build this structure with child asset to BuildingA of "**Floor1**", and finally a child asset to Floor1 called "**VAV_1A**". The resulting AssetWorX structure should look like Figure 1.

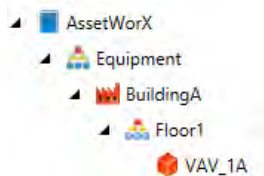


Figure 1 - Configured AssetWorX structure

6. With the VAV_1A asset selected, click the + tab on the right which will provide the option to add new support for FDDWorX.

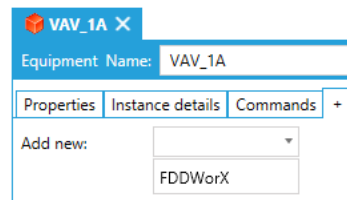


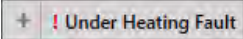
Figure 2 - Adding FDDWorX support to VAV_1A asset

Faults

Some of the key functions of Faults include the ability to:

- use a powerful expression engine to generate additional abnormal conditions that may not be exposed already by your equipment
- trigger the Fault Detection and Diagnostics calculations on that equipment using the field knowledge configured in the Fault Diagnostic Model to assist in the diagnosis of the cause a fault
- capture up to 20 Related Values which can include snapshots of other real-time points at the time of the fault, or using expressions for possible cost savings equations, etc.

Now that the Facility AnalytiX support has been added to our VAV_1A equipment, we will configure a fault for an "Under Heating Fault". This fault will be enabled (ability for the fault to trigger or not) based on whether or not the VAV is in Heating Mode. The actual fault will trigger if the Discharge Temperature from the VAV is less than or equal to the Zones Temperature plus 5 degrees for more than 1 minute.

1. On the **Fault Definitions** tab, click the **Add Fault** button. This will create a new fault.
 2. Rename this fault to "**Under Heating Fault**"
 3. Click the + button to edit the fault.
- 
4. In General Tab set the **Enabled** value to a point that indicates if the VAV is in Heating Mode. Set it to the appropriate point address if available or to a simulation point.
 5. In the **Fault Rule** tab enter an expression such as:

```
IF (trueforduration(((<<DAT>> <= <<ZoneTemp>> + 5), 60000))
THEN 1
ELSE 0
```



- Notice that elements in the rule that are wrapped with "<<...>>" show up in the parameters list below the rule. This parameter support allows the rule to be created in a generic way and be saved in the rule library. Rules from the rule library can then be reused for multiple similar equipment, with each equipment binding its unique value to each parameter.
- Now we need to bind each parameter with the address of the corresponding data point.
- To bind a value, double click in the "Bound to Value" field of the parameter and click on the "..." button to the right.
- This brings up the data browser that lets you browse to the appropriate point and bind the point address as the value for the parameter.
- For each parameter in our fault, bind it to the appropriate point address if available or to a simulation point.
- Click **Apply** to save your changes. Your completed **Fault Definitions** tab may look similar to Figure 3.

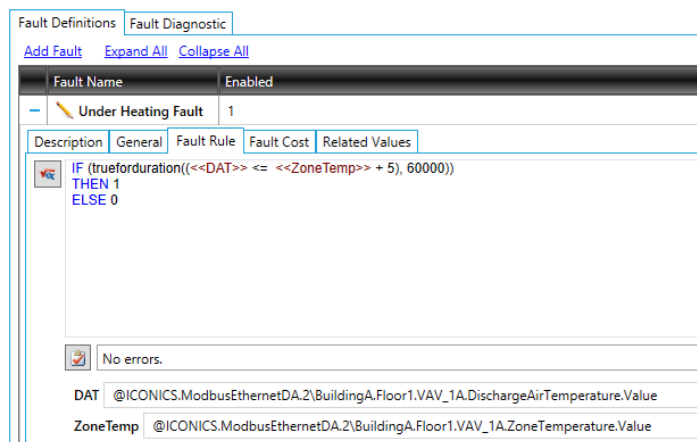


Figure 3 - Configured Fault Definitions tab

NOTE: You can also you can enter the cost to associate with the fault in the Fault Cost tab.

NOTE: You can also you can enter the related values to associate with the fault in the Related Values tab.

Fault Diagnostics

Creating Fault Diagnostic Model

The key to an effective FDDWorX configuration is to configure a Fault Diagnostic Model that fits your particular piece device you wish to perform your Fault Detection and Diagnostics on. In this example, we will configure some Symptoms and Causes that may related to a VAV device.

First we will create a new FDDWorX Fault Diagnostic Model using the following steps:

- Open **Workbench Desktop** if closed from the previous section.
- Browse to **AnalytiX → FDDWorX → Fault Diagnostic Models**
- Right click on **Fault Diagnostic Models** and select **Add Diagnostic Model Folder** or with the Fault Diagnostic Model selected, click the Add Diagnostic Model Folder option in the ribbon above.
- Enter a Name for these Diagnostic Models such as "Building Automation Systems" and click **Apply**.
- Right click on the the newly created Building Automation Systems Diagnostic Model Folder and click **Add Diagnostic Model**.
- Enter a Name such as "VAV" and click **Apply**.

Symptoms

With our "VAV" Fault Diagnostic Model created we will now configure some Symptoms. You can think of Symptoms as alarms that may typically generate on that piece of equipment, and in this case a VAV. We will correlate these Symptoms to Symptom Alarms later in the "Configuring Fault Diagnostics" section of this Application Note.

- Click the **Add/Remove/Edit Symptoms** button at the bottom of your VAV page.
- Enter some possible Symptoms, one symptom per row, such as:

- High Zone Temperature
- High Airflow
- Damper Alarm
- Low Airflow
- Low Zone Temperature

- Click OK on the Add/Remove/Edit Diagnostics Model Symptoms dialog. Your Fault Diagnostic Model should now look similar to Figure 4.

Fault Symptoms/Causes Diagnostics Matrix:

Diagnostic Symptoms	High Zone Temperature	High Airflow	Damper Alarm	Low Airflow	Low Zone Temperature
Possible Causes					

Figure 4 - Configured Symptoms

Causes

Now that we have defined some possible Symptoms for this VAV Fault Diagnostic Model, next we will configure the Causes portion of the model. Causes are basically possible reasons for



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those previously configured Symptoms to occur. You can then further define what percent or likelihood of the Symptoms would contribute to these Causes.

Click the **Add/Remove/Edit Probable Causes** button. 

21. Enter some possible Causes or components, one cause per row, that would relate to the previously configured Symptoms such as:

- Fan
- Motor
- Controls
- Electric Heater

22. Click **OK** on the Add/Remove/Edit Diagnostics Model Causes dialog.

23. Now you must enter some values or percentages in the resulting matrix based on our knowledge of the equipment, in this example is a VAV, which will define the probability that the Symptoms along the top attribute to the Causes along the left side. Make sure to click **Apply** when you are done.

24. With the matrix configured make sure to click **Apply** to save your changes. Your completed Fault Diagnostic Model may look similar to Figure 5.

Fault Symptoms/Causes Diagnostics Matrix:

Diagnostic Symptoms Possible Causes	High Zone Temperature	High Airflow	Damper Alarm	Low Airflow	Low Zone Temperature
Fan	20 (20%)	50 (50%)	0 (0%)	70 (70%)	25 (25%)
Motor	0 (0%)	0 (0%)	75 (75%)	15 (15%)	0 (0%)
Controls	20 (20%)	50 (50%)	25 (25%)	15 (15%)	10 (10%)
Electric Heater	60 (60%)	0 (0%)	0 (0%)	0 (0%)	65 (65%)

Figure 5 - Completed Fault Diagnostic Model for VAV

Configuring Fault Diagnostics

After creating Diagnostics model we need to apply it to particular equipment we wish to perform Fault Diagnostics on.

25. In AssetWorX provider browse to **"BuildingA - Floor1 - VAV_1A"** equipment created before
26. In the equipment FDDWorX tab click on Fault Diagnostics tab
27. Select created **"Building Automation Systems\VAV"** diagnostics model

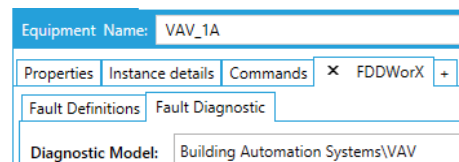


Figure 6 - Selecting Fault Diagnostic Model

Symptom Alarms

As mentioned in Symptoms section, we now need to associate Symptom Alarms to the different Symptoms of the VAV Fault Diagnostic Model. These Alarms can come from any existing OPC Alarm and Event Server such as AlarmWorX64 Server, or even BACnet Alarms.

We will not go into great detail in this section, but for this section, we need to configure 5 alarms in AlarmWorX64 server to account for the High Zone Temperature, High Airflow, Damper Alarm, Low Airflow, and Low Zone Temperature symptoms we previously mentioned.

For more details on configuring alarms with AlarmWorX64 Server please refer to the help documentation.

The resulting **Fault Diagnostic** tab may look similar to Figure 7.

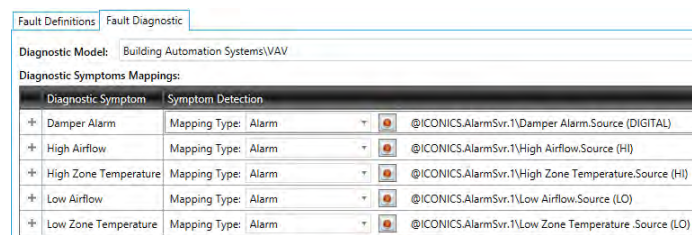


Figure 7 - Configured Fault Diagnostic tab

Lastly, you will want to start the ICONICS FDDWorX Windows Service from Start → Control Panel → Administrative Tools → Services. You will find an **ICONICS FDDWorX** service in this list. Right click on this service and select **Start**.

With the FDDWorX Service running you can now monitor your equipment and view the Fault Detection and Diagnostics results from an FDDWorX Viewer in the various client applications such as GraphWorX64, PortalWorX, and PortalWorX SL.

For more details on the FDDWorX Viewer, please refer to the help documentation, *FDDWorX - Viewer* and *FDDWorX - Faults Incidents View and Fault Acknowledgement* application notes.