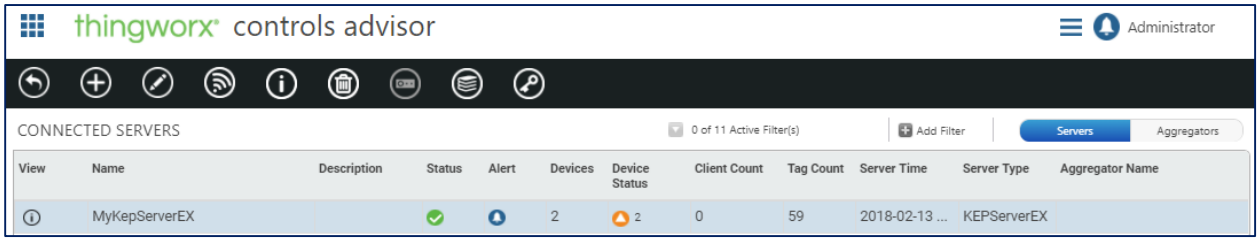
LEARN THINGWORX MANUFACTURING APPS USING SIGMA TILE GUIDE

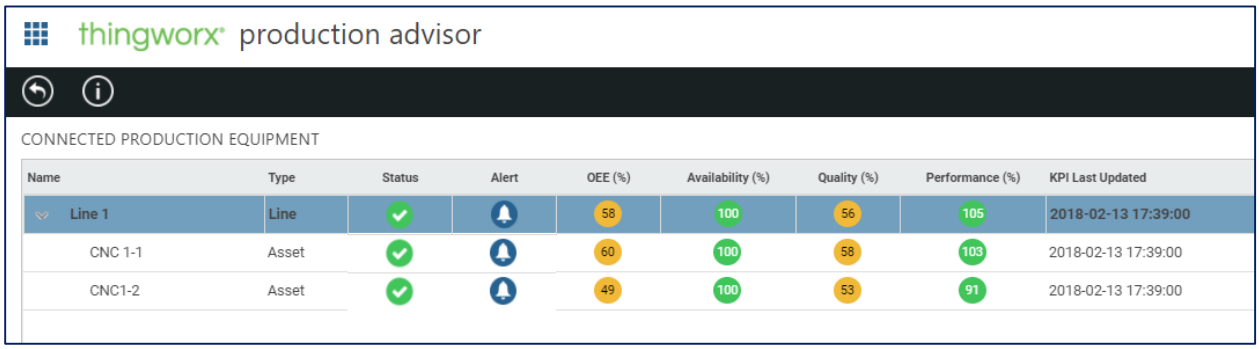
Apps: V8.2 or later

KepServerEX: 6.3 or later

Sigma Tile: V5

05/07/2018





CONTENTS

INTRODUCTION

In this guide you will learn how to install, configure and use the **ThingWorx Manufacturing Apps** using a **Sigma Tile acting as a production asset** such as a CNC machine to understand the power of the **ThingWorx Industrial Innovation platform** and the Manufacturing starter Apps.

You will learn about the main ThingWorx for Manufacturing Apps: **Controls Advisor, Asset Advisor** and **Production Advisor**. You will also use the **Trending & Troubleshooting** and **Alert Monitoring** functionality using the sensor readings and controls on the Sigma Tile to trigger events and alerts.

If you are new to the Sigma Tile and want to better understand what it is and how it can be used, go to Appendix A

SYSTEM REQUIREMENTS

Before proceeding with this guide, ensure that you have the required hardware, software and that the following requirements are met:

HARDWARE REQUIREMENTS

- Sigma Tile
- WIFI router / network
- Computer running Windows (you must have administrative privileges on the computer.)

OPERATING SYSTEMS REQUIREMENTS

Servers:

- Windows Server 2012 R2
- windows Server 2008 R2 SP1

Clients:

- Windows 7
- Windows 8.1
- Windows 10

If you are going to install the ThingWorx Manufacturing Apps in a Virtual Machine, ensure that you have the latest VM tools installed. You will need at least 4 cores and 16GB of RAM

RECOMMENDED BROWSERS

- Chrome 51 (recommended)
- Firefox ESR 47+
- Internet Explorer 11

OTHER REQUIREMENTS

- **.Net** Framework (version 3.5.1 and 4.5) needs to be installed and running if you are working with the ThingWorx Manufacturing Apps Version 8.2.x. Installation will not work with version 4.6.1 of .NET

STEP 1 – DOWLOAD THE THINGWORX MANUFACTURING APPS

Prior to starting this step, you should have:

- connected your Sigma Tile to a network,
- installed KepServerEX
- configured KepServerEX to communicate with your Sigma Tile

If you have not completed these steps, refer to the **Learn KEPServerEX using a Sigma Tile** guide.

1. From your computer connected to a **network with internet access**, navigate to the ThingWorx Manufacturing Apps Developer Portal. (https://developer.thingworx.com/apps/manufacturing)

2. Login using your PTC credentials. If you do not have an account with PTC already, you will need to create one.

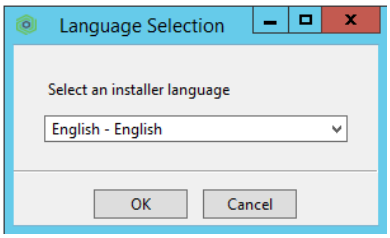
3. Locate and click on **Download ThingWorx Manufacturing Apps Free Trial** (Version 8.3) or **Download 30-Day Developer Kit Edition** (Version 8.2.1). (you may be asked to authenticate again to continue with the download)

4. Once you have downloaded the installer for the Apps, ensure that your computer is connected to the same network as your Sigma Tile.

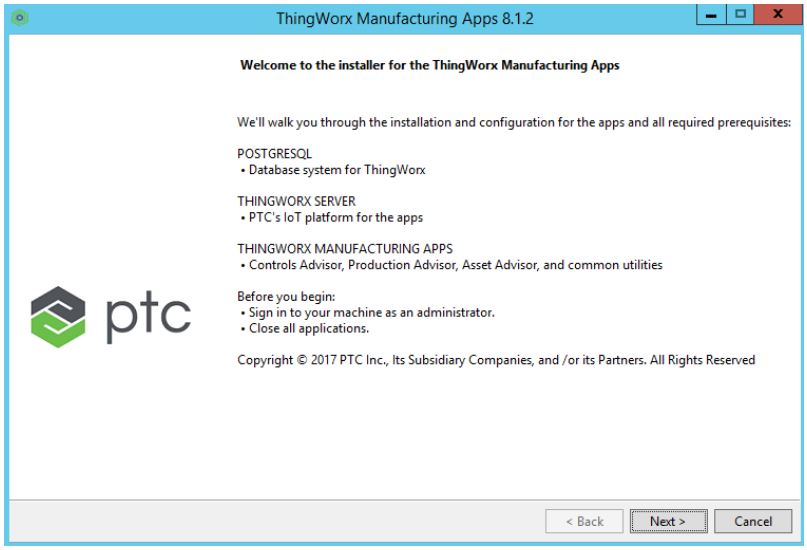
STEP 2 – INSTALL THE THINGWORX MANUFACTURING APPS

1. Extract the **ThingWorx-Manufacturing-Apps-8.2.0-XX-Devkit.zip** file (or later version of the installer) to a file where you have administrator privileges.

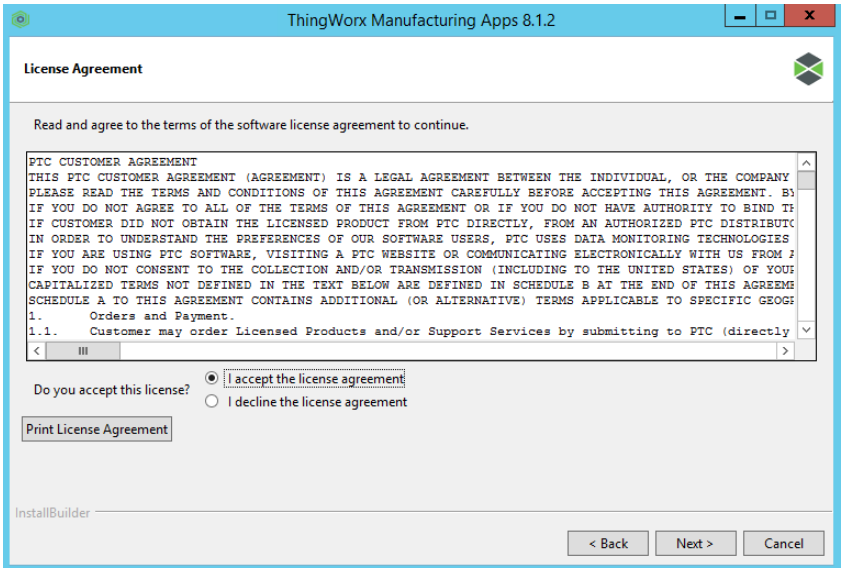
2. Navigate to and **run** ThingWorx-Manufacturing-Apps-8.2.X-XX-Devkit.exe. Select your language.



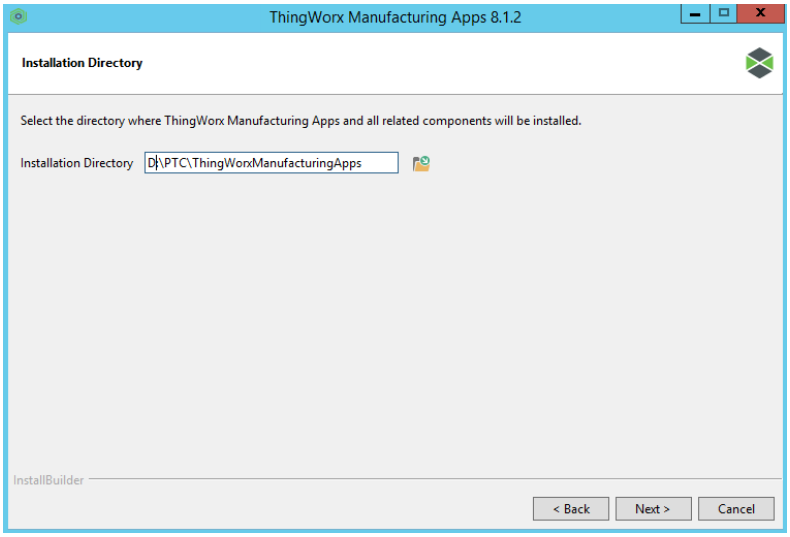
3. Follow the instructions on the Welcome screen, then select **Next.**



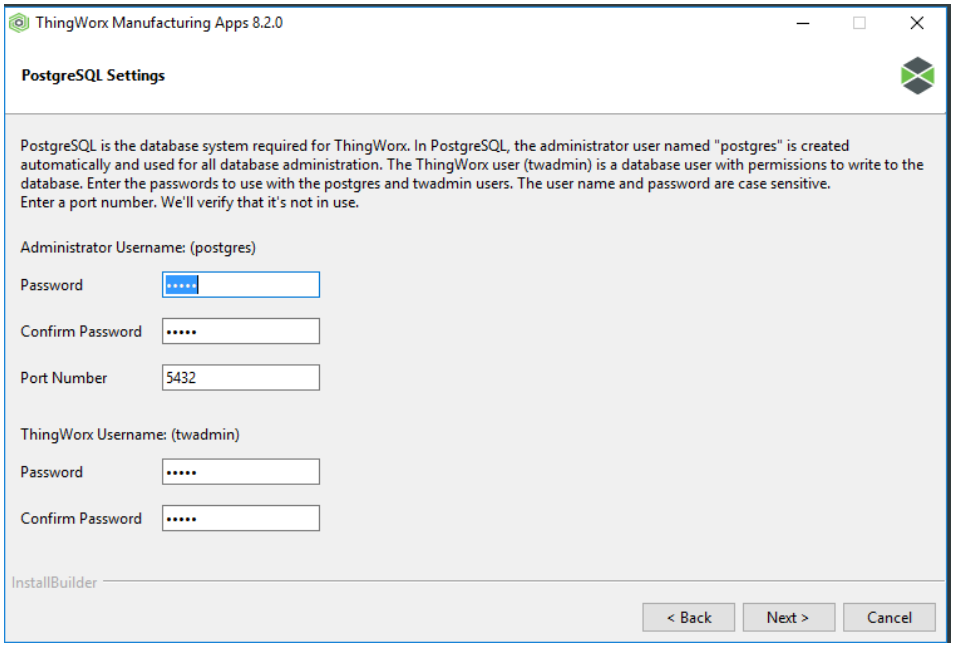
4. Accept the License Agreement, select **Next.**



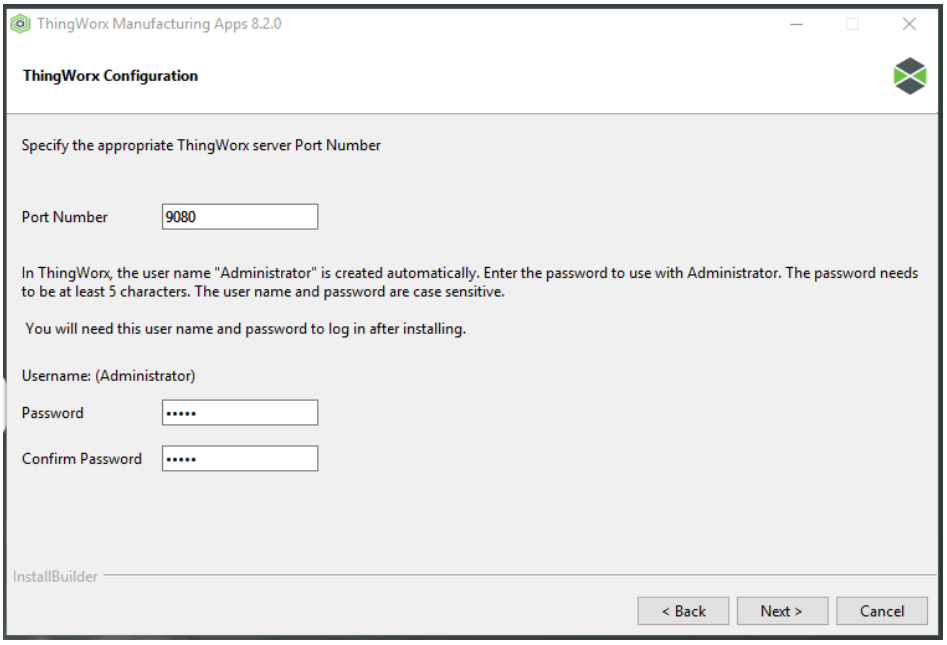
5. Choose the installation directory and select **Next.**



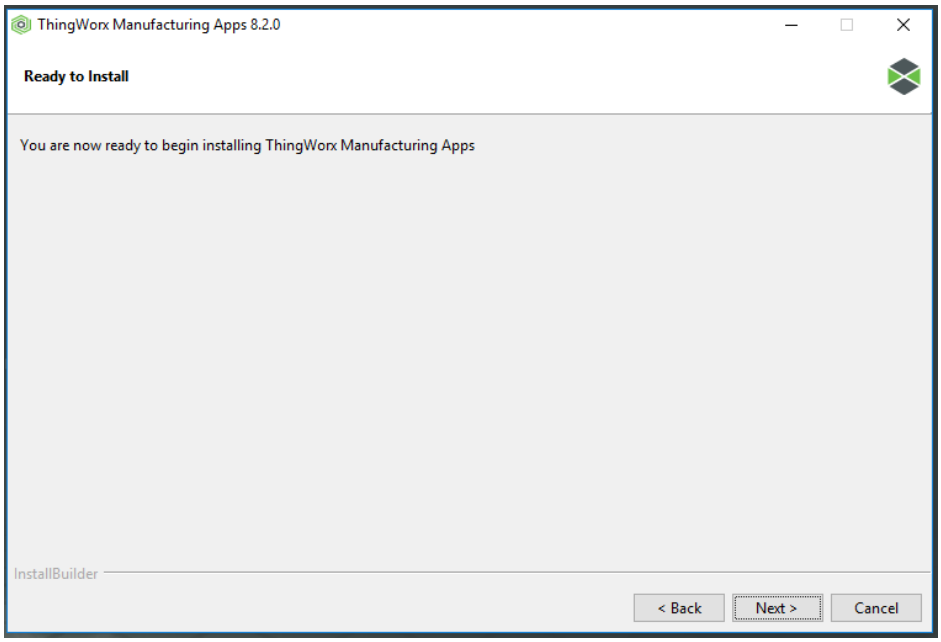
6. On this dialog, specify the Postgres administrator password, which will be needed to install the software, as well as the password for twadmin which ThingWorx will use to interact with the database. Accept the default port for postgres(5432), then select **Next**.



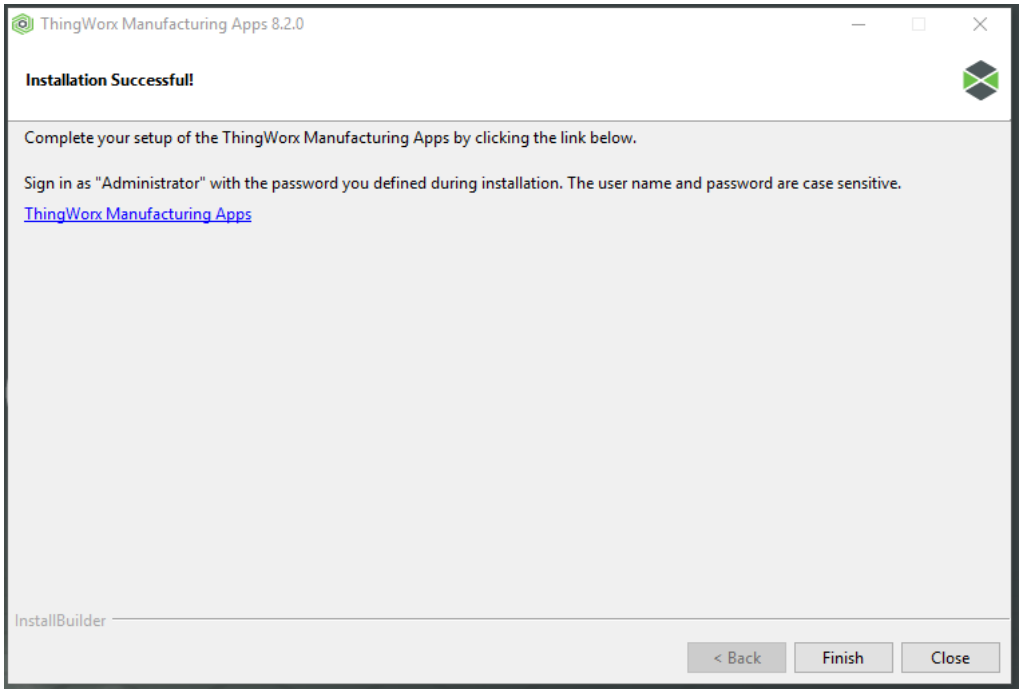
7. Set the **ThingWorx Server port** number (you can keep the default of 9080), and password for the ThingWorx server **Administrator** user and select **Next.** Be sure to record your password and port number as you will need this information later.



8. The following dialog should appear, indicating that the Manufacturing Apps are ready to install. The install will take between 5 and 10 minutes. Select **Next**.



9. This screen will appear after a successful install.



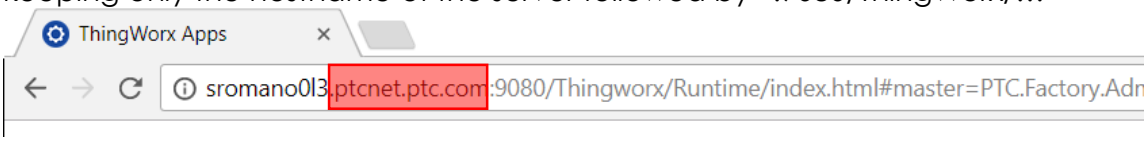
10. Select **Finish**

STEP 3 - CONFIGURE AND CONNECT KEPSERVEREX TO THE THINGWORX MANUFACTURING APPS

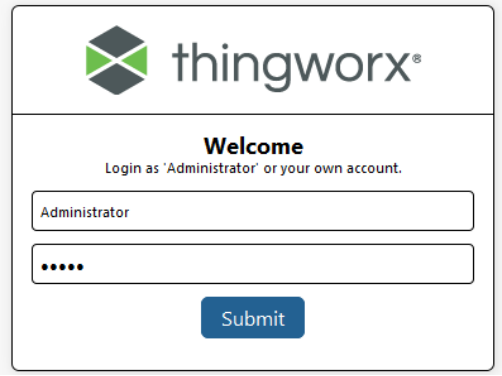
1. Launch the ThingWorx Manufacturing Apps from the icon on your desktop or the **Start** menu.

Troubleshooting Tip:

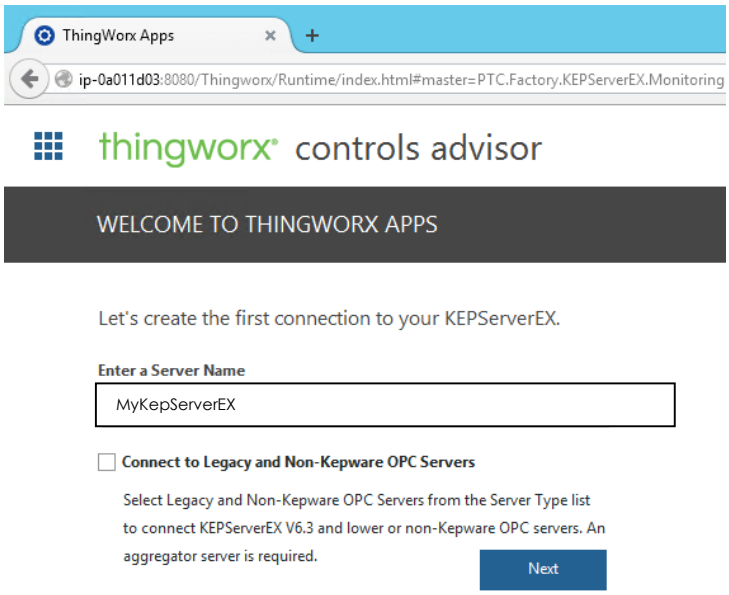
If nothing comes up and/or ThingWorx does not appear to open in the browser, try modifying the URL in your browser and removing any domain information and keeping only the hostname of the server followed by ":9080/ThingWorx/…"



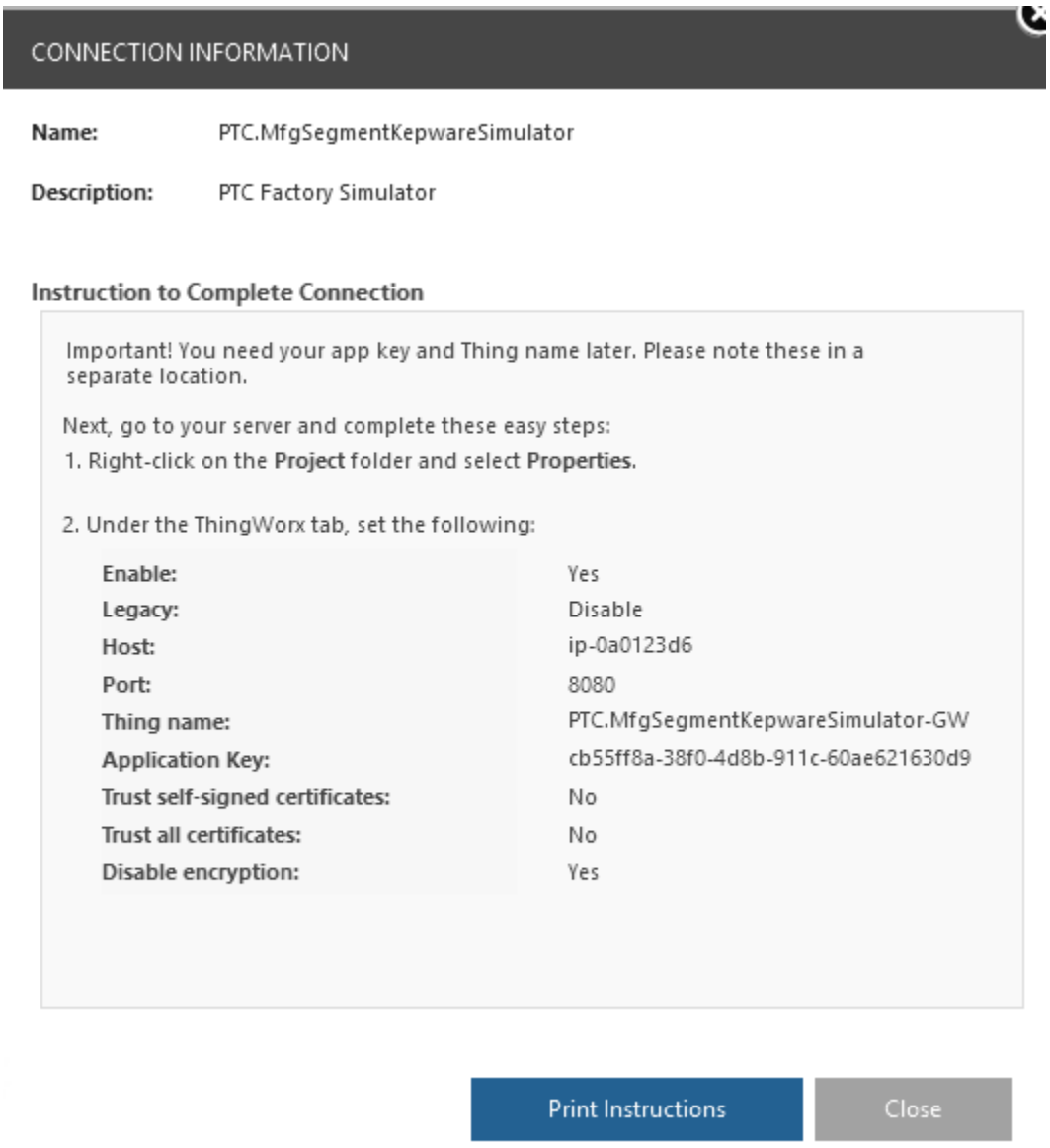
2. Log in using the username **Administrator** and the ThingWorx password created during installation:



3. When you open the ThingWorx Manufacturing Apps for the first time, it will prompt you to enter a server or Thingname. Make this name something you can later use to identify this KEPServerEX instance, for example "**MyKepServerEX".** Please note that you will need to reference this server name for future configuration tasks. Click **Next.**

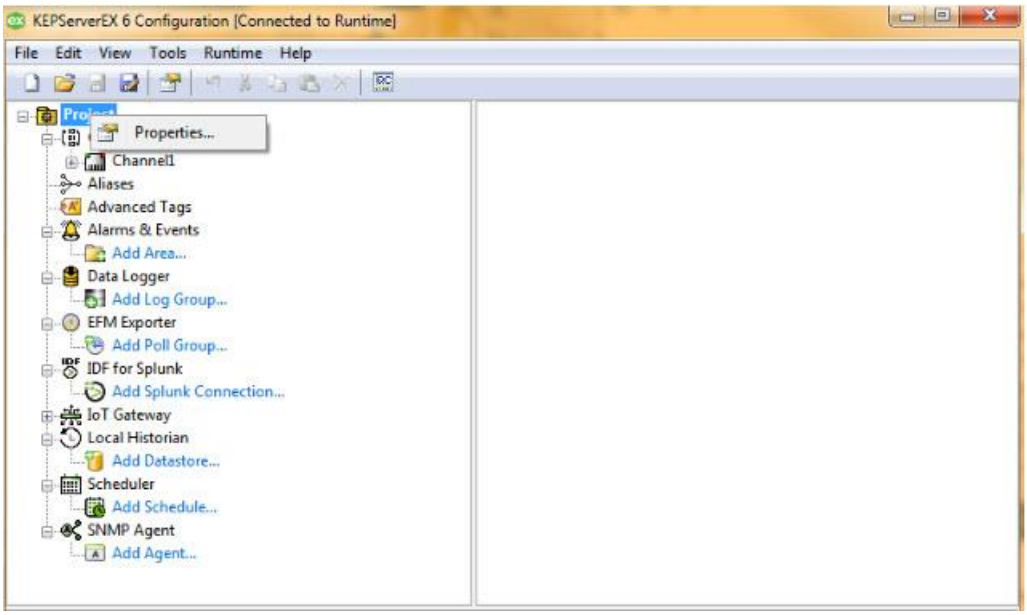


4. Once your KEPServerEX connection is created, a dialog box will appear providing a log of information about the connection that you will need to configure KepServerEX to communicate with the Manufacturing apps. Keep this window open to set properties in a future step.

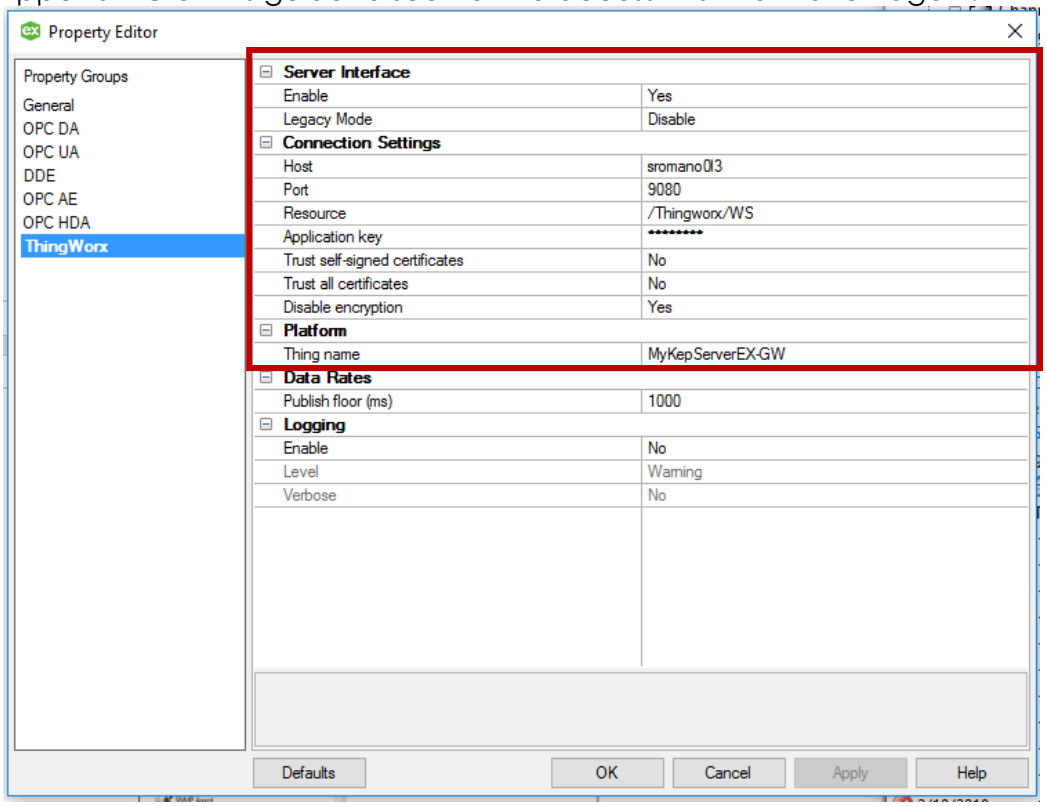


5. Open the KEPServerEX application: 

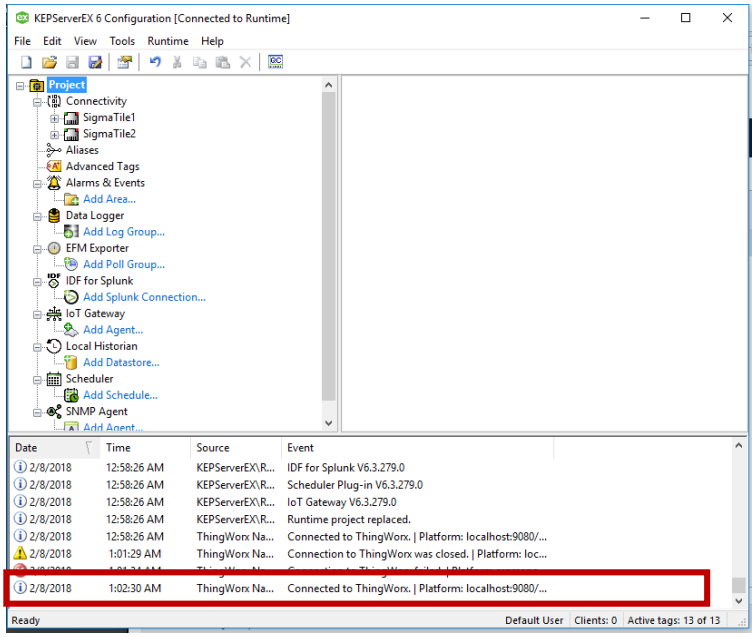
6. On the project folder icon, right mouse to open the context menu. Select **Properties** to open the **Property Editor** dialog.



7. Select the **ThingWorx** tab. Change all the settings to match the configuration information shown in the dialog from step 4 above. Select **OK**. If you forgot, to take a screen capture and/or to keep the configuration page open go to Appendix C of this guide to see how to access this information again.



8. In KEPServerEX Configuration, confirm a connection to ThingWorx displays in the **Event** column.



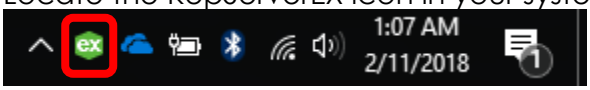
Troubleshooting Tips:

If you receive an error message similar to "Connection to ThingWorx platform <URL or Host>/Thingworx/WS failed: could not initialize a secure socket connection," try the following steps:

- Verify the **host, port, resource, Thing name and application key** are all valid and correct
- Verify the host of KEPServerEX can reach the machine you've installed ThingWorx Manufacturing Apps on by pinging the ThingWorx Manufacturing Apps Host hostname or IP address.
- Verify that the proper certificate settings are enabled
- If your KepServerEX and ThingWorx servers are running on the same machine, try replacing the machine host name with "**localhost**"

If you encounter other issues, check the following:

- Your KepServerEX license (or trial license) has not expired. If you are using a trial license of Kepware, keep in mind that it will expire every 2 hours. To reinitialize the trial period, follow these steps:
    1. Locate the KepServerEX icon in your system tray

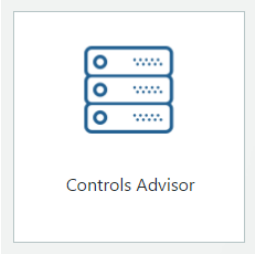


    2. Right click on the KepServerEX icon and click "Stop Runtime Service". The system will ask you to confirm that you want stop the runtime service, say "Yes".
    3. Right click again on the KepServerEX icon and click "Start Runtime Service"

STEP 4 - GETTING STARTED WITH CONTROLS ADVISOR

1. Launch the ThingWorx Manufacturing Apps from the icon on your desktop or the **Start** menu.

2. Click **Controls Advisor.**

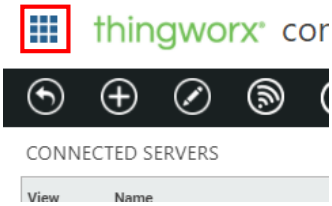


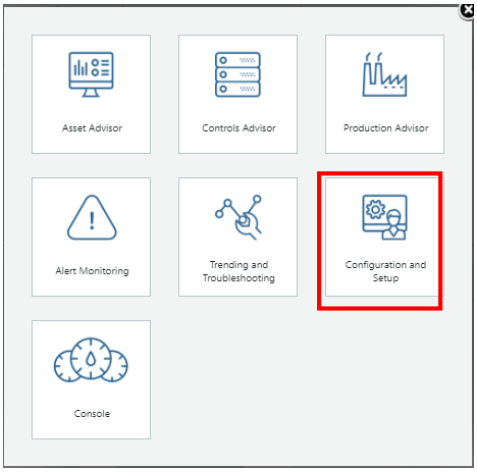
3. The server you connected displays in the Connected Servers list. Select it and click discover devices  .

4. The action scans the server and creates the devices in the ThingWorx Manufacturing Apps. **Confirm that you see at least 1 new device.** The number of devices you will see here will depend on the number of Sigma Tiles (devices) that you have configured with KepServerEX.

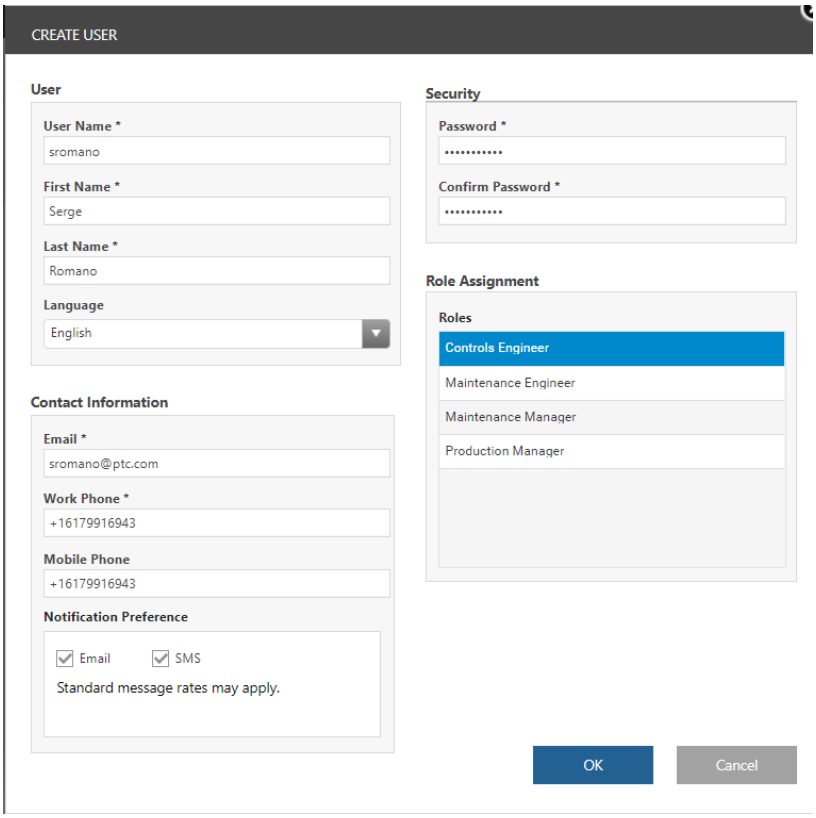
STEP 5 - CONFIGURE USERS AND ROLES

1. In the top left corner of your window, click the console icon and select the **Configuration and Setup** App





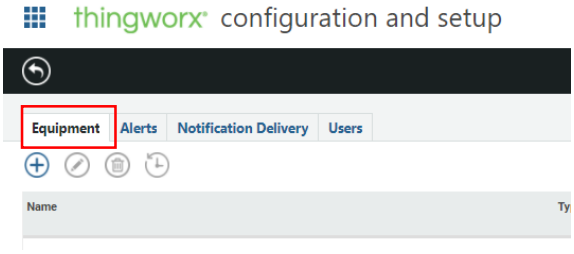
2. Select the "User" tab and click ⊕ to create a new user.
3. Begin by **creating a user for yourself in the Controls Engineer role.**



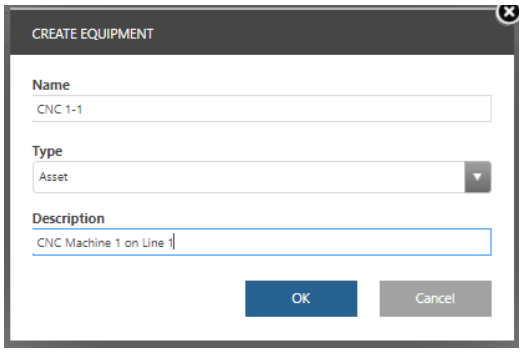
4. Add two other users: one **Maintenance Manager** and one **Production Manager**.

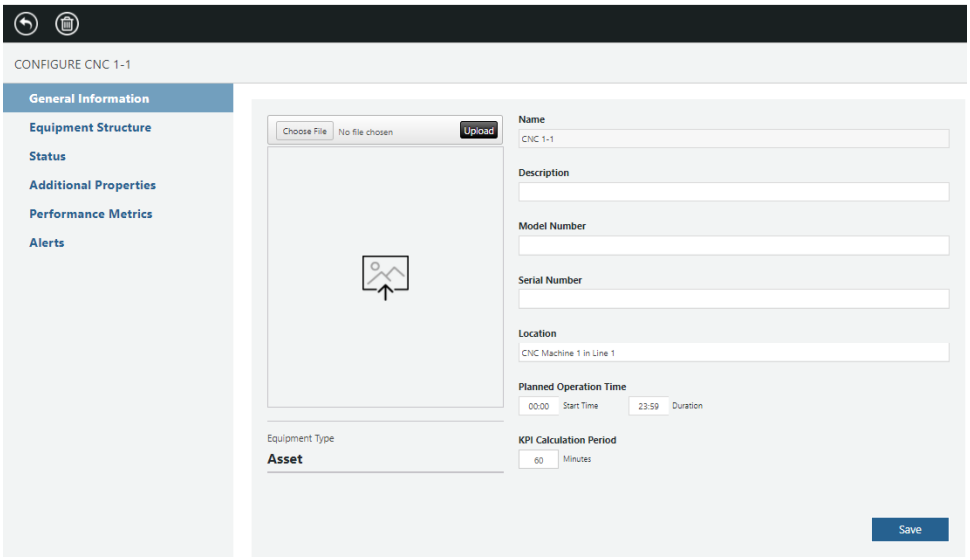
STEP 6 - CREATE LINES AND ASSETS

1. Select the **Equipment** tab.

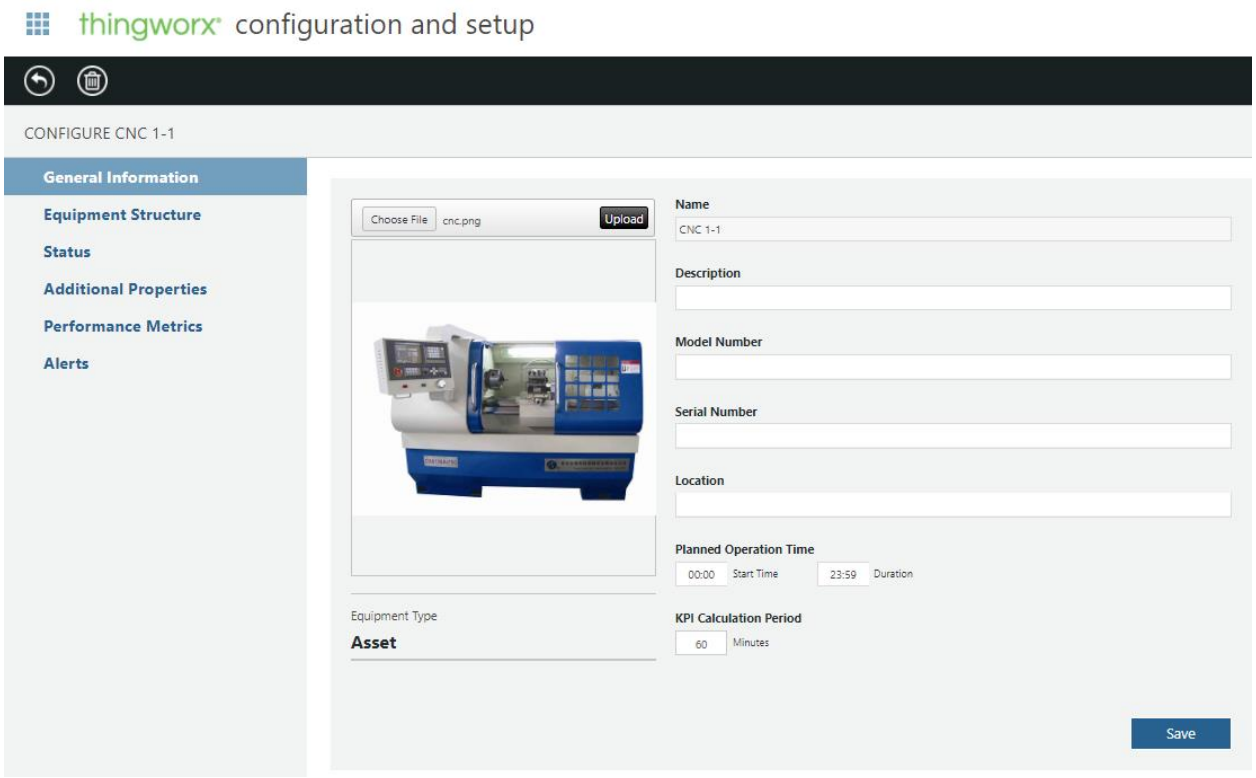


2. Create an **asset** naming it what you would like your Sigma Tile to simulate (e.g. a CNC machine, naming it **CNC 1-1**) and click **OK**.

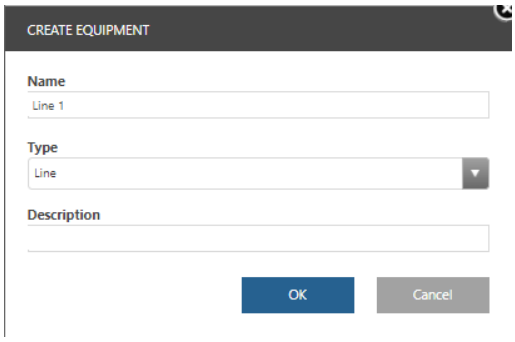


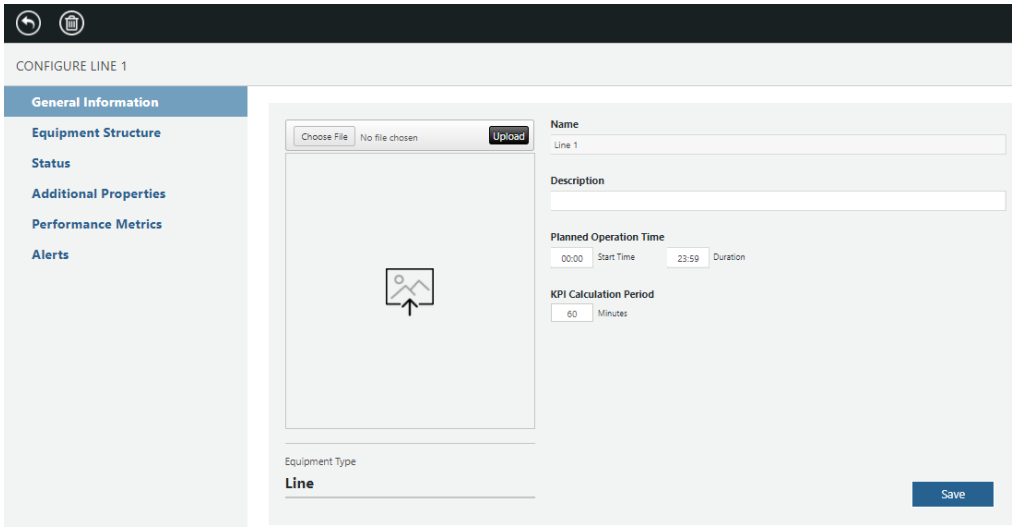


3. Optionally find and add an image to represent your machine by choosing a file. Select **Upload** and make sure to select **Save**.

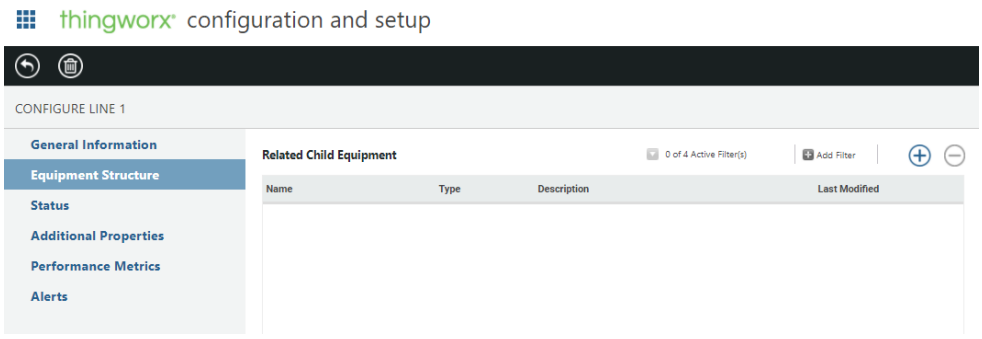


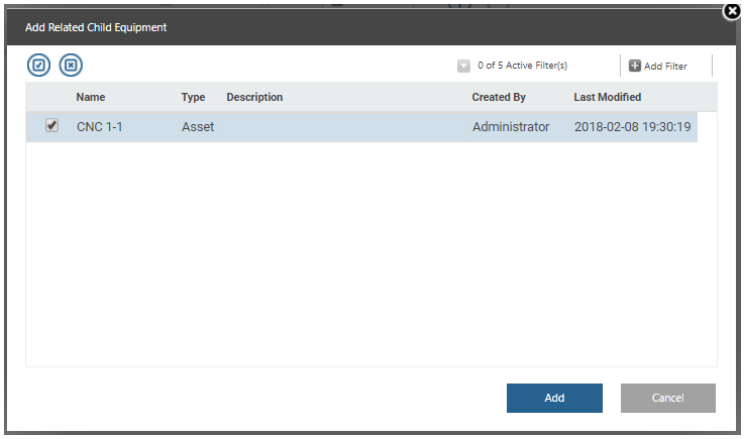
4. Create a new equipment by clicking ⊕. Select **Line** for the Type and name it **Line 1** and click **OK.**

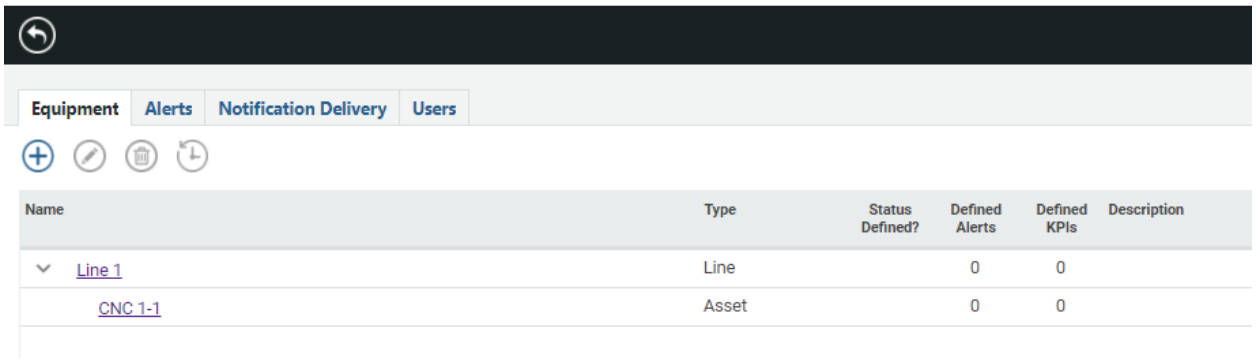




5. Configure **Line 1** by selecting **Equipment Structure** and adding the **CNC 1-1** asset that you created earlier to your Line (using the ⊕)





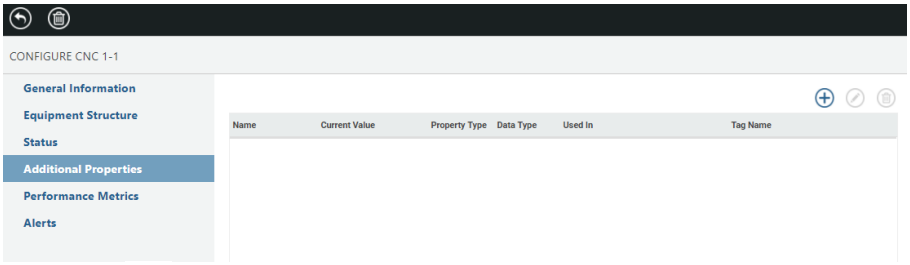


STEP 7 - CONFIGURE LINES AND ASSETS

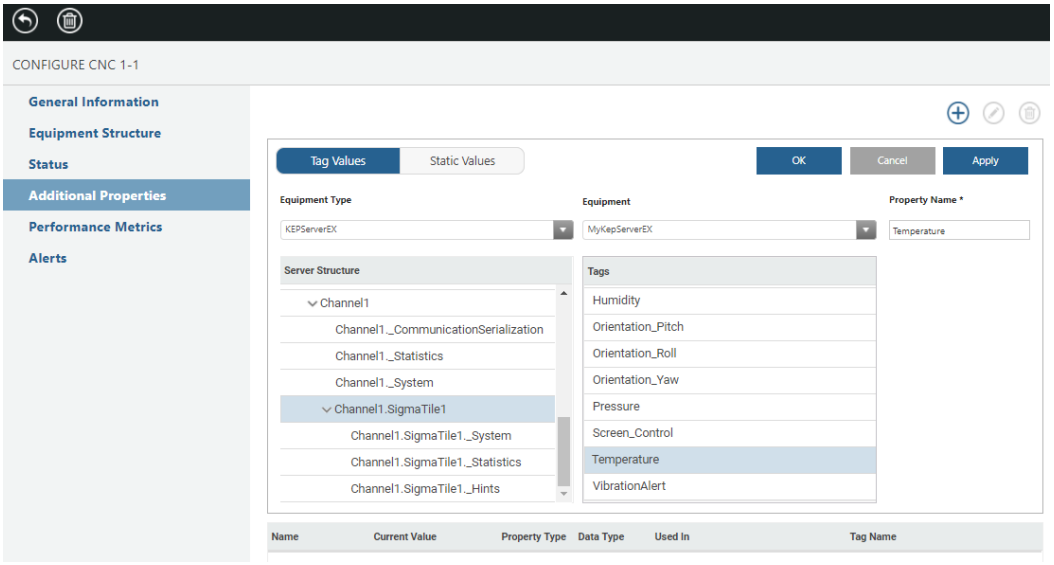
Now that the line and asset are created, you will learn how to configure and define their properties, status, and performance metrics.

1. Under **Configuration and Setup**.

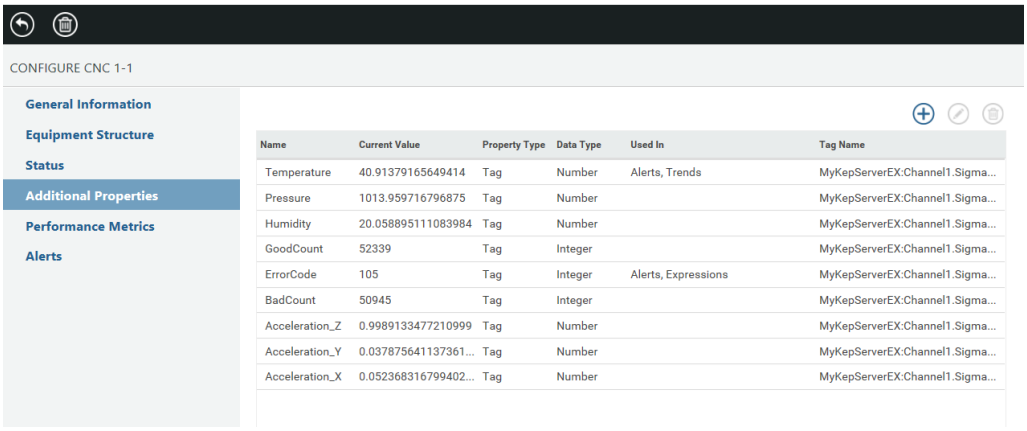
2. Select your asset (CNC 1-1) and select **Additional Properties**



a. Click on ⊕ to create a new property.
b. Locate and select the information from your Kepware server. Locate the **Temperature** Tag from **Channel 1 / SigmaTile1** device:



c. Click **Apply**.
d. Add the following additional tags to your asset:
    i. Temperature
    ii. Pressure
    iii. Humidity
    iv. GoodCount
    v. ErrorCode
    vi. BadCount
    vii. Acceleration_X
    viii. Acceleration_Y
    ix. Acceleration_Z
e. Click on the **Additional Properties** tab again to confirm that you have added all the desired tags and notice their values:



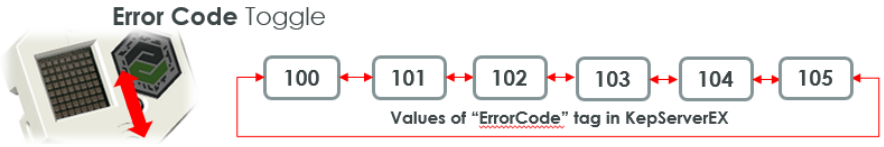
3. Now select the **Status** configuration tab. You will be entering and modifying the status definitions for your asset to match this screen:

Define Status

Icon	State	Expression
	Not Configured (0)	The resource status has not been configured.
	Unplanned Downtime (4)	"Asset_CNC 1-1:ErrorCode"=104 OR "Asset_CNC 1-1:ErrorCode"=105
	Planned Downtime (3)	"Asset_CNC 1-1:ErrorCode"=103
	Warning (1)	"HAS_ALERTS:Asset_CNC 1-1"
	Running (2)	true
	Unavailable (5)	Default value if no other expressions are true.

First, let's understand the behavior that we want:

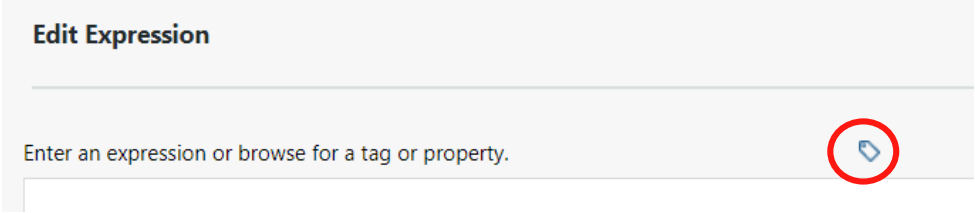
a. Using the up and down positions on the joystick of the Sigma Tile, we want to be able to trigger various alerts and conditions that will update the **asset status**. As you have seen in the **Learn KEPServerEX using a Sigma Tile** guide, the up and down joystick toggles update the **ErrorCode** tag in KepServerEX between the following values:



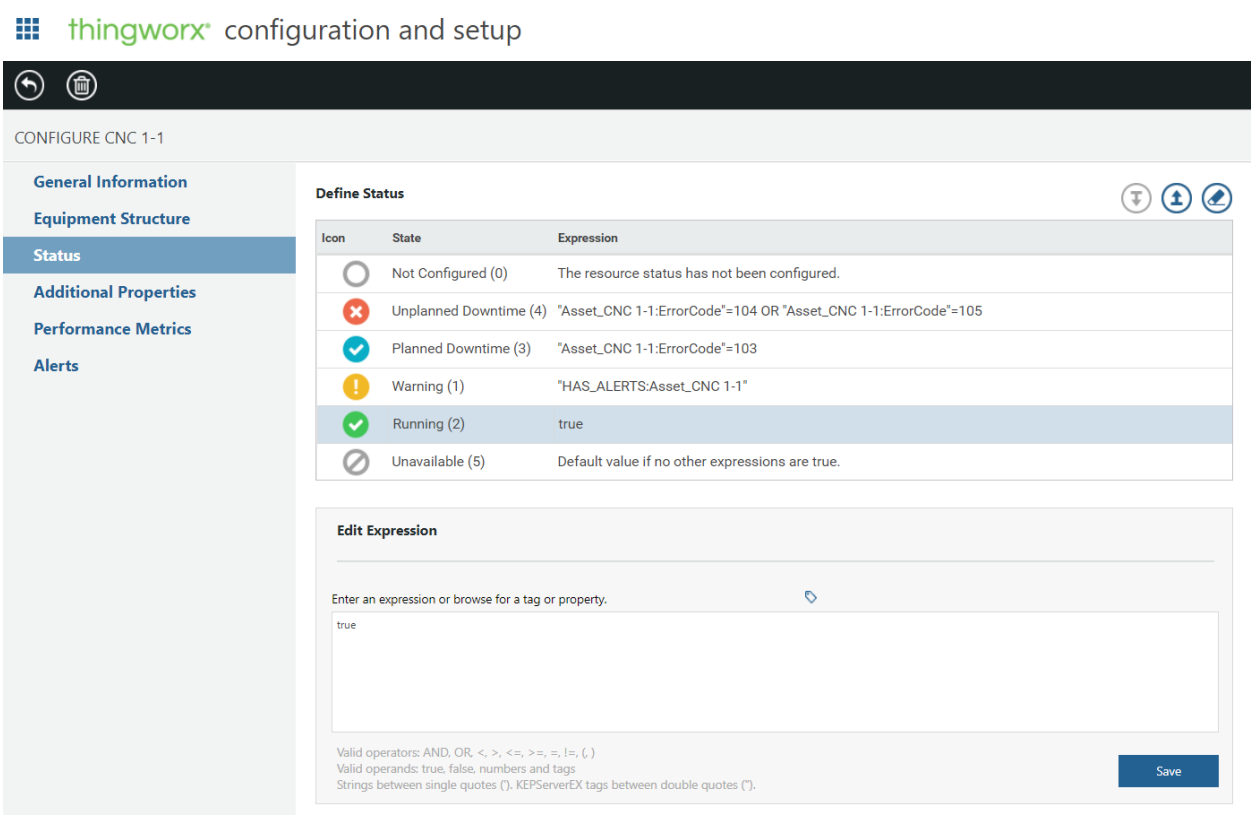
b. We want ErrorCode **105** to represent an **"E-Stop" condition** of the machine. When that condition is met, we want both an **alert** to be created that specifies that the "E-Stop" on the machine was triggered and we want to bring the asset status to **"Unplanned Downtime (4)"**.
c. We want ErrorCode **104** to represent an **unknown unplanned downtime condition** of the machine. When that condition is met, we want both an **alert** to be created for the asset and bring the asset status to **"Unplanned Downtime (4)"**.
d. We want ErrorCode **103** to represent a **planned downtime condition** of the machine. When that condition is met, we want to bring the asset status to **"Planned Downtime (3)"**.
e. We want ErrorCode **101** to represent an **alert** on the machine but that doesn't stop the machine.
f. When any alert comes up for this asset, we want the asset status to change to **"Warning (1)"**.
g. Under all the other conditions, the asset will be considered to be running and the status will be **"Running (2)".**

Now, let's go ahead and configure the asset status definition to match the screen shot above and using these tips:

- Use the arrows in the Define Status header ( ) to place the states in the order they are checked by the system. The statuses are **read by the system from the top to the bottom**. The moment an expression is determined by the system to be true, the status associated with that expression is used. The numbers associated with the state name, for example (1), do not apply to the order in which they are read. They are used when you create a new alert.
- For each state, enter the desired expression to enable the behavior described previously. You can manually enter the expression or browse to select tags from your Kepware server by clicking on the tag icon as shown below. Click **Save** after entering each expression.



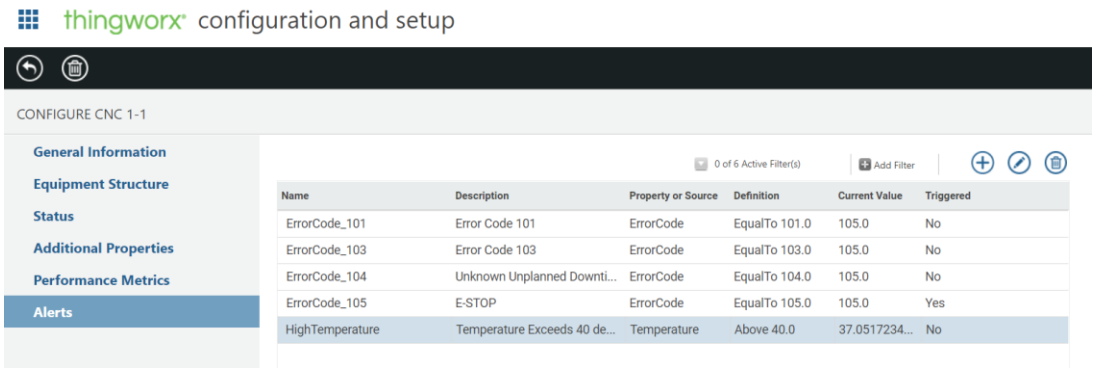
- Verify that you have entered all the expressions correctly:



4. Select the Alert tab now and define the following **alerts:**
   a. If ErrorCode = **101** an alert should be triggered on the asset specifying the Error Code reference number.
   b. If ErrorCode = **103** an alert should be triggered on the asset specifying the

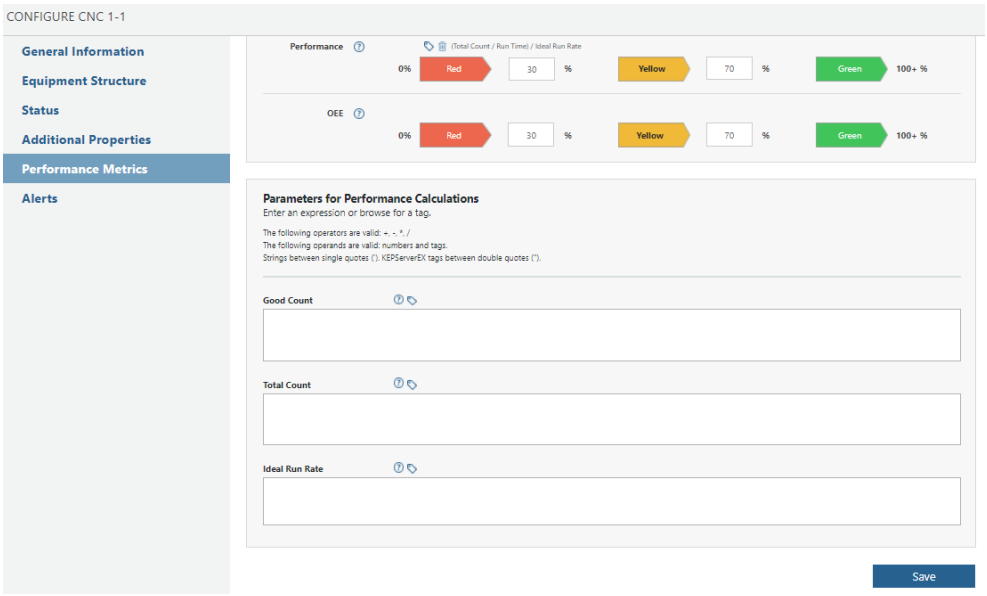
Planned Downtime condition

c. If ErrorCode = **104** an alert should be triggered on the asset specifying an **"Unknown Unplanned Downtime"** condition
d. If ErrorCode = **105** an alert should be triggered on the asset specifying an **"E-Stop"** condition
e. Finally, if an alert should also be triggered if the **temperature of the Sigma Tile exceeds 40 degrees C**.
f. When done, you screen should look like this:

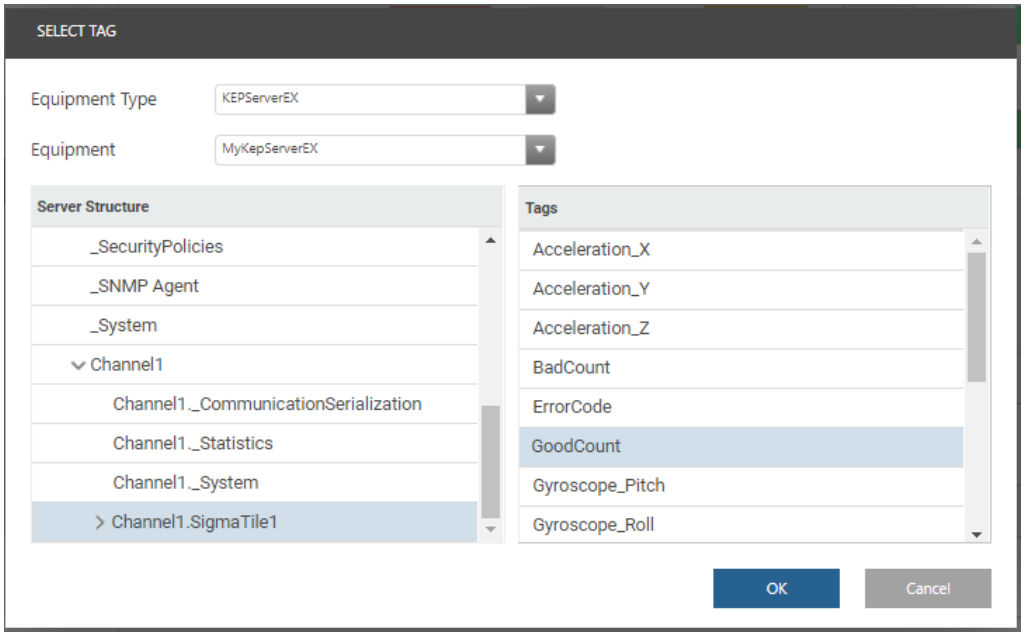


5. From the details page of the asset select the **Performance Metrics** tab.

a. First let's understand the behavior of the Sigma Tile. As you have learned in the **Learn KEPServerEX using a Sigma Tile** guide, the program running on the Sigma Tile (Python script that starts automatically at startup) includes a routine that will increment the **GoodCount** and **BadCount** tag values in KEPServerEX as if the Sigma Tile was a real production asset or line producing parts at an average rate of 35 parts / minutes under baseline conditions. But as the conditions of the Sigma Tile change (e.g. temperature and pressure) the production rate and quality may change. For example, as the temperature rises the ratio of bad parts to good parts will increase, representing a decrease in quality.
b. The procedure below describes how to enter performance metrics for your asset. The **help icons** in each field state the equations used.



c. Define the **Good Count.** Browse to the Kepware tag labeled **GoodCount** for your Sigma Tile.

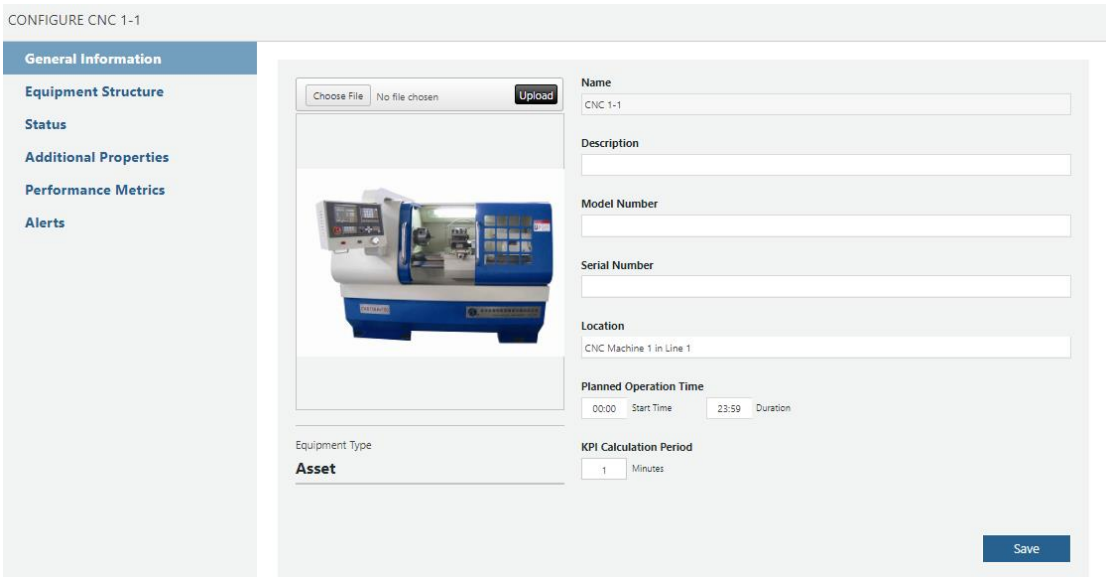


d. **Total Count.** Browse for your **BadCount** and then add your good count. You can copy and paste the good count from the previous field, as seen in the example below

e. **Ideal Run Rate.** Identify how quickly your factory would be producing parts for the asset or line in an ideal situation. Enter parts per minute. For the Sigma Tile and this example, that would be approximately **25** parts per minute.

f. Click **Save**.

6. Go back to **General Information** and change the **KPI Calculation Period** to **1 min** and click **Save**.

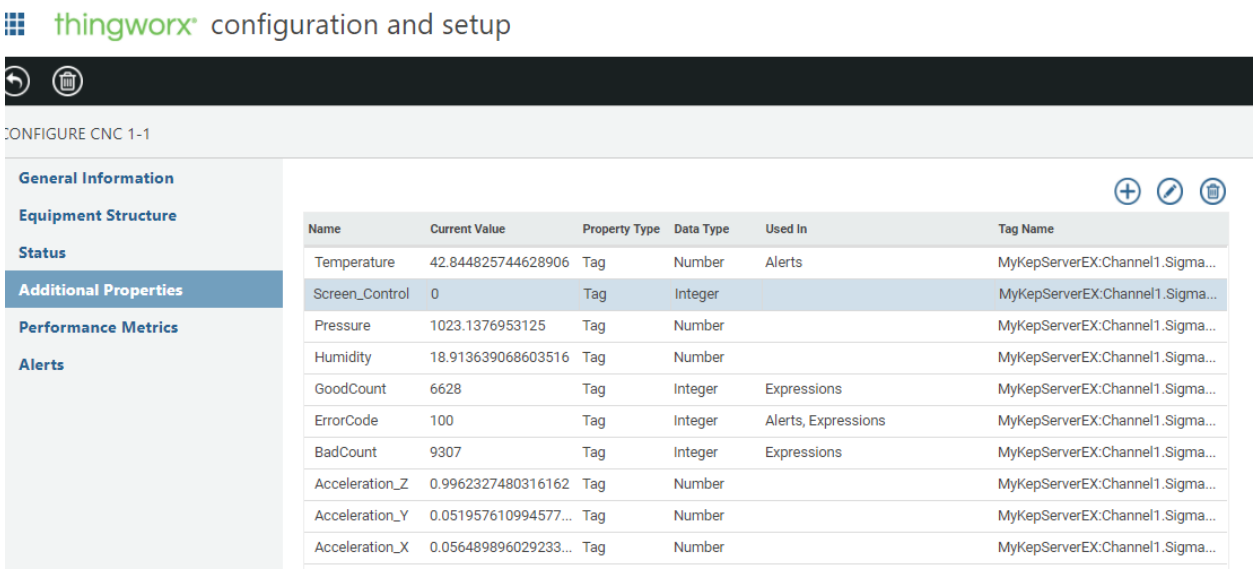


STEP 8 – EXTENDING THE APP TO UPDATE THE SIGMA TILE DISPLAY WITH STATUS

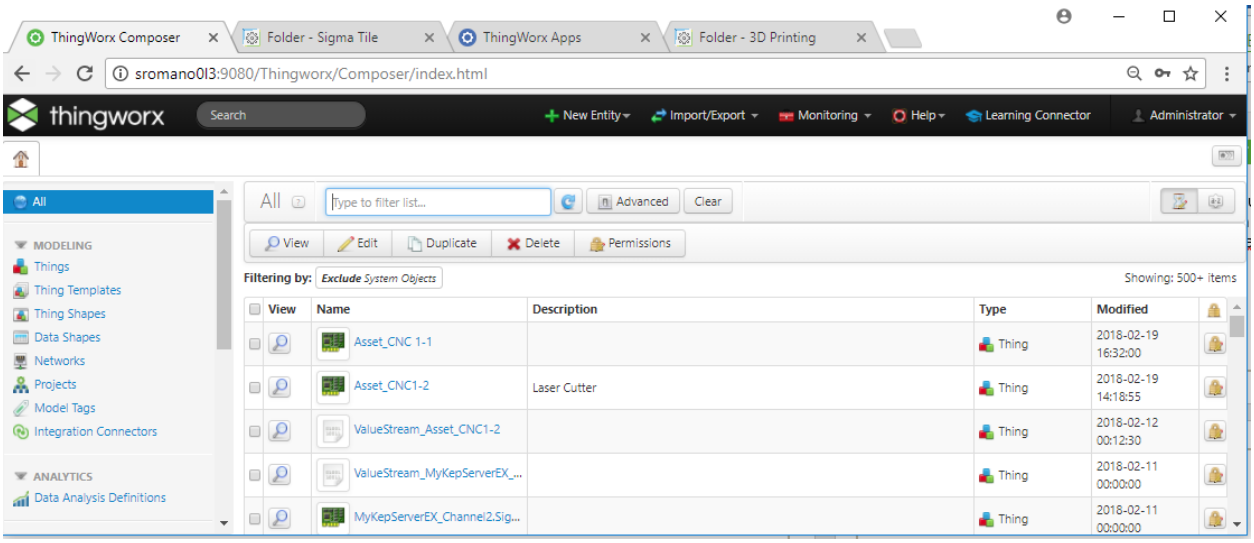
Now that we have defined the status for the asset representing the Sigma Tile, we will need to extend the asset object in ThingWorx composer to ensure that the status value updates the "Screen_Control" KEPServerEX tag and thus **updates the LED display on the Sigma Tile.**

1. From the Console, go to the **Configuration & Setup**, and click on the asset **CNC 1-1.**

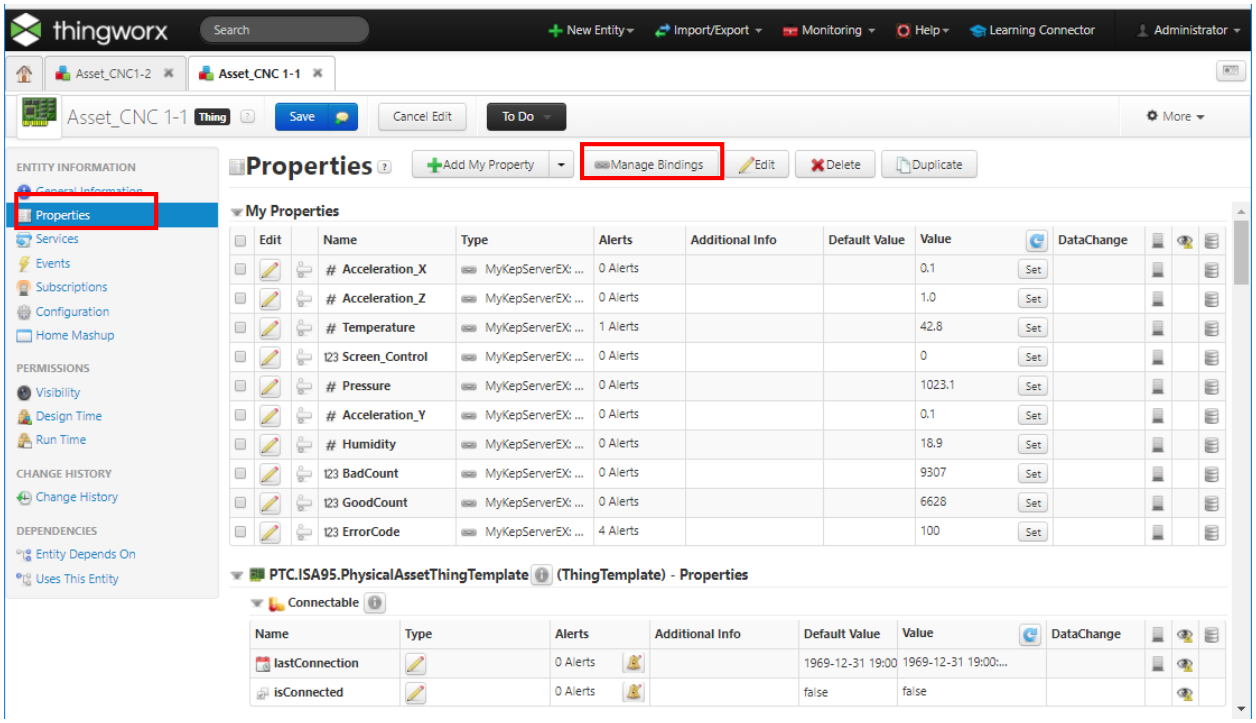
2. Add the **Screen_Control** tag from Kepware to the **Additional Properties**



3. Now, go to Composer by deleting all the characters following "/ThingWorx/" in the URL of the Apps. It will automatically redirect you to **ThingWorx composer**.

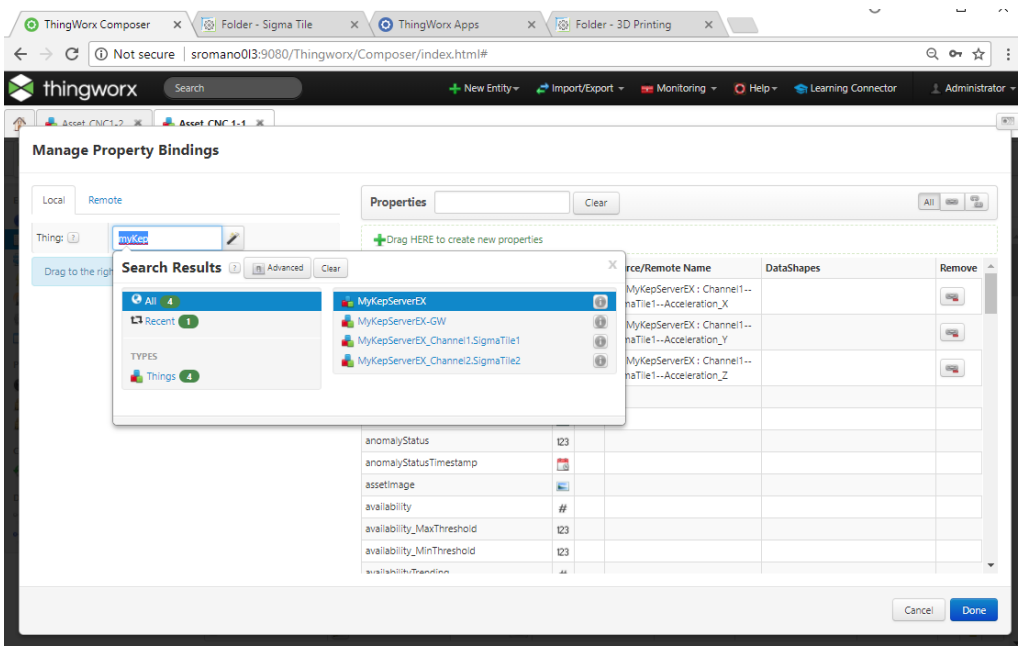


4. Locate *the* ***Asset_CNC 1-1*** and click on it.



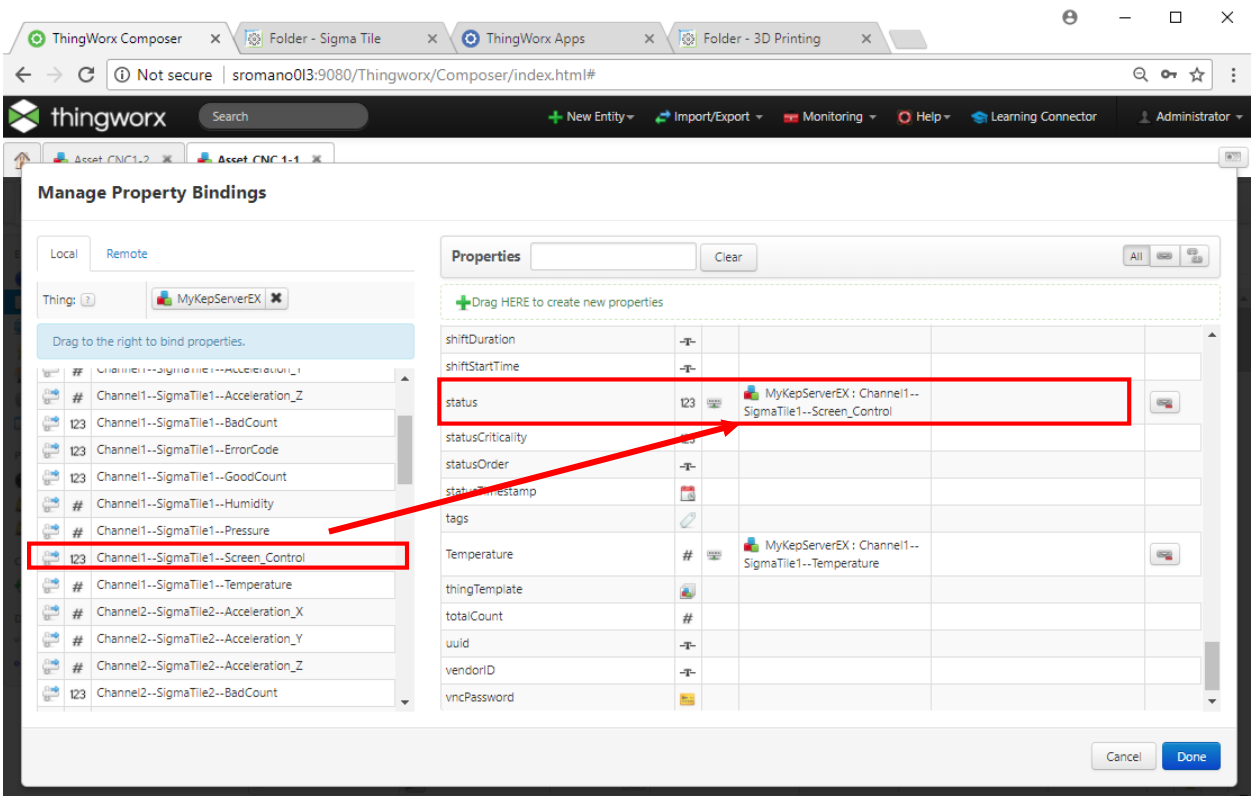
5. Click on **Properties** and select the **Manage Bindings tab** as shown on the screen shot above.

6. In the **Thing** field start typing the name of your KEPServerEX thing as you defined during configuration. In this case, "MyKEPServerEX" and click the **enter** key to select it.



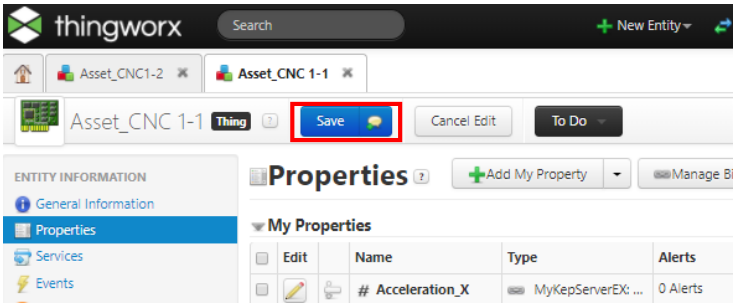
7. Drag and drop the **"Channel1-SigmaTile1--Screen_Control"** tag to the **status**

property of the asset as shown below:

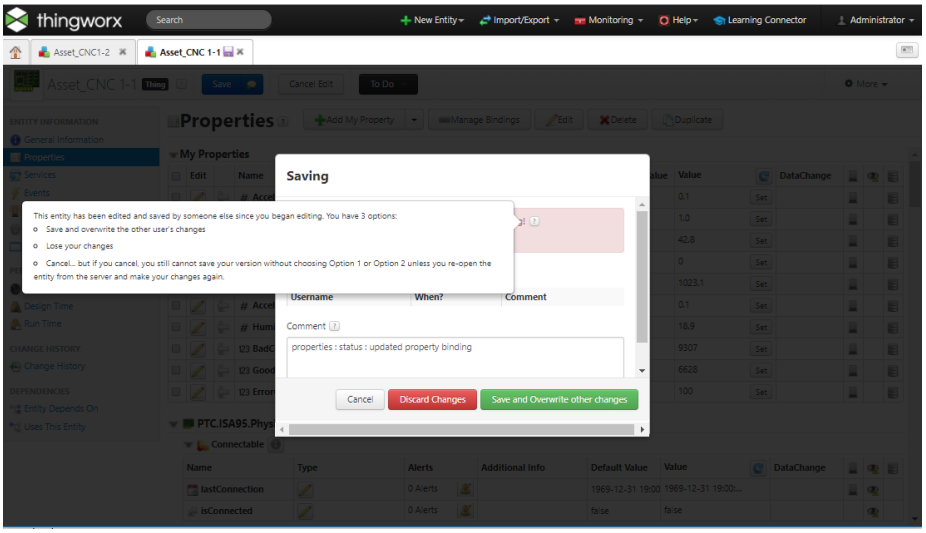


8. Click **Done**.

9. Click **Save**.

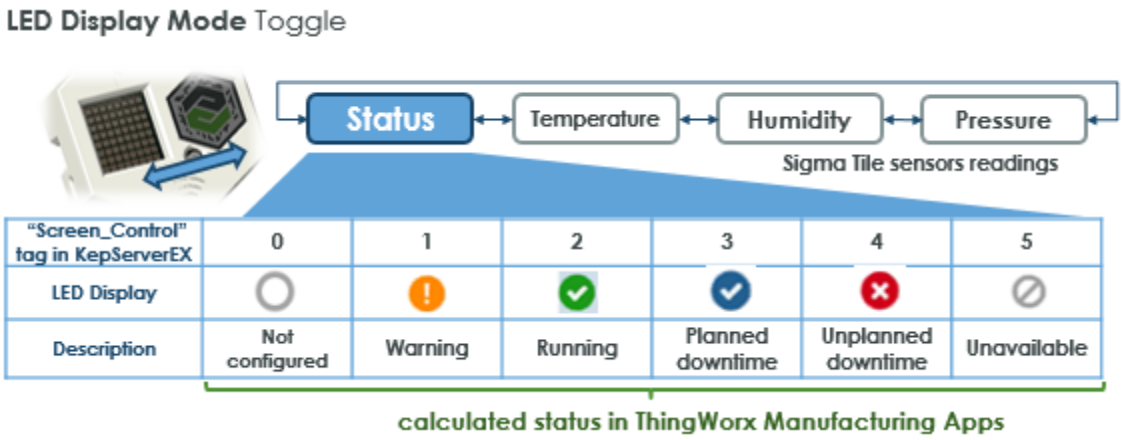


10. Select **Save and Overwrite other Changes**.



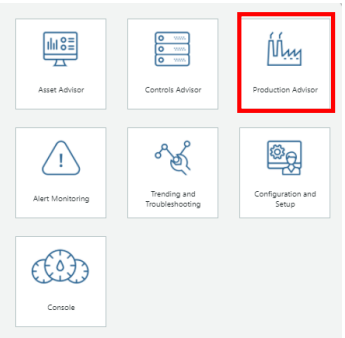
11. Now wait for a few seconds and watch your Sigma Tile status display change from the ○ (white disk) icon to the status icon representing the status of your asset as calculated by ThingWorx based on how you defined it above. You will learn more about Status monitoring in the next steps.

Your Sigma Tile LED display will now reflect the status of your Asset anytime you have the Status mode selected on the LED display. Remember that you can toggle between modes of the LED display by clicking the joystick left or right as shown below:

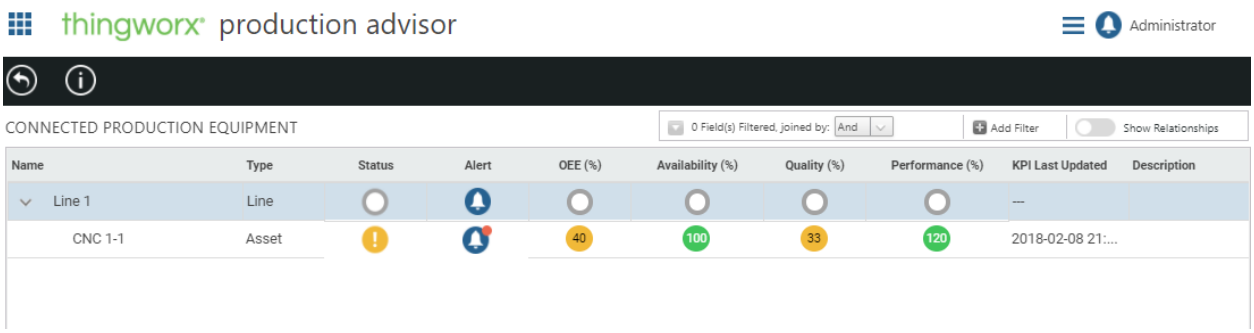


STEP 9 - MONITOR PRODUCTION METRICS WITH PRODUCTION ADVISOR

1. Navigate to the **Production Advisor** App from the console.

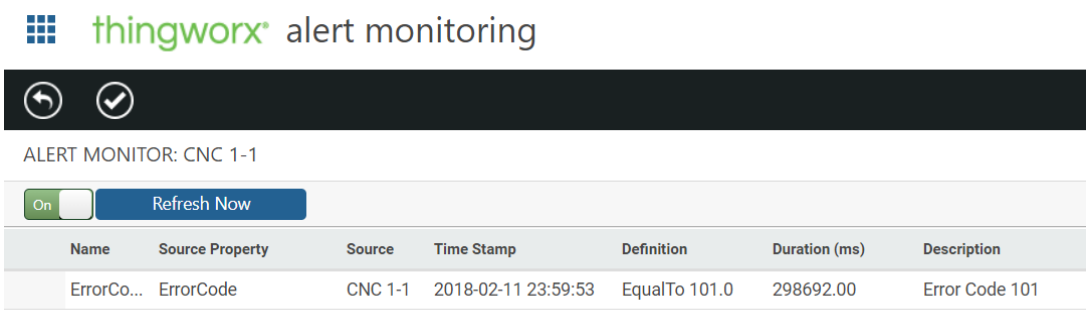


2. View the performance metrics you have defined for your asset.



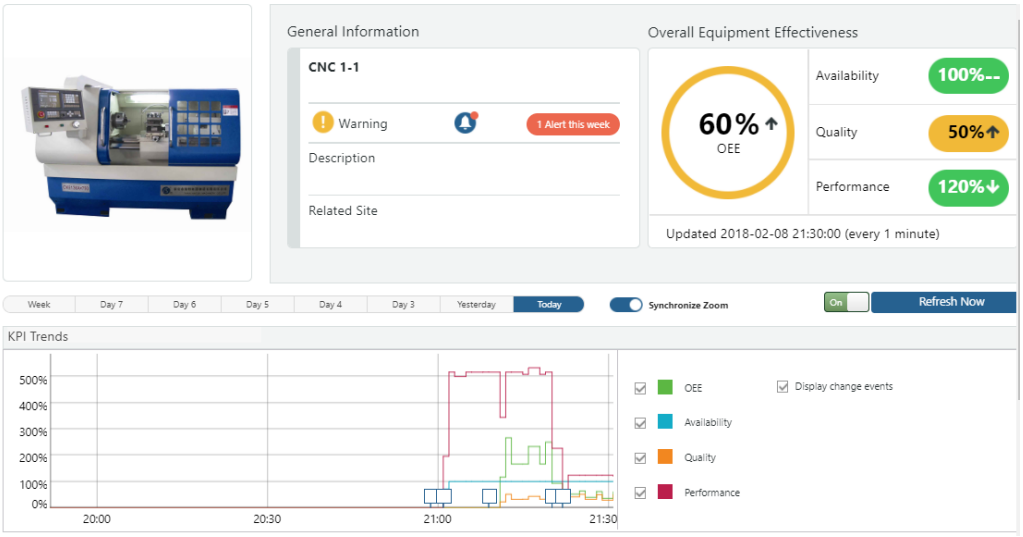
NOTE: Immediately after configuring performance metrics, the performance metrics may appear wrong or out of expected range. Because we set the KPI recalculation period to 1 min, these values will update every minute. Wait for a couple of minutes for the performance metrics to stabilize.

In the case represented by the image above, there is an **Alert** with this asset. Consistent with the definition of the status entered, the status of the asset is "Warning" and we can see that there is an alert on this asset. To investigate the reason for the warning, we can click on the "Alert" icon:



3. Return to Production Advisor and select your asset (CNC 1-1) and click on the ⓘ to see the details of the performance metrics of that asset including production history data.

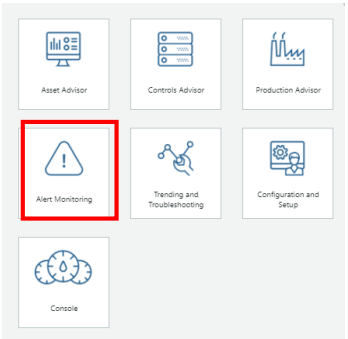
Asset Production History Data



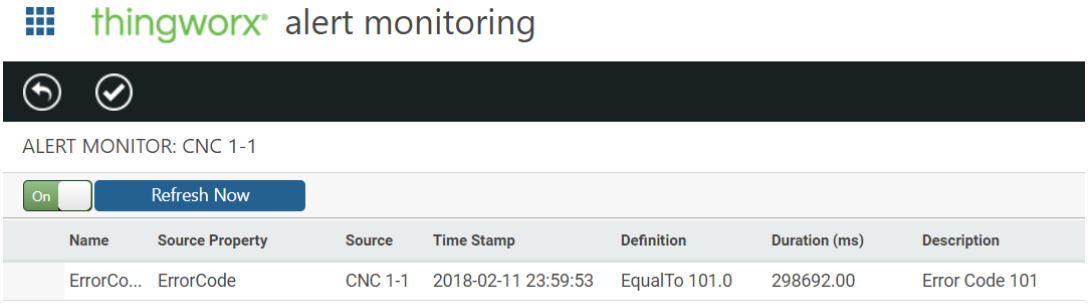
STEP 10 - MONITORING ALERTS

You can create alerts using the status expressions set when you configure assets and lines. In this example, follow these directions to create an alert whenever your asset is in a particular status.

1. Go to **Console ▸ Alert Monitoring**

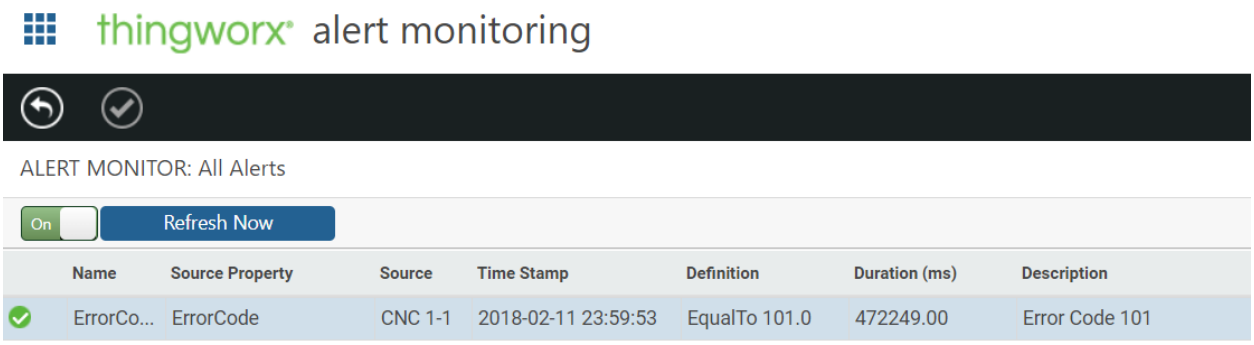


2. Check to see if you have any alerts:



3. If you see an alert, acknowledge it.

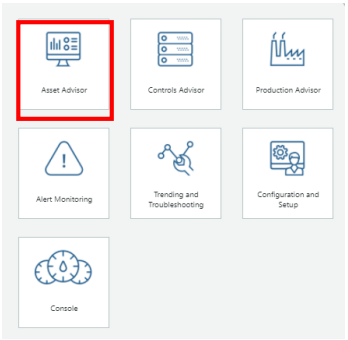
NOTE: In our example, the asset has an ErrorCode 101 and an active alert. Select the alert and click on  to acknowledge it. Once an alert has been acknowledged, a **checkmark** appears in the table and it no longer sends out emails and text messages.

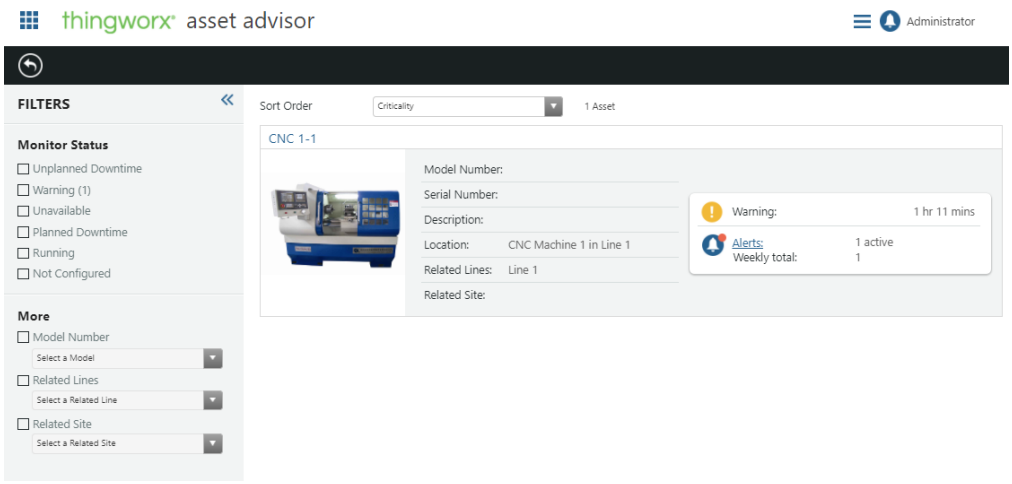


STEP 11 – MONITORING YOUR ASSETS WITH ASSET ADVISOR

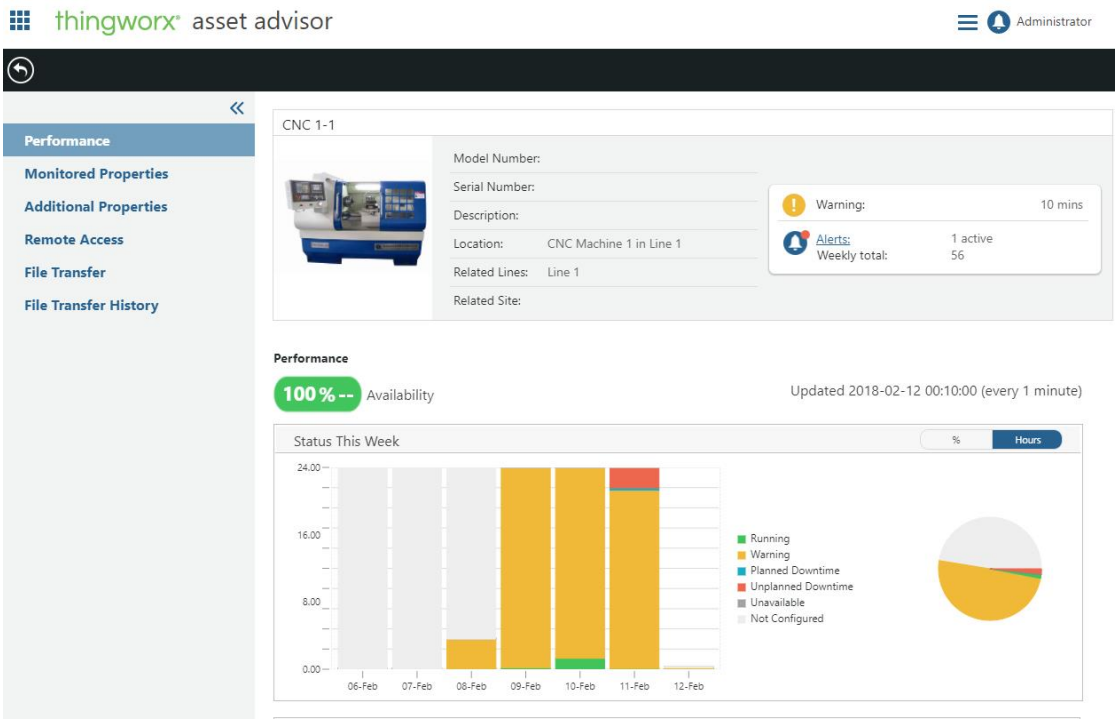
With the Asset Advisor App, you can monitor the status of your assets.

1. Go to **Console ▸ Asset Advisor**

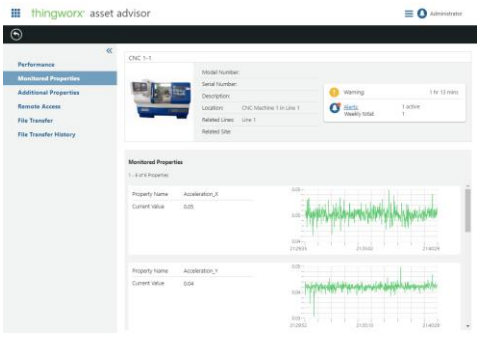


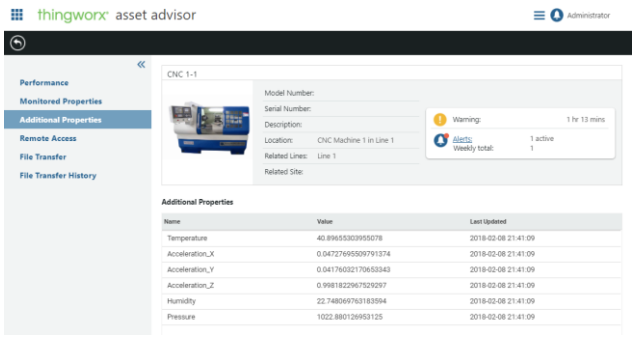


2. Click on your CNC 1-1 asset to see more details on the status of this asset.



3. Toggle between the different tabs to see different set of properties and information about the asset.



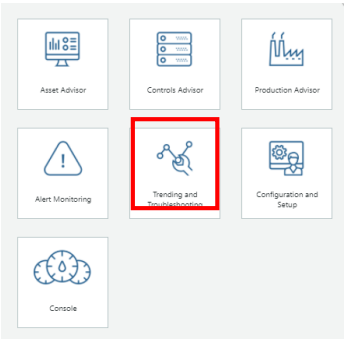


STEP 12 - CONFIGURING TRENDS

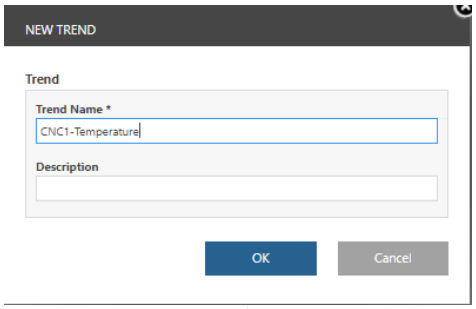
Each trend you create in ThingWorx Manufacturing Apps tracks up to five tags or properties for a given equipment (line or asset). Follow the directions below to create trends for several properties of your Sigma Tile.

To create a trend:

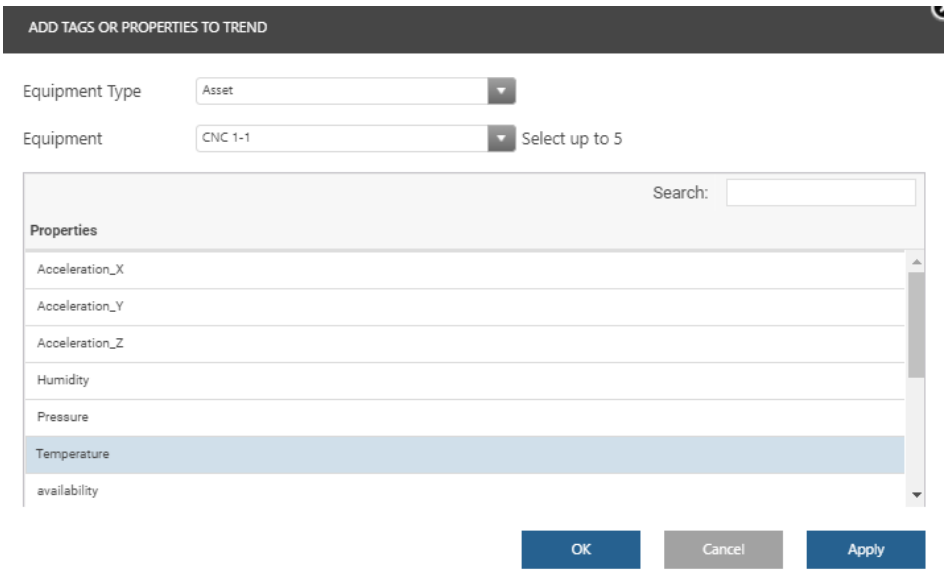
1. From the console, go to **Trending and Troubleshooting**.



2. Click new trend  .
3. In the **New Trend** window, enter a name and optionally, a description: e.g. CNC 1-Temperature

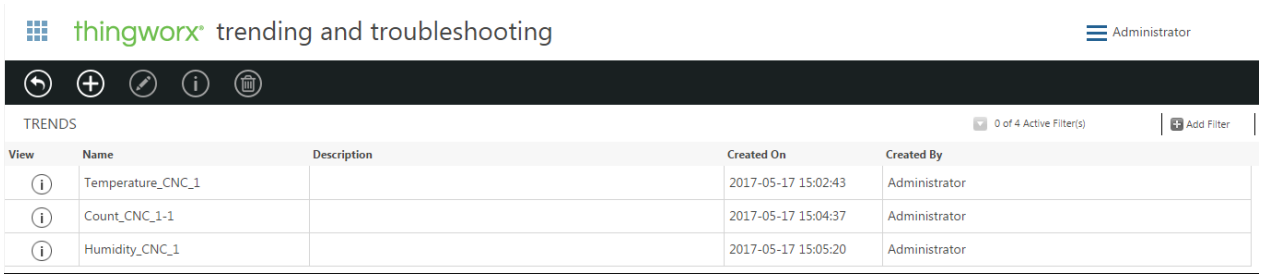


4. In the Tags section on the right, select  to add the properties you want to track. Select the **Equipment** and **Equipment Type** for the asset your created earlier. Select the **Temperature** property.



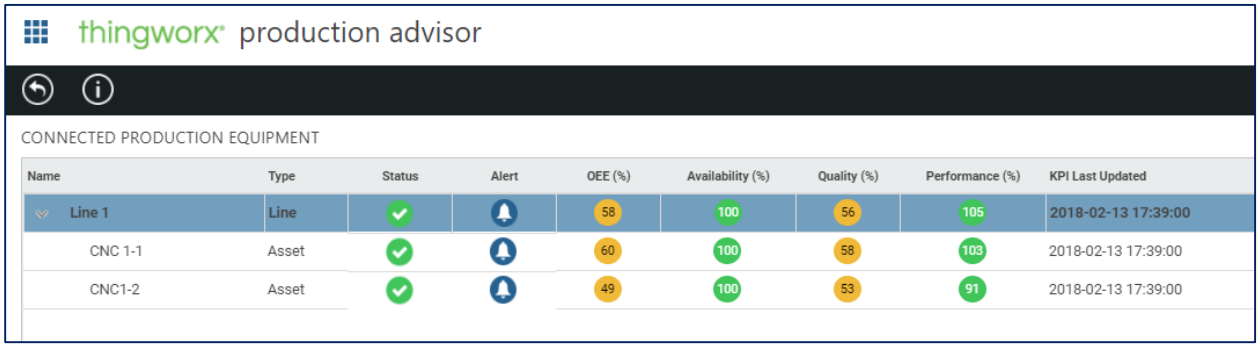
5. Once the trend is created, you can view any of the selected properties over different lengths of time.

6. Create additional trends showing the Parts counts for your asset and the Humidity.


thingworx® trending and troubleshooting
Administrator
TRENDS
0 of 4 Active Filter(s)
Add Filter
View
Name
Description
Created On
Created By
Temperature_CNC_1
2017-05-17 15:02:43
Administrator
Count_CNC_1-1
2017-05-17 15:04:37
Administrator
Humidity_CNC_1
2017-05-17 15:05:20
Administrator

STEP 13 - ADDING MORE ASSETS AND LINES

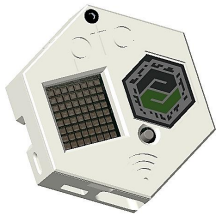
If you have multiple assets connected to your KEPServerEX server, such as multiple Sigma Tiles follow steps 4 through 12 to configure these additional assets and associated trends.



Congratulations! You have now completed this guide and **learned how to use the ThingWorx Manufacturing Apps using one or several Sigma Tiles acting as a production asset(s).**

WHAT IS A SIGMA TILE?

The **PTC Sigma Tile** is a **very low cost, ultra-portable** IoT device that you can **build yourself**. It is equipped with sensors and controls and can act as a **Smart Connected Product** or as the **Industrial Controller (PLC) of a production asset or line**. It is intended to be used for **IoT demonstration** and **IoT applications development and testing** purposes.



For a quick demo overview of the Sigma Tile in action, check out this video:

https://vimeo.com/246388214
(2-minute video)

GET STARTED

Step 1 – Learn Industrial Connectivity with KEPServerEX and a Sigma Tile

LearnKepServerEXUsingSigmaTileGuide.pdf

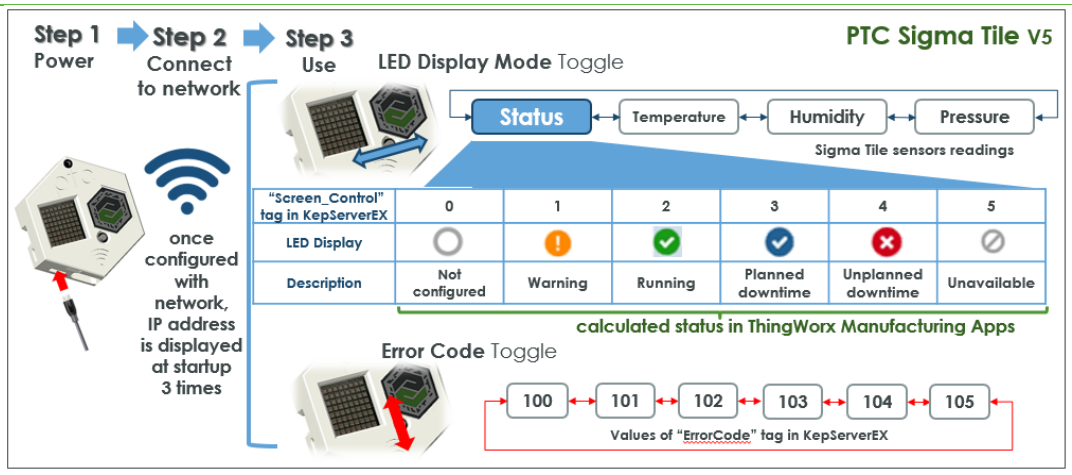
Install and configure the free trial edition of Kepware KEPServerEX to connect to the Sigma Tile and, in less than 10 minutes, stream real time readings from the Sigma Tile sensors: temperature, pressure, humidity… and control the Sigma Tile from KEPServerEX.

Step 2 – Learn ThingWorx Manufacturing Apps

LearnThingWorxMFGAppsUsingSigmaTileGuide.pdf

Download the ThingWorx Manufacturing Apps Free Trial and, in less than 60 minutes, experience the power of the Industrial IoT with your Sigma Tile acting as the PLC of a production asset or line.

SIGMA TILE FUNCTIONAL REFERENCE GUIDE



- Sigma Tile related Guides – on ThingWorx Developer Portal (under **Additional Resources**):
  https://developer.thingworx.com/apps/manufacturing
- Kepware KepServerEX - Trial Edition:
  https://my.kepware.com/mykepware/Landing.aspx
- ThingWorx Manufacturing Apps Free Trial:
  https://developer.thingworx.com/apps/manufacturing

APPENDIX B: TECHNICAL SUPPORT

If you have **any questions related to the Sigma Tile or this guide**, (installation, configuration, capabilities), we invite to check our ThingWorx User Community page at the link below:

- https://community.ptc.com/t5/PTC-Sigma-Tile/gp-p/sigma-tile.

You will be able to search and view posts from other users, from PTC Subject Matter Experts. You will be able to ask questions, share your lessons learned and provide feedback. If you already a PTC customer, you probably already have an account. If you do not have an account, you will first have to login on the top right end side of the page

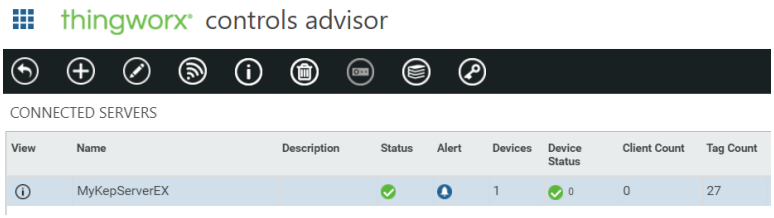
If you have **any questions related to the ThingWorx Manufacturing Apps,** check the following Community page:

- https://community.ptc.com/t5/Manufacturing-Apps/bd-p/manufacturingapps

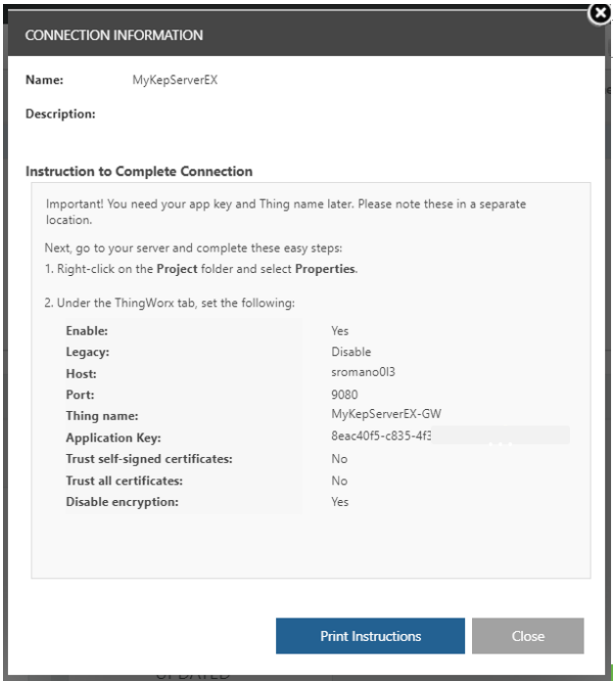
If you have **any questions related to the KEPServerEX**, check the Kepware Technical Support page:

- https://www.kepware.com/en-us/support/technical-support/

1. Navigate to **Controls Advisor** App from the console.



2. Select the Server for which you want to display the connection information and click 



3.