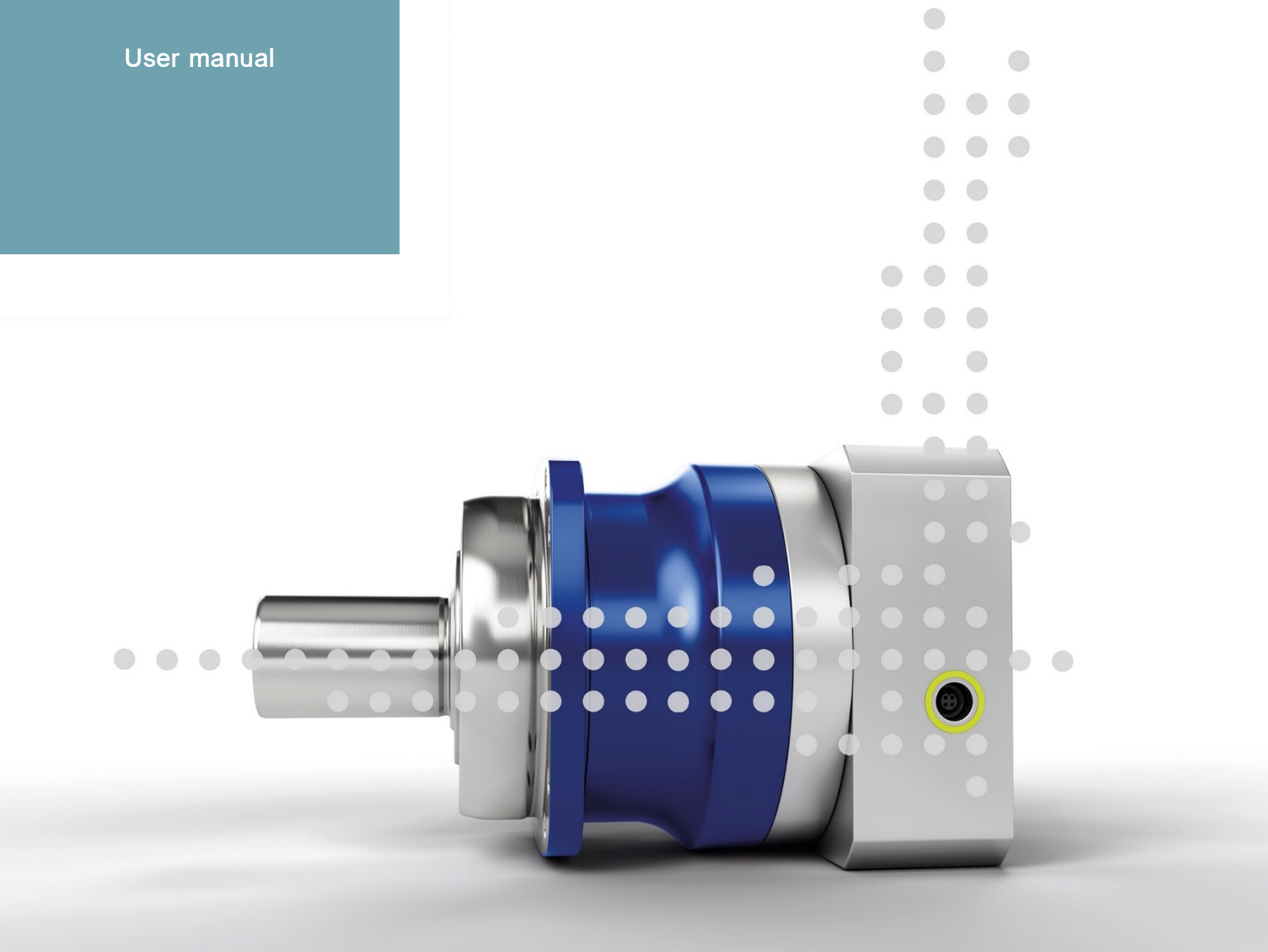
WITTENSTEIN

Smart Service
cynapse® Monitor

User manual



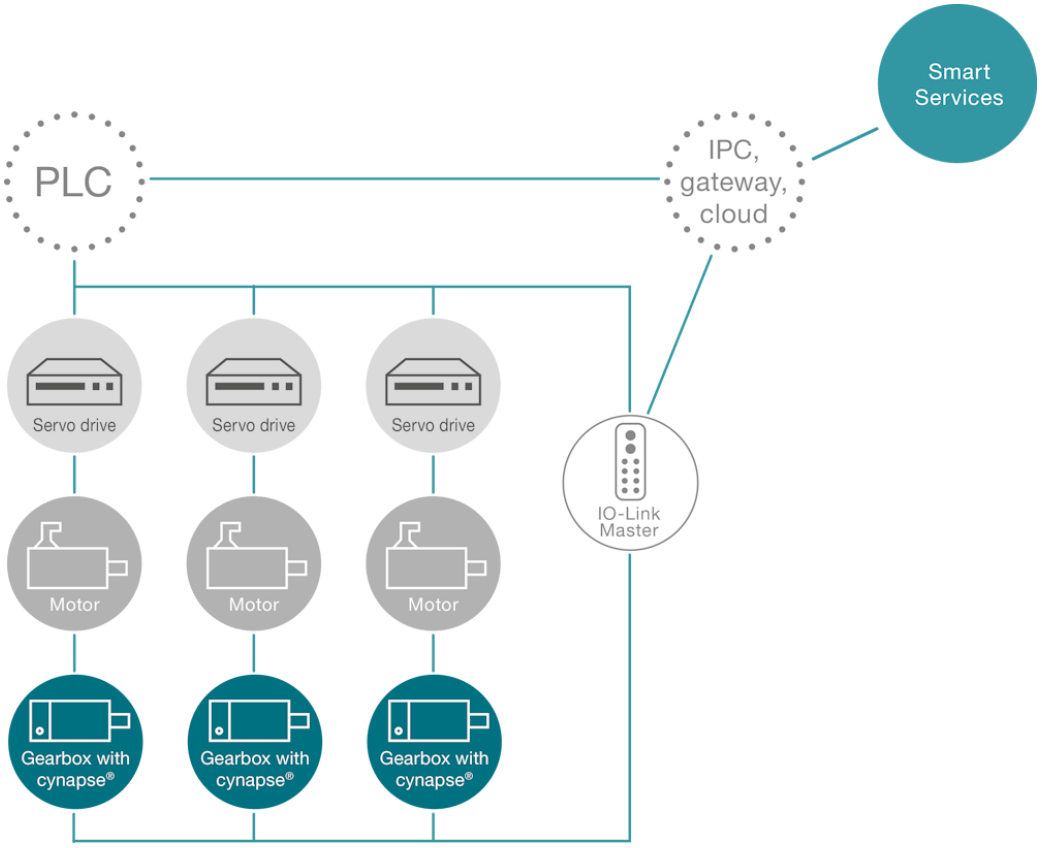
This document describes the features of the Smart Service **cynapse® Monitor** in the version **2.0.2**.

For older versions, please contact cybertronic-support@wittenstein.de

System requirements

The WITTENSTEIN Smart Services are based on the hardware abstraction via the container virtualization and support various daten sources and manufacturers.

We recommend a system setup with an IPC as a Docker host or the use of the Bosch Rexroth ctrlX CORE as well as systems with ctrlX OS in combination with cynapse® sensor cubes as data sources and an IO-Link master as part of the infrastructure.



Using this system as an example, the gearboxes with cynapse® are connected to an IPC/gateway via an IO-Link master in addition to the PLC via a separate network connection. This IPC serves as a Docker host and offers the option of integrating additional machine data from the PLC or sending data to the cloud using WITTENSTEIN's Smart Services.

Data sources

The following sources are supported for communication between WITTENSTEIN Smart Services and the cynapse® Sensor Cube:

- IO-Link master with integrated OPC-UA server according to Companion Specification "OPC-UA for IO-Link"
- ifm IO-Link master (e.g.: AL13xx, AL19xx)
- Pepperl+Fuchs or Comtrol with integrated OPC-UA server (e.g.: IEC2-8IOL or IEC3-8IOL)

Furthermore, OPC-UA servers (e.g.: SIMATIC S7-1500 OPC-UA server) are supported as a data source to integrate machine data.

Host

- IPC for running Smart Services using Docker from version 2.5.0.1.
- Bosch Rexroth ctrlX CORE or systems with ctrlX OS.

The requirements for running WITTENSTEIN Smart Services using Docker are:

- 64-bit kernel and CPU support for virtualization
- KVM virtualization
- QEMU in version 5.2 or later
- systemd init system
- At least 4 GB of RAM

(Source: https://docs.docker.com/desktop/install/linux-install/)

This user manual explains the functionalities and setup instructions of the WITTENSTEIN smart service **cynapse® Monitor**.

Digital Nameplate

1. Digital Nameplate – specific product information

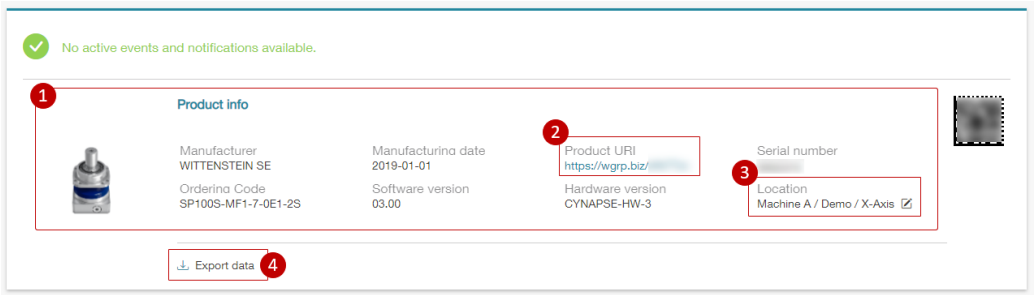
   > ***Note**: With single sensors or gearboxes where the serial number has not been programmed, some of these information can be missing.*

2. Link to the WITTENSTEIN Service Portal which provides much more gearbox specific information.

   > ***Note**: In case of individual sensors, there is no further information provided in the Service Portal*

3. The location tags of the asset can be edited using cynapse® Monitor. Click the *edit* button and the edit dialog, which is described afterwards, will appear.
4. Export of histories and histograms using CSV format in a compressed ZIP archive for archiving and further analysis.

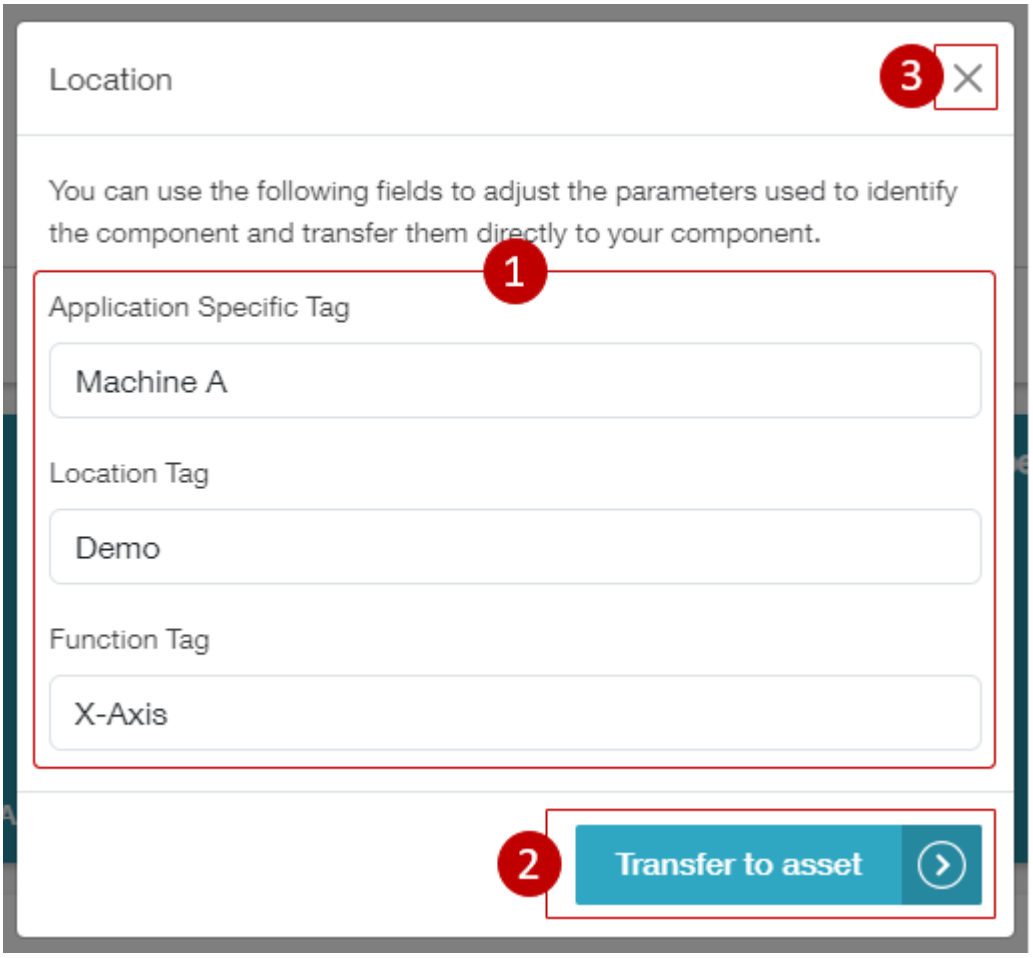
   > ***Note**: This feature is available only when having a **cynapse® Monitor Advanced** license which can be purchased separately.*



Edit asset location

In the Digital Nameplate, you can open the dialog which allows you to edit the asset's location tags.

1. Application specific tag, Location tag, and Function tag can be changed.
2. Save changes to cynapse® Sensor Cube.
3. Discard changes and close the dialog.

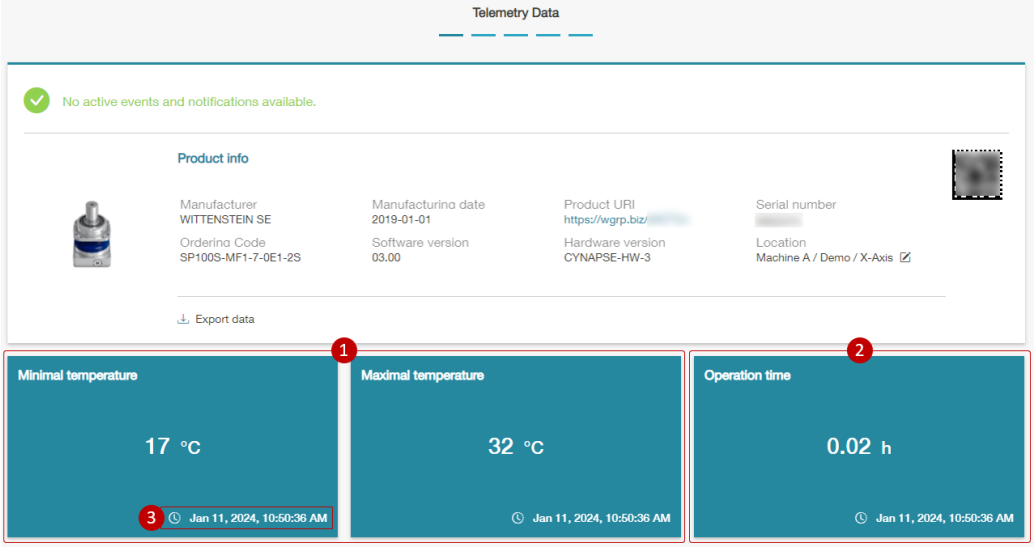

Location
3
You can use the following fields to adjust the parameters used to identify the component and transfer them directly to your component.
1
Application Specific Tag
Machine A
Location Tag
Demo
Function Tag
X-Axis
2
Transfer to asset

Temperature range & Operation time

This area displays information regarding operating temperature and time which is stored in the internal memory of the cynapse® Sensor Cube.

1. Indication of temperature range the gearbox has been operated over lifetime.
2. Indication of the gearbox operation time based on a calculation executed on cynapse® Sensor Cube.
3. Timestamp indicating the time of most recent data request from cynapse® Sensor Cube.

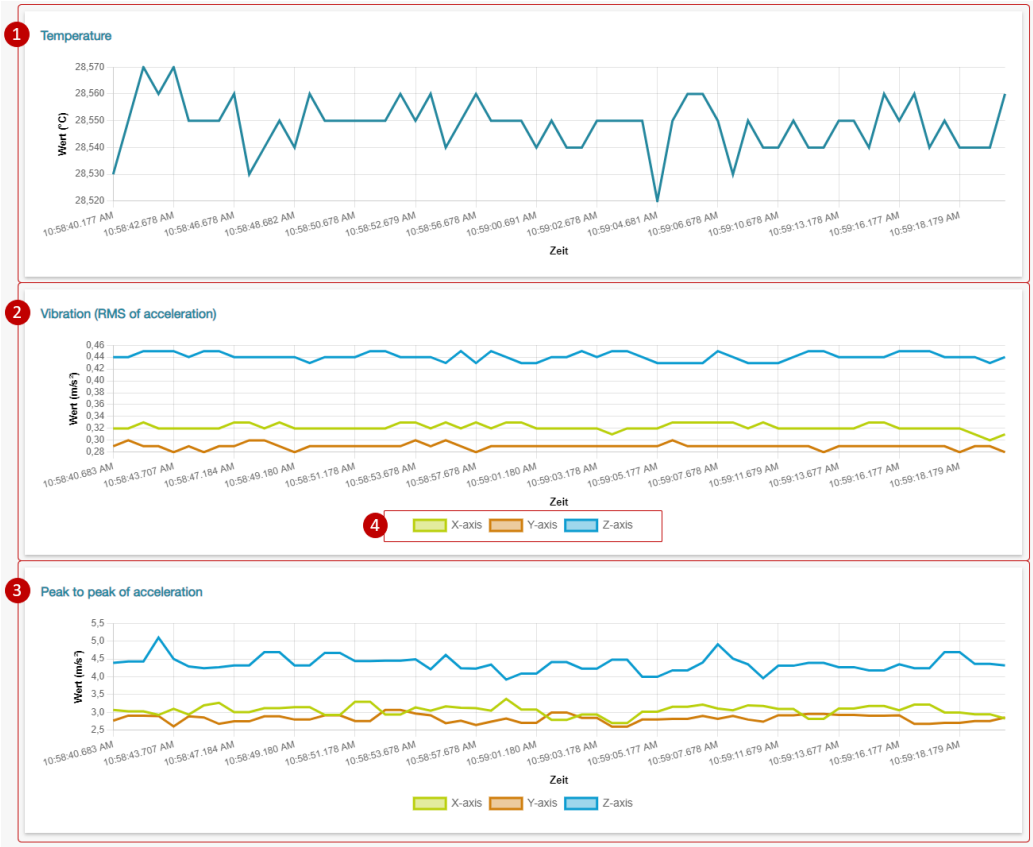
> ***Note**: Data is requested cyclically in fixed time intervals through the software.*



Process data for temperature, acceleration & vibration

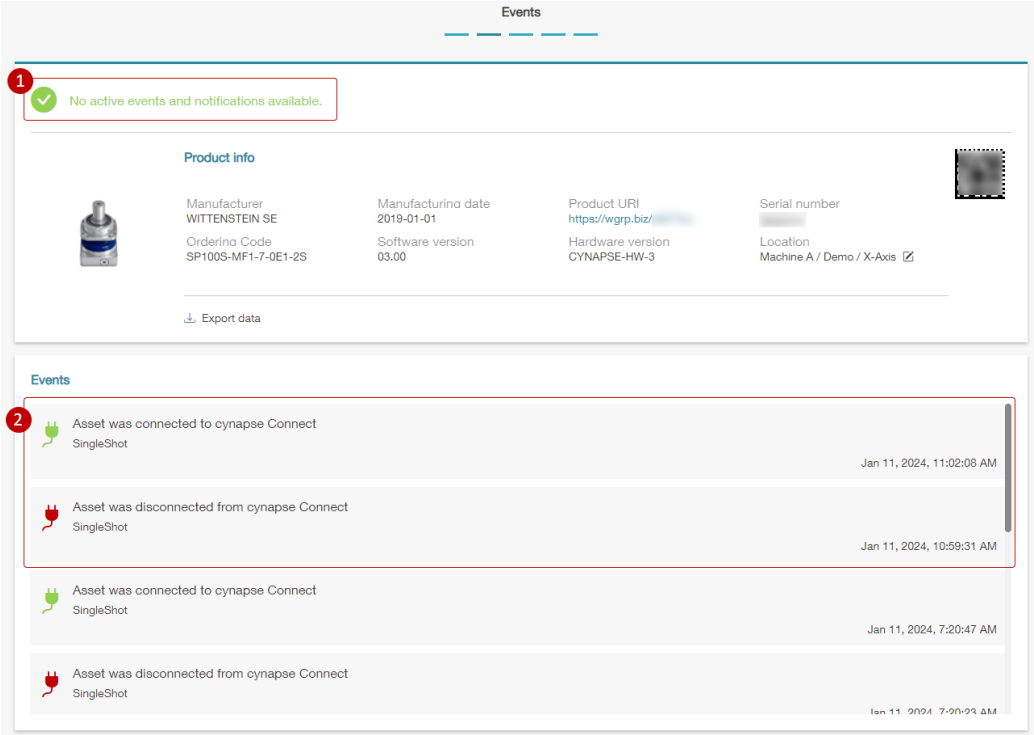
This area visualizes the cynapse® Sensor Cube measurement values in real-time.

1. Indication of current temperature of the gearbox / cynapse® Sensor Cube.
2. Indication of current vibration in the form of the root mean square (Root-Mean-Square).
3. Indication of current acceleration in the form of the peak-to-peak value (Peak-to-Peak).
4. By clicking on the labels in the legend, different axes can be hidden or displayed again.



Events

1. Notifications informing about exceeded thresholds monitored by cynapse® Sensor Cube.
2. List of the events that have occurred. Each entry includes the event classification and associated timestamp. Up to 16 events are shown in the user interface.



Product- & application-specific thresholds

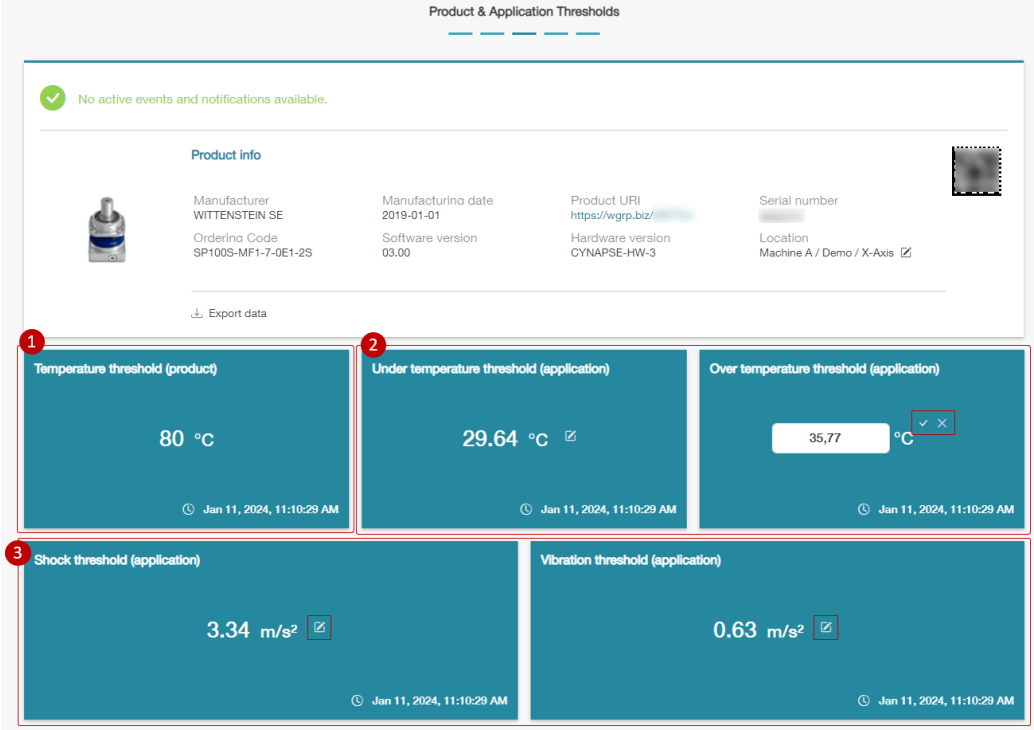
This area allows viewing and changing the thresholds set on the cynapse® Sensor Cube based on which it triggers the above-mentioned events.

1. The **product-specific temperature threshold** is used to monitor the maximum gearbox temperature in order to prevent a thermal overload.

   > ***Note**: Threshold is set by default at 80°C by WITTENSTEIN.*

2. The **application-specific thresholds** can be specified individually and are used to identify deviations from the expected application process.

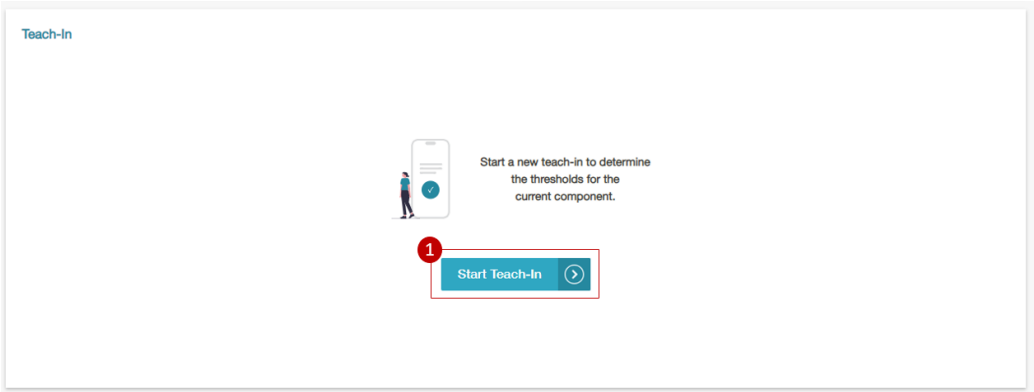
   > ***Note**: Thresholds can be set and changed via the "Edit" button, the teach-in feature or by a PLC Integration.*



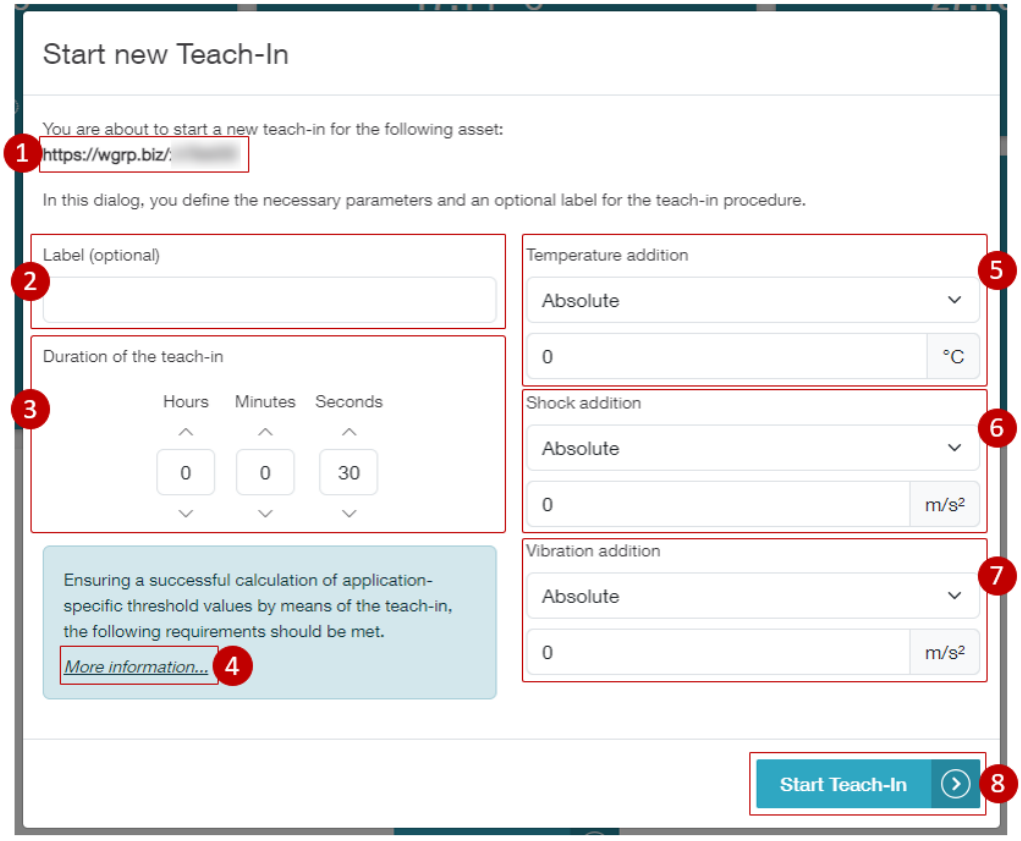
Automated Teach-In

The *Teach-In* feature allows you to automatically set thresholds for your asset or your cynapse® Sensor Cube based on the incoming process data.

> ***Note**: This feature is available only when having a **cynapse® Monitor Advanced** license which can be purchased separately.*



1. When you click the *Start Teach-In* button, the following dialog will open. Inside the dialog you will have to enter the teach-in parameters as well as duration and then confirm your settings.



1. First, the dialog will show the selected asset ID for which the teach-in will be started.
2. You can optionally define a label in order to later identify the teach-in.

   > ***Note**: The label must be unique among all teach-ins of all assets.*

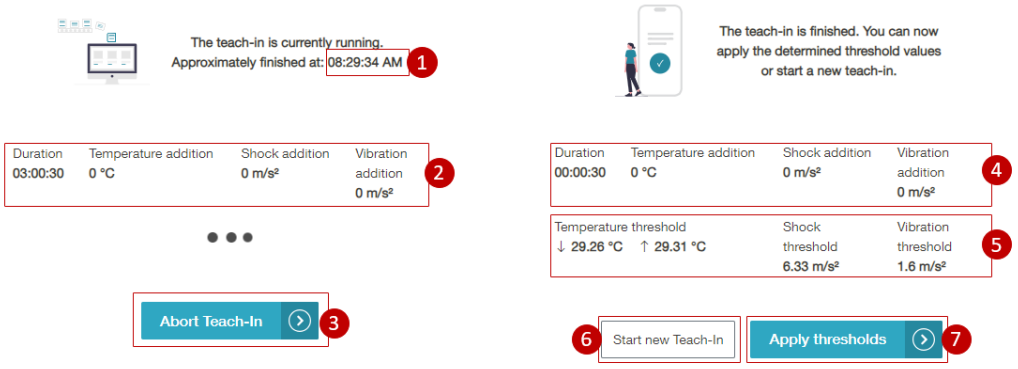
3. Define the duration of the teach-in. Must be at least 30 seconds.

4. Click on *More information* to read further notes on how to optimally set the duration (3) and the additions (5-7).
5. Set the addition for the temperature threshold.
6. Set the addition for the shock threshold.
7. Set the addition for the vibration threshold.
8. Start the teach-in with the configured parameters and duration.

Considering the additions, you have the following options:

- **Absolute**: After the teach-in procedure, a user-defined absolute value is added to the threshold (subtracted in case of lower temperature threshold). For example: `65°C` with an absolute addition of `5°C` would result in `70°C`.
- **Percent**: After the teach-in procedure, a user-defined percentage of the threshold is added to the threshold (subtracted in case of lower temperature threshold). For example: `6m/s²` with a percent addition of `25%` would result in `7,5m/s²`.
- **Automatic**: Addition based on empirical values that are suitable for the respective threshold values. Only available for shock and vibration thresholds.

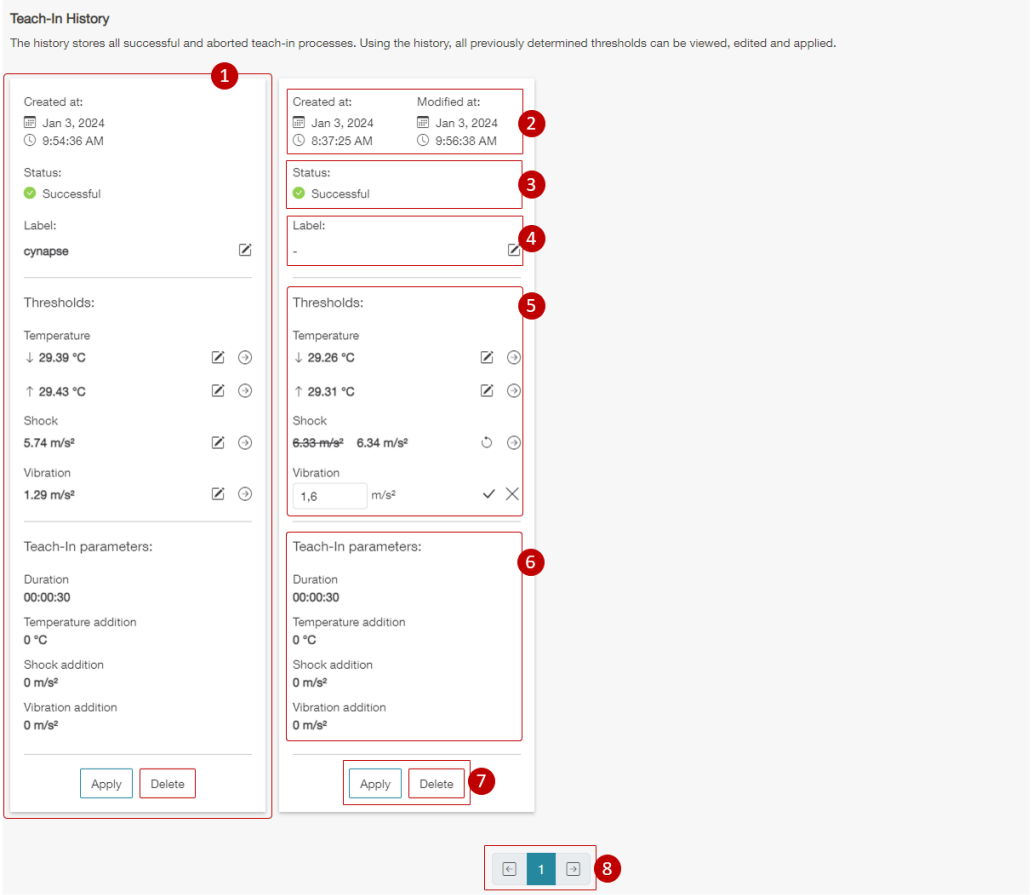
After starting a teach-in, the teach-in tile will change to the following image (left). After the teach-in is finished, the appearance will change to the right-side view.



1. The time when the teach-in will approximately be finished.
2. The duration and the parameters of the current teach-in.
3. Using the *Abort Teach-in* button, you can stop the teach-in while it is still running. The detected threshold values will still be saved.
4. The duration and parameters of the finished teach-in.
5. The resulting threshold values. The specified values already include the corresponding additions.
6. Start a new teach-in with the same or with different parameters.
7. Apply the detected threshold values to your asset or cynapse® Sensor Cube.

> ***Note**: The current threshold values will be overwritten.*

Below the teach-in tile you will see the teach-in history:



1. Every previous teach-in is displayed as a separate tile.
2. The timestamp, when the teach-in was finished. If it has been modified manually, the timestamp of the last modification is also shown.
3. Whether the teach-in was finished or aborted by the user.
4. The label which was defined when the teach-in was started. Using the *edit* button, the label can be changed.

   > ***Note**: The label must be unique among all teach-ins of all assets.*

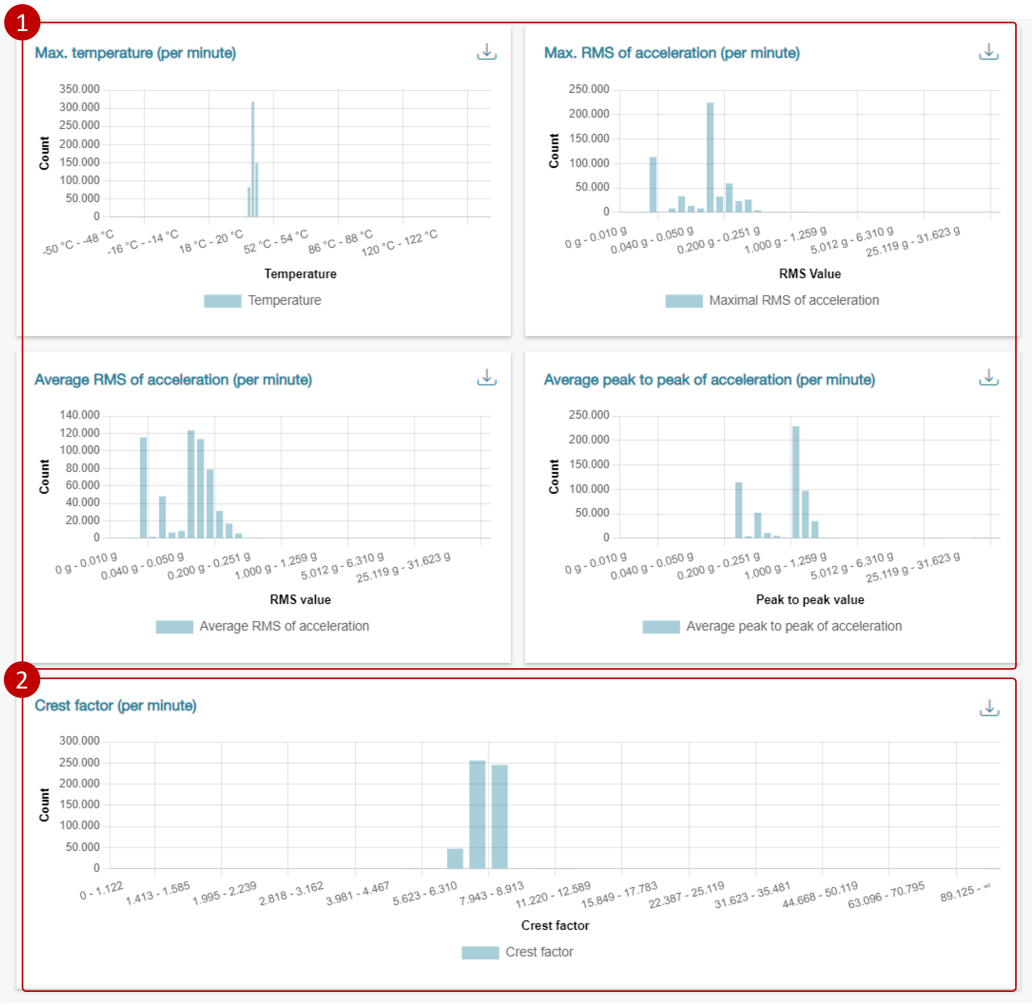
5. The detected threshold values of the teach-in. All threshold values can be edited using the *edit* button and transmitted to your asset or cynapse® Sensor Cube using the *arrow* button. In this image, the following examples are shown:
   - The temperature thresholds have not been modified.
   - The shock threshold was previously modified. The original value is shown as strikethrough text and the modified value is shown next to it. Using the *reset* button, the original value can be restored.
   - The vibration threshold is currently being edited. The new value can be inserted into the text field and using the *accept* and *X* buttons, the new value can be saved or reverted.
6. The original teach-in parameters. Please note that, if the teach-in was aborted by the user, the duration will still display the duration that was configured when starting the teach-in.
7. Apply all threshold values to your asset or your cynapse® Sensor Cube or delete this history entry.
8. If there are more than four teach-ins in your history, you can toggle through the available pages.

> ***Note**: The current threshold values will be overwritten when applying threshold values from the history.*

Data Logger – Histograms

cynapse® Sensor Cube has an internal memory that can store data during up to 40,000 operation hours. Data is stored in different formats (histograms and histories).

1. Selected sensor data is stored in the form of histograms which indicate the distribution of all recorded data points. Each minute, one data point is stored (maximum or average).
2. The Crest factor is a special value in the context of vibration analysis and is calculated by the ratio of peak-to-peak to RMS. This calculation is executed on cynapse® Sensor Cube and its result is stored in the form of a histogram.



Besides visualization, cynapse® Monitor supports the export of individual histograms. Each histogram has an export button which can be used to initiate the export. When pressed, a CSV file contaning the histogram labels and data is generated and downloaded to your computer.

> ***Note**: This feature is available only when having a **cynapse® Monitor Advanced** license which can be purchased separately.*

> ***Note**: The combined export of all histograms and histories is provided via the export button found on the digital nameplate tile.*


Max. temperature (per minute)
300.000
250.000
200.000
150.000
100.000
50.000
0
Count
-50 °C - -48 °C
-16 °C - -14 °C
18 °C - 20 °C
52 °C - 54 °C
86 °C - 88 °C
120 °C - 122 °C
Temperature
Temperature
1
Export data
Export all data points
Max. RMS of acceleration (per minute)
160.000
140.000
120.000
100.000
80.000
60.000
40.000
20.000
0
Count
0 g - 0.010 g
0.040 g - 0.050 g
0.200 g - 0.251 g
1.000 g - 1.259 g
5.012 g - 6.310 g
25.119 g - 31.623 g
RMS Value
Maximal RMS of acceleration
Average RMS of acceleration (per minute)
250.000
200.000
150.000
100.000
50.000
0
Count
0 g - 0.010 g
0.040 g - 0.050 g
0.200 g - 0.251 g
1.000 g - 1.259 g
5.012 g - 6.310 g
25.119 g - 31.623 g
RMS value
Average RMS of acceleration
Average peak to peak of acceleration (per minute)
300.000
250.000
200.000
150.000
100.000
50.000
0
Count
0 g - 0.010 g
0.040 g - 0.050 g
0.200 g - 0.251 g
1.000 g - 1.259 g
5.012 g - 6.310 g
25.119 g - 31.623 g
Peak to peak value
Average peak to peak of acceleration

Data Logger – Histories

Because histograms do not preserve any temporal context, a small set of values are stored in the memory of cynapse® Sensor Cube in the form of histories (time series).

1. Trend of the maximum recorded temperature in time steps with a duration of 15 minutes.
2. Trend of the maximum recorded acceleration (raw values) in time steps with a duration of 15 minutes.

   > ***Note**: This history refers to the acceleration raw data.*

3. The x-axis shows relative timestamps since there is no real time clock available on cynapse® Sensor Cube. Each data point represents a 15-minute-long interval.

After each such interval, the single maximum temperature or acceleration value, which occured during that interval, is stored.

Additionally, cynapse® Monitor provides the ability to export histories and to only view a select time range.

> ***Note**: This feature is available only when having a **cynapse® Monitor Advanced** license which can be purchased separately.*

1. Select the desired scope for the export.

   > ***Note**: Select the desired export time range using the slider.*

   > ***Note**: The combined export of **all** histories and histograms is provided via the export button found on the digital nameplate tile.*

2. The slider can be used to select the displayed subset of data points in the histogram. By default, the latest 500 data points are shown.

   > ***Note**: The shown time range is selected for each history individually.*

3. Reset the slider and show only recent data by clicking the arrow icon.