MAY 2021

ABB Ability™ Smart Sensor

User guide for Smart Sensor Platform app and web portal for mechanical products

Outline

1. ABB account registration
2. Organization management
3. Sensor activation and commissioning – mobile app
4. Mobile app functionality
5. Web portal
6. Guidance on setting alert and alarm levels
7. On demand raw and trend data
8. Data visualization and interpretation
9. ABB Ability™ Digital Powertrain portal
10. KPI Terminology

LINKS AND MANUALS

PLEASE NOTE INSTRUCTIONAL VIDEOS AND INSTALLATION MANUALS

Links

General information and documentation:

ABB Ability™ Smart Sensor:

https://new.abb.com/motors-generators/service/advanced-services/smart-sensor

For motors:

https://new.abb.com/motors-generators/service/advanced-services/smart-sensor/smart-sensor-for-motors

For pumps:

https://new.abb.com/motors-generators/service/advanced-services/smart-sensor/smart-sensor-for-pumps

For mechanical products:

https://new.abb.com/mechanical-power-transmission/smart-sensor-for-mechanical-products

Cloud Interface API:

https://new.abb.com/motors-generators/service/advanced-services/smart-sensor/cloud-interface

Videos

Introduction Smart Sensor:
https://www.youtube.com/watch?v=AgUVI63mY3g

First time user guide: https://youtu.be/z8ug2az-_ww

User / asset / organization management:

https://youtu.be/JnJcJoJmIwQ

Activation and commissioning:
https://youtu.be/rcOWbXf55ec?list=PLFwq1JTSL1fh7Xv2q2YIIe83EZi0SLVFH

Data visualization on app:

https://youtu.be/vxMMr-t0Cl8

Data visualization on portal:

https://youtu.be/QjMSj-_pTJY

Gateway installation manuals:

https://youtu.be/4KTmrBtfgEo

https://youtu.be/BXB6nuUl8-g

https://youtu.be/P8Bj0-VtqRA

1. ABB account registration

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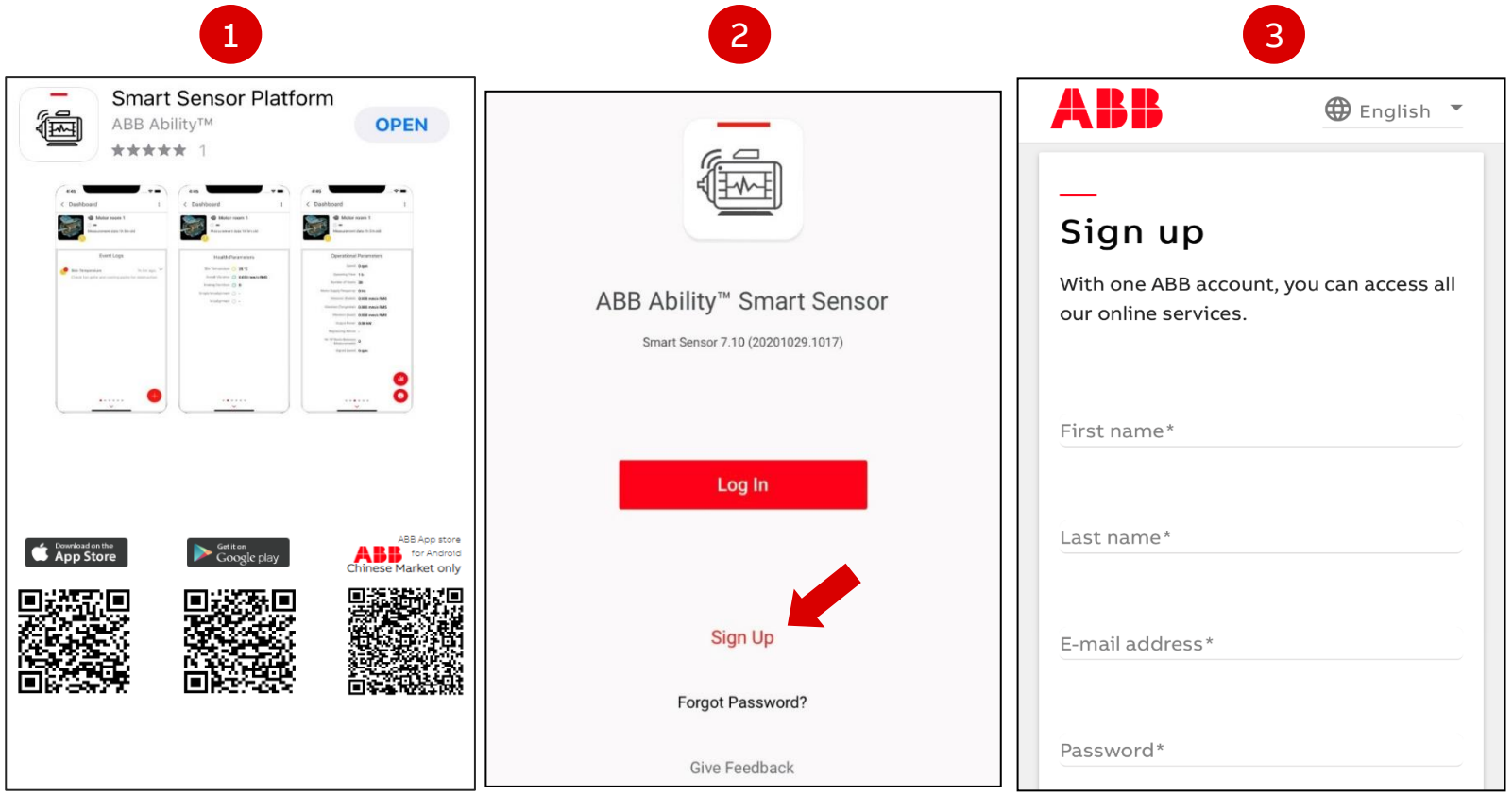
https://youtu.be/z8ug2az-_ww

ABB account registration – mobile app

Register new account in ABB system via the mobile app or web portal



1) **Install** "Smart Sensor Platform" on mobile device (iOS or android)

2) Click "**Sign Up**" on initial screen

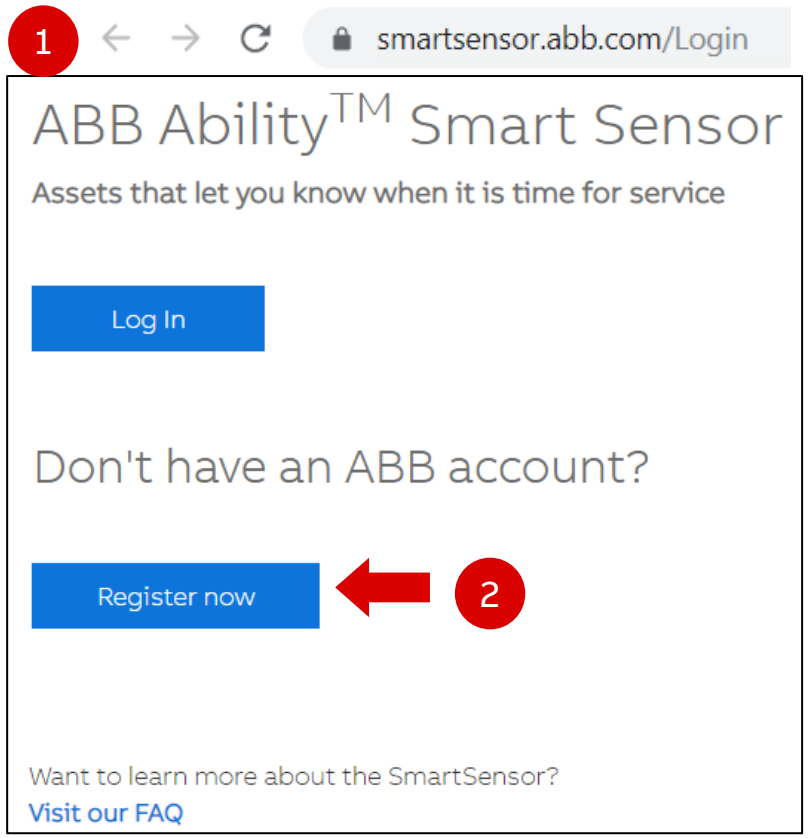
3) Follow steps to create account

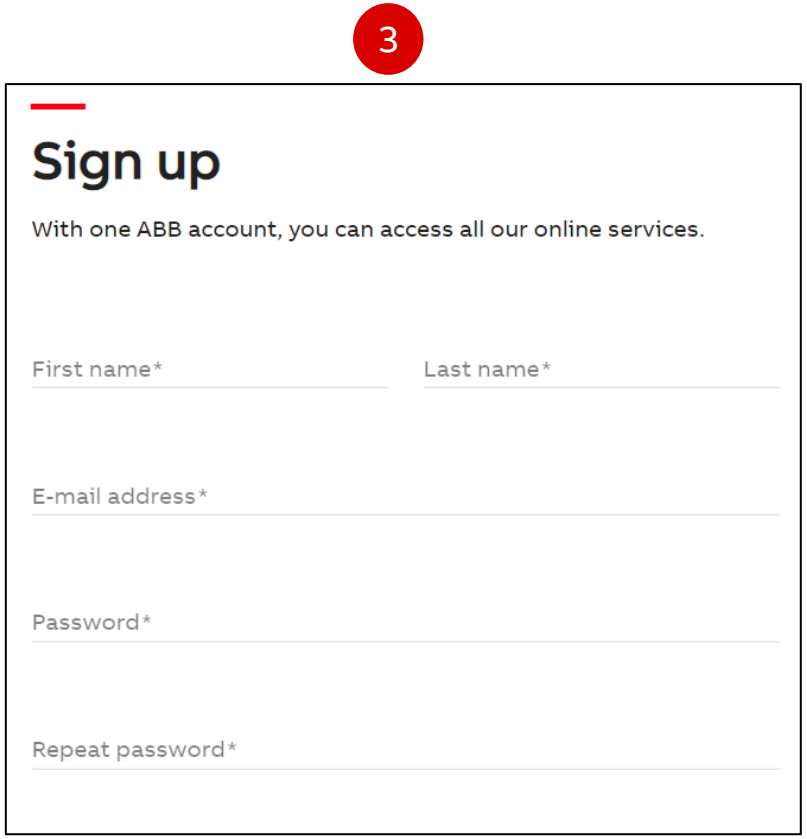
➢ Alternative: web portal (next slide)

1) Android™ 6 / iOS 8 or higher
2) Bluetooth® version 4.0 or higher

ABB account registration – web portal

Register new account in ABB system via mobile app or web portal





1) **Open link** in web browser:
   https://smartsensor.abb.com
   **Google Chrome recommended*

2) Click "**Register now**"

3) Follow steps to create account

https://smartsensor.abb.com/Login
Google Chrome is recommended

2. Organization management

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https://youtu.be/JnJcJoJmIwQ

ABB Ability™ Smart Sensor virtual organization management

Virtual environment for sensor data access configuration

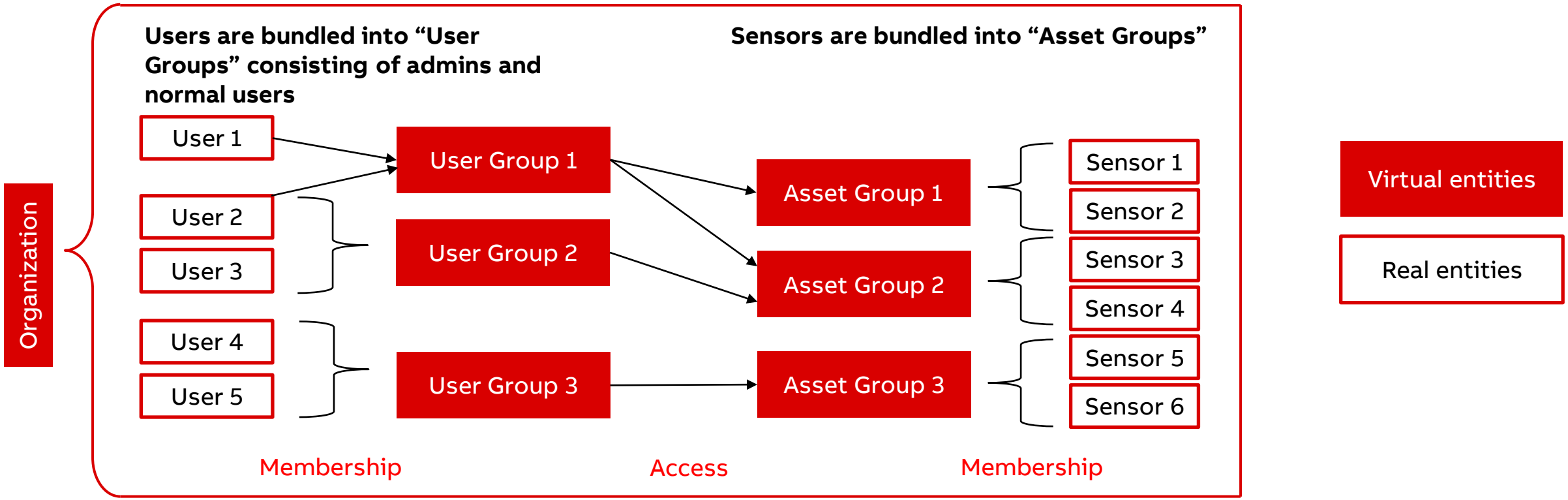
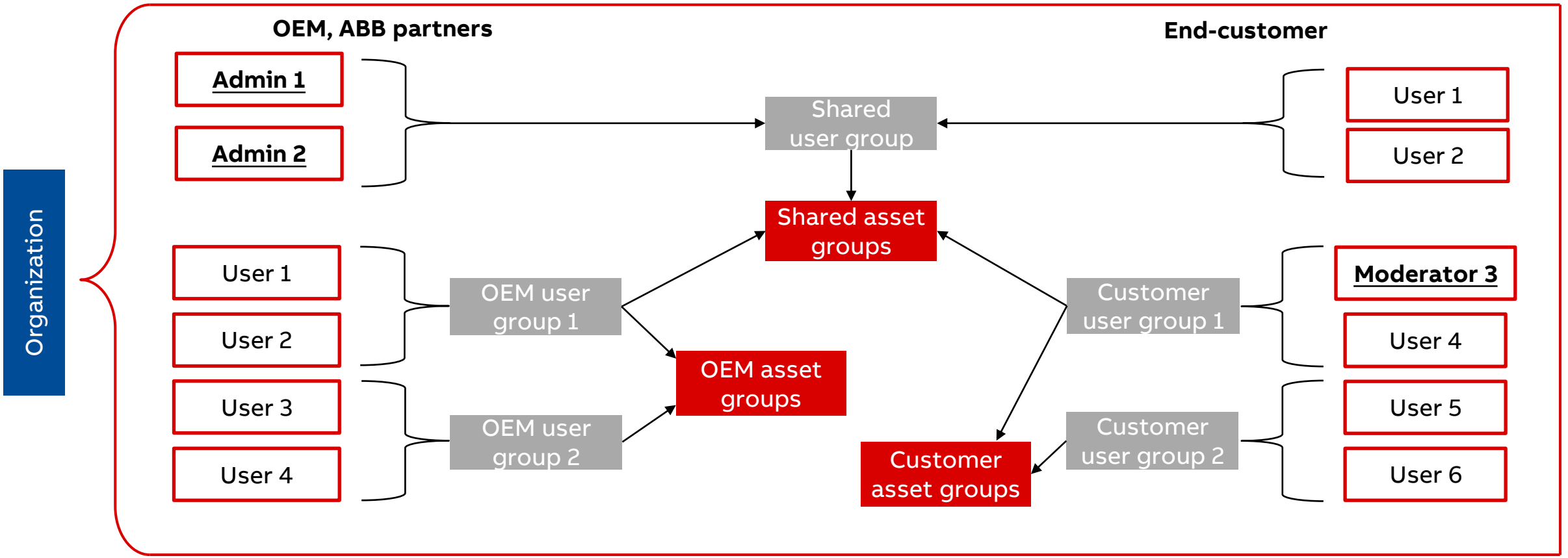


ABB Ability™ Smart Sensor virtual organization management - OEM

Example case for OEMs: you decide what your end customers see



User groups | Asset groups | People

ABB Ability™ Smart Sensor app architecture - notes

Organization and user/asset groups: trade-offs

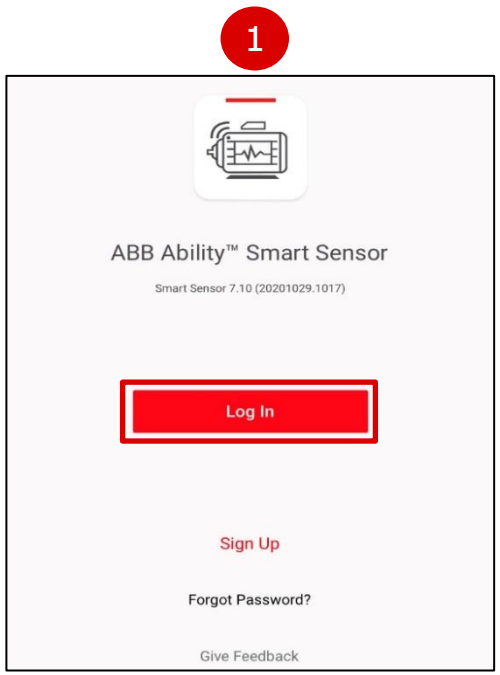
Organization

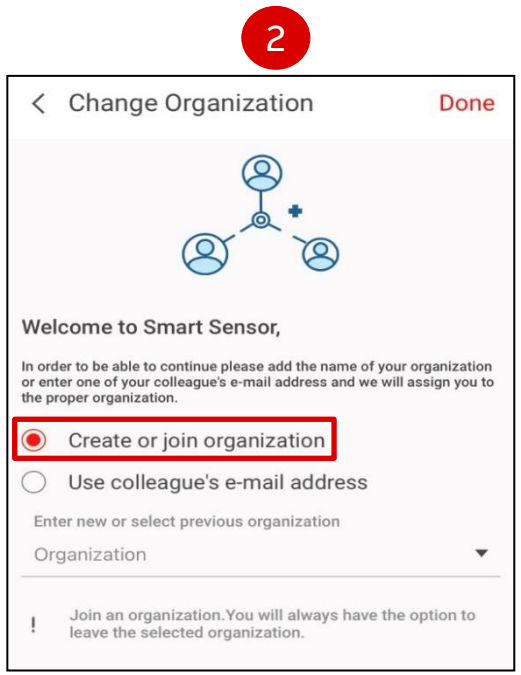
Notes:

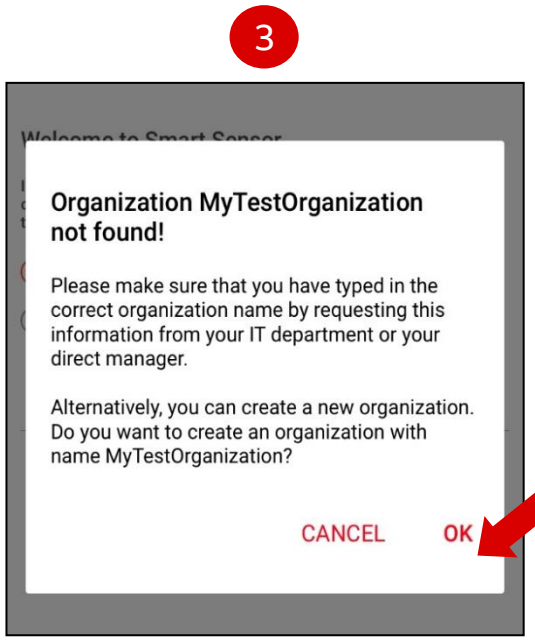
1) **Only one "layer"** of user groups and asset groups available, i.e. subgroups are **not** possible.
2) You can have as many "organizations" as you want.
3) An "organization" can represent, for example:
   - **Your whole company:**
     - Advantage: one-stop solution for all your end customers/plants and sensors (full benchmarking).
     - Disadvantage: keeping track of all sensors gets harder as the number of user and asset groups increases.
   - **A specific end-customer:**
     - Advantage: balance between number of organizations and complexity of user and asset group structure.
     - Disadvantage: decreased benchmarking capability, since only one organization can be viewed at a time.
   - **A specific plant/location:**
     - Advantage: complex group/access structures are easier to manage if isolated in one organization.
     - Disadvantage: too many organizations make benchmarking harder and may also be hard to keep track of.

Create or join organization on the mobile app

First use: create or join organization



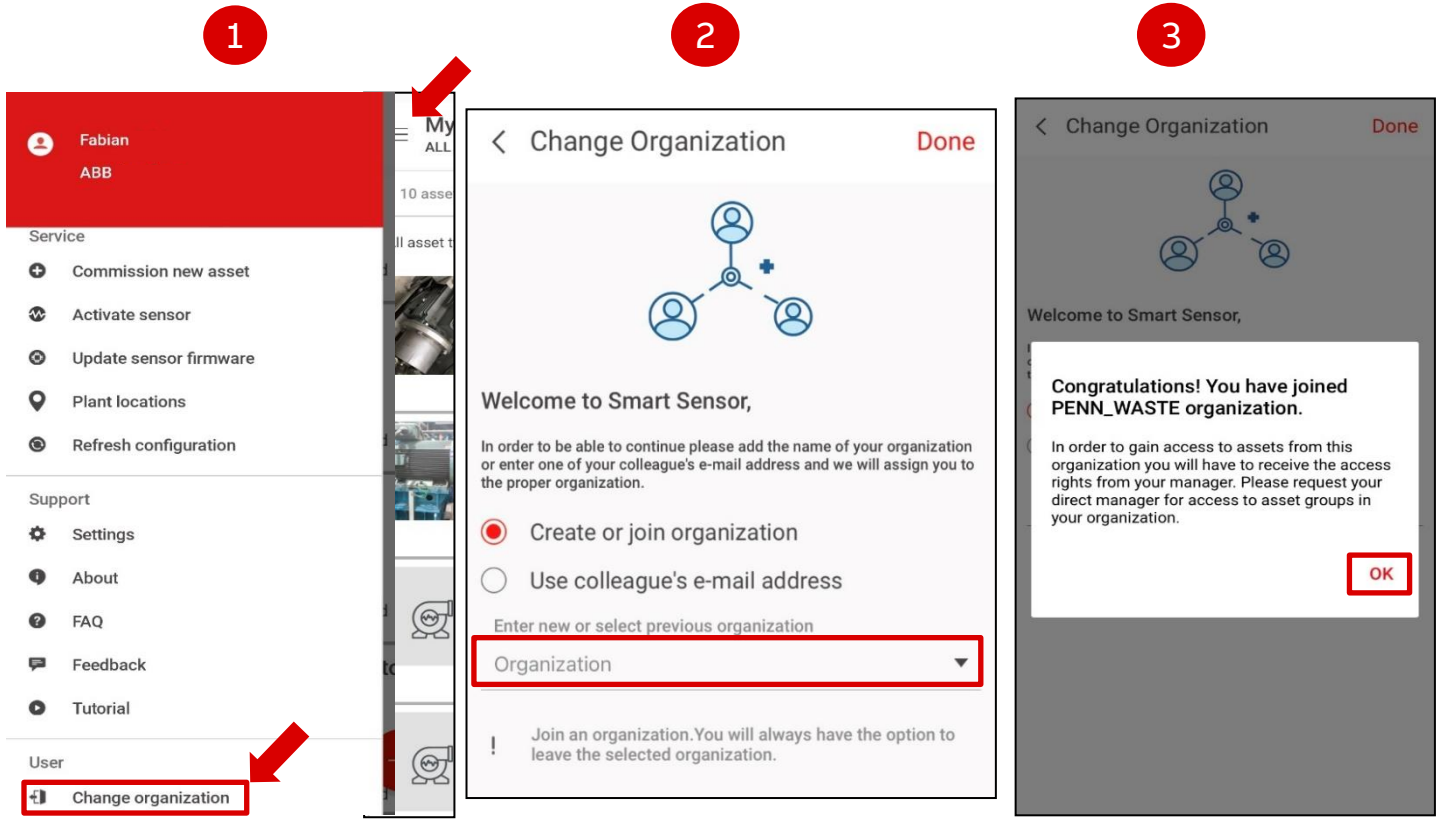




1) Log in to the app using ABB credentials
2) Click "**Create or join organization**"
   - *Admins of an organization must grant access*
3) If the organization does not exist, type desired name and confirm to create a new one
   - *This can also appear due to typos when trying to join an existing organization.*
   - *Organization names are case sensitive!*
   - *If you create an organization, an asset group called "Default Asset Group" is automatically created*

Switch organization on the app

Moving between organizations



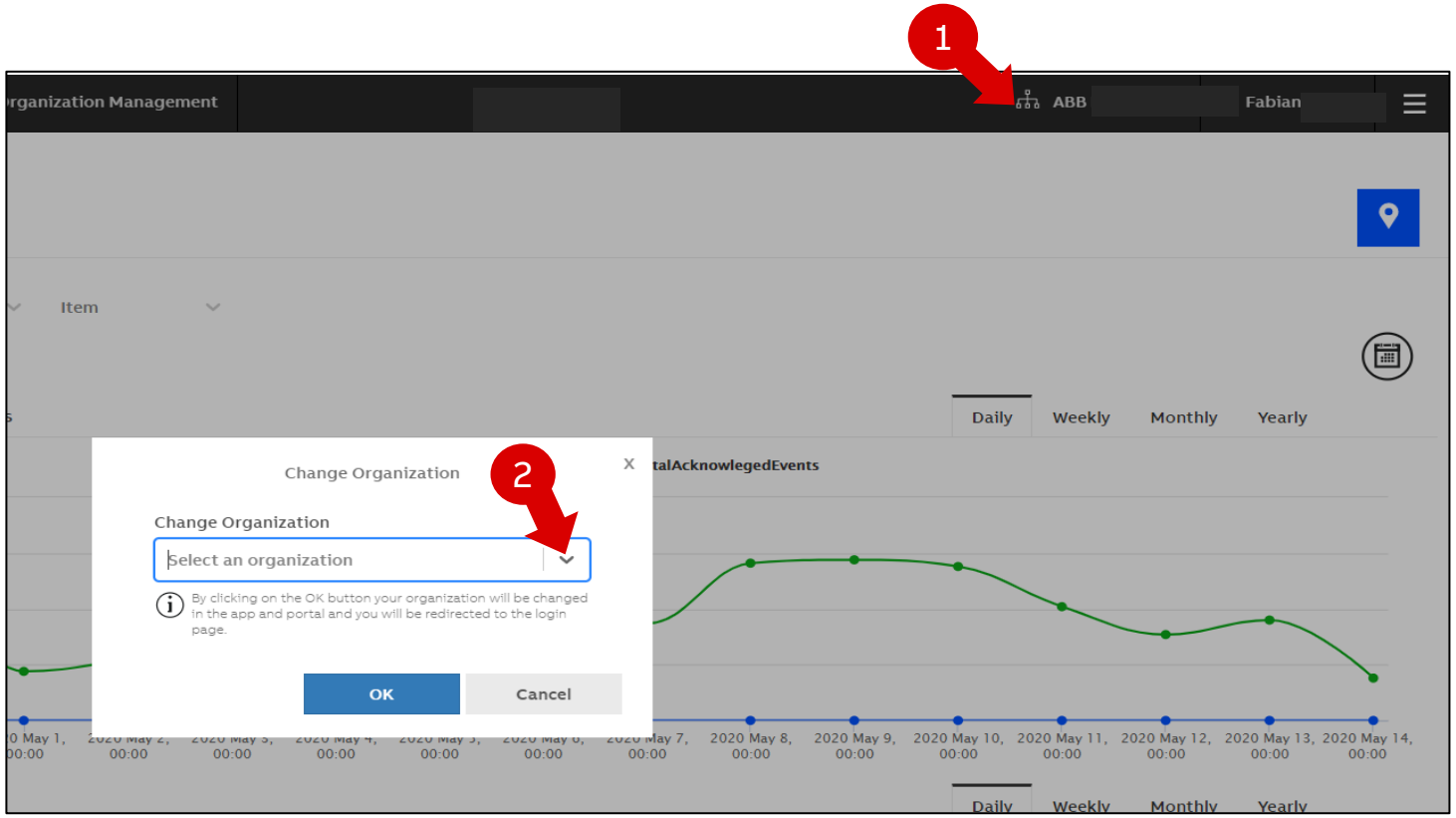
1) Click **“Change organization”** on main menu (top left sandwich menu of main screen)
2) Enter one of the following:
   - The name of the organization
   - The e-mail address of a member
3) Click “**OK**” on pop up.
   - *Organization switches automatically on web portal*

Notes:

- Sensor data is not visible until the User is added to a User Group with the correct access rights.
- The asset group Default Asset Group is created automatically with the organization.

Switch organization on the portal

Moving between organizations

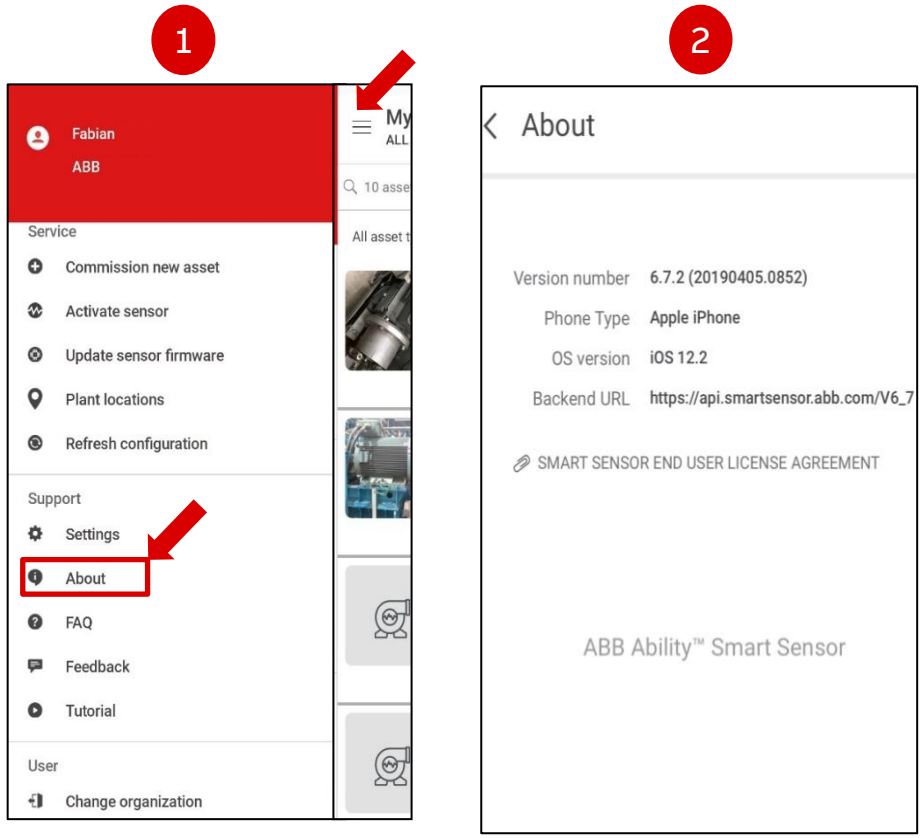


1) Click on the **organization** in the main menu (top right)

2) **Select organization** by name from the drop-down list and click “OK”
   - *Organization switches automatically on the app*

Info about organization and app

Where to find the name of my current organization and other information



1) Click "**About**" on the main menu
   - Organization shown under user name

2) App, phone, back-end (cloud) API and EULA information displayed.

User management - role types

Access management within one organization in the Smart Sensor portal

Moderator of the ”Admin” User Group (equivalent to Organization Admin)

- **Can add members to the Admin User Group**
- **Can create new User Groups for the organization**
- **Can create new Asset Groups for the organization**
- **Can connect User Groups and Asset Groups**

Admin User Group Member

- **Can create new Asset Groups**
- **Can connect User Groups and Asset Groups**

All users can commission new sensors

Normal User Group Moderator

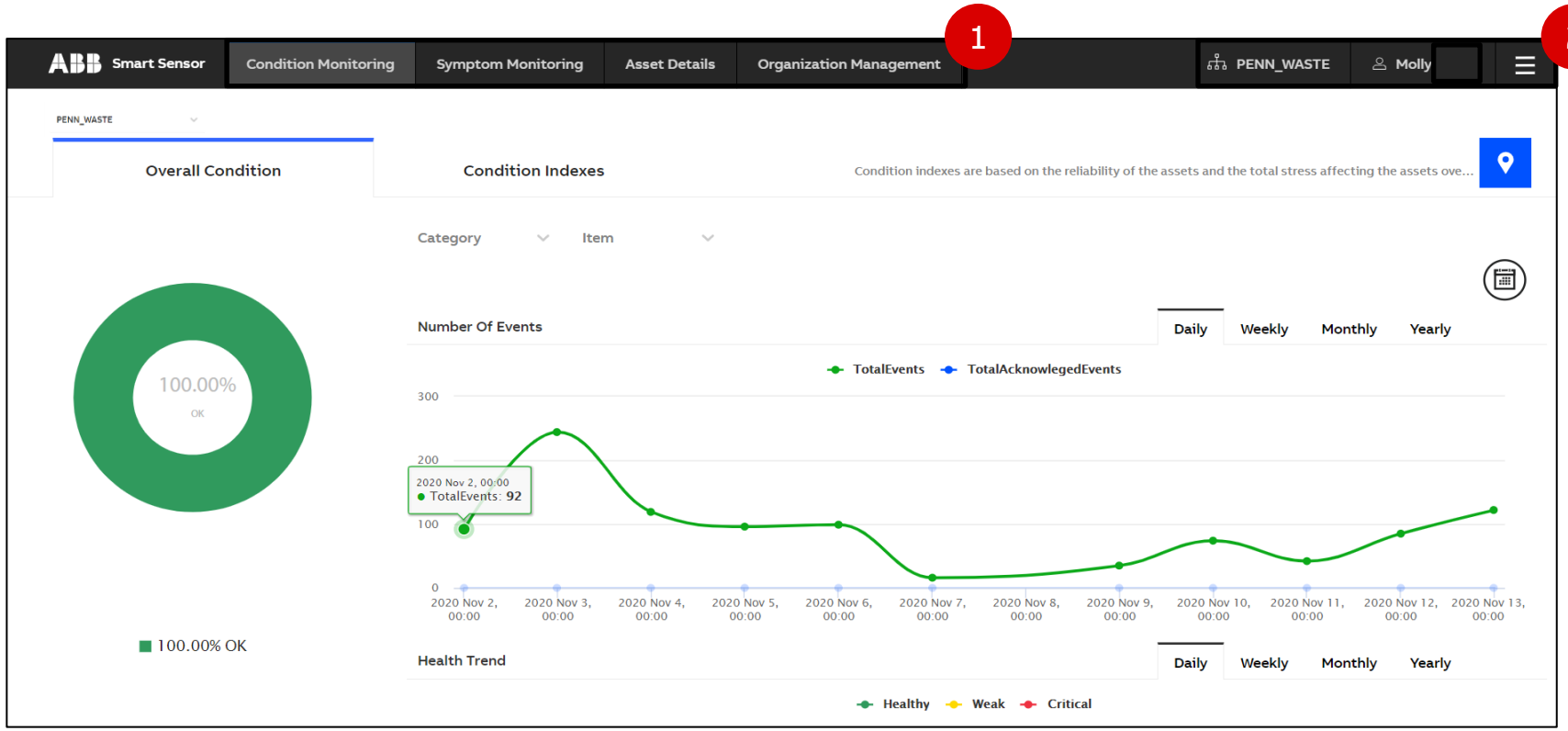
- **Can add users to that particular User Group**

Normal User Group Member

- **Can view asset data to which this User Group was granted access (by a member of Admin User Group)**

Portal Overview

Starting point for Condition Monitoring, Symptom Monitoring, Asset Details & Organization Management



Landing Page of the Smart Sensor portal. From Here you can:

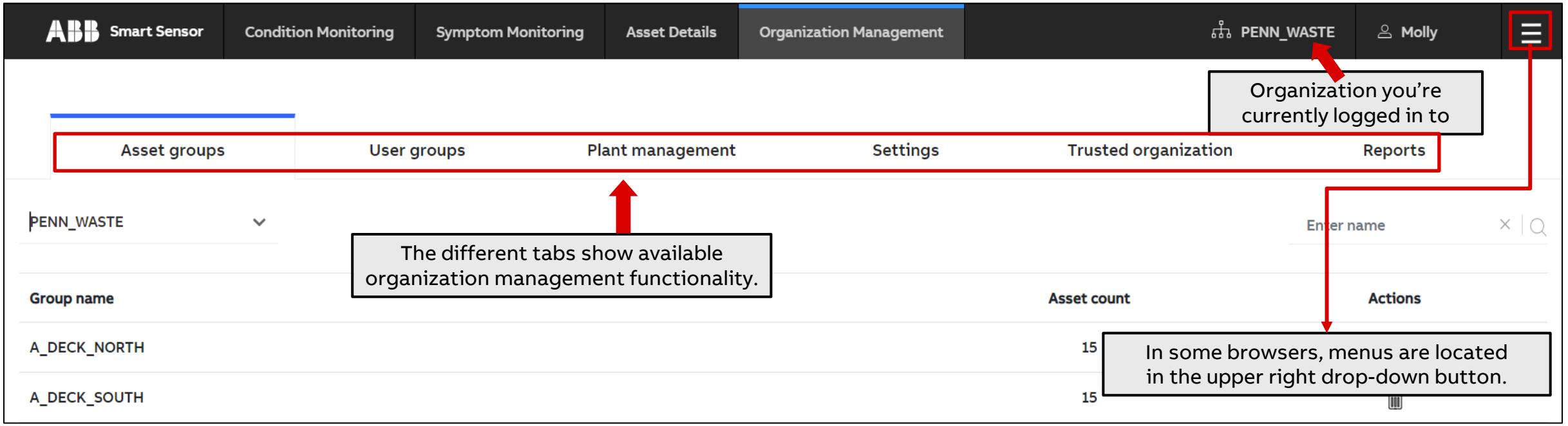
1) Access **Condition Monitoring** overview, **Symptom Monitoring** Dashboard, go into **Asset Details** (see chapter 5.) and **Organization Management** (following slides).

2) Change your Organization by clicking , see personal account details and Access FAQ (**Motor sensor only***), EULA, Privacy Policy and Logout via the symbol

*Smart Sensor for mechanical products FAQ: https://new.abb.com/mechanical-power-transmission/smart-sensor-for-mechanical-products/questions-and-answers

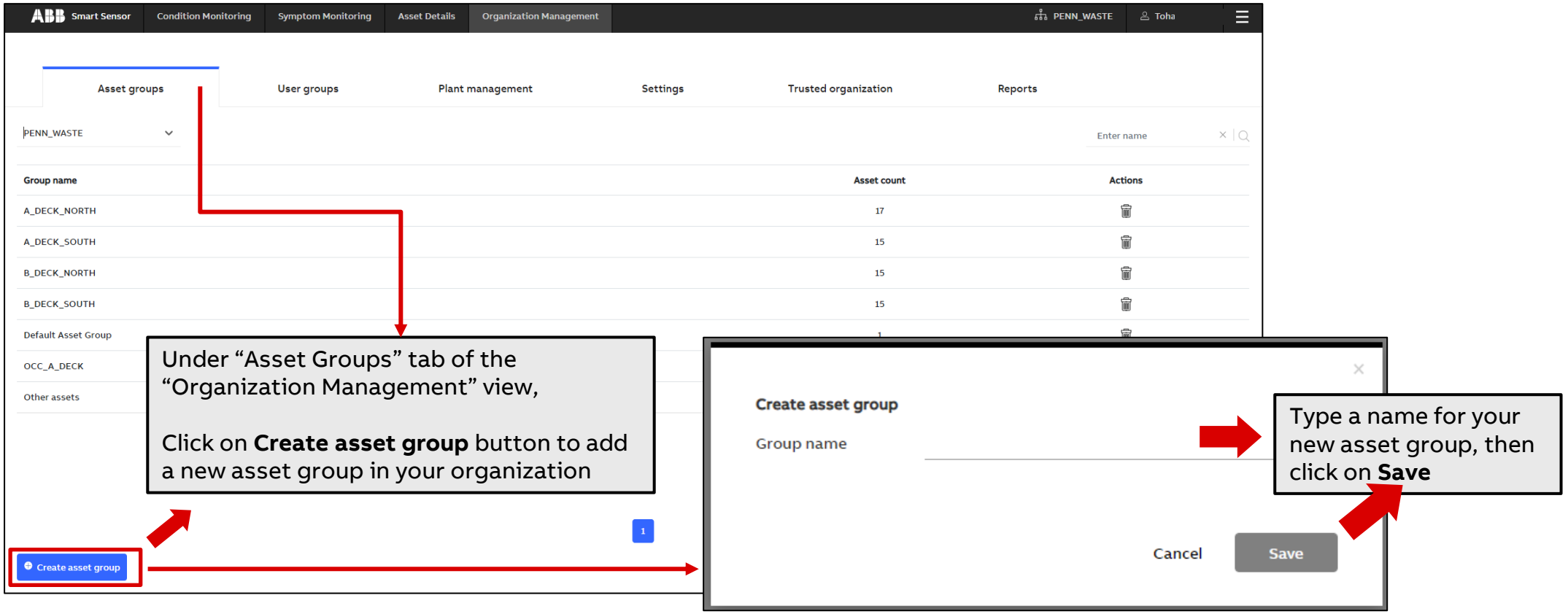
Organization management

Managing Asset or User Groups in your organization, and more



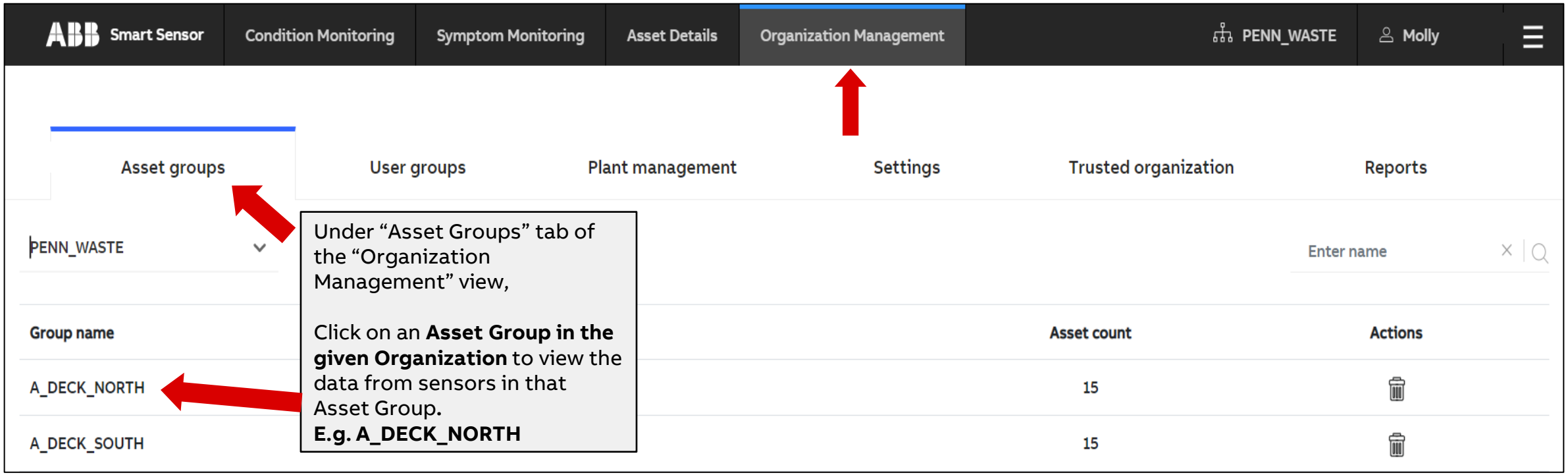
Organization management

Creating new asset groups in your organization



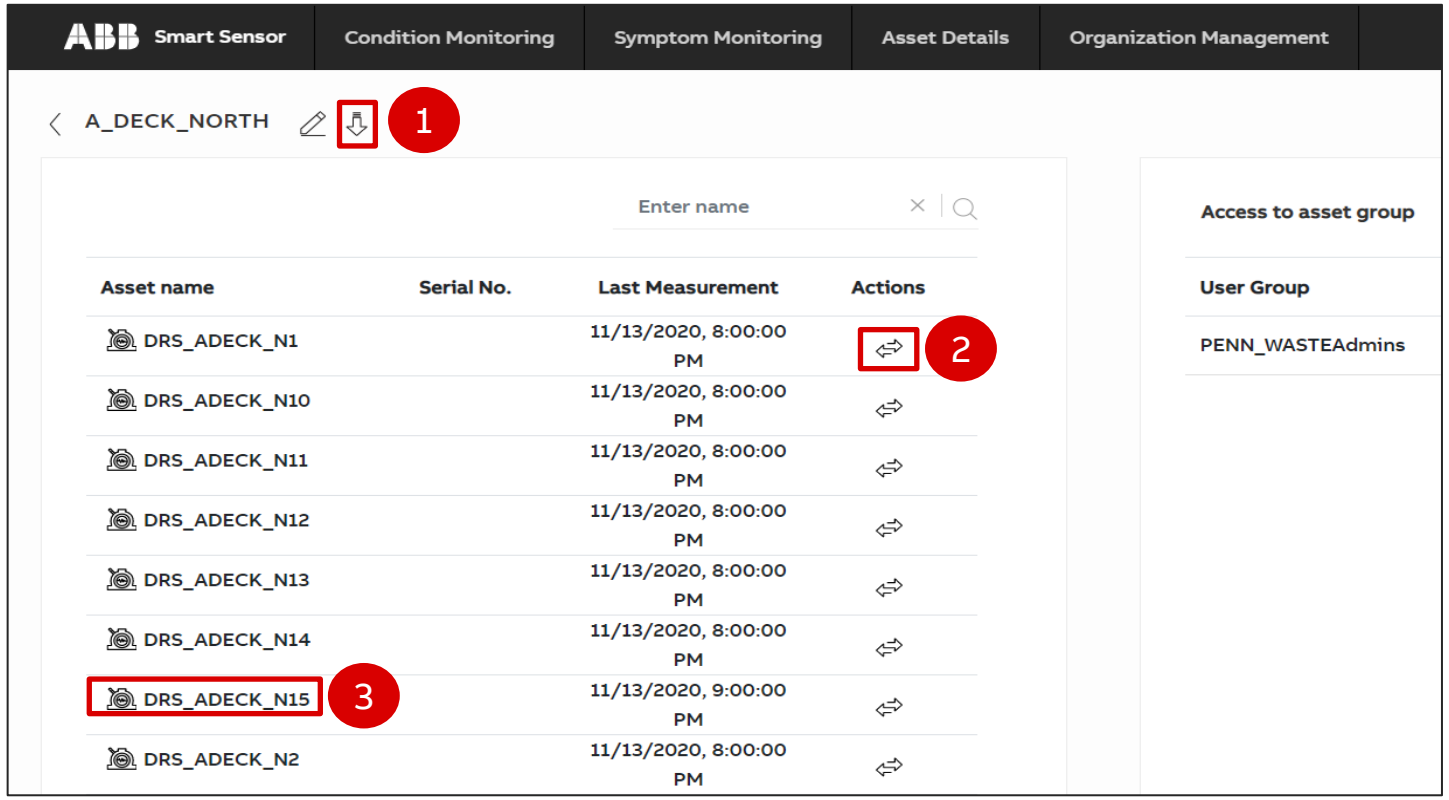
Organization management – Asset Groups

Manage assets in the «Asset Groups» page



Organization management – Asset Groups

Download measurements and transfer assets from one asset group to another



After choosing an Asset Group in your Organization:

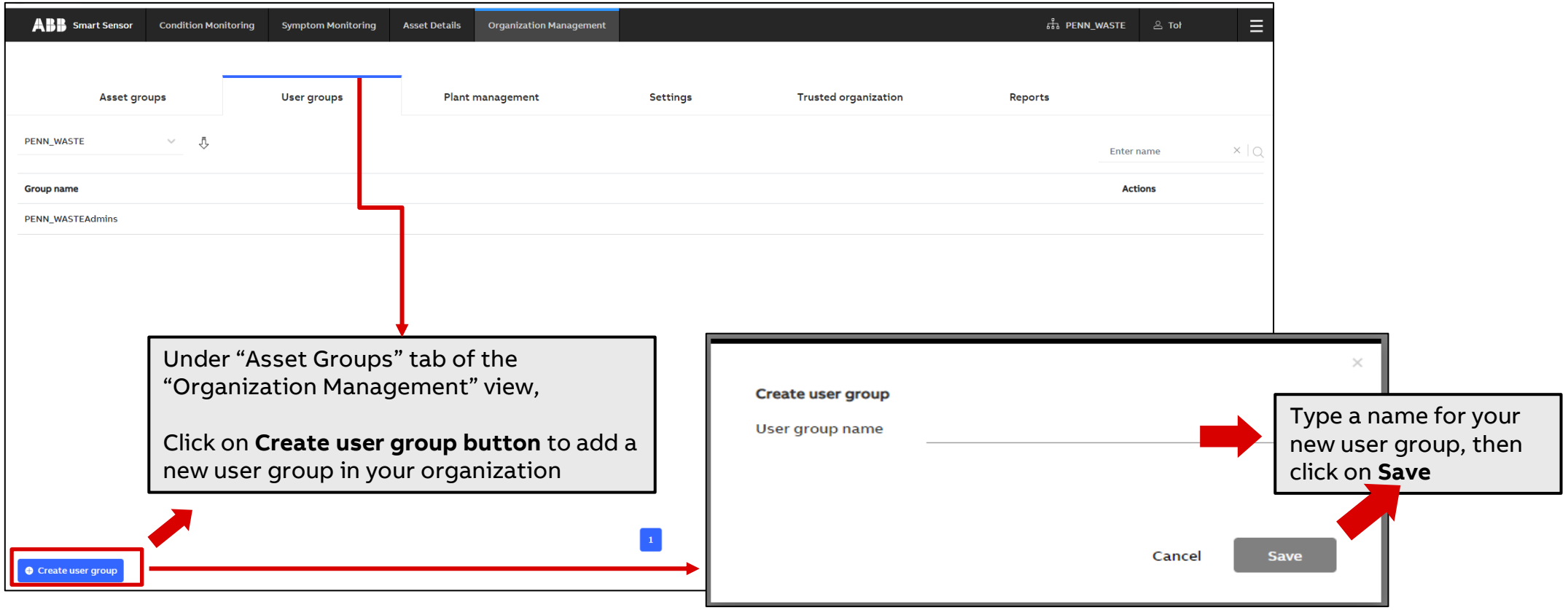
1) Click arrow to **download the measurement data of all the assets** in the Asset Group. Data will be sent by email.

2) You can transfer assets to other Asset Groups via the double-arrow icon.

1) By clicking on one of the assets, you are directed to the detailed asset view where you have access to the measurements and Asset/Sensor Information.

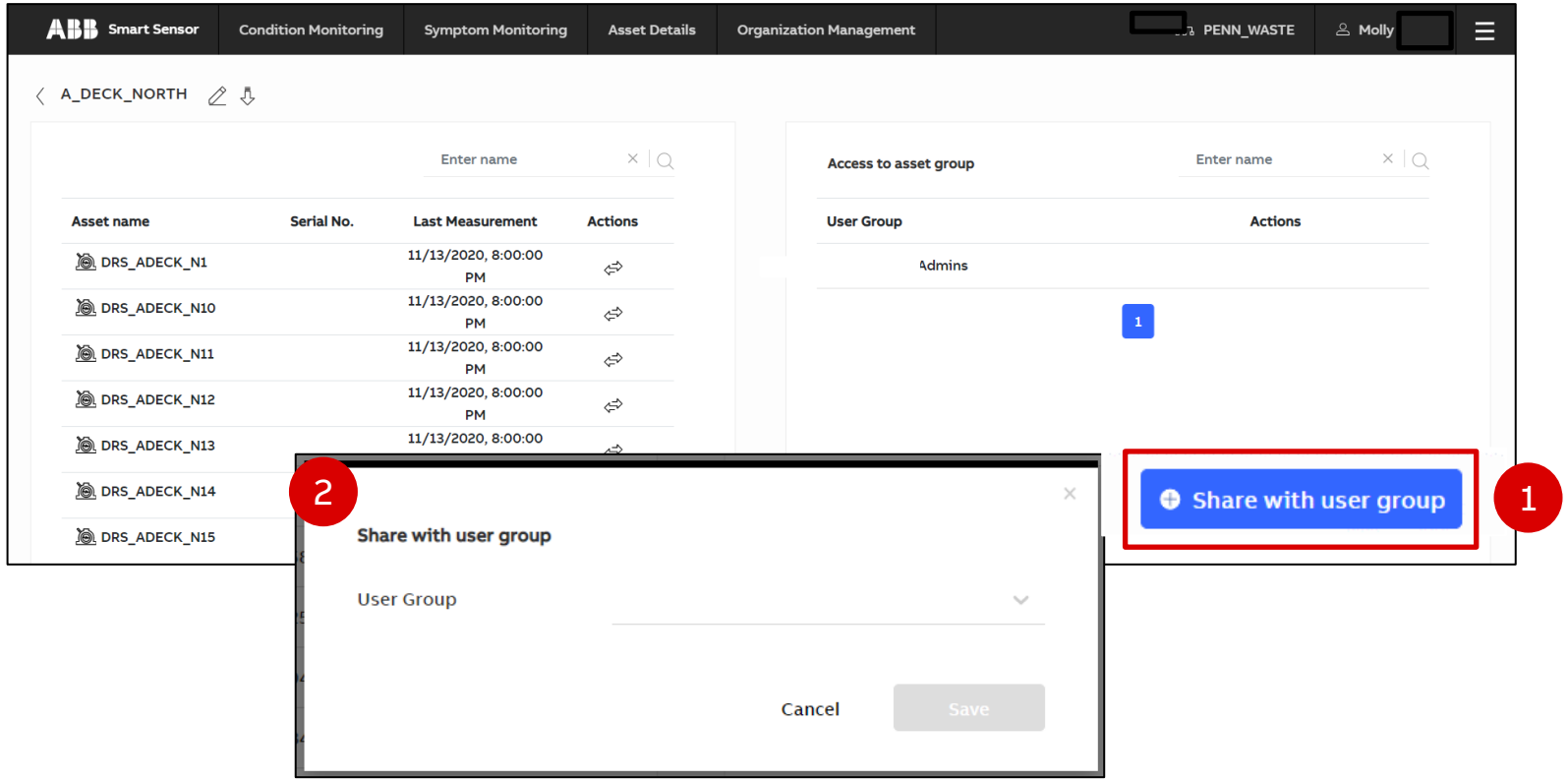
Organization management

Creating User Groups in your organization



Organization management – Asset Groups

Give access to each Asset Group by defining User Groups



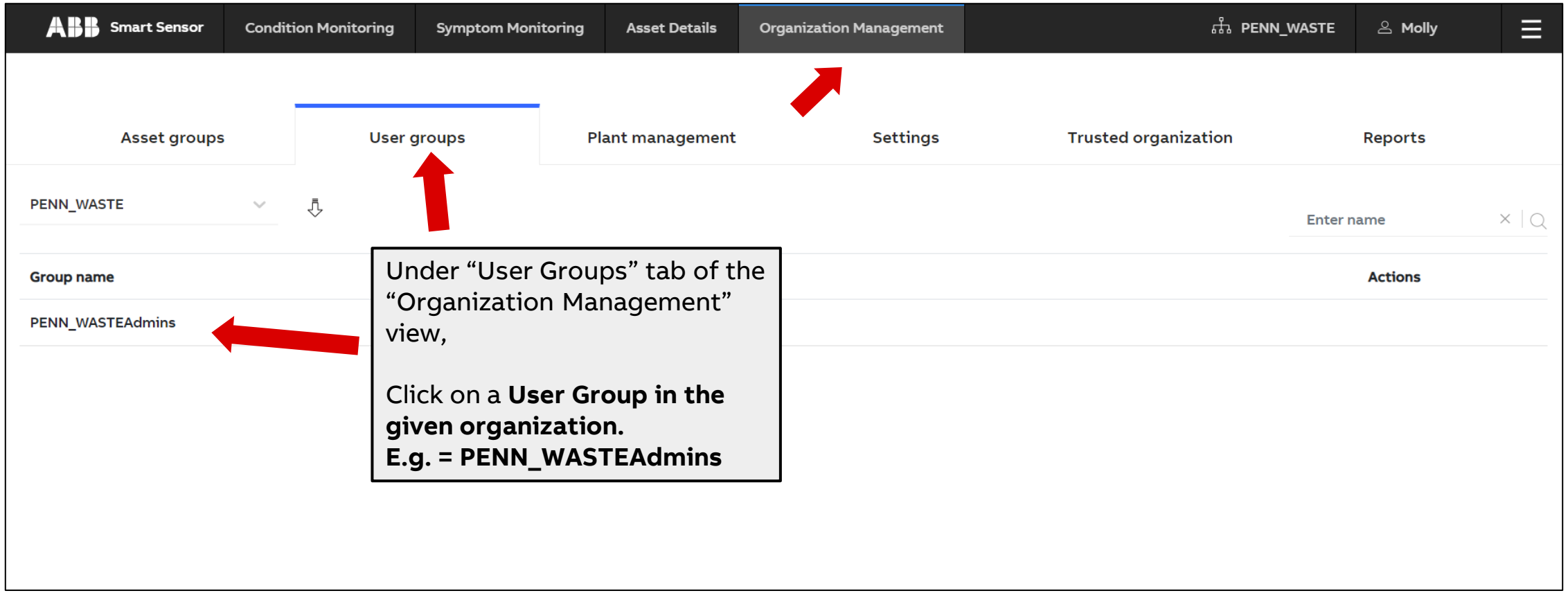
After choosing an Asset Group:

1) Click bottom right button “Add User Group”

2) On the pop-up prompt, choose which User Group you want to give access. Data from all assets in this Asset Group are visible to the members of the User Groups that you, as a moderator, can add to it.

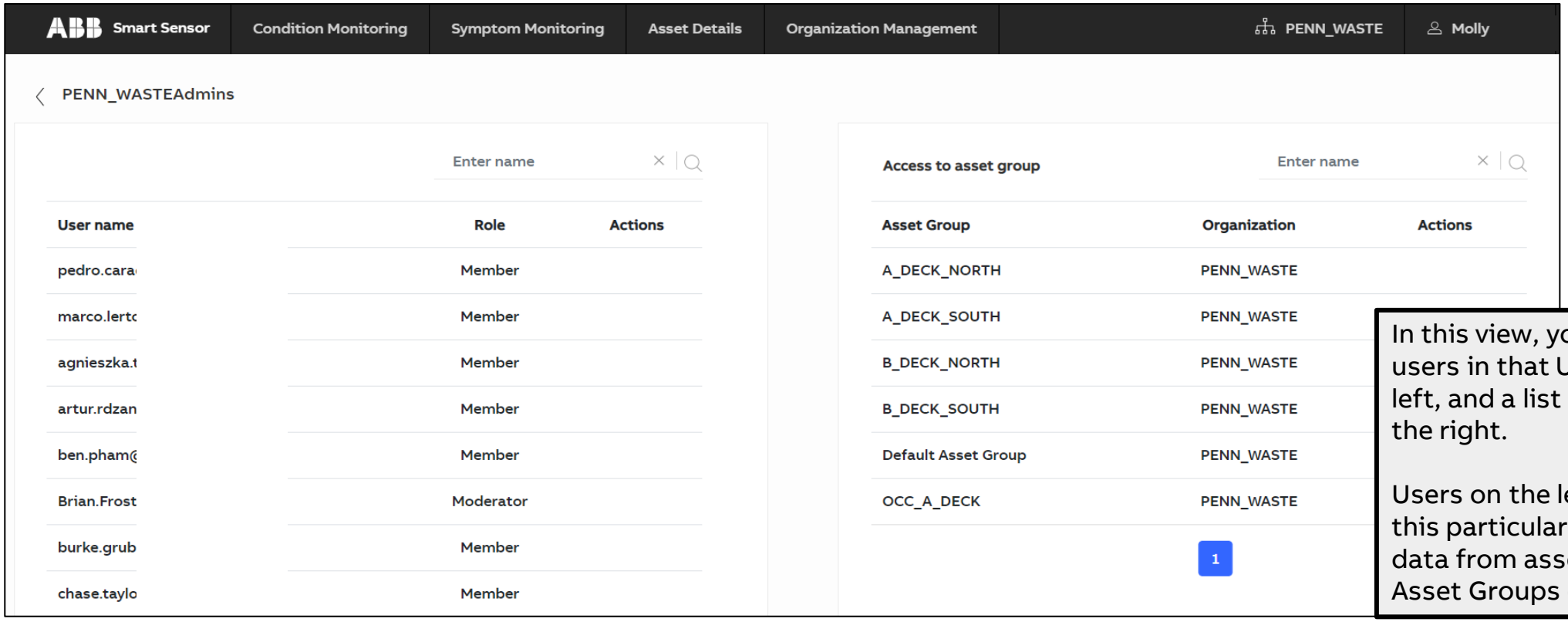
Organization management – User Groups

Manage membership and access in the «User Groups» page



Organization management – User Groups

Manage membership and access in the «User Groups» page

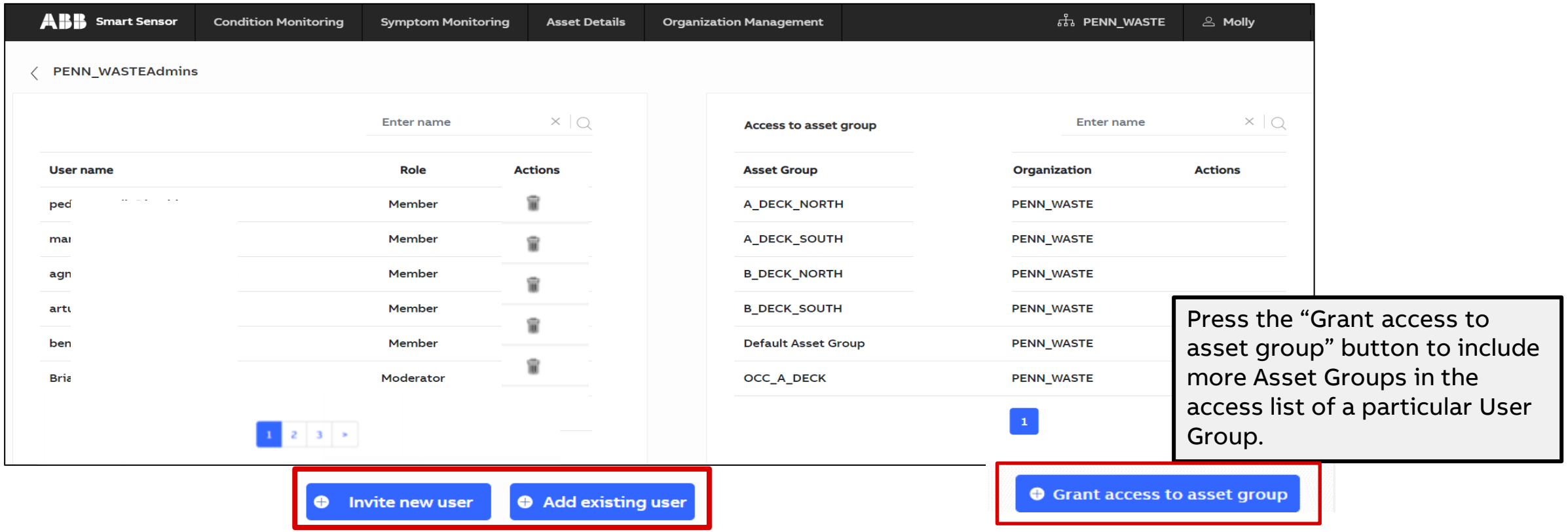


In this view, you can see a list of users in that User Group on the left, and a list of Asset Groups on the right.

Users on the left, belonging to this particular User Group, can see data from assets belonging to the Asset Groups on the right.

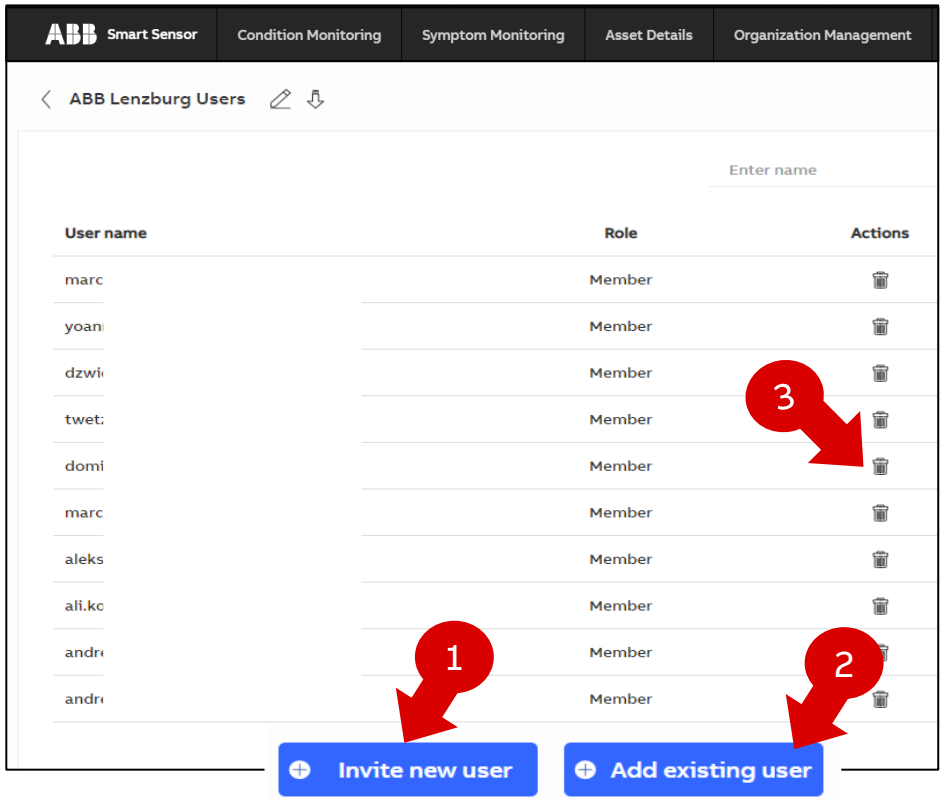
Organization management – User Groups

Manage membership and access in the «User Groups» page



Add users to User Group

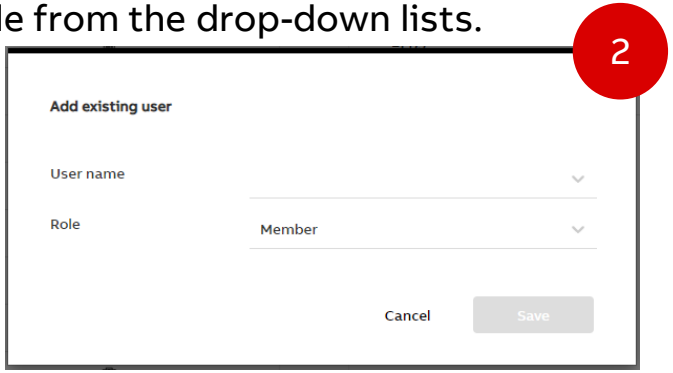
Give other people visibility of your sensors



If you are a moderator of a User Group, you can add users to grant them access to sensor data.

1) If a user is not yet a member of your Organization, click **“Invite new user“.** The user should receive an e-mail with the invitation to join the Organization and User group.

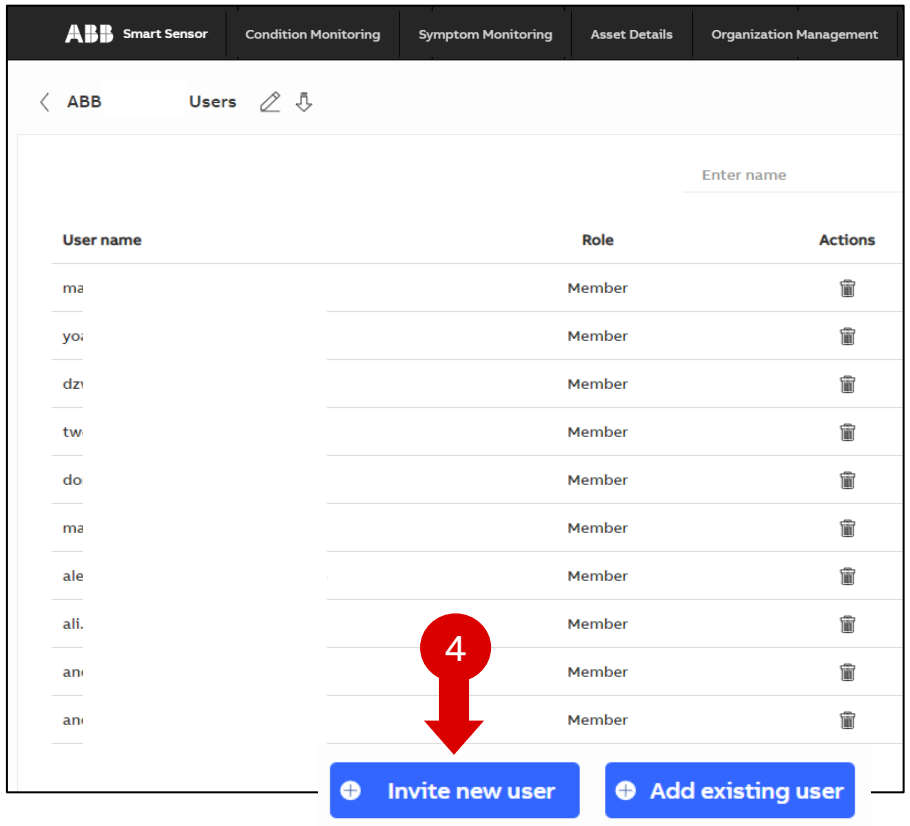
2) For existing Organization members, click **“Add existing user”. C**hoose user and role from the drop-down lists.



2) You can delete users if you are a moderator by clicking the trash bin.

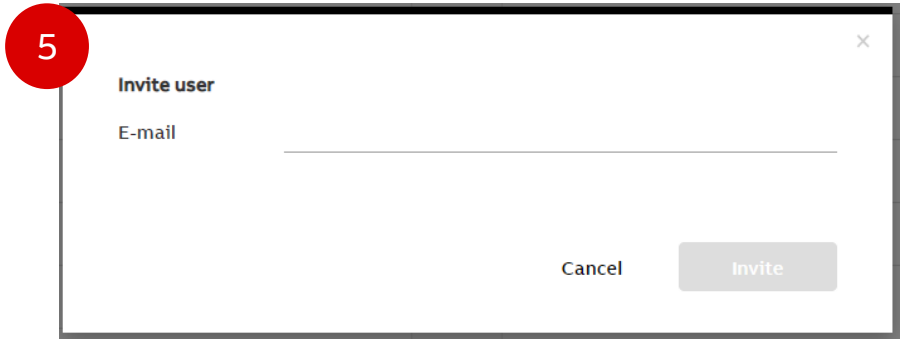
Add users to User Group

Give other people visibility of your sensors



4) If the user is not in the organization, click “**Invite new user**"

5) Input e-mail address. New member will receive e-mail instructions to join the organization.

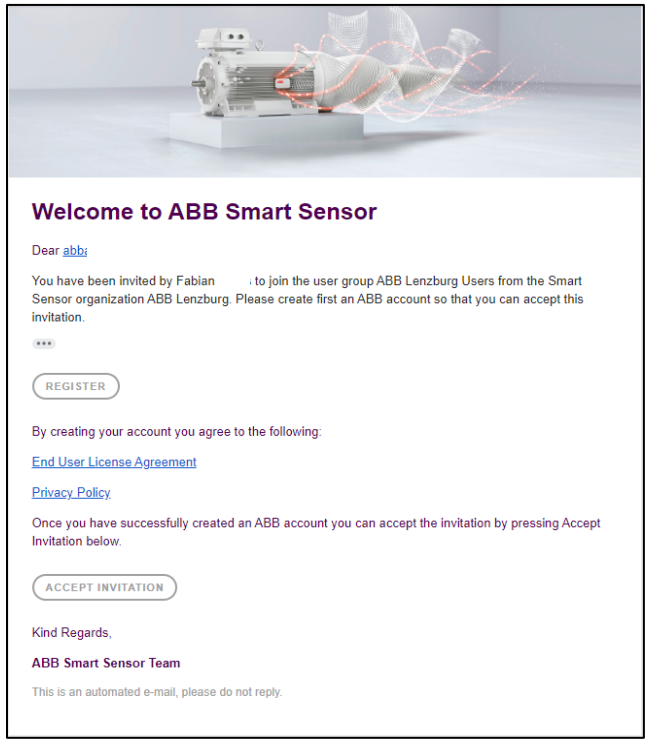


6) To change access from “**Member**” to “**Moderator**”, the user must be currently active in the organization.
   - **Delete** the user from the Group and add to the user again, repeating step 2, setting moderator rights from the start.

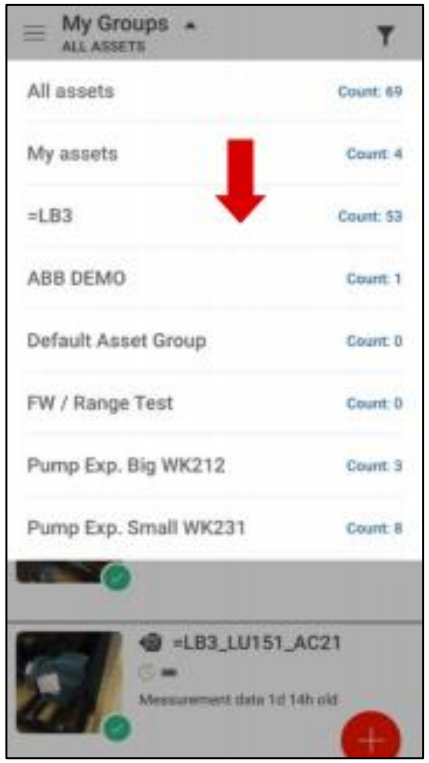
Give access to new members

E-mail invitation: Please join my group

1



2



1) <u>If you already have an ABB account</u>:
   - One link to **accept the invitation**
   - Only 1 organization access at a time
   - You can always switch organizations

   <u>If you do not have an ABB account</u>:
   - First: set up a user ID in ABB
   - Second: accept the invitation*

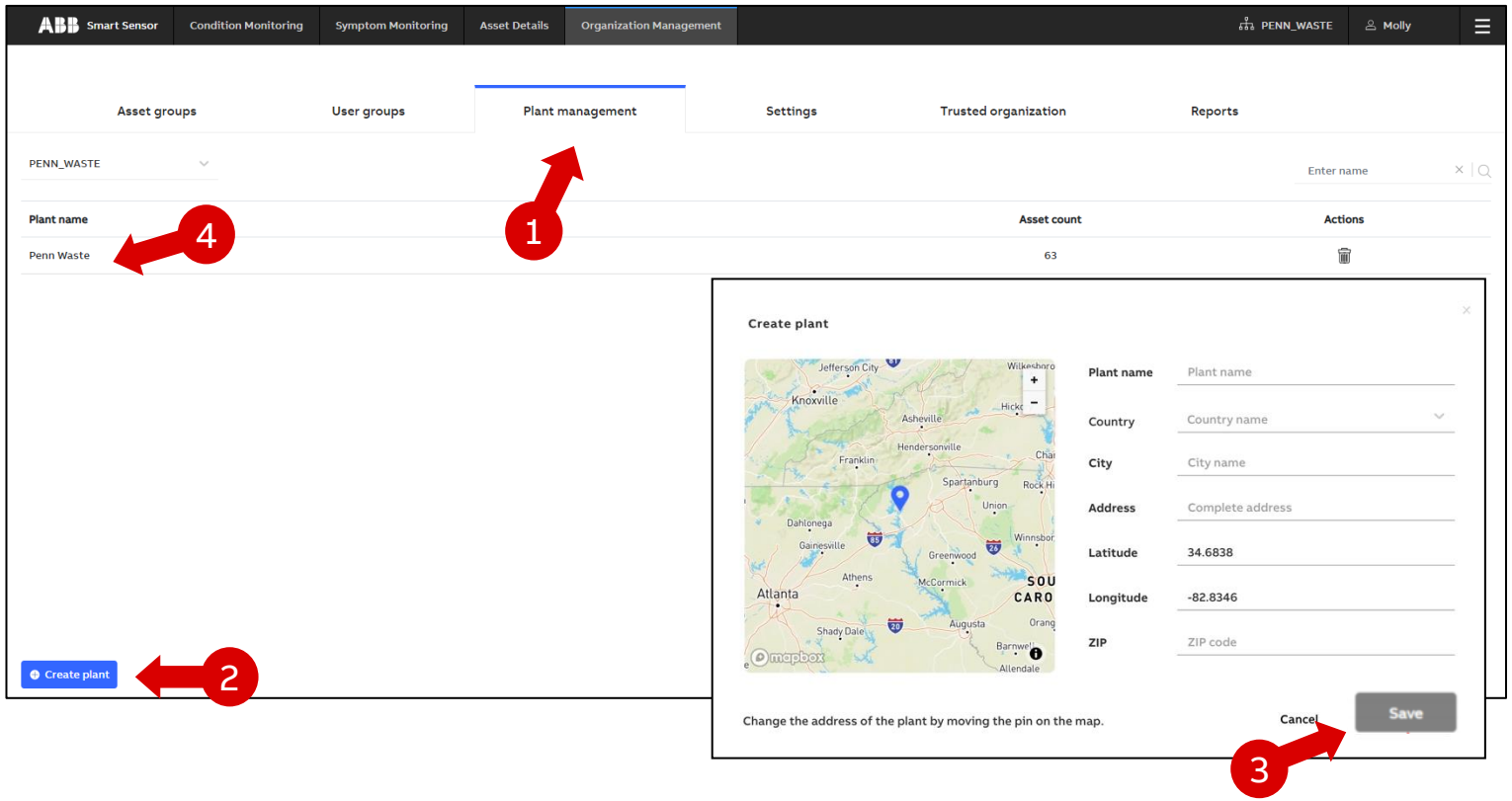
Make sure you log in to the Smart Sensor portal after clicking on the **ACCEPT INVITATION button to be automatically added to the user group.*

1) Refresh your app to log into the new organization and see the sensors for the User Group you were invited to.

Email invite comes from email address: global-noreply_smartsensor_temp@abb.com with subject: **Welcome to ABB Ability SmartSensor**

Plant management – add new plant

Add a new plant to your organization



Add a new plant to the organization

1) Go to **Plant Management**, under **Organization Management**

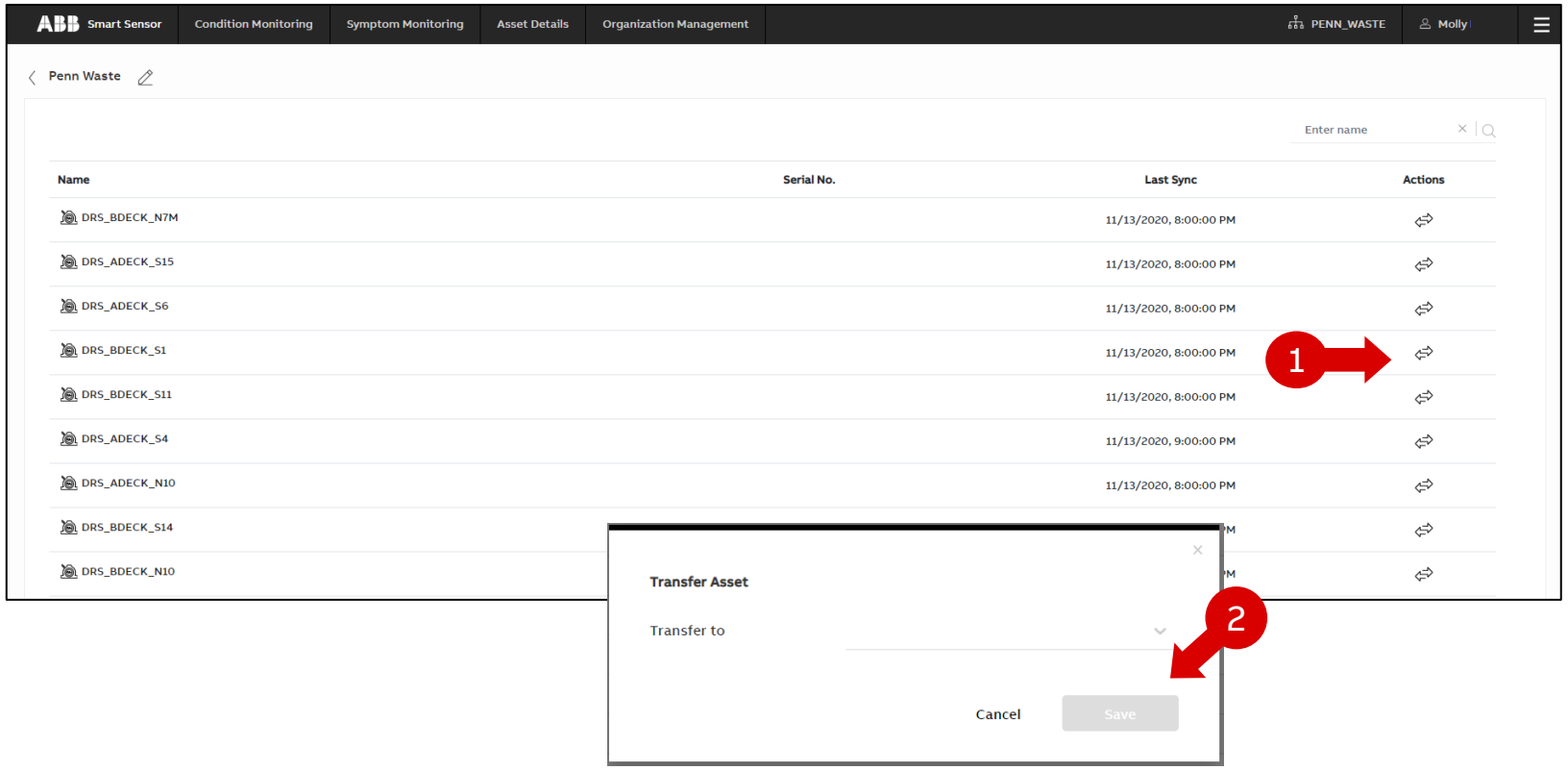
2) Click “**Create plant**”

3) Enter details in the pop-up prompt and **save.**

4) To enter a plant and manage the assets that are located at that plant, click one on the side the list. E.g.: “Penn Waste”.

Plant management – transfer asset to other plants

Transfer sensor from plant to plant to change location on the map



Transfer asset to another plant:

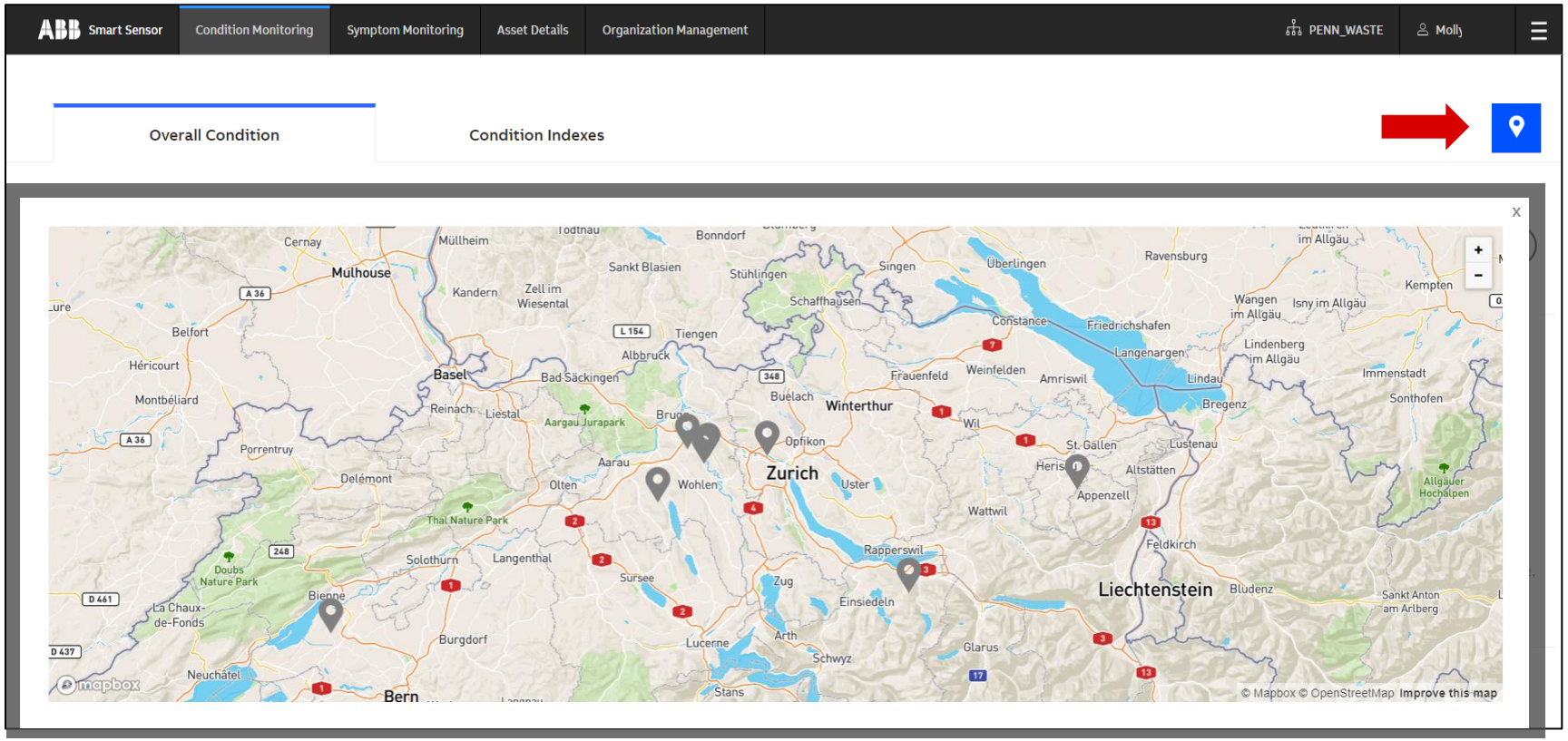
In the “Plant Management” page, the “Plant List” is visible

1) Choose sensor from the plant to **transfer**, clicking on the arrows

2) In the pop up, **choose plant** from dropdown list and click “Save”. Your sensor will now be visible on the map at that new location.

Plant location

Location of the plants on a world map

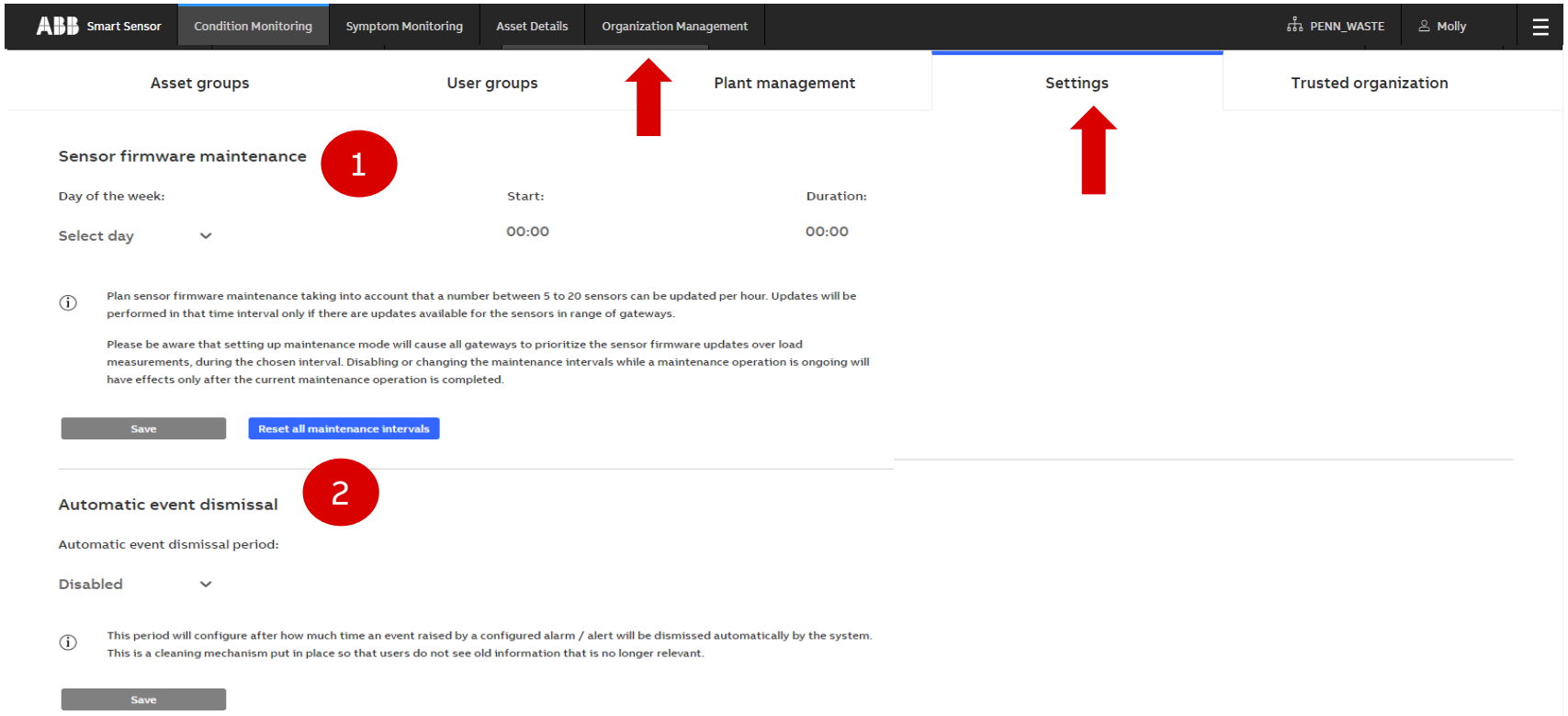


To see the location of your Organization's plants on a world map, navigate to **Condition Monitoring** view and click on the Map symbol

1) The location is automatically saved at the moment a sensor is commissioned to a specific plant
2) Address can also be input manually, but will not influence the location in the map

Organization management – Settings

Remote firmware updates through gateway

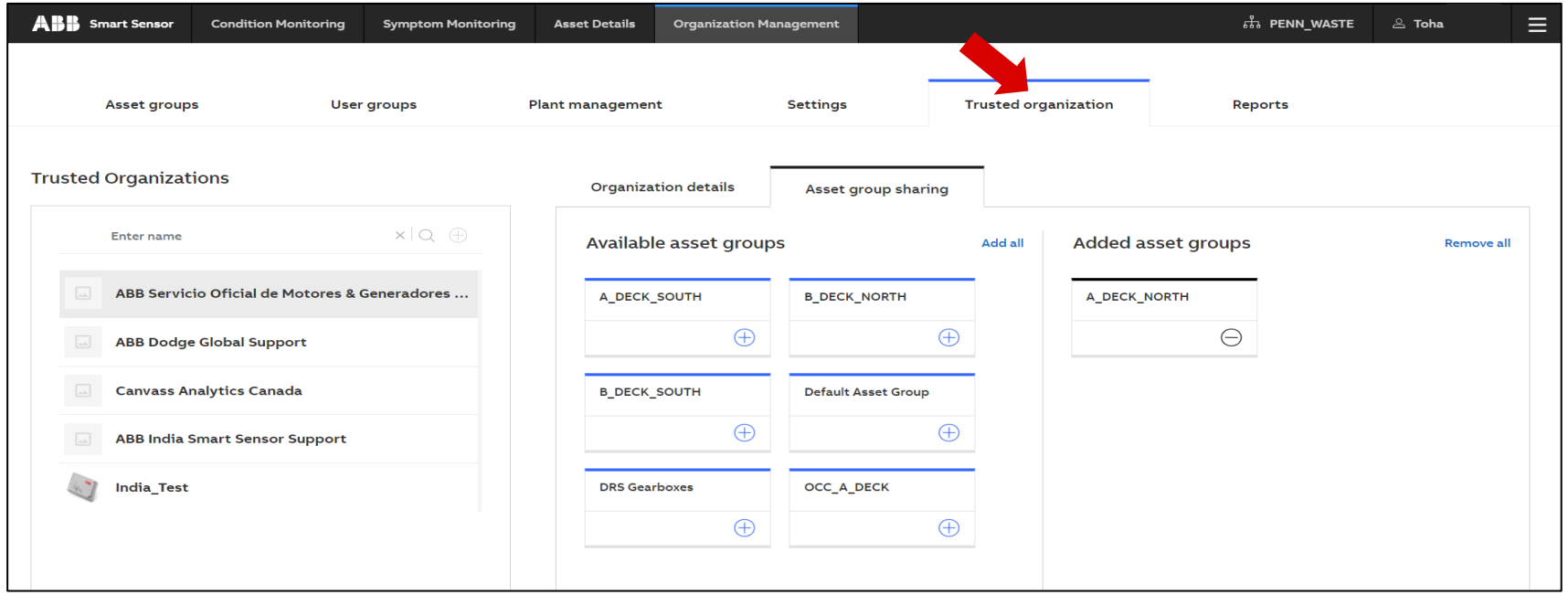


Under the tab **Settings** in the Organization Management view

1) The **Sensor firmware maintenance** mode enables **remote sensor firmware updates.** During the configured update time, measurements are not updated, but remain saved on sensor memory.
   Note: 5 to 20 sensors can be updated per hour.
1) The **Automatic event dismissal** allows to specify a time period for automatic dismissal of events that were not handled in the defined time period.

Organization management – Trusted Organization

Share Asset Groups with Trusted Organization



Advantages:

- Easy access to multiple Organizations from one portal
- Powertrain capabilities from similar assets of different plants
- **Ability to certify third-party support without adding as members of Organization**

Trusted Organization

Introduction

Terminology

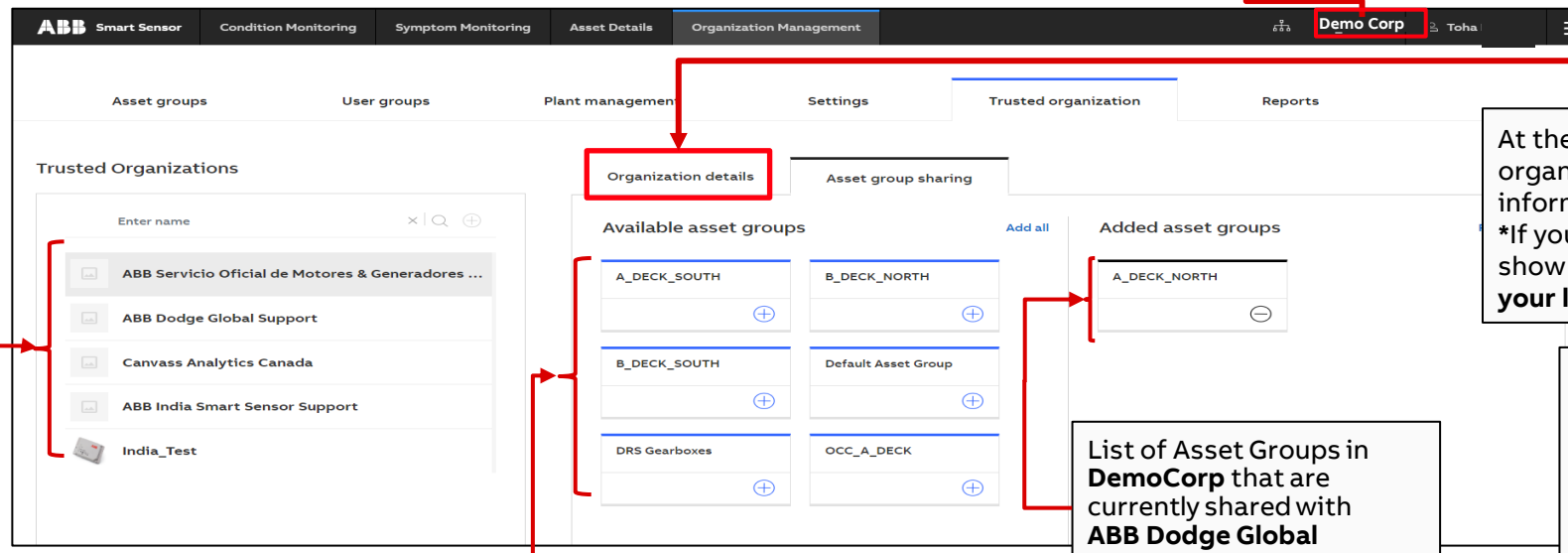
- **Admin:** Person that creates Organization. The Admin role is called Moderator in the User Group context
- **Sharing Organization**: Organization deciding which Trusted Organization to trust and share data with
- **Trusted Organization**: a support group certified by ABB and chosen by the end user to have access to hand-picked Asset Groups
- **Trusted User:** Member of “Trusted User” user group of Trusted Organization

Notes

- User must be a Moderator from the “Admins” User Group in the Trustee Organization to view the Trusted Organization option and to “trust” their Asset Groups to the Trusted Organization.
- The user only has to be a User Group member in the “Trusted User” User Group within the Trusted Organization to view the Sharing Organization’s data (if the Sharing Organization picked that Trusted Organization to “trust”).
- Trusted User does not need to be a member in the Sharing Organization to see data from that organization, as long as the Sharing Organization Moderator has granted that access to the Trusted Organization.

Trusted Organization

Background info



Sharing Organization Demo Corp

At the **Organization details** tab, the Sharing organization can view the logo and promotional information of the trusted organization (if available).
***If you have a trusted organization and would like to show a logo and some commercial info, please **contact your local Smart Sensor support**.

Adding an Organization to "Trusted Organizations" automatically creates a "Trusted User Group". Users must be added to this user group in order to view assets of organizations with trust relations.

The Trusted Organization feature allows **trusted service providers or ABB personnel** to view all organizations/customers they have been selected for within the same portal.

List of Asset Groups in **DemoCorp** that are currently shared with **ABB Dodge Global Support**

List of **Trusted Organizations**. The **Sharing Organization Demo Corp** can specify which asset groups are visible for which Trusted Organization. In this Example **ABB Dodge Global Support** is a **Trusted Organization**.

List of Asset Groups in **Demo Corp** that are currently not shared with **ABB Dodge Global Support**. A click on the **+** symbols makes the asset groups visible to **ABB Dodge Global Support**

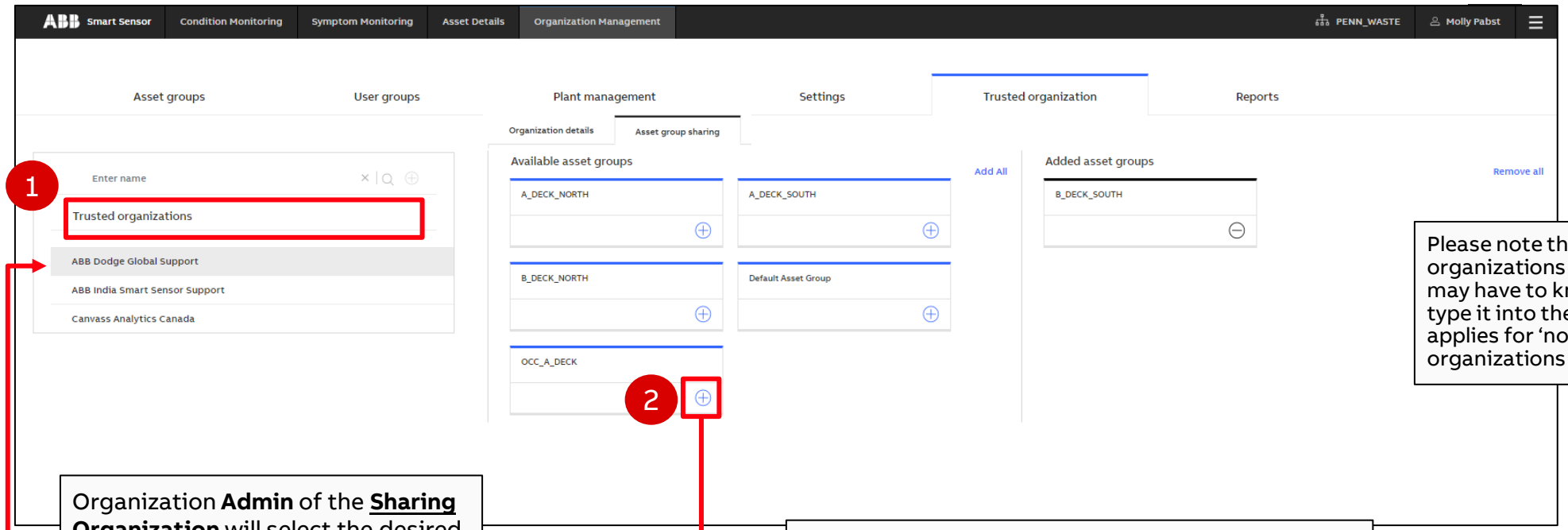
Trusted Organization

How to Create

1. Create Organization (will appear as normal organization)
2. Follow specific procedure to certify created organization as ‘Trusted’ → **please refer to your local Smart Sensor contact or support**
3. Once the organization has been trusted, a ‘Trusted User’ user group is automatically created.
4. The Admin of the trusted organization must manually add each user individually to the ‘Trusted User’ user group.
5. Request the trustee organization Admin to trust the created ‘Trusted Organization’. See examples on following slides

Trusted Organization

How to “trust” a Trusted Organization



1

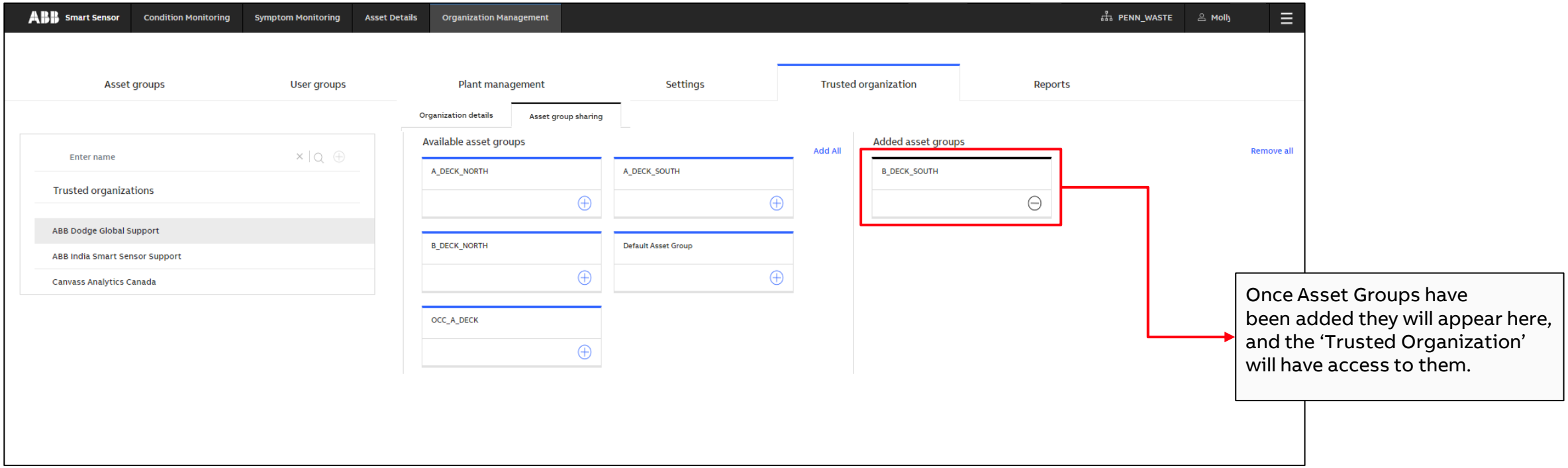
Please note that not all available trusted organizations will be visible in this list. You may have to know the name in advance and type it into the name field to choose it. This applies for ‘non-public’ trusted organizations

Organization **Admin** of the **Sharing Organization** will select the desired “Trusted Organization” to which they want to grant access. Here ABB Dodge Global Support.

Organization Admin of **Sharing Organization** will select the Asset Groups that shall be shared with the ‘Trusted Organization’. Click on + to add.

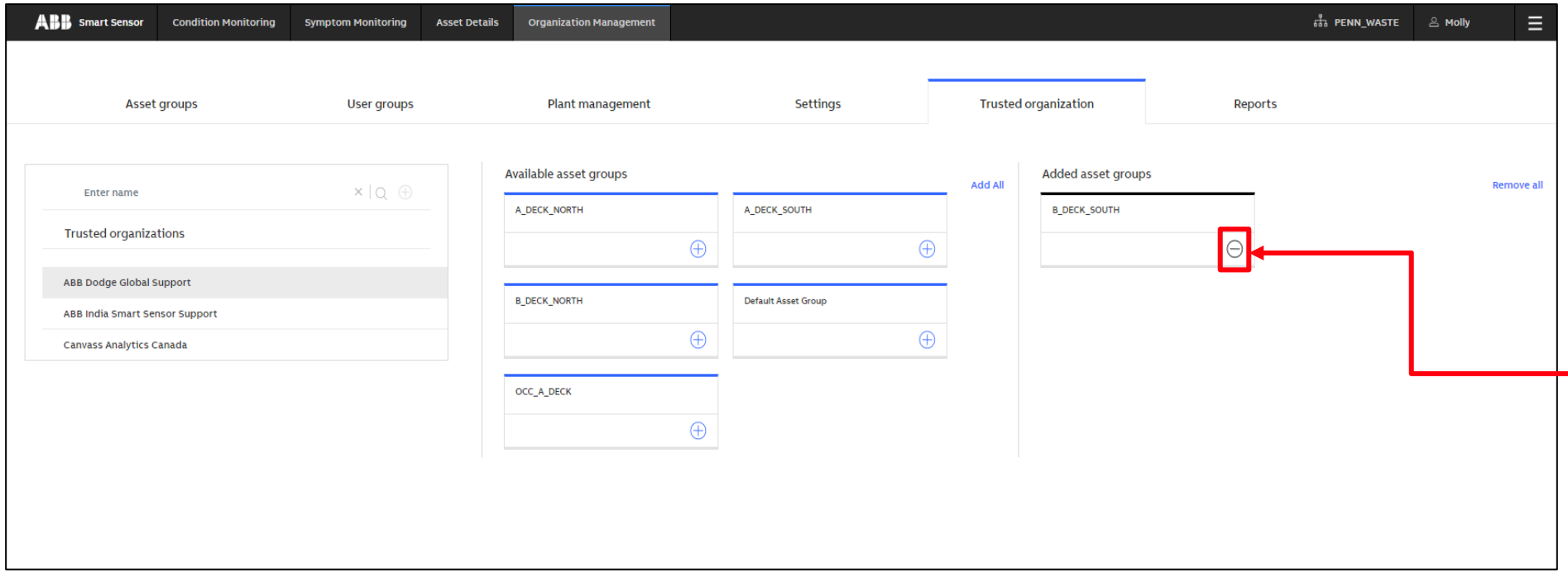
Trusted Organization

How to **share** asset data with a Trusted Organization



Trusted Organization

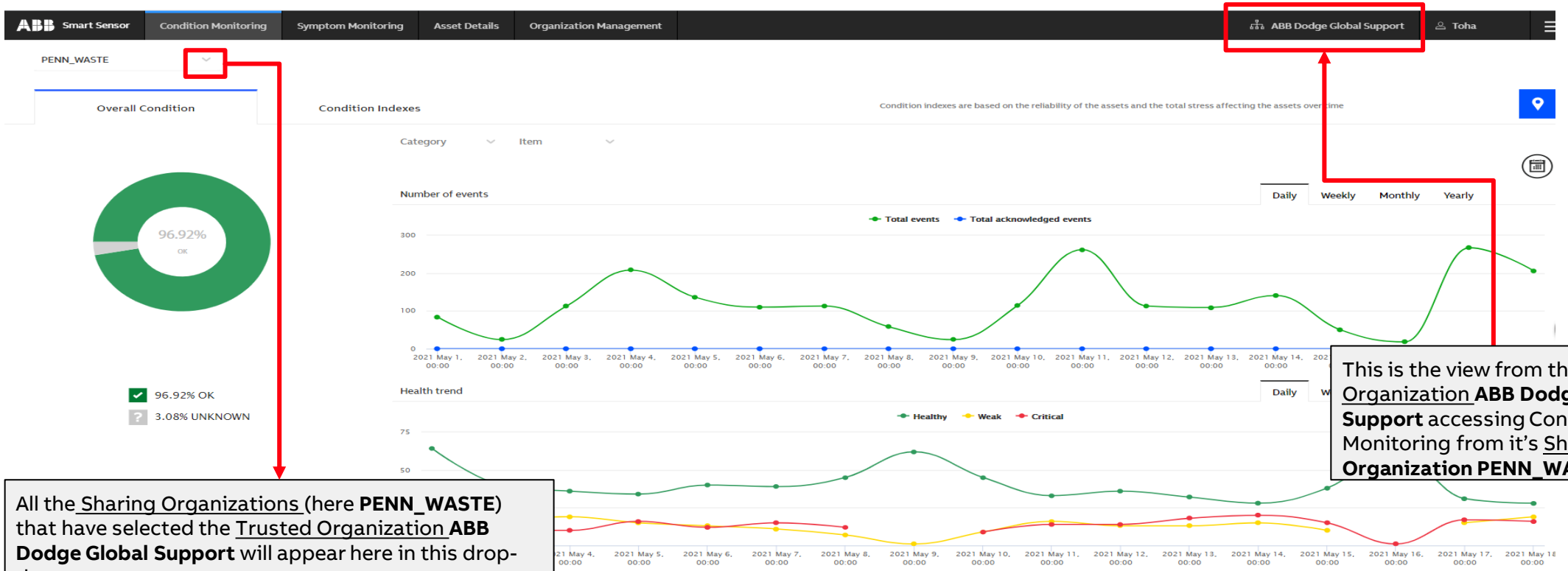
How to **stop sharing** asset data with a Trusted Organization



If, for some reason, an asset group shall not be shared anymore, it can be removed from the 'Added asset groups', by clicking on the minus sign. This will revoke the trusted organization's access to rights and data is no longer shared (for this asset group).

Trusted Organization

How to view Condition Monitoring from sharing organizations while on the portal of the Trusted Organization

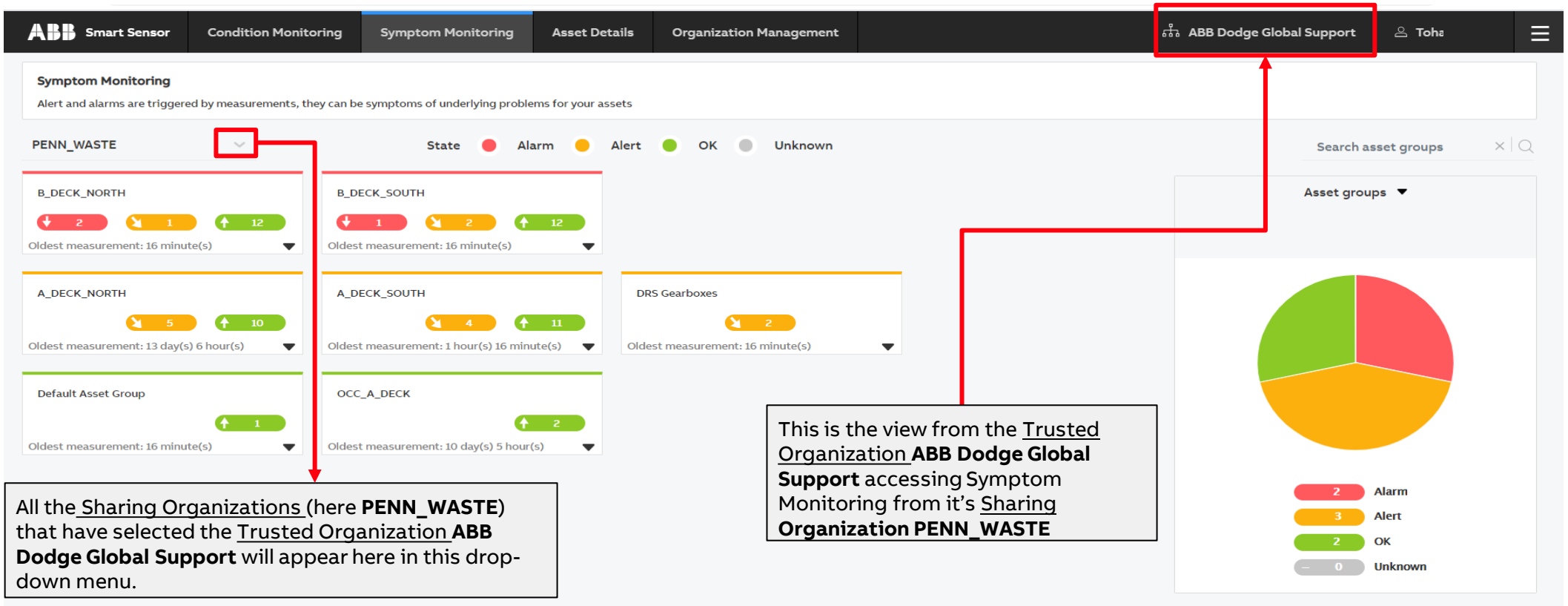


All the Sharing Organizations (here **PENN_WASTE**) that have selected the Trusted Organization **ABB Dodge Global Support** will appear here in this drop-down menu.

This is the view from the Trusted Organization **ABB Dodge Global Support** accessing Condition Monitoring from it's Sharing **Organization PENN_WASTE**

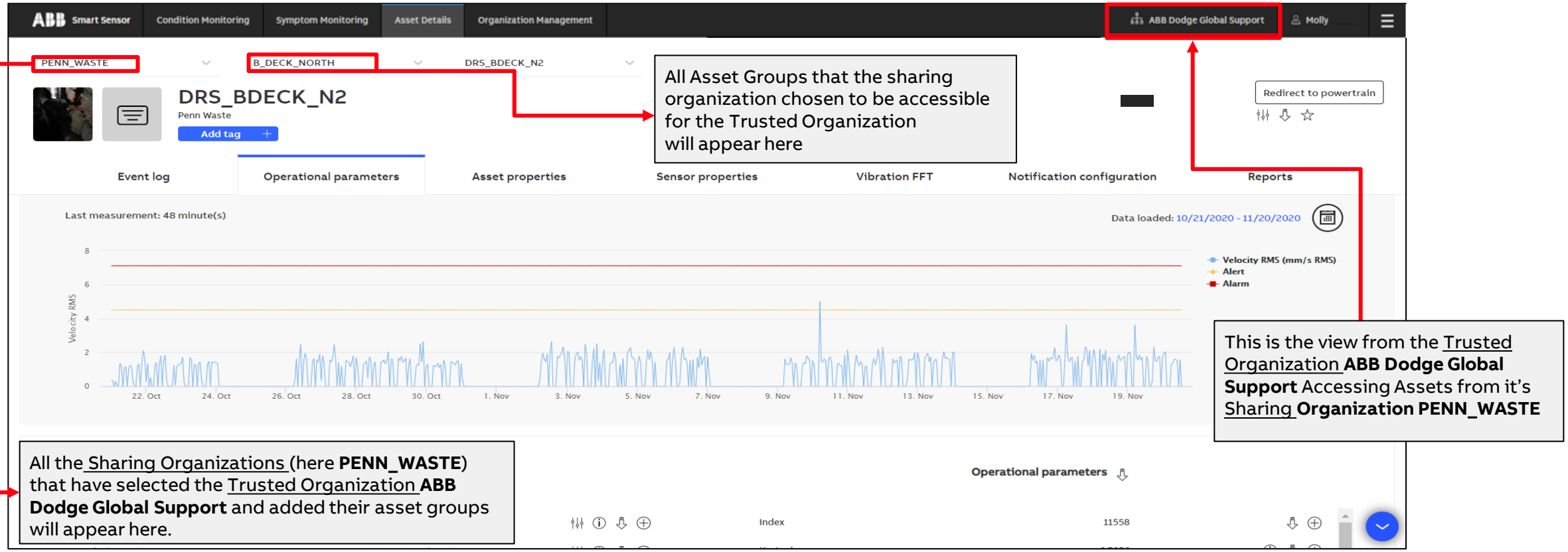
Trusted Organization

How to view Symptom Monitoring from sharing organizations while on the portal of the Trusted Organization



Trusted Organization

How to view assets from sharing organizations while on the portal of the Trusted Organization



3. Sensor activation and commissioning

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https://youtu.be/rcOWbXf55ec?list=PLFwq1JTSL1fh7Xv2q2YIIe83EZi0SLVFH

Sensor Activation & Commissioning

How to identify the sensor’s serial number

Note the sensor serial number located on the side of the sensor.

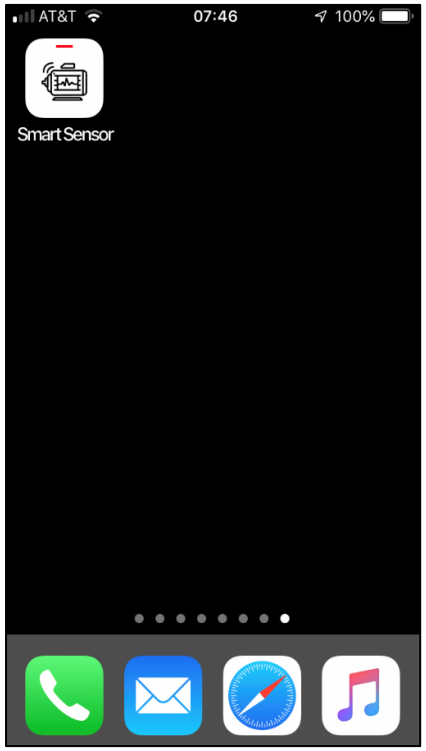
You’ll need the serial number to identify this sensor during the activation process.

This serial number can also be found by scanning the **QR code** on the lower left side of the box the sensor arrives in.

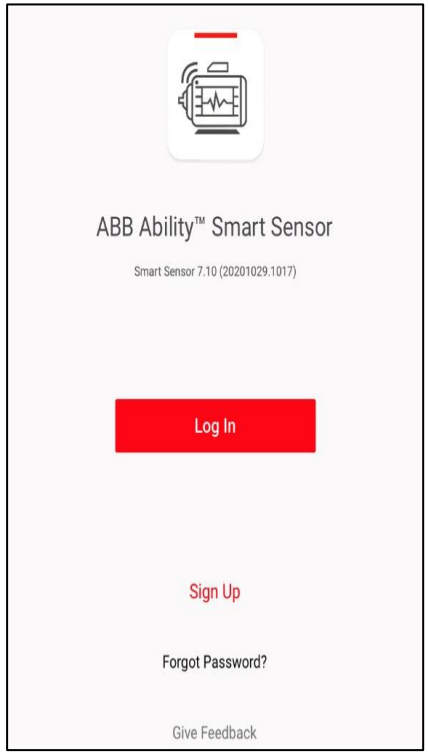
Sensor Activation & Commissioning

Log in to ABB Ability Account

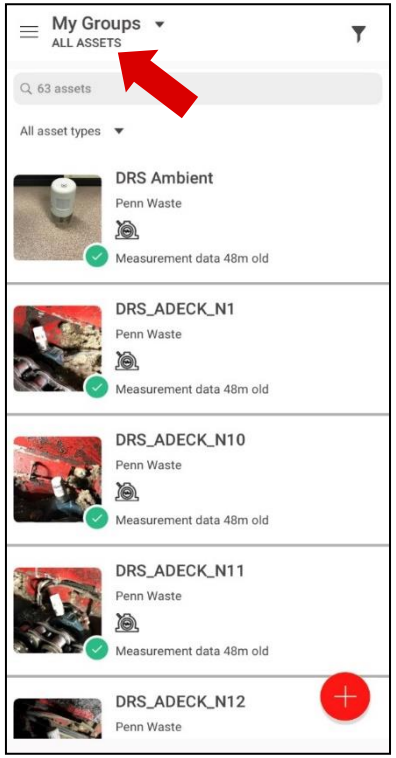
1



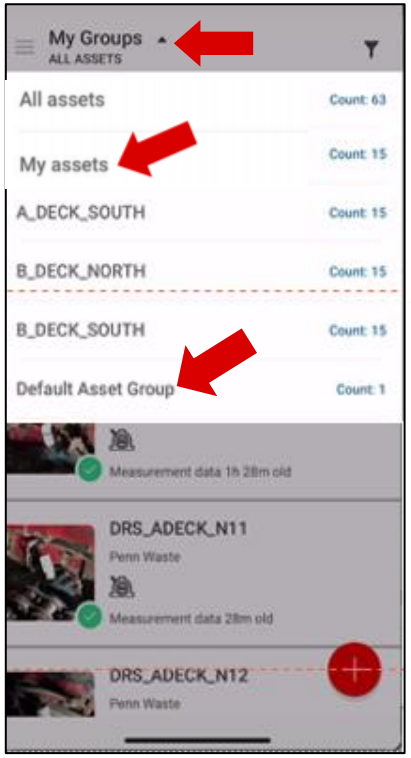
2



3



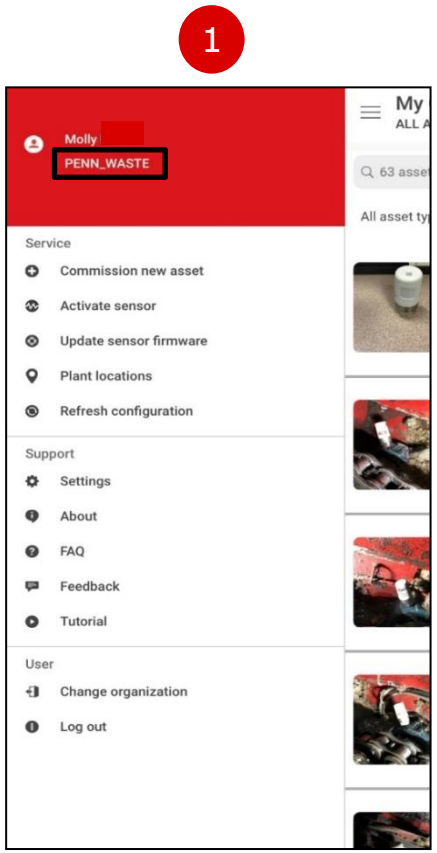
4



1) Launch the Smart Sensor app on your smartphone.
2) Login to the app by entering your credentials (email and password when required).
3) Default starting screen: “**All Assets**“
   - This initial screen shows you all assets in the organization
4) Access “**My Groups**” view:
   - All authorized asset groups are shown in drop-down
   - Initially, the only groups are **“My Assets”** and **“Default Asset group”**
   ”My assets**” group is private, every user has one and no assets should be here, please transfer all assets to another asset group as this group will no longer be available in a future app release.*

Sensor Activation

Check the organization name and activate sensor



1) Carefully check the organization name.

The sensor will be commissioned to this organization. Sensors can be easily transferred between asset groups but will need to be deleted to transfer between organizations.

2) Activate the sensor by pressing the silicon button.

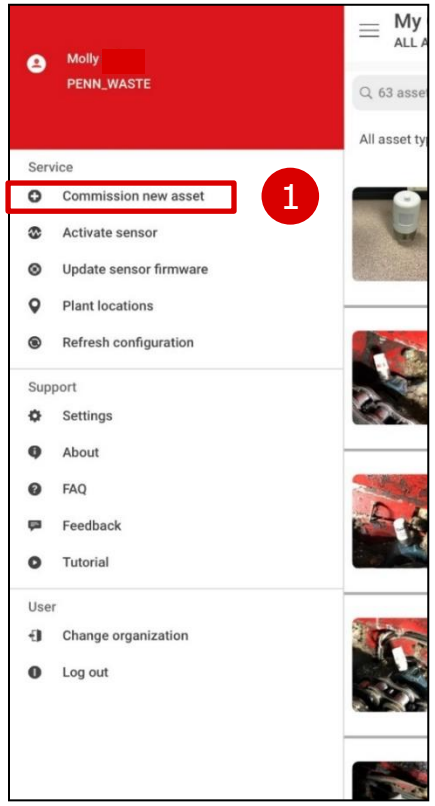
3) A 3 x blinking LED light indicates the sensor is active.

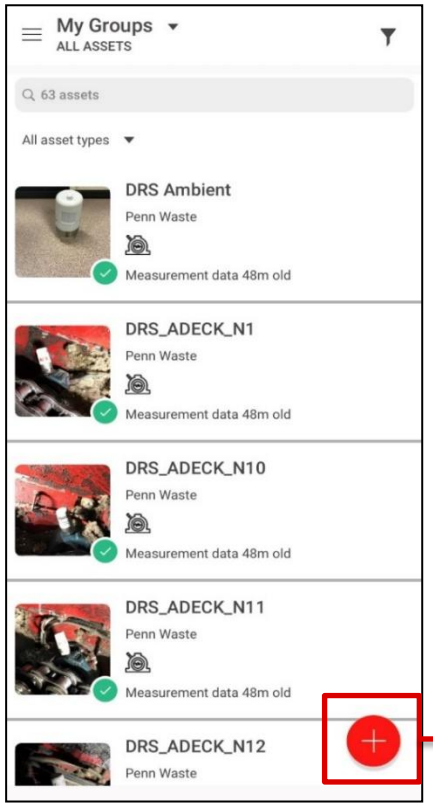
Remember, silicon button must be pressed **only (!)** when sensor is ready to be commissioned. After successful commissioning sensor is always active and collects measurement on the top of the hour.

Remember, user has 10min for sensor commissioning. If you do not finalize commissioning during this time sensor will "go to sleep" and you will need to press silicon button again.

Sensor Commissioning

Commission New Asset





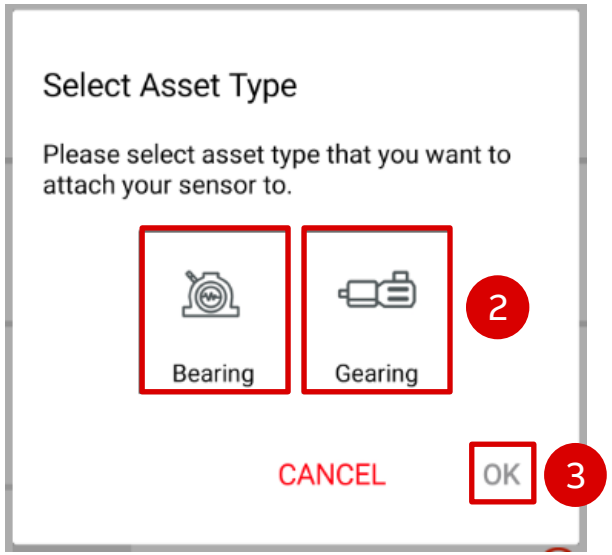
1) Now tap **“Commission new asset”** to see a list of all active sensors within range.

You may also add a new asset directly from the main page by tapping **the red plus sign** at the bottom of the screen.

Attention: sensor must be in Bluetooth range

Sensor Commissioning

Viewing your sensor on the app and selecting an asset type



1) Select the sensor that corresponds to the serial number on the sensor that was noted earlier.

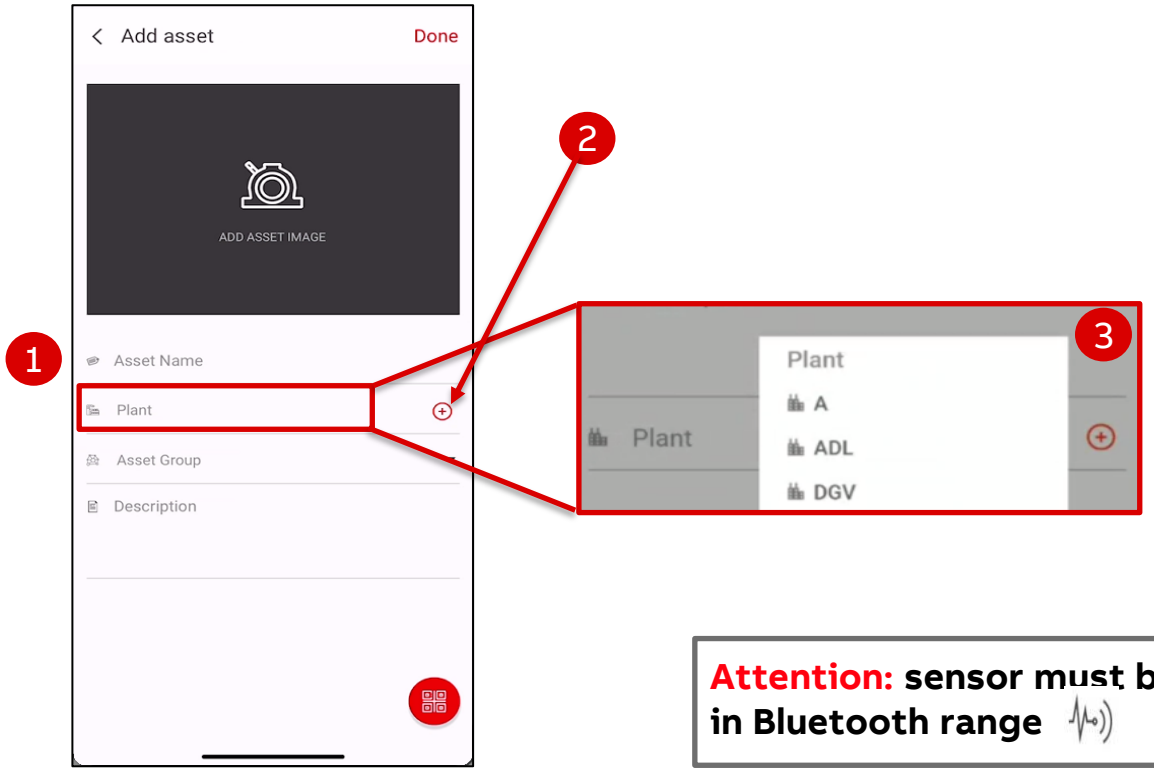
2) Select the asset type that you want to attach your sensor to either bearing or gearing.

3) Once you have made a selection, tap on **OK**.

Attention: sensor must be in Bluetooth range

Sensor Commissioning

Enter asset information

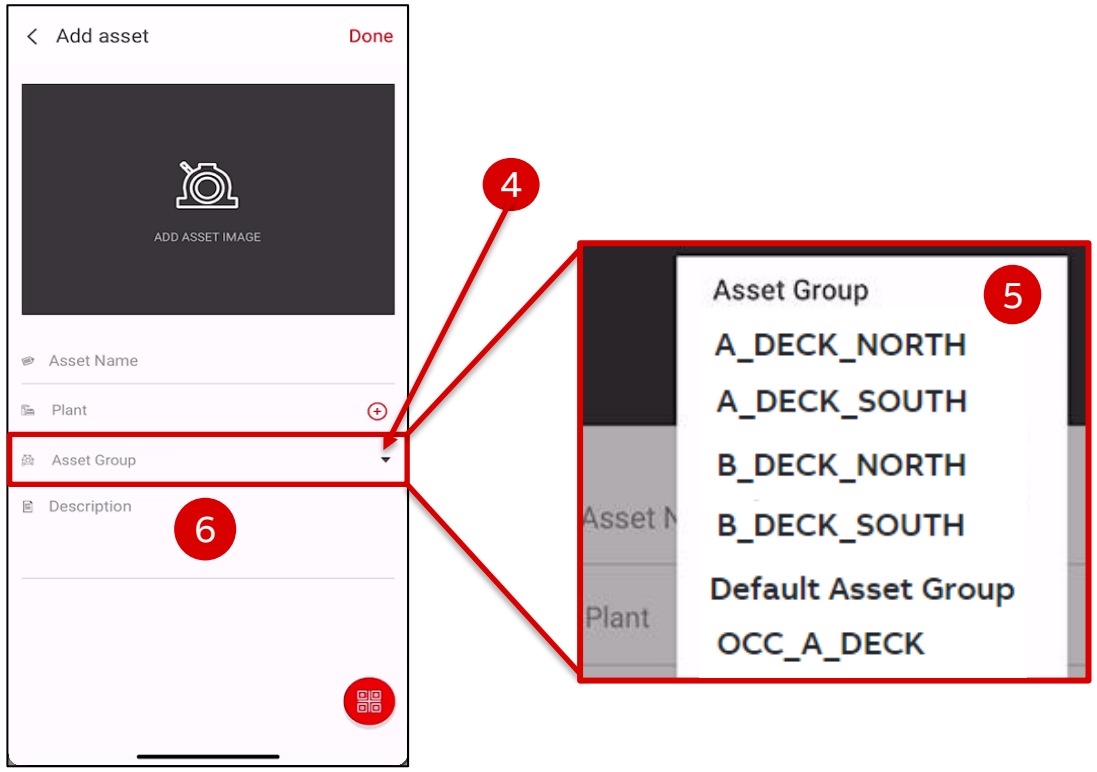


Attention: sensor must be in Bluetooth range

1) Type in the name of the asset, for example the equipment type and/or location of the bearing or gearbox being monitored by the sensor.
2) If you have not created a plant for your organization yet, you'll need to create a plant…that is, the fabrication facility
   - To create a new plant, tap the plus sign ⊕
   - Should the app ask for permission to access your location, tap "**Allow**" to continue to the next step.
   - Fill out the required plant information and tap "**Done**".
3) You may choose to add the sensor to an already existing plant in your organization, if a plant has been previously created. To select an existing plant, tap on the Plant field to display the list of available plants. Select the plant.

Sensor Commissioning

Enter asset information



4) Click on the Asset Group drop down menu.
5) Select one of the available asset groups.
6) Type description (this is an optional field, **not mandatory**). You may choose to type the Dodge nomenclature string, for example P2B517-ISAF-215R or you may choose to add a further description of your equipment being monitored with the ABB smart sensor for mounted bearings.

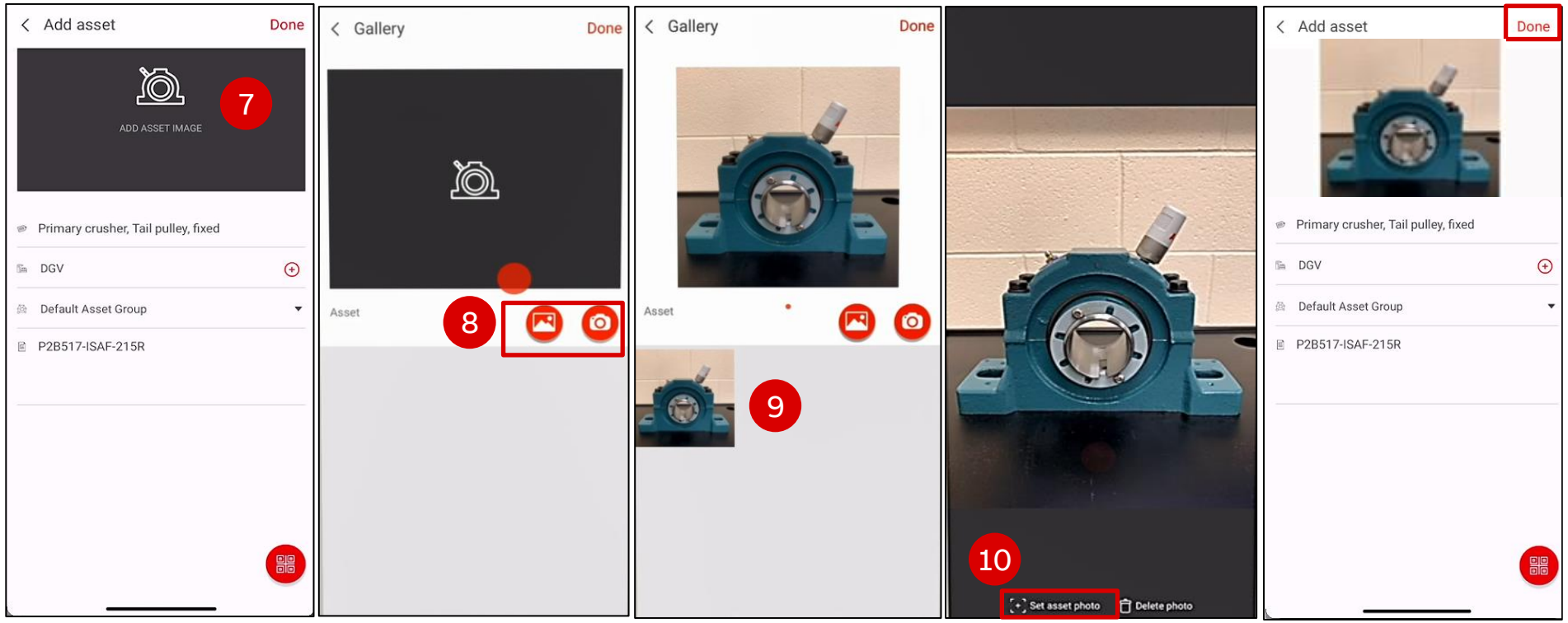
Notes:

- Asset Group list will be empty if you are not a user in the organization you are currently joined to. Please contact the organization admin to get added as a user.
- You won't be able to pass this screen until you become a user of the organization.

Attention: sensor must be in Bluetooth range

Sensor Commissioning

Add asset photo

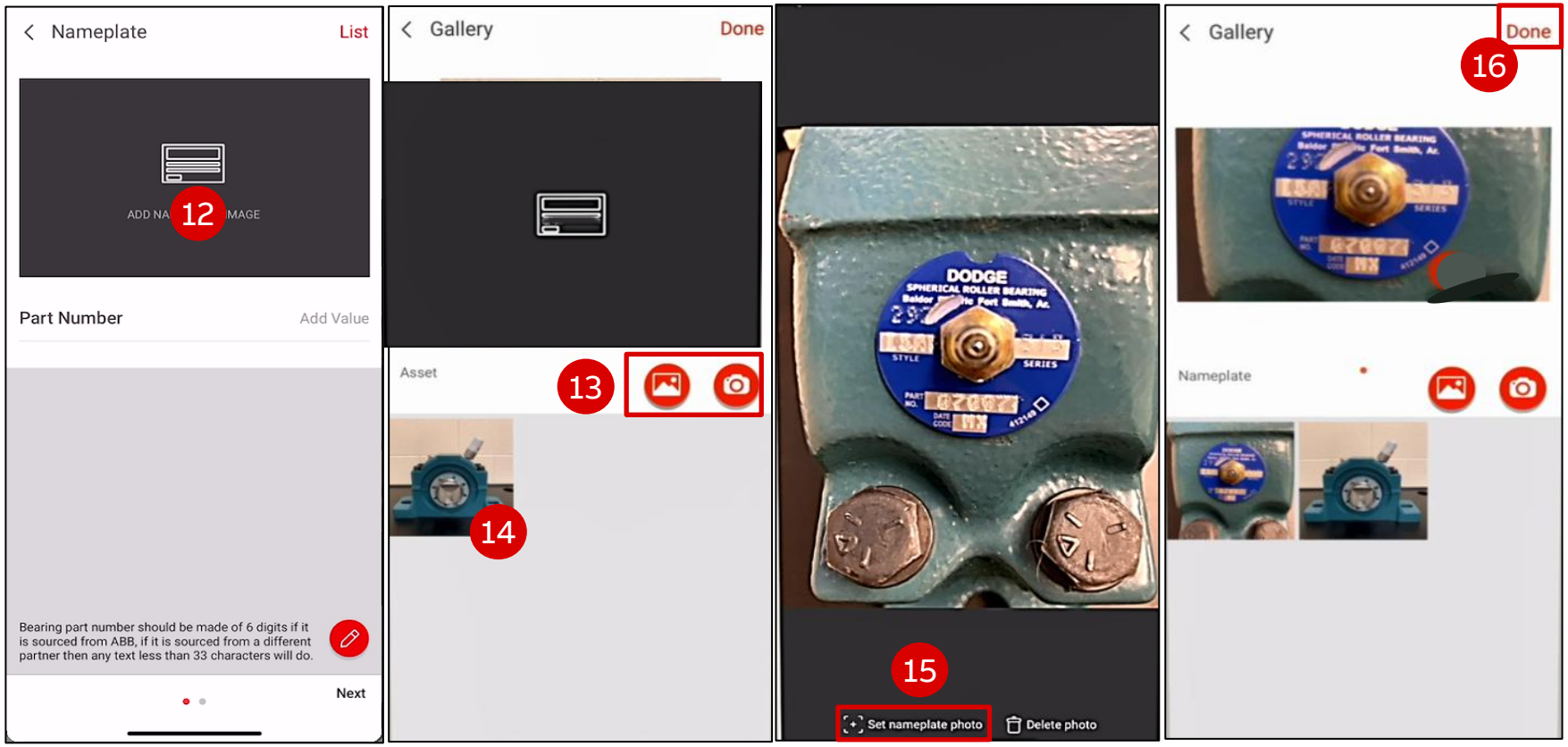


7) Tap “**Add asset image**”.
8) You may select a photo from your photo library, or take a new picture.
9) Select the photo you want to use.
10) Tap “**Set asset photo**”.
11) Tap “**Done**”, and tap “**Done**” once more to save the asset information.

Attention: sensor must be in Bluetooth range

Sensor Commissioning

Nameplate configuration

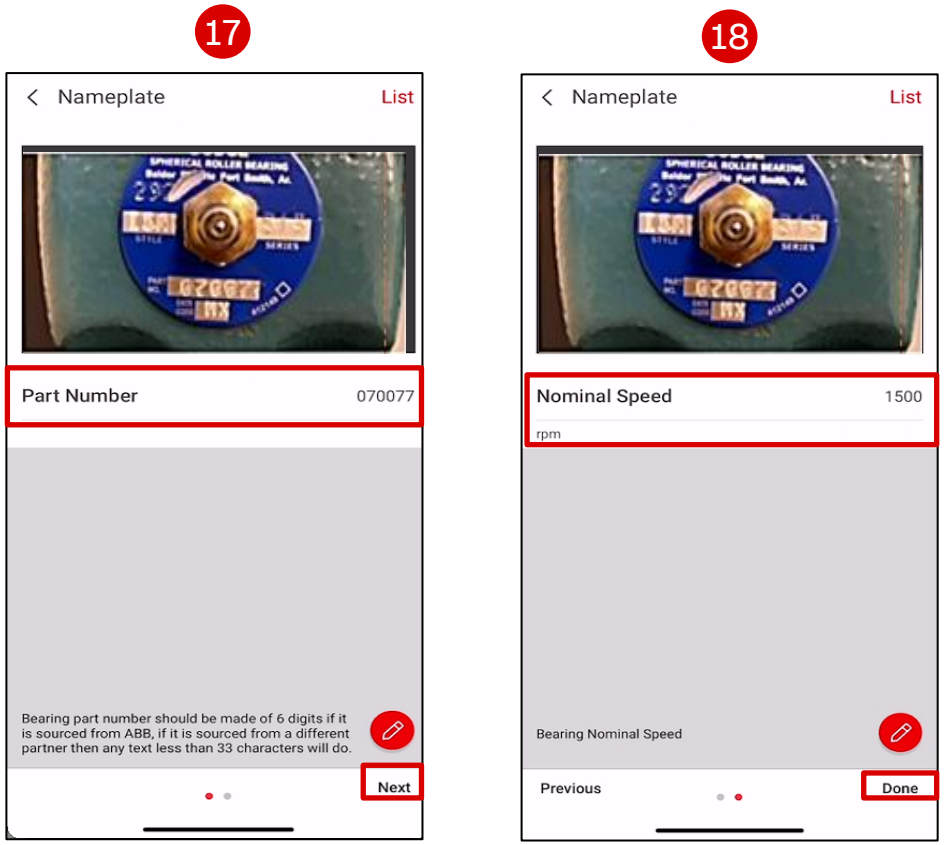


12) The next step is to capture an image of the nameplate data.
13) You may select a photo from your photo library, or take a new picture.
14) Select the photo you want to use.
15) Tap “**Set nameplate photo**”.
16) Tap “**Done**”.

Attention: sensor must be in Bluetooth range

Sensor Commissioning

Nameplate configuration: Mandatory nameplate details



17) Enter the six-digit part number of the Dodge mounted bearing, the appropriate nomenclature of the Dodge gearbox or if sensor is mounted in a competitors' mounted bearing or gearbox, enter NA. Tap "**Next**".

Note: On this field you may enter up 32 characters.

18) Enter the nominal operating shaft speed, and then tap "**Done**" to save the nameplate data.

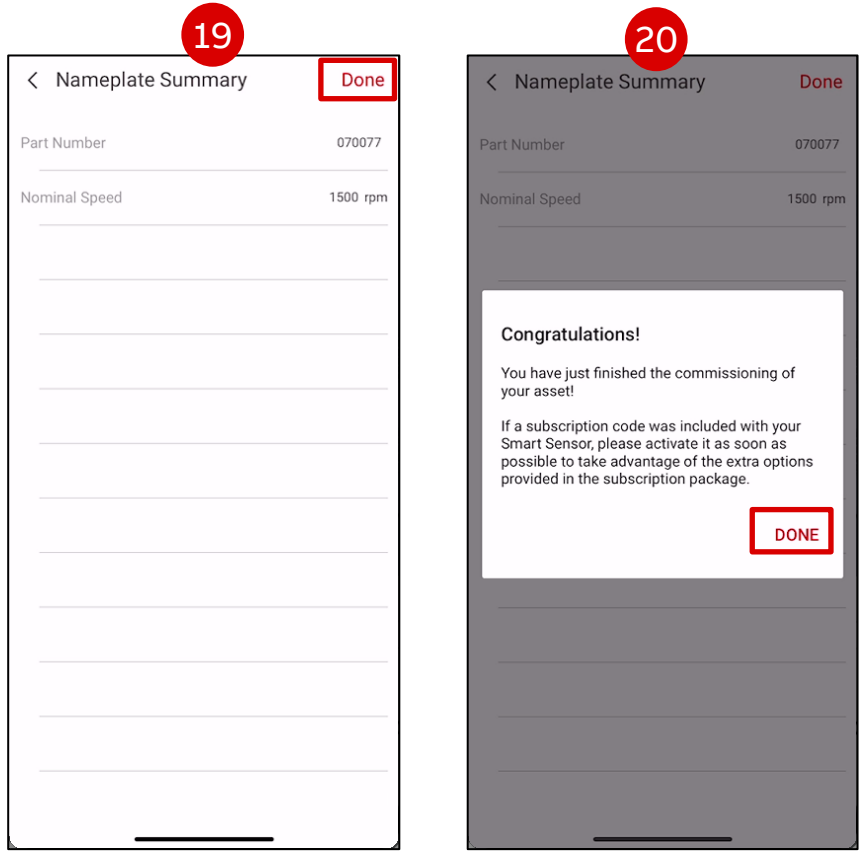
Note: On this field you may enter up 5 digits.

If you are installing the sensor on a gearbox, we recommend to enter the speed of the input shaft in the Nominal Speed field.

Attention: sensor must be in Bluetooth range

Sensor Commissioning

Last steps



19) Tap “**Done**”.

20) Tap “**Done**”.

Your ABB Ability smart sensor is now successfully commissioned and ready to monitor the condition of your asset.

Attention: sensor must be in Bluetooth range

Configuration and commissioning

Summary

Create account

– Become part of the Smart Sensor user base and enable predictive maintenance for your assets.

You now have access to the Smart Sensor Platform app and to the Digital Powertrain and Smart Sensor portals.

1

Create your organization

– Create organization via app.

– Create User and Asset Groups via the Portal.

– Connect User/Asset Groups.

– Invite users to an Organization.

– Add users to User Groups.

You are ready to activate and commission your sensors.

2

Activate your sensor

– Activate the Sensor by pressing on the sensor's silicon button.

Recommendations:

1. *Do not commission sensor before previous steps.*
2. *Gather nameplate information beforehand to commission your sensors from the comfort of your office.*

You can now add sensors to Asset Groups.

3

Configure and deploy!

– Find sensor with mobile app.

– Add sensor to the desired Asset Group.

– Enter nameplate data for the monitored asset.

– Mount sensor on the asset.

Load measurements with the app or wait for the gateway, and view trend data online!

4

4. Smart Sensor app general functionalities

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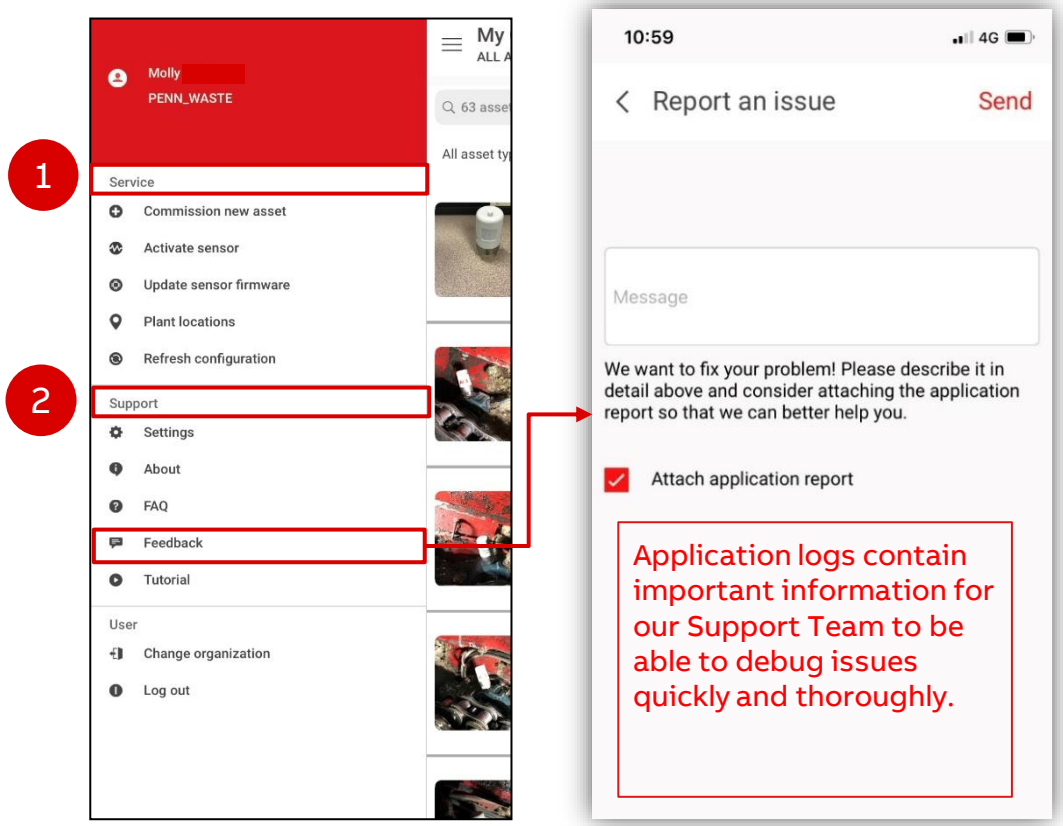
Download app to tablet or cellphone with iOS or Android

Main Menu – Services and Support functions

Smart Sensor Platform mobile app: main menu



From the main menu, you can:

1) <u>Services</u> that allow you to:

- Commission new assets
- Update Sensor Firmware (after activation, before commissioning)
- See plant locations on a map
- Refresh configuration (sync app with the back-end)

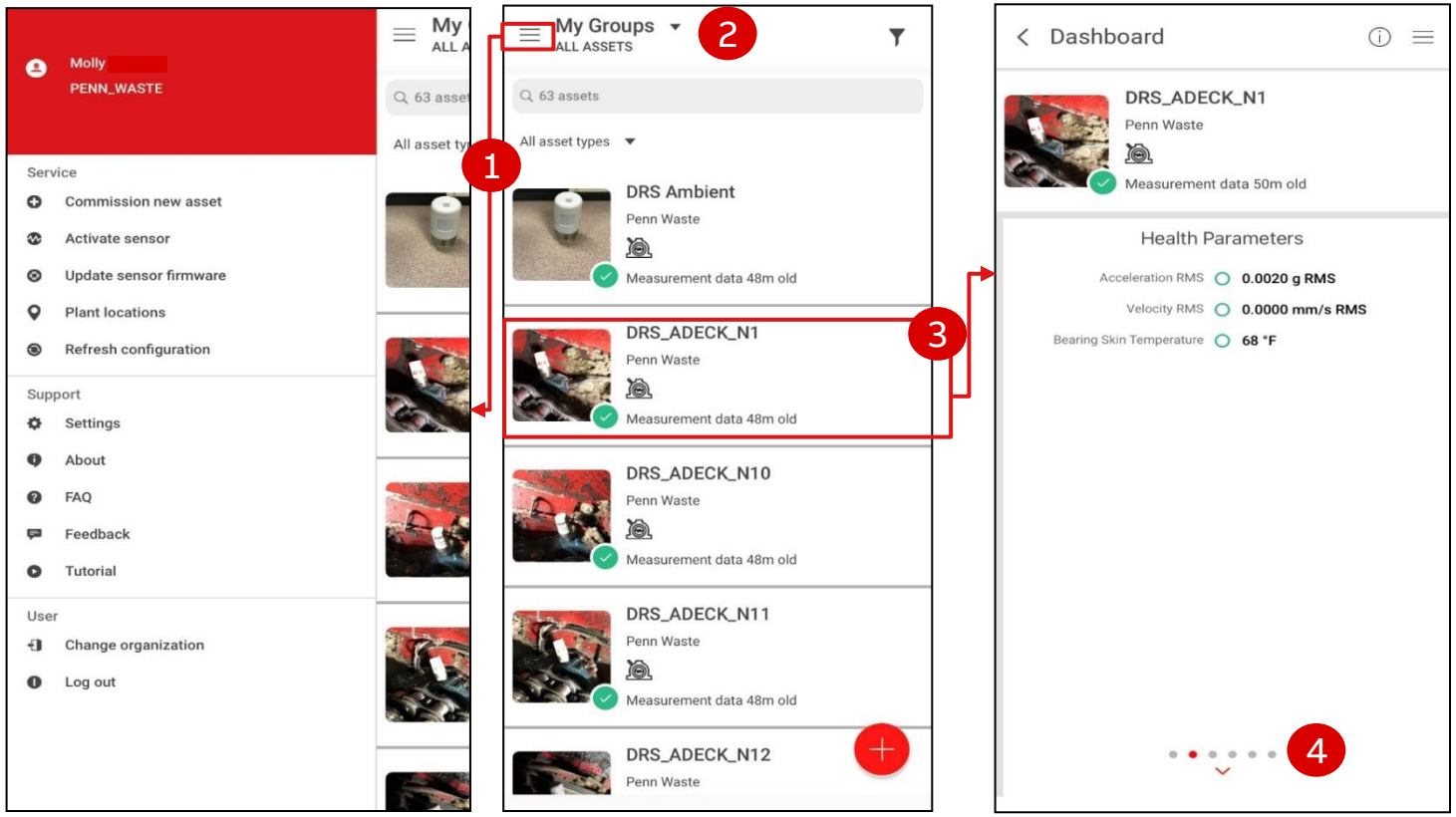
2) <u>Support</u> functions:

- **Settings:** Define measurement units, language etc.
- **About**: App information
- **FAQ**: Redirects to online FAQ for Smart Sensors for motors and pumps*
- **Feedback**: Report an issue directly to the Support Team. In order to get the best possible support, attach the application reports.
- **Tutorial**: Walks user through sensor activation and commissioning process of the smart sensor for **motors and pumps only**

***FAQ for the Smart Sensor for mechanical products** https://new.abb.com/mechanical-power-transmission/smart-sensor-for-mechanical-products/questions-and-answers

Landing page of the app

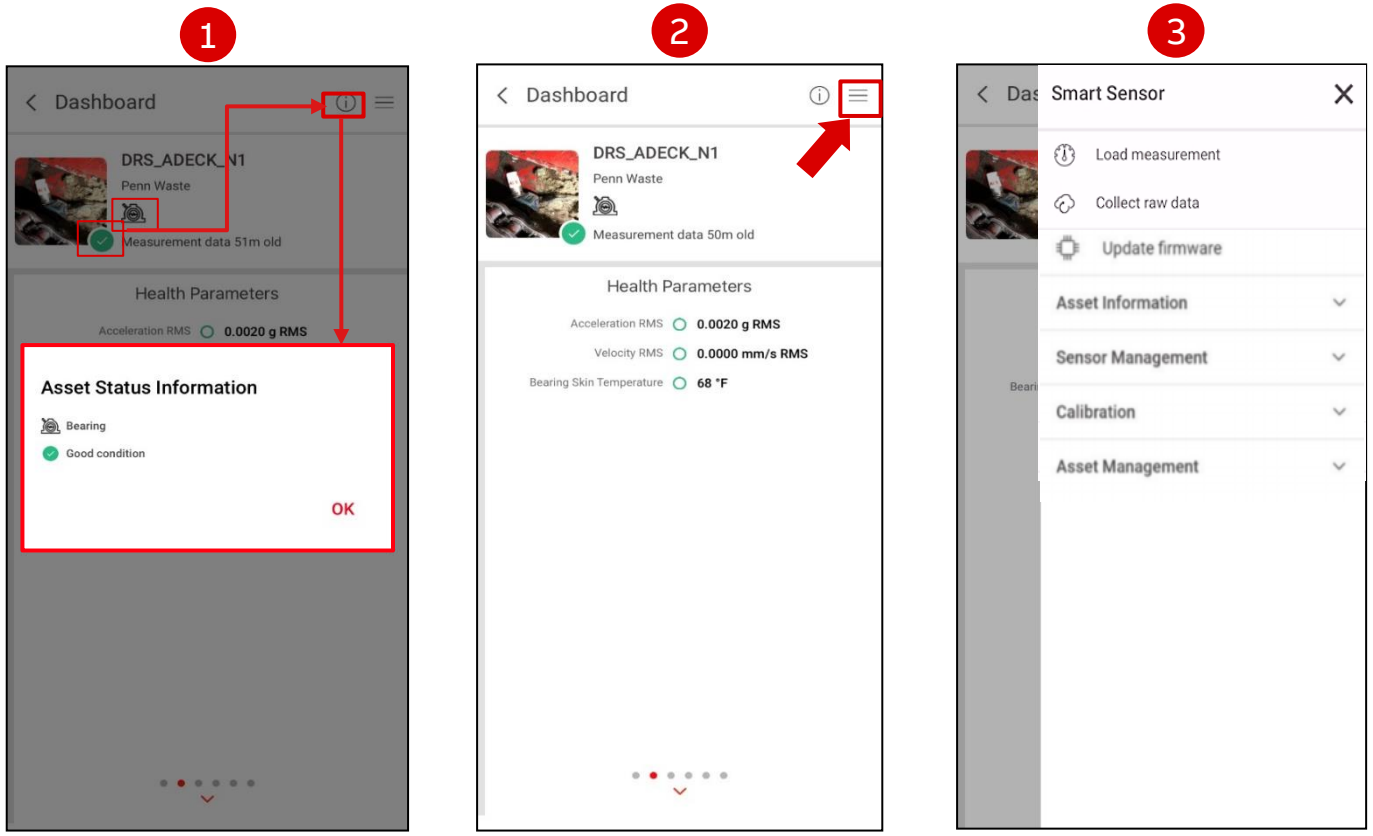
Organization, Asset Group and Asset views



1) **Landing page. Clicking on the top left icon leads you to the main menu (≡).**
2) The active organization is visible below your name. You can commission, activate sensors, (**for motor and pump sensors only**), update Sensors, request support and change your organization .
3) Clicking on an asset shows the detailed view for that particular asset.
4) Swiping left or right on the information card shows you additional information such as events and health status.

Landing page of the asset

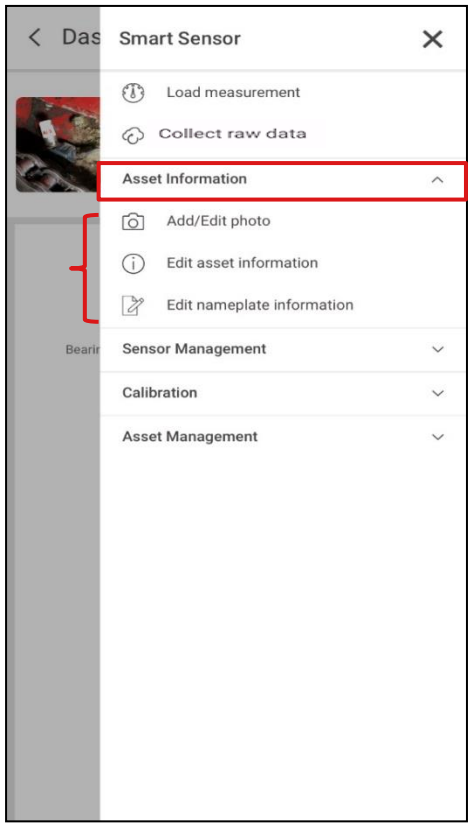
Organization, Asset Group and Asset views

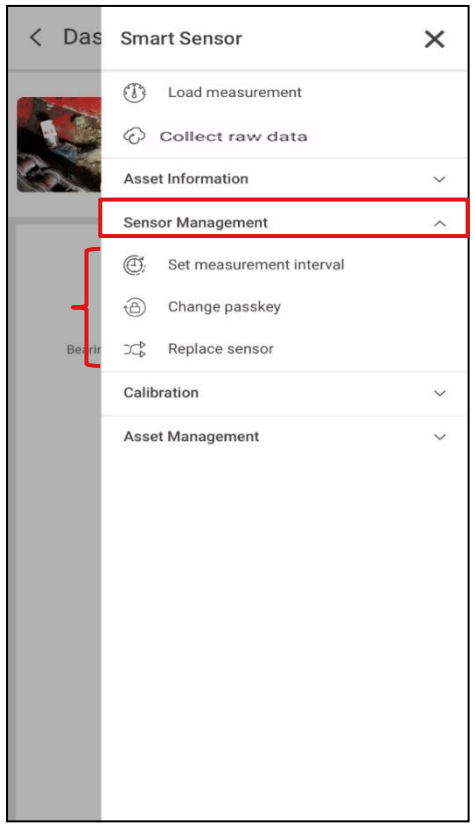


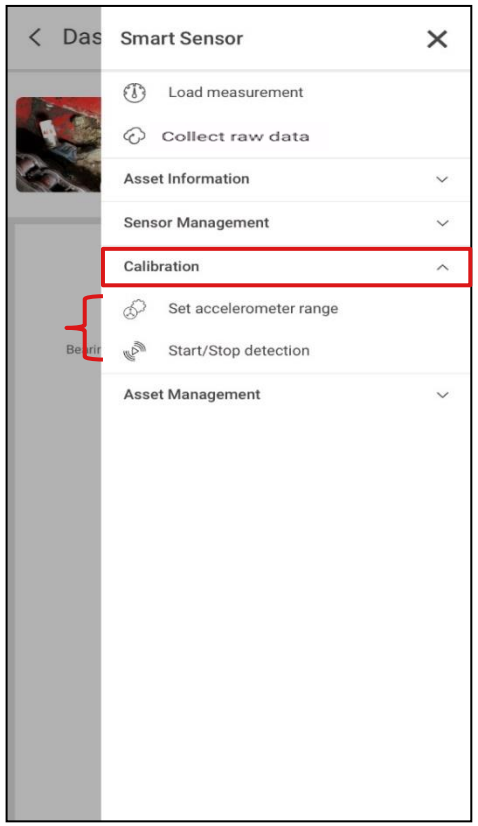
1) Click on the information icon ⓘ on the top left for an explanation of the pictograms.
2) Click the **menu** button to access further functionalities.
3) Several functionalities available:
   - **a) Load measurements**
   - **b) Collect raw data**
   - **c) Update firmware** (only visible if firmware is not newest)
   - d) Further functions on next slides.

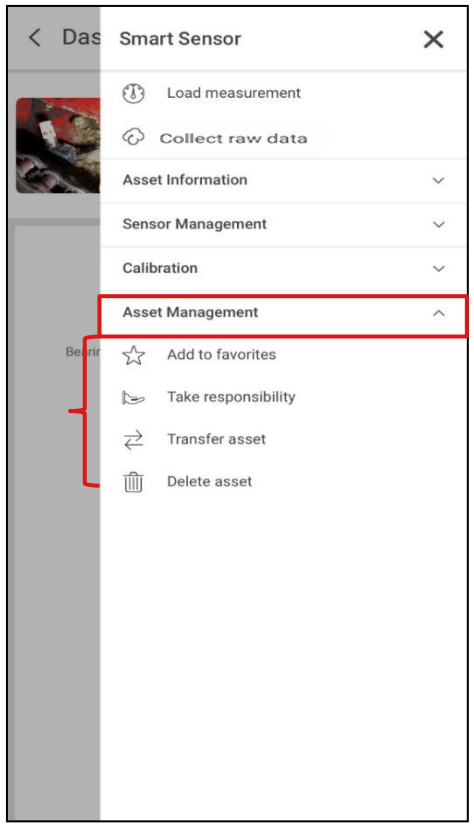
Functionality menu of the asset

Asset views and Asset management



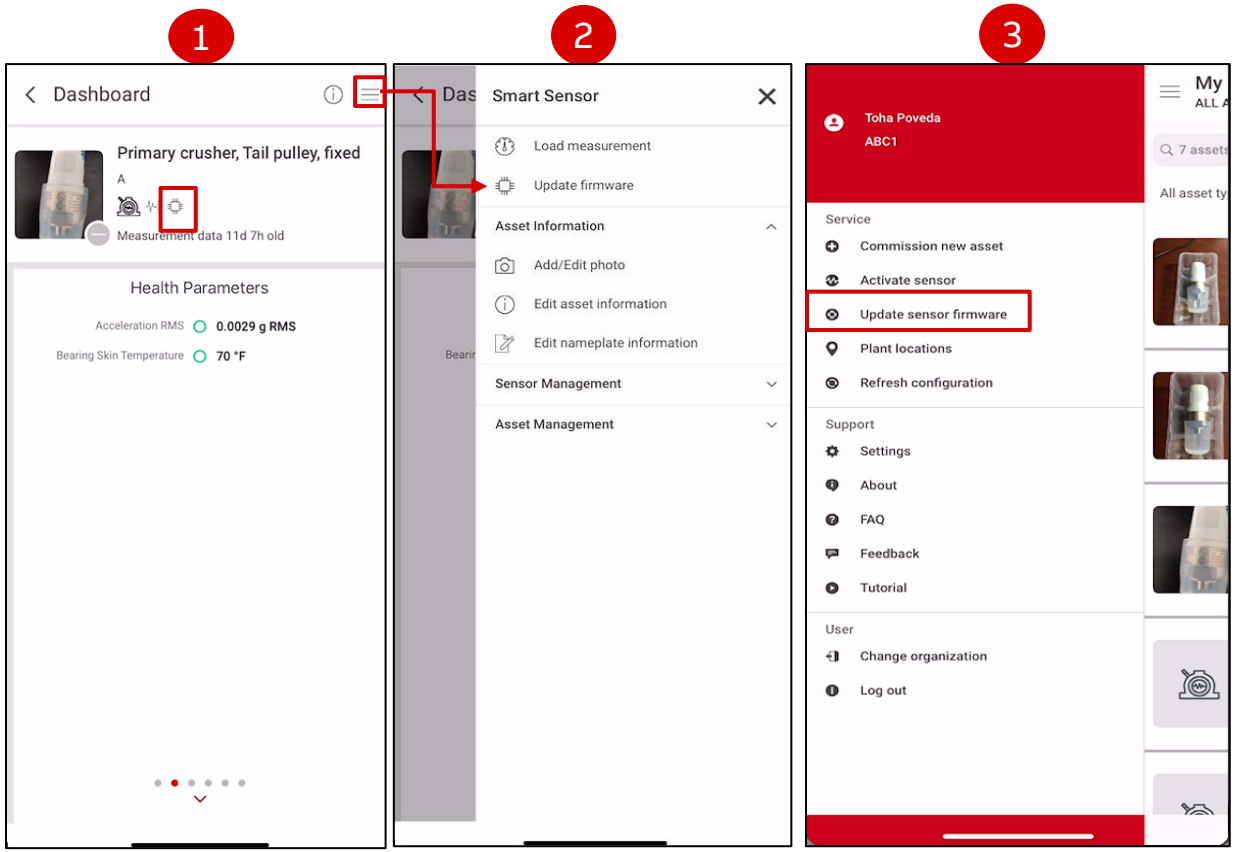






Update firmware

How to keep your sensor up-to-date



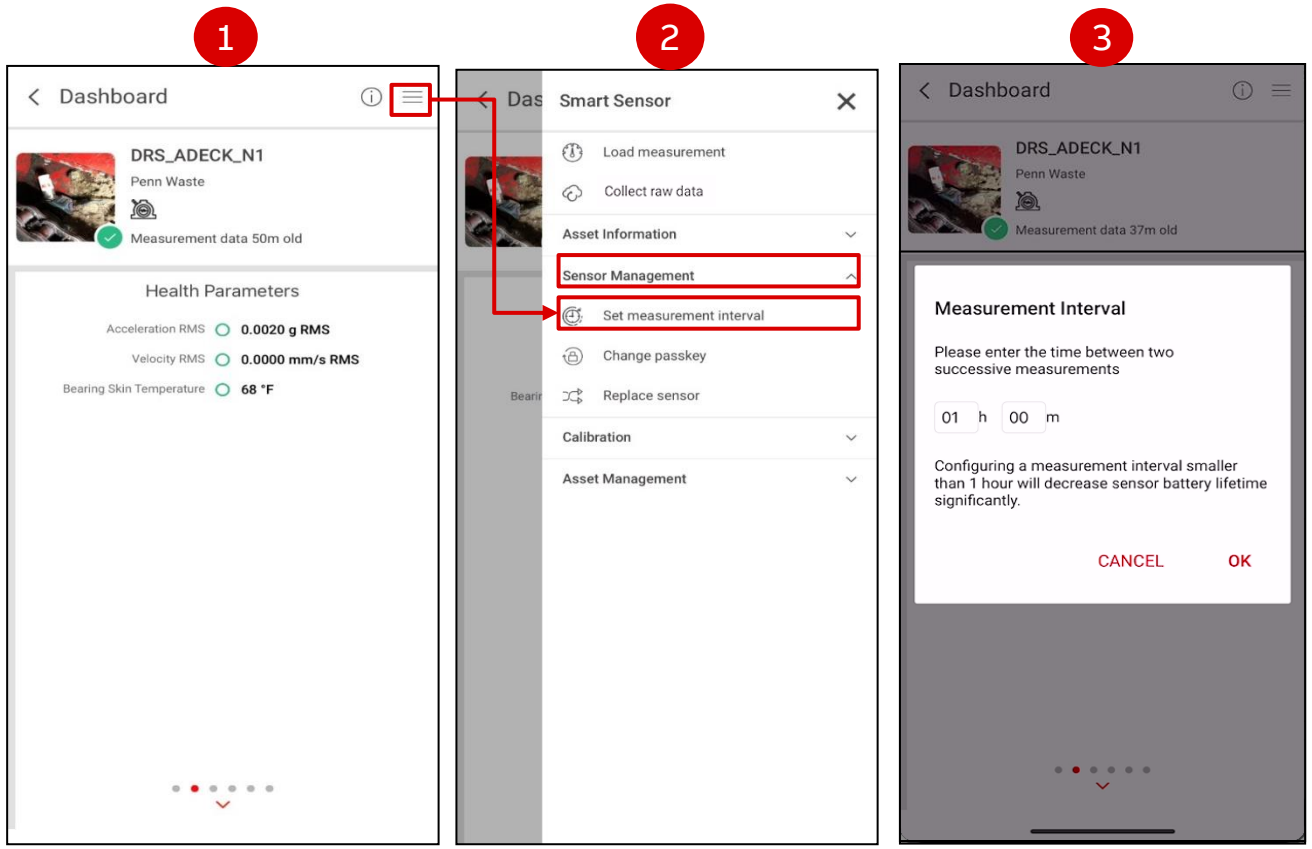
1) If your commissioned sensor needs a firmware update, you will see the "**microchip**" pictogram under the asset name.
2) Open the asset menu at the top right corner and click "**Update firmware**".
   - Follow the instructions on the screen
   - Average update time approx. 3 minutes.
3) **<u>To update the firmware before commissioning</u>**, activate the sensor (refer to page 47) then use the main menu functionality.

Attention: sensor must be in Bluetooth range

All the shown screenshots are from the iOS app.

Measurement interval

Adjust the measurement interval



Sampling interval: 1 h by default.

Max. Interval: 12 h

Min. Interval: 15 min

Memory: 6400 measurements

Estimated battery life: 2 years

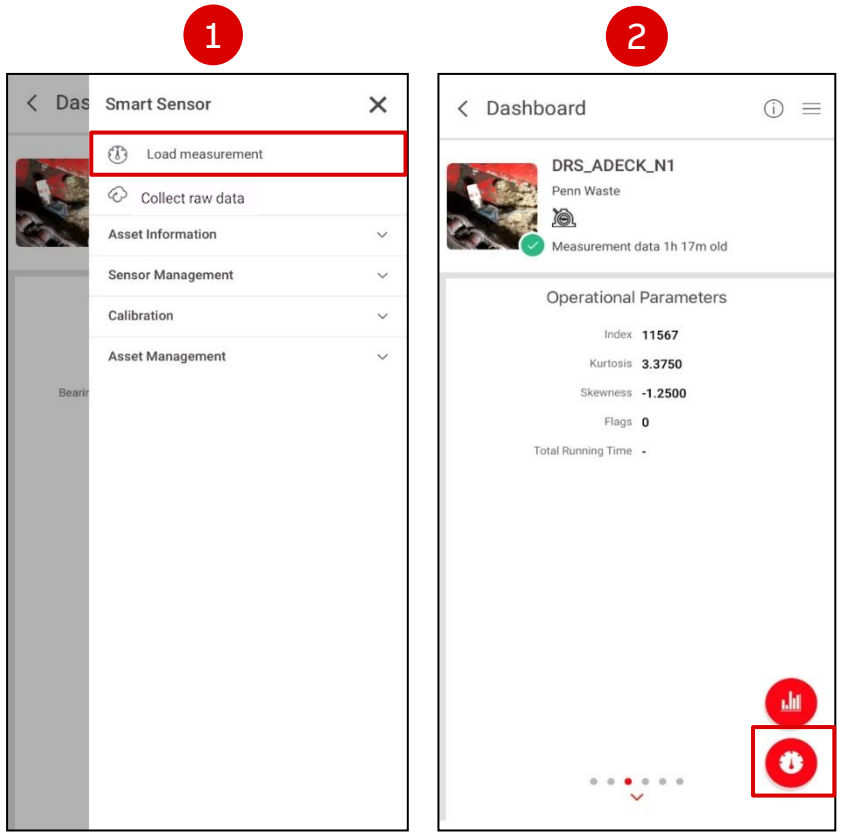
Shortening the interval decreases the battery life and the length of internal history proportionately.

Attention: sensor must be in Bluetooth range

All the shown screenshots are from the iOS app.

Load measurement

Smart Sensor Platform mobile app



Load measurements from the asset detail view:

1) Tap “**load measurement”** from the asset menu to load from sensor’s memory.
2) From the “operational parameters” asset card, click on gauge button to trigger a new measurement on-demand.

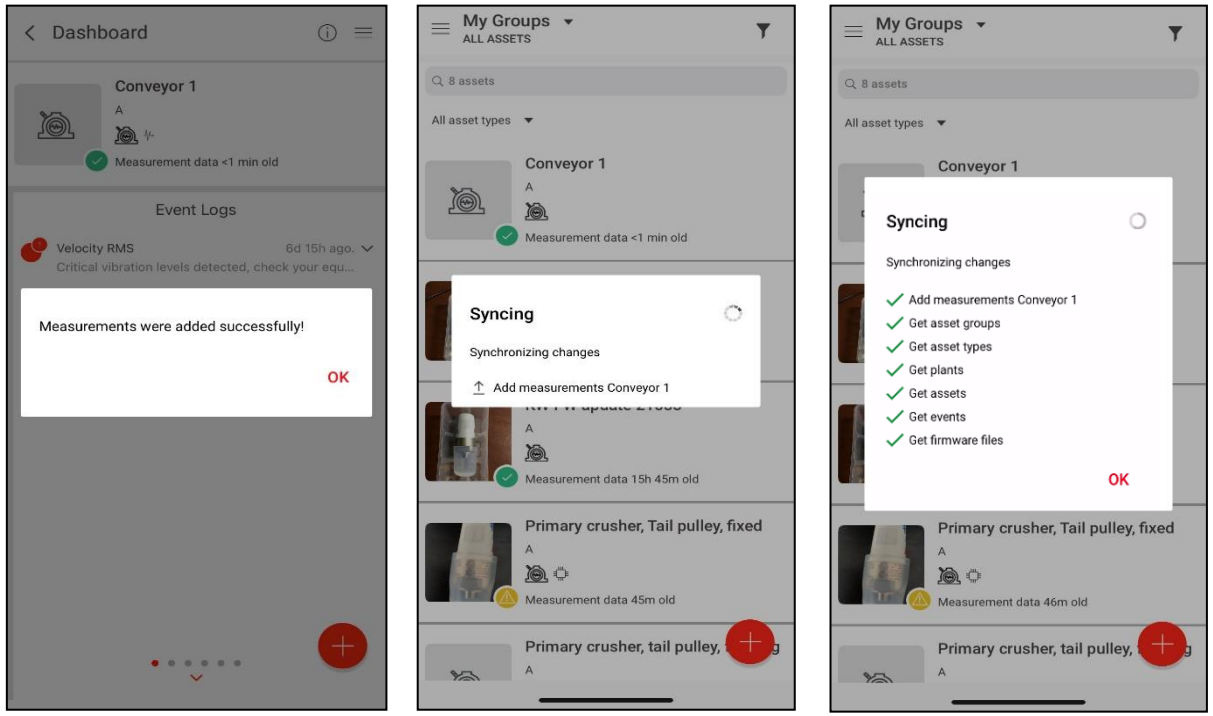
Measurements are loaded to the cloud (app and portal)

The measurement is triggered immediately, outside of the fixed schedule.

Attention: sensor must be in Bluetooth range

Load measurement offline (weak or no mobile internet)

1 → 2 **Move towards better mobile connectivity**



3

With weak or no internet connection:

- Log in to Smart Sensor app and to your organization.
- While the phone is connected to internet either via Wi-Fi or LTE.
- Leave app open and transit to sensor area, and
  - turn Wi-Fi and cellular data OFF

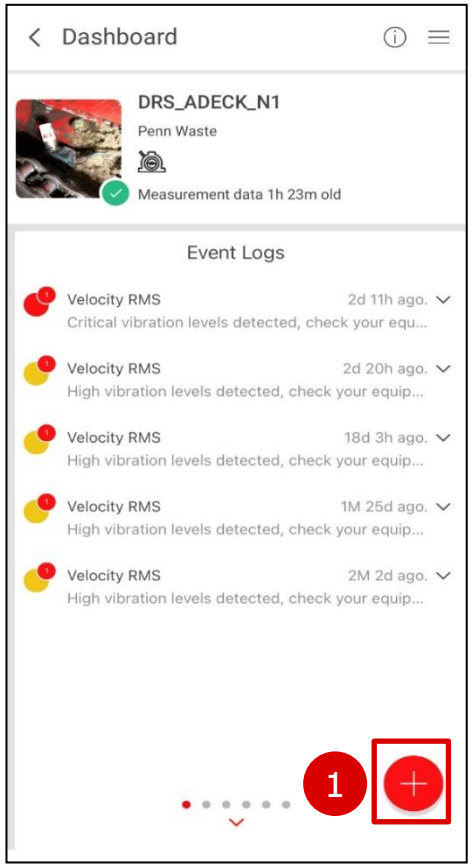
1) Load data(from sensor to mobile device via Bluetooth), and leave app open.
2) Go back to **My Groups** screen, transit to connectivity area, and
   - turn Wi-Fi and cellular data ON
3) App automatically starts syncing (uploading all measurements, and sensor changes to the cloud).

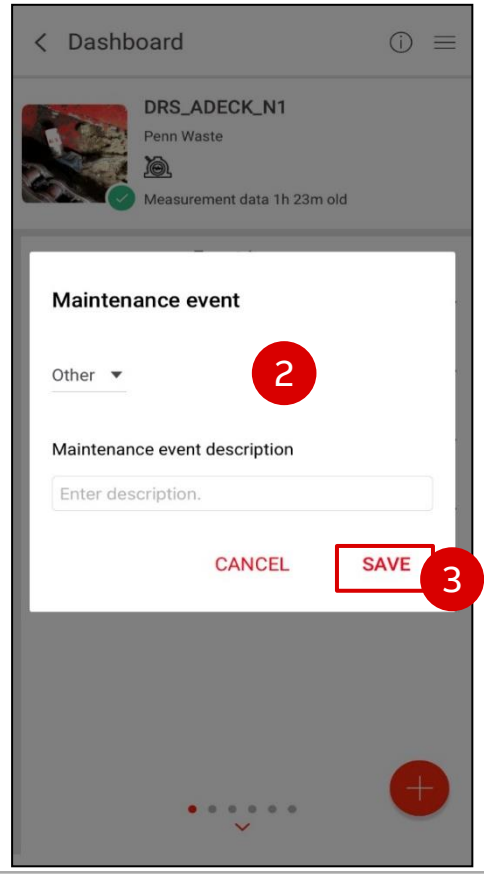
You should see *"Add measurements<Asset Name> "* in the sync prompt.

Attention: sensor must be in Bluetooth range

Add maintenance event

Add maintenance event in the app





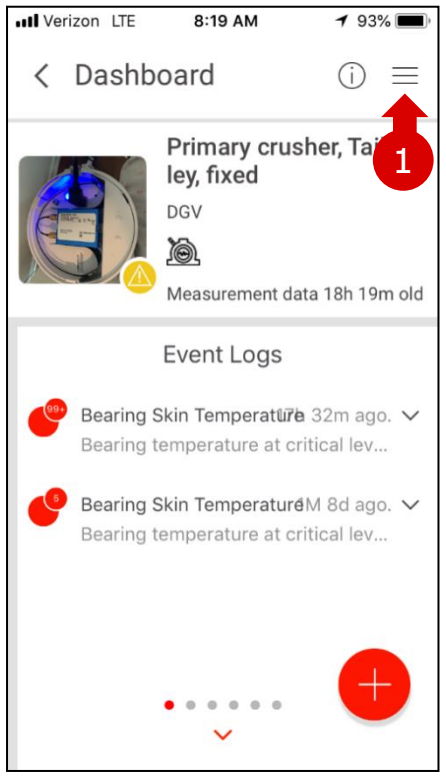
To add new maintenance event, click on an asset in the app.

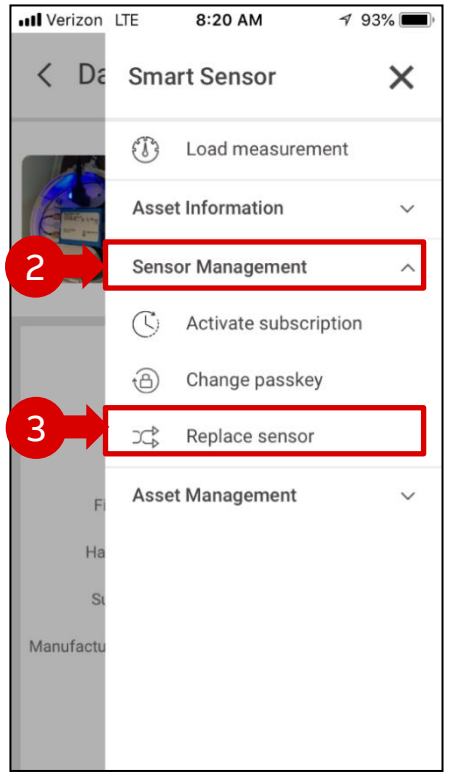
1) In the event log of the asset, click **+** to **add new** maintenance event
2) Write a description
3) Click save

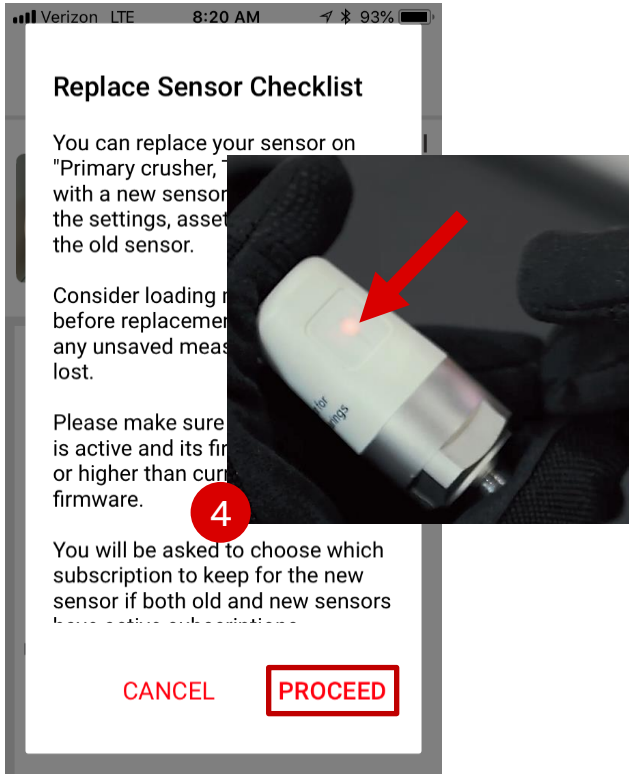
**This feature is currently only possible from the app.*

Replace Sensor

Replacing a sensor for the same asset







1) Tap on the asset's menu
2) Tap on **Sensor Management**
3) Tap on **Replace Sensor**
4) At this point take your new sensor and press on the silicon button, then tap on **PROCEED**
5) Select new sensor from the list
6) Commissioning happens automatically

From now on, historical data as well as nameplate details and picture are carried over to continue with the new sensor's data.

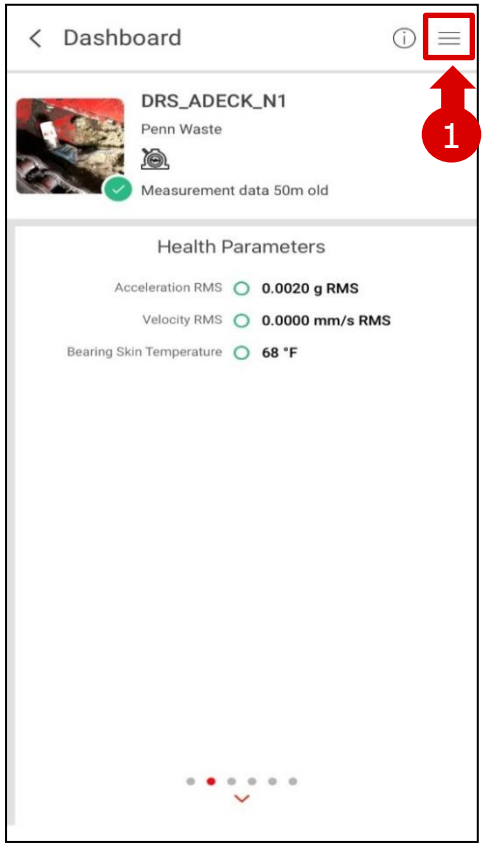
**Make sure your new sensor has the same firmware as your old sensor. If not please update its firmware (refer to page 62, step 3).*

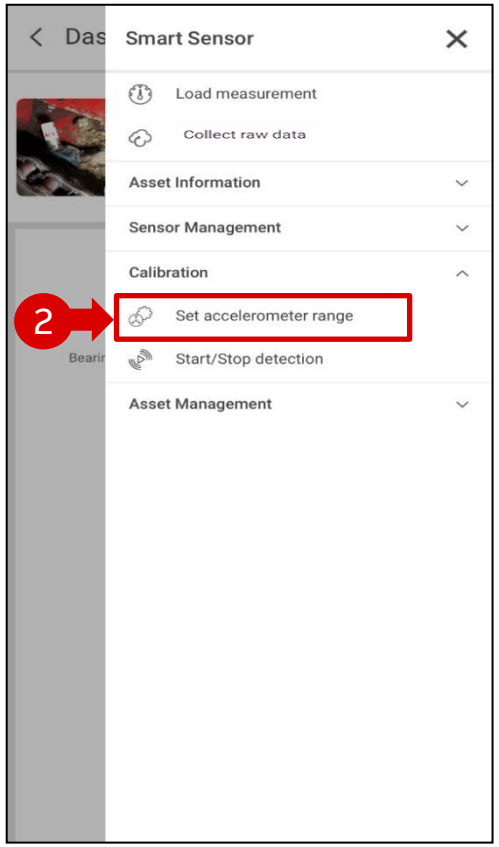
Note: New sensors have 2019.01.09.1 firmware version.

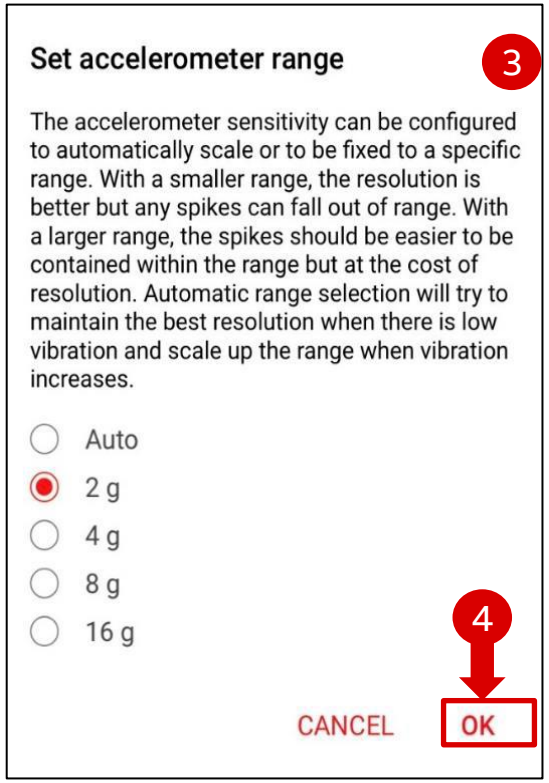
Attention: sensor must be in Bluetooth range

Accelerometer range

Change the accelerometer range





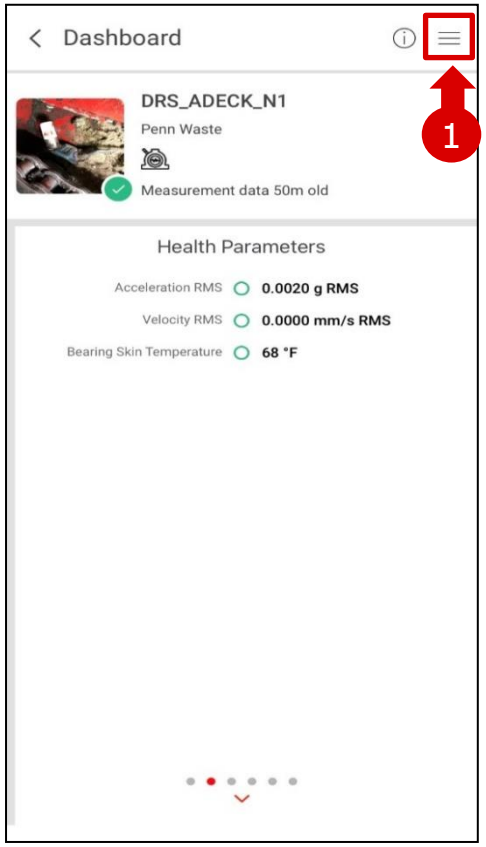


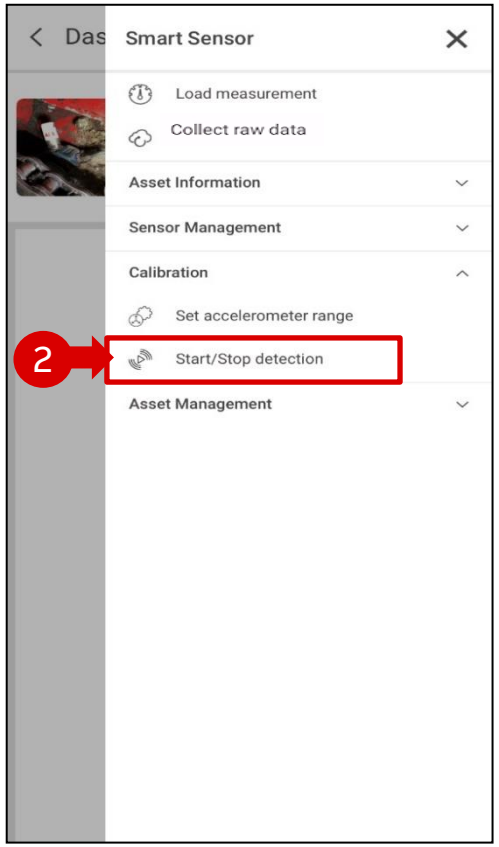
1) Tap on the asset menu.
2) Under "**Calibration**" in the asset menu, click "**Set accelerometer range**" button.
3) Read the info box.
4) Click on one of the accelerometer ranges and click **OK.**

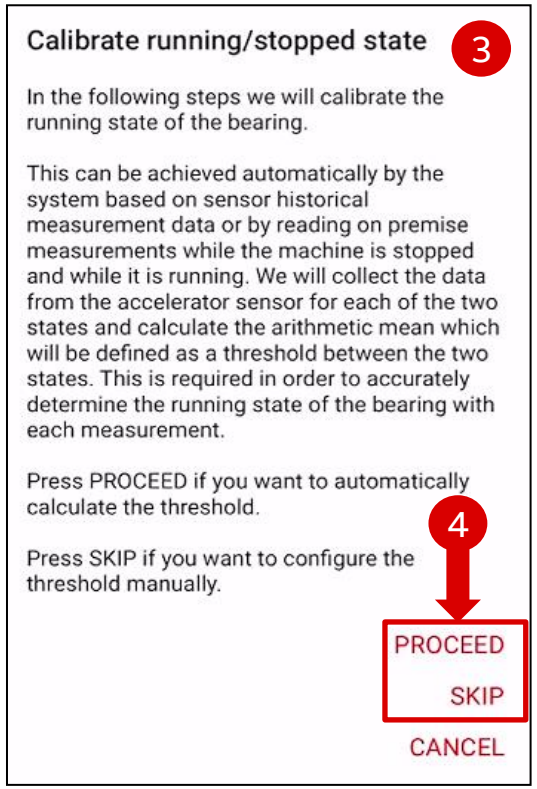
Attention: sensor must be in Bluetooth range

Enable Total Running Time operational parameter

Set the Running State Calibration







1) Tap on the asset menu.
2) Under "**Calibration**" in the asset menu, click "**Star/Stop detection**" button.
3) Read the info box.
4) Click on "**PROCCEED**" or "**SKIP**" depending on your choice.

Enable Total Running Time operational parameter

Set the Running State Calibration

1

Confirm threshold value

Auto calibration process was skipped. Please insert manually the calibration value or edit the existing one and press OK to finish this process.

g RMS

CANCEL OK

2

Calibrate stopped state

For on premise calibration, you will be asked to start and stop the machine in order to finalize the configuration. Please ensure that the machine is not running and the bearing is not spinning after which press the READ button to take a measurement.

Press AUTO if you want to automatically calculate the threshold based on historical measurements, if available. For valid results, historical measurements for both running / stopped states must be available.

Attention: sensor must be in Bluetooth range

READ

AUTO

CANCEL

3

Calibrate stopped state

For on premise calibration, you will be asked to start and stop the machine in order to finalize the configuration. Please ensure that the machine is not running and the bearing is not spinning after which press the READ button to take a measurement.

Press AUTO if you want to automatically calculate the threshold based on historical measurements, if available. For valid results, historical measurements for both running / stopped states must be available.

READ

AUTO

CANCEL

There are three options to calibrate running state of your asset:

1) Manual
2) On premise
3) Auto

5. Smart Sensor web portal

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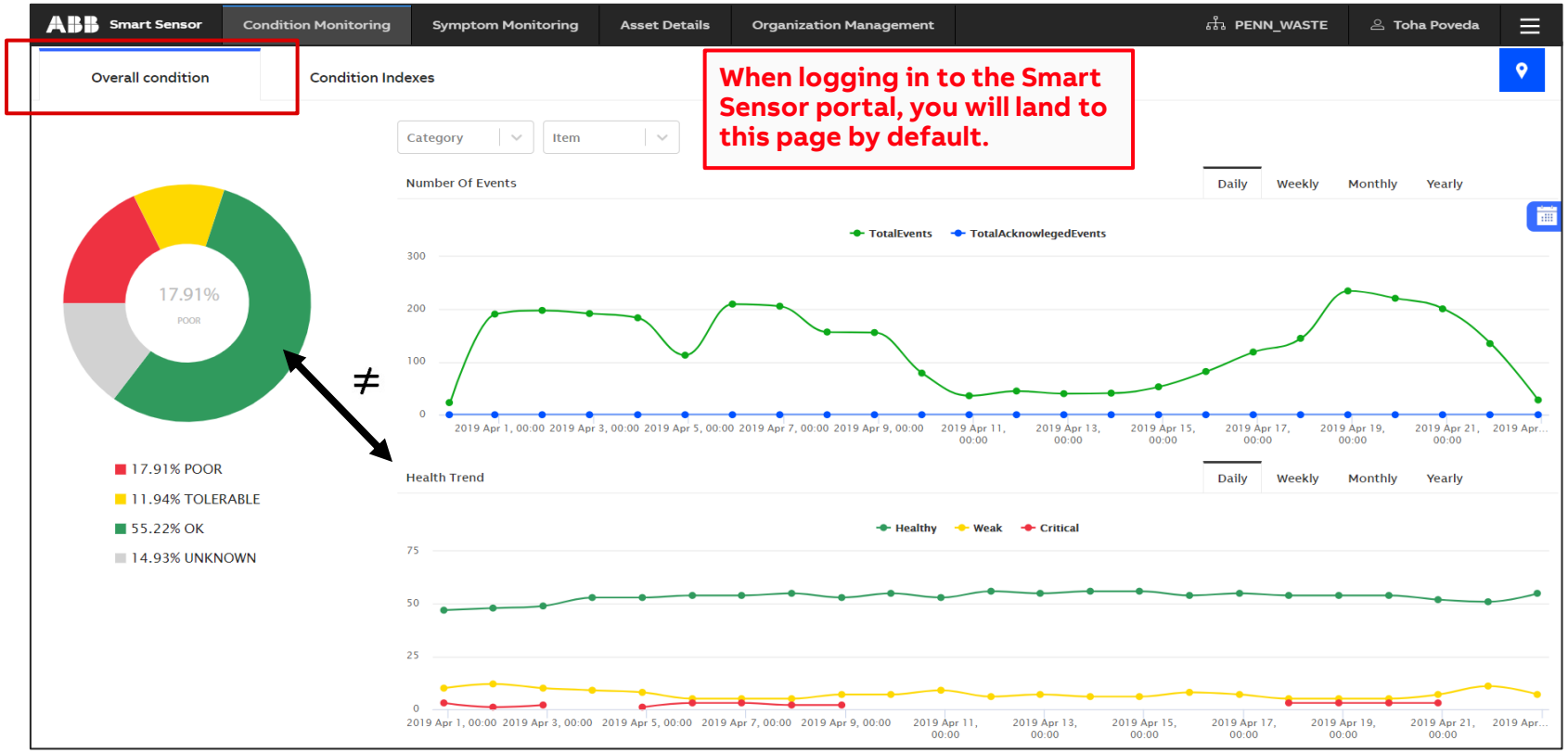
Dashboard – overall condition index

Overall condition «donut»: calculated from separate Condition Indexes over a period of time



The **overall condition** represented by the donut is calculated over a **period of time**, out of **several KPIs.**

The first line graph shows **events** you have received for the fleet per unit time (see next page for explanation on events).

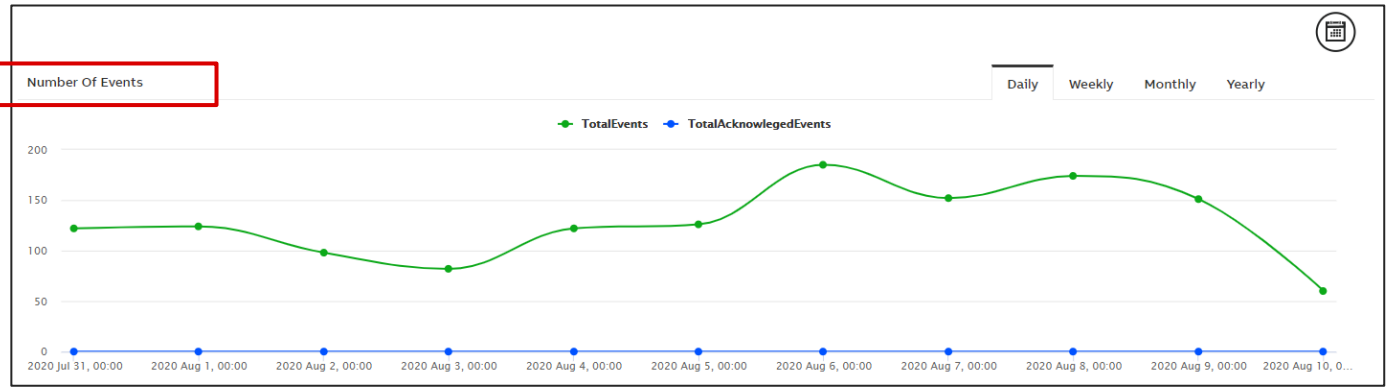
The second graph shows the history of **health status** of each asset in your fleet (see next few pages for differentiation of health status and condition index).

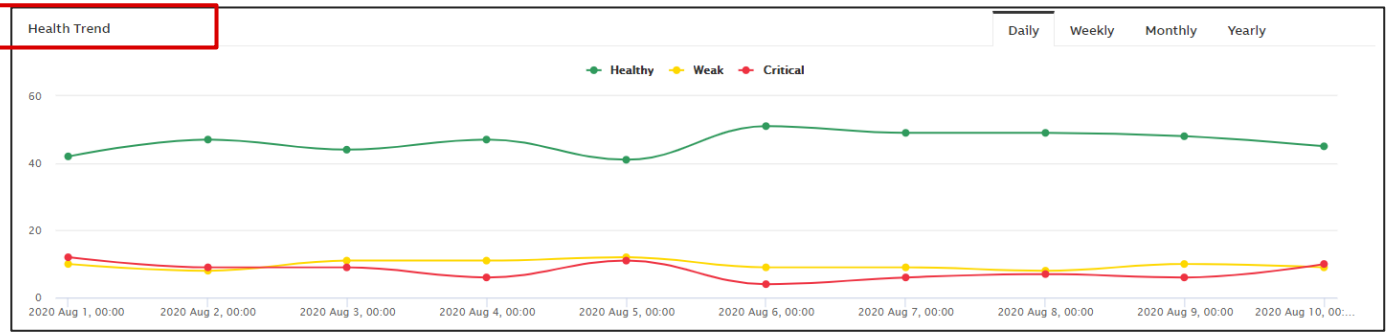
The line graphs do not correspond to the donuts; ***this page will be redesigned.***

*** Unknown assets indicate no measurements loaded in the last 7 days.**

Dashboard – Number of Events & Health Trend

The three types of events





Number of Events

The **green line** shows the development of the daily total number of alarms and alerts combined.

The **blue line** shows the number of acknowledged alarms and alerts

Health Trend

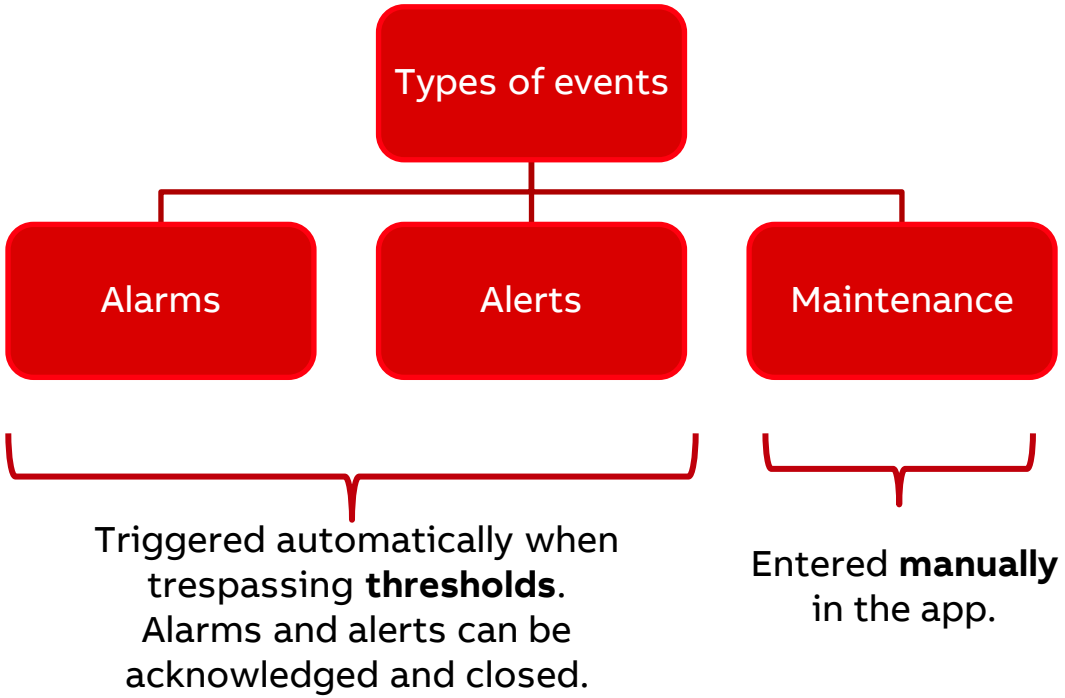
Shows daily total of **green** (healthy) **yellow** (weak) and **red** (critical) assets.

Note: the health trend indicator shows the status based on the last measurement.

The condition indexes (donuts) are based on the last 7 days.

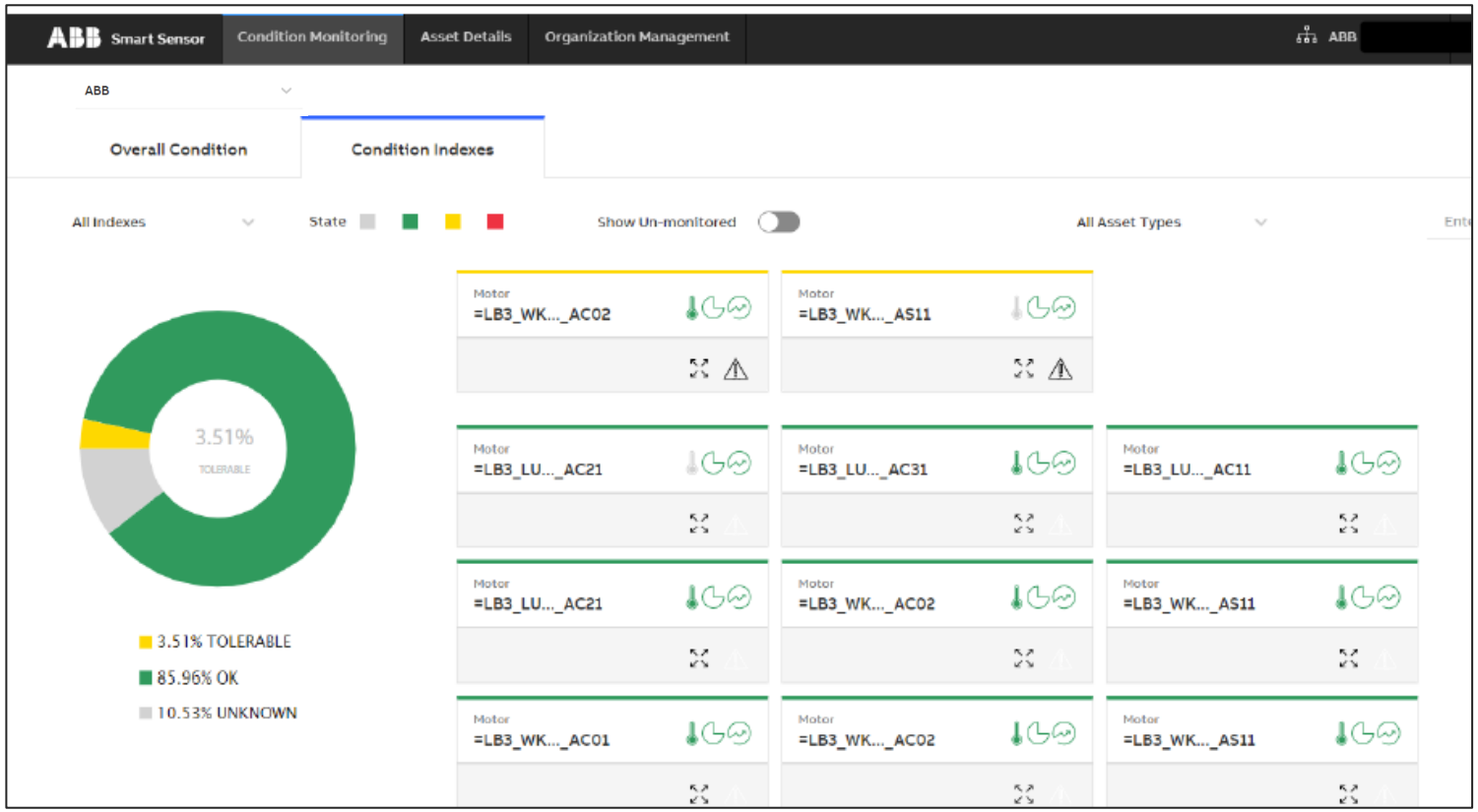
Dashboard – Events

The three types of events



Dashboard – Condition Indexes

Indicators calculated over long periods of time from several KPIs



→ "Condition Indexes" are an aggregation of several KPIs over several days.

Assets can be filtered by type of condition index, status or asset type.

The condition indexes are defined as below:

- **Environmental stress**: Vibration and temperatures while machine is stopped.*
- **Operational stress:** Vibration and temperatures while machine is running.
- **Total stress:** aggregates **operational** and **environmental** stress.
- **Reliability:** Bearing condition, other KPIs*
- **Overall health:** aggregates **total stress** and **reliability** indexes

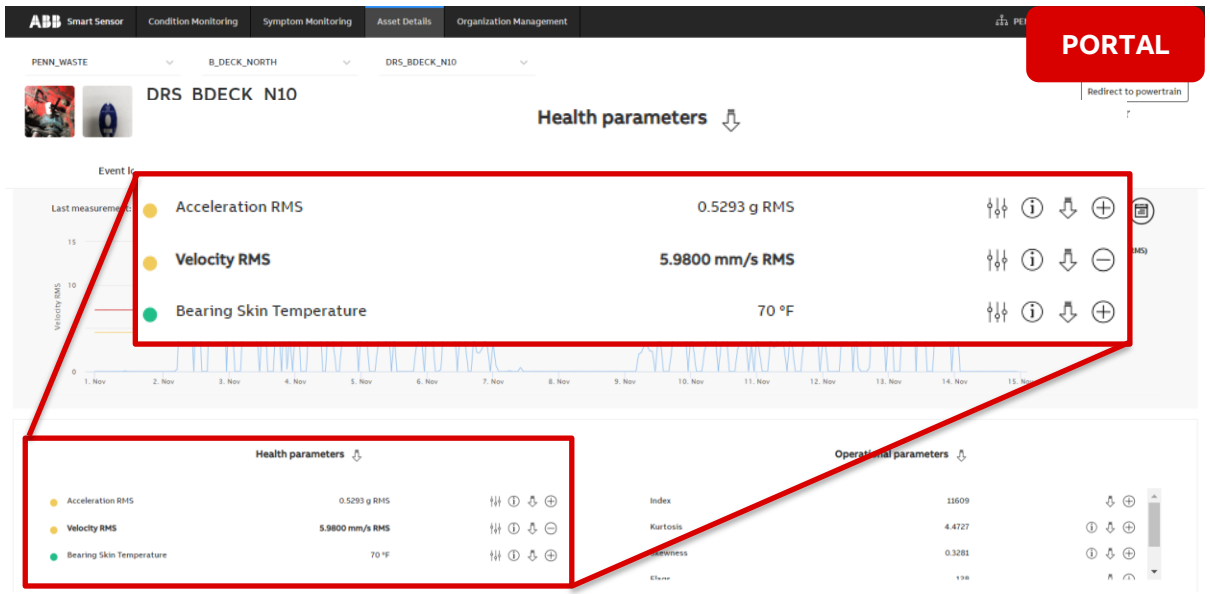
NOTE: CONDITION INDEXES ARE NOT MEANT TO MATCH THE STATUS OF INDIVIDUAL KPIs!

*** No yet available for the Smart Sensor for mechanical products**

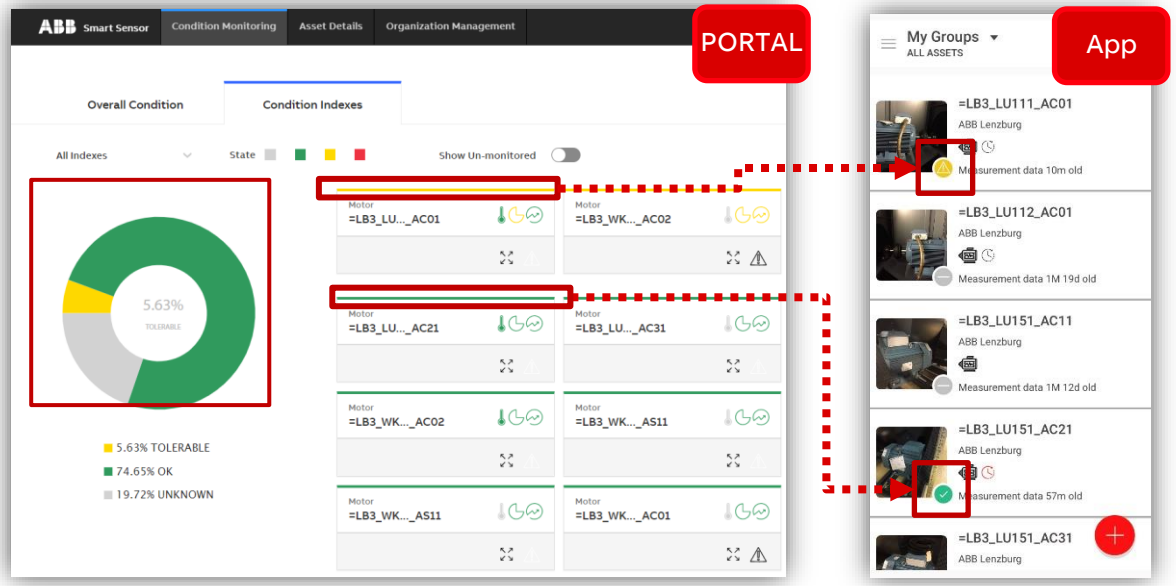
Health Indicator vs. Condition Index

Differences between health indicators and condition indexes

Health Status Indicators under Asset Details are based on the last measurement

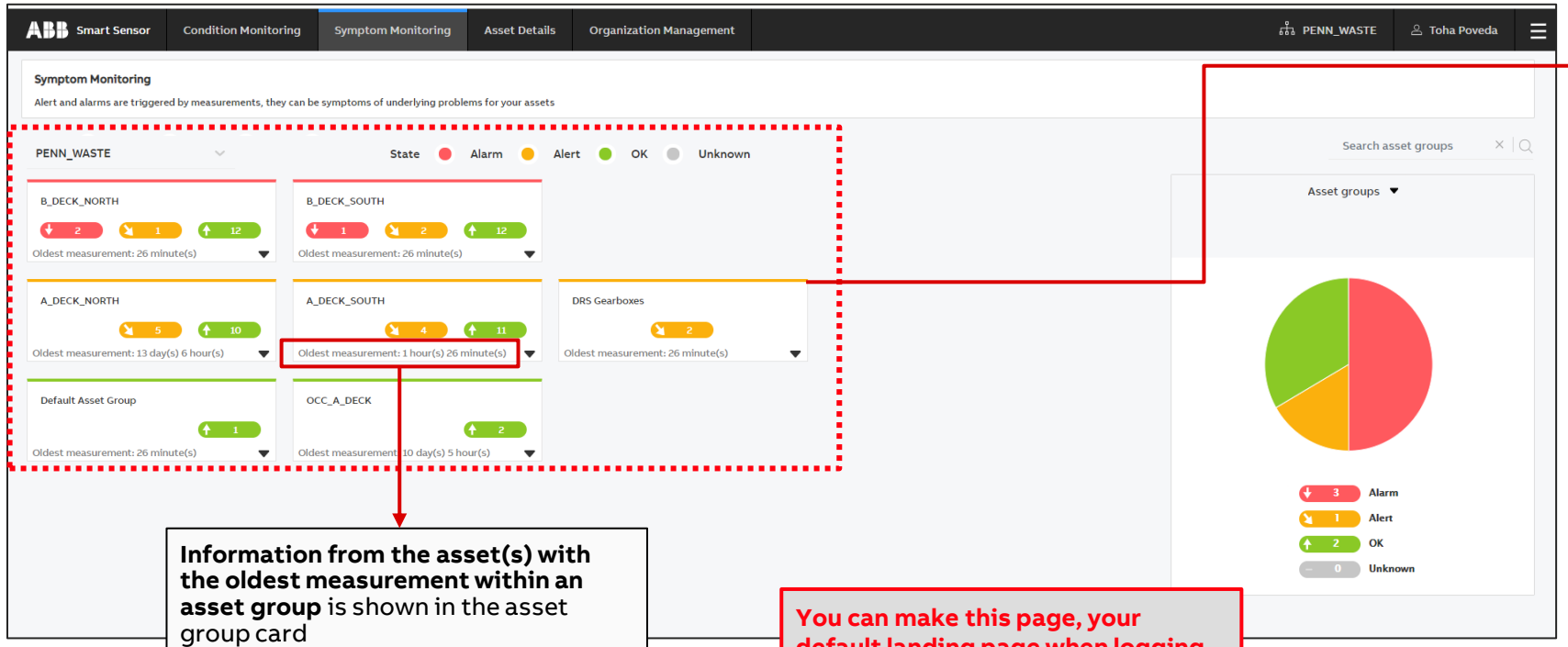


Condition Indexes are calculated over time and aggregate several KPIs



Dashboard – Symptom Monitoring

Asset group cards assets displaying assets health status from the last loaded measurement



Information from the asset(s) with the oldest measurement within an asset group is shown in the asset group card

You can make this page, your default landing page when logging in to the Smart Sensor portal, by following instructions on page 81

Asset group card color based on the most critical health parameter status of included assets.

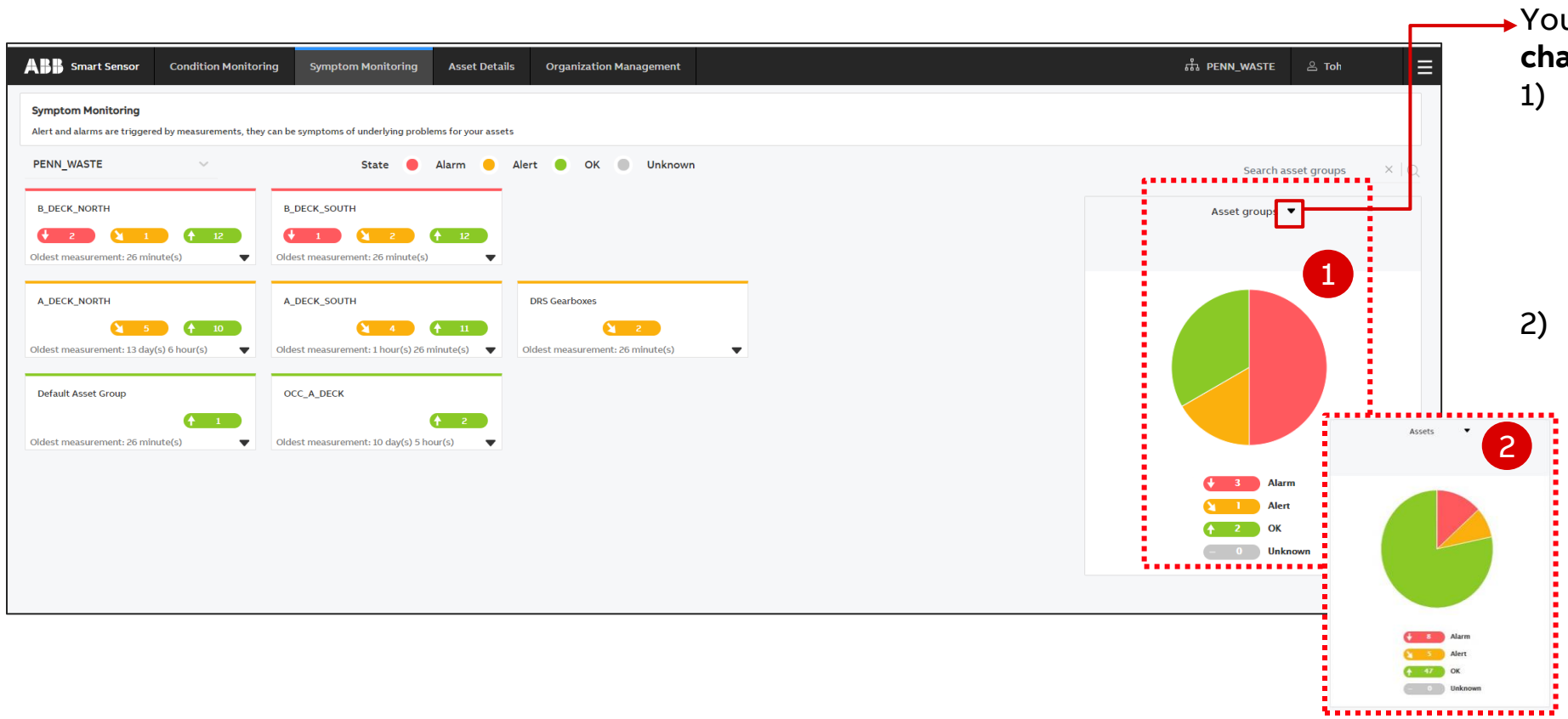
For example: if asset group has **5 assets** with the following health status: **3 in OK status, 1 in alarm and 1 in alert**, then the asset group card will have an **alarm status (red color).** Unknown status* is not considered in the calculation of the status which means: if an asset group has **2 assets**, **1 asset in OK status, and 1 asset in unknown status**, the asset group card will have the **OK status (green color).**

Only exception will be if all assets are in unknown status, then the asset group state will also be unknown.

***Commissioned assets with no measurements are in unknow status.**

Dashboard – Symptom Monitoring

Asset groups and assets «pie charts» indicating the asset health parameter status from last loaded measurement

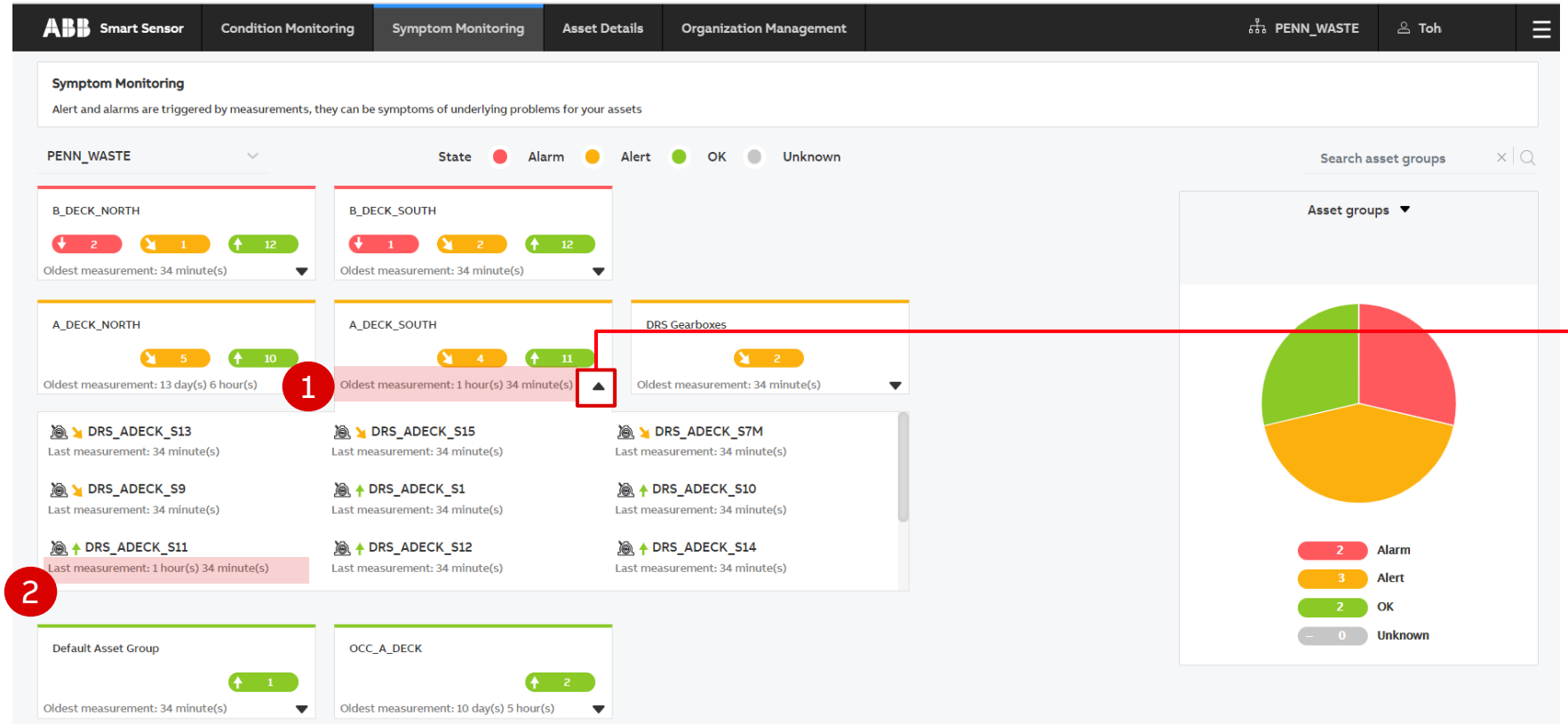


You can switch between **2 pie charts** that represent:

1) Most critical health parameter status of all **asset groups** within the organization based on the assets last loaded measurement.
2) Health parameter status of all **assets** within the organization *based on their last loaded measurement.**

Dashboard – Symptom Monitoring

Asset groups cards expanded view (latest measurement indication)

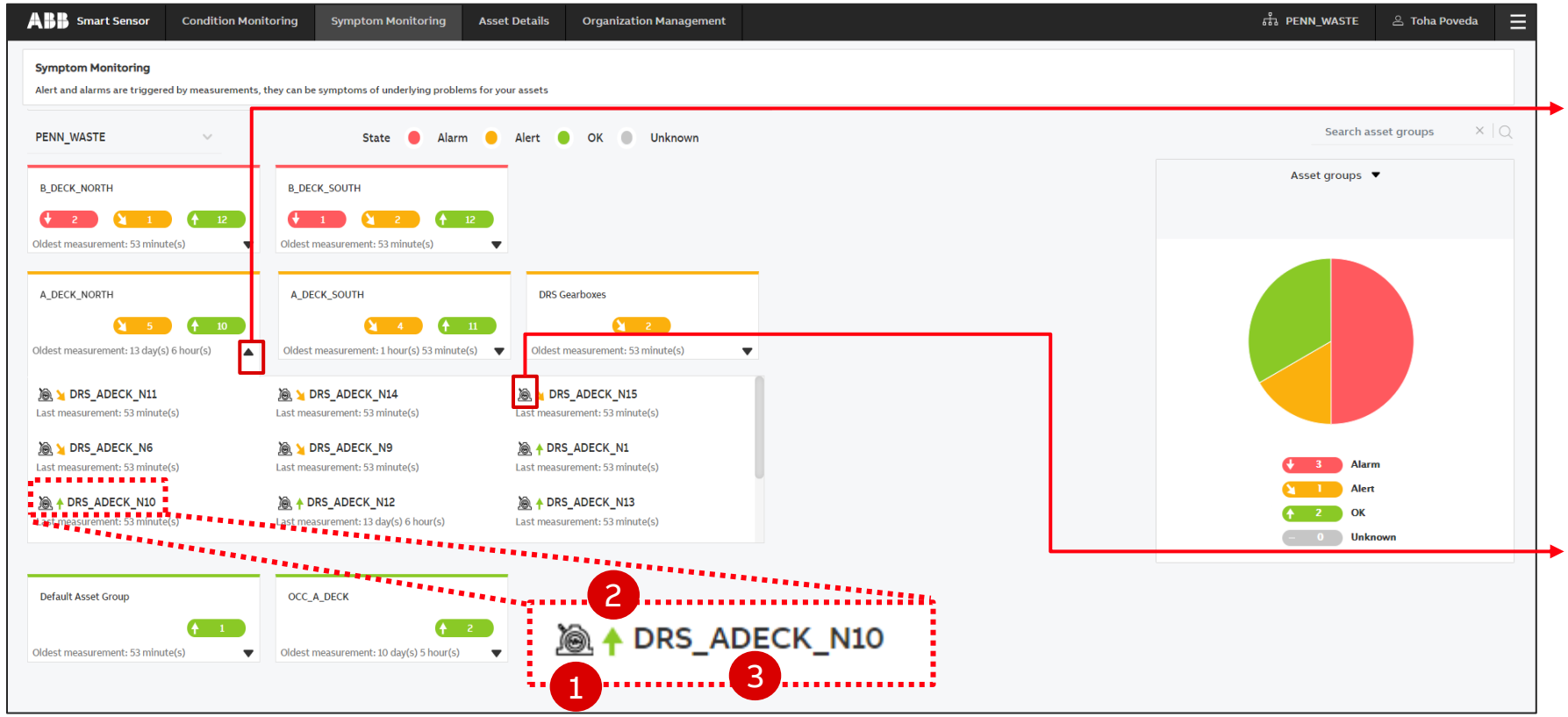


1) **Information from the asset (s) with the oldest measurement within an asset group** is shown in the asset group card.

2) You can click on the **drop-down menu** to expand an asset group card and view the last measurement info from each individual asset within an asset group.

Dashboard – Symptom Monitoring

Asset groups cards expanded view



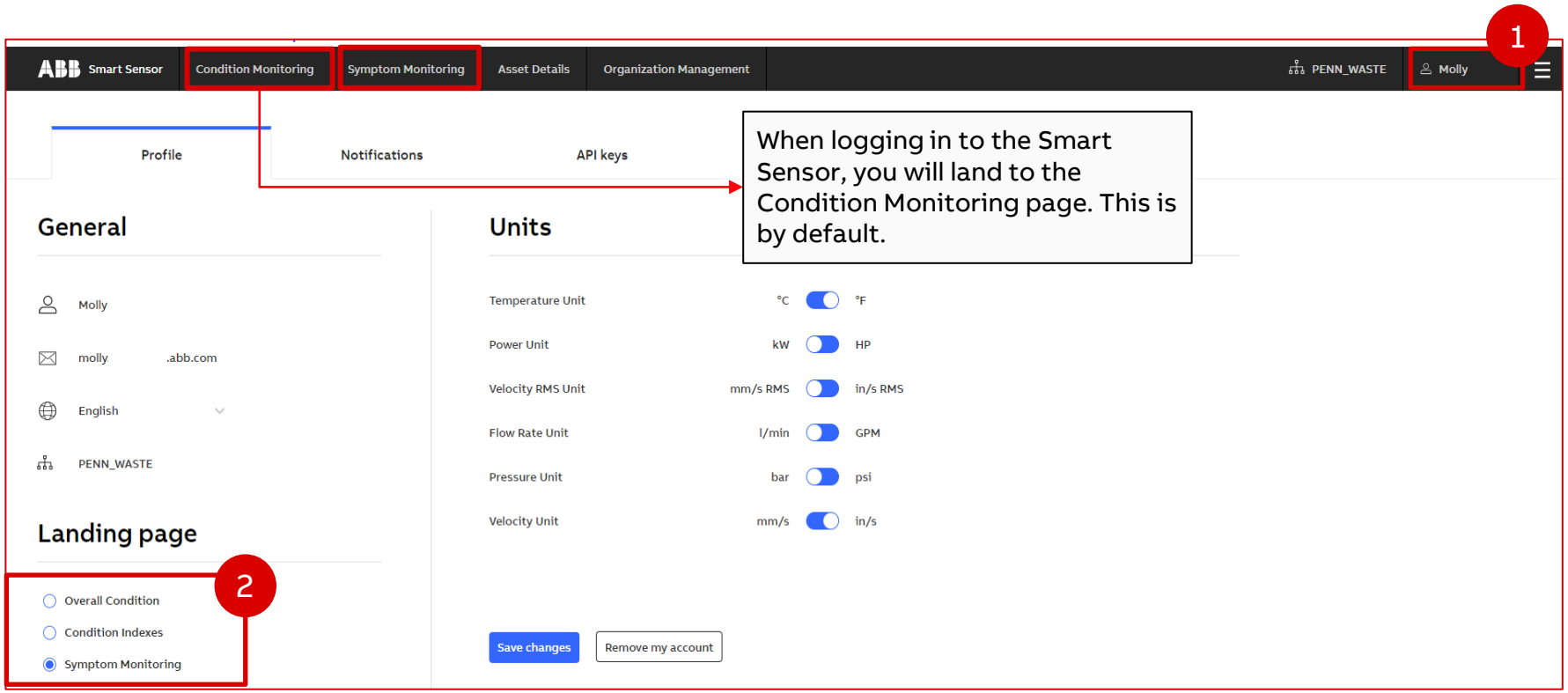
You can click on the **drop-down menu** to expand the asset group cards and view the asset list (up to 10 assets). Each asset will have the following components:

1) Asset type icon
2) Asset symptom indicator based on the most critical health parameter status of the asset
3) Asset name

When clicking on the **asset type icon**, you will be redirected to the **Operational parameters page under the Asset Details view** (see page 84).

Portal Overview

Changing Landing Page Settings



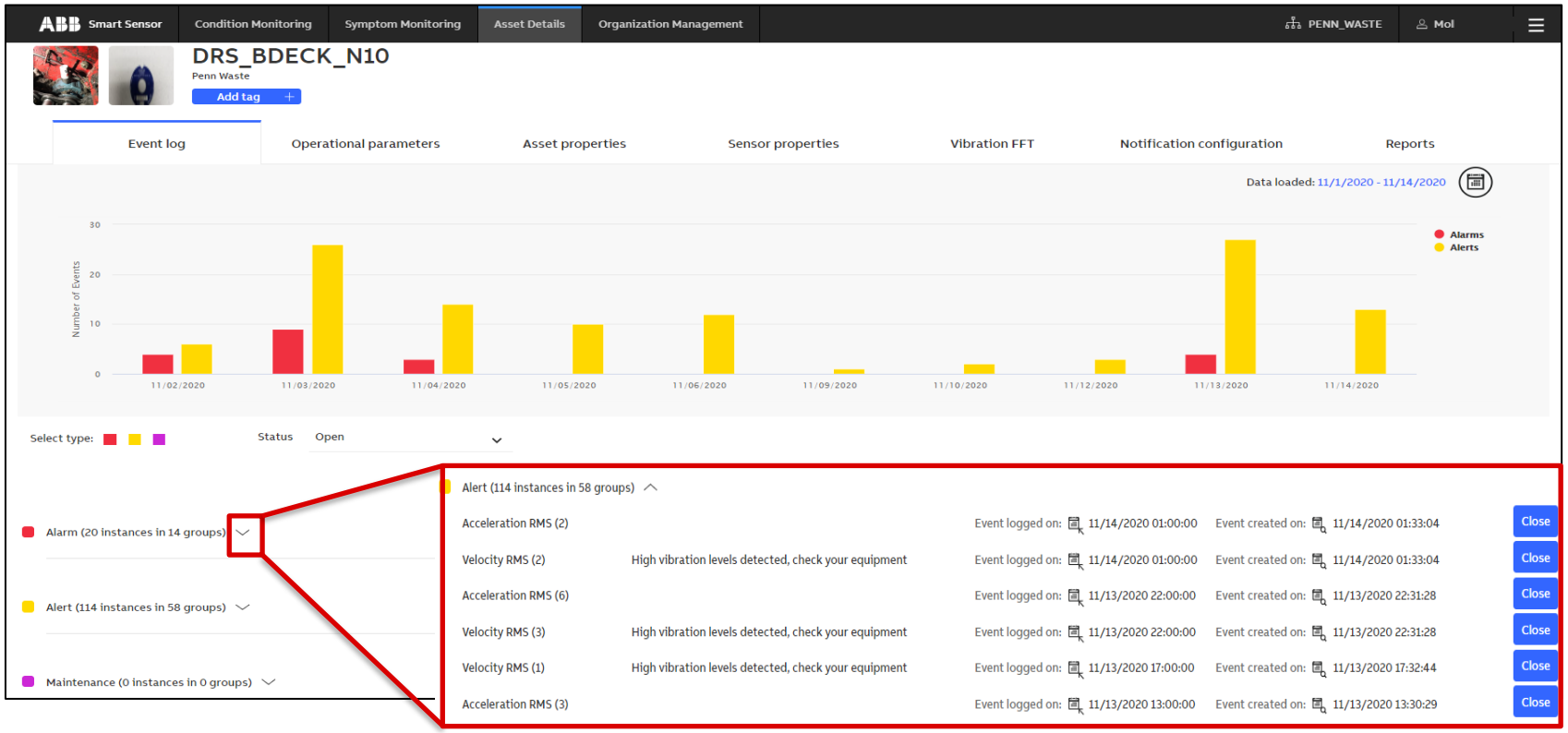
If you would like to have as a landing Page **Symptom Monitoring** instead of Overall Condition you can do so by following the steps below:

1) Click the symbol in the top right corner that displays your name.

2) Select **Symptom Monitoring** in the bottom left corner. Next time you log in the Landing Page will automatically go to the Symptom Monitoring page.

Asset Details view – Event Log

Events on the portal



The Event Log is a list of events:

- **Alarms**
- **Alerts**
- **Maintenance**

Within the selected time frame you can see the history of events.

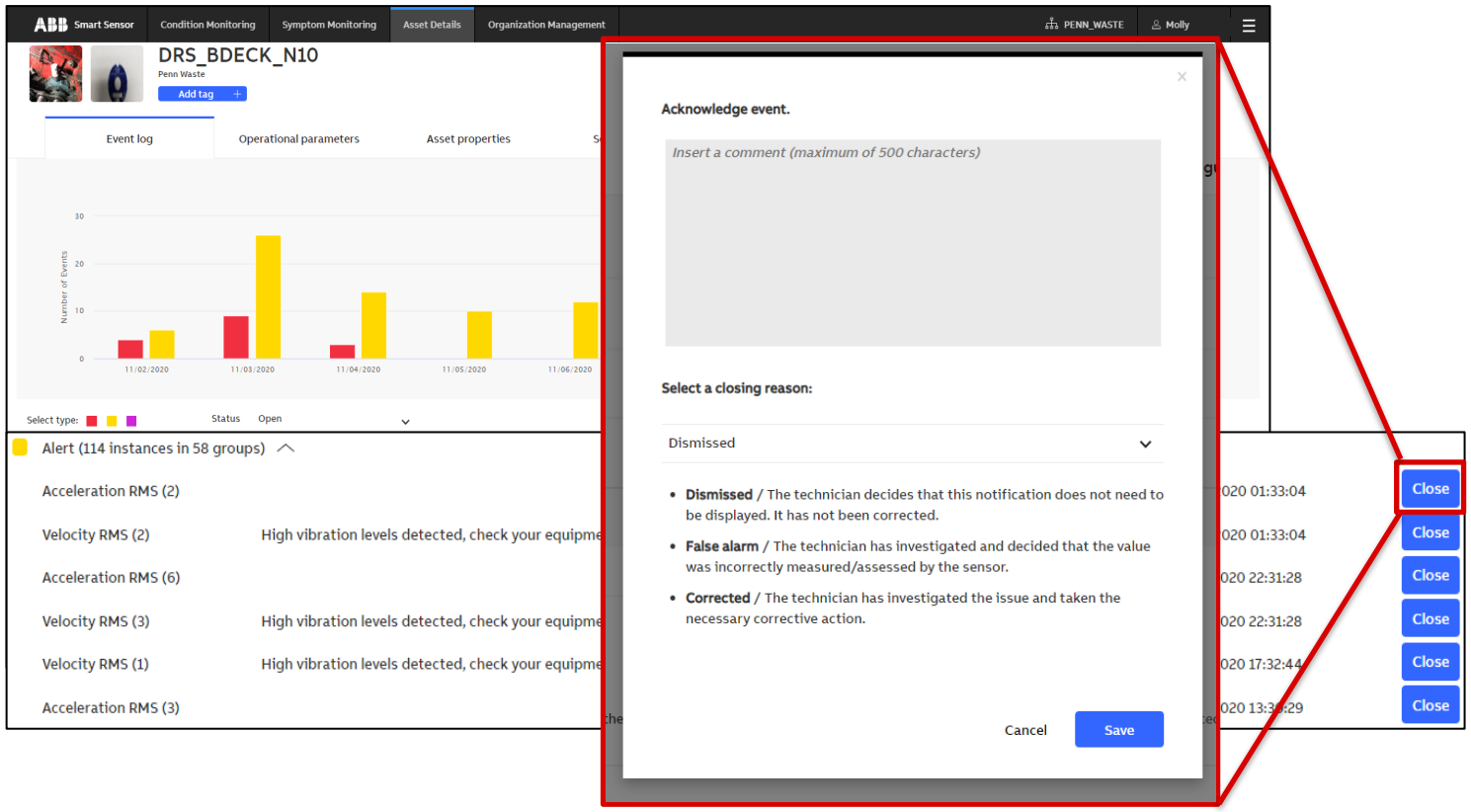
By clicking on the dropdown, a list events of that type is shown.

You can see the recommended action, close the event and, by clicking on an event, add comments.

Maintenance events can be added manually in the mobile app **(see page “Add maintenance event» in the previous section)**

Asset Details view – Event Log

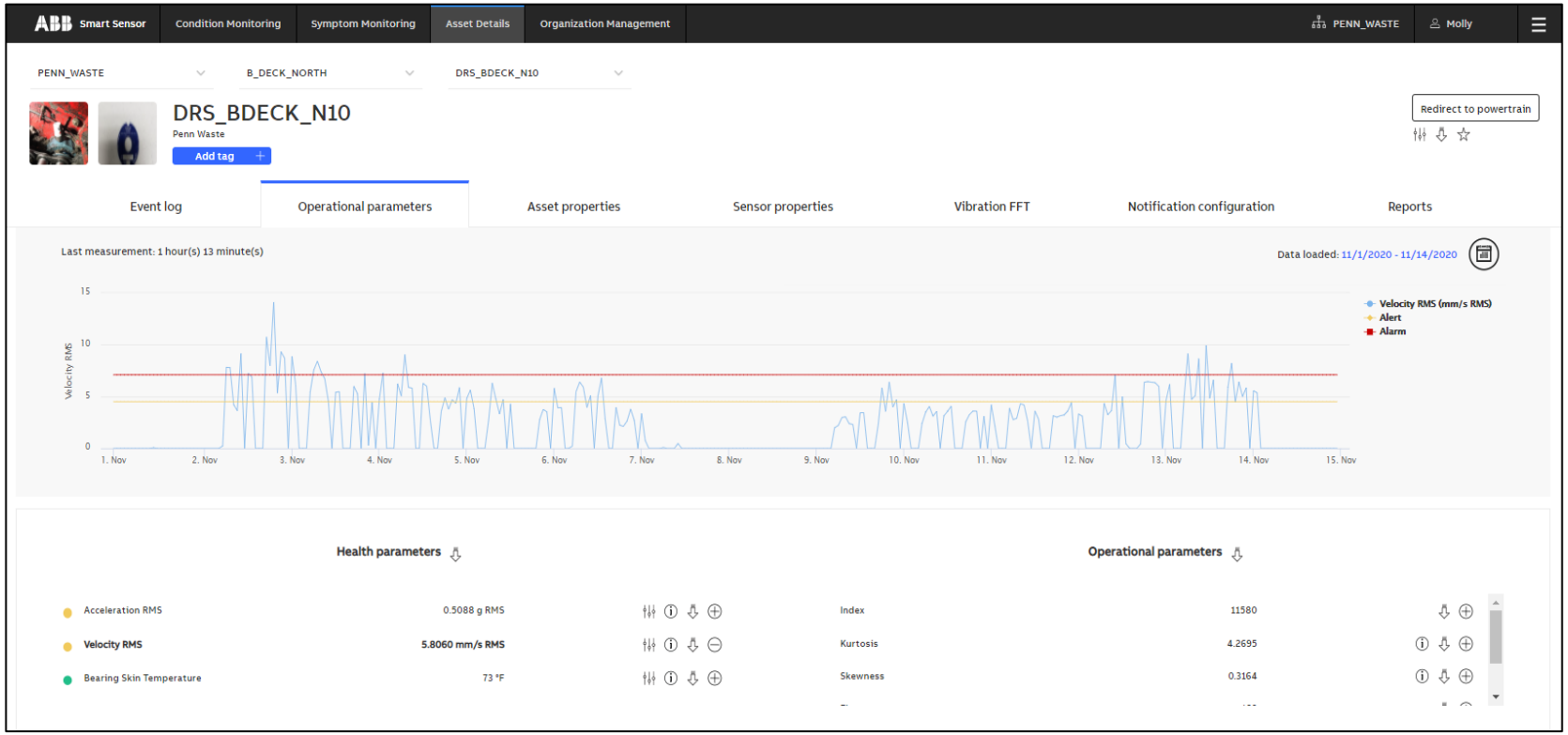
Closing an event



When closing an alarm or alert, provide a closing reason and a comment.

Asset Details view – Operational parameters

View the data trends of your assets

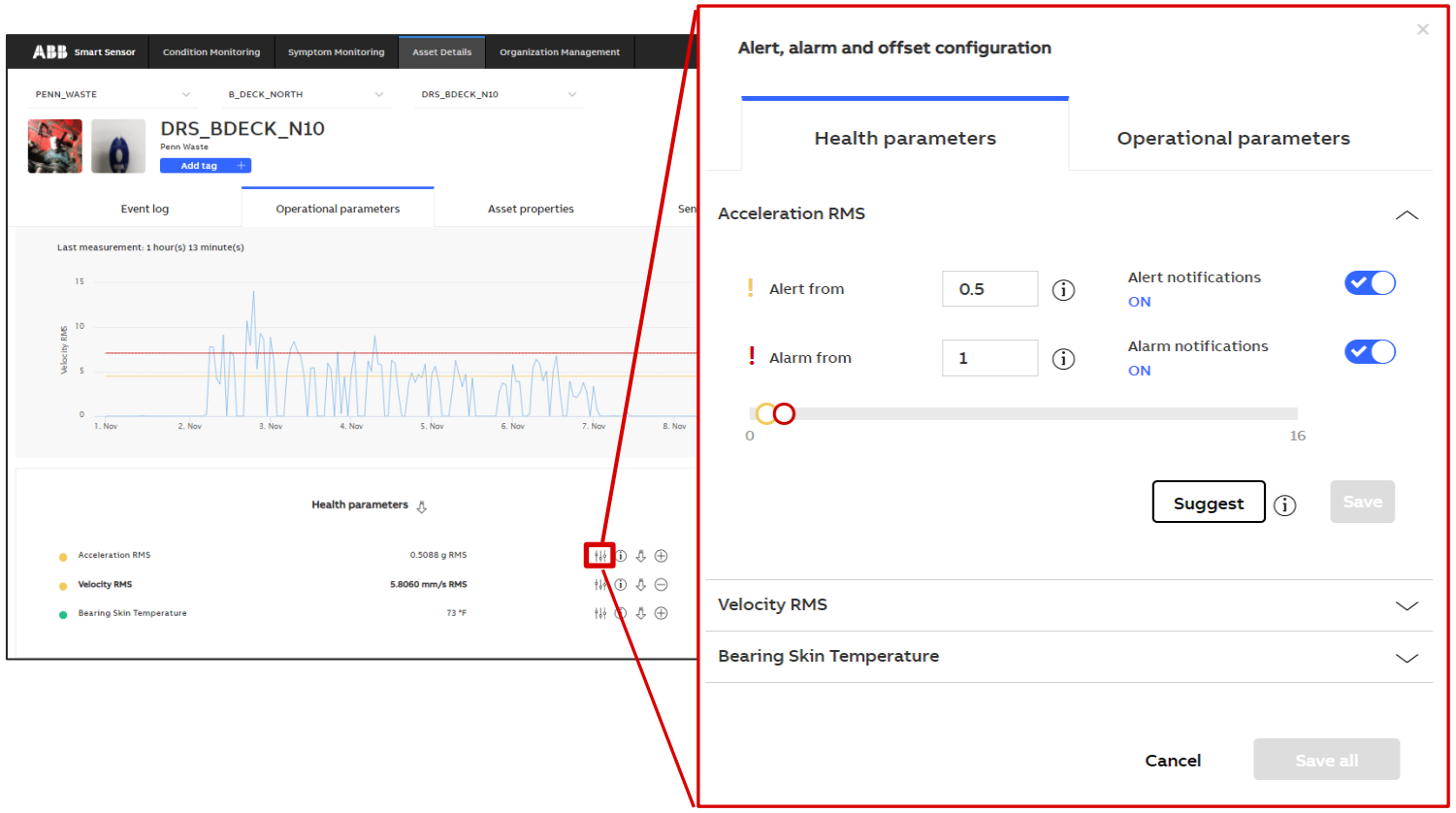


The **Operational Parameters** tab in the **Asset Details** view visualizes trend data.
You can add and remove KPIs by clicking on the + and – symbols respectively.

- Click ⓘ for further information on parameters.
- Click to **adjust alarm and alert levels** for the health parameters.
- Click to receive an e-mail with an export of the measurements.

Asset Details view – Operational parameters

Adjusting Alarm and Alert levels for health parameters



Click ⚙ next to the Health KPI to adjust the alarm and alert levels.

Acceleration RMS limits by default are set in [g RMS], **Velocity RMS** in [mm/s RMS], and **Bearing Skin Temperature** levels in [°C]. *For guidance on what alert and alarm levels should be entered, refer to chapter 6.

Attention: If user that commissions the asset sets up the alert and alarm levels. Other users that will have access to this asset will see the same alert and alarm levels.

KPIs without this option are scaled proportionally to signal energy values and therefore have no physical unit.

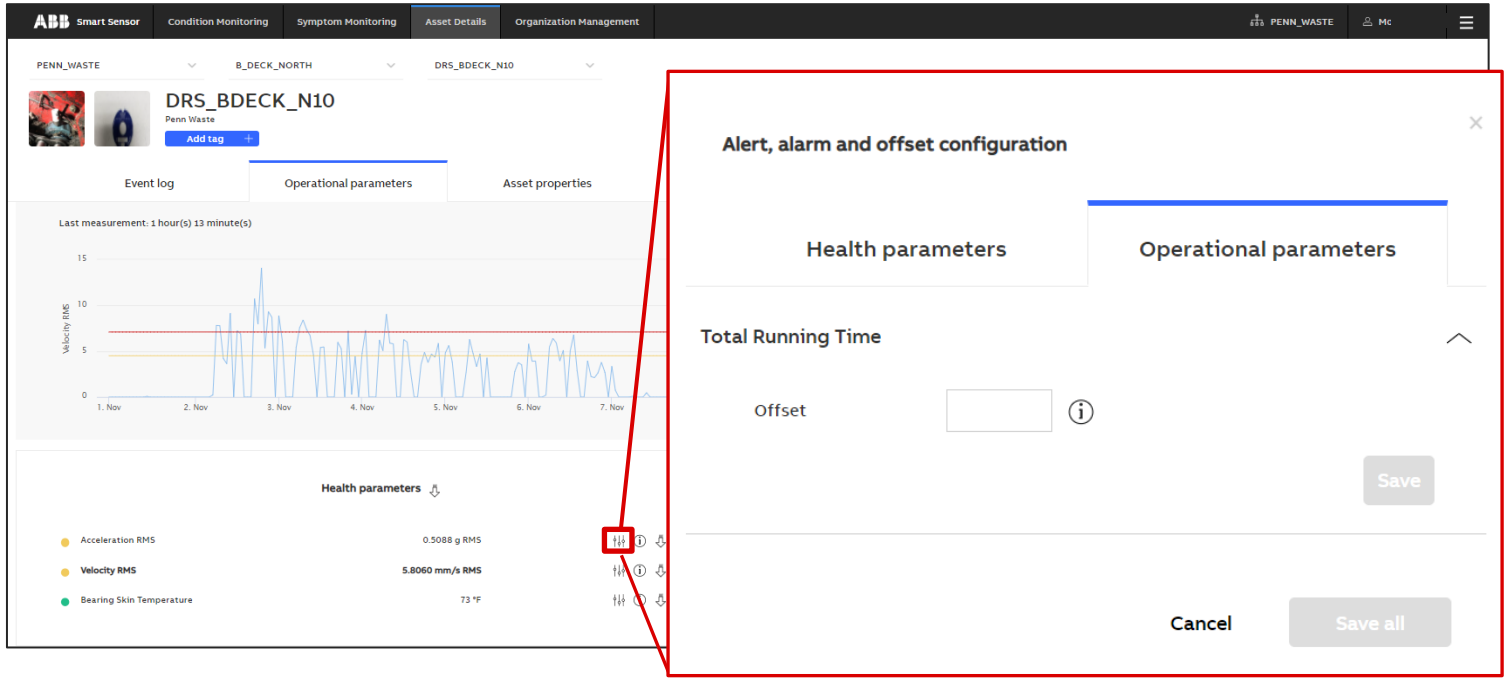
A suggestion is calculated by the portal based on previous measurements and other aspects.

You can also turn on/off notifications from this screen.

For more information on the recommended alarm and alert levels, click ⓘ

Asset Details view – Operational parameters

Setting Offset values for configured Operational Parameters



While on the **Alert, alarm and offset configuration** screen, click on **Operational parameters** tab.

next to the Health KPI to adjust the alarm and alert levels.

Total Running Time offset is set in hours[h].

For more information about offset configuration, click ⓘ

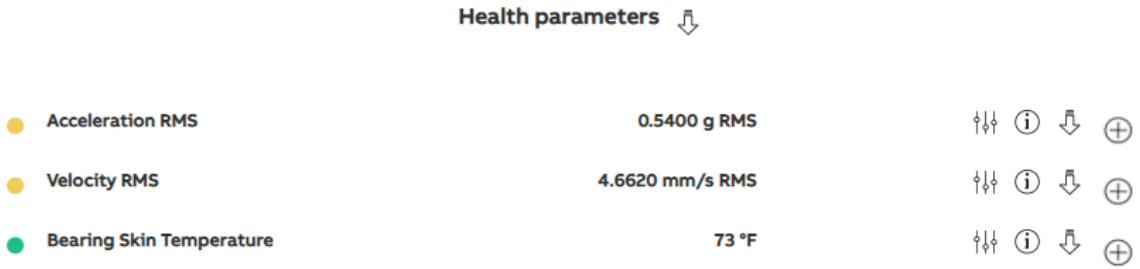
Please note that Operational parameters offset configuration is enabled only for those assets with configured Total Running Time (please refer to KPI Terminology).

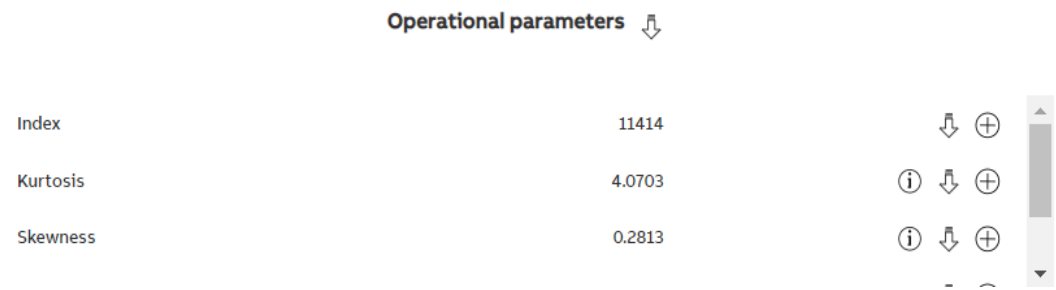
Parameters in Asset Details view

Health vs. operational parameters and operations on the data

HEALTH PARAMETERS: influence on the health of the asset

OPERATIONAL PARAMETERS: for information





Add a parameter to the trend graph by clicking the "plus" button.

Click arrows to download measurements. A file will be sent by email.

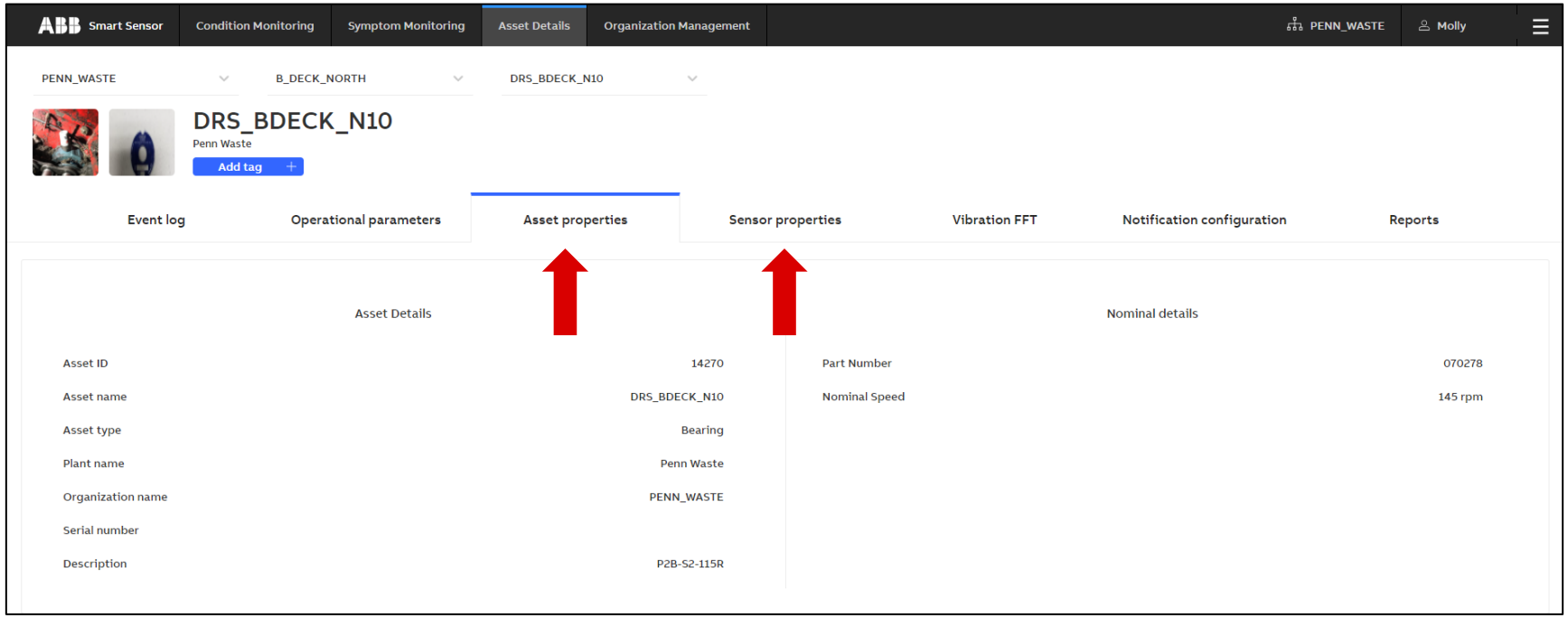
Click on the info button for more information about each parameter.

For some KPIs, thresholds can be adjusted by pressing the "knobs" pictogram.

Please refer to KPI Terminology chapter to learn more about these parameters

Asset Details view - Asset and Sensor Properties

Information about your machine and the sensor monitoring it

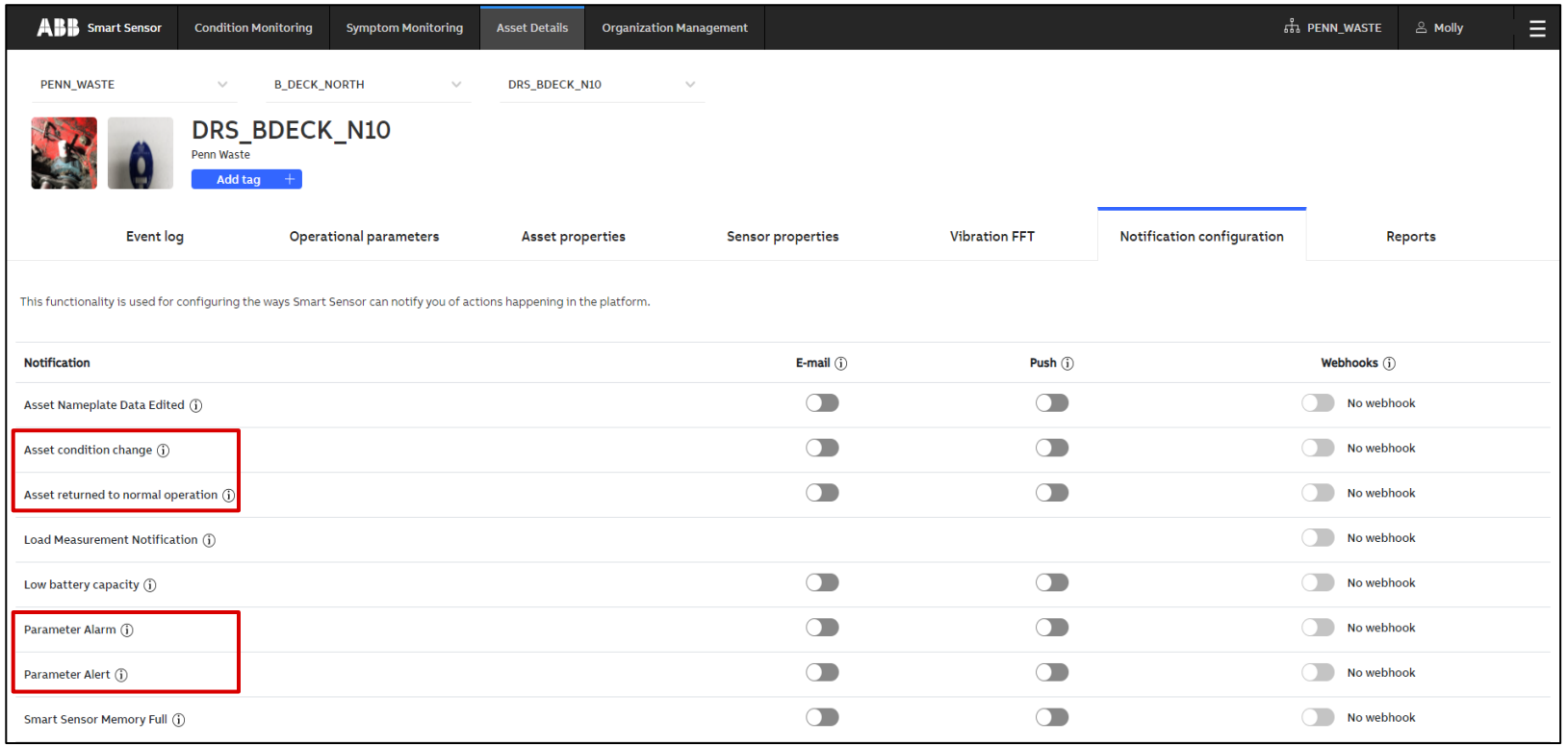


Asset information is visible under **"Asset Properties".**

Sensor-related information is found in the **"Sensor Properties"** tab next to Asset Properties.

Asset Details view - Notifications

Turn on different kinds of notifications for selected assets



Configure the notification mode for each asset under **“Asset Details”**.

Attention: this applies only for the user currently logged in the portal.

Click the **“info”** button for more details about each notification type.

Note:

→ **Parameter alert / alarm notifications** are triggered for all individual KPI threshold violations: short-term, detailed monitoring.

→ **Condition change notifications** happen when a Condition Index status changes: longer term, overview monitoring.

6. Guidance on setting alert and alarm levels

Back to table of contents

Guidance on setting alert and alarm levels

Determine best values to put in for alert and alarm for any asset - Acceleration RMS and Bearing Skin Temperature

Let your equipment run for a week or two (depending on your equipment's run time schedule) to determine the baseline values for overall vibration and skin temperature.

– Example: Let's say your acceleration RMS baseline value is **0.04 g RMS** and your temperature value is **117˚F**.

Acceleration RMS

1. Vibration– Alert Value: It is recommended that your alarm value is set to a value equal to *3 times* the baseline value.
2. Vibration – Alarm Value: It is recommended that your alarm value is set to a value equal to *6 times* the baseline value.

Acceleration RMS alert value (g RMS)= 0.04*3=**0.12 // Acceleration RMS alarm value (g RMS)=** 0.04*6=**0.24**

Bearing Skin Temperature

1. Temperature – Alert Value: It is recommended that your alarm value is set to a value equal to *20% higher* of the baseline value.
2. Temperature – Alarm Value: It is recommended that your alarm value is set to a value equal to *30% higher* of the baseline value.

Temperature alert value (˚F)= 117*1.20=**140 // Temperature alarm value (˚F)=** 117*1.30=**152**

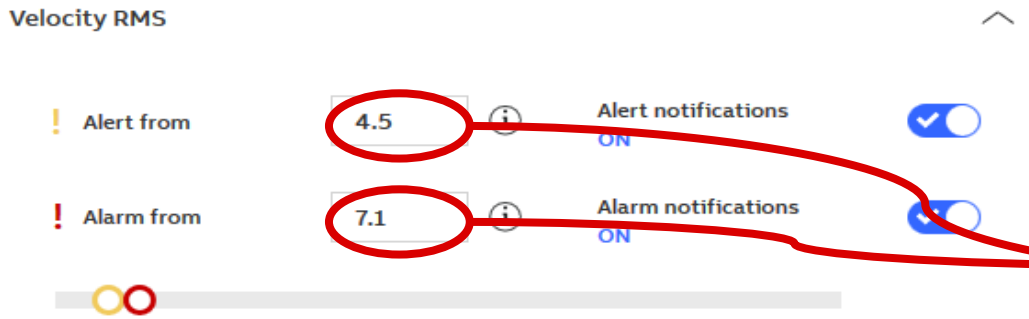
The alert level is an initial warning that tells you that your equipment is getting close to reach an alarm level. When the alarm level is reached, you should consider investigating the reason for that change. At the alarm level, remedial action may be necessary.

*Please note that is just a recommendation, you may set up the alert and alarm levels to your own convenience as you know how your equipment operates.

Guidance on setting alert and alarm levels

Determine best values to put in for alert and alarm for machines operating between 600 to 12,000 RPM – Velocity RMS

Default Velocity RMS alert and alarm values in the Smart Sensor portal are set based on Class I small machines from ISO standard 10816.



This standard provides guidance for machines operating in the ***10 to 200 Hz (600 to 12,000 RPM)*** frequency range.

VIBRATION SEVERITY PER ISO 10816

Machine		Class I small machines	Class II medium machines	Class III large rigid foundation	Class IV large soft foundation
in/s	mm/s				
Vibration Velocity Vrms					
0.01	0.28				
0.02	0.45				
0.03	0.71		good		
0.04	1.12				
0.07	1.80				
0.11	2.80		satisfactory		
0.18	4.50				
0.28	7.10		unsatisfactory		
0.44	11.2				
0.70	18.0				
0.71	28.0		unacceptable		
1.10	45.0				

Guidance on setting alert and alarm levels

ISO Standard 10816

Examples of types of machines from **ISO standard 10816** are small, direct-coupled, electric motors and pumps, production motors, medium motors, generators, steam and gas turbines, turbo-compressors, turbo-pumps and fans. Some of these machines can be coupled rigidly or flexibly, or connected through gears. The axis of the rotating shaft may be horizontal, vertical or inclined at any angle.

Machinery class designations are from **ISO standard 10816**:

Class I: Individual parts of engines and machines, integrally connected to the complete machine in its normal operating condition. (Production electrical motors of up to 15 kW are typical examples of machines in this category.)

Class II: Medium-sized machines (typically electrical motors with 15 kW to 75 kW output) without special foundations, rigidly mounted engines or machines (up to 300 kW) on special foundations.

Class III: Large prime-movers and other large machines with rotating masses mounted on rigid and heavy foundations which are relatively stiff in the direction of vibration measurements.

Class IV: Large prime-movers and other large machines with rotating masses mounted on foundations which are relatively soft in the direction of vibration measurements[1].

[1] https://www.intech2000.com/downloads/web/41/41.2/Applying%20Examiner.pdf

Guidance on setting alert and alarm levels

Determine best values to put in for alert and alarm for machines operating between 60 to 600 RPM – Velocity RMS

There is no ISO standard than can help set the alert and alarm values for machines operating at speeds *lower than 600 RPM*, so here is what you can do:

- Let your equipment run for a week or two (depending on your equipment's run time schedule) to determine the baseline values for overall vibration.

Example: Let's say your Velocity RMS baseline value is **0.1725 in/s RMS.**

1. Alert Value: It is recommended that your alarm value is set to a value equal to *50% higher* of the baseline value.
2. Alarm Value: It is recommended that your alarm value is set to *two times* the baseline value.

Alert value (in/s)= 0.1725*1.50=**0.25875 // Alarm value (in/s)=**0.1725*2=**0.345**

The alert level is an initial warning that tells you that your equipment is getting close to reach an alarm level. When the alarm level is reached, you should consider investigating the reason for that change. At the alarm level, remedial action may be necessary.

*Please note that is just a recommendation, you may set up the alert and alarm levels to your own convenience as you know how your equipment operates.

Guidance on setting alert and alarm levels

Determine best values to put in for alert and alarm for machines operating above 12,000 RPM – Velocity RMS

There is no ISO standard than can help set the alert and alarm values for machines operating at speeds *above 12,000 RPM*, so here is what you can do:

- Let your equipment run for a week or two (depending on your equipment's run time schedule) to determine the baseline values for overall vibration.

  Example: Let's say your Velocity RMS baseline value is **0.0172 in/s RMS.**

1. Alert Value: It is recommended that your alarm value is set to a value equal to 25% higher of the baseline value.
2. Alarm Value: It is recommended that your alarm value is set to a value equal to 30% higher of the baseline value.

Alert value (in/s)= 0.0172*1.25=**0.0215 // Alarm value (in/s)=**0.0172*1.3=**0.02236**

The alert level is an initial warning that tells you that your equipment is getting close to reach an alarm level. When the alarm level is reached, you should consider investigating the reason for that change. At the alarm level, remedial action may be necessary.

*Please note that is just a recommendation, you may set up the alert and alarm levels to your own convenience as you know how your equipment operates.

7. On Demand Raw Data and Trend Data

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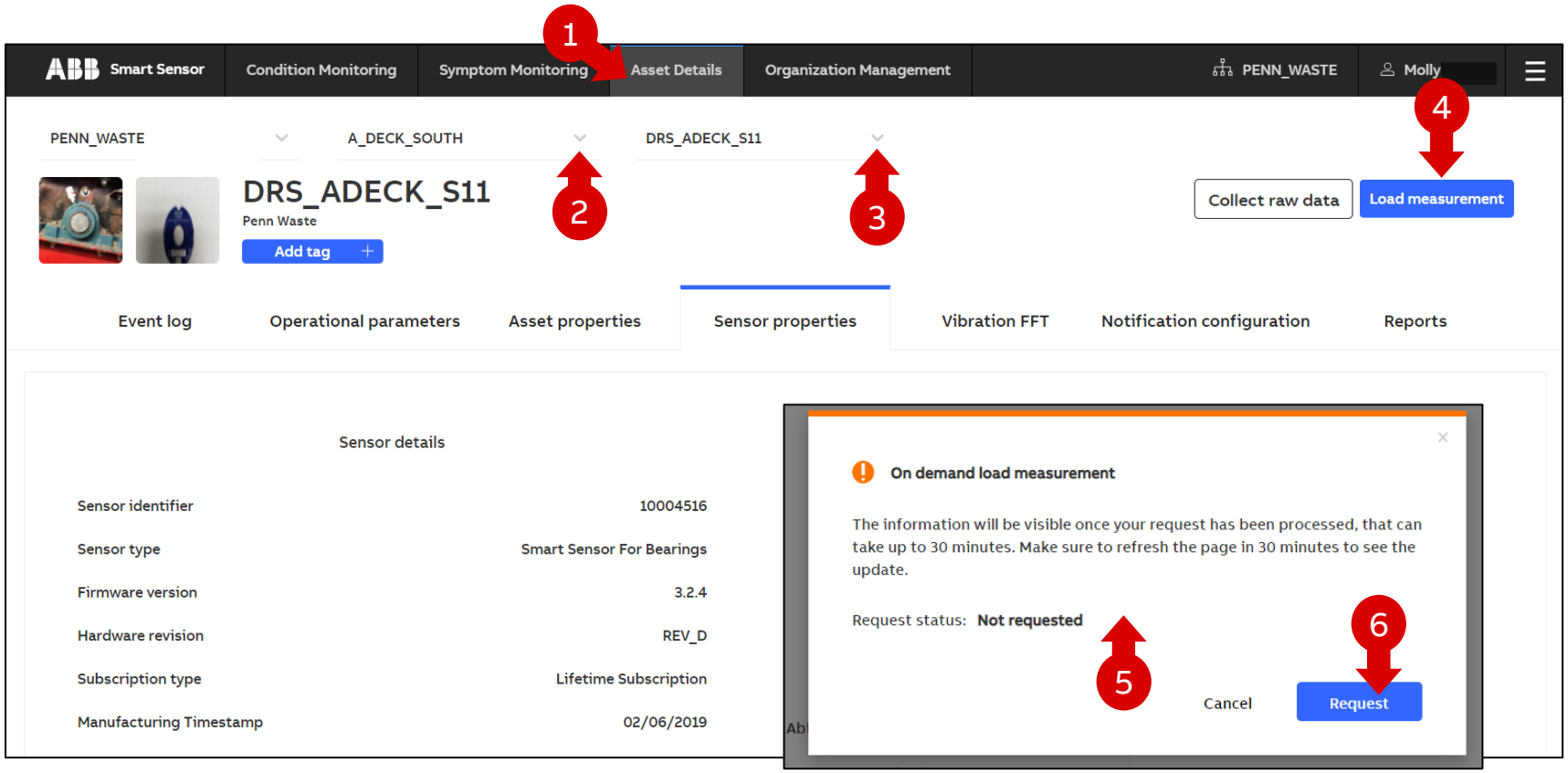
On Demand Load Measurement

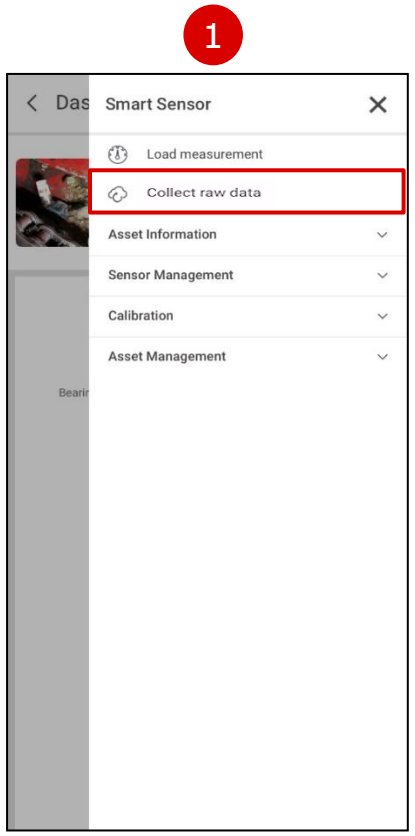
Request a trend measurement manually



1) Navigate to **Asset Details** on the main menu bar on top.
2) Select asset group
3) Choose sensor
4) Click **Load measurement**
5) Read the notification.
   It can take up to 30 min until the requested load measurement is visible on the portal.
6) Click **Request.**

On Demand Raw Data Collection

Request a raw data measurement from a specific sensor via the mobile app if no gateway is in range



Requirement: *The firmware version of the sensor needs to be 3.2.4*

Collect raw data from the asset detail view:

1) Tap "**Collect raw data"** from the asset menu to download sensor's last measurement raw data from sensor's memory.

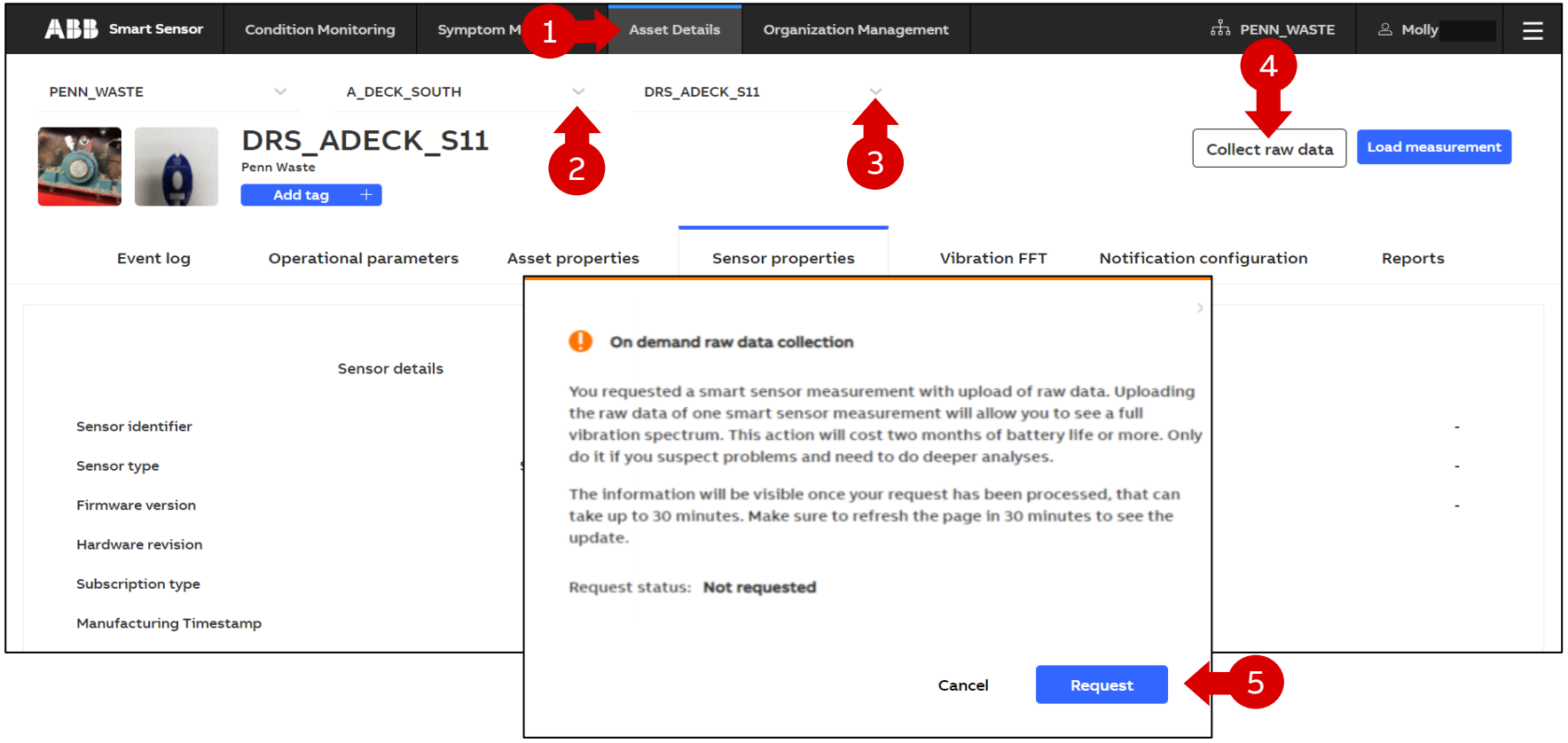
Once the raw data has been collected, it is automatically used by the back end to calculate the discrete Fourier transform (commonly referred to as the frequency spectrum or the FFT) of the vibration. The frequency spectrum is displayed in the Vibration FFT tab in the web portal (see page 100).

Attention: sensor must be in Bluetooth range

Note: This feature is only available for moderators of the organization's Admin user group

On Demand Raw Data Collection

Request a raw data measurement from a specific sensor via the portal if gateway is in range



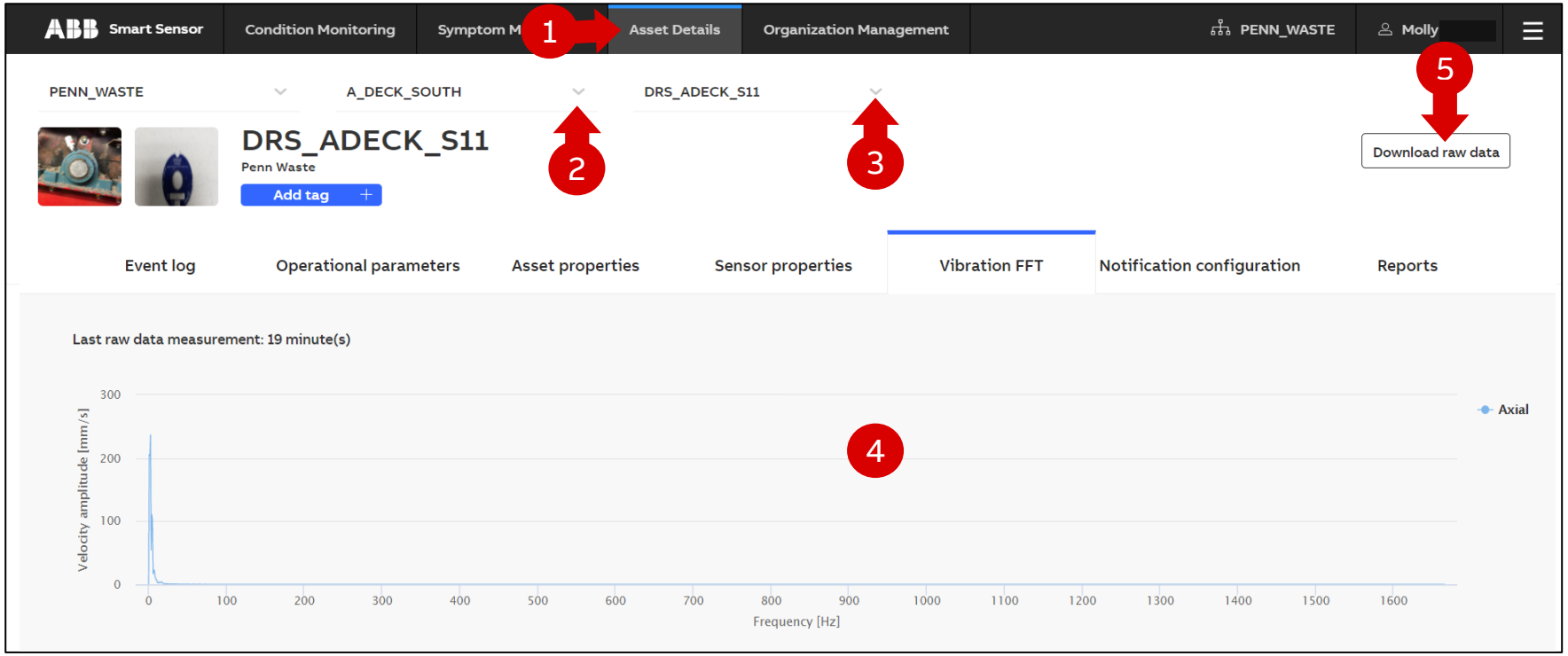
Requirement: *The firmware version of the sensor needs to be 3.2.4*

1) Navigate to **Asset Details.**
2) Select asset group.
3) Choose sensor.
4) Click **Collect raw data.**
5) Read the notification. Click **Request.**

Note: This feature is only available for moderators of the organization's Admin user group

Asset Details view – Vibration FFT

Get a vibration FFT plot for your assets and download raw data



1) Navigate to **Asset Details.**
2) Select asset group.
3) Choose sensor.
4) In the **Vibration FFT** tab of the **Asset Details** view, the velocity vibration spectrum is visible for your latest raw dataset that has been successfully triggered and transferred to the cloud.
5) Click **Download raw data**.

A zip folder containing a CSV file will be downloaded (csv files can be open with Excel).

8. Visualization and interpretation of data

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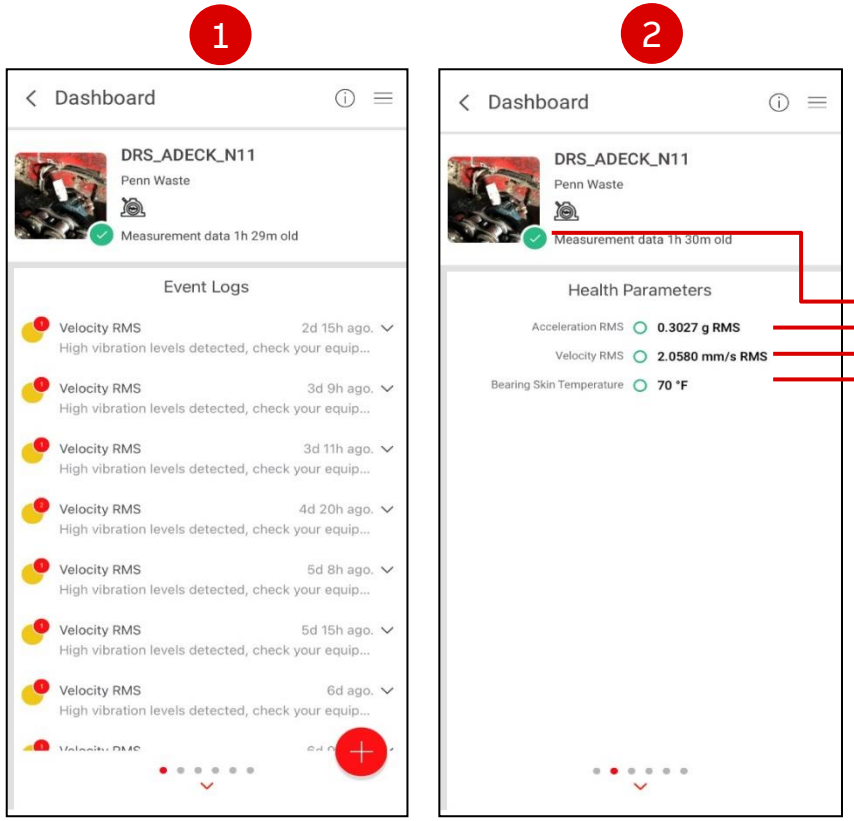
App: https://youtu.be/vxMMr-t0Cl8

Portal: https://youtu.be/QjMSj-_pTJY

Data visualization on the mobile app

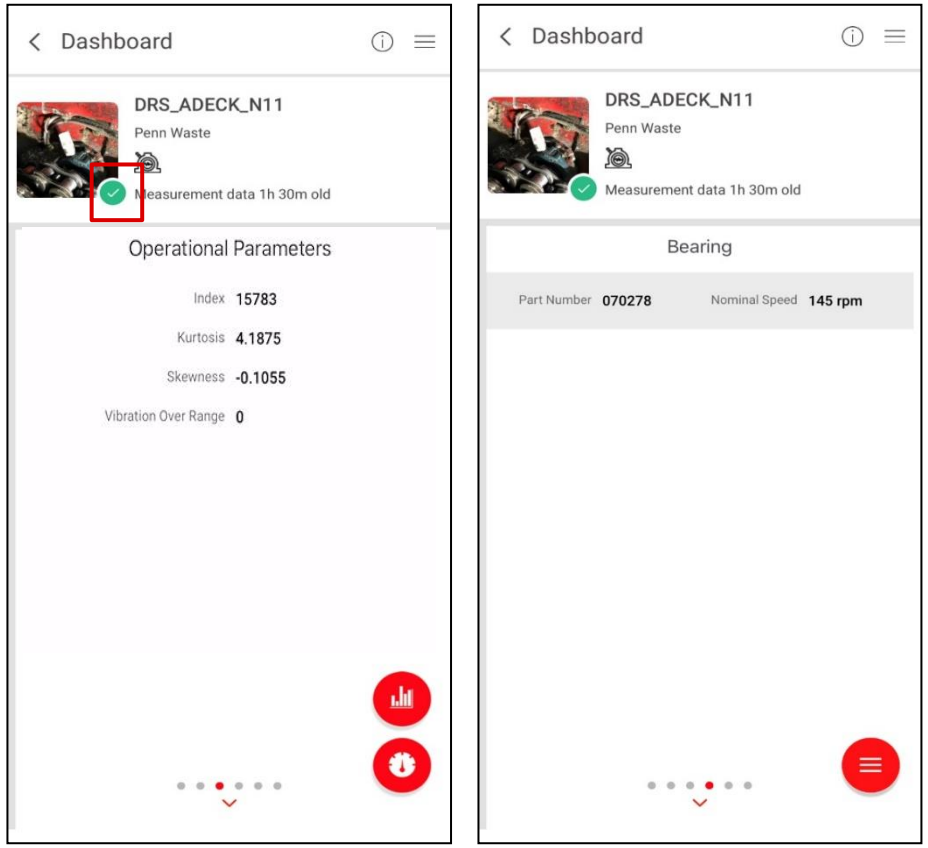
Viewing data on the mobile app



1) "**Event Logs**" card: individual, momentary limit violations.
   • Switch panels by swiping the screen left and right.
2) "**Health Parameters**" card: KPIs influencing condition indexes.
3) **This is the overall condition index / indicator:**
   → aggregates health parameters (KPIs) over the last 7 days.
   → This is why it does not follow a single health KPI's status.

Data visualization on the mobile app

Viewing data on the mobile app



The **Condition Index** indicator at the bottom right corner of the asset thumbnail aggregates all KPIs over a 7-day period.

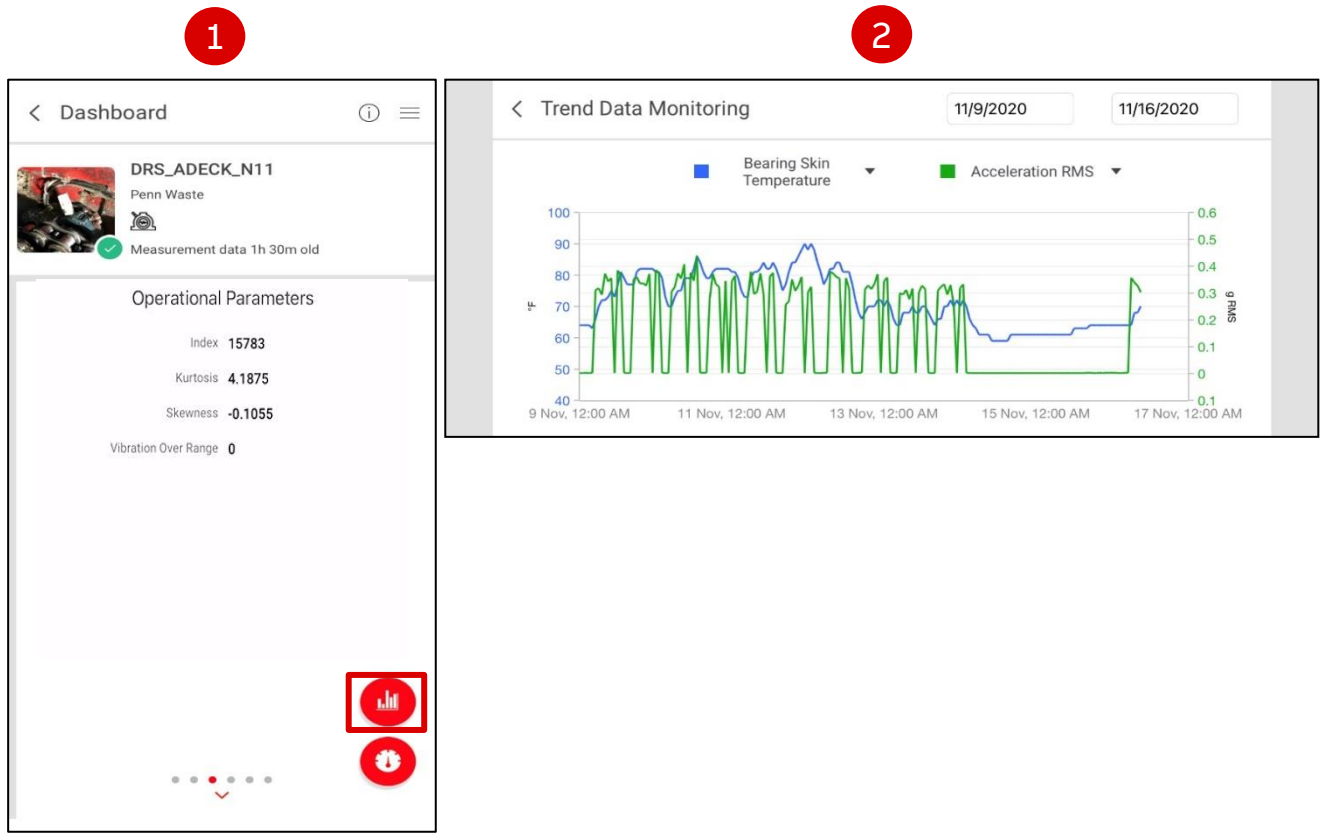
- **Green** when everything is fine
- **Yellow** when some KPIs have been occasionally above their thresholds in the 7-day period.
- **Red** when alarm limits have lately been violated more often than recommended and equipment condition is deteriorating.

Other panels include:

- Latest operational parameters
- Asset nameplate data

Trend data monitoring on the mobile app

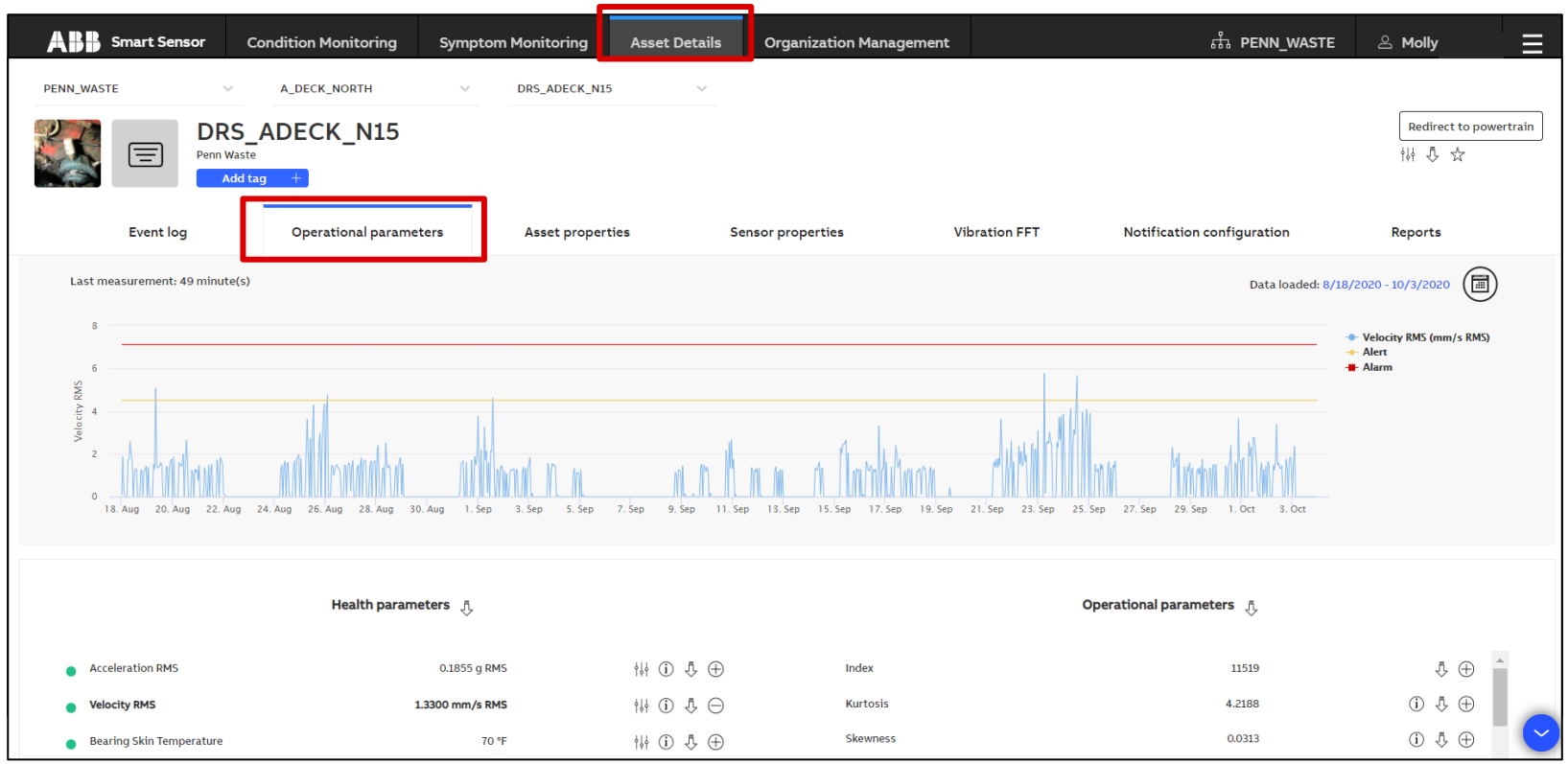
Viewing data on the mobile app



1) On the “Operational Parameters” screen, click the trend button on the lower right corner
2) Choose **the time period** and up to **two KPIs** to superimpose on the graph view

Trend data monitoring on the portal

Portal view “Asset Detail”: “Operational Parameters”

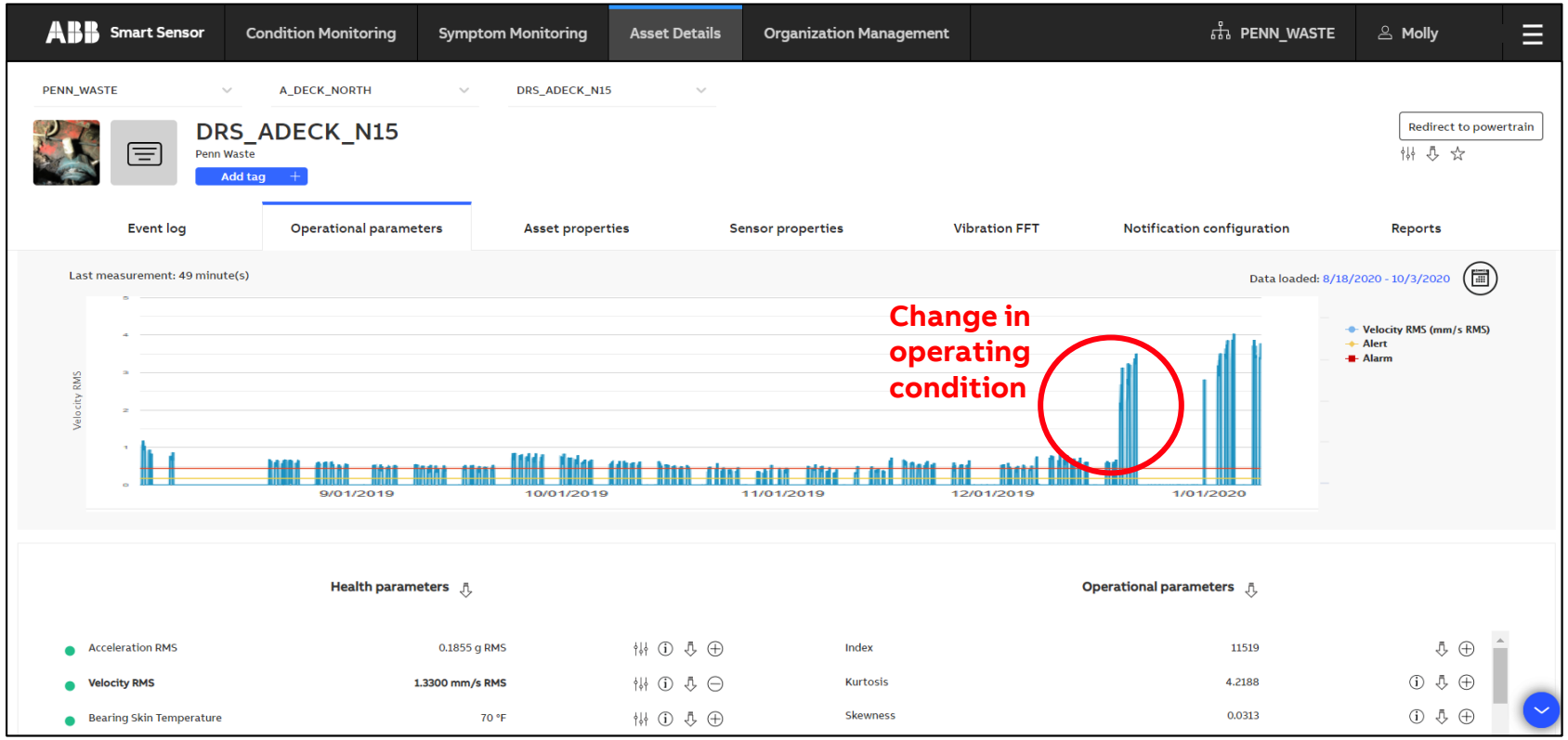


This view shows **individual KPIs** over time for each asset in turn.

You can choose to be notified on any individual alert or alarm triggered.

Trend data monitoring on the portal

Portal view “Asset Detail”



The **evolution of data trends over time**, which may indicate a deterioration in the equipment condition.

9. Digital Powertrain portal

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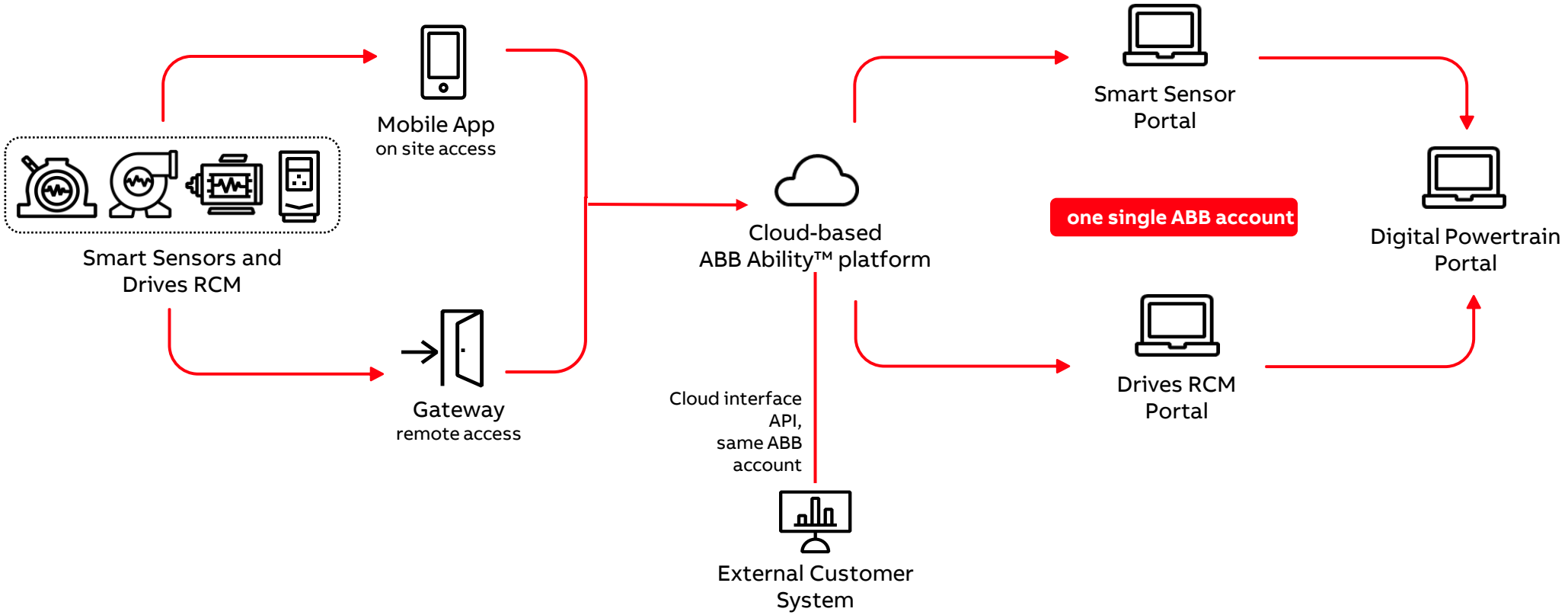
System architecture

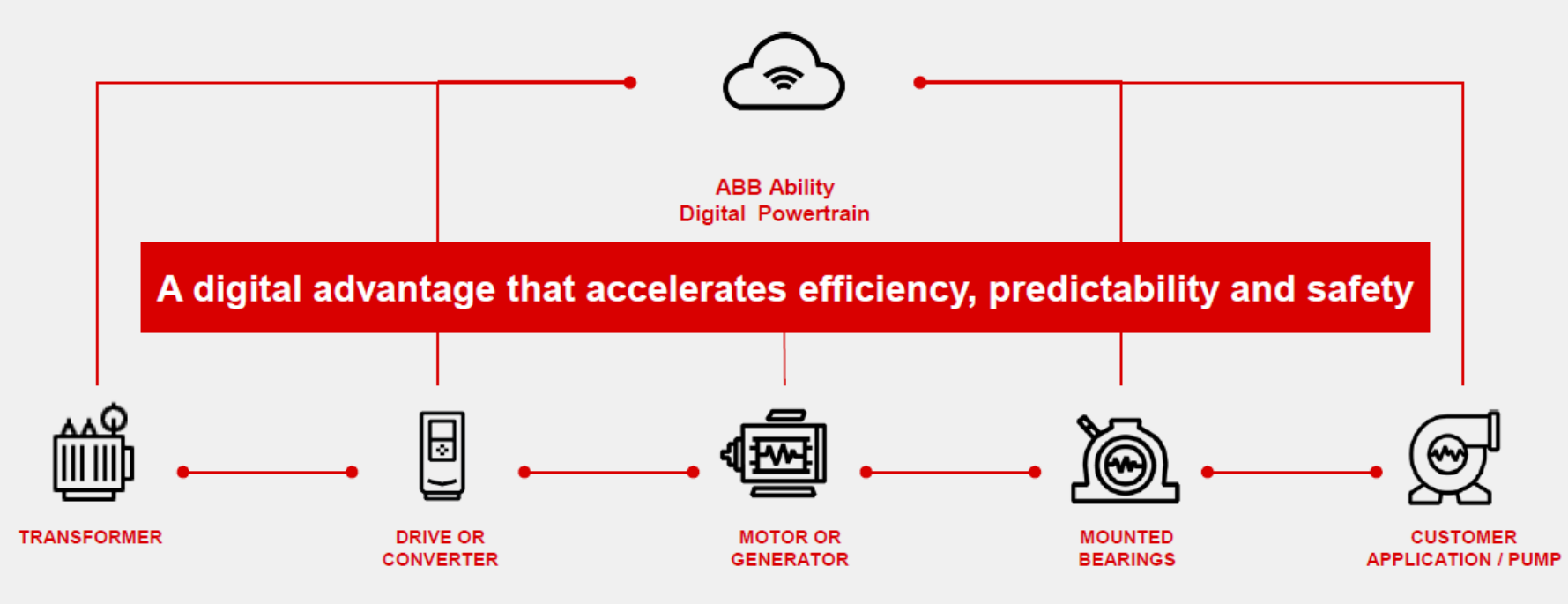
Interfaces of the Digital Powertrain portal



Users own the sensors that they commission themselves.
For other sensors, access rights must be manually granted to a user before data can be accessed.

What is a Digital Powertrain?

An intelligent powertrain equipped with **sensors** and **cloud connectivity**. It can include motors, drives, mechanical components including bearings, couplings and gearboxes, and applications like pumps, fans and compressors.



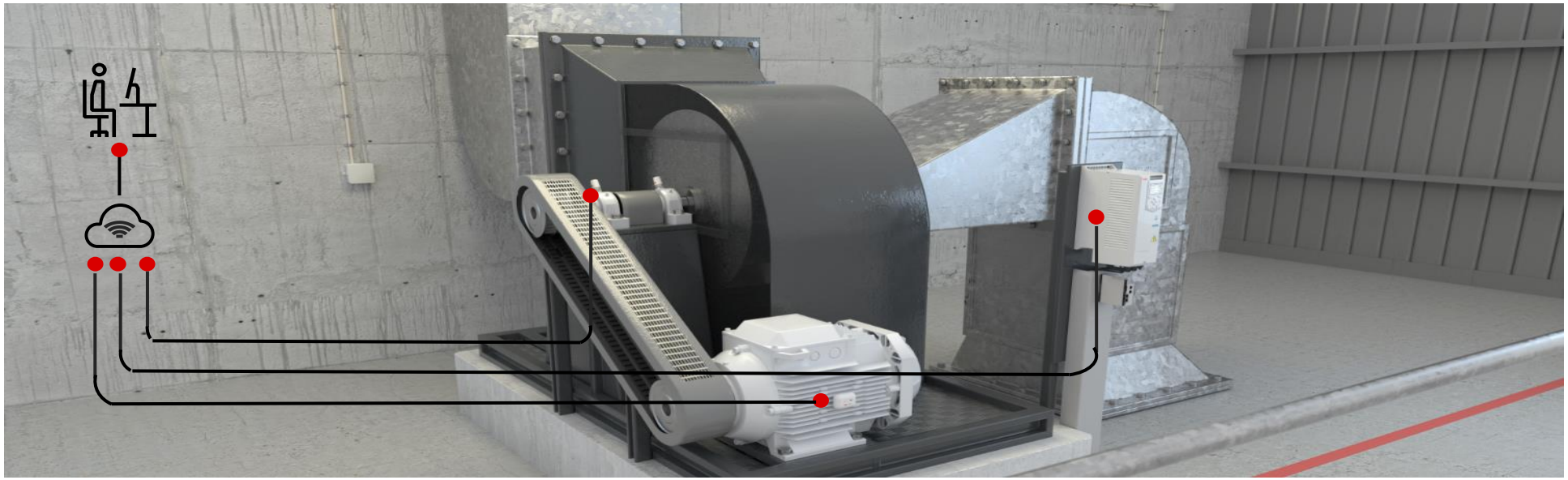
It is a combination of 2 existing web interfaces:

- **Smart Sensor** portal for motors, pumps and mounted bearings;
- RCM portal for **drives.**

The only additional step is to build up a digital powertrain by combining multiple monitored assets in the Powertrain portal.

Why Digital Powertrain?

So that the customers can monitor their entire process / powertrain or benchmark performance accross multiple similarly rated assets, e.g. bearings performing similar tasks as defined by load and speed.



Our digital powertrain **combines connectivity and data analytics** with our expertise to make your operations efficient, predictable and safe.

Creating a powertrain step by step

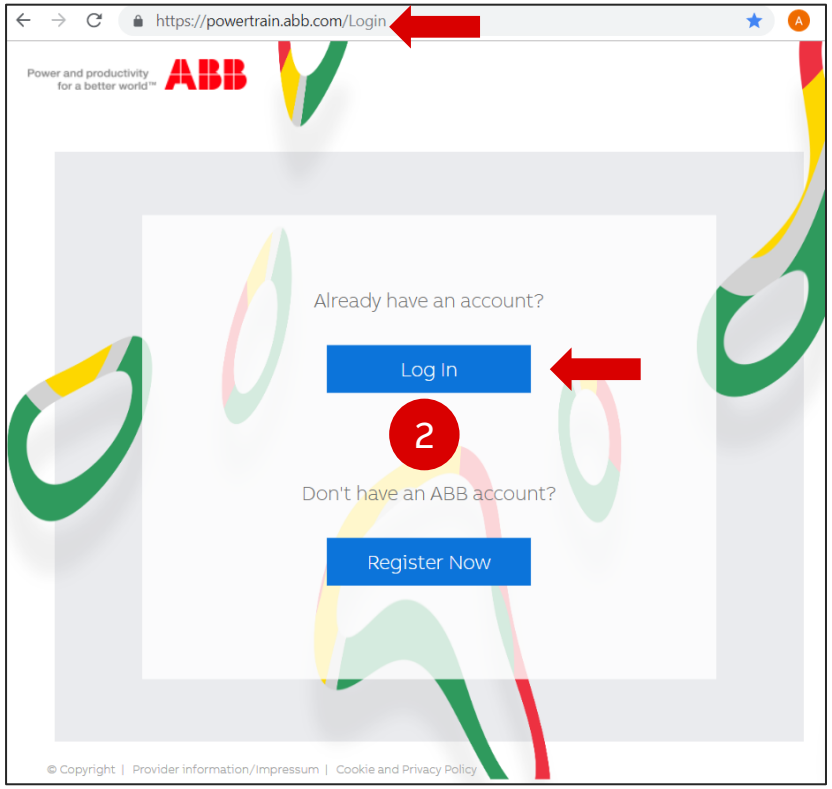
Preparation steps

1

The Powertrain Portal puts together the following assets:

- From the **Drives portal**:
  - Drives
- From the **Smart Sensor Portal**:
  - Motors
  - Pumps
  - Mounted bearings
  - Gearing

Therefore, **access to both portals** is a pre-requisite.



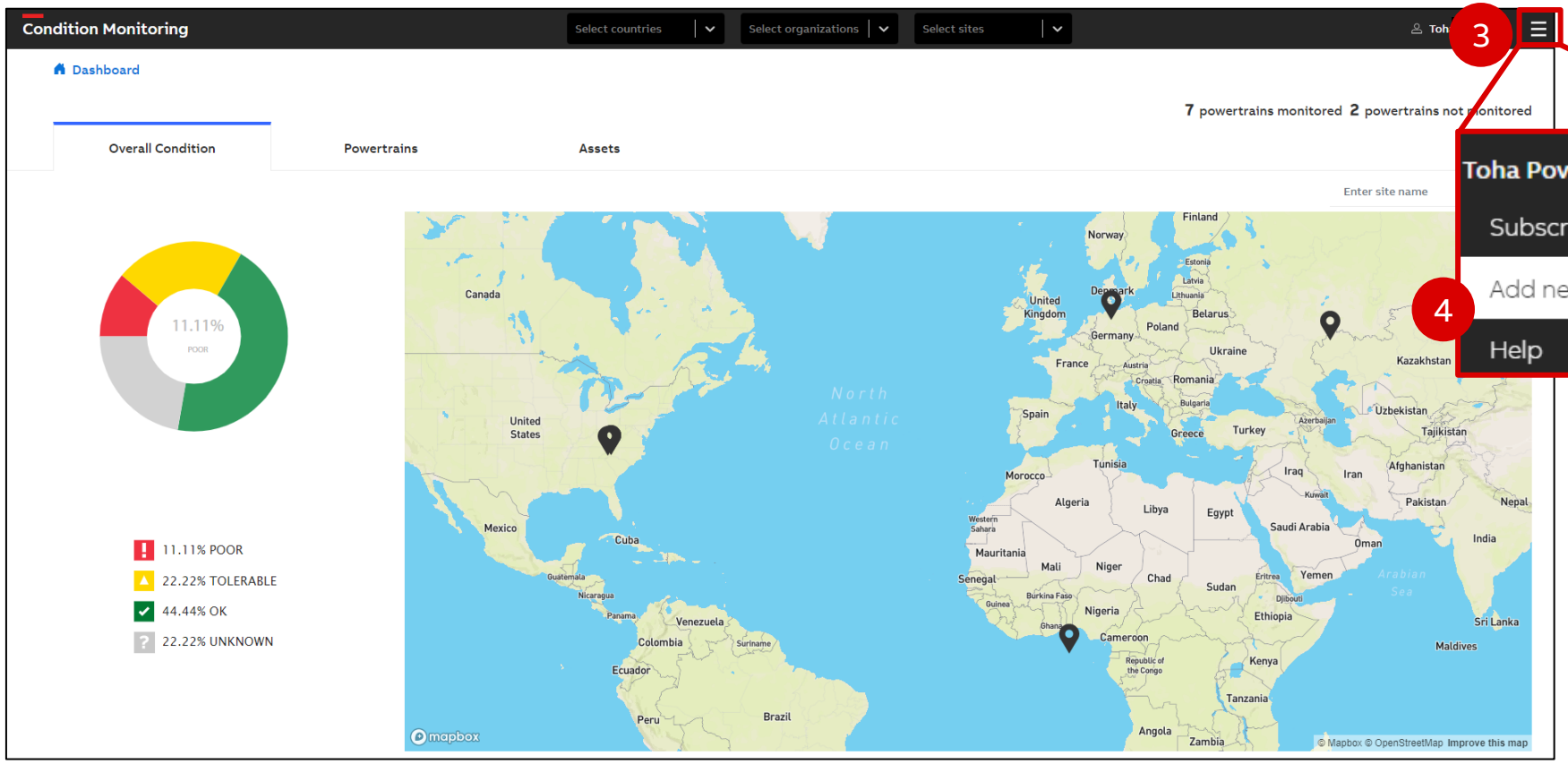
Log in to the portal:

1) Enter the following link in the web browser: https://powertrain.abb.com

2) Log in with the existing ABB account

Creating a powertrain step by step

Preliminary steps

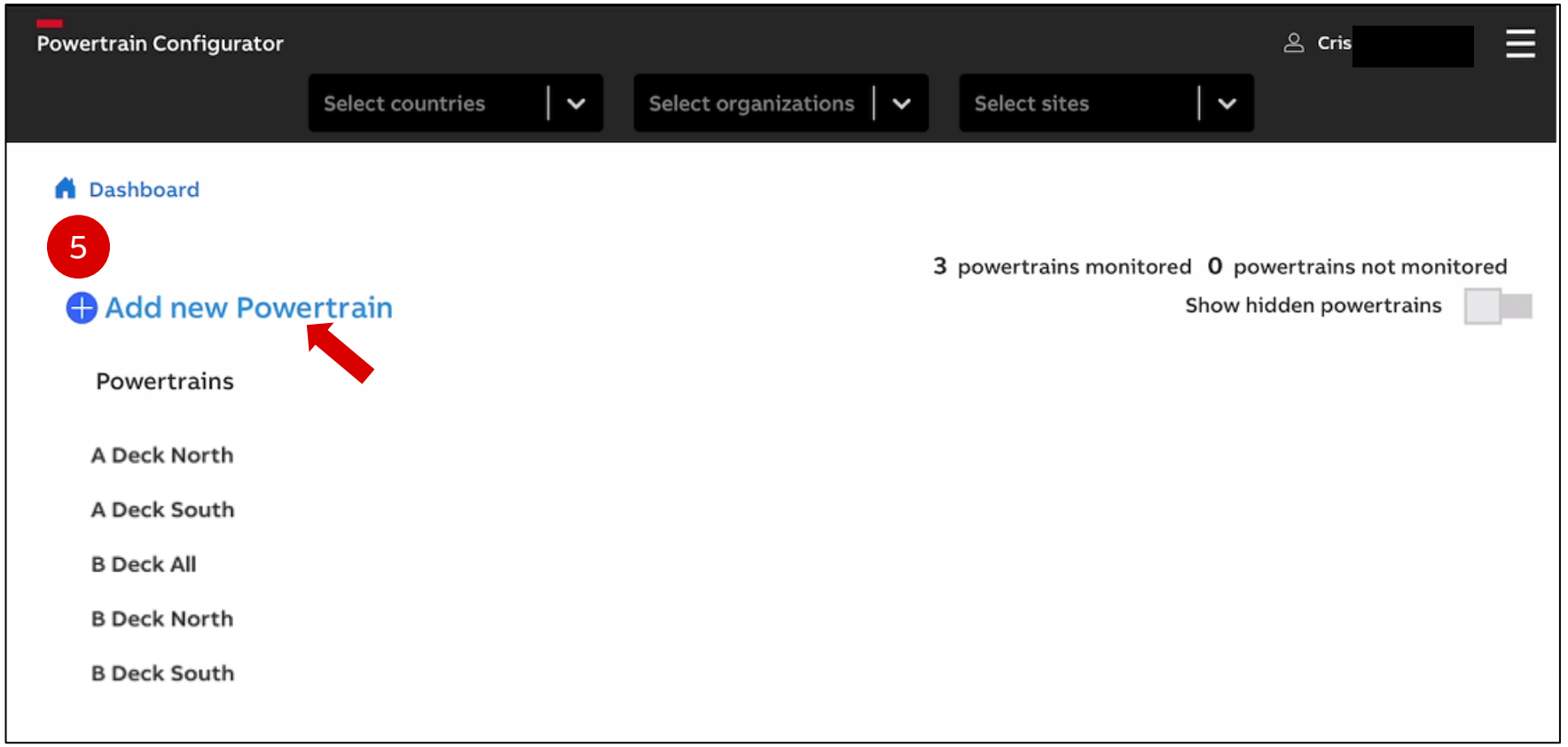


3) When entering the dashboard, click on the three-bar menu on the top right.

4) Click on "**Add new Powertrain**" to go to the Powertrain configurator page.

Creating a powertrain step by step

Preliminary steps

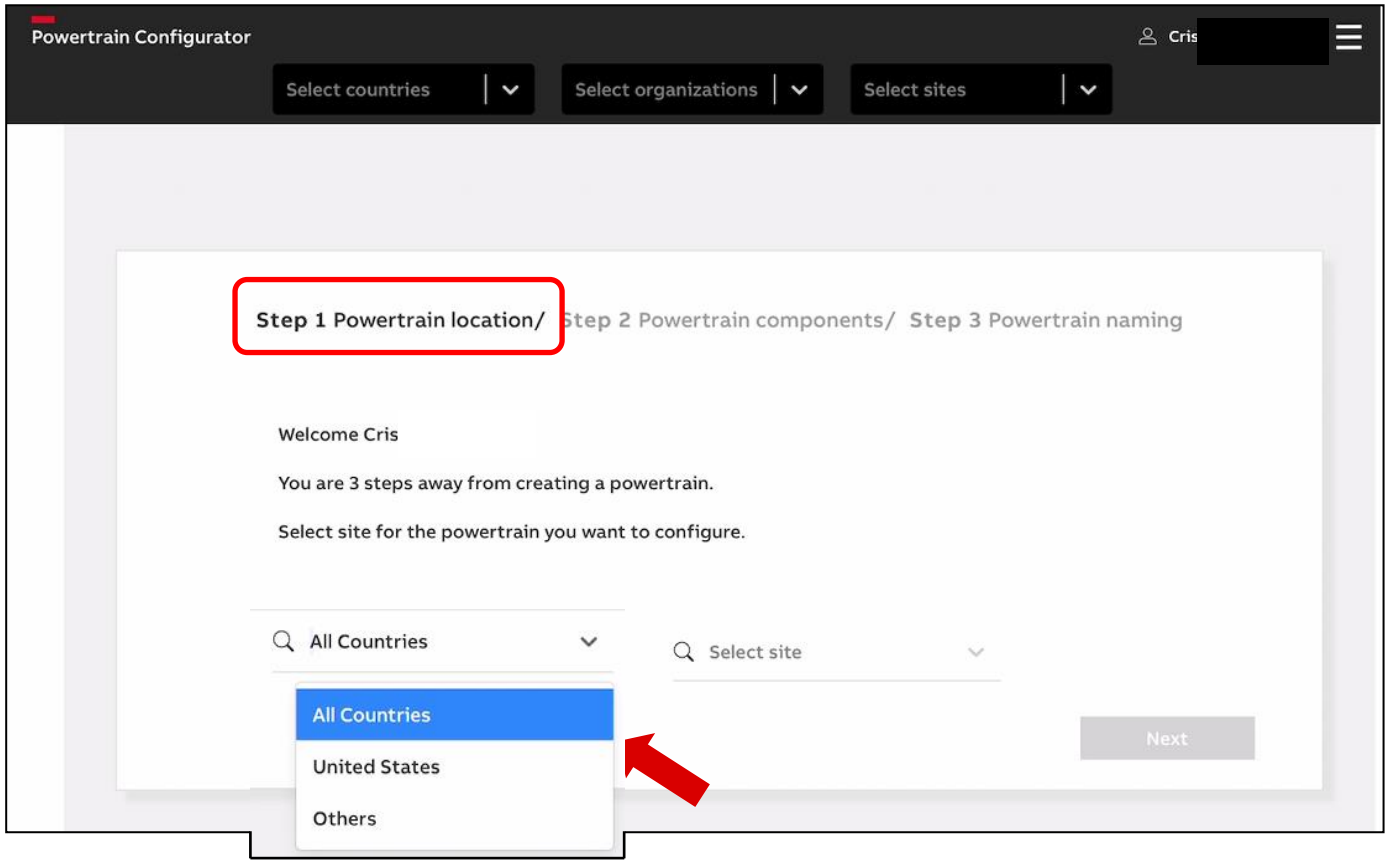


5) Click on "**+ Add new Powertrain**" to open the Powertrain configurator.

Configuring a powertrain step by step

Three main steps

1



There are 3 main steps to add and configure a new powertrain:

- Location
- Components
- Naming

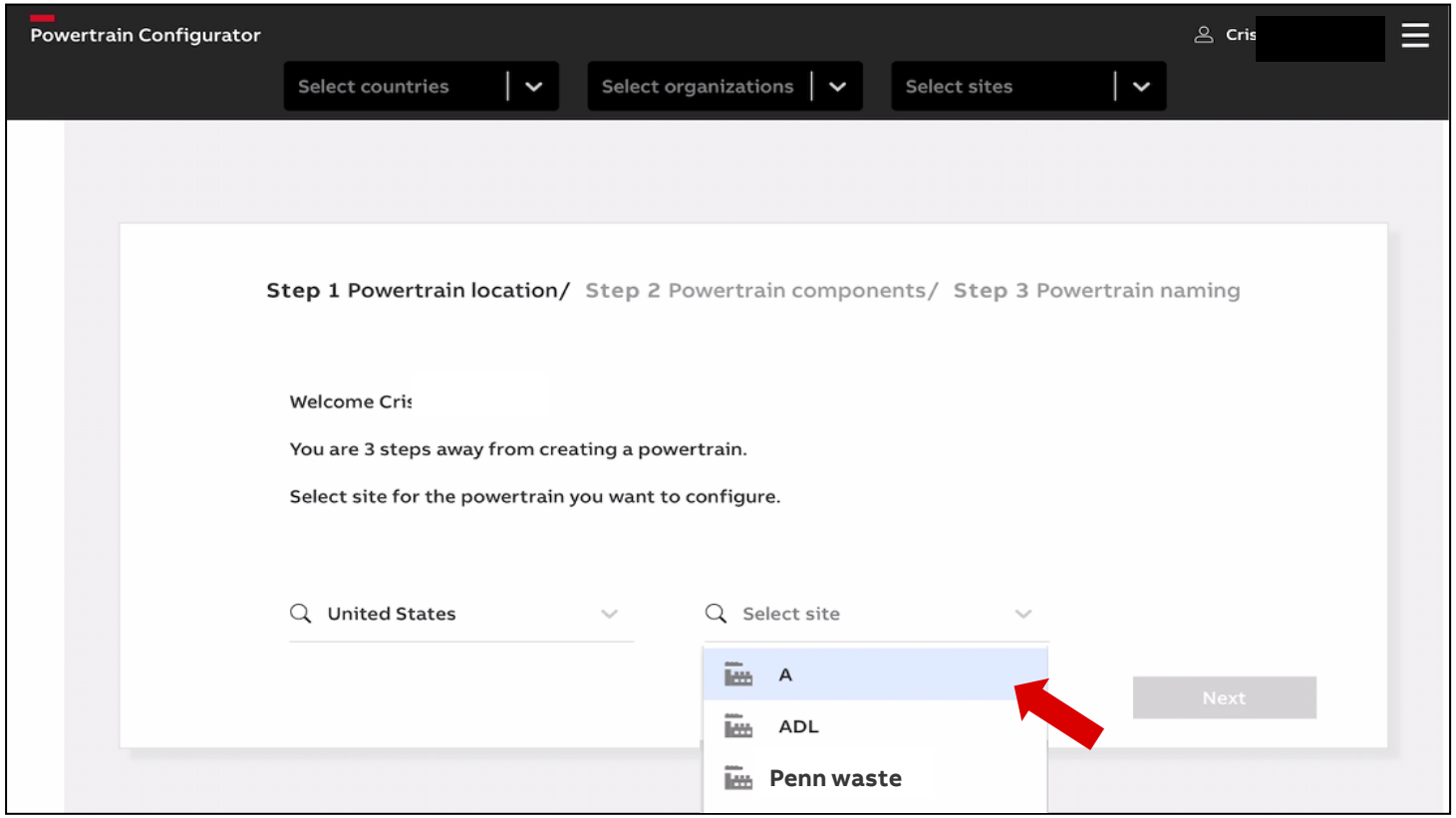
Step 1) Location

Choose a **country** from the dropdown list.

Configuring a powertrain step by step

Three main steps

1

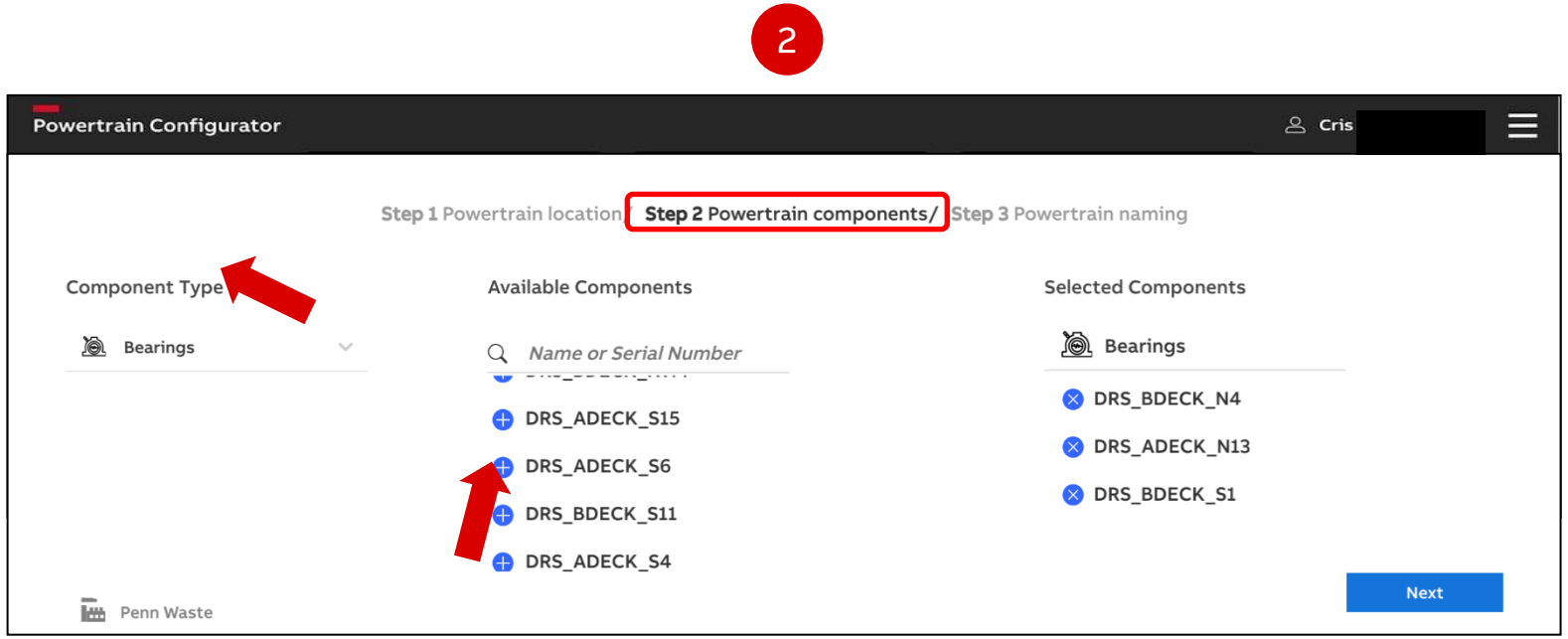


Step 1) Location

Choose a **site** from the dropdown list and click on **Next**.

Configuring a powertrain step by step

Three main steps

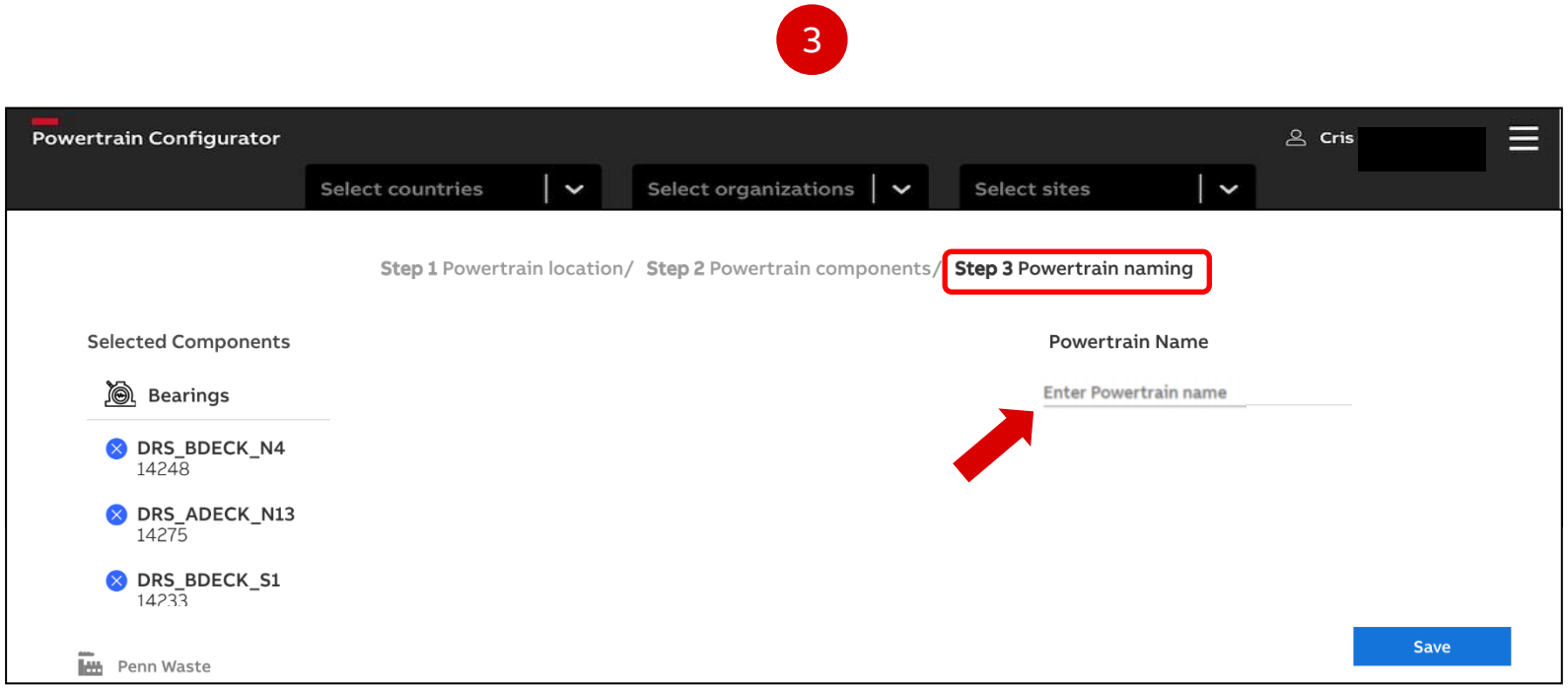


Step 2) Components

- Select the **component type** from the dropdown list.
- Add the specific assets from the list of **available components** by clicking on the **+.**
- Repeat process for more assets.
- Click on **Next**.

Configuring a powertrain step by step

Three main steps



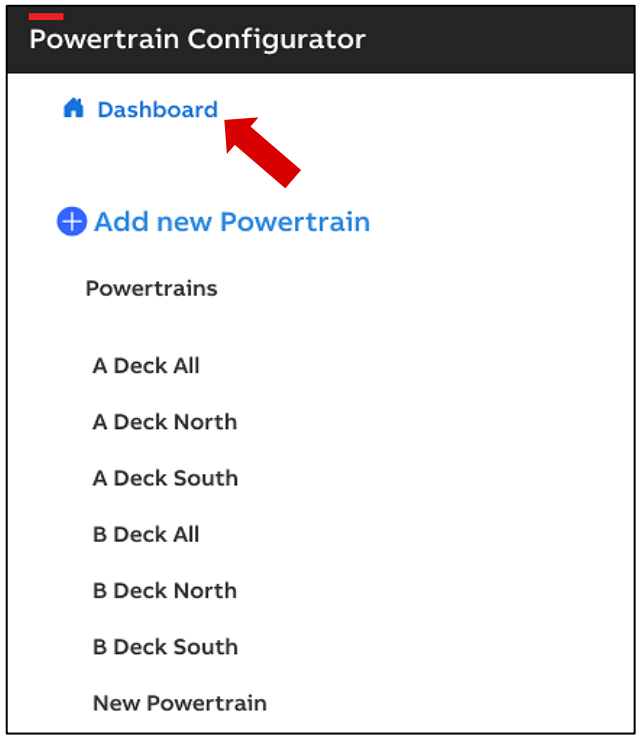
Step 3) Naming

Enter a **name** for the powertrain and click on **Save**.

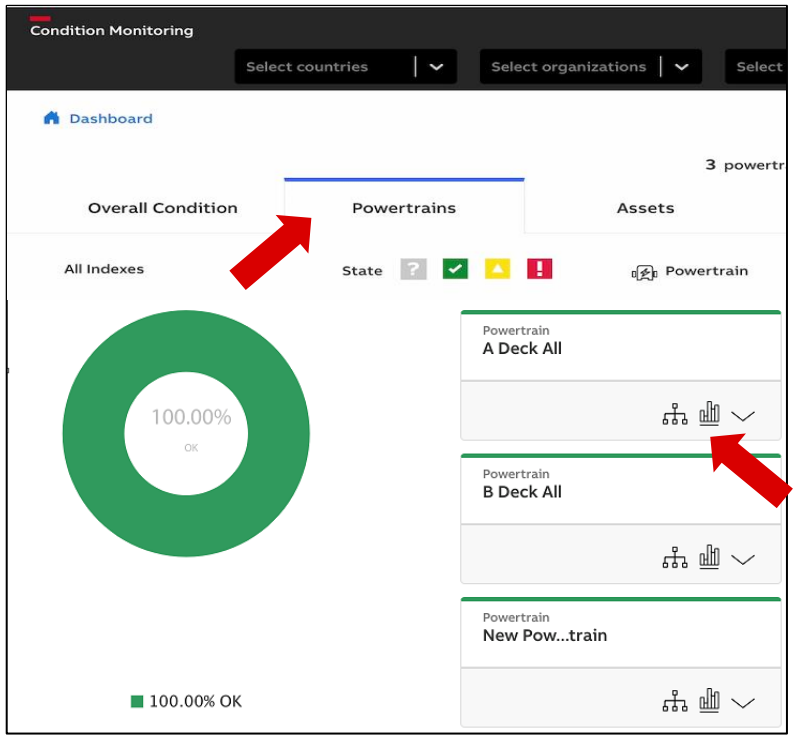
Visualization of powertrain data

A few clicks to creating a graph

1



2



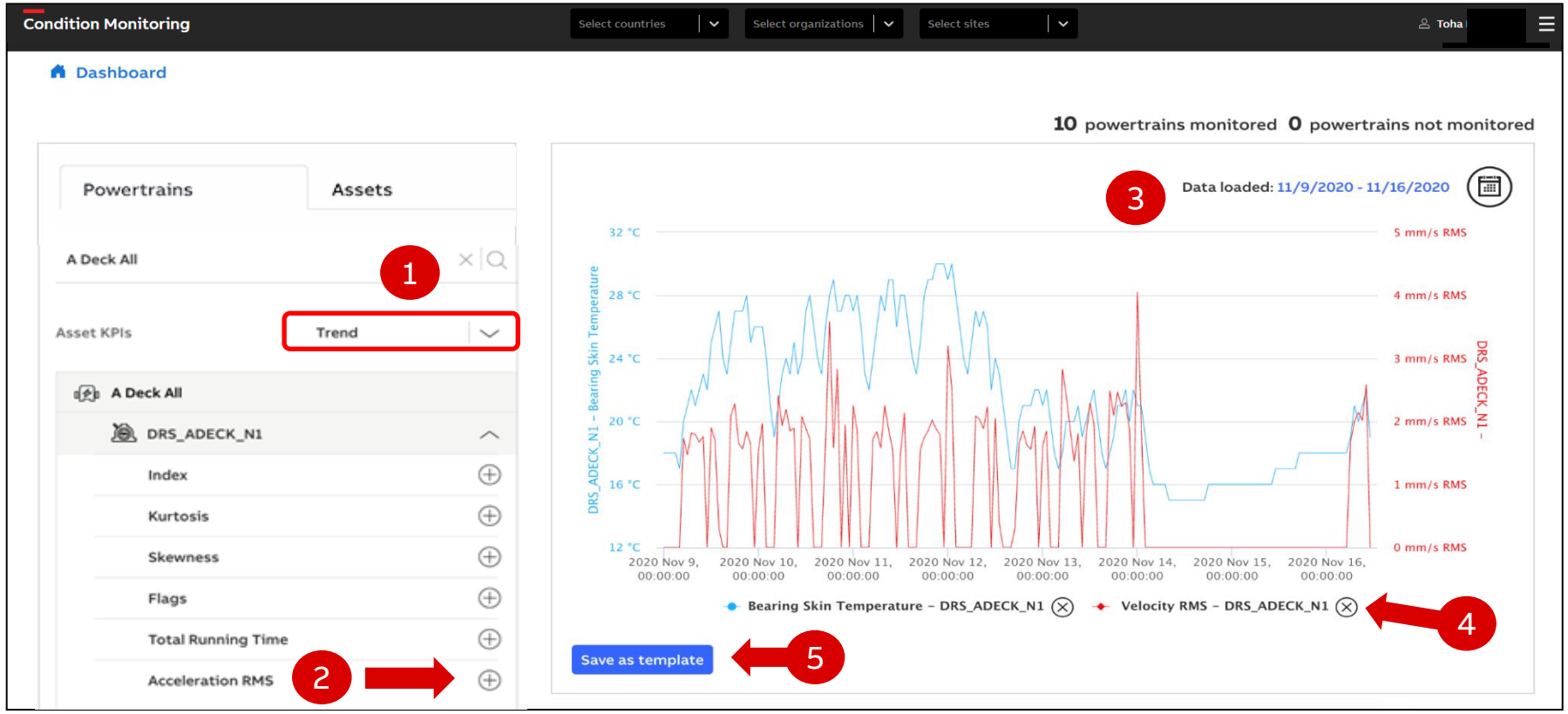
1) Click on the home icon on the top left to go to the **Dashboard.**

2) Click on «**Powertrains**» to see the condition of each powertrain. Then click on the **bar graph icon** of the powertrain.

* The **hierarchy** shows the details of the condition of the powertrains and their assets.

Visualization of powertrain data: trends

Visualize time-series data



1) "Trend" is selected by default.

2) On the «Cross Asset KPI Visualization" page, **add** the desired KPIs for **each** asset in your digital powertrain from the dropdown lists by clicking **+.**

3) Adjust the **timeframe on the top right**.

4) Click on the KPIs below the graph to **hide/show** them

5) Save as template if desired

10. KPI Terminology

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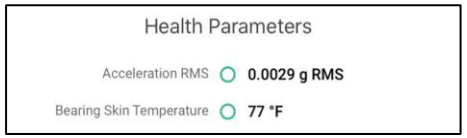
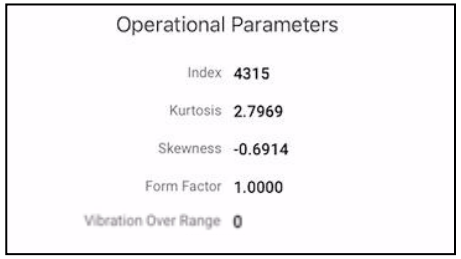
Smart Sensor for mechanical products KPIs

KPI's description for sensors with firmware **2019.01.09.1**

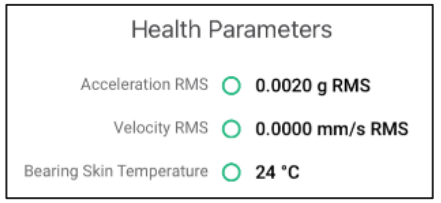


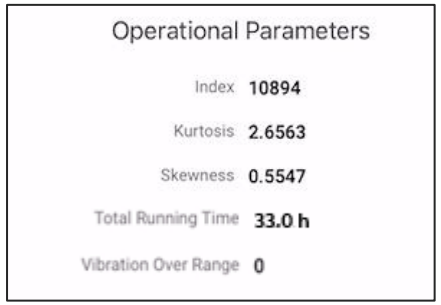


Health Parameters	**Acceleration RMS**	The sum of all vibration measured within a specified range
	Bearing Skin Temperature	Bearings surface temperature
Operational Parameters	**Index**	Number of the measurements collected by sensor
	Kurtosis	A statistical parameter characterizing a random signal compared to a normal distribution
	Skewness	A statistical measure of the asymmetry of the signal
	Form Factor	A ratio of the average value and RMS value of the waveform
	Vibration Over Range	A value of 1 indicates that the vibration is higher than what the current accelerometer range setting allows, and 0 indicates vibration is good for the current range setting

Smart Sensor for mechanical products KPIs

KPI's description for sensors with firmware **3.2.4**





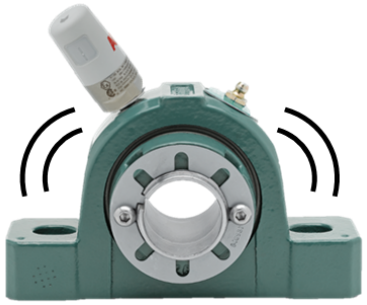
Health Parameters	**Acceleration RMS**	The sum of all vibration measured within a specified range
	Velocity RMS	Fixed point value of Root Mean Square of vibrations
	Bearing Skin Temperature	Bearings surface temperature
Operational Parameters	**Index**	Number of the measurements collected by sensor
	Kurtosis	A statistical parameter characterizing a random signal compared to a normal distribution
	Skewness	A statistical measure of the asymmetry of the signal
	Total Running Time*	Number of hours that your equipment has been in operation
	Vibration Over Range	A value of 1 indicates that the vibration is higher than what the current accelerometer range setting allows, and 0 indicates vibration is good for the current range setting

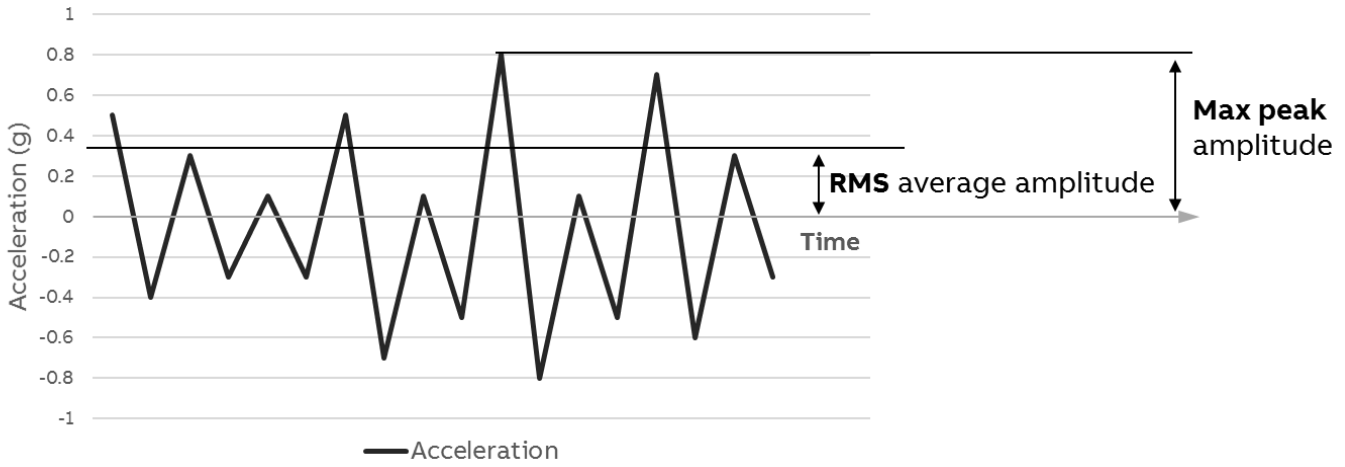
***In order to enable this KPI, a running state must be calibrated (refer to page 69)**

Smart Sensor for mechanical products KPIs

Overall Vibration: **Acceleration RMS** - Health Parameter

- Provides overall vibration energy of the entire system.
- Graph shows the data of the vibration energy in the system over time.
- Units are in terms of ‘root-mean-square’ amplitude of the acceleration of gravity (g RMS). *
- Serves as a basic method for determining the condition of the system throughout their lifetime.
- RMS value can detect the occurrence of system failure but cannot determine cause of vibrations.



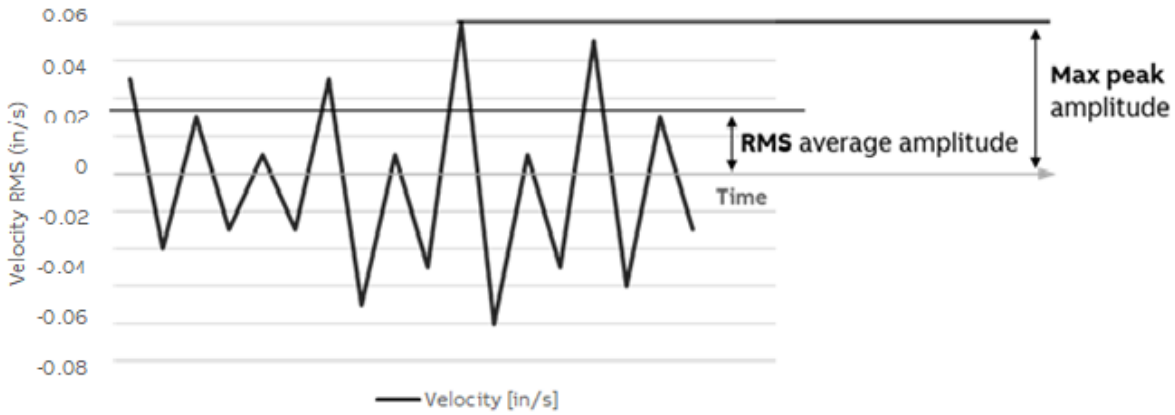


*** Vibration measurement is done by taking 4096 acceleration of gravity (g) measurements during 1.2 seconds in the the sensor’s Z axis, and g RMS is the average of all those measurements.**

Smart Sensor for mechanical products KPIs

Overall Vibration: **Velocity RMS** - Health Parameter

- Provides overall vibration energy of the entire system.
- Graph shows the data of the vibration energy in the system over time.
- Units are in terms of ‘root-mean-square’ amplitude of the velocity integrated from the acceleration of gravity (in/s RMS or mm/s RMS).
- Serves as a basic method for determining the condition of the system throughout their lifetime.
- RMS value can detect the occurrence of system failure, but cannot determine cause of vibrations.



Smart Sensor for mechanical products KPIs

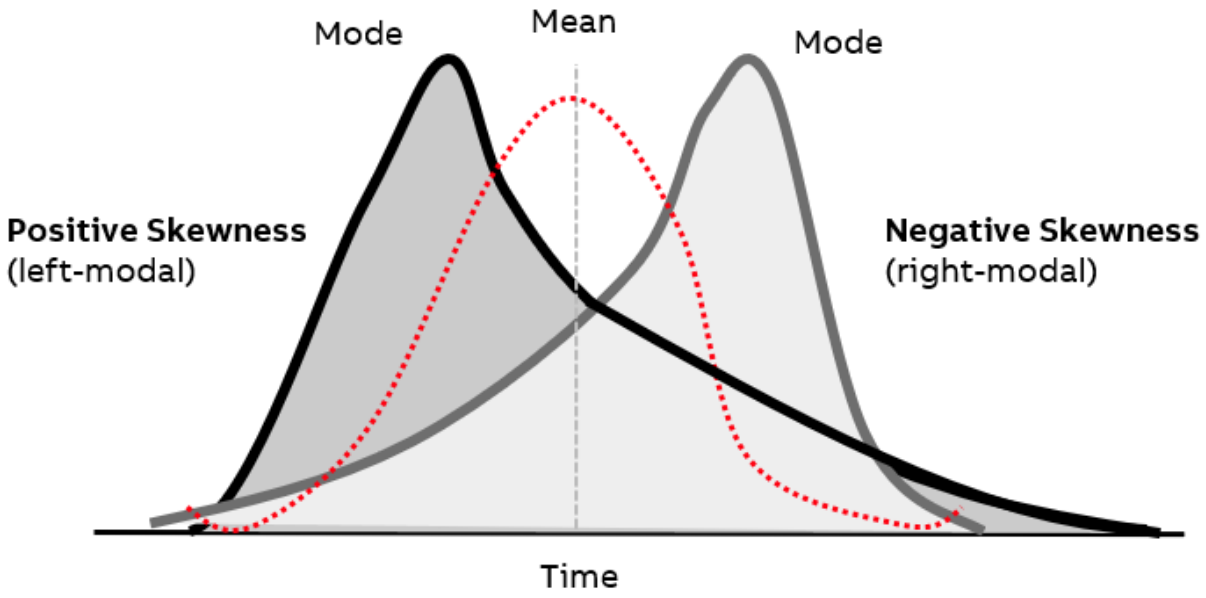
Kurtosis - Operational Parameter

- Dimensionless parameter.
- Helps detect failures in the system.
- A kurtosis value of 3 generally indicates a healthy system.
- Values significantly greater than 3 show progressing failures.

Smart Sensor for mechanical products KPIs

Skewness - Operational Parameter

- Dimensionless parameter that measures the lack of symmetry of the distribution.



Smart Sensor for mechanical products KPIs

Form Factor - Operational Parameter

- Widely used in the field of electrical engineering for assessing the shape of a periodic signal.
- Metric is related to a normalized value of 1.11 for a pure tone.
- Any changes in the nature of the signal are likely to be reflected in the changing values of the FF.

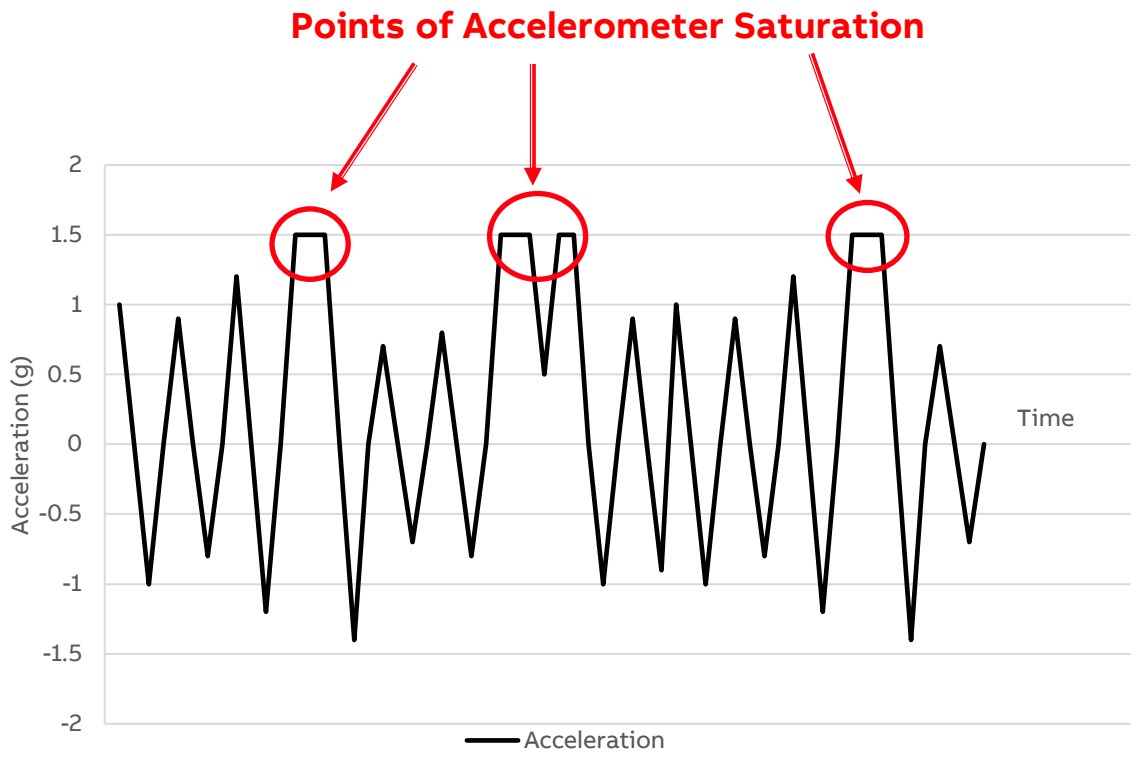
$$FF = \frac{RMS}{\frac{1}{n}\sum_{i=1}^{n}|x_i|}$$

Smart Sensor for mechanical products

Vibration Over Range – operational parameters

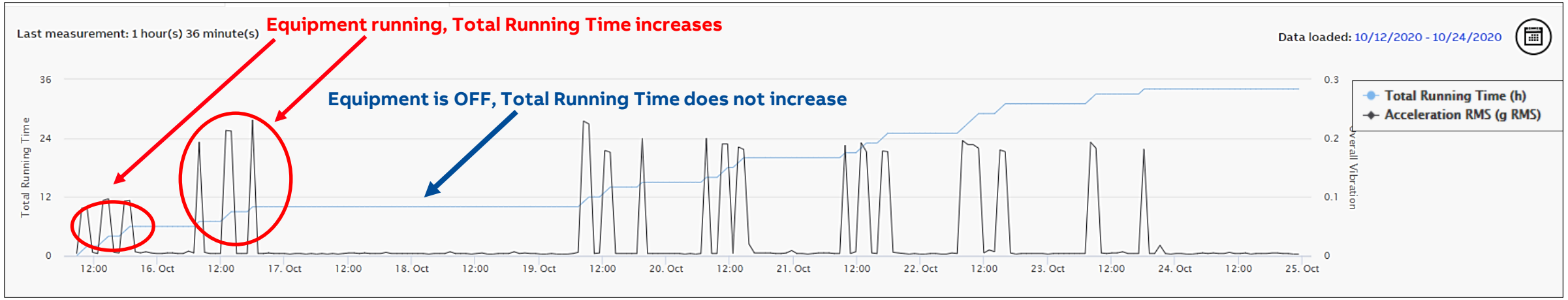
Your Smart Sensor for mounted bearings has an embedded accelerometer which is the component that senses the vibration of your equipment. By default, the firmware in your sensor sets the accelerometer range to 2gs (2 gravities). However, depending on your application and the way the sensor is mounted on your equipment, the vibration amplitude might be exceeding this range, and this can cause the accelerometer to saturate.

Refer to page 66 to learn how to adjust the accelerometer range of your sensor.



Smart Sensor for mechanical products KPIs

Total Running Time – Configured Operational Parameter



- To enable Total Running Time operational parameter, **the running state of your asset** must be calibrated (refer to page 69).
- Counts the number of hours your equipment has been in **operation**.
- All acceleration RMS values above the Running State Calibration value will be counted as "**running**" and those below as "**stopped**".

Total Running Time operational parameter is only available for sensors with 3.2.4 firmware.


ABB