



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 configuring a Fault Diagnostic Model, and applying that model to an Asset. The example used is based on a Variable Air Volume (VAV) device commonly found in Building Automation Systems.

Configuring a 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:

1. Open Workbench Silverlight from **Start → All Programs → ICONICS → Workbench SL**.
2. Select the **FDDWorX Provider** and expand your database (AssetWorX is the default configuration database) to see the **Fault Diagnostic Model** option.

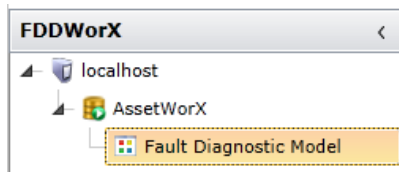


Figure 1 - FDDWorX Provider with Fault Diagnostic Model option

3. Right click on **Fault Diagnostic Model** and select **Add Diagnostic Model Folder** or with the Fault Diagnostic Model selected, click the Add Diagnostic Model Folder option in the ribbon above.
4. Enter a Name for these Diagnostic Models such as **“Building Automation Systems”** and click **Apply**.

5. Right click on the the newly created Building Automation Systems Diagnostic Model Folder and click **Add Diagnostic Model**.
6. 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 an Asset” section of this Application Note.

7. Click the **Add/Remove/Edit Symptoms** button at the bottom of your VAV page.
8. Enter some possible Symptoms, one symptom per row, such as:
 - High Zone Temperature
 - High Airflow
 - Damper Alarm
 - Low Airflow
 - Low Zone Temperature
9. Click OK on the Add, Remove, or Edit Symptoms dialog. Your Fault Diagnostic Model should now look similar to Figure 2.

Fault Symptoms/ Causes Diagnostics Matrix					
Diagnostic Symptoms	Damper Alarm	High Airflow	High Zone Temperature	Low Airflow	Low Zone Temperature
Possible Causes					

Figure 2 - 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 those previously configured Symptoms to occur. You can then further define what percent or likelihood of the Symptoms would contribute to these Causes.



1. Click the **Add/Remove/Edit Causes** button.
2. 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

3. Click **OK** on the Add, Remove, or Edit Causes dialog.
4. 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.
5. With the matrix configured make sure to click **Apply** to save your changes. Your completed Fault Diagnostic Model may look similar to Figure 3.

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

Figure 3 - Completed Fault Diagnostic Model for VAV

Configuring an Asset

With FDDWorX configured, we will now want to add this support to one of our AssetWorX assets. To start, we will quickly create a structure in AssetWorX that will contain a single VAV device.

1. Open **Workbench Silverlight** if closed from the previous section.
2. Select the **AssetWorX** provider and expand the AssetWorX database (if using default configuration) to show the **Assets** option.
3. While there is already a sample Asset structure in the default configuration database, we will create one for our VAV. Right click on Assets, 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 4.

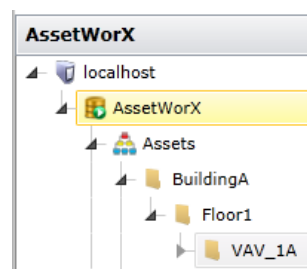


Figure 4 - Configured AssetWorX structure

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

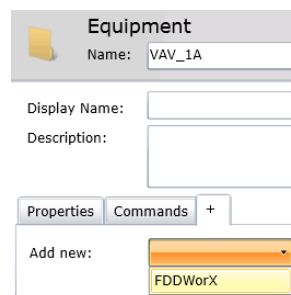


Figure 5 - Adding FDDWorX support to VAV_1A asset

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 asset, 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 called "Fault1".
2. Rename this fault to "**Under Heating Fault**"
3. Set the **Enabled** value in General Tab to a point that indicates if the VAV is in Heating Mode.
4. In the Fault Rule enter an expression such as:

```
IF(trueforduration(((@ICONICS.ModbusEthernetDA.2\BuildingA.Floor1.VAV_1A.DischargeAirTemperature.Value)) <=
{{@ICONICS.ModbusEthernetDA.2\BuildingA.Floor1.VAV_1A.ZoneTemperature.Value}} +5),60000))
THEN 1
ELSE 0
```

5. Click **Apply** to save your changes. Your completed **Fault Definitions** tab may look similar to Figure 7.

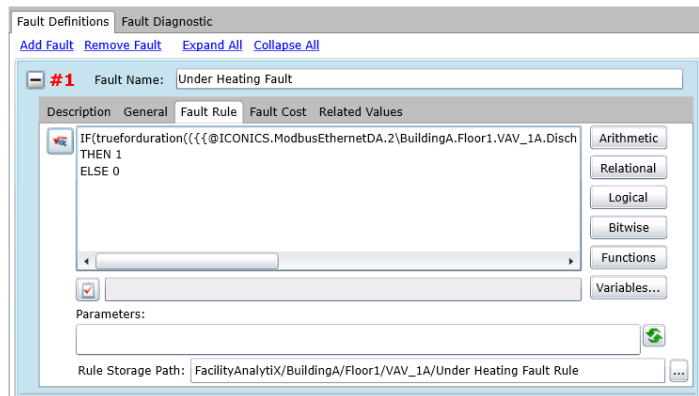


Figure 6 - Configured Fault Definitions tab

NOTE: You can also parameterize your expression to make them more reusable for other equipment.

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.

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 example there were 5 alarms configured in the AlarmWorX64 Server to account for the High Zone Temperature, High Airflow, Damper Alarm, Low Airflow, and Low Zone Temperature symptoms we previously mentioned. The resulting **Fault Diagnostic** tab may look similar to Figure 7.

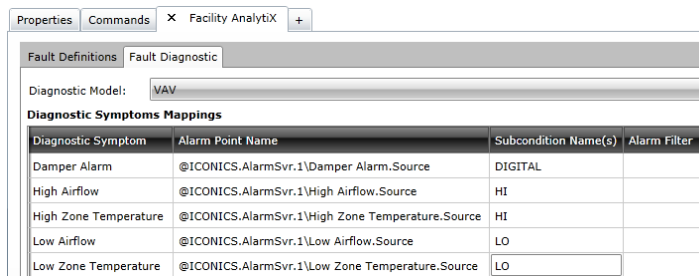


Figure 7 - Configured Fault Diagnostic tab

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

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 and *FDDWorX - Viewer* application note.