



# **Asset Performance Management**

## **APM Prognostics Guide**

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APM Prognostics Version: 3.3.221130.0

January 2023

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# About This User Guide

This user guide contains information about the prognostic capabilities of the APM Prognostics application. Operators of industrial assets can use this application to get information when their assets will experience complications or reach critical conditions. APM Prognostics allows for maintenance optimization, extending remaining useful life before maintenance can occur, and maximization of your assets to lower repair costs.

This guide also contains API document for APM Prognostics and sample Postman collections. For more information, see [this chapter](#).

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# Chapter 1: APM Prognostics Overview

## Application Overview

APM Prognostics is a web application with prognostic capabilities for industrial asset management. It can calculate asset condition and show an explicit prognostic horizon and risk profile. You can use this information to understand when in the future a malfunction of your asset is likely to occur. Based on the asset condition, you can make informed decisions about the asset maintenance planning to reduce unplanned downtime.

**Report no.:** DEMO-FOSSIL DEMO-FOSSIL PPA1.DFGU1.STB1.20210728062542-00  
**Date:** 28 Jul'21  
**Version:** 3.2.210714, Release: 1.0

**Equipment specification**

Operator name: DEMO-FOSSIL  
 Unit name: DFGU1  
 Unit location: STB  
 Contact person: Don Demo  
 Phone: +1234567890  
 E-mail: don@demo.com

Component type: Steam turbine  
 Component OEM & model: OEM demo, model demo  
 Component group: STB  
 Serial number: STB1  
 Elements monitored: Bearings, casing, blades, oil, oil pump  
 Alarm owner: An Example  
 Phone: +1234567890  
 E-mail: an@example.com

**Condition diagnostics**

Condition: Normal

**Malfunction prognostics**

Select	Malfunction modes	Data sources	Jul'21	Oct'21	Jan'22	Apr'22	Jul'22	Oct'22	Jan'23	Apr'23	Jul'23	Oct'23	Jan'24	Apr'24
<input checked="" type="checkbox"/>	Hitachi health index	KCS	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Insufficient gas quality	(E) (F) (R)	0%	0%	1%	1%	2%	2%	3%	3%	4%	5%	5%	6%
<input checked="" type="checkbox"/>	Gas mixer defect	(G)	0%	0%	0%	0%	1%	1%	1%	1%	2%	2%	3%	3%
<input checked="" type="checkbox"/>	Fail-safe gas loop defect	(R)	0%	0%	1%	2%	4%	5%	7%	8%	11%	13%	16%	18%
<input checked="" type="checkbox"/>	Ignition system defect	(R)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Engine knocking	(S)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Cylinder temperature deviation	(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Excessive overspeed	(E) (R)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Engine bearing defect	(E) (S) (X)	0%	0%	1%	2%	3%	5%	6%	8%	10%	11%	13%	15%
<input checked="" type="checkbox"/>	Generator bearing defect	(E) (S) (X)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Turbo bypass defect	(E) (P) (R)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Cooling system defect	(E)	0%	0%	1%	2%	4%	5%	7%	8%	11%	13%	16%	18%

**Next maintenance:** 30 Jun'22 (proposed) [Schedule](#)

**Prognostic horizon:**  Short (12 days)  Long (12 weeks)  Maximum (12 quarters) (zoom)

**View:**  Percentages

**Load min:** 150 MW **Load max:** 650 MW  
**History start:** 01 Jan'08 **History end:** 28 Jul'21  
**Reference date:** 28 Jul'21 (UTC)

**Schedule:** Risk, Hold, Safe

In the navigation panel on the left side, you can select a language for the interface of your application and a page that you want to see. The main pages are:

- Prognostic report
- Configuration log

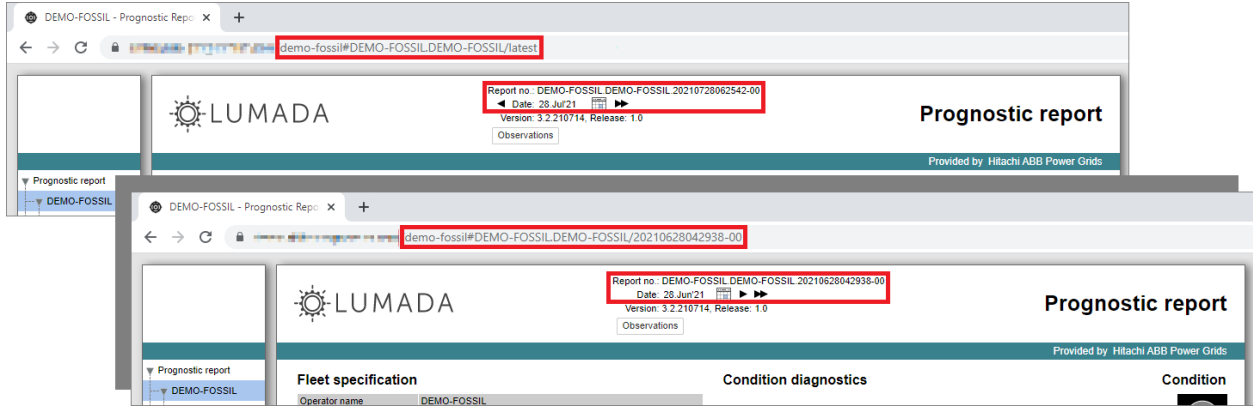
**Note:** This page is available only in English.

- Administration tool
- Project portfolio

These pages and individual reports in the Prognostic report page have dedicated links (URLs) that you can use to access them directly.

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## Roles

You control access to the APM Prognostics pages and options that are available in the pages by assigning roles to the application users. Most of the users will have roles that let them see and do tasks in the Prognostic report and Configuration log pages.

The APM Prognostics roles are:

- None – A user with this role has no access to APM Prognostics.
- Front End – A user with this role has access to prognostic reports.
- Config Doc Viewer – A user with this role can see configuration documents.
- Config Doc Editor – A user with this role can edit configuration documents.
- Admin – A user with this role can release configuration documents.

The roles are ordered from the lowest to the highest level of access that they give to users. The assignment of a certain role causes the assignment of the lower role as well. For example, a user with the Config Doc Editor role, has all the permissions of the Config Doc Viewer and Front End roles.

You can assign roles globally or per an operator. The per-operator assignment can only extend the user permissions, not restrict them. For example, if a user has the Config Doc Viewer role globally, you can only extend it to the Config Doc Editor or Admin role in scope of a specific operator. You cannot restrict it to the Front End or NONE roles.

**Important:** Make sure that you do not grant external users the global access. A global role assignment that is higher than NONE gives a user the access to all the operators in the system. It includes the FTP access. When the users with the global Front End role or higher log into the FTP server, they can see the full list of operators along with all their data.

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## Prognostic report page

APM Prognostics offers objective, condition-based information on the remaining useful life (RUL) of assets and computed risk profiles over an explicit time horizon. It gives an overview of the condition diagnostics and malfunction prognostics. The report has several functions that let the asset operators to make significant cost savings in the following areas:

- Reduced preventive scope and frequency
- Shift of maintenance into periods with low maintenance costs
- Shift of maintenance into periods when revenue from production is low
- Reduction of the unscheduled maintenance and repair
- Better maintenance work order preparation
- Preemption of damages
- Reduction of redundancies

The prognostic report is hierarchical, you can view it for the entire fleet of assets, a unit in the fleet, or a particular asset (equipment) in a unit. When you configure this hierarchy, we recommend to use names that identify the name of the company and are related to how the asset fleet is organized in the company. Usually, the units are collections of assets in one location or close to each other. In some cases, it is necessary (and possible) to have more than three levels in the hierarchy. So for example, in more complex hierarchies, units can be also collections of other units, like in the hierarchy below. Note, that the lowest level in this hierarchy displays the most details.

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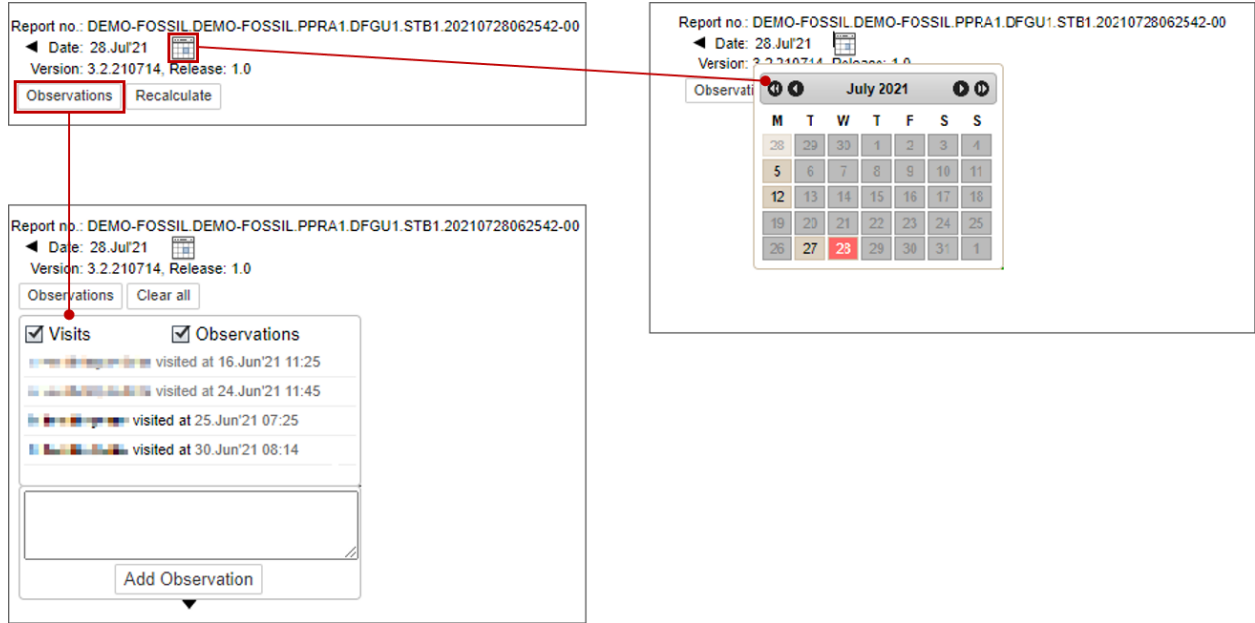
The screenshots show the LUMADA Prognostic report interface at different levels of detail:

- Fleet:** Shows a list of units and a 'Fleet specification' report for the entire fleet.
- Unit:** Shows a 'Unit specification' report for a specific unit (PPRA1).
- Asset (Equipment):** Shows an 'Equipment specification' report for a specific component (STB).
- Malfunction prognostics:** A table showing the historical and predicted occurrence of various faults over time.

Date	Malfunction modes	100% severity	Jan21	Feb21	Mar21	Apr21	May21	Jun21	Jul21	Aug21	Sep21	Oct21	Nov21	Dec21	Jan22	Feb22	Mar22	Apr22	May22	Jun22	Jul22	Aug22	Sep22	Oct22	Nov22	Dec22
Jan 21	Oil leak	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jan 21	Oil cooler defect	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jan 21	Oil leakage	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jan 21	Oil particle contamination	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jan 21	<b>Total oil</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>

At the top of the Prognostic report page, you can:

- See the number and date of the prognostic report.
- Click the **Calendar** icon to see a prognostic report from a different date.
- See the version and release number of your APM Prognostics instance.
- Click **Observations** to see who used your instance of APM Prognostics recently and if they left any comments by adding an observation.
- Click other buttons that appear only when you do some specified steps in APM Prognostics. For example, run simulations.



There are two main data inputs that have effect on what you see in the Prognostic report page. The first one is the configuration document (config doc) with static data like equipment specification, names of the malfunction modes, names and number of the data sources. For more information, see the [Configuration log](#). The second one is the data about the assets from the measuring devices. This is the data that APM Prognostics uses to calculate the risk prognoses for the assets.

At the bottom of the Prognostic report page, you can:

- Download the release notes and user guide.
- See the third-party components that APM Prognostics uses.
- Convert this page into a PDF file.
- See the Hitachi Energy privacy policy.
- Switch the account or log out.

**Note:** The Convert option is available only for the Prognostic report. All the other options are available in the whole application.

## Details of the Prognostic report page

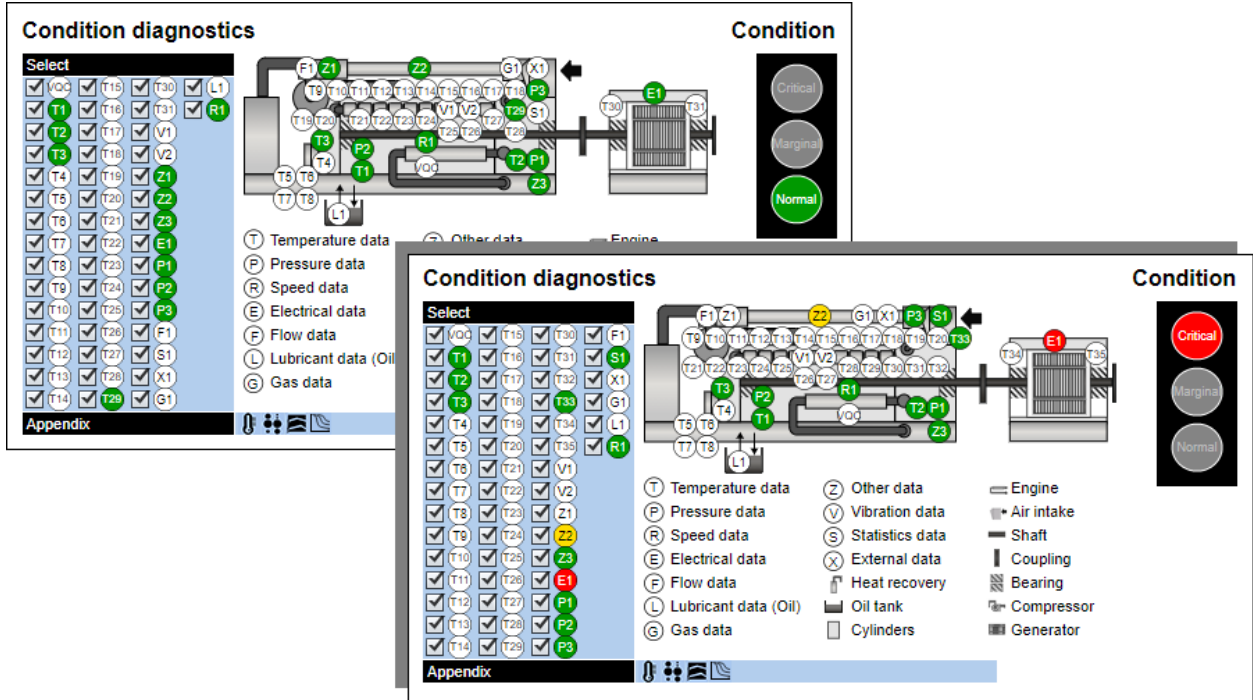
The Prognostic report page is a customer-facing dashboard with information about the assets. There are several settings on this page that you can select to change what you see. To learn about all the options and settings, let us look at an example of a component level.

### Condition diagnostics section

The Condition diagnostic section contains a referential diagram with a legend that explains its elements.

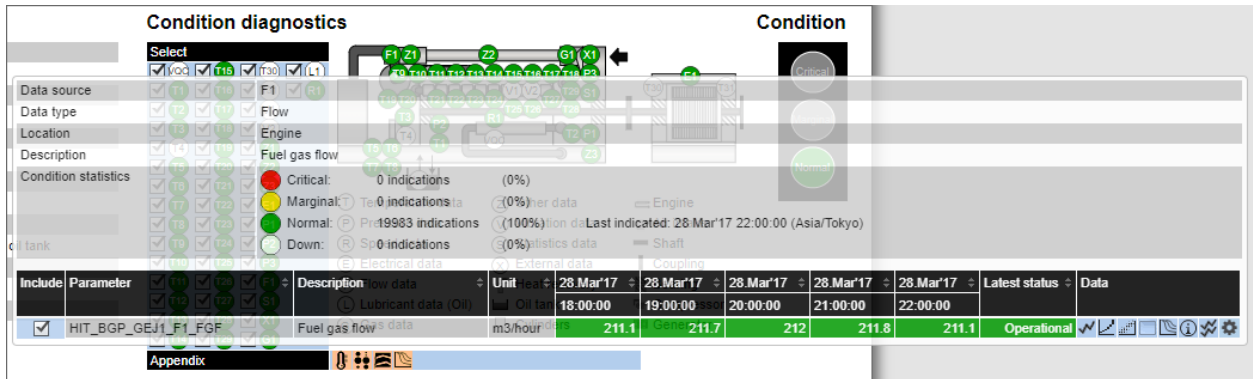
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The circles on the diagram are data sources that supply information about the asset elements. The data sources usually represent measuring instruments that are on or in the asset and monitor its work and condition. The letter in the circle identifies the data source type, the numbers identify instances of a particular data source type.

You can hover over the diagrams to display tool tips with additional information. Additionally, when you are on the fleet or unit level, the diagrams have a drill-down option. You can click on the diagram elements to go to a lower hierarchy level.



During the normal operation (when the asset condition is normal), the data sources are highlighted green. It means that the latest data that was uploaded into APM Prognostics is in the operational range. When the data starts to be in the marginal range, the diagnostic condition of asset elements (and the asset itself) becomes worse and the data sources are highlighted yellow. Finally, when the data is in the critical range, the data sources are highlighted red.

The data source circles can also be white. It happens when:

- There is no data for the data source.
- The data that is available is below the threshold.
- The data is excluded from the solution.

## Additional visualizations in the Prognostic report page

In the bottom appendix in the Condition diagnostics section, you can click any of the icons to display additional information:

**Note:** The icons are available for you depending on the assigned roles. For more information, see [Roles](#).

- Latest parameters values

This page shows a table with an overview of the latest values of all parameters, grouped by the data source. The table identifies with colors: gray, green, yellow, red, and dark red which parameters are in the excluded, normal, marginal, severe, and critical ranges, respectively.

Report no. DEMO-FOSSIL DEMO-FOSSIL PPR1 DFGU1 STB1 SUMMARY VALUES 2021...  
 Date: 28 Jul 21  
 Version: 3.2.210714, Release: 1.0  
 Observations Delete

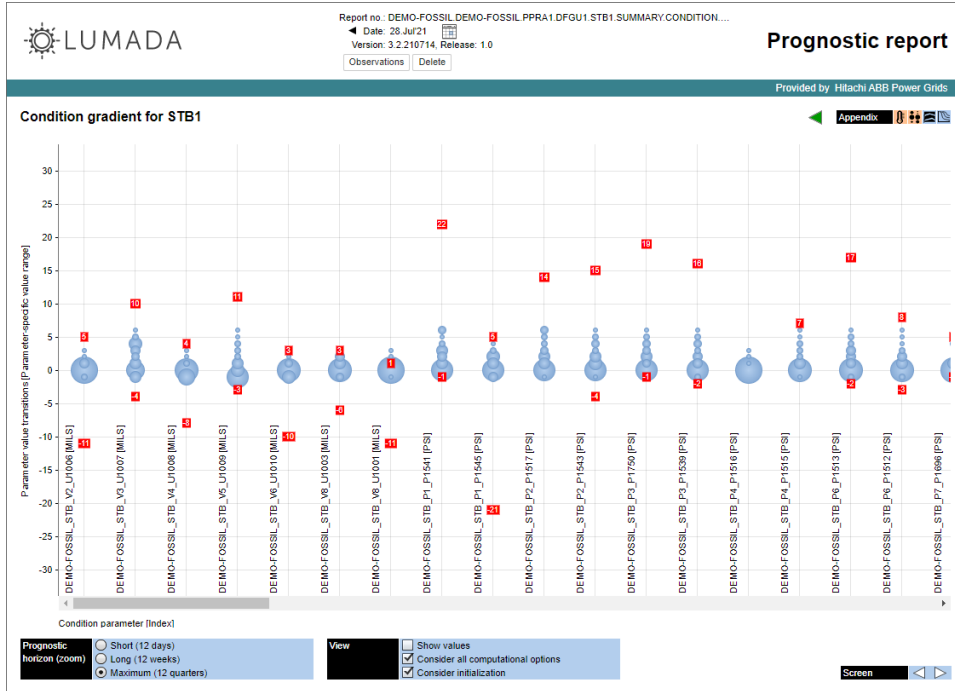
**Prognostic report**  
 Provided by Hitachi ABB Power Grids

Latest parameter values for STB1

Include	Parameter	Description	Unit	10 Oct 18	11 Oct 18	11 Oct 18	11 Oct 18	11 Oct 18	Latest status	Data
				23:00:00	00:00:00	01:00:00	02:00:00	03:00:00		
<input type="checkbox"/>	DEMO-FOSSIL_STB_V1_U1005	Turb Big Vibration	MILS	0.033	-0.132	0.108	0.467	0.936	Excluded	
<input checked="" type="checkbox"/>	DEMO-FOSSIL_STB_V2_U1006	Turb Big Vibration	MILS	4.194	4.064	4.438	4.803	5.154	Operational	
<input checked="" type="checkbox"/>	DEMO-FOSSIL_STB_V3_U1007	Turb Big Vibration	MILS	1.367	1.289	1.22	1.157	1.299	Operational	
<input checked="" type="checkbox"/>	DEMO-FOSSIL_STB_V4_U1008	Turb Big Vibration	MILS	1.739	1.769	2.042	2.222	2.454	Operational	
<input checked="" type="checkbox"/>	DEMO-FOSSIL_STB_V5_U1009	Turb Big Vibration	MILS	0.768	0.705	0.689	0.715	0.76	Operational	
<input checked="" type="checkbox"/>	DEMO-FOSSIL_STB_V6_U1010	Turb Big Vibration	MILS	3.878	3.743	3.650	3.703	3.674	Operational	

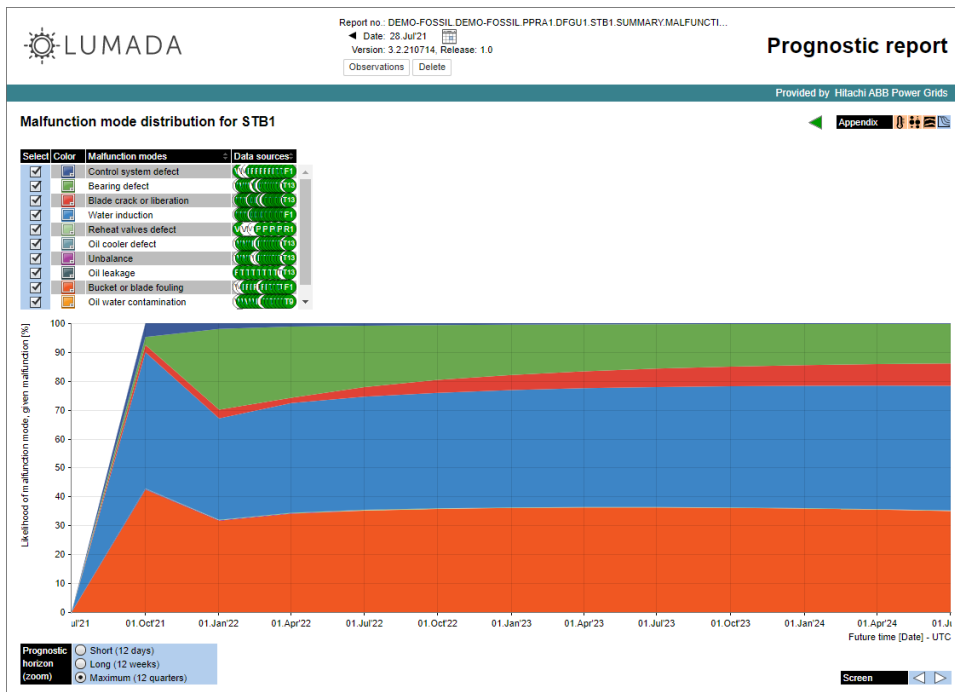
- Condition gradient

This chart shows the transition probability from the current category to the next categories for all the parameters. The horizontal axis lists all parameters, while the vertical axis shows the maximum and minimum categories for all the parameters that can be reached (read squares with the white fonts) and circles with radius proportional to the probability of transition. This chart lets you do an in-depth technical analysis of the transitions, focused on the current parameter values.



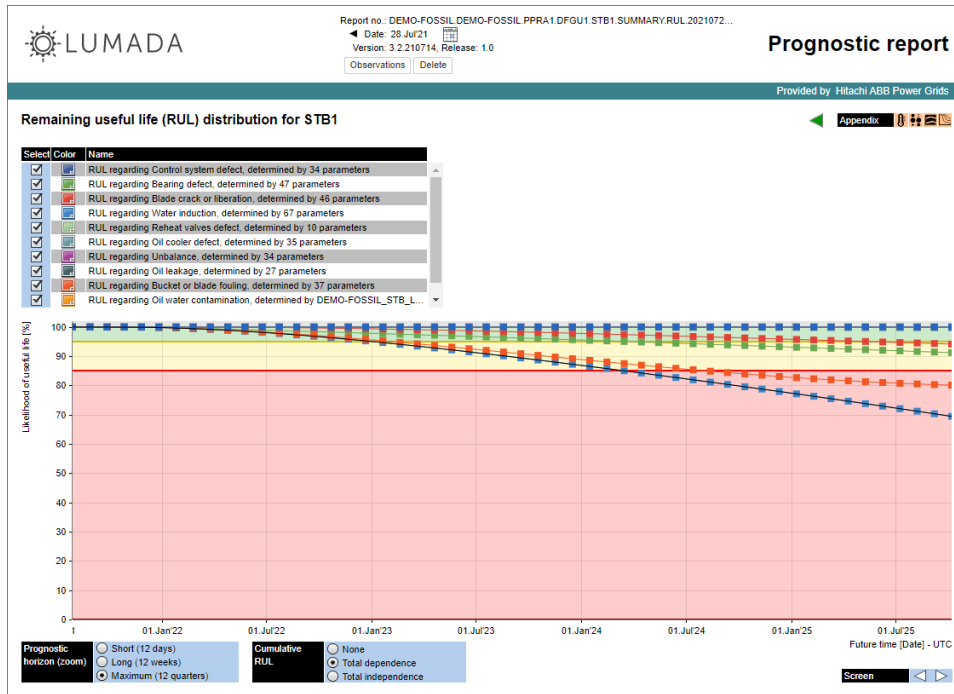
■ Malfunction mode distribution

This chart shows the prognosticated relative likelihood of the different malfunction given you have a malfunction. The sum of all likelihoods is 100%.



■ Remaining useful life (RUL) distribution

This chart displays, for each malfunction mode, the prognosis for the remaining useful life based on that malfunction. It shows which malfunction modes contribute to an accelerated reduction of RUL.

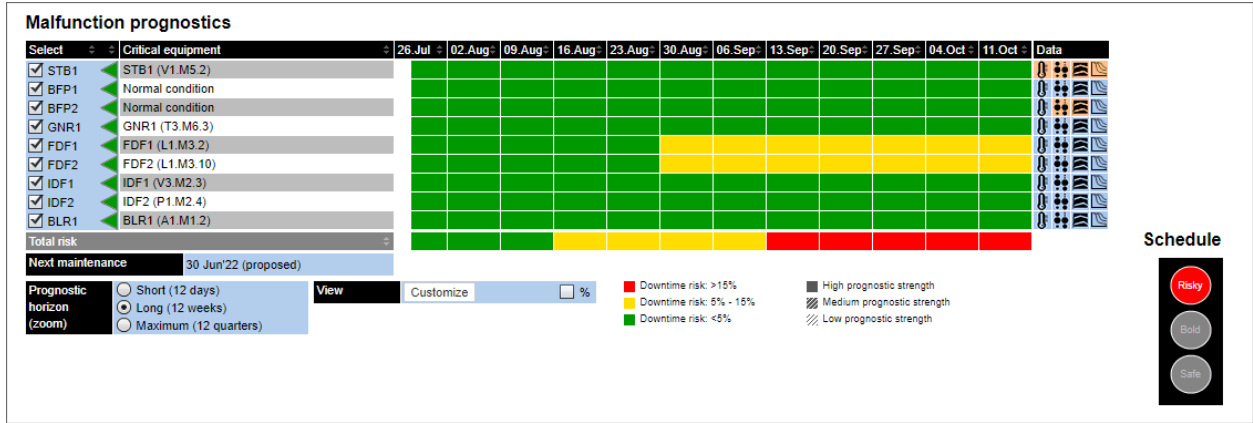


## The Malfunction prognostics section

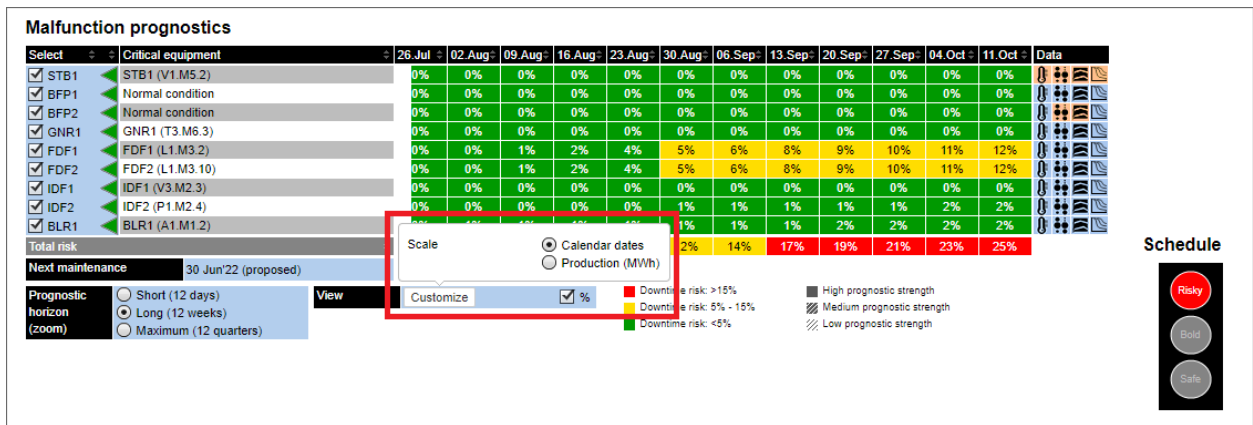
The Malfunction prognostics section shows how the asset condition (total risk) changes over time and a prognosis how it might change in the future. Such prognosis helps you determine the remaining time to the asset malfunction and mitigate risks related to this malfunction. For example, you can schedule maintenance activities with a higher precision or temporarily decrease asset utilization to extend the asset life. The asset condition and condition prognosis represent the asset malfunction likelihood that APM Prognostics displays in one of the three colors:

- Green (Safe)
- Yellow (Bold)
- Red (Risky)

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For more detailed information, you can select the Percentages view. The malfunction likelihood is measured in percentages, where 0% indicates no likelihood of malfunction, 100% indicates the asset malfunction.



The columns that have dates in their headings show prognoses of how the malfunction modes change over time. Instead of the calendar dates, you can select a different scale if is available for your APM Prognostics instance. In the View section, you can click Customize and select a scale that you want to show.

On the left side of the chart, there is a list of malfunction modes for the individual asset. Similarly to the asset condition (total risk), they are measured in percentages. In the Data sources column, you can see which data sources (measuring devices or sensors) are correlated with the malfunction modes. In other words, APM Prognostics uses data from these devices to calculate the risk prognoses for the malfunction modes.

Malfunction modes impact the malfunction risk of the entire asset and are typically dependent on one another. With respect to cross-dependencies, the asset condition is defined as the maximum likelihood of any malfunction mode at any given time. When extending the scope from condition to risk and aggregating risk from asset component to unit level, the malfunction risk of your asset is as high as the highest malfunction risk of any of the asset components. You can define different risk computation levels in configuration document for each level.

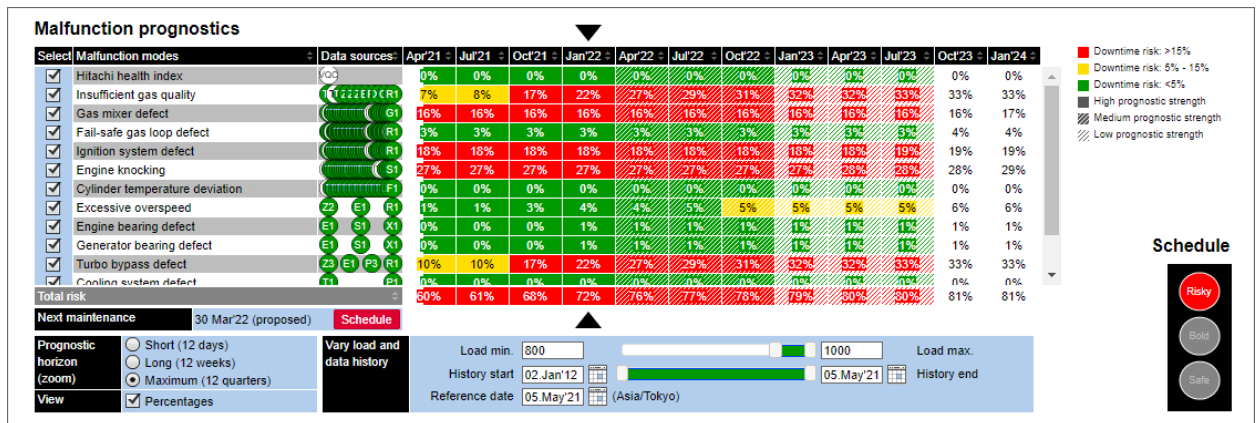
Also, instead of defining the risk as the Maximum risk, you can also define it as Multiplied risk where the value of the asset risk is a sum of the malfunction risks. You do it in the configuration document.



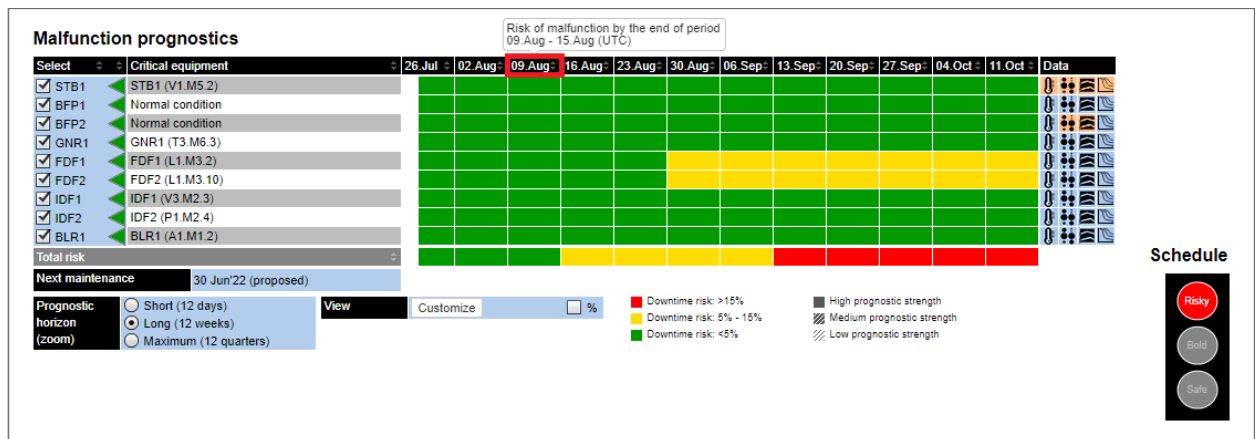
## Available settings and options in the Malfunction prognostics sections

- In the Select column, you can select which malfunction modes you want to display on the chart.
- In the Prognostic horizon (zoom) section, you can select if you see the next 12 days or sample dates from the next 12 weeks or quarters.

When you select the longest horizon for your asset prognoses, you can notice that at some point the strength for the malfunction prognoses and total risk decreases. In other words, based on the available data, the prognostic strength decreases. You can see the strength levels in the legends on the right side of the Malfunction prognostics section.



- For the Long and Maximum prognostic horizons, the date in the column heading identifies the start of a time period for which APM Prognostics calculates condition prognosis (risk malfunction). However, the risk that you see in a given cell is calculated for the end of this time period.



- When you schedule the next maintenance date, a black arrow shows at the top and bottom of a column with a date that is nearest to the maintenance date.



## Simulations

Each asset has a referential parameter that we call **load parameter** and define it in the configuration document. This parameter corresponds to the main measurable feature or functionality of the asset. For example, in a wind turbine, it is a shaft speed that is expressed in rotations per minute; in a hydro-generator, it is active power that is expressed in Megawatts (MW).

The load parameter has a dedicated interval of values (the range between **Load min** and **Load max**) that indicates normal operation range of the asset. For calculating a condition prognosis of the asset, APM Prognostics takes values of asset parameters only from the time periods when the value of the load parameter was between the minimum and maximum load. As a result, APM Prognostics excludes data that might blur condition prognosis. For example, you start the asset and it has not reached its normal operation mode yet. So, APM Prognostics does not consider the asset data until the values of the load parameter reach the load interval.

APM Prognostics lets you to simulate condition prognosis for assets to see how the condition prognosis changes for the asset when you change the load. You do this change in the **Vary load and data history** section and click **Recalculate** at the top of the page.

**Equipment specification**

**Condition diagnostics**

**Condition**

**Malfunction prognostics**

Select	Malfunction modes	Data sources	03.May	10.May	17.May	24.May	31.May	07.Jun	14.Jun	21.Jun	28.Jun	05.Jul	12.Jul	19.Jul
<input checked="" type="checkbox"/>	Hitachi health index		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Insufficient gas quality	(E) (Z) (Z) (E) (E) (C) (R)	4%	5%	6%	6%	7%	7%	7%	7%	7%	7%	7%	7%
<input checked="" type="checkbox"/>	Gas mixer defect	(G) (I)	7%	12%	14%	15%	15%	16%	16%	16%	16%	16%	16%	16%
<input checked="" type="checkbox"/>	Fail-safe gas loop defect	(R) (I)	2%	2%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
<input checked="" type="checkbox"/>	Ignition system defect	(R) (I)	8%	13%	16%	17%	17%	18%	18%	18%	18%	18%	18%	18%
<input checked="" type="checkbox"/>	Engine knocking	(S) (I)	12%	20%	24%	25%	26%	27%	27%	27%	27%	27%	27%	27%
<input checked="" type="checkbox"/>	Cylinder temperature deviation	(E) (Z) (Z) (E) (E) (C) (R) (I) (F) (I)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Excessive overspeed	(Z) (E) (I) (R) (I)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
<input checked="" type="checkbox"/>	Engine bearing defect	(E) (I) (S) (I) (X) (I)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Generator bearing defect	(E) (I) (S) (I) (X) (I)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Turbo bypass defect	(Z) (E) (I) (F) (I) (R) (I)	5%	7%	9%	10%	10%	10%	10%	10%	10%	10%	10%	10%
<input checked="" type="checkbox"/>	Cooling system defect	(I) (L) (E) (I)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>Total risk</b>			<b>33%</b>	<b>48%</b>	<b>55%</b>	<b>57%</b>	<b>58%</b>	<b>59%</b>	<b>59%</b>	<b>60%</b>	<b>60%</b>	<b>60%</b>	<b>60%</b>	<b>60%</b>

**Next maintenance** 30 Mar'22 (proposed) **Schedule**

**Prognostic horizon**  Short (12 days)  Long (12 weeks)  Maximum (12 quarters)

**Vary load and data history**

Load min: 600 Load max: 800

History start: 02 Jan'12 History end: 05 May'21

Reference date: 05 May'21 (Asia/Tokyo)

**Schedule**

**Condition**

- Downtime risk: >15%
- Downtime risk: 5% - 15%
- Downtime risk: <5%
- High prognostic strength
- Medium prognostic strength
- Low prognostic strength

**Condition**

Critical

Warning

Normal

**Schedule**

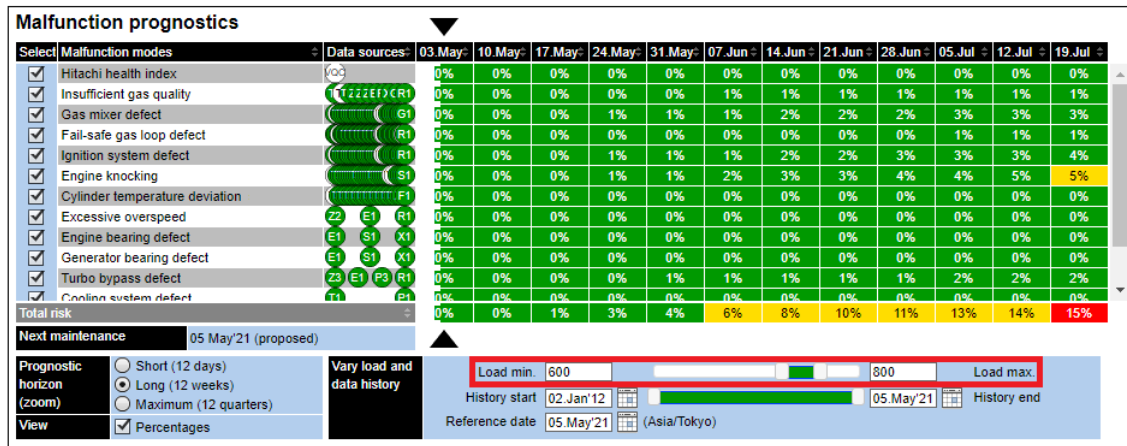
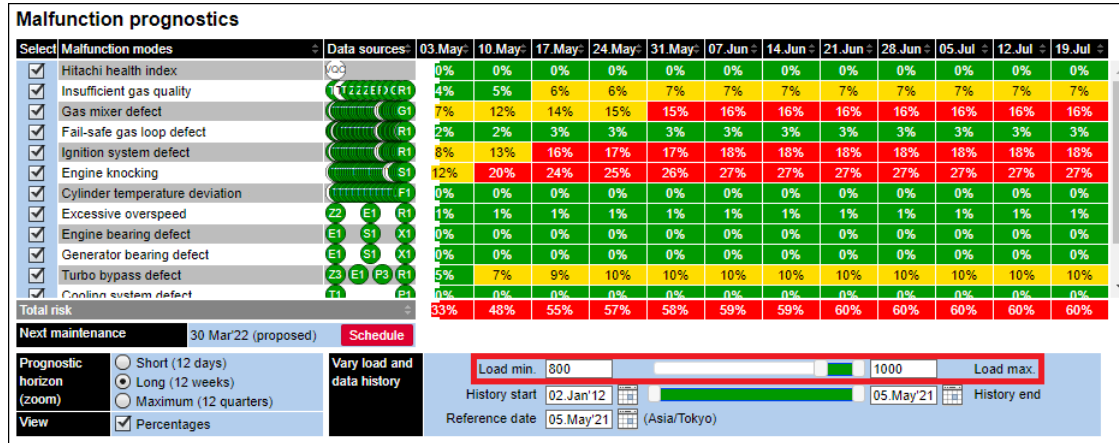
Risky

Bold

Safe

In our example, when the same gas engine asset operates within the load interval of 600 to 800 instead of 800 to 1000, the total risk of the asset becomes red on 19th July and is 15%, compared to 60% at the same date.

Such a small configuration change of the actual asset extends the time that is available for the asset maintenance and helps to prevent the asset failure.



You can also do a retrospective analysis on your historical data by changing the history interval (history start and history end). This way you can see what could be a result of the prognosis in the past under different operating conditions (load parameter). If you had asset failures in the past, this is a simple way to do a check that APM Prognostics would have prognosticated them based on the available data back then.

### Equipment specification

It is a referential section in the Prognostic report page where you can see information about a particular asset. It is similar to an asset nameplate. When you select the Unit or Fleet level, the name of the section changes and it shows the specification for the selected level.

The screenshot displays the LUMADA Prognostic report interface, showing a hierarchy of Fleet, Unit, and Asset (Equipment) views. Red boxes and arrows highlight the 'Fleet', 'Unit', and 'Asset (Equipment)' sections across four overlapping report windows.

**Fleet:** The top window shows the 'Fleet specification' for DEMO\_FOSSIL, including details like Fleet location, Fleet type (DEMO\_FOSSIL), and Fleet capacity (876 MWh).

**Unit:** The second window shows the 'Unit specification' for DEMO\_FOSSIL, including details like Unit name (PPRA1), Unit location, and Unit capacity (900 MW).


**Asset (Equipment):** The third and fourth windows show the 'Equipment specification' for DEMO\_FOSSIL, including details like Unit name (DFGU1), Unit type (Dual-feed generating unit), and Component type (Steam turbine). The fourth window also displays a 'Malfunction prognostics' table and a 'Schedule' section.

In some cases, it is necessary (and possible) to have more than three levels in the hierarchy. So for example, in more complex hierarchies, units can be also collections of other units, like in the hierarchy below.

For the unit and equipment levels, you can change the view of this section to the Location view and display where the unit is in the fleet

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Report no.: DEMO-FOSSIL-DEMO-FOSSIL-PPRA1.20210728062542-00  
 Date: 28 Jul'21  
 Version: 3.2.210714, Release: 1.0

## Prognostic report

Provided by Hitachi ABB Power Grids



### Unit location

Fleet: Select  
 DEM...  
 Units: 2  
 678 MW

Region: Select  
 PPRA1  
 PPRA1  
 600 MW

View:  Specification  Location


### Condition diagnostics

### Condition

Normal

or where the equipment is in the unit.




Report no.: DEMO-FOSSIL-DEMO-FOSSIL-PPRA1.DFGU1.STB1.20210728062542-00  
 Date: 28 Jul'21  
 Version: 3.2.210714, Release: 1.0

## Prognostic report

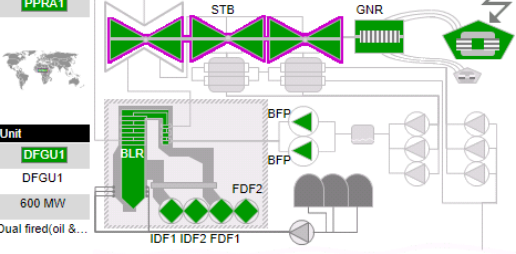
Provided by Hitachi ABB Power Grids

### Equipment location

Region: Select  
 PPRA1



Unit: Select  
 DFGU1  
 600 MW  
 Dual fired/oil &...

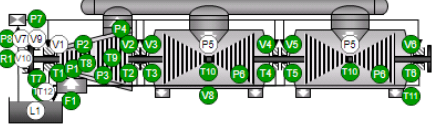


View:  Specification  Location


### Condition diagnostics

Select

<input checked="" type="checkbox"/>	V1	<input checked="" type="checkbox"/>	P6	<input checked="" type="checkbox"/>	T11
<input checked="" type="checkbox"/>	V2	<input checked="" type="checkbox"/>	P7	<input checked="" type="checkbox"/>	T12
<input checked="" type="checkbox"/>	V3	<input checked="" type="checkbox"/>	P8	<input checked="" type="checkbox"/>	T13
<input checked="" type="checkbox"/>	V4	<input checked="" type="checkbox"/>	L1	<input checked="" type="checkbox"/>	F1
<input checked="" type="checkbox"/>	V5	<input checked="" type="checkbox"/>	P1	<input checked="" type="checkbox"/>	T1
<input checked="" type="checkbox"/>	V6	<input checked="" type="checkbox"/>	P2	<input checked="" type="checkbox"/>	T2
<input checked="" type="checkbox"/>	V7	<input checked="" type="checkbox"/>	P3	<input checked="" type="checkbox"/>	T3
<input checked="" type="checkbox"/>	V8	<input checked="" type="checkbox"/>	P4	<input checked="" type="checkbox"/>	T4
<input checked="" type="checkbox"/>	V9	<input checked="" type="checkbox"/>	P5	<input checked="" type="checkbox"/>	T5
<input checked="" type="checkbox"/>	V10	<input checked="" type="checkbox"/>	P6	<input checked="" type="checkbox"/>	T6
<input checked="" type="checkbox"/>	V11	<input checked="" type="checkbox"/>	P7	<input checked="" type="checkbox"/>	T7
<input checked="" type="checkbox"/>	V12	<input checked="" type="checkbox"/>	P8	<input checked="" type="checkbox"/>	T8
<input checked="" type="checkbox"/>	V13	<input checked="" type="checkbox"/>	P9	<input checked="" type="checkbox"/>	T9
<input checked="" type="checkbox"/>	V14	<input checked="" type="checkbox"/>	P10	<input checked="" type="checkbox"/>	T10
<input checked="" type="checkbox"/>	V15	<input checked="" type="checkbox"/>	P11	<input checked="" type="checkbox"/>	T11
<input checked="" type="checkbox"/>	V16	<input checked="" type="checkbox"/>	P12	<input checked="" type="checkbox"/>	T12
<input checked="" type="checkbox"/>	V17	<input checked="" type="checkbox"/>	P13	<input checked="" type="checkbox"/>	T13
<input checked="" type="checkbox"/>	V18	<input checked="" type="checkbox"/>	P14	<input checked="" type="checkbox"/>	T14
<input checked="" type="checkbox"/>	V19	<input checked="" type="checkbox"/>	P15	<input checked="" type="checkbox"/>	T15
<input checked="" type="checkbox"/>	V20	<input checked="" type="checkbox"/>	P16	<input checked="" type="checkbox"/>	T16
<input checked="" type="checkbox"/>	V21	<input checked="" type="checkbox"/>	P17	<input checked="" type="checkbox"/>	T17
<input checked="" type="checkbox"/>	V22	<input checked="" type="checkbox"/>	P18	<input checked="" type="checkbox"/>	T18
<input checked="" type="checkbox"/>	V23	<input checked="" type="checkbox"/>	P19	<input checked="" type="checkbox"/>	T19
<input checked="" type="checkbox"/>	V24	<input checked="" type="checkbox"/>	P20	<input checked="" type="checkbox"/>	T20
<input checked="" type="checkbox"/>	V25	<input checked="" type="checkbox"/>	P21	<input checked="" type="checkbox"/>	T21
<input checked="" type="checkbox"/>	V26	<input checked="" type="checkbox"/>	P22	<input checked="" type="checkbox"/>	T22
<input checked="" type="checkbox"/>	V27	<input checked="" type="checkbox"/>	P23	<input checked="" type="checkbox"/>	T23
<input checked="" type="checkbox"/>	V28	<input checked="" type="checkbox"/>	P24	<input checked="" type="checkbox"/>	T24
<input checked="" type="checkbox"/>	V29	<input checked="" type="checkbox"/>	P25	<input checked="" type="checkbox"/>	T25
<input checked="" type="checkbox"/>	V30	<input checked="" type="checkbox"/>	P26	<input checked="" type="checkbox"/>	T26
<input checked="" type="checkbox"/>	V31	<input checked="" type="checkbox"/>	P27	<input checked="" type="checkbox"/>	T27
<input checked="" type="checkbox"/>	V32	<input checked="" type="checkbox"/>	P28	<input checked="" type="checkbox"/>	T28
<input checked="" type="checkbox"/>	V33	<input checked="" type="checkbox"/>	P29	<input checked="" type="checkbox"/>	T29
<input checked="" type="checkbox"/>	V34	<input checked="" type="checkbox"/>	P30	<input checked="" type="checkbox"/>	T30
<input checked="" type="checkbox"/>	V35	<input checked="" type="checkbox"/>	P31	<input checked="" type="checkbox"/>	T31
<input checked="" type="checkbox"/>	V36	<input checked="" type="checkbox"/>	P32	<input checked="" type="checkbox"/>	T32
<input checked="" type="checkbox"/>	V37	<input checked="" type="checkbox"/>	P33	<input checked="" type="checkbox"/>	T33
<input checked="" type="checkbox"/>	V38	<input checked="" type="checkbox"/>	P34	<input checked="" type="checkbox"/>	T34
<input checked="" type="checkbox"/>	V39	<input checked="" type="checkbox"/>	P35	<input checked="" type="checkbox"/>	T35
<input checked="" type="checkbox"/>	V40	<input checked="" type="checkbox"/>	P36	<input checked="" type="checkbox"/>	T36
<input checked="" type="checkbox"/>	V41	<input checked="" type="checkbox"/>	P37	<input checked="" type="checkbox"/>	T37
<input checked="" type="checkbox"/>	V42	<input checked="" type="checkbox"/>	P38	<input checked="" type="checkbox"/>	T38
<input checked="" type="checkbox"/>	V43	<input checked="" type="checkbox"/>	P39	<input checked="" type="checkbox"/>	T39
<input checked="" type="checkbox"/>	V44	<input checked="" type="checkbox"/>	P40	<input checked="" type="checkbox"/>	T40
<input checked="" type="checkbox"/>	V45	<input checked="" type="checkbox"/>	P41	<input checked="" type="checkbox"/>	T41
<input checked="" type="checkbox"/>	V46	<input checked="" type="checkbox"/>	P42	<input checked="" type="checkbox"/>	T42
<input checked="" type="checkbox"/>	V47	<input checked="" type="checkbox"/>	P43	<input checked="" type="checkbox"/>	T43
<input checked="" type="checkbox"/>	V48	<input checked="" type="checkbox"/>	P44	<input checked="" type="checkbox"/>	T44
<input checked="" type="checkbox"/>	V49	<input checked="" type="checkbox"/>	P45	<input checked="" type="checkbox"/>	T45
<input checked="" type="checkbox"/>	V50	<input checked="" type="checkbox"/>	P46	<input checked="" type="checkbox"/>	T46
<input checked="" type="checkbox"/>	V51	<input checked="" type="checkbox"/>	P47	<input checked="" type="checkbox"/>	T47
<input checked="" type="checkbox"/>	V52	<input checked="" type="checkbox"/>	P48	<input checked="" type="checkbox"/>	T48
<input checked="" type="checkbox"/>	V53	<input checked="" type="checkbox"/>	P49	<input checked="" type="checkbox"/>	T49
<input checked="" type="checkbox"/>	V54	<input checked="" type="checkbox"/>	P50	<input checked="" type="checkbox"/>	T50
<input checked="" type="checkbox"/>	V55	<input checked="" type="checkbox"/>	P51	<input checked="" type="checkbox"/>	T51
<input checked="" type="checkbox"/>	V56	<input checked="" type="checkbox"/>	P52	<input checked="" type="checkbox"/>	T52
<input checked="" type="checkbox"/>	V57	<input checked="" type="checkbox"/>	P53	<input checked="" type="checkbox"/>	T53
<input checked="" type="checkbox"/>	V58	<input checked="" type="checkbox"/>	P54	<input checked="" type="checkbox"/>	T54
<input checked="" type="checkbox"/>	V59	<input checked="" type="checkbox"/>	P55	<input checked="" type="checkbox"/>	T55
<input checked="" type="checkbox"/>	V60	<input checked="" type="checkbox"/>	P56	<input checked="" type="checkbox"/>	T56
<input checked="" type="checkbox"/>	V61	<input checked="" type="checkbox"/>	P57	<input checked="" type="checkbox"/>	T57
<input checked="" type="checkbox"/>	V62	<input checked="" type="checkbox"/>	P58	<input checked="" type="checkbox"/>	T58
<input checked="" type="checkbox"/>	V63	<input checked="" type="checkbox"/>	P59	<input checked="" type="checkbox"/>	T59
<input checked="" type="checkbox"/>	V64	<input checked="" type="checkbox"/>	P60	<input checked="" type="checkbox"/>	T60
<input checked="" type="checkbox"/>	V65	<input checked="" type="checkbox"/>	P61	<input checked="" type="checkbox"/>	T61
<input checked="" type="checkbox"/>	V66	<input checked="" type="checkbox"/>	P62	<input checked="" type="checkbox"/>	T62
<input checked="" type="checkbox"/>	V67	<input checked="" type="checkbox"/>	P63	<input checked="" type="checkbox"/>	T63
<input checked="" type="checkbox"/>	V68	<input checked="" type="checkbox"/>	P64	<input checked="" type="checkbox"/>	T64
<input checked="" type="checkbox"/>	V69	<input checked="" type="checkbox"/>	P65	<input checked="" type="checkbox"/>	T65
<input checked="" type="checkbox"/>	V70	<input checked="" type="checkbox"/>	P66	<input checked="" type="checkbox"/>	T66
<input checked="" type="checkbox"/>	V71	<input checked="" type="checkbox"/>	P67	<input checked="" type="checkbox"/>	T67
<input checked="" type="checkbox"/>	V72	<input checked="" type="checkbox"/>	P68	<input checked="" type="checkbox"/>	T68
<input checked="" type="checkbox"/>	V73	<input checked="" type="checkbox"/>	P69	<input checked="" type="checkbox"/>	T69
<input checked="" type="checkbox"/>	V74	<input checked="" type="checkbox"/>	P70	<input checked="" type="checkbox"/>	T70
<input checked="" type="checkbox"/>	V75	<input checked="" type="checkbox"/>	P71	<input checked="" type="checkbox"/>	T71
<input checked="" type="checkbox"/>	V76	<input checked="" type="checkbox"/>	P72	<input checked="" type="checkbox"/>	T72
<input checked="" type="checkbox"/>	V77	<input checked="" type="checkbox"/>	P73	<input checked="" type="checkbox"/>	T73
<input checked="" type="checkbox"/>	V78	<input checked="" type="checkbox"/>	P74	<input checked="" type="checkbox"/>	T74
<input checked="" type="checkbox"/>	V79	<input checked="" type="checkbox"/>	P75	<input checked="" type="checkbox"/>	T75
<input checked="" type="checkbox"/>	V80	<input checked="" type="checkbox"/>	P76	<input checked="" type="checkbox"/>	T76
<input checked="" type="checkbox"/>	V81	<input checked="" type="checkbox"/>	P77	<input checked="" type="checkbox"/>	T77
<input checked="" type="checkbox"/>	V82	<input checked="" type="checkbox"/>	P78	<input checked="" type="checkbox"/>	T78
<input checked="" type="checkbox"/>	V83	<input checked="" type="checkbox"/>	P79	<input checked="" type="checkbox"/>	T79
<input checked="" type="checkbox"/>	V84	<input checked="" type="checkbox"/>	P80	<input checked="" type="checkbox"/>	T80
<input checked="" type="checkbox"/>	V85	<input checked="" type="checkbox"/>	P81	<input checked="" type="checkbox"/>	T81
<input checked="" type="checkbox"/>	V86	<input checked="" type="checkbox"/>	P82	<input checked="" type="checkbox"/>	T82
<input checked="" type="checkbox"/>	V87	<input checked="" type="checkbox"/>	P83	<input checked="" type="checkbox"/>	T83
<input checked="" type="checkbox"/>	V88	<input checked="" type="checkbox"/>	P84	<input checked="" type="checkbox"/>	T84
<input checked="" type="checkbox"/>	V89	<input checked="" type="checkbox"/>	P85	<input checked="" type="checkbox"/>	T85
<input checked="" type="checkbox"/>	V90	<input checked="" type="checkbox"/>	P86	<input checked="" type="checkbox"/>	T86
<input checked="" type="checkbox"/>	V91	<input checked="" type="checkbox"/>	P87	<input checked="" type="checkbox"/>	T87
<input checked="" type="checkbox"/>	V92	<input checked="" type="checkbox"/>	P88	<input checked="" type="checkbox"/>	T88
<input checked="" type="checkbox"/>	V93	<input checked="" type="checkbox"/>	P89	<input checked="" type="checkbox"/>	T89
<input checked="" type="checkbox"/>	V94	<input checked="" type="checkbox"/>	P90	<input checked="" type="checkbox"/>	T90
<input checked="" type="checkbox"/>	V95	<input checked="" type="checkbox"/>	P91	<input checked="" type="checkbox"/>	T91
<input checked="" type="checkbox"/>	V96	<input checked="" type="checkbox"/>	P92	<input checked="" type="checkbox"/>	T92
<input checked="" type="checkbox"/>	V97	<input checked="" type="checkbox"/>	P93	<input checked="" type="checkbox"/>	T93
<input checked="" type="checkbox"/>	V98	<input checked="" type="checkbox"/>	P94	<input checked="" type="checkbox"/>	T94
<input checked="" type="checkbox"/>	V99	<input checked="" type="checkbox"/>	P95	<input checked="" type="checkbox"/>	T95
<input checked="" type="checkbox"/>	V100	<input checked="" type="checkbox"/>	P96	<input checked="" type="checkbox"/>	T96
<input checked="" type="checkbox"/>	V101	<input checked="" type="checkbox"/>	P97	<input checked="" type="checkbox"/>	T97
<input checked="" type="checkbox"/>	V102	<input checked="" type="checkbox"/>	P98	<input checked="" type="checkbox"/>	T98
<input checked="" type="checkbox"/>	V103	<input checked="" type="checkbox"/>	P99	<input checked="" type="checkbox"/>	T99
<input checked="" type="checkbox"/>	V104	<input checked="" type="checkbox"/>	P100	<input checked="" type="checkbox"/>	T100



- V Vibration data
- T Thermal data
- L Lubricant data
- P Pressure data
- R Speed data
- HP/IP turbine
- LP turbine
- Axle shaft
- Radial bearing
- Axial bearing
- Oil pump
- Oil tank
- Crossover pipe
- Flow direction

Appendix: 

### Condition

Normal

# Configuration log

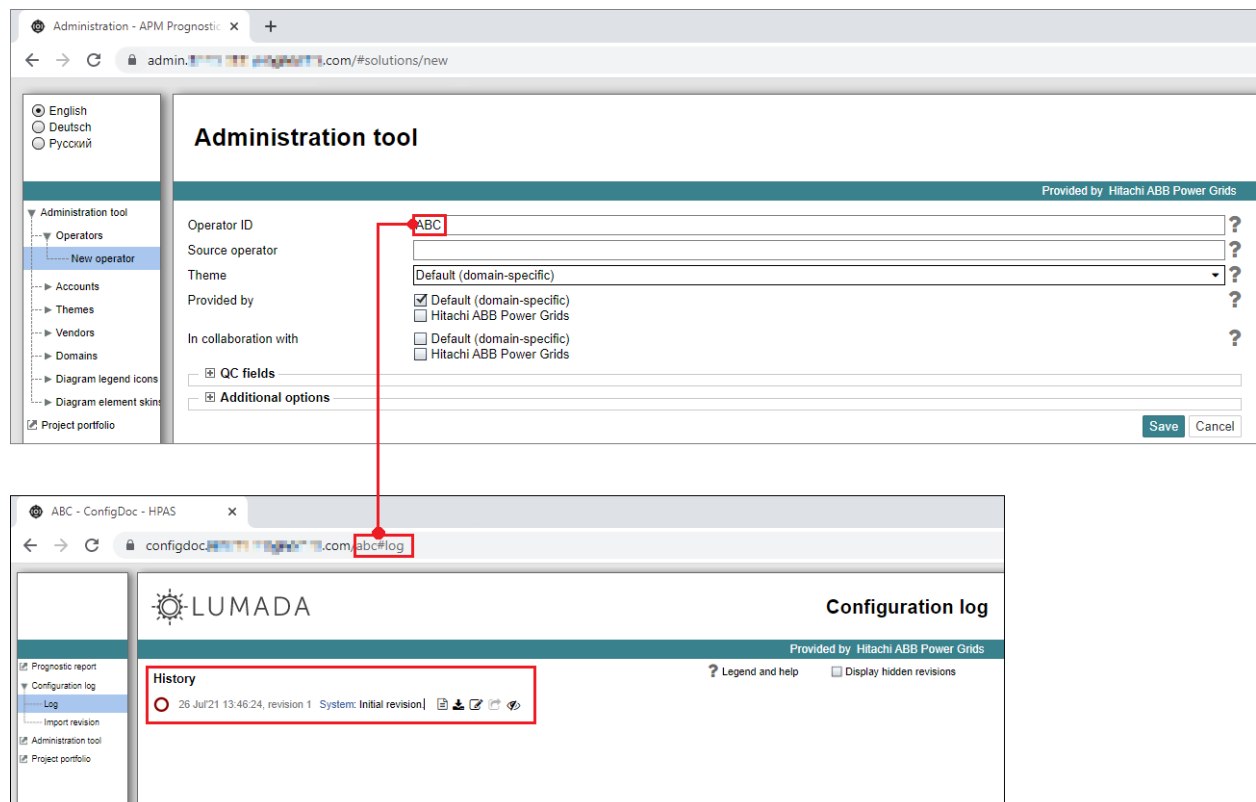
The Configuration log page is a place where you do the configuration of APM Prognostics models.

**Note:** This page is available only in English.

To use the Configuration log page on a brand new system, it is necessary to start from creating an operator in the Administration tool page. After you create an operator, APM Prognostics creates a special configuration log environment for that operator. In that special environment, the system automatically creates the initial revision with a configuration document that you can edit and modify. The access to the initial revision is online. The URL address for the configuration log has the format that follows:

**configdoc.<domain\_name>/<Operator\_ID>#log**

For example: configdoc.abb-prognostics.com/abc#log



APM Prognostics has a version control system for its configuration. On APM Prognostics instances that are in operation or in the process of configuration, in the Log page you can see more revisions of the configuration document that are related to your system. These revisions contain changes to the Prognostic report page and configuration of your system.

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In the History section, you can see the chronological order of changes to your system (revisions). To see all of them, make sure that you select the **Display hidden revisions** option in the upper-right corner of the page.

By clicking the icons for each of the revisions, you can:

- Open the read-only view of the revision.
- Export the revision to a JSON file.

You import a revision, in the Import revision page. For more information, see [Importing a revision](#).

- Edit the revision.

This option is available for users with at least the Config Doc Editor role. For more information, see [Editing a revision](#).

- Release the revision.

This option is available for users with the Admin role.

- Hide or show the revision in the History list.

This option is available for users with at least the Config Doc Editor role. Editors of the configuration document might want to hide some of the revisions from the users with the Config Doc Viewer role. For more information, see [Roles](#).

At the top of the page, there is a list of currently edited revisions.

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The screenshot displays the LUMADA Configuration log interface. The main content area is divided into two sections: 'Currently edited revisions' and 'History'. The 'Currently edited revisions' section shows a list of revisions with their dates, times, and revision numbers, along with brief descriptions of changes. The 'History' section shows a chronological list of revisions. A red box highlights the 'Legend and help' tooltip, which provides detailed information about revision statuses, ownership, release status, and environment. The tooltip includes sections for Legend, Ownership, Release status, Environment, and Guide.

To better understand the Log page, you can click **Legend and help** to display a tool tip with helpful information. There, you will see the explanation of the user interface elements and revision ownership. It is good to know that you can release only the valid revisions (drafts that pass the technical validation).

When you release a revision, the Prognostic report gets the updates immediately, for example, updates of the asset hierarchy and malfunctions. Changes like new parameters, thresholds for parameters, and correlations have an effect after you recalculate the prognostic report. Make sure that you do it after you release a revision.

## Overview of the configuration and technical validation loop

Configuration of your APM Prognostics system follows a cycle that you can repeat to do changes or small adjustment of your system. The steps that you do are the same whether you create the very first revision or a new revision from an existing one.

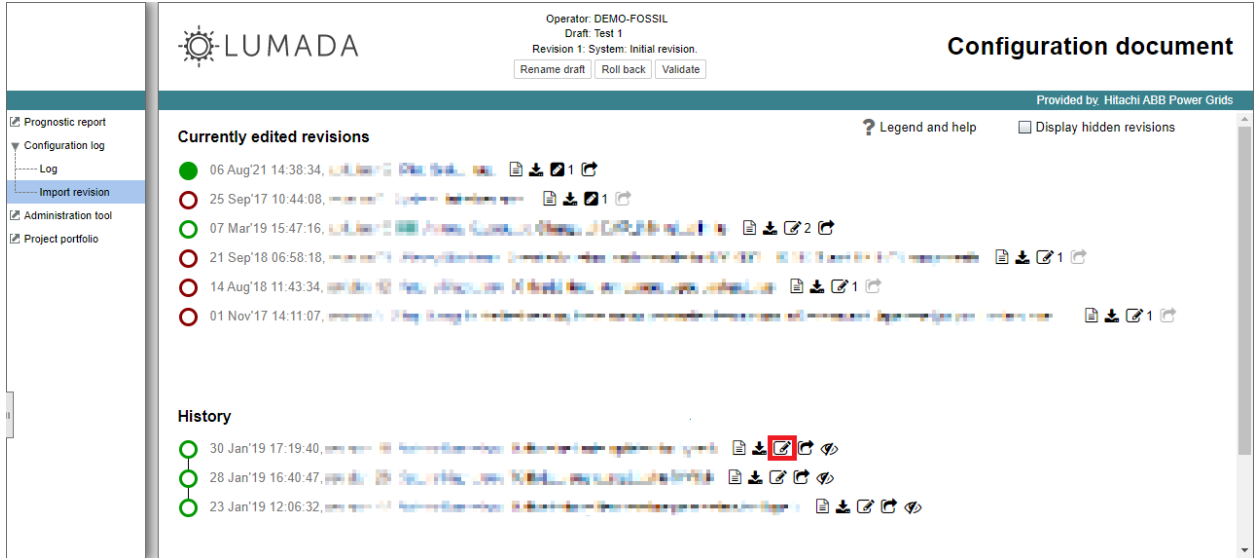
**Note:** To configure a brand new system, it is first necessary to create an operator in the Administration tool page. After that, APM Prognostics creates a new configuration document that you can edit and modify.

1. Select a revision with a configuration document and edit it.

On an initial revision (or any other) in the Configuration log page, click the **Edit this revision** icon.

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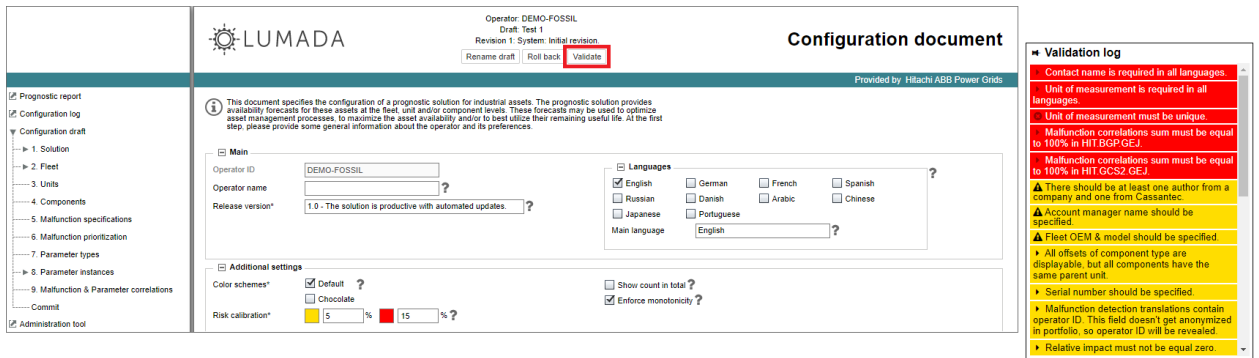




For more information about editing, see [Editing a revision - preparing a configuration document](#).

2. Validate the revision draft.

It is necessary to validate your revision draft at least before you want to commit it. You can also do it at any step of the configuration process.



When you do a technical validation of your revision draft, the Validation log shows in a new window and you can see all the errors and warnings in your configuration document. The warnings (in yellow) identify missing values in some parts of the configuration. Although we recommend to supply these values, you can still release a revision draft with these warnings, because they are not critical. The errors (in red) are the ones that you must repair. Click a warning or an error to open the related configuration step that contains it. After you repair all the errors, you can commit the revision draft to become a new release in the Configuration log page.

3. Commit the revision draft.

The commit option is in the navigation panel on the left side below step 9. When you commit your revision draft, make sure that you enter a detailed commit message (it is typically equal to the name of the draft and will become a name of the revision after the commit) and refer to the changes that you made. To create a logical connection with other revisions in your system, you may select revisions that are considered merged to your new revision.

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After you commit the revision draft, the Configuration manager can start another validation manually, the so called delivery validation. It is a process of aligning assets with the provided condition information.

4. Release the revision.

In the Configuration log, you can click the Release revision icons for revisions that are valid.

See the [Good to know](#) section for more information.

5. Generate a new report.

APM Prognostics applies some of the configuration changes automatically, for the rest of them it is necessary to generate a new report. You do it in the navigation panel of the Prognostic report page. This step is necessary after you release each configuration revision.

The screenshot shows the LUMADA Prognostic report interface. On the left, there is a navigation panel with a tree view showing the configuration hierarchy: DEMO-FOSSIL, PPR1, DFGU1, PPRB1, and HRSR. A red box highlights the 'Generate new report' button. The main content area is divided into three sections: 'Equipment specification' (Operator name: DEMO-FOSSIL, Unit name: DFGU1, etc.), 'Condition diagnostics' (a grid of data points with status indicators), and 'Jobs in progress' (showing a 'Normal' status with a green indicator). The top right corner displays the report number, date (28 Jul 21), version (3.2.210714), and release (1.0).

6. Review the report.

Do a check that the configuration changes that you did are in the report and are correctly applied.

7. Validate the configuration retrospectively by doing some recalculations (simulations).

The retrospective analysis is a popular validation technique where you do a historical forecast for a reference date in the past. For this validation, you select the date some weeks or months before an important event happened (for example, asset failure). Next, you run a simulation to verify that APM Prognostics would have identified the event with the correct mode and time to malfunction.

The other thing that you can do as a part of this step is to generate a PDF report before you do the configuration changes and a PDF report after you apply your changes and regenerate the report. You will see the effect of the new configuration. If you use APM Prognostics for some time, it can happen that you want to adjust its configuration because something changes in your asset fleet or new or data is available for you. For more information, see [Simulations](#).

In the History section of the Configuration log page, you will see that APM Prognostics marks your revision with a black dot. We recommend to refresh this page at some small time intervals to see the validation result (the dot changing from black to green (if everything is correct) or red (if the technical validation failed)). The size of the configuration document has an effect on the technical validation time. It can take seconds or even minutes before you get the validation results. For more information, click the Legend and help icon in the Log page.

8. Repeat the configuration process if necessary.

### Good to know

When you work with revision releases, it is good for you to know that:

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- You can release only one revision at a time.
- Any changes in the configuration document (config doc) take effect after you release them. In particular:
  - User Interface gets updated with the updated asset hierarchy.
  - Parameters get updated in the database. For the deleted parameters, their data gets deleted immediately. For the created parameters, you may now upload their data to the database (you can only upload data for parameters that exist in the database).
- If you generate a new report, it gets computed based on the new configuration.
- The release operation can not be reliably reverted. If a parameter was deleted on release, its data is gone. The data cannot be automatically recovered if you attempt to release the previously released revision.

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# Chapter 2: Configuration

## Configuration Overview

This chapter contains procedures that you can use to effectively manage your APM Prognostics instance.

## Editing a revision - preparing a configuration document

With the Config Doc Editor role, you can edit the configuration of your APM Prognostics operator by editing an existing revision. APM Prognostics automatically creates the initial revision with a configuration document on an empty system after you create an operator. You can edit such revision to prepare the configuration document for your APM Prognostics operator. Every revision has a unique URL address that you can use for a direct access. You can also edit a revision that you or some other user created.

The screenshot displays the LUMADA Configuration document editor. The header shows the operator name 'DEMO-FOSSIL', draft 'Test 1', and revision 'Revision 1, System: Initial revision'. A navigation bar includes 'Rename draft', 'Roll back', and 'Validate' buttons. The sidebar on the left lists configuration steps: 1. Solution, 2. Fleet, 3. Units, 4. Components, 5. Malfunction specifications, 6. Malfunction prioritization, 7. Parameter types, 8. Parameter instances, 9. Malfunction & Parameter correlations, and Commit. The main content area contains a 'Main' section with fields for Operator ID (DEMO-FOSSIL), Operator name, and Release version (1.0 - The solution is productive with automated updates). It also features a 'Languages' section with checkboxes for English, German, French, Spanish, Russian, Danish, Arabic, and Chinese, and a 'Main language' dropdown set to English. An 'Additional settings' section includes 'Color schemes' (Default and Chocolate) and 'Risk calibration' (5% and 15%).

**Note:** The pages where you prepare the configuration document contain the **Question mark** icons that you can click to show more information or explanations of the given options. We recommend to read them at your convenience because APM Prognostics Guide does not contain all the information from these tool-tips.

In the page header, you can see some information about the draft that you edit, for example the revision from which it was created. You can also do the actions that follow:

- Rename the revision draft that you edit.
- Do a roll back and remove the draft from your system. When you do this action, you return to the Configuration log page.
- Validate the configuration document in your revision to make sure that the draft of the configuration document contains all the obligatory data and that you can release it to become a new revision.

The procedure of editing a revision has nine main steps. Steps 1, 2, and 8 are complex and contain several sub-steps. APM Prognostics automatically saves changes to the revision drafts that you edit to prevent the data loss. It is useful for the situation when you, for example, lose the Internet connection.

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## Prerequisites for creating a configuration document

Before you edit an initial revision to create your first configuration document, we recommend to prepare information about your asset fleet and the available data that you will use to configure your APM Prognostics instance.

We recommend to prepare the resources that follow:

- Specification of the asset hierarchy (unit and its components).
- Sketches of the units and components with identification of the physical location of the data sources (diagrams or schematic depiction is acceptable).
- Possible types of the critical malfunctions that occur in the components.
- Relevant alert and alarm levels of the measured parameters.
- Data history from at least 1 year (ideally 3–5 years) in the CSV or other machine-readable format.
  - Sampling rate at least hourly (average). Different rate is also acceptable.
  - Sampling point, for example, on the casing.
  - Process data, for example: temperature, speed, electrical, pressure, and flow.
  - Condition data, for example: vibration, lubricant analysis results, thermography, dissolved gas analysis results, and acoustic data.

For more details, speak with the Customer Experience support team.

## Configuration steps

To learn more about the configuration steps, see the links that follow:

1. [Solution](#)
2. [Fleet](#)
3. [Units](#)
4. [Components](#)
5. [Malfunction specification](#)
6. [Malfunction prioritization](#)
7. [Parameter types](#)
8. [Parameter instances](#)
9. [Malfunction & Parameter correlations](#)

After you complete the configuration steps, you can commit your revision and release it. Next, you can recalculate the Prognostic report to contain the latest configuration changes.

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Operator: DEMO-FOSSIL  
Draft: Test 1  
Revision 1: System: Initial revision.  
Rename draft | Roll back | Validate

**Configuration document**

Provided by Hitachi ABB Power Grids

**Commit ConfigDoc draft and create a new revision**

Please enter the detailed commit message. The message should refer to all changes that you've made in this draft, so the other configuration managers could repeat them if they edit this ConfigDoc concurrently (automatic merge is not supported yet). References to corresponding tasks/tickets/change-requests can be useful.

Please select the revisions that are "merged" to the imported revision. It will create additional connections between revisions in the ConfigDoc history graph. Base revision (the one which this draft was created from) is always considered "merged".

- 26 Jul'21 12:45:17, revision 48 **(base revision)** Imported HIT-23\_srokp revision.json
- 19 Mar'19 14:40:54, revision 47 : With extreme values excluded except HK3, HK4 & IG9 for demo purposes
- 07 Mar'19 15:47:16, revision 46 : Change of CWP\_INV value limits
- 07 Mar'19 14:25:22, revision 45 : Clean-up with latest value limits

## Configuring the solution

This step has five sub-steps where you can do the following tasks:

- In the **General** sub-step, you configure general settings of the solution, for example: operator name, languages, color schemes, and risk calibration. There are different release version that you can use for your APM Prognostics instance.

The release version shows how prepared the configuration document is, it also has an effect on some parts of the application business logic and validation rules. You will usually increase this version when you complete the specified configuration steps. The higher the version is, the more restrictive validation rules are. For more information, click the **Question mark** icon for the Release version field.

You supply the operator name to provide more information about the Operator ID of your APM Prognostics. Usually the Operator ID is an abbreviation of your company for convenience. We recommend to make it two or three letters long, for example HIT for Hitachi.

In the Additional settings section, you do the risk calibration for the risk levels in the Malfunction prognostics section in the Prognostic report page. You set these values depending on your assets. For example, the assets in the mining industry can have much higher risk tolerance levels than the assets in a nuclear plant.

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The screenshot shows the LUMADA configuration interface. At the top, it displays the LUMADA logo, version information (Operator: DEMO-FOSSIL, Draft: Test 1, Revision 1: System: Initial revision), and a 'Configuration document' title. Below this is a legend for risk calibration, showing a red box around the 'Risk calibration' field with values 5, 15, and 15. The main area displays a 'Malfunction prognostics' table with columns for months from Jul 21 to Apr 24. The table shows various malfunction types like 'Control system defect', 'Bearing defect', etc., with corresponding risk percentages. A 'Schedule' section at the bottom shows a graph of load over time, with a 'Next maintenance' date of 30 Jun 22 (proposed) and a 'Schedule' button.

- In the **Contacts** sub-step, you supply information about the contact persons and alarm owners for your assets. You will see this data in the Equipment specification section in the Prognostic report page if you assign these persons to assets in the Units step.
- In the **Authors** sub-step, you supply referential information about the persons who are responsible for the configuration of your APM Prognostics instance. This information is not visible in the Prognostic report page.
- In the **Scope** sub-step, you can supply referential information about the configuration of your APM Prognostics instance. This information is not visible in the Prognostic report page.
- In the **Units of measurement** sub-step, you supply all the units of measurement that you want to use in your APM Prognostics instance. You will use the list of units of measurement to define parameter types in the Parameters types step.

Skip the **Diagram legend icons** and **Diagram elements skins** sub-steps. They were optional in the configuration process. We stopped developing these options.

## Configuring the fleet

When you configure the fleet, supply values for the fields according to the recommendations that you can see by clicking the **Question mark** icon.

**Note:** If you do not have a fleet, you can ignore this step by selecting **Skip fleet**. When you skip the fleet, remember to select a default time zone. It is an obligatory setting when you configure this step.

This step has two sub-steps where you can do the following tasks:

- In the **General** sub-step, you can configure general settings of the fleet. Most of the information that you supply here you will see it in the Fleet specification in the Prognostic report page.

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Operator: DEMO-FOSSIL  
Draft: Test 1  
Revision 1: System: Initial revision

**Configuration document**  
Provided by Hitachi ABB Power Grids

The solution configuration may be valid for several assets. This document specifies the configuration for one asset fleet with multiple types of units and mission-critical components. These entities build up the asset hierarchy. The hierarchy is the tree. Fleet is the root of the tree and components are the leafs of the tree. At this step, please configure fleet properties.

Used as identifier in side navigation bar. Defaults to asset ID.  
Example: GEN1  
Recommended: Leave blank.

Operating hours are: Not applicable  
Capacity is: Sum of subasset capacities  
Capacity/generation units of measurement: MW, MWh  
Capacity factor: Capacity = Hourly generation

Side bar name: ?  
Fleet name: ?  
Fleet location: ?  
Fleet type: ?  
OEM & model: OEM demo, model demo  
Units monitored: Fossil & dual-fired power plants  
Description for location: ?  
Aggregation type: Maximum risk  
Default time zone: UTC (0h)  
Contact person: Don Demo  
Meta data: ?

Operator: DEMO-FOSSIL  
Draft: Test 1  
Revision 1: System: Initial revision

**Prognostic report**  
Provided by Hitachi ABB Power Grids

**Fleet specification**

Operator name: DEMO-FOSSIL  
Fleet location: ?  
Fleet type: ?  
OEM & model: OEM demo, model demo  
Fleet capacity: 678 MW  
Fleet ID: DEMO-FOSSIL  
Units monitored: Fossil & dual-fired power plants  
Contact person: Don Demo  
Phone: +1234567890  
E-mail: don@demo.com

**Condition diagnostics**

**Condition**

Normal

Operator: DEMO-FOSSIL  
Draft: Test 1  
Revision 1: System: Initial revision

**Configuration document**  
Provided by Hitachi ABB Power Grids

The solution configuration may be valid for several assets. This document specifies the configuration for one asset fleet with multiple types of units and mission-critical components. These entities build up the asset hierarchy. The hierarchy is the tree. Fleet is the root of the tree and components are the leafs of the tree. At this step, please configure fleet properties.

Operating hours are: Not applicable  
Capacity is: Sum of subasset capacities  
Capacity/generation units of measurement: MW, MWh  
Capacity factor: Capacity = Hourly generation

Aggregation type: Multiplied risk

**Malfunction prognostics**

Select	Critical equipment	Jul21	Oct21	Jan22	Apr22	Jul22	Oct22	Jan23	Apr23	Jul23	Oct23	Jan24	Data
<input checked="" type="checkbox"/>	STB1 (V1.M5.2)	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
<input checked="" type="checkbox"/>	BFP1 Normal condition	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
<input checked="" type="checkbox"/>	BFP2 Normal condition	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
<input checked="" type="checkbox"/>	GNR1 (T3.M6.3)	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
<input checked="" type="checkbox"/>	FDF1 (L1.M3.2)	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	
<input checked="" type="checkbox"/>	FDF2 (L1.M3.10)	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	
<input checked="" type="checkbox"/>	IDF1 (V3.M2.3)	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	
<input checked="" type="checkbox"/>	IDF2 (V3.M2.3)	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	
<input checked="" type="checkbox"/>	BLR1 (A1.M1.2)	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	
Total risk		Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	

Next maintenance: 30 Jun22 (proposed)

Prognostic horizon: Short (12 days), Long (12 weeks), Maximum (12 quarters)

View: Customize, 5%

Legend: High prognostic strength (Red), Medium prognostic strength (Yellow), Low prognostic strength (Green)

Formula: Multiplied risk


Schedule: Risky

The other settings that you can find here are settings for the fleet and unit capacity.

- In the **Settings** sub-step, you can supply other fleet settings. In most configurations, the advanced sections are not necessary. If you want, you can customize the language options for the fleet and units.

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Operator: DEMO-FOSSIL  
Draft: Test 1  
Revision 1: System: Initial revision.

Rename draft Roll back Validate

## Configuration document

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**?** The solution configuration may be valid for several assets. This document specifies the configuration for one asset fleet with multiple types of units and mission-critical components. These entities build up the asset hierarchy. The hierarchy is the tree. Fleet is the root of the tree and components are the leaves of the tree. At this step, please configure fleet properties.

**Simple**

Terminology	<input type="text" value="Default: Fleet/Unit/Capacity"/>	?
Profit margin role	<input type="text" value="Thermal electric power fleet"/>	?
Fuel price label	<input type="text" value="gas price"/>	?
Fuel unit	<input type="text" value="MMBtu"/>	?
Temperature unit	<input type="text" value="°F"/>	?
Currency ID	<input type="text" value="USD"/>	?
Currency symbol	<input type="text" value="\$"/>	?
Currency format	<input type="text" value="\$%v"/>	?

**Profit margin values** ?

Low profit*	<input type="text" value="0"/>	\$/MWh
Average profit*	<input type="text" value="12"/>	\$/MWh
High profit*	<input type="text" value="20"/>	\$/MWh


**Advanced**

<input checked="" type="checkbox"/> Sum margin at risk ?	In navigation bar, display child assets as:
<input checked="" type="checkbox"/> Expand prognostics ?	
<input type="checkbox"/> Custom language options ?	<input checked="" type="radio"/> Asset short name or ID. Example: 1209 <input type="radio"/> Slot ID (Asset short name or ID). Example: WT1 (1209)

## Configuring the units

When you configure the units, supply values for the fields according to the recommendations that you can see by clicking the **Question mark** icon.

In the **General** tab, you can configure general settings per unit. Most of the information that you supply here you will see it in the Unit specification in the Prognostic report page.



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Revision 1: System: Initial revision.

Rename draft Roll back Validate

## Configuration document

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**?** Units are the middleware nodes in the asset hierarchy. The next assets can play role of units as long as they have subunits or components to keep track of: power plants, trains, train wagons, factories, ships, planes etc.

**Expand all**

**CCPP**

General	ID*	<input type="text" value="CCPP"/>	?
Settings	Unit type	<input type="text" value="Combined cycle power plant"/>	?
Instances	OEM & model	<input type="text" value="OEM demo, model demo"/>	?
	Components monitored	<input type="text" value="CTB, HRSG, STB, GNR, TFR"/>	?
	Description for location	<input type="text"/>	?
	Aggregation type	<input type="text" value="Multiplied risk"/>	?
	Parent unit	<input type="text" value="DEMO-FOSSIL PPRB"/>	?
	Units in parent*	<input type="text" value="0"/>	?

Operating hours are	<input type="text" value="Not applicable"/>	?
Capacity is	<input type="text" value="Equal for all assets"/>	?
Asset capacity*	<input type="text" value="78"/>	MW ?
<input type="checkbox"/> Capacity/generation units of measurement differ from parent unit		
<input checked="" type="checkbox"/> Include in portfolio		
Anonymized ID	<input type="text"/>	?
Anonymized name	<input type="text"/>	?

PPRB

DFGU

PPRA

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In the **Settings** tab, you can supply other unit settings. In most configurations the advanced sections are not necessary.

The screenshot shows the LUMADA Configuration document interface. At the top, it displays the LUMADA logo, the operator name 'DEMO-FOSSIL', draft name 'Draft: Test 1', and revision information 'Revision 1: System: Initial revision.' There are buttons for 'Rename draft', 'Roll back', and 'Validate'. The title 'Configuration document' is on the right, and 'Provided by Hitachi ABB Power Grids' is at the bottom right of the header.

An information icon and text state: 'Units are the middleware nodes in the asset hierarchy. The next assets can play role of units as long as they have subunits or components to keep track of: power plants, trains, train wagons, factories, ships, planes etc.'

The main content area is titled 'Expand all' and shows a tree view with 'CCPP' selected. The 'Settings' tab is active, showing a 'Simple' section with checkboxes for 'Include unit fleet?' and 'Include configurable unit function?'. Below these are dropdown menus for 'Terminology' (set to 'Inherit from parent unit') and 'Profit margin role' (set to 'None').

The 'Advanced' section includes checkboxes for 'Sum margin at risk?' and 'Expand prognostics?'. To the right, there is a section 'In navigation bar, display child assets as:' with radio buttons for 'Asset short name or ID. Example: 1209' (selected) and 'Slot ID (Asset short name or ID). Example: WT1 (1209)'. A 'Custom language options' field is also present.

At the bottom, there is a sidebar with expandable sections for 'PPRB', 'DFGU', and 'PPRA'.


In the **Instances** tab, you can assign specific features for particular Unit instances, for example, the side bar name, different contact person, or different time zone. You can also create Orphan Unit instances to assign them to different Parent units.

## Configuring the components

In this step, you can export the component by clicking the **Export** icon in the upper-right corner.

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[Rename draft](#) [Roll back](#) [Validate](#)

## Configuration document

Provided by: Hitachi ABB Power Grids

**Components are the leaves of the asset hierarchy. These are the most important items of the prognostics solution. The prognostics is built per-component, and then aggregated up in the units via trivial algorithms right in the FrontEnd.**

The prognostic solution is based on current and historical condition and process data, typically recorded and archived by the operator. This data may for instance include temperature, vibration, lubricant, acoustic, electrical, optical, pressure, speed, flow and/or other parameters describing the asset's condition and operating process.

At component level, in particular, this document specifies relevant condition and process parameters, potential asset malfunction modes, and parameter correlations subject to different malfunction scenarios. Thereby, this document defines the interface between the asset operator and the prognostic solution provider. The raw data provided by the operator, and the complementing technical indications, specifications and assumptions listed in this document, represent the quantitative basis of the prognostic solution.

At this step, please provide general info about the components that the prognostics solution should be built for.

Expand all

DEMO-FOSSIL (-) [collapse] [refresh] [delete]

CCPP (HRSG) [collapse] [refresh] [delete]

Collapse all

HRSG [collapse] [refresh] [delete] [download]


<b>General</b>	ID*	HRSG ?	Operating hours are	Not applicable ?
<b>Settings</b>	Name	Heat rec stm gen ?	Capacity is	Not applicable ?
<b>Instances</b>	OEM & model	OEM demo, model demo ?	<input checked="" type="checkbox"/> Include in portfolio ?	
	Elements monitored	Tubes, pipes, drums, valves ?	Anonymized ID	?
	Aggregation type	Maximum risk ?	Anonymized name	?
	Parent unit*	DEMO-FOSSIL.PPRB.CCPP ?		
	Count per unit*	1 ?		

PPRB (-) [collapse] [refresh] [delete]

DFGU (STB, BFP, GNR, FDF, IDF, BLR) [collapse] [refresh] [delete]

PPRA (-) [collapse] [refresh] [delete]

Next, you can import such component in some other revision where this component is necessary. To import a component, you must open the revision in the edit mode.



Operator: DEMO-FOSSIL  
Draft: Test 1  
Revision 1: System: Initial revision.

[Rename draft](#) [Roll back](#) [Validate](#)

## Configuration document

Provided by: Hitachi ABB Power Grids

**Components are the leaves of the asset hierarchy. These are the most important items of the prognostics solution. The prognostics is built per-component, and then aggregated up in the units via trivial algorithms right in the FrontEnd.**

The prognostic solution is based on current and historical condition and process data, typically recorded and archived by the operator. This data may for instance include temperature, vibration, lubricant, acoustic, electrical, optical, pressure, speed, flow and/or other parameters describing the asset's condition and operating process.

At component level, in particular, this document specifies relevant condition and process parameters, potential asset malfunction modes, and parameter correlations subject to different malfunction scenarios. Thereby, this document defines the interface between the asset operator and the prognostic solution provider. The raw data provided by the operator, and the complementing technical indications, specifications and assumptions listed in this document, represent the quantitative basis of the prognostic solution.

At this step, please provide general info about the components that the prognostics solution should be built for.

Expand all

DEMO-FOSSIL (-) [collapse] [refresh] [delete] [download]

CCPP (HRSG) [collapse] [refresh] [delete] [download]

Collapse all

HRSG [collapse] [refresh] [delete] [download] [upload] [refresh] [delete]

<b>General</b>	ID*	HRSG ?	Operating hours are	Not applicable ?
<b>Settings</b>	Name	Heat rec stm gen ?	Capacity is	Not applicable ?
<b>Instances</b>	OEM & model	OEM demo, model demo ?	<input checked="" type="checkbox"/> Include in portfolio ?	
	Elements monitored	Tubes, pipes, drums, valves ?	Anonymized ID	?
	Aggregation type	Maximum risk ?	Anonymized name	?
	Parent unit*	DEMO-FOSSIL.PPRB.CCPP ?		
	Count per unit*	1 ?		

PPRB (-) [collapse] [refresh] [delete] [download]

DFGU (STB, BFP, GNR, FDF, IDF, BLR) [collapse] [refresh] [delete] [download]

PPRA (-) [collapse] [refresh] [delete] [download]

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In the **General** tab, you can configure general settings per component. Most of the information that you supply here you will see it in the Component specification in the Prognostic report page. It is necessary to supply two attributes in this step: the ID of the component and the Parent unit. In the Parent unit field, you supply the asset type hierarchy (the name of the fleet and unit(s) for the component).

In the **Settings** tab, you:

- Select the data sources and their quantity to display them in the Condition diagnostics section in the Prognostic report page.
- Set how you want to display the data sources in columns.
- Supply details of each data source.

**Note:** Make sure that the **Enable load scenario** option has the correct setting.

By default, the **Enable load scenario** option is selected. With such setting, APM Prognostics takes values from the data source only from the time periods when the value of the load parameter was between the minimum and maximum load. The load parameter has a dedicated interval of values (the range between Load min and Load max) that indicates normal operation range of the asset.

A good example for this setting is the Vibration data source. When you start an asset (machine) and it does not reach its normal operation mode, the vibration data is unreliable and might blur the condition prognosis. However, you will clear the **Enable load scenario** option for the Lubricant data source because the value of the load parameter is not related with this data source. The lubricant has an effect even when the asset is in the stand-by mode.

The screenshot displays the LUMADA Configuration document interface. At the top, it shows the operator 'DEMO-FOSSIL', draft 'Test 1', and revision '1: System: Initial revision'. The main content area is titled 'Configuration document' and is provided by Hitachi ABB Power Grids. The interface is divided into several sections: 'General', 'Settings', and 'Instances'. The 'Settings' tab is active, showing various configuration options. Under 'Data sources', there is a grid of data types with checkboxes and numerical values. The 'T1' instance is highlighted with a red box, showing its ID, location, description, and the 'Enable load scenario' checkbox which is checked. A 'Select' column on the right shows a grid of data source identifiers (T1-F8, G1-G8, E1-E8, F1-F8, W1-W8) with checkboxes.

In the **Instances** tab, you create Orphan instances of components of similar type and add component-specific features to them (such as the side bar name, abbreviation, serial number, time zone). If all component types are in the same Unit, the count per unit in the General tab has to be adjusted to the number of similar component types.

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## Configuring the malfunction specification

In this step, you can add malfunction modes for each component that are the most important or frequent failures that can occur in your asset. We recommend to add about 8 to 12 malfunction modes but you can add up to 15 for one component type. When you add malfunction modes, make sure that they follow the MECE principle – they are mutually exclusive and collectively exhaustive. In short, there can be no two or more malfunction modes for the same component failure, only one. The malfunction modes that you have represent all possible failures that can occur.

When you have your malfunction modes, you select which data sources supply data that has effect on a particular malfunction mode. This is a preliminary correlation, you can do a change to these settings in step Configuring the malfunction and parameter correlations.

The screenshot displays the LUMADA Configuration document interface. At the top, it shows the operator 'DEMO-FOSSIL', draft 'Test 1', and revision '1: System: Initial revision'. The document is provided by Hitachi ABB Power Grids. A warning message states: 'The prognostic solution to be configured will compute and display malfunction risk profiles. In particular, it will compute the risk of component malfunction with respect to several malfunction modes. Please list and define the 8 to 12 most important and prominent malfunction modes for each component considered (there is space for up to 15). These malfunction modes should: (1) address the dominant technical challenges of the selected components; (2) be essentially detectable (e.g. via condition and process data) before component failure or damage occurs; (3) be as independent of each other as possible.'

The main configuration area shows a list of components. The 'Control system defect' component is expanded, showing its ID, title, mitigation ('Remove turbine from service and troubleshoot'), definition ('Inability to meet/maintain load, or unit trip. It can be related to mechanical or EH problem, e.g. switch misalignment. Typically more of an instantaneous failure.'), and detection ('Control valve position vs. load or first stage pressure, limit switch indications'). A 'Related data sources' table is visible, listing sources V1-V9, P1-P8, L1-L7, R1-R7, T8-T13, and F1.

The 'Malfunction prognostics' section shows a table of malfunction modes and their correlation with data sources over time. The modes listed include Control system defect, Bearing defect, Blade crack or liberation, Water induction, Reheat valves defect, Oil cooler defect, Unbalance, Oil leakage, Bucket or blade fouling, Oil water contamination, and Oil particle contamination. The data sources are V1-V9, P1-P8, L1-L7, R1-R7, T8-T13, and F1. The prognostics table shows risk levels (High, Medium, Low) for each mode across various time periods from July 2021 to April 2024. A legend indicates risk levels: red for >15%, yellow for 5%-15%, green for <5%, and patterns for prognostic strength.

At the bottom, there are controls for 'Next maintenance' (30 Jun 22 proposed), 'Prognostic horizon' (Short, Long, Maximum), 'View' (Percentages), 'Vary load and data history' (Load min: 150 MW, Load max: 850 MW, History start: 01 Jan 08, Reference date: 28 Jul 21), and a 'Schedule' button.

In the upper-right corner of each component, you can click the icons to move to other steps in the configuration revision. These icons are general navigation options that are available when you prepare the configuration document.


This close-up screenshot shows the navigation icons in the upper-right corner of a component's configuration area. The icons include a home icon, a back icon, a forward icon, a refresh icon, a search icon, a settings icon, a help icon, and a close icon. The component name 'Control system defect' is visible below the icons.

In the upper-right corner of each malfunction mode, you have the edit options that let you reorder, move, clone, and delete malfunctions. They are also available in other parts of APM Prognostics.

## Configuring the malfunction prioritization

In this step, you set the likelihood and impact of the malfunction modes on the scale from 0 (very low) to 10 (very high). You set these two attributes to identify how possible it is that a malfunction mode occurs in the component and the mitigation cost that this occurrence causes, respectively.

**Note:** When you have a long list of malfunction modes and you want to add new ones, identify the malfunction modes with the very low likelihood and impact (0 or 1). These malfunction modes might be the first ones that you remove in favor of malfunction modes that occur more frequently and have higher impact.



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[Rename draft](#) [Roll back](#) [Validate](#)

### Configuration document

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**i** The malfunction modes listed for each component typically differ in terms of their likelihood and impact. Both are perceived as a measure of risk, but should be thoroughly distinguished.

Please first prioritize the malfunction modes in terms of relative likelihood. This is typically the relative frequency of occurrence, either in the asset unit considered, or in comparable unit. Then, please prioritize the malfunctions according to their relative impact. This is typically the relative costs and effort of mitigation, i.e. maintenance, repair or replacement of the component.

**Expand all**

DEMO-FOSSIL PPRB.CCPP.HRSG

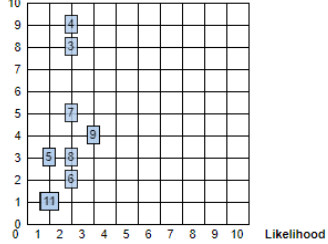
DEMO-FOSSIL PPRA.DFGU.STB

Number	Title	Relative likelihood	Relative impact
1	Control system defect	1	3
2	Bearing defect	3	4
3	Blade crack or liberation	2	8
4	Water induction	2	9
5	Reheat valves defect	1	3
6	Oil cooler defect	2	2
7	Unbalance	2	5
8	Oil leakage	2	3
9	Bucket or blade fouling	3	4
10	Oil water contamination	1	1
11	Oil particle contamination	1	1

Share of malfunction risk\*  % ?

Availability of the asset component\*  % ?

**Impact**



**Comments**

DEMO-FOSSIL PPRA.DFGU.BFP

DEMO-FOSSIL PPRA.DFGU.GNR

There are two more settings in this step:

- **Share of malfunction risk** – This setting identifies how much effect the malfunction modes have on the total asset risk. By default, it is 80%. It means that factors other than malfunction modes have effect on the asset deterioration in 20%.
- **Availability of the asset component** – This setting identifies how much time during a year the asset is in operation. With this setting at 95%, it means that 5% of the year, the asset is off (for example, for maintenance).

## Configuring the parameter types

In this step, you add parameter types to group parameters by their data source, unit of measurement, thresholds, or correlations, because these properties are often shared across multiple parameters.

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When you add a new parameter type, a number is automatically assigned to it. You must supply the ID of the parameter type by using the ID builder and selecting at least one data source.

**Note:** Parameter IDs can and frequently change to some internal abbreviations that are meaningful for the customers. For example, these can be the KKS codes, the identification system for power plants that identifies power plants, sections of plants, and items of equipment in any kind of power plants according to task, type, and location.

A data source (typically equals to one sensor) might have several parameter types that might have several parameter instances. Make sure to add a description of the parameter type (details that describe what parameter it reflects), a unit of measurement, and its position (it typically coincides with position of the data source/sensor).

The screenshot shows the LUMADA Configuration document interface. At the top, it displays the operator name 'DEMO-FOSSIL', draft status 'Draft: Test 1', and revision information 'Revision 1: System: Initial revision.' There are buttons for 'Rename draft', 'Roll back', and 'Validate'. The title 'Configuration document' is prominently displayed on the right. Below the title, it states 'Provided by: Hitachi ABB Power Grids'.

An information icon (i) is followed by a detailed note: 'The prognostic solution to be configured is based on current and historical condition and process parameters. The corresponding data sources have been specified in step 4 (Component). The recorded parameters can oftentimes be clustered by parameter type. For instance, "bearing temperature" is a parameter type that is being recorded at several different data sources, typically at each bearing. While the prognostic solution considers every single parameters, the entire configuration and in particular the correlation to malfunction modes is based on parameter types only. Please list the most important parameter types for each component. These parameter types should (1) correspond directly to the condition and process data taken, or represent suitable arithmetic or logical function of that data, (2) relate to one or several of the data sources specified, and (3) be correlated to at least one of the malfunction modes defined. The parameter types should be given unique IDs (ideally based on operator IDs, such as groups of PI tags) used by the operator.'

The main configuration area is divided into sections for different parameter types. The first section is for 'P2.1 - DEMO-FOSSIL\_T1900'. It includes a 'Number' field with 'P2.1' and a question mark. Below it is an 'ID builder' section with checkboxes for 'Include fleet ID' (checked), 'Include unit ID', and 'Include component ID'. There are also checkboxes for 'Include data type' and 'Include data source'. An 'ID\*' field contains 'DEMO-FOSSIL\_T1900'. To the right is a 'Data sources' grid with checkboxes for V1-V10, P1-P8, T1-T13, and F1. The 'T13' checkbox is checked. Below the grid is a 'Comments' field.

The second section is for 'P2.2 - DEMO-FOSSIL\_U1005-1010'. It has a 'Number' field with 'P2.2'. The 'ID builder' section has 'Include fleet ID' checked. The 'ID\*' field contains 'DEMO-FOSSIL\_U1005-1010'. The 'Data sources' grid has checkboxes for V1-V8, P1-P8, T1-T13. The 'V1', 'V2', and 'V3' checkboxes are checked.

In the upper-right corner of each component and parameter type, you can click the icons to move to other steps in the configuration revision. These icons are general navigation options that are available when you prepare the configuration document.

Also, in the upper-right corner of each parameter type, you have the edit options. They are available in several parts of APM Prognostics.

Under the list of parameter types, you have an option to select one of them as the load parameter. You will use this parameter in the Malfunction prognostics section in the Prognostic report page. For more information, see [Simulations](#).

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**Malfunction prognostics**

Select	Malfunction modes	Data sources	Jul'21	Oct'21	Jan'22	Apr'22	Jul'22	Oct'22	Jan'23	Apr'23	Jul'23	Oct'23	Jan'24	Apr'24
<input checked="" type="checkbox"/>	Control system defect	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Bearing defect	(F)(F)(F)(F)(F)(F)	0%	0%	1%	1%	2%	2%	3%	3%	4%	5%	5%	6%
<input checked="" type="checkbox"/>	Blade crack or liberation	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	1%	1%	1%	2%	2%	3%	3%
<input checked="" type="checkbox"/>	Water induction	(F)(F)(F)(F)(F)(F)	0%	0%	1%	2%	4%	5%	7%	9%	11%	13%	16%	18%
<input checked="" type="checkbox"/>	Reheat valves defect	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Oil cooler defect	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Unbalance	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Oil leakage	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Bucket or blade fouling	(F)(F)(F)(F)(F)(F)	0%	0%	1%	2%	3%	5%	6%	8%	10%	11%	13%	15%
<input checked="" type="checkbox"/>	Oil water contamination	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<input checked="" type="checkbox"/>	Oil particle contamination	(F)(F)(F)(F)(F)(F)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total risk			0%	0%	1%	2%	4%	5%	7%	9%	11%	13%	16%	18%

Next maintenance: 30 Jun'22 (proposed) **Schedule**

Prognostic horizon:  Short (12 days)  Long (12 weeks)  Maximum (12 quarters)

View:  Percentages

Vary load and data history: Load min. 150 MW, Load max. 650 MW, History start: 01 Jan'08, Reference date: 28 Jul'21 (UTC), History end: 28 Jul'21

Legend: Downtime risk >15% (Red), Downtime risk 5% - 15% (Yellow), Downtime risk <5% (Green), High prognostic strength (Dark Green), Medium prognostic strength (Light Green), Low prognostic strength (White with diagonal lines)

Schedule: Risky, Bold, Safe

Load parameter type: P1.5 - HRSRG\_LT10521S, Load interval type: Static, Start date: [empty], Min value: 150, Max value: 650

Make sure to select a load parameter for all the component types. When you configure the load intervals, you can select static ones (fixed min and max values that you add manually) or you can disable them (automatically include the min and max values from the load parameter as boundaries).

## Configuring the parameter instances

You can configure the parameter instances by doing tasks in one of the following sub-steps:

- Edit parameter templates
- Edit parameters grouped by component instance
- Edit parameters grouped by parameter type

**Note:** We recommend to use the **Edit parameter templates** option as your first choice. It is for the situation when you have the same components with similarly structured raw data. When you use the other two options, you introduce customizations that prevent the export of the configuration document to another APM Prognostics instance.

In the **Edit parameter grouped by component instance** sub-step, you browse the available components and edit parameters instances per parameter type.

In the **Edit parameters grouped by parameter type** sub-step, you browse the available parameter types and edit parameters instances per component.



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**LUMADA**

**Configuration document**

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**i** Given component instances configured at step 4 and parameter types configured at step 7, it is time to determine specific parameter instances in the corresponding component instances.

Considering that all components of the same type may have common set of parameters, it makes sense to auto-generate them to prevent duplicating work. Switch to "Edit parameter templates" section and define such common parameters there. Once a template is created, the corresponding parameter instances appear in all instances of the component type automatically. Switch back to "Edit parameter instances" section to see them. We call such parameters "automatic".

Automatic parameters inherit all their properties from the parameter template, however, you can customize them in every specific component. To do that, open an automatic parameter, select the appropriate "Custom" checkbox and enter the custom value manually. We call such parameters "customized". They inherit just a subset of their properties from the template, and all the rest are specified manually. You can even customize an automatic parameter by deleting it in a specific component instance. In this case, it is marked as deleted, and it won't be used in calculation, but you can always return it back by "Configure" button click.

The last type of parameter is "manual" parameter. It is created separately for every specific component instance and it doesn't inherit any properties from templates.

Expand all

DEMO-FOSSIL\_PPRB\_CCPP\_HRSG

Expand all

P1.1 - HRSG\_PT10522

Collapse all

DEMO-FOSSIL\_HRSG\_P2\_PT10522

ID builder

Include fleet ID  Include unit ID  Include component ID

Include data type  Include data source

ID\* DEMO-FOSSIL\_HRSG\_P2\_PT10522

Description

Key

Include  ?

Display  ?

Family ID

Data source

P2

Value (alarm) level offsets

	Value limit	Offset	Sum
Extreme	1550	0	1550
Significant	1500	0	1500
Advanced	1460	0	1460
Normal	1400	0	1400

When you add a new parameter instance, you must supply the ID of the parameter instance by using the ID builder. The ID builder automatically provides an option that you can use while creating new parameter instances. The data sources that you selected in the previous steps, you must also select them in this step. However, you can only select a single data source for a parameter instance. In special cases, there is an offset option, so that offsets can be provided for a particular parameter instance of the component type.

**Note:** APM Prognostics uses the parameter Key value as the external ID during the model export to Lumada APM.

In this step, you also provide a key that is the identifier or formula of the parameter in the raw data. The key is a unique identifier that maps raw data to the parameter instance. It is a reference of raw data for the Data transformer that uses it as identification during the data load.

**Important:** When a key in a raw parameter contains a comma and you reference the parameter key in a derivative parameter expression, it is necessary to put the backslash (\) sign before the comma. APM Prognostics uses comma as a separator between different references. To compensate for backslash special meaning, you must place two backslashes in order to refer a raw parameter key that contains a backslash. For example:

- Raw parameter key: distance,from\coast
- Inverted parameter: B!INV:distance,\,from\\coast

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The description in the parameter instance overwrites the description in parameter type. If you do not want to include a parameter instance in the prognosis calculation, clear the **Include** option. Also, if you do not want to display a parameter in the Prognostic report, clear the **Display** option.

In this step you also supply value (alarm) level offsets for each parameter instance.

## Configuring the malfunction and parameter correlations

In this step, you configure the correlation between the malfunction modes and parameters types. In the columns, you have all the malfunction modes. All the rows are parameter types.

When you want to set a correlation, you click the Not possible cell at the intersection of a parameter type and a malfunction mode. For the four value intervals (alarm levels) you supply values from 0 – 100 % to identify the likelihood of the parameter reaching a particular level when the malfunction mode occurs. The sum of the four values must be 100%. The higher the value, the higher the likelihood of reaching the alarm level.



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### Configuration document

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**Examples & illustrations**


**?**

Parameter type specification		Value specifications			Malfunction modes (Scenarios)					
					M2.1. Element Fouling	M2.2. SCR Degradation	M2.3. Thermal Fatigue	M2.4. Flow-accelerated corrosion	M2.5. Duct Burner Defect	M2.6. Attemperator Defect
Number	Parameter type ID & description	Unit of measu...	Value limits	Value intervals	P(M) = Likelihood of observing a malfunction based on indication in step 6					
					P(Ci   Mj) = Likelihood of reaching an alarm level given malfunction (scenario)					
P1.1	HRSO_PT10522 HP steam drum pressure	PSIG	1550 1500 1460 1400	(1550, +∞) [1500, 1550] [1460, 1500] [1400, 1460]	3.20%	2.56%	3.20%	3.20%	1.92%	1.92%
P1.2	HRSO_LT10520S HP drum level select	In WC	7 5 2 -2	(7, +∞) [5, 7] [2, 5] [-2, 2]	Not possible	Not possible	Not possible	Not possible	Not possible	Not possible
P1.3	HRSO_PT1220 LP steam pressure	PSIG	200 185 170 100	(200, +∞) [185, 200] [170, 185] [100, 170]	Not possible	Not possible	Not possible	5 % 5 % 90 % n %	Not possible	Not poss

To help you understand these settings, you can unfold the **Examples & illustrations** section to see sample correlations and their explanations. You can also click the Question mark icon in the upper-left corner for information how to navigate in the tables and edit them.

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## Configuration document

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**i** The prognostic solution to be configured correlates malfunction modes for each asset component to the component's available condition and process parameters. Please indicate this assessment for each malfunction mode and for each parameter type at qualitative and quantitative levels. Please consider 4 value levels for each parameter type: (1) the normal condition (green); (2) the marginal condition (yellow); (3) the critical condition(s) (red); and (4) the emergency, shut-off or post-mortem condition(s). Then, for each malfunction mode, indicate the likelihood of a particular parameter value level. This is based on a logic rationale, grounded in physical causality, not in guesswork.

**Examples & illustrations**

Shaft unbalance cannot be detected by 0.5X shaft vibration.

Shaft unbalance	
0.5X	Shut off 0 %
	Alarm 0 %
	Alert 0 %
	Normal 100 %

Shaft unbalance can rarely be detected by 0.5X shaft vibration.

Shaft unbalance	
0.5X	Shut off 0 %
	Alarm 1 %
	Alert 9 %
	Normal 90 %

Shaft unbalance can always be detected by increasing 1X vibration.

Shaft unbalance	
1X	Shut off 20 %
	Alarm 30 %
	Alert 50 %
	Normal 0 %

Bearing looseness can often be detected by increasing 2X vibration.

Bearing loose	
2X	Shut off 5 %
	Alarm 25 %
	Alert 40 %
	Normal 30 %

Bearing looseness will show a clear 0.5X amplitude signature.

Bearing loose	
0.5X	Shut off 0 %
	Alarm 40 %
	Alert 60 %
	Normal 0 %

Oil additive depletion may be detected, but is not serious issue.

Additive depletion	
%	Shut off 0 %
	Alarm 0 %
	Alert 50 %
	Normal 50 %

Rotor rub has a high impact on 1X vibration, leading to shutdown.

Rotor rub	
1X	Shut off 50 %
	Alarm 30 %
	Alert 20 %
	Normal 0 %

Fortunately, we have a mechanical protection against rotor rub.

Rotor rub	
1X	Shut off 0 %
	Alarm 10 %
	Alert 90 %
	Normal 0 %

When you finish step 9, commit your revision in the Navigation panel. Until you release the revision, the changes that you commit do not have an effect on your system.

## Fine-tuning a model

When you do a configuration of your model, you can test it during the validation phase (that is part of deployment) based on the customer data. If it is necessary to fine-tune the model, the Configuration manager can do the steps that follow:

1. Do a check and adjust the parameter thresholds in one of these steps:
  - **Value limits** column for parameter types in the [Malfunction & Parameter correlations](#) step.
  - **Value level offsets** in the [Parameter instances](#) step.
2. Do a check and apply data cleansing methods or introduce additional derivative parameters to indicative parameter values.
3. Do a check and adjust the correlation between malfunctions and parameters. For more information, see [Configuring the malfunction and parameter correlations](#).
4. Set the **No malfunction** correlation in the [Configuring the malfunction and parameter correlations](#) step.

The values that you set here identify the probability that a component can still be operational even when an indicative parameter reaches certain values and crosses certain set thresholds.

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Revision 14: System: Synchronized demo revision with the original one.

EMO-FOSSIL  
system: Synchronized demo revision with the original one.

Validate

DEMO-FOSSIL.PRRB.CC.PP.HRS.G

Parameter type specification	Value specifications	P(M) = Likelihood of observing a malfunction based on indications in step 6							Other specific			
		Element Fouling	SCR Degradation	Thermal Fatigue	Flow-accelerated corrosion	Duct Burner Defect	Attemperator Defect	No malfunction				
P1.1	HRSG_PT10522 HP steam drum pressure	PSIG	1550 1500 1450 1400	(1550, +∞) [1500, 1550) [1450, 1500) [1400, 1450)	3.20%	2.95%	3.20%	3.20%	1.92%	1.92%	84.00%	P(Ci)
P1.2	HRSG_L1102203 HP drum level select	In WC	7 5 2 -2	(7, +∞) (5, 7) (2, 5) (-2, 2)	Not possible	Not possible	Not possible	Not possible	Not possible	Not possible	Not possible	0.00%
P1.3	HRSG_PT1220 LP steam pressure	PSIG	200 185 170 100	(200, +∞) [185, 200) [170, 185) (100, 170)	Not possible	Not possible	Not possible	5 % 5 % 90 % 10 %	Not possible	Not possible	Not possible	0.00% 0.00% 100.00%
P1.4	HRSG_PT10538S LP drum pressure	PSIG	230 225 250 240	(230, +∞) [225, 230) [250, 230) [240, 250)	Not possible	Not possible	Not possible	5 % 5 % 90 % 0 %	Not possible	Not possible	Not possible	0.15% 0.15% 2.88% 96.80%

In the example above, when **there is no significant risk (no malfunction)**, there is:

- 91% chance that the value of the HP steam drum pressure is Normal (green).
- 7% chance that the value of the HP steam drum pressure is Advanced (yellow).
- 2% chance that the value of the HP steam drum pressure is Significant (red).

**Important:** This is a setting for users who have expert knowledge about the component and configuration process. APM Prognostics assigns high risk levels for a particular malfunction mode already when parameter values reach the yellow (not to mention the red or dark red) threshold. If you supply any values in the **No malfunction** column for ranges other than green, APM Prognostics will reduce risk levels for malfunction mode prognostic result when the parameter reaches these thresholds.

## Good practices

Here is a set of recommendations for you when you start to use APM Prognostics:

- When you work with revisions, do not create too many draft instances. Make sure that you use unique names for your drafts that are related to your release process of APM Prognostics. Remember to do a rollback of the unnecessary revisions.
- When you add parameters, make sure you add clear descriptions. Do not use the parameter ID in the description or abbreviated texts.
- When you select the load parameter for a fleet of comparable units, be consistent with the parameter that you select, its unit of measurement and value level.

## Importing a revision

When you create a revision of a configuration document, it can become a template for a new system configuration or a new operator. When you have the same types of industrial assets, such templates make configuration of new APM Prognostics instances faster and easier. For example, you can have a library with reusable configurations that you import and use with your assets. Sometimes it can be necessary to do small

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changes or adjustments in the configuration document, but it is still faster than to create a new configuration document from the beginning.

APM Prognostics has a simple import wizard for revisions that users with at least the Config Doc Editor role can use.

**Note:** APM Prognostics also lets you export and import components. If it is not necessary for you to import full revisions, you can import components. For more information, see [Configuring the components](#).

## Procedure

1. In the navigation panel of the Configuration log page, click **Import revision**.
2. Click **Choose a file** and select a revision that you want to import.
3. Enter a detailed commit message for the revision.
4. Select the revisions that are merged with the imported revision.

The screenshot shows the 'Import ConfigDoc revision file and create a new revision' wizard in the LUMADA Configuration document interface. The interface includes a navigation panel on the left with options like 'Prognostic report', 'Configuration log', 'Log', 'Import revision', 'Administration tool', and 'Project portfolio'. The main content area has a header with the LUMADA logo, user information (Operator: DEMO-FOSSIL, Draft: Test 1, Revision 1: System: Initial revision), and buttons for 'Rename draft', 'Roll back', and 'Validate'. Below the header, there is a section for 'Import ConfigDoc revision file and create a new revision' with a 'File' field containing 'Choose a file', 'Reset', and 'ABC-10.revision.1...'. A text area for the commit message contains 'Imported ABC-10.revision.json'. Below this, there is a section for selecting revisions to be merged, with a list of revisions and checkboxes. The selected revision is '26 Jul'21 12:45:17'. At the bottom right, there are 'Import' and 'Cancel' buttons.

5. Click **Import**.

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6. Your revision shows in the History section of the Configuration log page.



When the solid black dot changes into an empty green dot, you can release this revision by clicking the **Release this revision** icon for this revision. After you release a revision, APM Prognostics makes some of the changes immediately, for example, asset hierarchy, and malfunctions. Changes like new parameters, thresholds for parameters, and correlations have an effect after you recalculate the prognostic report.

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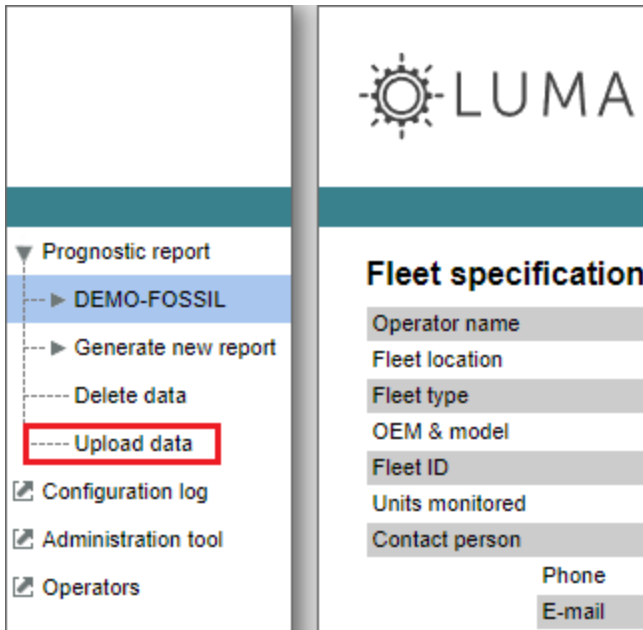
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# Chapter 3: API

## APM Prognostics API

### Feeder API in Swagger

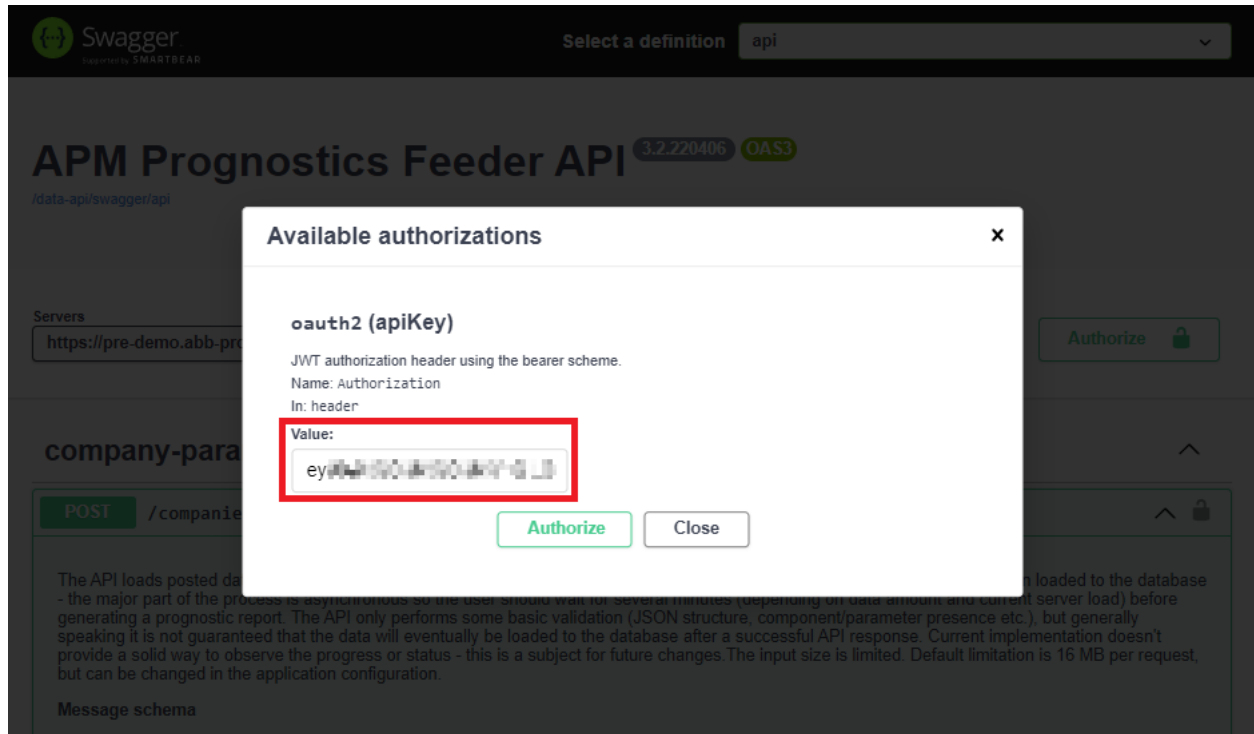
We created APM Prognostics Feeder API in Swagger that loads the posted data to the database. Users with the Admin role can go to Swagger by clicking **Upload data** in the navigation panel.



The Feeder API is also available directly at this URL address:

**{{baseUrl}}/data-api/public/swagger-ui/index.html?url=/data-api/swagger/api-docs**

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Authorization is necessary for this Swagger API, so you must supply the **ID token** for your APM Prognostics environment to use it. For information how to obtain the ID token, see the *Getting an access token by using account credentials* procedure in the [Authentication](#) section.

## Internal API

APM Prognostics has API that is designed for the internal usage in the application. At your own discretion, you can also use some of these methods for integrations between APM Prognostics and 3rd-party systems, platforms, or tools. When you use APM Prognostics API, make sure that the integrations are on top of the generic HTTP(S) protocol. APM Prognostics API does not follow the REST conventions. Do not use any integration tools that require accurate REST implementations.

**Important:** APM Prognostics API changes constantly. If you decide to use any of the methods on a production environment, read APM Prognostics release notes regularly to learn about the coming changes. We supply such information two weeks in advance.

To show and explain APM Prognostics API, we use [Postman](#) and special collections that contain all the API methods in APM Prognostics. These collections will help you understand our API and use it correctly. For more information, see the sections that follow:

- [Authentication](#)
- [Using APM Prognostics API](#)
- [Explanation of the Postman collections](#)
- [Examples](#)

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- GET update/list – Downloading all the prognostic reports for an operator
- GET update – Downloading details of a prognostic report
- Good to know

## Authentication

A service account is necessary to have access and use APM Prognostics API. When the service account is registered in the associated OpenID Connect provider, you can get an access token to authenticate the service requests in the APM Prognostics application.

In the SaaS delivery model, only the application vendor can create the service account for you. Open a ticket in Salesforce (or contact the Customer Experience support team) and describe who wants the service account and why. It is also necessary to describe the requested access permissions, for example operator names and access level: prognostics reports (read/write), ConfigDoc (read/write/release).

When an account is ready, you get a login request URL and parameters. The request returns a JSON file with the `access_token` field. You must send the value of this field as the `idToken` parameter value with every request to APM Prognostics API. As a result, the application authenticates the service account correctly.

The token expires depending on the configuration of the OpenID Connect provider (AAD: 1 hour, Keycloak: 15 minutes). Make sure to refresh it on a regular basis. You can identify the token expiration event by the `"authenticationError": true` response field.

**Note:** We recommend to change the service account secrets regularly (at least every 3 months). The change is also necessary when the secrets are or might be compromised, and when a person who manages or uses them leaves the company.

If you do not have a service account, you can get the access token by using your account credentials. You can use it only to do a functional test of APM Prognostics API.

### Getting an access token by using account credentials

1. Log in to APM Prognostics in the Chrome or Firefox browser by using your user account credentials.
2. Open the browser developer tools. For example, press the F12 key.
3. In the **Application** tab, click **Cookies > https://<Your\_domain\_name>**.
4. Find a cookie with the `id_token` suffix.

Name	Value	D...	Path	Expires /...	Size	HttpO...
https://demo.ctb.prognostics.com/id_token_expires	164...	d...	/	2022-02...	54	
https://demo.ctb.prognostics.com/id_token	eyJ2O...	d...	/	2022-02...	1112	✓
https://demo.ctb.prognostics.com/last_redirect	164...	d...	/	Session	51	
https://demo.ctb.prognostics.com/prognostics_csrf_token...	073H...	d...	/	Session	116	✓
https://demo.ctb.prognostics.com/session_id	f85d...	d...	/	Session	71	✓

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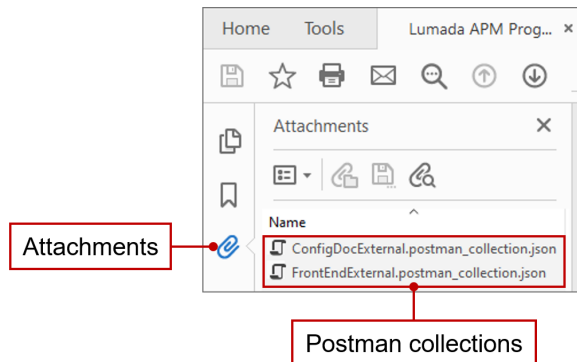


5. Double click its value and copy it to your clipboard.

This is the value for the `idToken` parameter that you send with every request to APM Prognostics API.

## Using APM Prognostics API

Before you start using APM Prognostics API on your own, we recommend to use our Postman collections first. You can download these collections from the attachment section in this guide. Import these collections into Postman and authenticate yourself to use the API methods that you select.



Last update date of the Postman collections in this section: 1st March 2022.

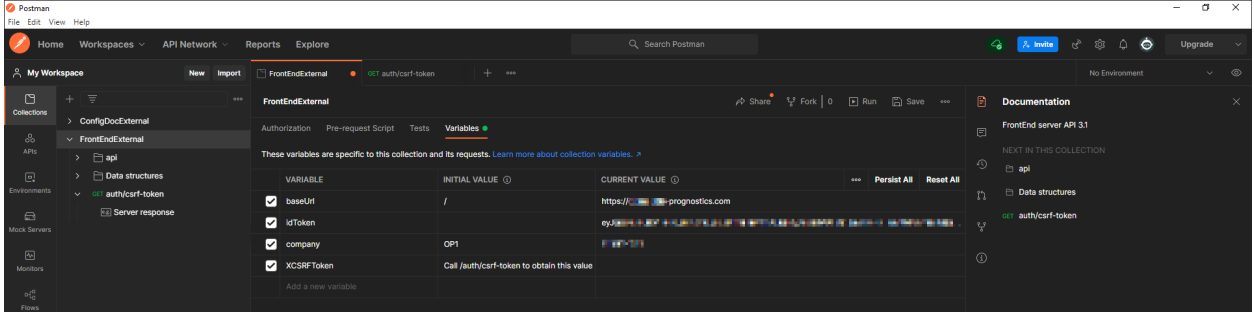
### Procedure:

In this procedure, you will use Postman HTTP client that you can download [here](#).

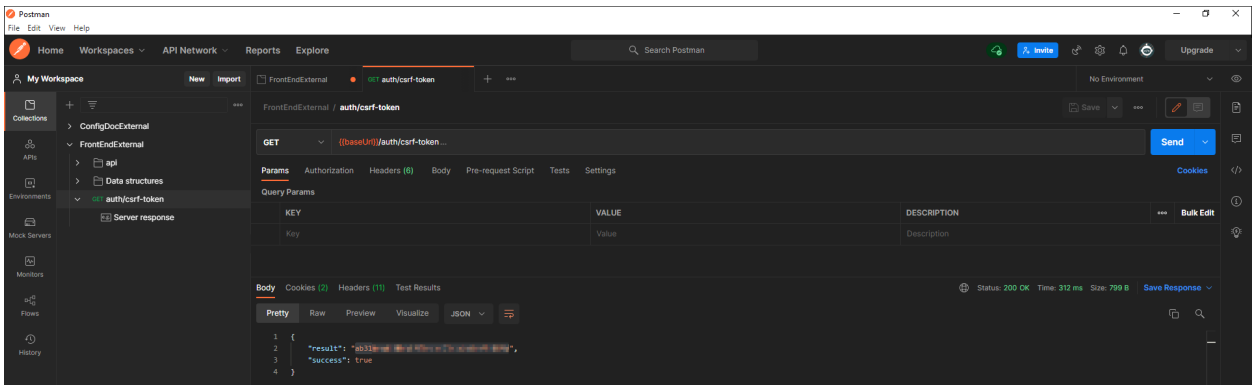
**Note:** Postman is a 3<sup>rd</sup> party tool that is only an aid to illustrating how APM Prognostics API works. You can continue to use API with this tool or select a different one. If you find any problems or look for more information about the 3<sup>rd</sup> party tool that you select to use, it is necessary to see the official 3<sup>rd</sup> party documentation or contact their customer support.

1. Import Postman collections. For more information, see the official documentation about [Importing and exporting data](#).
2. Click the FrontEnd or ConfigDoc collection to configure it.  
It is necessary to configure both of the collections if you want to use all the API methods.
3. In the **Variables** tab, supply values for the variables that follow:
  - **baseUrl** – URL address of your APM Prognostics system.
  - **idToken** – Authentication token. For more information, see [Authentication](#).
  - **company** – Name of your operator. For more information, see [Configuration log](#).

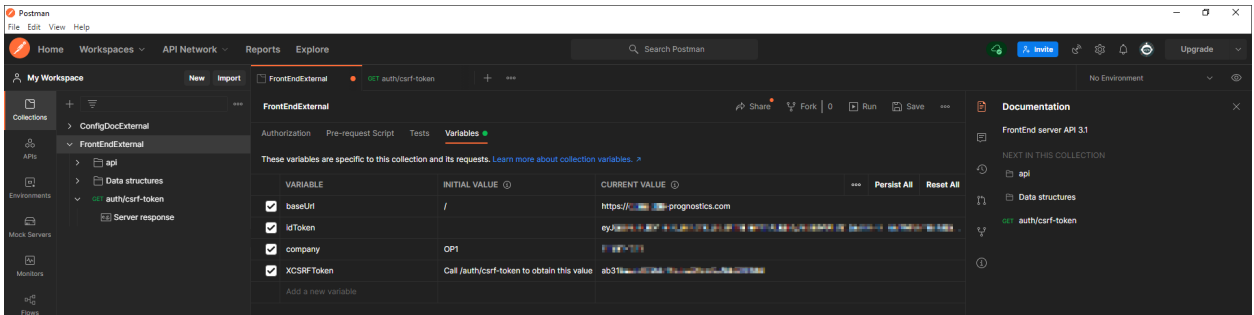
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4. Save the collection.
5. Go to the **GET auth/csrf-token** method and click **Send** to generate a CSRF token.
6. Copy the CSRF token from the **Body** section.



7. Return to the **Variables** tab and paste the CSRF token as the value for **XCSRFToken** variable.



8. Save the collection.

You are ready to use the methods in APM Prognostics API that are available for you (see [Explanation of the Postman collections](#)). For more information, see [Examples](#).

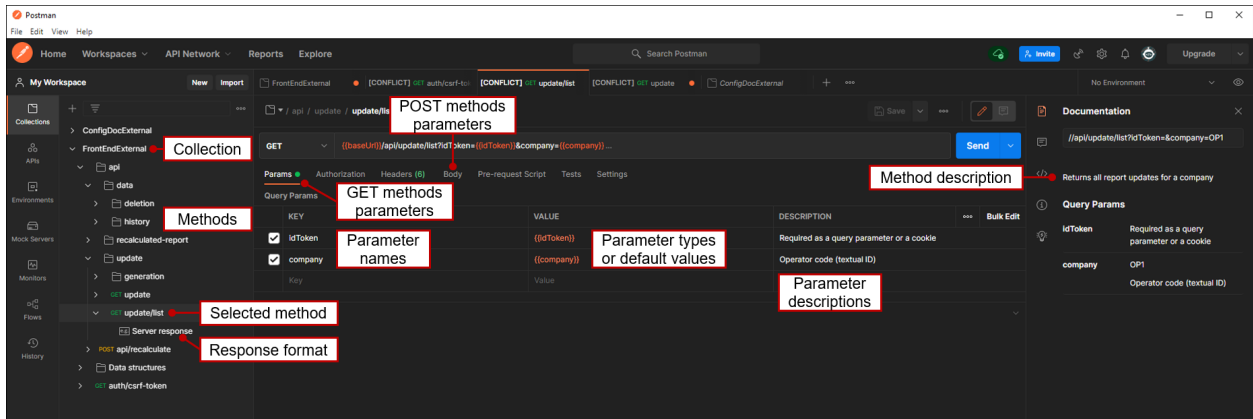
## Explanation of the Postman collections

Depending on your access level, you can use up to two API collections:

- **FrontEndExternal** – Contains methods to generate and retrieve prognostic reports, obtain raw data history, delete data, manipulate UI elements. The basic (FRONT\_END) access level is necessary to use this collection.

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- ConfigDocExternal – Contains methods to fetch, push or release ConfigDocs. The access to the ConfigDoc (CONFIG\_DOC\_VIEWER, CONFIG\_DOC\_EDITOR) is necessary to use this collection.



Each Postman collection contains two folders:

- api or cd-api (depending on the collection) – Contains a full hierarchy of external API methods, their URLs, parameters, descriptions, and the response format.
- Data structures – Contains full specifications of all data structures used in the API method responses.

## Examples

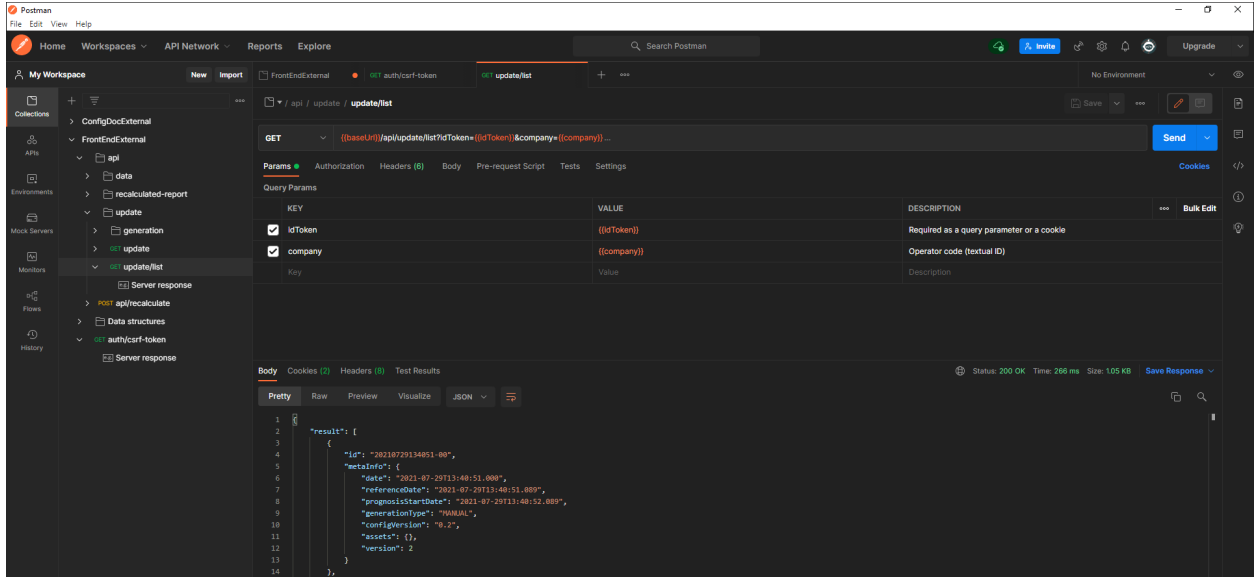
In this section, you will see how to use two of the most commonly used methods: **GET update/list** and **GET update**. Use them to download all prognostic report updates for an operator and details for a prognostic report update that you select.

### GET update/list – Downloading all the prognostic report updates for an operator

Before you start, make sure that the FrontEndExternal collection is configured. For more information, see [Using APM Prognostics API](#). The variables in the **Params** tab for the GET update/list method get values from the **Variables** tab in the FrontEndExternal collection.

1. In Postman, click **FrontEndExternal > api > update > GET update/list**.
2. Click **Send**.
3. In the **Body** section, see all the prognostic report updates.

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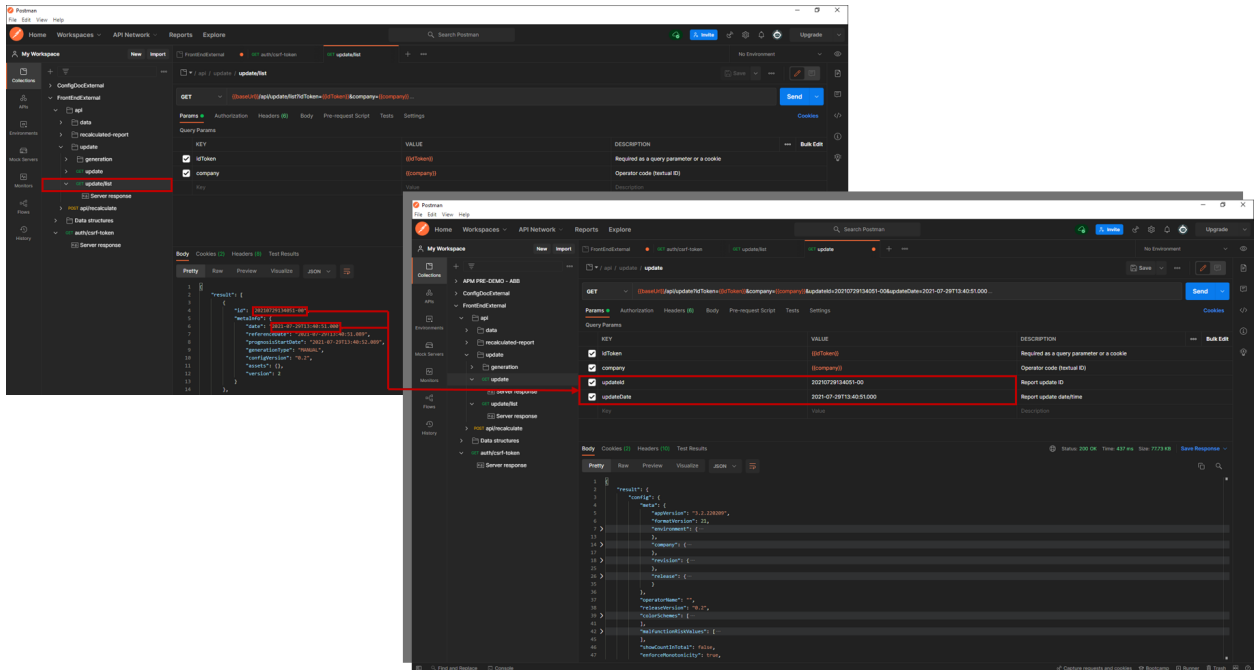
4. Copy the value of the `id` and `date` parameters to use them with the GET update method.

## GET update – Downloading details of a prognostic report update

Before you start, make sure that the `FrontEndExternal` collection is configured. For more information, see [Using APM Prognostics API](#). Some of the variables in the **Params** tab for the GET update method get values from the **Variables** tab in the `FrontEndExternal` collection. The rest of the values will be in the response body of the **GET update/list** API method.

1. In Postman, click **FrontEndExternal > api > update > GET update**.
2. In the **Params** tab, supply values for:
  - **updateId** – Report update ID.
  - **updateDate** – Report update date/time.

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3. Click **Send**.
4. In the **Body** section, see all the details of the prognostic report. You can see the Configdoc and prognostic matrix for every component.

## Good to know

Every API method returns a JSON response with information if the API call was successful or not:

- **Success:**

```
{
  "success": true,
  "result": ...
}
```

- **Error:**

```
{
  "success": false,
  "error": "...",
  "message": "...",
  ... // potentially some other fields that describe the error details
}
```

### Known issue:

Every API method returns the **200 OK** status code even for errors. It is necessary to see the JSON response to identify the API calls that have errors.

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