



Forecasting



Contents

Chapter 1: Forecasting Analysis	1
Plot Forecast Tags Using Analysis	2
Chapter 2: Multi Forecasting Chart Widget	5
About the Multi Forecasting Chart Widget	6
Configure the Multi Forecasting Chart Widget to Plot Tags	6
Add a Forecast Configuration	9
Delete a Forecast Configuration	11
Chapter 3: OPM Forecasting Widget	12
About the OPM Forecasting Widget	13
About Confidence Bands	13
Configure the OPM Forecasting Widget	13
Access the OPM Forecasting Widget	15
Chapter 4: Troubleshooter	17
About Troubleshooter	18
Discovering Correlation	18

Copyright GE Digital

© 2020 General Electric Company.

GE, the GE Monogram, and Predix are either registered trademarks or trademarks of General Electric Company. All other trademarks are the property of their respective owners.

This document may contain Confidential/Proprietary information of General Electric Company and/or its suppliers or vendors. Distribution or reproduction is prohibited without permission.

THIS DOCUMENT AND ITS CONTENTS ARE PROVIDED "AS IS," WITH NO REPRESENTATION OR WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF DESIGN, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. ALL OTHER LIABILITY ARISING FROM RELIANCE UPON ANY INFORMATION CONTAINED HEREIN IS EXPRESSLY DISCLAIMED.

Access to and use of the software described in this document is conditioned on acceptance of the End User License Agreement and compliance with its terms.

Chapter 1

Forecasting Analysis

Topics:

- [Plot Forecast Tags Using Analysis](#)

Plot Forecast Tags Using Analysis

Plot the forecast output tags generated by your deployed analytic using APM Analysis module.

Before You Begin

- You must be logged into an OPM tenant with access to the forecast feature set.
- You must deploy at least one analytic in the Spark environment. The Primary Category value of the deployed analytic template must be set to `Forecasting`.

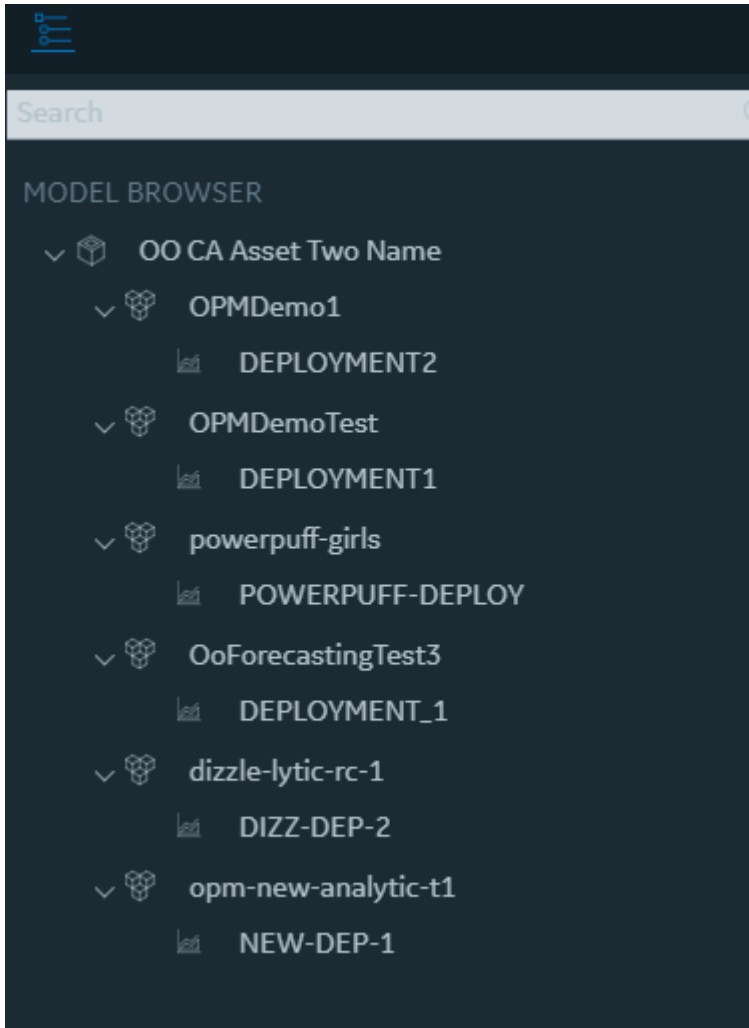
About This Task

After you have deployed and run an analytic deployment job successfully, you can use the APM Analysis module to plot and view the output tags resulting from the forecast analytic. You can perform analysis for only a single forecast analytic.

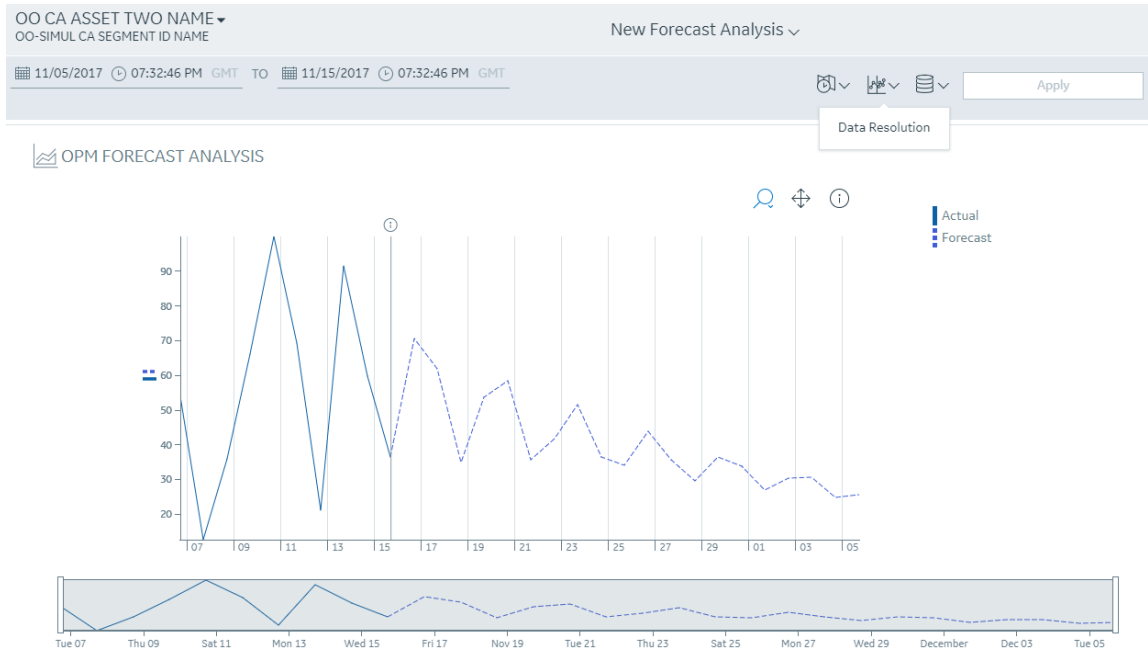
Use this procedure to plot forecast tags only. To plot tags for continuous data streaming see [Use the Streaming Graph Widget to Plot Tags](#).

Procedure

1. In the module navigation menu, select **Analysis**.
2. Using the Context Browser, navigate to the asset for which the forecast analytic is deployed, and then select **OPEN**.
3. In the list of views, select **New Forecast Analysis**. The **New Forecast Analysis** page appears, displaying the **MODEL BROWSER** section and the **OPM FORECAST ANALYSIS** section.
The **MODEL BROWSER** section contains a list of forecast analytics for the selected asset with its corresponding deployments.



4. To plot a deployment, drag the deployment from the **MODEL BROWSER** section to the chart area.



In the page for the forecast analysis, a chart plotting the actual and forecast values for the deployment appears. In the chart, a solid line is used to represent historical (that is, actual) data and a dotted line is used to represent forecast data. A vertical line in the chart is used to represent the date from that last data point of the historical data. The page also contains the **Historical** and the **Forecast** boxes, which you can use to select the time period for which the historical and forecast data must be plotted. By default, the time period selected for the analysis is from 30 days prior to the current date to 10 days after the current date. The actual and forecast plots are generated against the data retrieved from time-series information for the date range selected.

Tip: You can perform the following tasks in the page:

- In the page, to modify the time period for which historical data is plotted and the number of days for which forecast data is plotted, modify the values in the **Historical** box and the **Forecast** box, and then select **Update**.
- In the chart, you can hover over the chart to view the details of the data points plotted.
- In the chart area, you can select the **Actual** button or the **Forecast** button to highlight or dim the plotted line.

Chapter 2

Multi Forecasting Chart Widget

Topics:

- [About the Multi Forecasting Chart Widget](#)
- [Configure the Multi Forecasting Chart Widget to Plot Tags](#)
- [Add a Forecast Configuration](#)
- [Delete a Forecast Configuration](#)

About the Multi Forecasting Chart Widget

The Multi Forecasting Chart widget helps you to compare the outcome from multiple product lines, segments, or plants simultaneously. To identify additional insights, you can also plot data measured using two different units (for example, production vs cost, inventory vs sales order, product mix vs market price). You can visualize the observed values and forecast values for multiple tags using your preferred Unit of Measurement (UoM). The following features are provided in the widget:

- Ability to define a secondary y-axis and specify the UoM for the primary and the secondary axis. The ability to include a secondary y-axis helps you to compare data recorded using different measures of scales on the same widget.
 - Ability to define forecasts and specify the axis on which the data must be plotted. For each forecast configuration, the data from the tags are converted to the UoM selected for the representative axis (i.e., primary or secondary axis).
- Note:** The data from the tags are converted only for charting purposes. The actual data is not affected.
- Ability to generate charts with smoother lines. The data from the tags sometimes contain very few datapoints between the selected date range in the chart, resulting in the chart appearing with straight lines and sharp points. If you want to view smoother chart lines, you can use the data smoothing ability in the widget to generate charts with smoother lines.

Example: Using the Multi Forecasting Chart Widget

Suppose that your organization has distributors located in different countries. A distributor located in New Jersey will record sales in Dollars, whereas a distributor located in Bangalore will record sales in Rupees. An analyst who wants to present a forecast analysis to an audience in India can use the Multi Forecasting Chart widget to plot the overall sales data in Rupees so that the audience can relate to the data. The analyst can select the UoM for the primary axis as Rupees, and then configure the forecasts for the tags associated with sales data to use the primary axis. This ensures that sales data from all tags are converted to Rupees while plotting the data on the chart.

On the same widget, you can analyze the trend of profit margin against the sales by plotting the profit margin on the secondary y-axis. The secondary axis can be configured to plot margin in percentage, and then you can configure the forecasts for tags associated with profit margin to use the secondary axis.

Configure the Multi Forecasting Chart Widget to Plot Tags



Before You Begin

- Ingest the input and output tags for which you want to plot data.
- Ensure that the input tag (that is, historical tag) contains observable data and the output tag (that is, forecast tag) contains the forecast data.
- Ensure that the Systems of Measure (SoM) and Units of Measure (UoM) are configured for the tenant. The possibility and accuracy of conversion is related to the tenant level configuration of SoM and UoM.

About This Task

Add the Multi Forecasting Chart widget to plot historical and forecast tag data. You can add a maximum of four forecast configurations per widget. You can add more widgets to the same card to plot additional sets of tags. When you add multiple Multi Forecasting Chart widgets to the same custom card, for better data visibility, we recommend that you add each widget in a different row in the custom card.

Procedure

1. Access the card for the asset for which you want to add the widget.
2. In the card, select , and then select **Edit Card**.
In the card, the **Add Widget** button appears.
3. Select **Add Widget**.
The widget library appears, displaying a list of widgets.
4. In the widget library, navigate to the **Multi Forecasting Chart** widget, and then select **Add**.
The widget is added to the card.
5. In the widget, select .
The **Configure Widget** page appears, displaying the forecast chart and the options for configuring the widget.
6. In the **Widget Title** box, enter a title for the widget.
By default, the title for the widget is Forecast Widget. A unique title helps differentiate the purposes of the forecasts.
7. In the **DATE RANGE TO DISPLAY** section, enter values in the following fields:

Option	Description
Previous	The value in this box indicates the period for which the historical data must be plotted. By default, the value in this box is 30 Days. You can modify this value. The following UoM options are available: <ul style="list-style-type: none">• Days• Months• Years
Next	The value in this box indicates the period for which the forecast data must be plotted. By default, the value in this box is 30 Days. You can modify this value. The following UoM options are available: <ul style="list-style-type: none">• Days• Months• Years

8. In the **DATA SMOOTHING** section, enter a value in the following field:

Option	Description
Normalization	This drop-down list box contains the following options: <ul style="list-style-type: none">• Not Applicable: Select this option if you do not want to normalize the data to make the charts appear smooth. By default, this option is selected.• System Default: Select this option if you want the plotted charts to appear smoother.

9. In the **UNIT OF MEASURE Y-AXIS SELECTION** section, enter values in the following fields:

Option	Description
System Of Measure	This box is enabled only if there is at least one forecast configuration in the widget.

Option	Description
	<p>When you add the first forecast configuration to the widget, this box is enabled and the SoM associated with the UoM for the first forecast configuration is selected. The box is populated with the SoM values configured in the tenant. You can modify this value.</p> <p>Note: If you modify the SoM value, the UoM values associated with the SoM that you selected are populated in the Primary Y-axis and Secondary Y-axis boxes and a blank value is selected initially. You can then re-select the UoM for the primary and secondary y-axis. The charts in the widget are plotted based on the UoM that you selected.</p>
Primary Y-axis	<p>This box is enabled only if there is at least one forecast configuration in the widget and the first forecast configuration created contains tags that have associated UoM.</p> <p>The UoM associated with the tags in the first forecast configuration is selected as the default value for this box. The drop-down list box is then populated with related UoMs. For example, if the tags in the first configuration are associated with the UoM kilogram, the Primary Y-axis box is populated with all units of measure related to the measurement type weight, such as grams or pounds.</p> <p>When you modify the value selected in this box, the charts in the widget are reloaded. The forecast charts for configurations defined to be plotted on the primary axis are plotted based on the UoM that you selected in the Primary Y-axis box.</p>
Secondary Y-axis	<p>This box is enabled only if at least one forecast configuration exists in the widget for which the value in the Select axis box is Secondary.</p> <p>The UoM associated with the tags in the first forecast configuration for which the secondary axis is used is selected as the default value for this box. The drop-down list box is then populated with related UoMs. For example, if the tags in the first configuration for the secondary axis are associated with the UoM kilogram, the Secondary Y-Axis box is populated with all units of measure related to the measurement type weight, such as grams or pounds.</p> <p>When you modify the value selected in this box, the charts in the widget are reloaded. The forecast charts for configurations defined to be plotted on the secondary axis are plotted based on the UoM that you selected in the Secondary Y-axis box.</p>

10. As needed, add the forecast configurations to the widget.

Note: You can add a maximum of four forecast configurations to a widget.

Each new forecast configuration that you add appears in the list of configurations for the widget.

11. In the **Configure Widget** page, select **Done**.

The card to which you added the widget appears, displaying forecast charts based on your configuration of the widget.

12. In the card, select **Save**.

Your configuration for the widget is saved.

Add a Forecast Configuration

Before You Begin

- Ingest the input and output tags for which you want to plot data.
- Ensure that the input tag (i.e., historical tag) contains observable data and the output tag (i.e., forecast tag) contains the forecast data.
- Configure the Multi Forecasting Chart widget.

Procedure

1. Access the Multi Forecasting Chart widget to which you want to add a forecast configuration.
2. Next to the header **FORECASTS**, select **+**.

Important: You can add a maximum of four forecast configurations in a widget. If the widget contains four forecast configurations, the **+** button does not appear. If needed, you can delete a forecast configuration, and then add the new configuration to the widget.

In the **FORECASTS** section, a new section with options for configuring a forecast appears.

Note: By default, the title for the new section appears in the following format: **FORECAST <number>**, where *<number>* indicates the number of forecasts after addition of the new forecast. To modify the title, you can select the title, and then, in the box that appears, enter a new title.

3. As needed, in the section for configuring the forecast, enter values in the following fields:

Option	Description
Forecast Configuration Title	You can select the title of the forecast configuration, and then, in the box that appears, you can enter a title.
Select Axis	You can select one of the following options: <ul style="list-style-type: none">• Primary Select this option if you want to use the primary axis to represent the data for the forecast that you are configuring.• Secondary Select this option if you want to use the secondary axis to represent the data for the forecast that you are configuring.
Historical Tag	You can search for and select the tag that contains observed data for the asset. In the box, you can select Tag Search to search for tags associated with the selected asset. You can select Tag + Child Search to search for tags associated with the selected asset and the assets within the selected asset in the hierarchy.

Option	Description
Forecast Tag	<p>Note: You can associate a tag with only one forecast configuration.</p> <p>You can search and select the tag that contains predictive data for the asset. In the box, you can select Tag Search to search for tags associated with the selected asset. You can select Tag + Child Search to search for tags associated with the selected asset and the assets within the selected asset in the hierarchy.</p> <p>Note: You can associate a tag with only one forecast configuration.</p>
Target	You must enter a numeric value.
Threshold	You must enter a numeric value.

The forecast configuration is added to the widget, and the chart for the configuration appears in the widget.

Note: If the forecast that you are configuring is the first forecast configuration for the widget and the tags you selected are not associated with a Unit of Measure or a System of Measure, a message appears, stating that the selected tags are not associated with a UoM or SoM. The **Primary Y-Axis** and the **Secondary Y-Axis** boxes, which are used for selecting UoMs, remain disabled.

Note: The chart appears on the widget only if both the forecast and historical tags are selected and the tags contain a minimum of one data point in the selected date range. If the tags that you selected do not exist in the database, then the charts do not appear. When you modify a configuration in the widget, the chart is reloaded to display the changes.

4. In the **Configure Widget** page, select **Done**.
The card containing the widget appears, displaying the charts for the forecast configurations.
5. In the card, select **Save**.
The forecast configuration is saved.

Results

- In the chart, the x-axis represents the dates within the date range specified in the widget configuration.
- On the chart, the historical data is plotted using a solid line and the forecast data is plotted using a dashed line.
- The Target value appears as a horizontal, solid line and the Threshold value appears as a horizontal, dot-dashed line. The Target and Threshold values are plotted based on the UoM associated with y-axis in the forecast configuration.
- If the widget contains multiple forecast configurations, the chart for each forecast configuration appears in a different color. The Target and Threshold lines for each forecast configuration appear in the color in which the chart for the configuration appears.
- In the widget, the legend for the charts appear, displaying the legend keys for each forecast configuration, the Primary Axis UoM, and the Secondary Axis UoM. The legend keys are a set of a solid line pattern to represent the historical trend and a dashed line pattern to represent the forecast trend for each configuration. You can select the legend key to display or hide the trend for a configuration on the chart.
- When you hover over a data point, a tooltip appears, displaying the timestamp and value for the data point.
- Below the forecast charts, a pane appears, displaying the zoomed-in view of the charts for the configured time period. The pane contains a vertical bar on both the sides, which you can drag to view the chart only for the selected time period within the configured time period.

Delete a Forecast Configuration

Procedure

1. Access the **Multi Forecasting Chart** widget that contains the forecast configuration that you want to delete.
2. In the right pane, next to the forecast configuration that you want to delete, hover over the title of the forecast configuration.
Next to the title for the configuration, the **X** button appears.
3. Select **X**.
The **Delete Configuration** dialog box appears, asking you to confirm that you want to delete the forecast.
4. Select **OK**.
The forecast configuration is deleted. The widget is refreshed to display the charts for the available configurations.

Chapter 3

OPM Forecasting Widget

Topics:

- [About the OPM Forecasting Widget](#)
- [About Confidence Bands](#)
- [Configure the OPM Forecasting Widget](#)
- [Access the OPM Forecasting Widget](#)

About the OPM Forecasting Widget

Forecasting is essential for organizations to implement their operation management strategies. Forecasting is used to determine possible future outcomes for the business. Accurate forecasting plays an essential role in the operation and management of plants and sites, as it provides relevant and dependable information about past and present events, as well as probable future events

The primary advantage of forecasting is that it provides organizations with important information that they can use to make decisions about the future of the organization. Forecasting can be used as a vital tool in modern operations, as it enables you to visualize future trends and provides a clear picture of the environment in which you may operate. You can use accurate forecasting to minimize risk that arises because of guesswork.

The OPM Forecasting Widget uses historical data as inputs to make informed estimates that are predictive in determining the direction of future trends. Using the historical time-series data of assets, the widget creates a graphical forecast of the predicted future values of Key Performance Indicators (KPIs) and sensor values. You can use the widget as a decision-making tool to help in budgeting, planning, and estimating future events.

About Confidence Bands

A confidence band in a forecast is the range surrounding each predicted value in which the future forecast points are expected to fall. A confidence band on a forecast graph consists of two lines that depict the upper and lower confidence bounds for all points on a fitted line within the range of data. A confidence band indicates the variance or the deviation of the prediction.

Confidence bands help you determine the accuracy of predictions. A narrower band indicates more confidence in the prediction for the specific point.

Configure the OPM Forecasting Widget



Configure the OPM Forecasting widget to plot forecast data using historical data.

About This Task

This topic describes how to add the OPM Forecasting Widget to the dashboard, and then configure the widget.

Procedure

1. In the **Dashboards** page, select **Create New** to create a new dashboard for the widget.
2. In the **Title** box, enter a name for the new dashboard, and select **Save**.
The newly created dashboard appears.
3. Set the asset context using the **Select Asset Context** asset hierarchy.
4. Select **⋮**, and then select **Add New Card**.
5. Select **Add**, and then select **Done** to add a new custom card to the dashboard.
6. In the card, select **▼**, and then select **Edit Card**.
The **Add Widget** button appears.
7. Select **Add Widget** to add a widget to the card.
The widget library appears, displaying a list of widgets.


8. Navigate to the **OPM Forecast TF** widget, and then select **Add**.
9. Select **Save** to add the widget to the card.
The widget is added to the card.
10. In the widget, select , then select **Edit Card**, and then select .
The **Configure Widget** page appears, displaying a blank forecast chart workspace and the different options for configuring the widget.
11. In the **Enter Widget Title** box, enter a unique title for the widget, to specify the purpose of a particular forecast.
12. Drag tags from **Select Tag/Kpi** section to the chart workspace to create a forecast.
A forecast for the tags is plotted using the historical data.

Tip:

- Expand the tag hierarchy before performing the initial search.
- You can search for tags using the **Search** box or you can use the hierarchy of Tags in the **Select Tag/Kpi** section. The first search is limited to the expanded tree view, that is, the search performed for the visible tags.
- You can plot a maximum of three tags for your forecast.
- The used tags cannot be plotted again.

Important:

- A minimum of 30 days of data from the previous 90 days, at hourly resolution, is required to forecast.

Note: To delete a tag from the forecast, select , and then select **Delete**.

13. As needed, customize the forecast chart using the following options.

Settings	Description
Horizon Settings	To configure the period of the forecast from one to seven days, select a value in the Forecast box. By default, it is set at 5 days .
Resolution Settings	The Select Display Unit is currently fixed at Per Hour .
Confidence Band Setting	To enable or disable the confidence band, select the Display Confidence Band .

14. Set the historical data to be displayed in the forecast by selecting one of the options the workspace.
You can select from the following intervals:

- 15 days
- 30 days
- 60 days
- 90 days



The forecast chart is updated with the historical data and the confidence band.

Tip: If the forecast is plotted without historical data, select a larger historical data interval.

Note: Below the forecast chart, a chart navigator appears, using which you can track and analyze the forecast chart.

15. In the **Configure Widget** page, select **Done**.
The card to which you added the widget appears.
16. In the card, select **Save**.
The configuration for the widget is saved.

Access the OPM Forecasting Widget

After the Forecasting widget has been configured, you can use the widget to analyze forecast data.

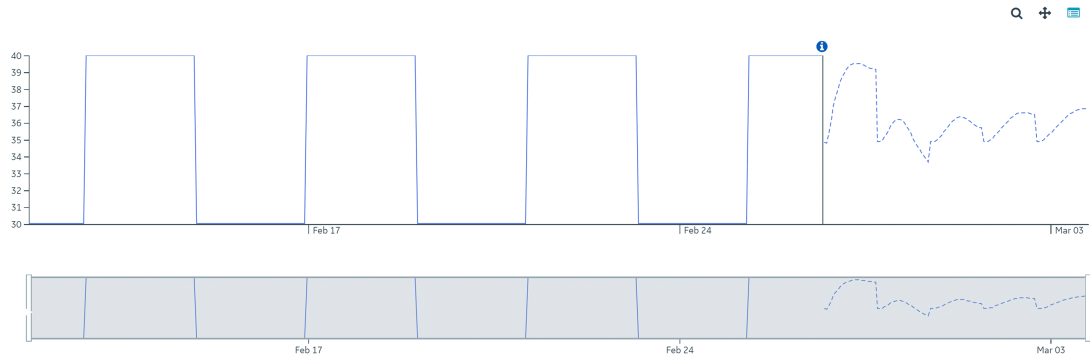
Procedure

1. In the module navigation menu, select **Dashboards**.
The **Dashboards** page appears.
2. Select the **All Dashboards** tab.
The available dashboards appear.
3. Select the dashboard where the Forecasting widget has been configured and added.
Note: You can add this dashboard to your favorites by selecting **★**. Recently opened dashboards are available in the **Recently Opened** section.
4. Use the context browser to navigate to the site for which the Forecasting widget has been configured, and then select **Open**.
The widget plots the forecast chart.
5. Set the historical data to be displayed in the forecast by selecting one of the options in the workspace. You can select from the following intervals:
 - 15 days
 - 30 days
 - 60 days
 - 90 days

Enter Widget Title

15 Days 30 Days 60 Days 90 Days

press...ctual press...ecast



The forecast chart is updated with the historical data and the confidence band. You can change the configuration settings of the widget using the different options.

Note: Below the forecast chart, a chart navigator appears, using which you can track and analyze the forecast chart.

Tip: The changes you make while viewing the forecast are not saved. When you access the widget the next time, it will open with the last saved configuration settings.

Chapter 4

Troubleshooter

Topics:

- [About Troubleshooter](#)
- [Discovering Correlation](#)

About Troubleshooter

A process engineer may observe some deviations in the process having impact on key indicators. To troubleshoot or analyze the root cause, the high contributing factors must be identified through variable importance and correlation to optimize the rectification of the process to bring the normalcy quickly.

Most of the process engineers are often overwhelmed by the amount of data available to them. Until recently, most industries collected only a small amount of information on their processes. Process engineers had a few observations on fewer critical variables that helped them decide on how the process had to be operated.

In the data-driven world, to overcome the human limitation on comprehending huge data set and interrelationship between various key parameters, OPM Troubleshooter helps in creating a correlations map for the given target variable by using a variable importance ranking to identify the critical impacting variable.

Discovering Correlation

Using the OPM Troubleshooter, you can examine data (that is, sensor data, calculated tags, attributes) to analyze the impact of ranked variable and correlation across variables with respect to the selected target variable or KPI.

Before You Begin

Ensure that the OPM Troubleshooter is enabled for the tenant, and the required permission set is assigned.

Procedure

1. In the module navigation menu, select **Troubleshooter**.
The **Trouble-Shooter** page appears.

Troubleshooter Analysis 01/01/2019 - 01/31/2019

SELECT TAG/KPI

- ▶ Navi Foods Inc
- ▶ Mining Enterprise
- ▶ Savory Foods Inc
- ▶ OO-SIMUL ASSET ENTERPRISE FOR TEST
- ▶ Saint-Gobain
- ▶ RenPowerCurveSample Enterprise_4_Assets
- ▶ Analytics ASSET ENTERPRISE FOR TEST
- ▶ Obeikan
- ▶ SCG Chemical
- ▶ Digital WindFarm
- ▶ K12Sample Enterprise_300_Assets
- ▶ Sample Enterprise

TARGET VARIABLE

CONTRIBUTING FACTORS

2. Adjust the timeline for which the troubleshooter functionality will be run. By default, the value is set to the previous seven days from the current date.

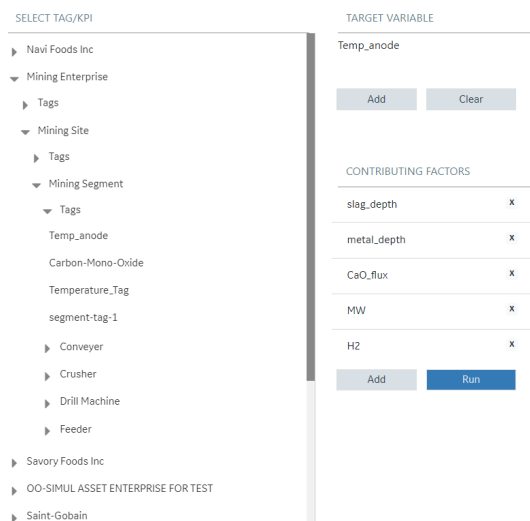
3. In the **Select Tag/KPI** pane, expand the enterprise that contains the tag that you want to add as a target variable.
4. Select the tag, and then in the **Target Variable** section, click **Add**.

Note:

- You can add only one tag at a time to the **Target Variable** section.
- The **Clear** button in the **Target Variable** section clears the target variable and the contributing factors such as the section and the graph.

The selected tag is added to the **Target Variable** section. An analysis runs in the background producing the five main contributing factors that appear in the **Contributing factors** section, and the **Run** button is enabled.

Note: The contributing factors are listed in the descending order starting with the most contributing factor first.



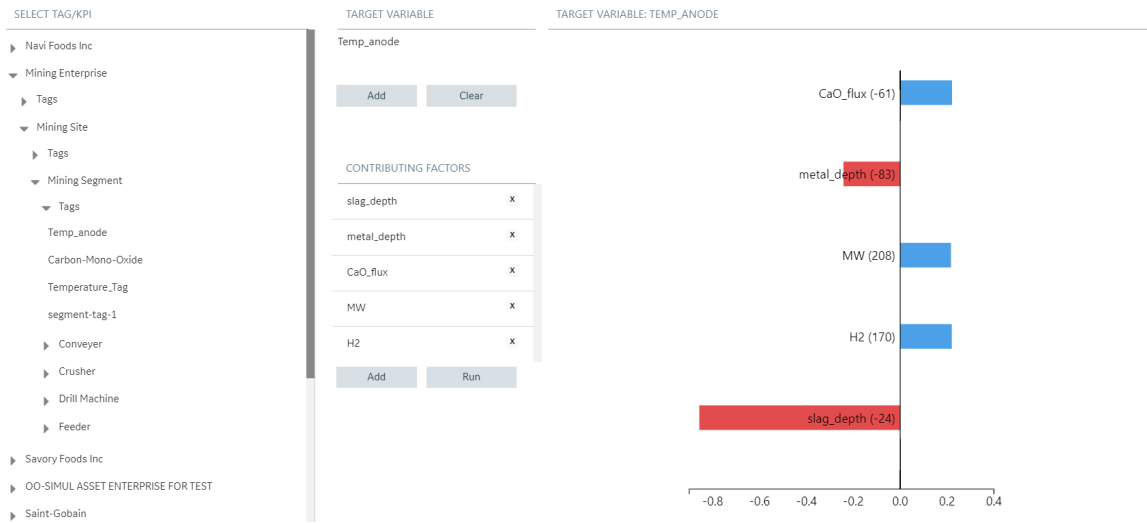
Also, to add tags as contributing factors click **Add** in the **Contributing factors** section.

To delete a contributing factor, select **X**.

Note:

- Making changes to the contributing factors by adding or deleting a tag removes the graph and highlights the **Add** button.
- Making changes to the date range recalculates and populates the contributing factors and correlation graph for the same target variable.

5. Select **Run**.
A bar graph appears based on the analysis.



The name of the contributing factor consists of a number that specifies the lag value that contributes to the correlation analysis. On the graph, the blue color indicates that the correlation is greater than zero, and the red color indicates that the correlation is less than zero.