GEM PRECARE

USER MANUAL

GEM PRECARE User Manual

Version 2.5

March 2021

Table of Contents

Abbreviations

Acronym	Meaning
OEE	Overall Equipment Effectiveness
OEE Utilization	Effective utilization of a machine
OEE Efficiency	Effective efficiency of a machine
OEE Quality	Effective yield of a machine
MTBF	Mean-Time-Between-Failures
MTBA	Mean-Time-Between-Assists
GUI	Graphical User Interface
CPS	Cyber Physical System
MES	Manufacturing Execution System
ERP	Enterprise Resource Planning

Preface

This User Guide is intended for GEM PRECARE platform users with no administrator rights. Familiarity with this User Guide is a prerequisite in order to use the GEM PRECARE platform and a prerequisite in order to gain the maximum benefit out of the platform.

GEM PRECARE supports a set of Web and REST APIs for 3rd party extensions and application integration, as well as a markup like syntax for dashboard and user interface customization. Developers and integrators should refer to the GEM PRECARE Developers Guide.

Administrators should refer to the GEM PRECARE GEM Administrator.

Document Organization

This User Guide is organized starting with an overview of the GEM PRECARE platform and GEM agents.

1 Overview

1.1 Introduction

The GEM PRECARE platform offers manufacturers the ability to easily connect to legacy and new factory floor machinery and access critical operational multi-dimensional (results, statuses, augmentive) data in real-time. GEM PRECARE combines powerful, best-in-class edge processing, analytics and predictive maintenance capabilities with versatile and user-friendly dashboards, which provide a uniform representation across all equipment assets.

GEM PRECARE includes powerful analytics, such as Quality, Availability, Performance and Custom, as well as predictive maintenance features to enable significant reductions in equipment downtime, hence positively effecting quality control, productivity and revenues. GEM PRECARE can be used in a private, public or hybrid cloud configuration.

GEM PRECARE integrates a wide variety of software agents and sensors which are tailored to suit each specific type of machine. These agents support a wide choice of different hardware platforms, including PCs, mobile devices, custom hardware, CPUs, FPGAs and more for factory floor data acquisition and enhanced, complex processing at the edge, including sensor signal processing, machine learning and complex event processing.

Although this GEM PRECARE has been tailored for application in the manufacturing industry, and more narrowly for the electronics manufacturing industry, GEM PRECARE is by no means limited as such and can be tailored to be an equipment asset management solution for any industry, including but not limited to other manufacturing sectors, healthcare, retail, energy production and distribution, etc.

1.2 Agent-Cloud Architecture

GEM PRECARE uses GEM Agents for equipment data acquisition and optional complex processing in case of minimum latency requirements. Complex processing can include any combination of signal processing, complex event processing and machine learning.

The GEM agent data from one or more agents is processed by the GEM PRECARE cloud platform for more comprehensive analytics for preventive and predictive maintenance, such as MTBF, MTBA and OEE, as well as equipment status and health monitoring. Figure 1 provides a functional overview of the platform.

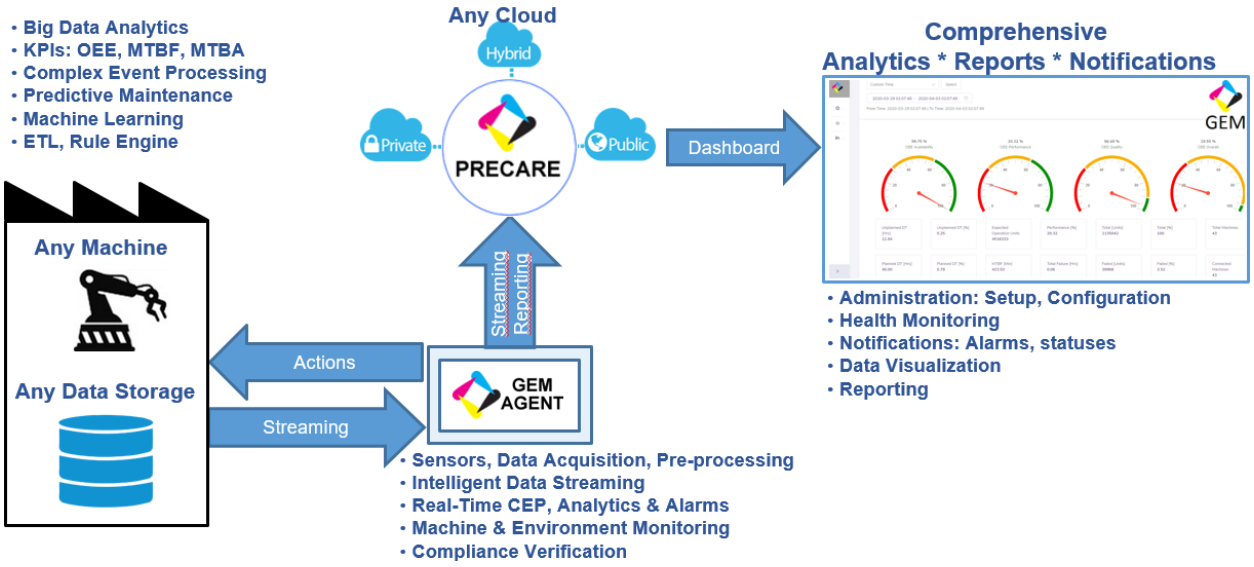


Figure 1: GEM PRECARE functional diagram

1.1.1 GEM Agents

GEM agents are responsible for real-time data acquisition. GEM agents support a range of sensors so that data acquisition can be supported for any of the following cases:

- Directly from the machine.
- From the PLC which controls the machine.
- From the machine and the PLC in case additional machine data is desired which is not provided by the PLC.
- From the machine, the PLC and the environment.

Data collected is streamed in real-time to the GEM PRECARE cloud platform, but can also be processed directly by the agent for latency sensitive actions, such as raising an alarm and compliance verification. The agents are also capable of performing data analytics and complex event processing to meet minimum latency requirements.

GEM agents uniquely support legacy machines and PLCs that are not equipped to provide the required operational data, as well as newer machines and PLCs that are equipped to provide a range of operational data.

1.1.2 GEM PRECARE Cloud Platform

The GEM PRECARE cloud platform is responsible for the processing of all GEM agent data being received. This processing includes, but is not limited to machine stats, big data analytics, complex event processing, rule-based event processing and machine learning. In addition future capabilities may include retrieving data from an MES, ERP or other backend system.

GEM PRECARE can run in a private, public or hybrid private/public cloud environment, or even on a dedicated server within the factory or organization.

GEM PRECARE also includes a comprehensive dashboard, which formats any processed and stored data for visualization and presentation. The dashboard supports a multitude of different GUI widgets, each specializing in the optimal way in which to visualize and present data for machine health monitoring, preventive and predictive maintenance OEE, MTBF, MTBA, logs, etc. These GUI widgets include analog meters, pie-charts, bar charts, graphs, tables, maps and more.

1.3 Factory Integration

GEM agents and GEM PRECARE easily integrate with existing manufacturing workflows, since they are overlaid on top of these workflows instead of inserted into or replacing parts of a workflow. See Figure 2.

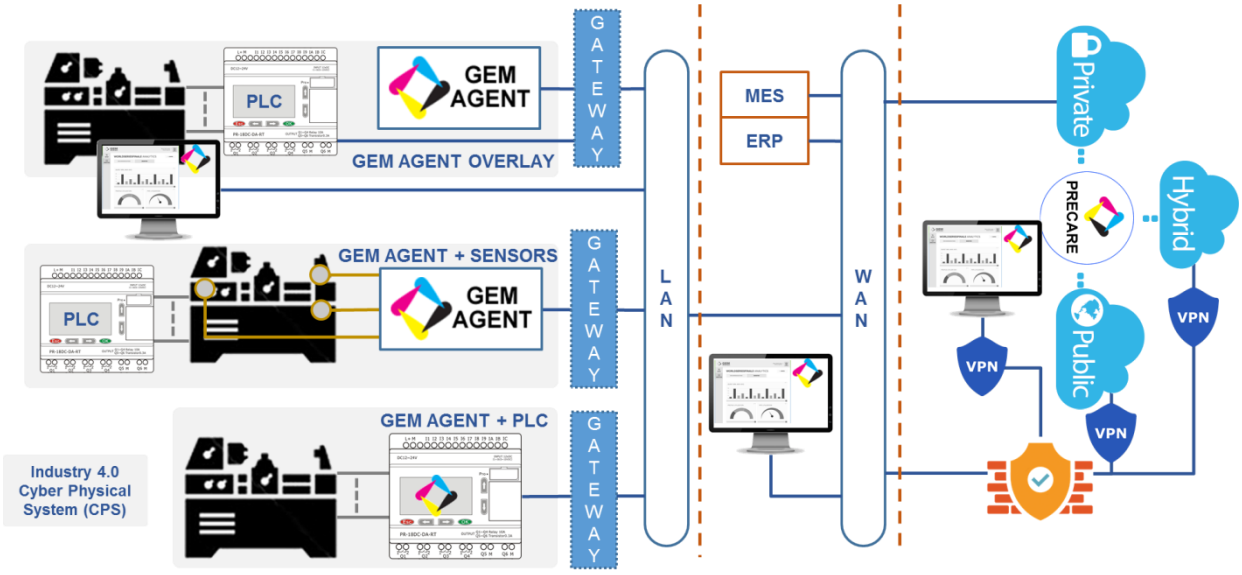


Figure 2: GEM agent and GEM PRECARE manufacturing workflow integration

1.3.1 Any Machine Support

A GEM agent turns any legacy or newer machine into a CPS, providing a digital twin representation of the physical machine in cyber space.

A GEM agent is paired with each machine. The GEM agent can communicate with a PLC over Ethernet or Industrial Ethernet if the PLC has this capability. In this case the GEM agent extracts most or all of the machine data through the PLC. For instance, the PLC may be storing machine statuses and events in local Flash memory or SD card.

Alternatively, a GEM agent can be integrated in the PLC itself as a software module in case the PLC has adequate processing power. Lastly, a GEM agent can also operate as an entirely independent entity from the PLC and harvests machine status and event data directly from the machine itself, using sensors. In this case the PLC is mostly a legacy, older device, with no Ethernet communication capabilities or other data communication capabilities with an external computer system while the PLC is operating the machine.

Lastly, a GEM agent can also support a hybrid model, in which it receives machine data partially from the PLC and from sensors hooked up to the agent. This situation is fairly common between newer as well as older machines and older PLCs.

1.3.2 Secure Communication

Cyber security takes central stage in the GEM PRECARE platform. GEM agents and GEM PRECARE use data encryption to communicate with each other over Ethernet across corporate firewalls and through corporate VPNs, while GEM PRECARE user access is fully password protected. GEM PRECARE platform servers may reside in the enterprise itself, in a private cloud, in a public cloud or in a hybrid private/public cloud.

2 User Access

2.1 Login

To access the GEM PRECARE login screen, enter the following URL in your browser's navigation box: ***https:\\my_precare.precare.gembo.co***. Replace ***my_precare*** with the keyword provided to you by GEM.

In the login screen enter your organization, user name and password. Click on ***Access*** to submit your account information. See Figure 3.

Figure 3: GEM PRECARE login screen

A successful login brings up a home screen as in Figure 4. The choice of home screen can be set up separately as explained further below.

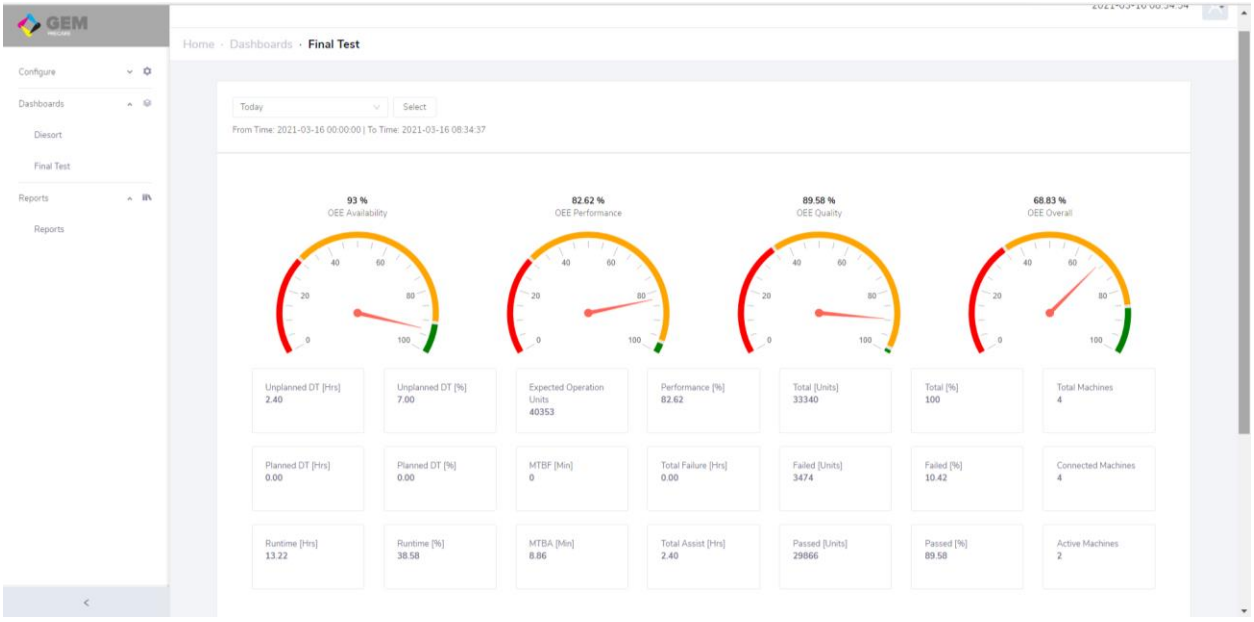


Figure 4: Home screen

2.2 Top Menu Bar

The top menu bar in Figure 5 is global to the GEM PRECARE platform and consists of the following:

1. Data and time. Displays the current date and time[1].
2. User Icon. Click on the icon to be able to see the username and Role. Click on Log out to terminate the user

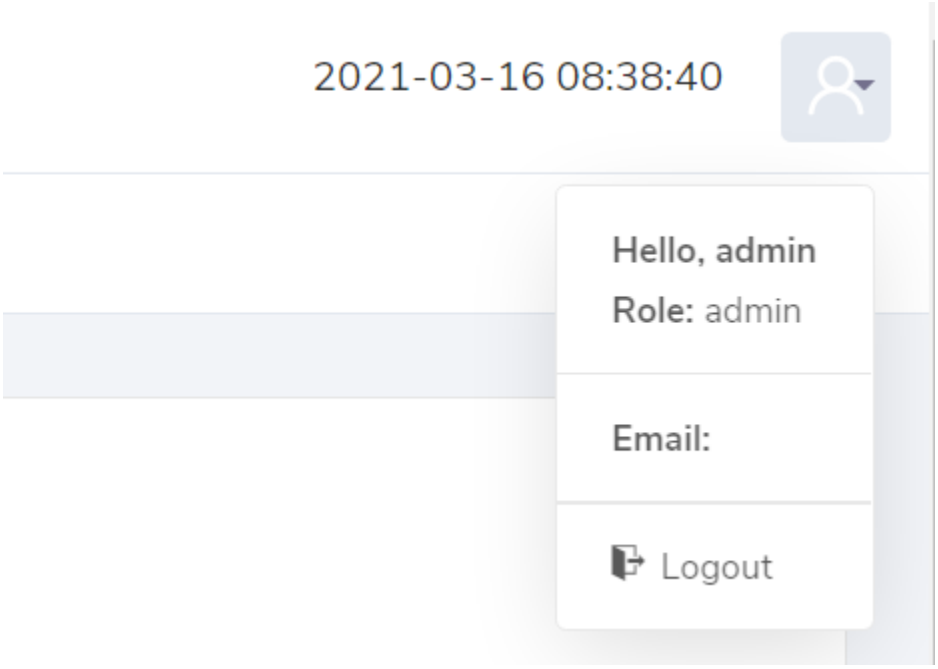


Figure 5: Global top menu bar

2.3 Side Menu Bar

The side menu shown in Figure 6 provides access to a Configuration ,an Analytics Dashboards, and Reports menu.

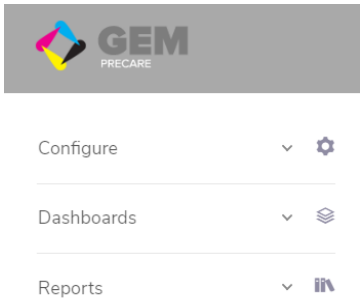


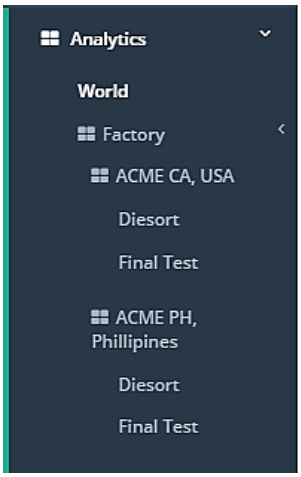
Figure 6: Side menu

[1] Time is recorded as Local time of the factory.

3 Analytics

The side menu shown in Figure 7 provides the flexibility to show initial factory, floor hierarchy, customized.

In case of multiple world factories: hierarchy of all factories (In case of multiple world locations, (example: ACME CA, USA and ACME PH) and factory floors (example: Die Sort and Final Test). Each machine's analytics and statuses are individually accessible at the floor level.



In case of one factory with 2 floors, showing only the floors:

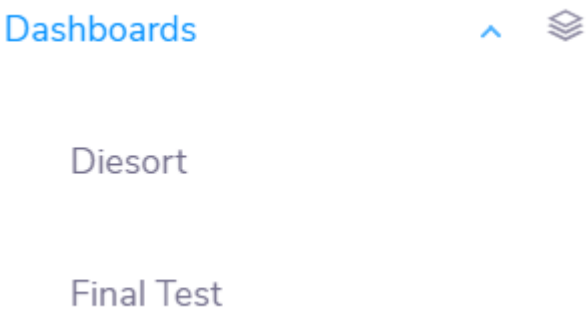


Figure 7: Analytical Dashboard menu

3.1.1 World Dashboard

The World level allows the user to see information across the complete corporation, multiple factories and any other installation sites. An example dashboard at the world level is shown in Figure 8. The appearance of this dashboard is customizable in terms of the different widgets and sections. Therefore Figure 8 serves only as an example. Nonetheless, it is representative of the widgets and how the dashboard is generically structured.

Figure 8: World level analytics and status dashboard

Dashboard as shown in figure 8, shows the location of all factories on world map. This dashboard will be provided only upon request and once the customer has multiple factories onboarded.**Time Selection**

The Widget offer multiple type of time selection. Once selected will apply on the widget below it.

OEE

Four gauges provide OEE analytics for Availability, Performance, Quality and Overall. See Appendix A for OEE metric definitions and calculations.

Active Machines

The horizontal bar graph provides data on three parameters:

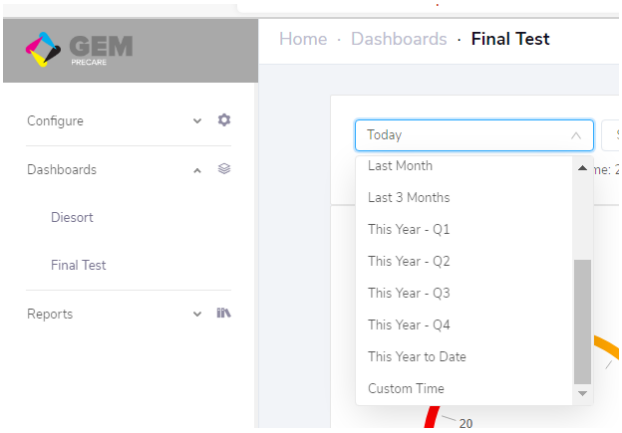
1. Total. The total number of machines.
2. Connected. The total number of machines connected to a GEM PRECARE agent.
3. Active. The total number of machines that reported activity in .

3.1.2 Factory Dashboard

An example dashboard at the factory level is shown in Figure 9. The appearance of this dashboard is highly customizable in terms of the different widgets and sections. Therefore Figure 9 serves only as an example. Nonetheless, it is representative of the widgets and how the dashboard is generically structured.

3.1.2.1 Top Level Analytics

Time Selection



The Widget offer multiple type of time selection. Once selected will apply on the widget below it.

OEE

Four gauges provide OEE analytics for Availability, Performance, Quality and Overall. See Appendix A for OEE metric definitions and calculations.

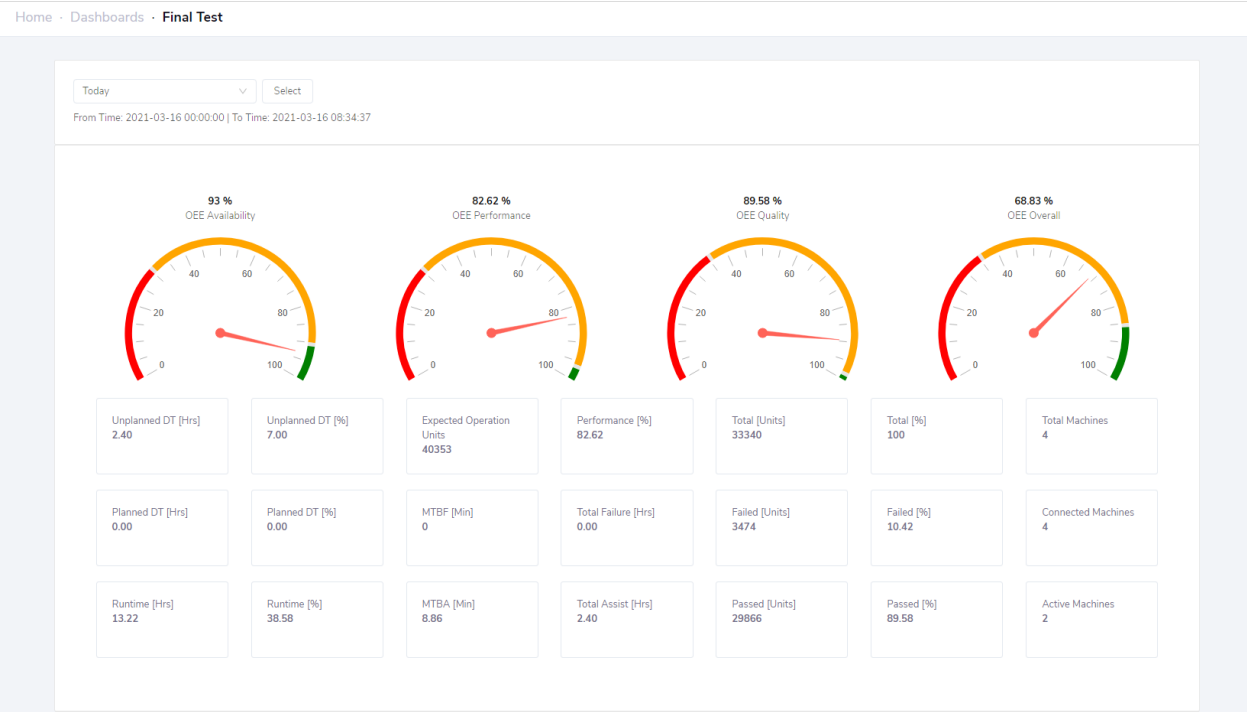


Figure 9: Factory level analytics dashboard

In addition to the different OEE gaugeskey indicators containing details for each gauge can be displayed.

OEE Availability key indicators

An example of this table is shown in Figure 10. In this table DT stands for Down Time. The **key indicators** show all planned and unplanned DT for the selected time period, in total number of hours and as a percentage of the total number of hours in the specified time period, for the entire factory.

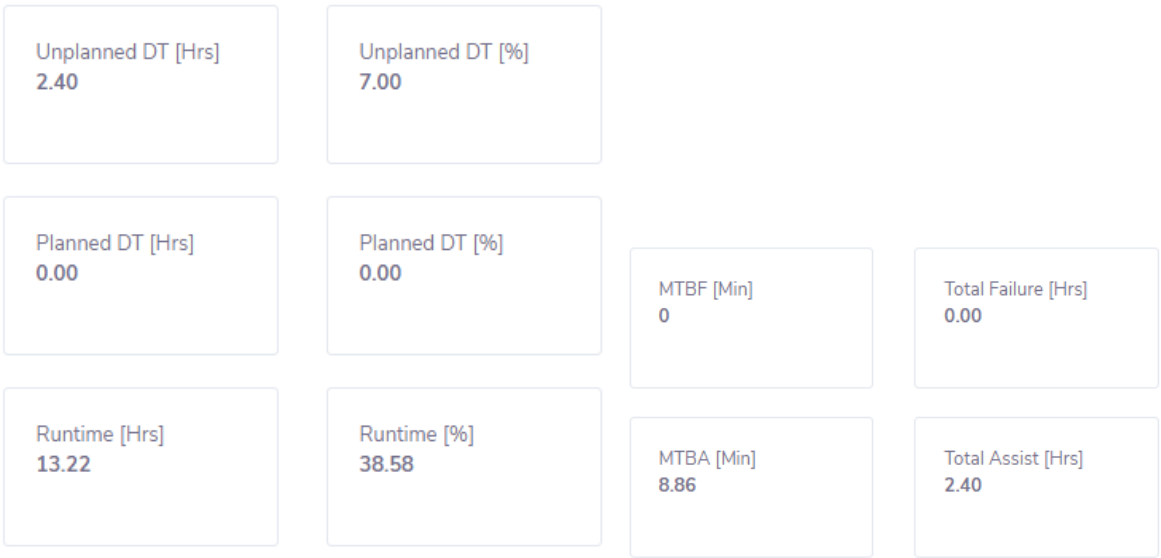


Figure 10: OEE Availability detail table

Unplanned DT includes all unexpected down time excluding any scheduled down time, such as machine malfunctions or any other unexpected event for which the machine was required to be stopped. Planned DT includes all expected and scheduled down time, such as scheduled maintenance and any other expected down time. The key indicators also include, MTBA and MTBF in minutes, and the total of assists and failures in hours for the specified time period, for the entire factory.

OEE Performance key indicators

An example of this table is shown in Figure 11. This table shows the MTBA and MTBF in minutes, and the total of assists and failures in hours for the specified time period, for the entire factory.

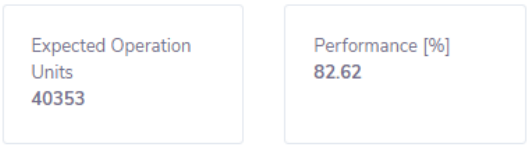


Figure 11: OEE Performance detail table

OEE Quality key indicators

An example of these **key indicators** is shown in Figure 12. These **key indicators** shows the total number of units produced, the total number of units that failed and the total number of units that passed, for the specified time period.

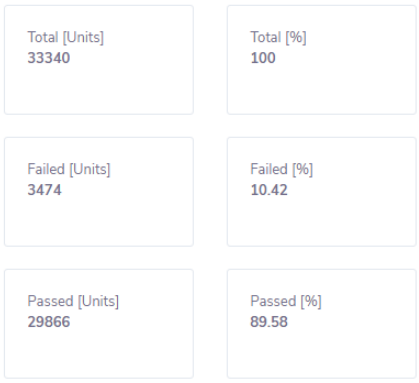


Figure 12: OEE Quality detail table

3.1.2.2 Dynamic Analytics

As part of the onboarding of each installation/ factory, the platform ingest a hierarchical model of it. With that the GEM PRECARE platform processing engines, automatically correlate each data elements to its corresponding hierarchical level.

The platform any-hierarchy-level-analytics using the information above: allows the user to navigate across the factory levels, and at each level, generate analytics.

At this level a menu is presented from which the following actions can be undertaken:

1. Click on dropdown under Analytics section
2. Navigate to the desired hierarchy (up or down) by selecting the given name of hierarchy.
3. Click on “Get Analytics” button at any level of hierarchy to get the detailed OEE analytics

An example of this menu is shown in Figure 13. The appearance of this menu is customizable. Therefore Figure 13 serves only as an example. Nonetheless, it is representative of the way the menu is generically structured.

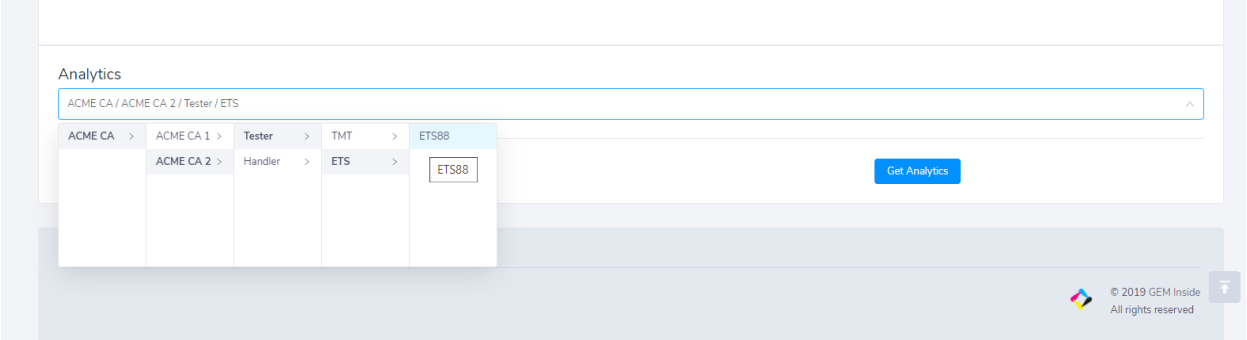


Figure 13: Machine type level dashboard

At every level the same types of analytics are displayed as shown before:

1. OEE Availability
2. OEE Performance
3. OEE Quality
4. OEE Overall
5. Table with details for each OEE type
6. MTBA
7. MTBF

In addition a separate analytics menu is displayed as shown in Figure 14. The appearance of this menu is customizable. Therefore Figure 14 serves only as an example. Nonetheless, it is representative of the way the menu is generically structured.

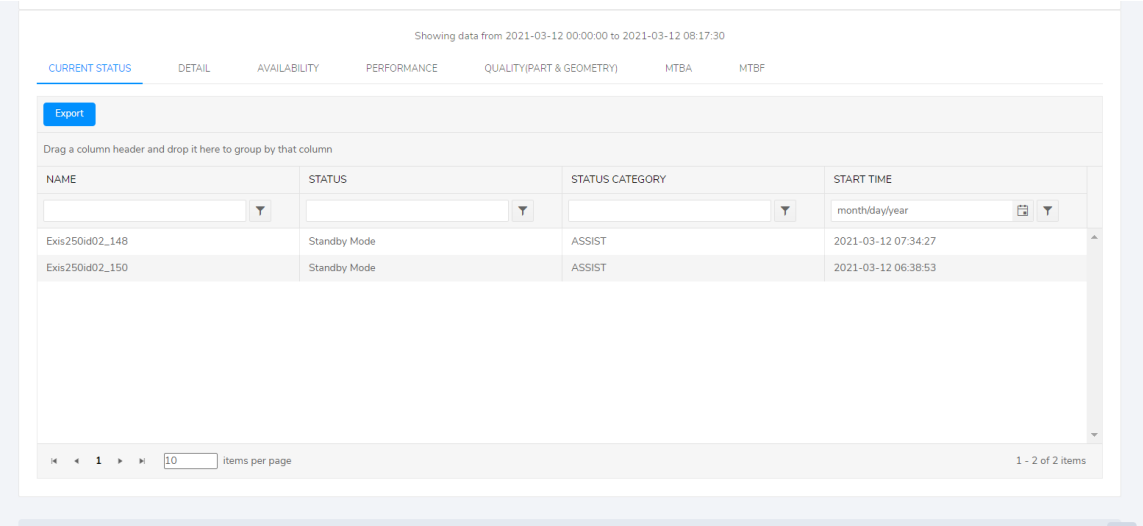


Figure 14: Analytics menu with current status table

Status

A table as Figure 14 displays the status for each machine at the selected hierarchy level for the selected time period. This table shows for each machine assist and failure events, what type of assist or failure per event with an explanation and the cumulative duration per event for the specified period of time.

(Event) Detail

A table as in Figure 15 displays for each machine for the selected time period each individual occurrence of each event with the start date and time and the duration of the occurrence.

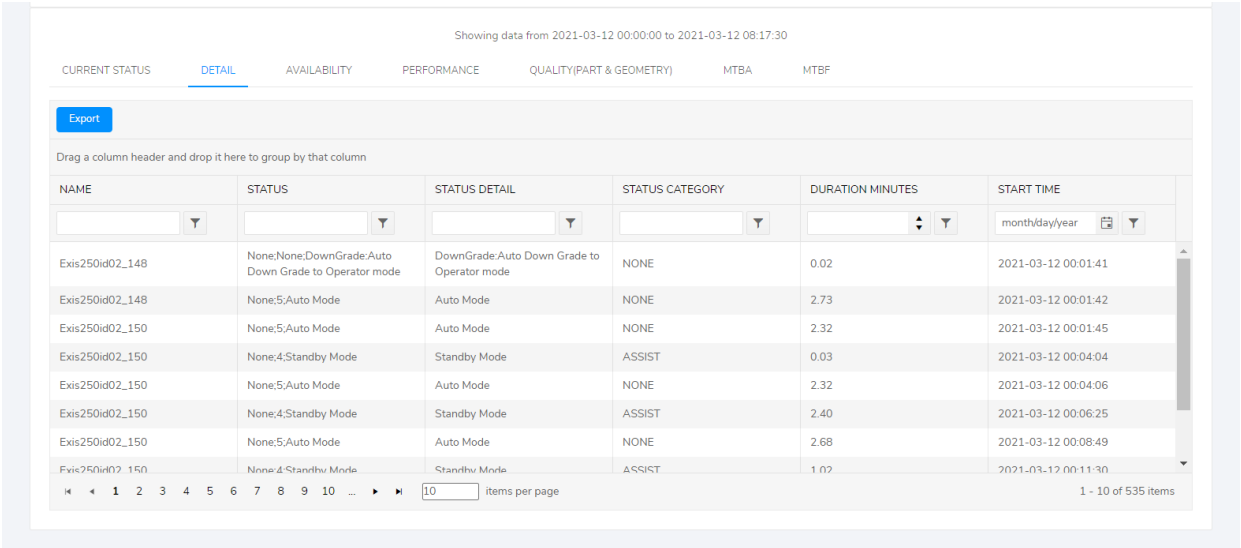


Figure 15: Event detail table

OEE Availability

A table as in Figure 16 displays the details for OEE Availability per machine.

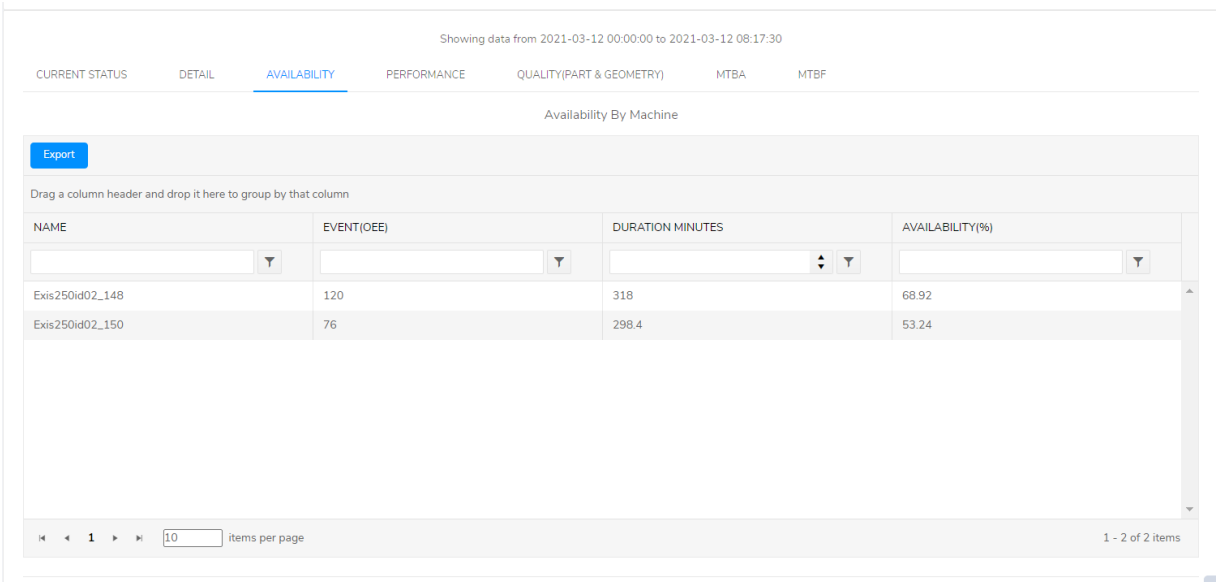


Figure 16: OEE Availability detail table

In this table the details for OEE Availability are shown in terms of

Name: The machine/ host/ asset name.

Events (OEE): Total Number of Events where the machine was available (working in normal operation).

Duration Minutes: Total Duration in minutes where the machine was available (working in normal operation).

Availability [%]: Percent of the time the machine was available (working in normal operation). This is the “OEE Availability” for that specific machine, for the specific time frame selected.

Note: Each machine/ asset/ host onboarded to oee availability analytics, is models with a digital twin. as part of that model, status categories are assigned. Default statuses are: ASSIST (machine waiting assistance), FAILURE (machine failed), NONE (normal operation).

A graph in Figure 16.1 displays the details for OEE Drains per category.

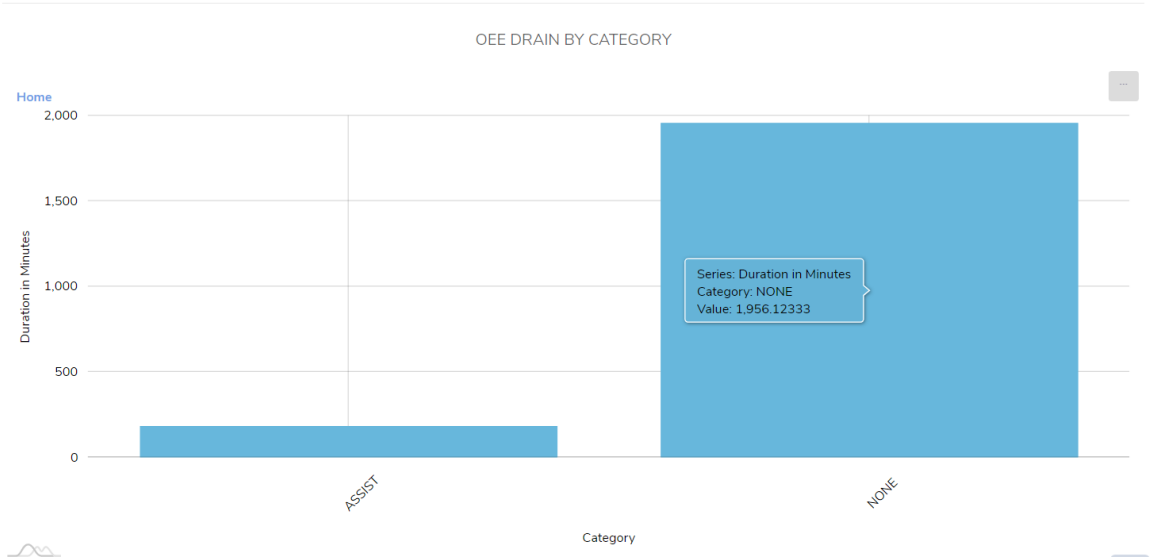


Figure 16.1: OEE Drains by category (Top Level)

The top level of graph displays total sum of duration per category of all machines under selected hierarchy and timeframe.

x-axis: Category

y-axis: Sum of duration in minutes per category

A graph in Figure 16.2 displays the drilldown level.

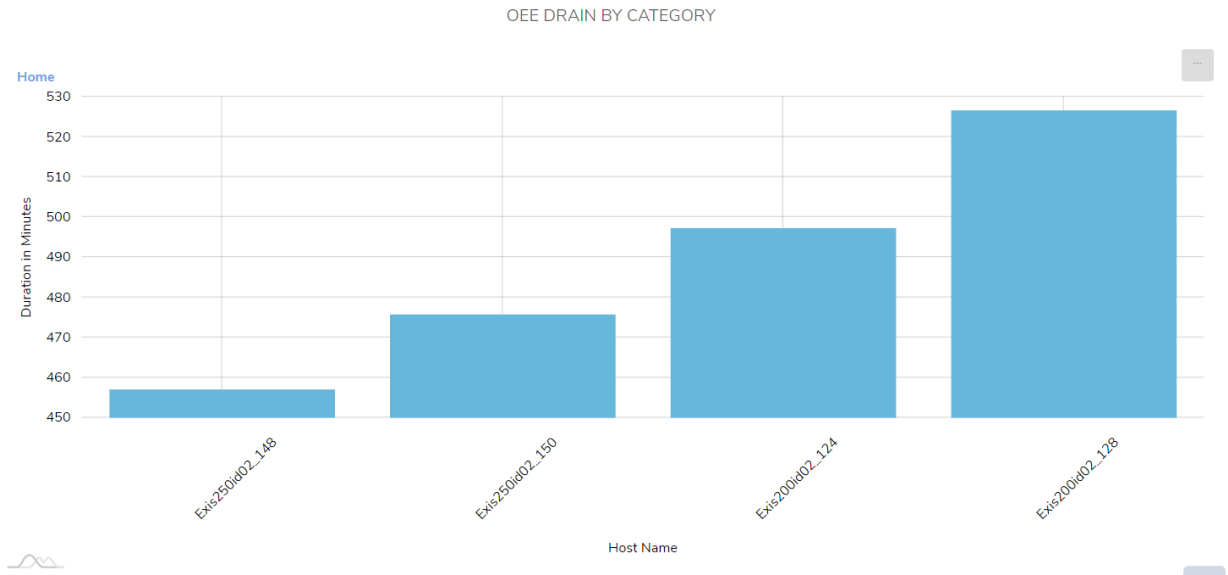


Figure 16.2: OEE Drains by category (Drilldown Level)

The drilldown level can be visualized by clicking on “category” bar shown in figure 17

The drilldown level of graph displays detailed information in terms of total sum of events duration for each selected category per machine

x-axis: Machine name

y-axis: Sum of duration in minutes per machine

A graph in Figure 16.3 displays the details for OEE Drains per machine.

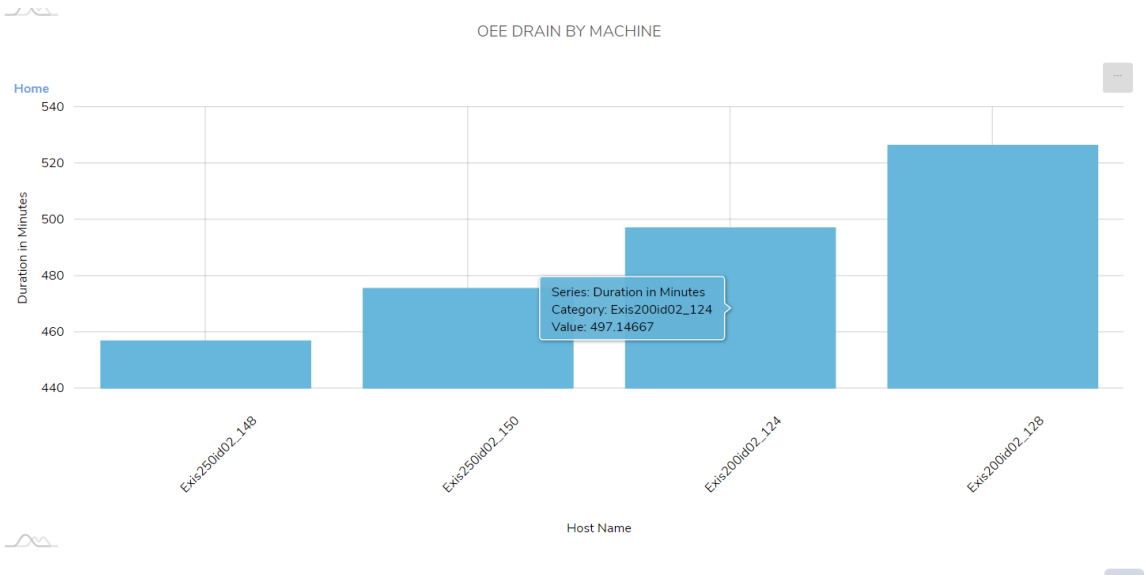


Figure 16.3: OEE Drains by machine (Top Level)

The top level of graph displays total sum of duration per machine under selected hierarchy and timeframe.

x-axis: Machine name

y-axis: Sum of duration in minutes per machine

A graph in Figure 16.4 displays the drilldown level.

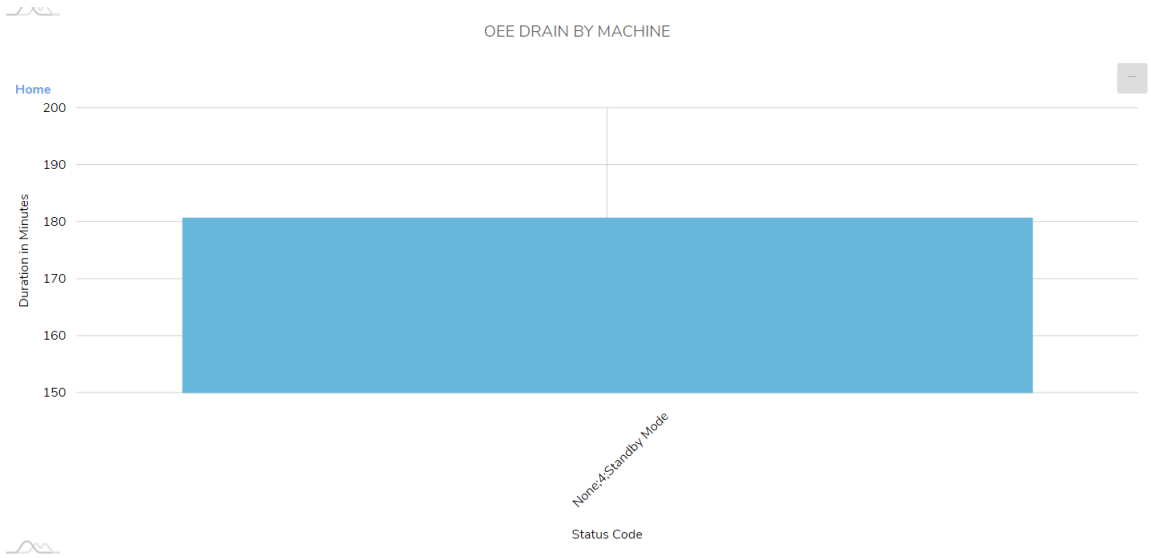


Figure 16.4: OEE Drains by status code (Drilldown Level)

The drilldown level can be visualized by clicking on “Machine name” bar shown in figure 19

The drilldown level of graph displays detailed information in terms of total sum of events duration for each status code of selected machine

x-axis: Machine Status Code

y-axis: Sum of duration in minutes per machine

OEE Performance

A table as shown in below Figure displays the total number of actual and expected units and performance [%] per machine in the specified time period and under selected hierarchy

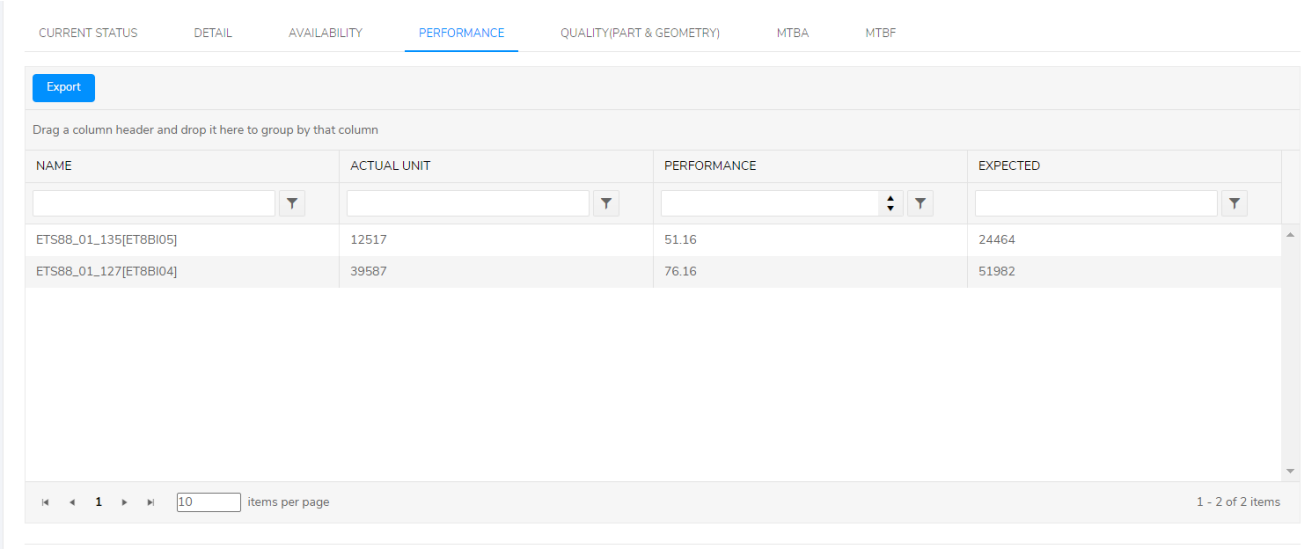


Figure: Performance Detail Table

MTBA

A table as in Figure 17 displays the MTBA details per machine in terms of the MTBA itself, the cumulative duration and number of assist occurrences in the specified time period. Also shown is the MTBA in minutes for the whole group of machines the analytics are displayed for. This is the simple ratio of the total of all machine MTBAs and the total of the number of machines

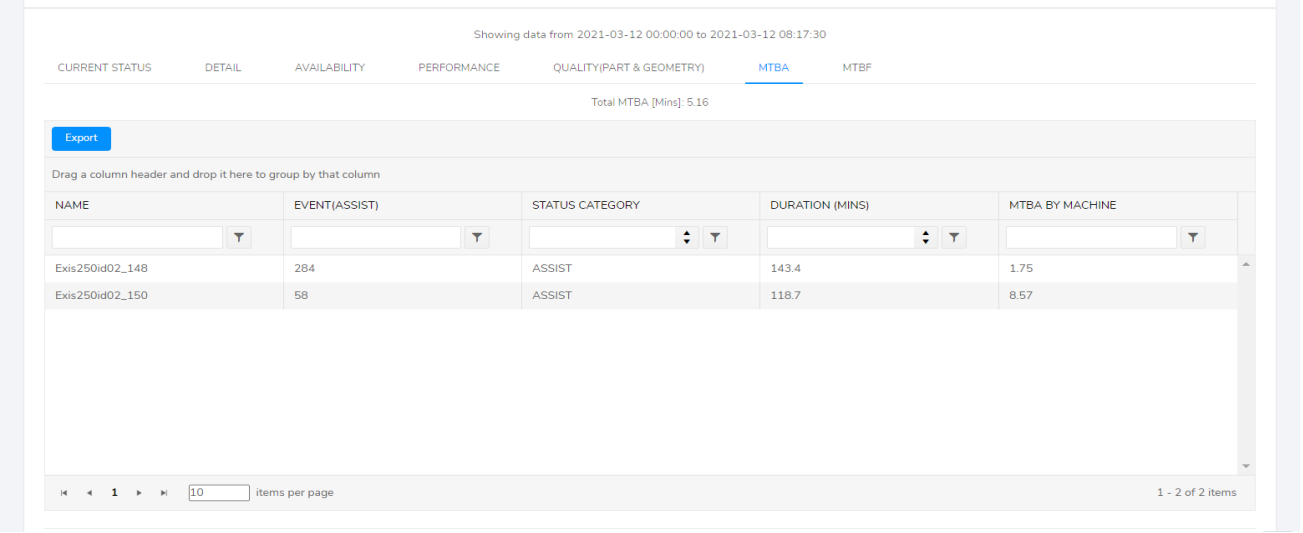


Figure 17: MTBA detail table

In addition the details per machine can be viewed for each assist occurrence within the specified time period. This includes the start time, duration status classification and explanation.

A graph in Figure 17.1 displays the details for MTBA Drains per machine status code.

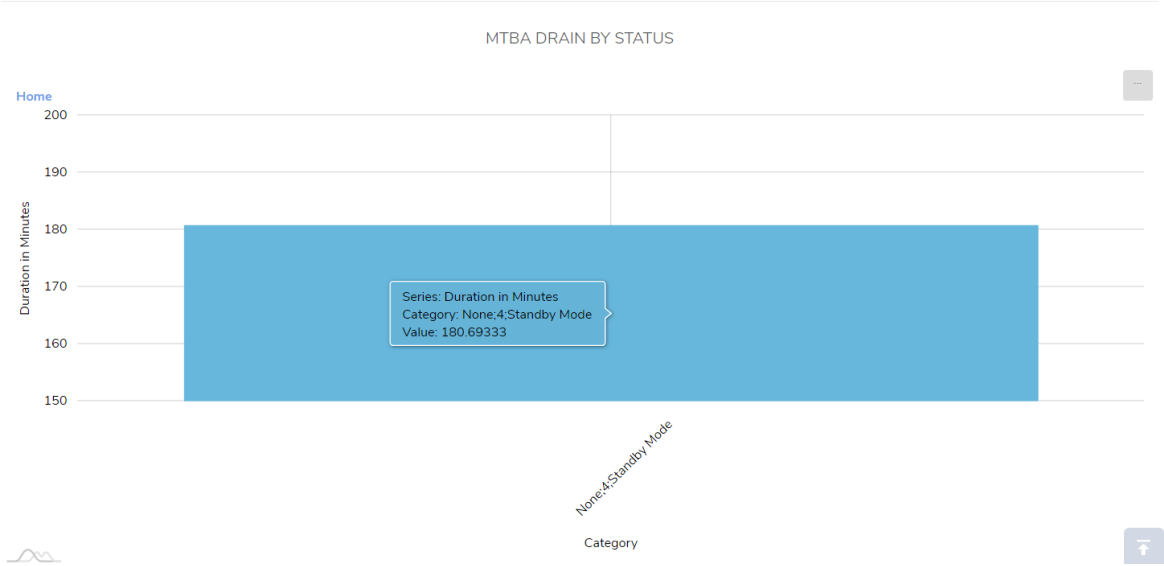


Figure 17.1: OEE Drains per status code (Top Level)

The top level of graph displays total sum of duration per Machine Status under selected hierarchy and timeframe.

x-axis: Machine status

y-axis: Sum of duration in minutes per status

A graph in Figure 17.2 displays the drilldown level to visualize per machine data of selected status code

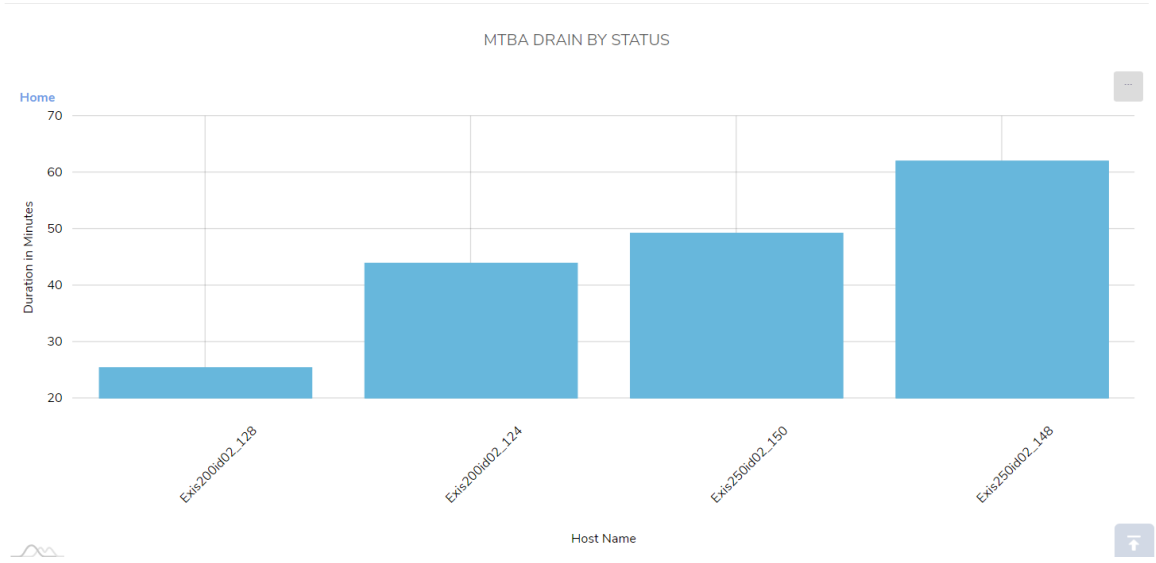


Figure 17.2: OEE Drains per machine (Drilldown Level)

The drilldown level can be visualized by clicking on “Status code” bar shown in figure 17.1

The drilldown level of graph displays detailed information in terms of total sum of events duration for each status code of selected machine

x-axis: Machine Name

y-axis: Sum of duration in minutes per machine

MTBF

A table as in Figure 18 displays the MTBF details per machine in terms of the MTBF itself, the cumulative duration and number of assist occurrences in the specified time period. Also shown is the MTBF in minutes for the whole group of machines the analytics are displayed for. This is the simple ratio of the total of all machine MTBFs and the total of the number of machines.

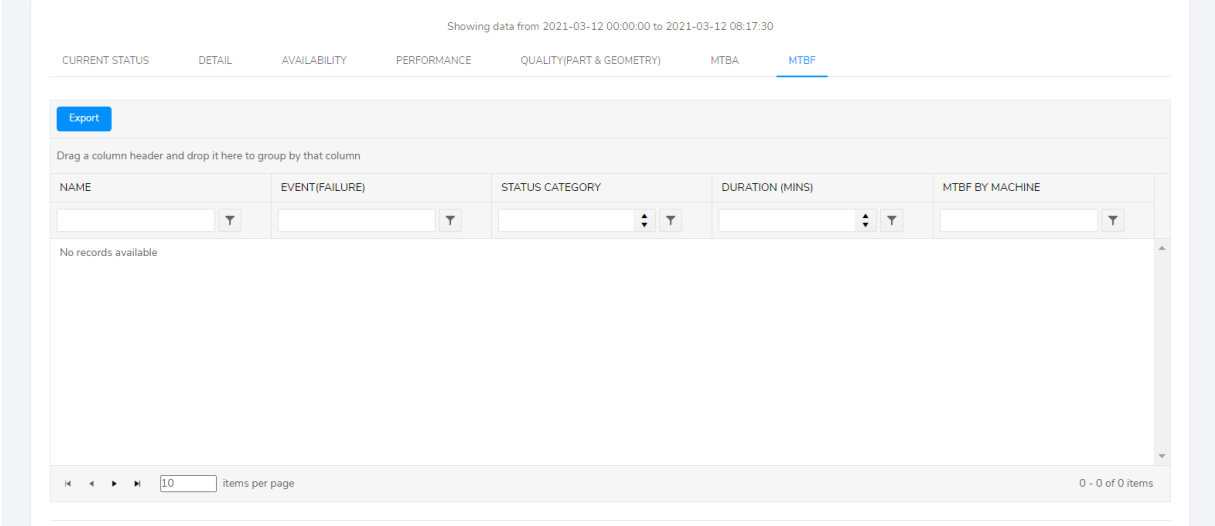
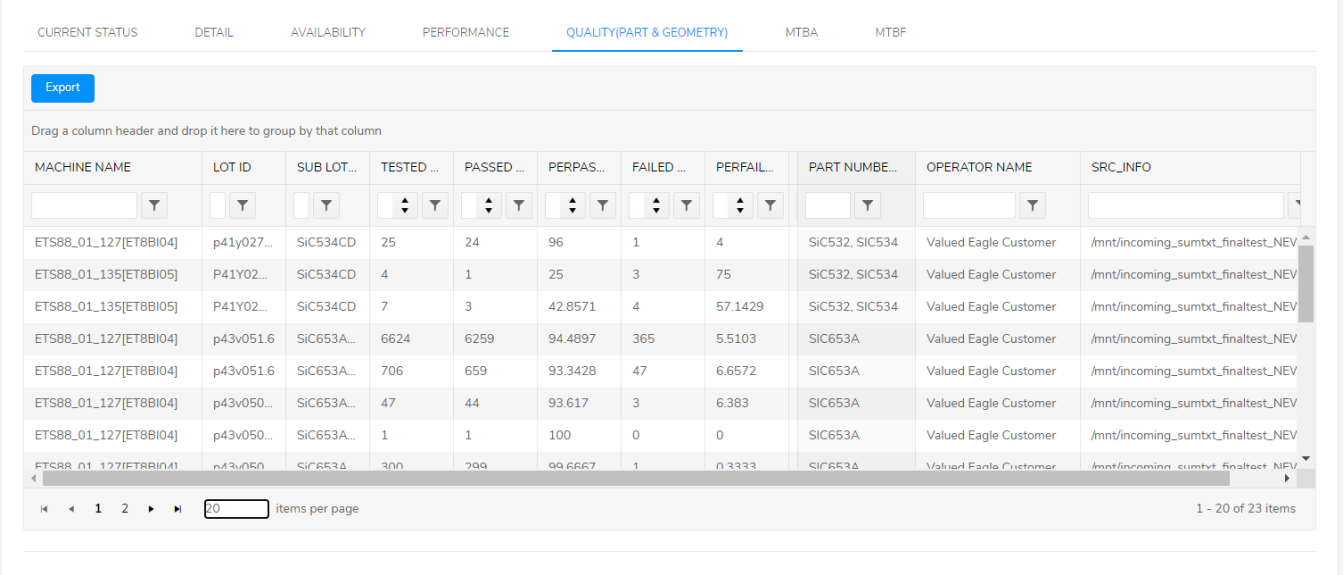


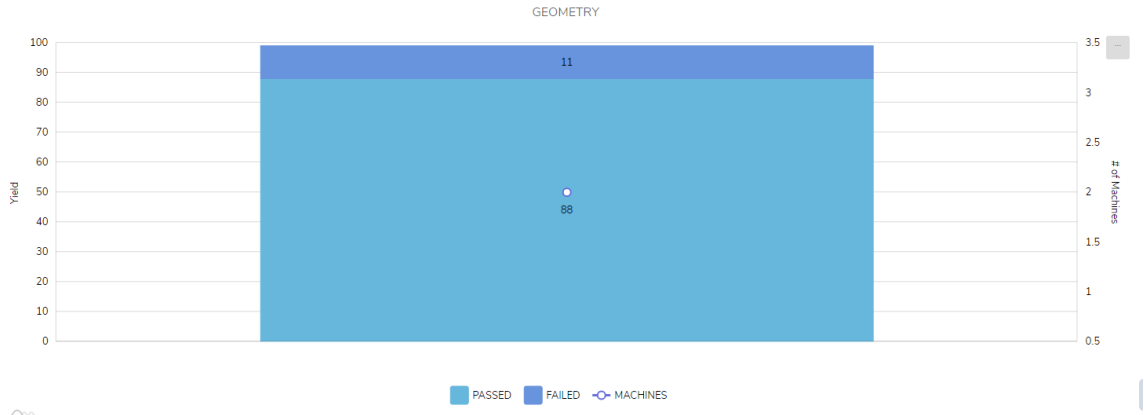
Figure 18: MTBF detail table

In addition the details per machine can be viewed for each assist occurrence within the specified time period. This includes the start time, duration status classification and explanation.

OEE Quality (**Part & Geometry)**

A chart and graph as shown in Figure 19 displays the total number of passed and failed units in the specified time period for each part and geometry, as well as the number of machines used.





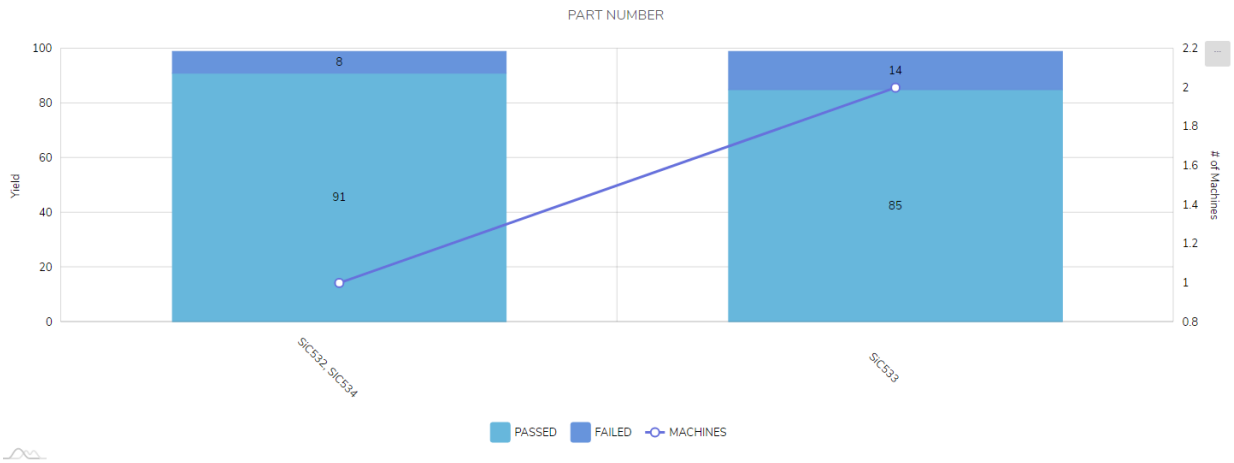


Figure 19: Part & Geometry detail chart & graph

4 Configuration

The ***Configure*** menu expands into the ***Sessions***, ***Sensors***, ***Hosts*** and ***Settings*** menu options, shown in Figure 20.

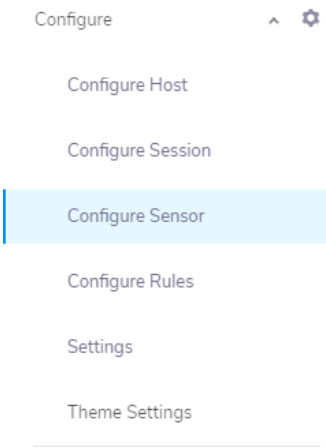


Figure 20: Configure menu

The relationship between sessions, sensors and hosts is as follows:

- A host is a logical entity which represents a GEM agent. One or more hosts can run simultaneously on the same agent hardware. Hosts communicate upstream with the GEM PRECARE platform and downstream with sensors. A host can have one or more sensors bound to it. Hosts are distinguished from each other via their ID. A host may run on multiple agent

hardware instances, where the ID is the same for each host instance[2]. Running a host across multiple agent hardware instances is transparent to GEM Precare.

- A sensor is a logical entity which represents a data port. The physical entity can be an actual sensor (temperature, humidity, accelerometer, etc.), or a virtual device, such as a PLC register or a data column in a CSV file on a PLC. Sensor types define different types of sensors, whereas sensor IDs distinguish between different sensors of the same sensor type. Two or more hosts may have sensors of the same or different sensor types bound to them, but each instance must have a unique sensor ID. Similarly, a single host may have multiple sensors where these are of the same or different sensor type bound to it. However, sensors of the same sensor type must have a unique ID. In case of multiple sensors of the same sensor type, each sensor is associated with a separate configuration. The scope of the sensor ID is global to GEM Precare, i.e., sensor IDs are unique. A sensor communicates upstream only with one host and downstream with only one session for the time that the sensor is bound to the particular host. Sensors can be stopped and bound to a different host and session at any time.
- A session is a logical entity which represents the setup and provision of a specific sensor (e.g. temperature only vs. humidity + temperature, or sampling every minute vs. every second). Session parameters can be changed on the fly without the need to stop the sensor first. More than one session can bind to the same sensor and the same session can bind to more than one sensor. In Most cases, the session can be changed while the agent is running.

Figure 21 illustrates the relationships between hosts, sensors and sessions.

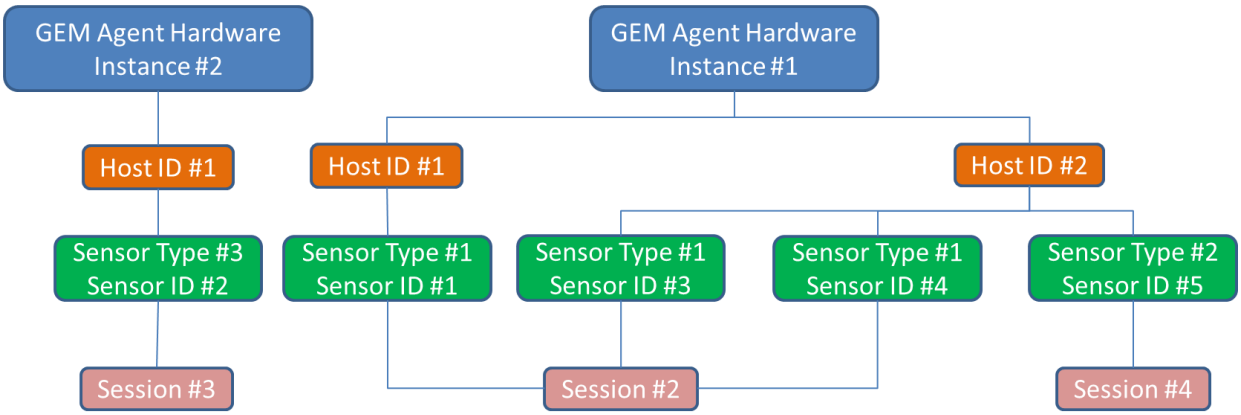


Figure 21: Relationships between hosts, sensors and sessions

4.1 Hosts

4.1.1 Host Configuration

An example of a host table is shown in Figure 22.

[2] An agent hardware instance may run more than one host, where each host has a unique ID.

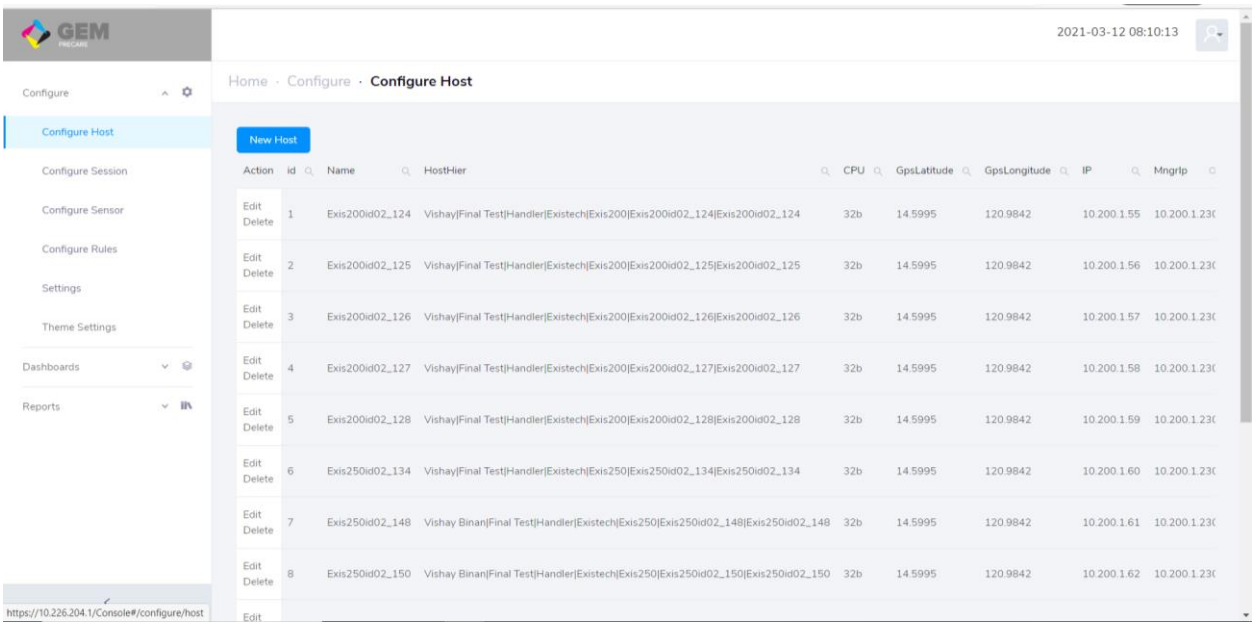


Figure 22: Host table example

The different columns are explained in Table 1.

Field	Description
Action	"View", "edit", delete" or "Add Downtime" action for selected host (machine)
Host ID	The numerical ID of the host (machine)
IP	The IP address of the host
Name	The name of the host (machine)
GPS Latitude	The latitude of the physical location of the host (machine)
GPS Longitude	The longitude of the physical location of the host (machine)
Host Hierarchy	Factory hierarchy in which the host (machine) exists
Planned Down Time	Scheduled machine down time per day in minutes per day

Table 1: The host table columns explained

A new host is added to the table via the "Add New Host" button. The form to add a new host's information is shown in Figure 23. The last row in the form is intended to specify the hierarchical levels[3] at which analytics and statuses can be displayed.

[3] Hierarchy levels are defined by the GEM Precare administrator.

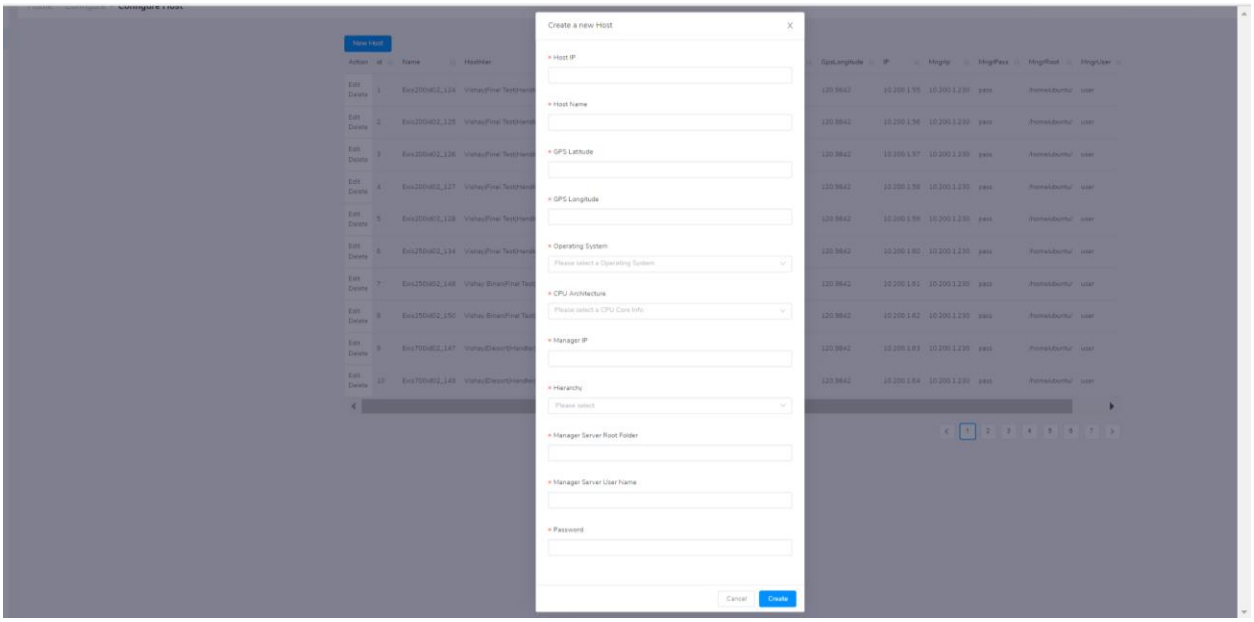


Figure 23: Add new host form

The different fields are explained in Table 2.

Field	Description
Host IP	IP address of the host (machine)
Host Name	Name of the host (machine)
GPS Latitude	The latitude of the physical location of the host (machine)
GPS Longitude	The longitude of the physical location of the host (machine)
Operating System	Host operating system (Linux or Windows)
CPU Core	Host CPU type (64-bit or 32-bit instruction set)
Manager Server IP	IP address of the server the host's manager resides on
Manager Server Root Folder	Root folder of the host's manager
Manager Server User Name	User name of the host's manager
Manager Server Password	Password of the host's manager
Host hierarchy	Factory hierarchy in which the host (machine) exists

Table 2: New host add fields explained

A selected host in the table can be deleted or updated via the "Delete" and "Edit" button respectively. See Figure 24 for the form via which a selected host is updated.

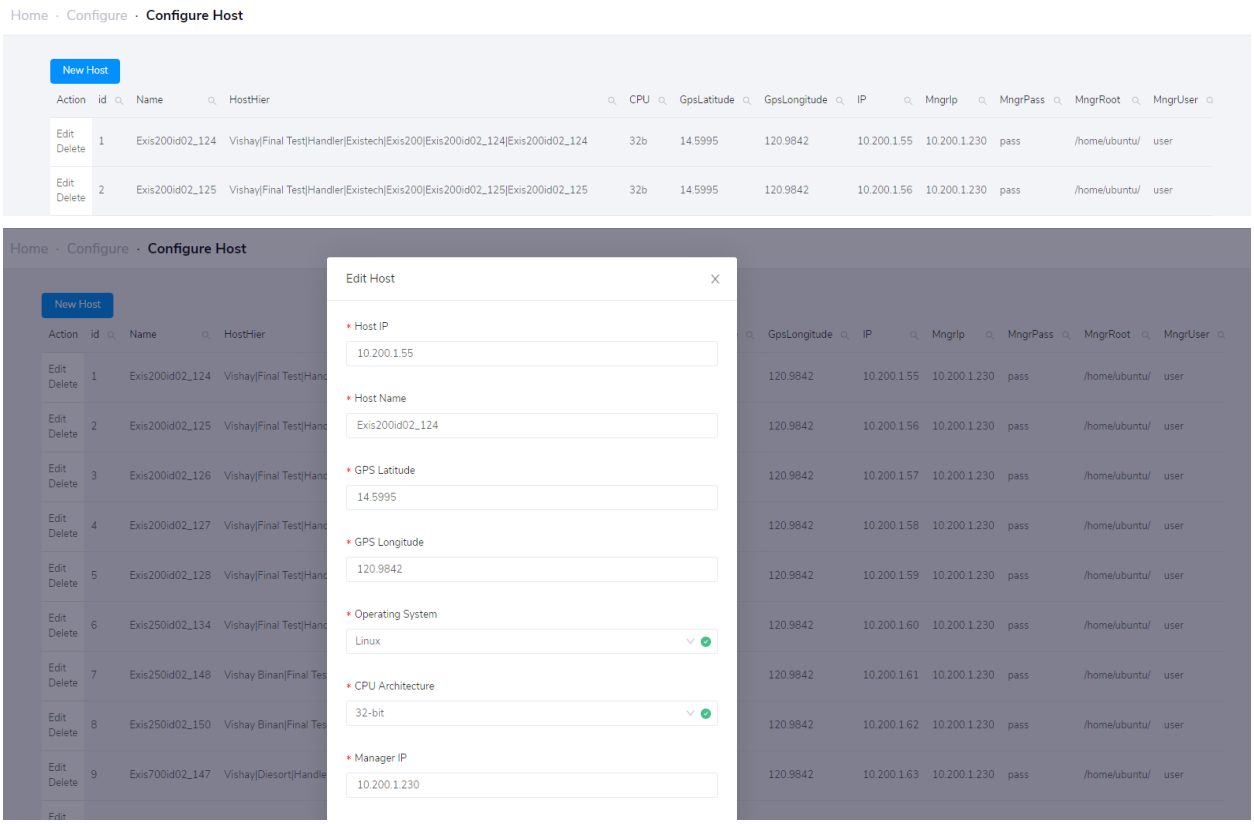


Figure 24: Edit existing host form

4.2 Sensors

An example of a sensor table is shown in Figure 27.

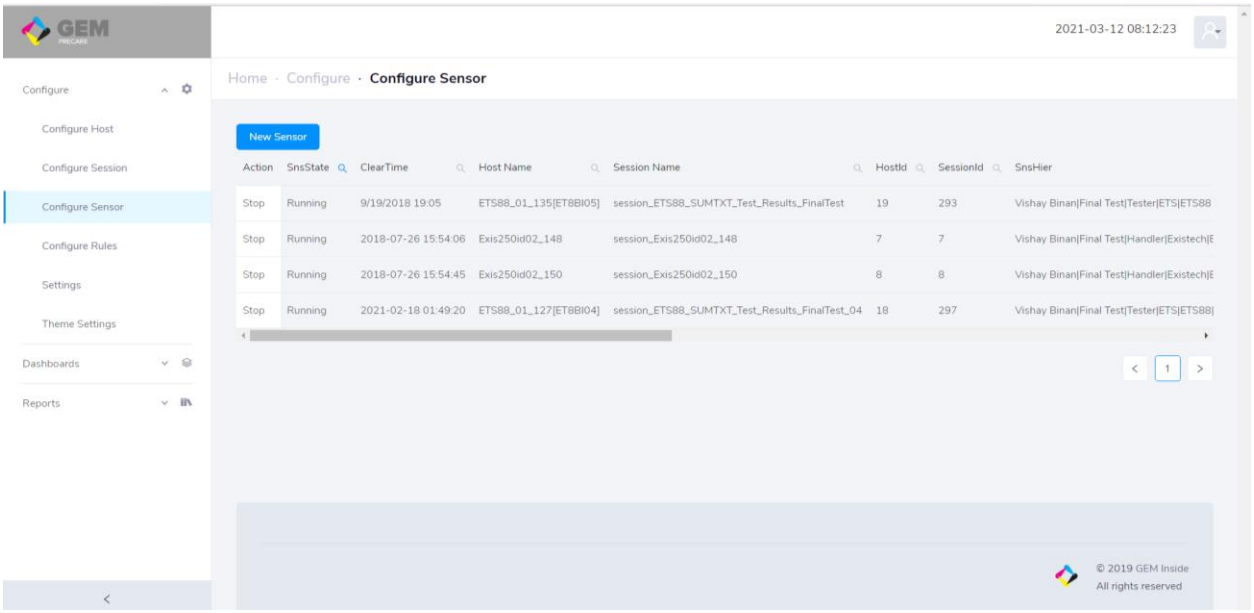


Figure 27: Sensor table example

The different columns are explained in Table 3.

Field	Description
Action	“View”, “edit”, “delete” or “stop” action for selected sensor
Sensor State	Operational state of the sensor (running or stopped)
Sensor ID	Numerical ID of the sensor
Sensor Name	Name of the sensor
Sensor Host	The host that the sensor binds to
Sensor Type	The type of sensor
Session	The session that binds to the sensor
Sensor Owner	The owner of the sensor
Sensor Hierarchy	Factory hierarchy in which the sensor exists

Table 3: The sensor table columns explained

A new sensor is added to the table via the “New Sensor” button. The form to enter a new sensor’s information is shown in Figure 28.

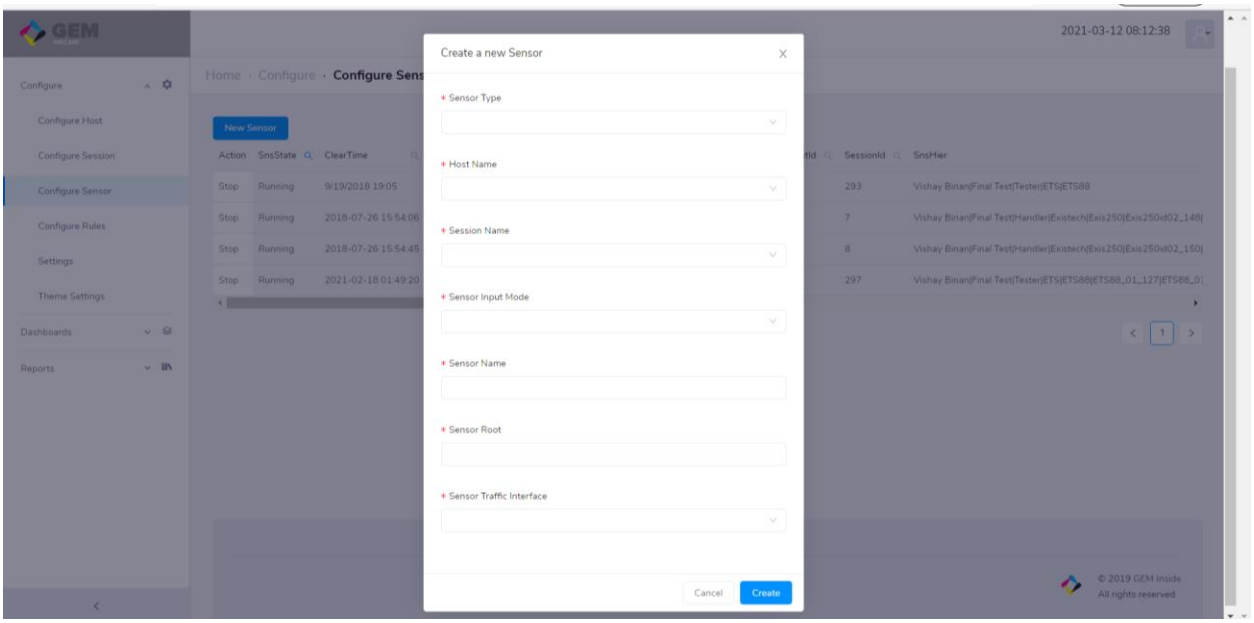


Figure 28: Add new sensor form

The different fields are explained in Table 4.

Field	Description
Host Name	The host that the sensor binds to
Sensor Type	The type of sensor
Session Name	The session that binds to the sensor
Sensor Input Mode	Input mode of the sensor (real-time or batch mode)
Sensor Name	Name of the sensor
Sensor Root	Sensor root folder
Sensor Traffic Interface	The traffic interface of the sensor (1 - default, or 2)

Table 4: New sensor add fields explained

A selected sensor in the table can be deleted, updated or stopped via the “Delete”,“Edit”, “Run/Stop” button. A sensor can only be deleted or updated once it has been stopped. See Figure 29 for the form via which a selected sensor is updated.

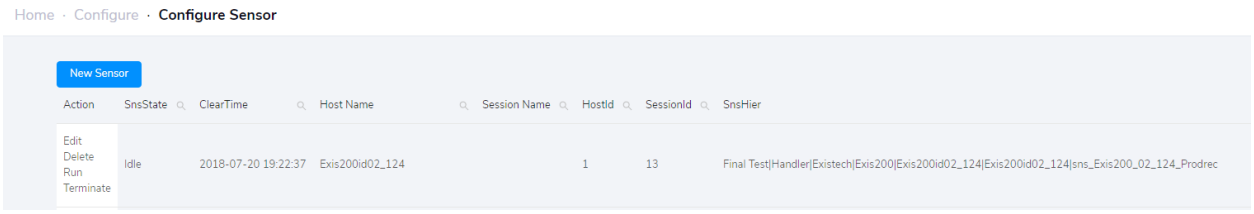


Figure 29: Edit existing sensor form

4.3 Sessions

An example of a session table is shown in Figure 30.

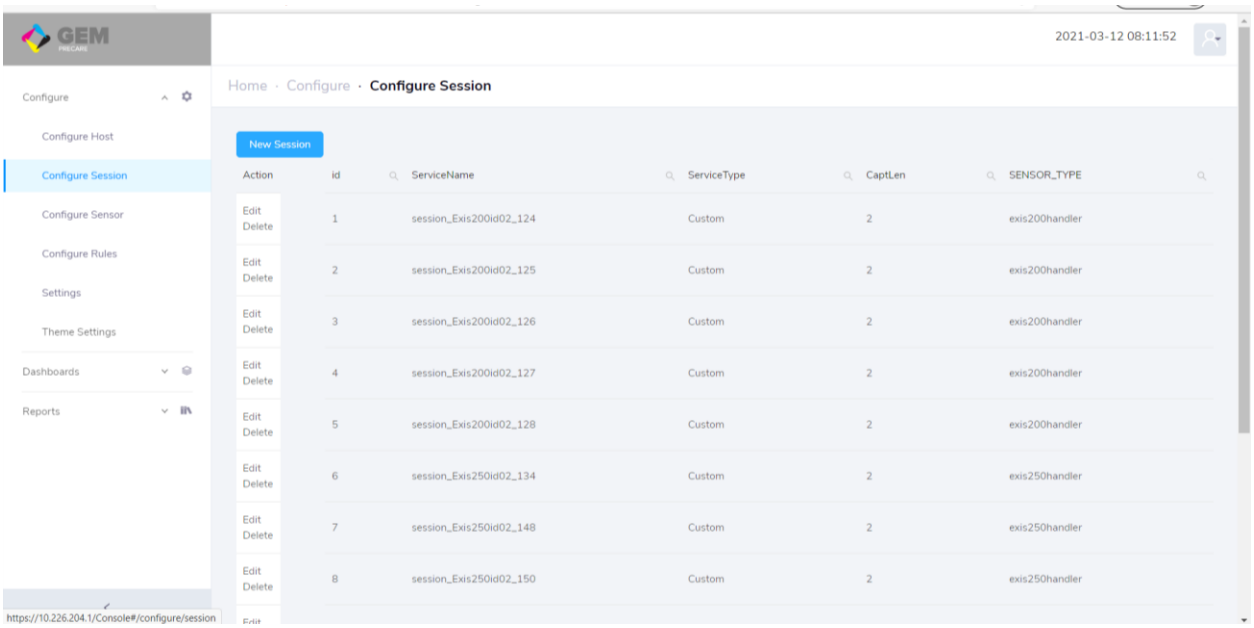


Figure 30: Session table example

The different columns are explained in Table 5.

Field	Description
Action	“View”, “edit” or “delete” action for selected session
Session ID	Numerical ID of the session
Session Name	Name of the session
Capture Length	The length of the data series captured by the session

Table 5: The session table columns explained

A new session is added to the table via the “New Session” button. Clicking this button brings up the screen shown in Figure 31. A list of available sensors (types) is presented for which to add a new session.

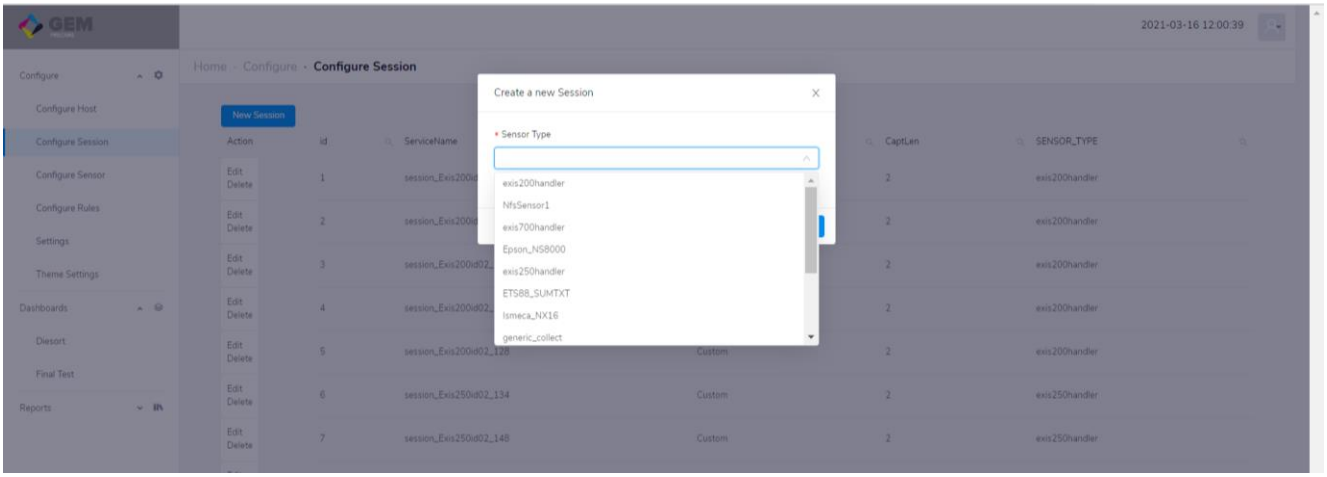


Figure 31: Sensor type list

Selecting the sensor (type) for which to add a new session from down brings up the form to enter the new session's information. Since each sensor has its own unique parameters, the screen to add the new session is sensor dependent. Note: The same is true for editing an existing session. New sessions are created by the GEM Precare administrator.

5 Settings

The menu to set widget parameter and landing page are accessed via the ***Settings*** menu.

5.1 Gauge Widget Settings

The available settings for the gauge widget are shown in Figure 30. Here ***range 1*** and ***range 2*** correspond to the first and second range on the gauge. Since the range for ***range 3*** follows from ***range 1*** and ***range 2***, only its color is listed to be specified.

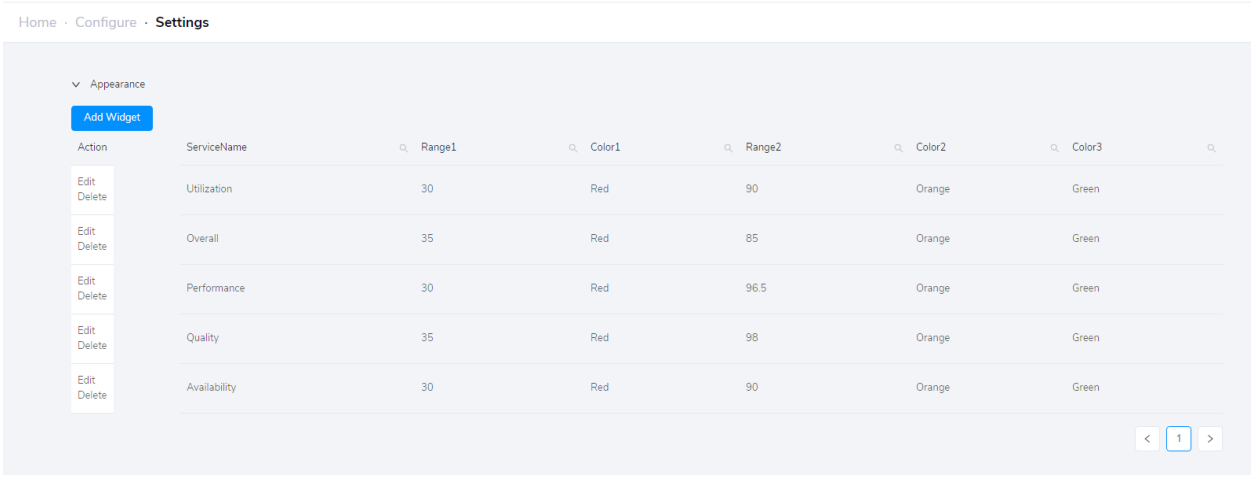


Figure 32: Widget settings

5.2 Landing Page Settings

The landing page is the screen that follows immediately after login. An example is shown in Figure 33.

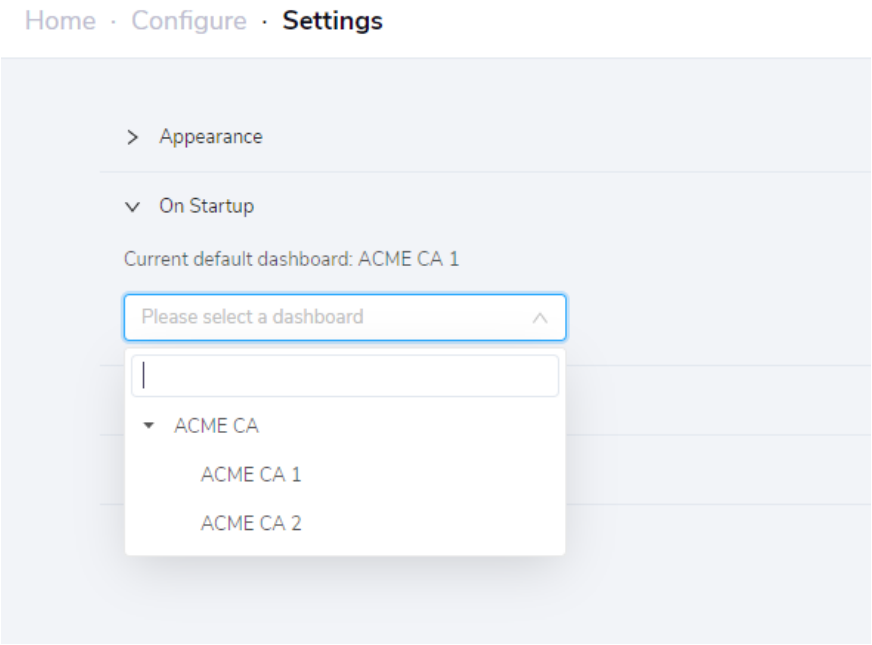


Figure 33: Landing page setting

The landing page options reflect the factory hierarchy. The landing page is therefore customizable for each customer.

5.3 Host (Machine) Planned Downtime Configuration

Planned Downtime (maintenance, calibration etc.) can be configured for each host (machine). See Figure 25. Once configured, that time will be considered in the analytics and processing by the platform.

The steps to follow are listed below:

- Go to Configure > Settings > Downtime
- Select machine from dropdown
- Click “Add Downtime” button

- Complete the details in popup and click on “Create”

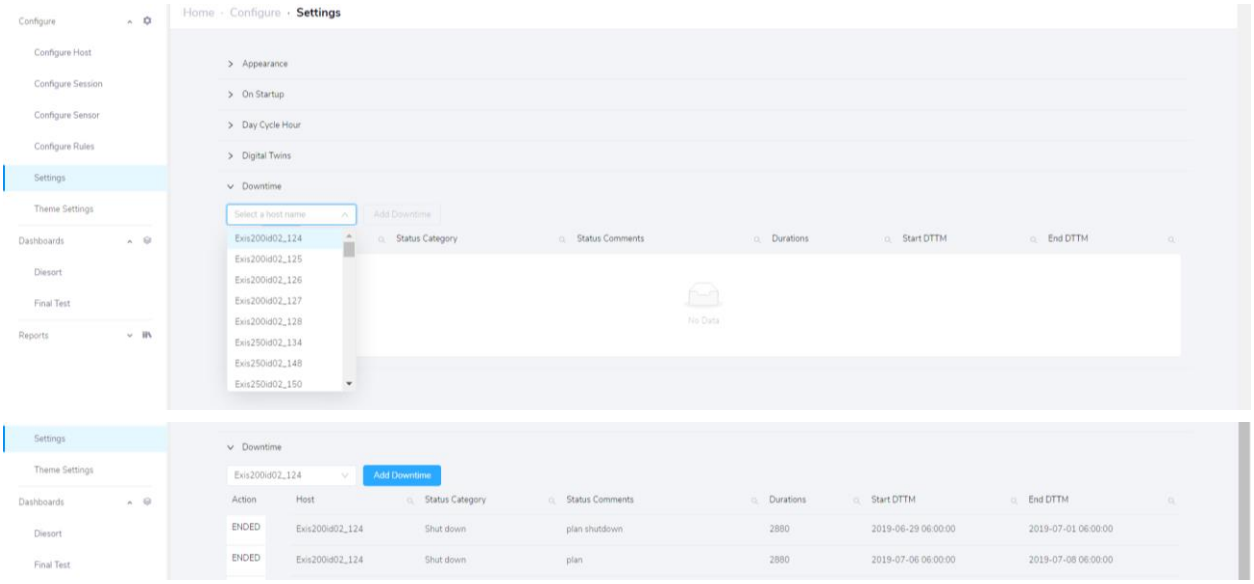


Figure 25: Planned Downtime Dropdown Menu

On the Popup, complete the required fields, add start and end time of the planned downtime. See below Figure 26.

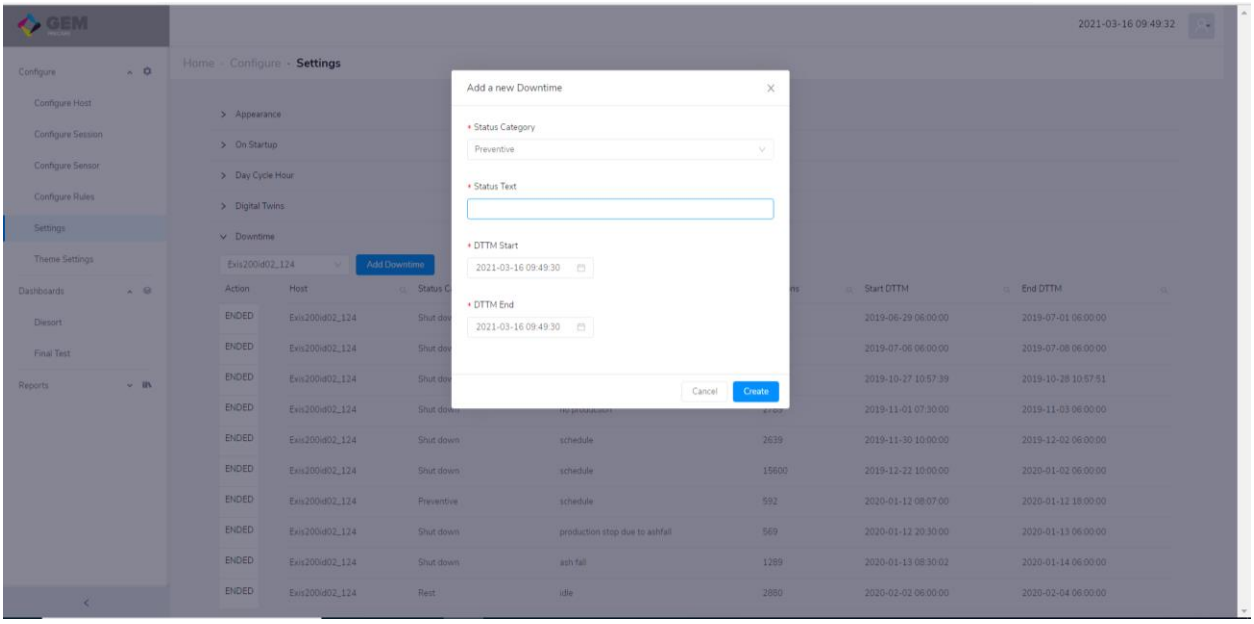


Figure 26: Planned Downtime Configuration

Appendix A: MTBF, MTBA and OEE Formulas

MTBF

MTBF per machine = DeltaT / (Total number of MTBF events per machine in DeltaT)

DeltaT = time period

Average MTBF for a group of machines = (Sum of all machine MTBFs in DeltaT) / (Total number of machines)

Example:

Delta T = 1440 mins (1 Day)

Total active machines for 1 day = 2

Number of MTBF status events for machine 1 = 25

Number of MTBF status events for machine 2 = 10

MTBF for machine 1 = 1440 / 25 = 57.6

MTBF for machine 2 = 1440 / 10 = 144

Average MTBF = (57.6 + 114) / 2 = 72

MTBA

MTBA per machine = DeltaT / (Total number of MTBA events per machine in DeltaT)

DeltaT = time period

Average MTBA for a group of machines = (Sum of all machine MTBAs in DeltaT) / (Total number of machines)

Example:

Delta T = 1440 mins (1 Day)

Total active machines for 1 day = 2

Number of MTBA status events for machine 1 = 25

Number of MTBA status events for machine 2 = 10

MTBA for machine 1 = 1440 / 25 = 57.6

MTBA for machine 2 = 1440 / 10 = 144

Average MTBA = (57.6 + 114) / 2 = 72

OEE Availability

PlannedProductionTime = (DeltaT-PlannedDT)

DeltaT = time period

OEE Availability = (PlannedProductionTime in DeltaT - (Sum Duration of Status events of machines (Failure+Assist+Other) in DeltaT) / PlannedProductionTime in DeltaT)*100

OperatingTime = PlannedProductionTime- Sum Duration of Status events of machines (Failure+Assist+Other)

OEE Performance

OEE Performance = sum (Total output in DeltaT)/sum (Theoretical output in DeltaT of machines)

DeltaT = time period

Total output in DeltaT = output of machines in DeltaT.

Theoretical output in DeltaT = theoretical output of machines in DeltaT.

OEE Quality

OEE Quality = (Sum good units in DeltaT of machines/ Sum total units in DeltaT of machines)*100

OEE Overall

OEE Overall = OEE Availability x OEE Performance x OEE Quality

Appendix B: Supported Machines

The following table lists the currently supported machines. This list is constantly growing. Contact your GEM customer representative for the latest list.

Application	Type	Make	Model	Sub-Model	Supported
Semi	Testers	Advantest	Verigy	93000	Yes
Semi	Testers	Teradyne	Catalyst	ETS88	Yes
Semi	Testers	LTX-Credence	Credence	TMTASL1000	Yes
Semi	Handlers	ExisTech	Exis200		Yes
Semi	Handlers	ExisTech	Exis250		Yes
Semi	Handlers	ExisTech	Exis300		Yes
Semi	Handlers	ExisTech	Exis400		Yes
Semi	Handlers	ExisTech	Exis550		Yes
Semi	Handlers	ExisTech	Exis700		Yes
Semi	Handlers	Ismeca	NT16		Yes
Semi	Handlers	Ismeca	NX16		Yes
Semi	Handlers	Ismeca	NX32		Yes
Semi	Handlers	SRM	XD248		Yes
Semi	Handlers	Epson	NS8000		Yes
Semi	Handlers	KLA Tencor	ICOS T3		Yes
Semi	Handlers	KLA Tencor	ICOS T7		Yes
Semi	Probers	Electroglas	EG4090U		Yes

Semi	Inspection	Sonix	Echo		Yes
Semi	Inspection	Camtek			Yes
Semi	Instrumentation	Keysight	Multimeters	344xxx DMM	Yes
Semi	Oven	CSUN	SMO-3		Yes
Semi	Oven	Thermo Scientific	Heratherm		Yes
Semi	Laser Cutter	Quest Laser	Rigid-FL500		Yes
Semi	Handlers	Vitrox	TR1100i		Yes
Semi	Probers	Accretech TSK	UF200		Partial
Semi	Handler	Ismeca	SRMTNR		No
Semi	Handler	Ismeca	SRMFES		No
Semi	Testers	Tektronix	Keithley	S530	
EMS	Functional Test	Keysight	TS-5400		

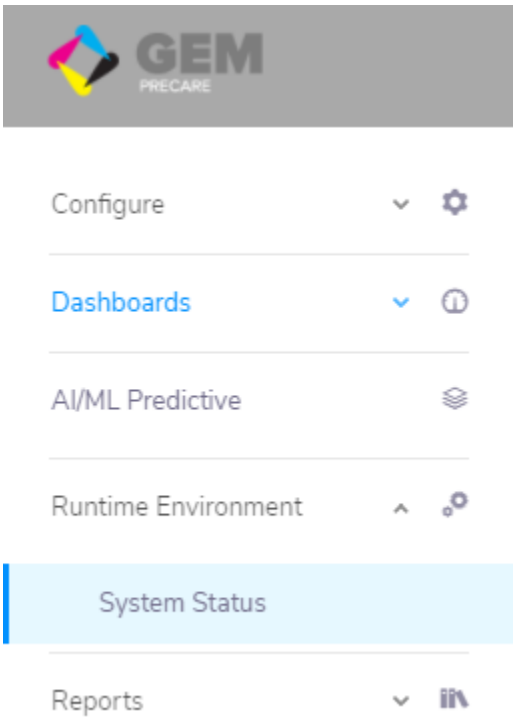
6 Runtime Environment

6.1 Introduction

The Runtime environment section provides the Precare users the ability to view status of the the execution platform that run tasks. A runtime environment are the set of agents, sensors and server (s). You must have runtime environment in each organization so that the platform can execute.

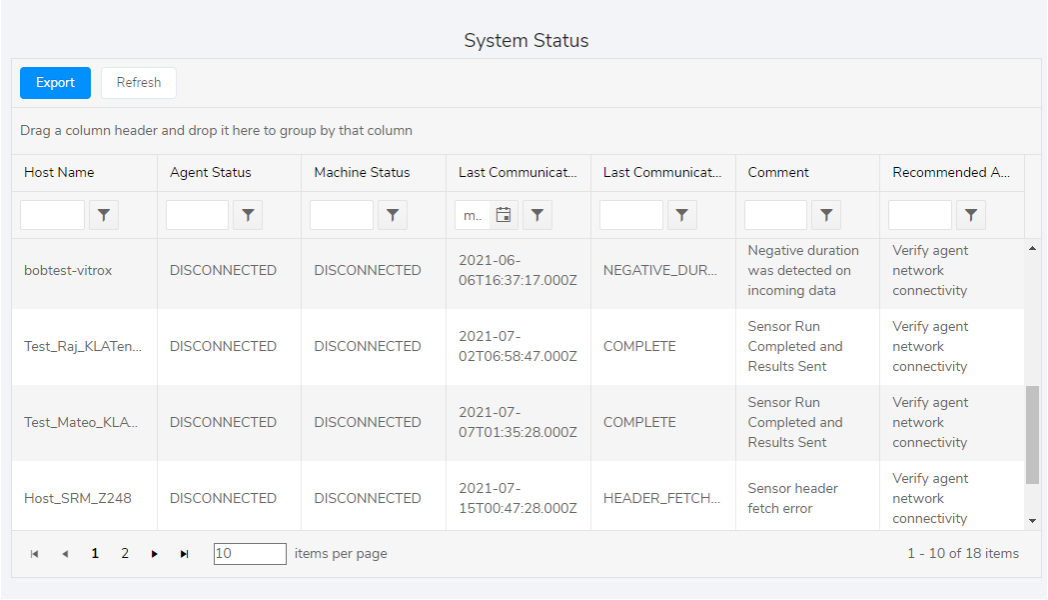
6.2 System Status Section

The System Status section can be found on the side menu as shown in the next Figure.



Once in the System Status section we can find the current status of the Hosts (machines as example), Agents connected and reporting to the system.

View of the Widget is provided below:



The table widget allows filtering and sorting on all of its columns.

Description of the columns and their meaning:

- **Host Name:** The name of the host/machine reporting its state
- **Agent Status:** The status of the agent attached to the machine
- **Machine Status:** The status of the host/machine reporting.
- **Last Communication Time:** The time of the last status report.
- **Last Communication Status:** The last received status code.
- **Comment:** A description of the current status
- **Recommended Action**: A recommended remediation action.

The refresh button updates the data shown to the latest and the export button export the current content of the table to a excel spreadsheet:

	A	B	C	D	E	F	
1	<	Agent Status	Machine Status	Last Communication Time	Last Communication Status	Comment	Recom
7	bobtest-vitrox	DISCONNECTE	DISCONNECTED	2021-06-06T16:37:17.000Z	NEGATIVE_DURATION	Negative duration was detected on incoming data	Verify a
8	Test_Raj_KLATencor790	DISCONNECTE	DISCONNECTED	2021-07-02T06:58:47.000Z	COMPLETE	Sensor Run Completed and Results Sent	Verify a
9	Test_Mateo_KLATencor790	DISCONNECTE	DISCONNECTED	2021-07-07T01:35:28.000Z	COMPLETE	Sensor Run Completed and Results Sent	Verify a
10	Host_SRM_Z248	DISCONNECTE	DISCONNECTED	2021-07-15T00:47:28.000Z	HEADER_FETCH_ERROR	Sensor header fetch error	Verify a
11							