USER MANUAL

OMEGA

Online Monitoring Expert Guard Application

Updated – 29 October 2024

Content

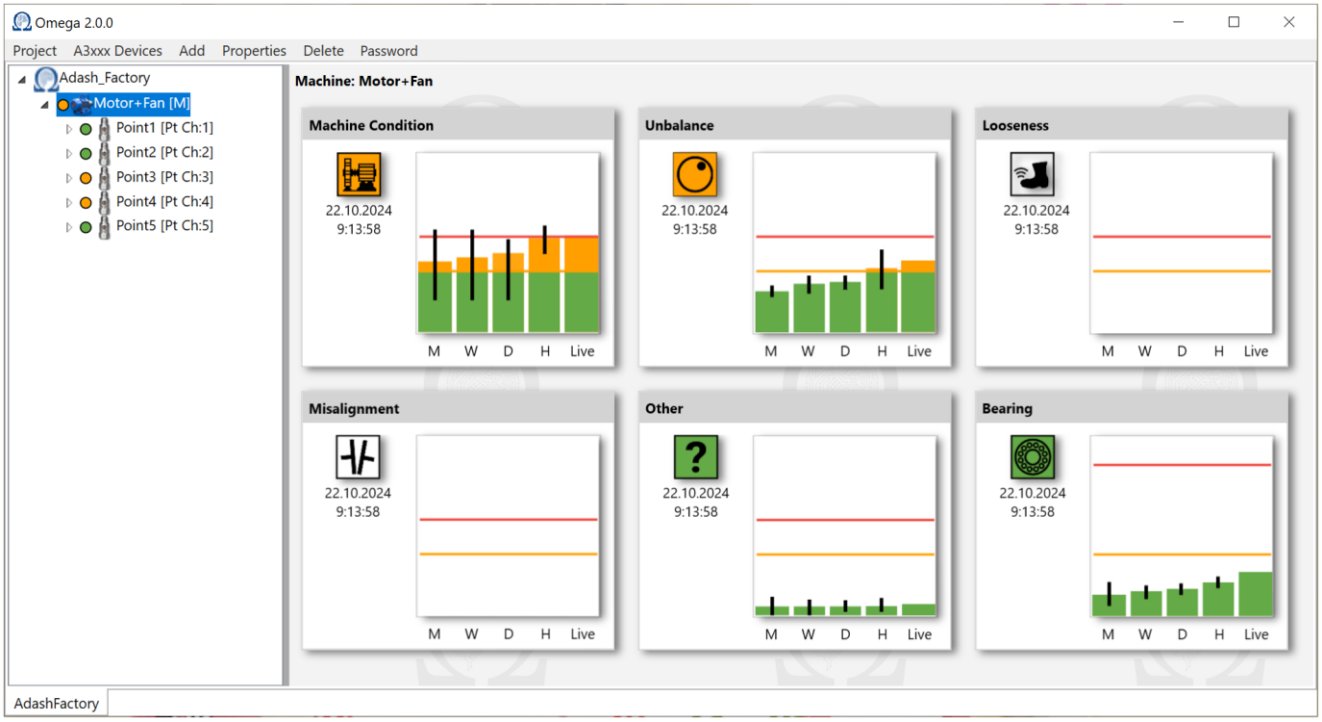
Introduction

OMEGA is created especially for factory control rooms where people monitor machinery pressures, temperatures and other process parameters. Along with these parameters you can display info about mechanical condition of your machines.

More and more factories are turning to online condition monitoring system due to lack of vibrations analysts or experienced people in this field.

At the beginning of Omega developing, we were inspired by our successful FASIT expert system. But we did not copy its algorithm. We started from the scratch and created much more sophisticated OMEGA system.

OMEGA displays machinery faults severities and makes predictive maintenance accessible to everyone with no expertise required.
Omega has a simple interface with tree of your machines with meas. points and you can see real-time machine condition + historical data. You can see machine faults like unbalance, mechanical looseness, misalignment, bearing and other factors which can cause issues to the machines.



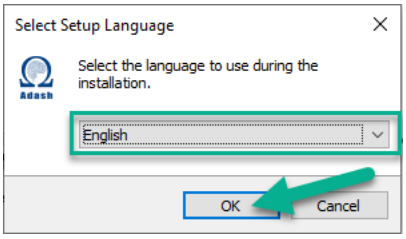
OMEGA engine itself exposes fault severity data (machine condition, unbalance, etc.) on OPC server. These values are of course displayed in Omega software.
There is also the opportunity to read the data from OPC and display them by third party software if you already have one.

Application installation

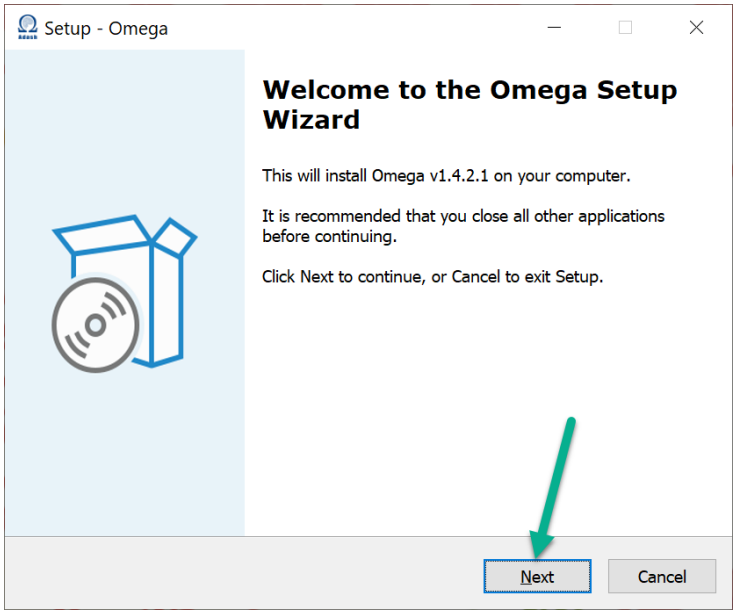
Application is installed with file **Omega_v1.0.0.0.exe** (name will differ with new versions of the application). Installation file can be downloaded from www.adash.com.

Note! Please keep in mind that **before installation** itself you need to upgrade the firmware of your online unit to **version 2.83.9 or higher.** The latest firmware is also available on Adash website: www.adash.com.

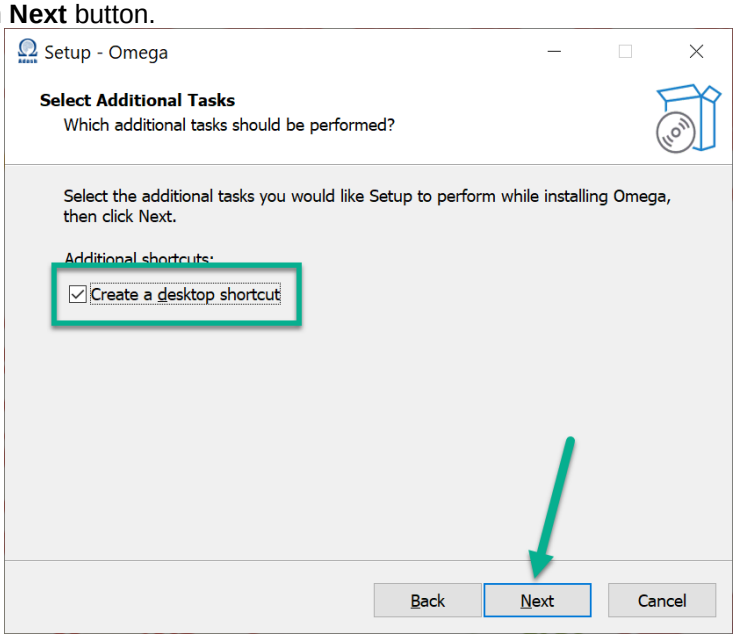
To proceed with the installation please see following steps. Select the setup **language**. Confirm it with '**OK**' button.



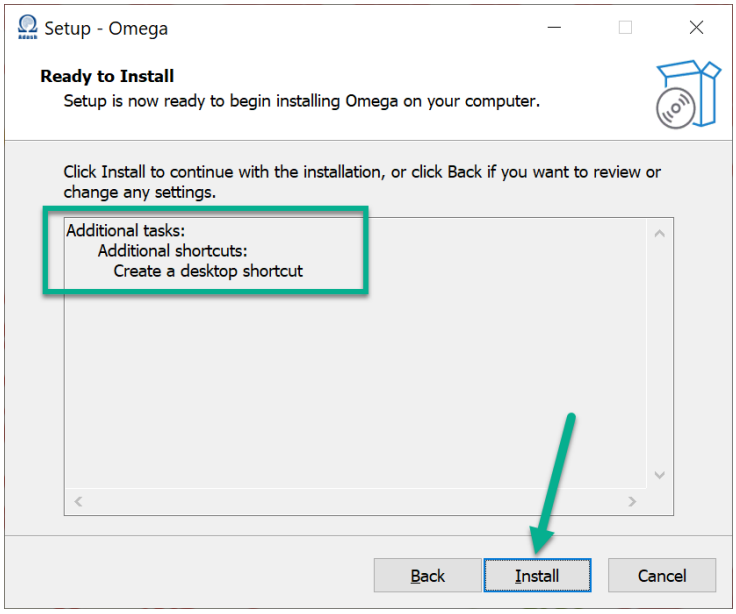
Next window is '**Setup**' window. Click through it and read the information included.



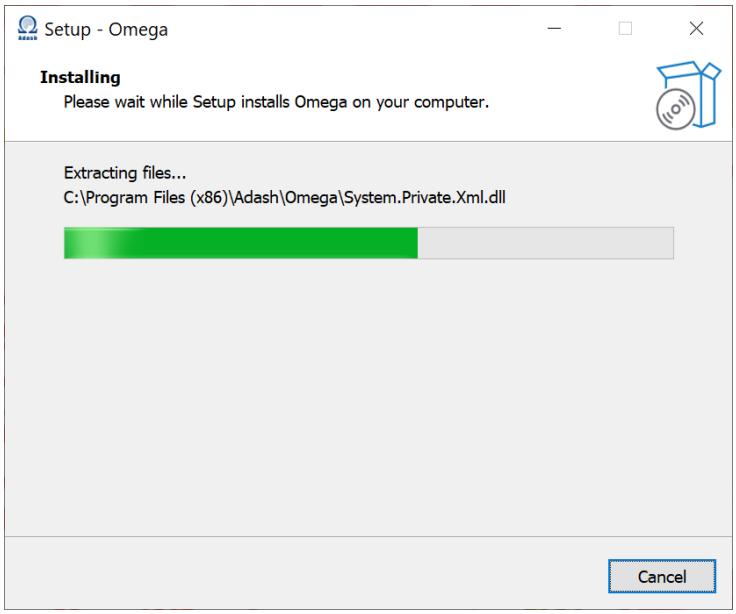
You can create Omega desktop shortcut if you want to. Otherwise, unmark the checkbox and the shortcut will not be created. Proceed with **Next** button.



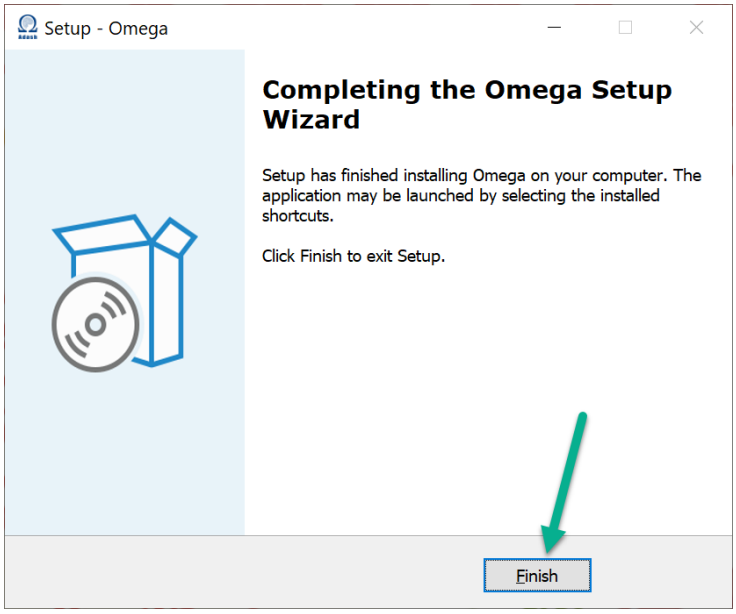
You can see the summary of your choices in the next window. Press '**Install**' button.



Now the installation starts.



It is done! Click on '**Finish**' button to complete the installation.



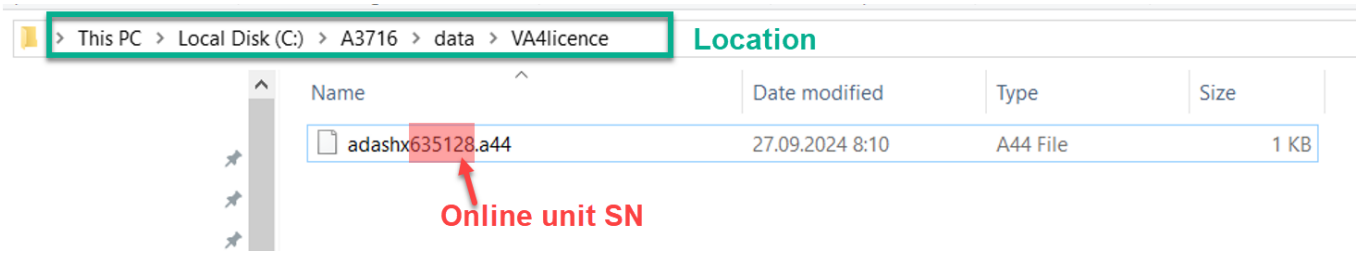
You have Omega installed in your computer now.

Licenses

You need a license file to make Omega work. The license itself is not related to any dongle key (as it is in case of DDS software).

You only need the license file from Adash to make Omega work properly. All you need to do is to send us the serial number of your online unit. The license file will be sent to you.

The license file needs to be saved directly to online unit. This file is named e.g. **adashx635128.a44** (**635128** is online unit serial number.).
It is important to save this license file to online unit folder in following location: **c:\A3716\data\VA4licence**.



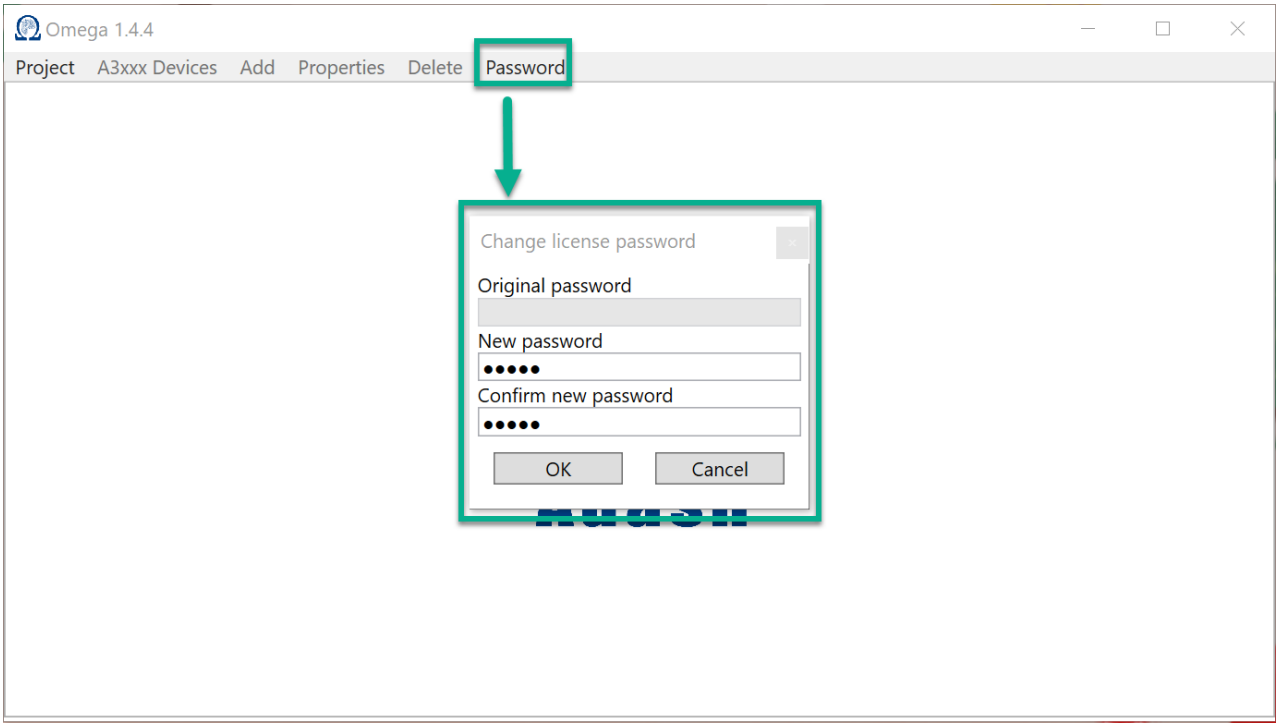
Password and Login

Open Omega software. By default, there is no password set. You can use all functions of Omega software.

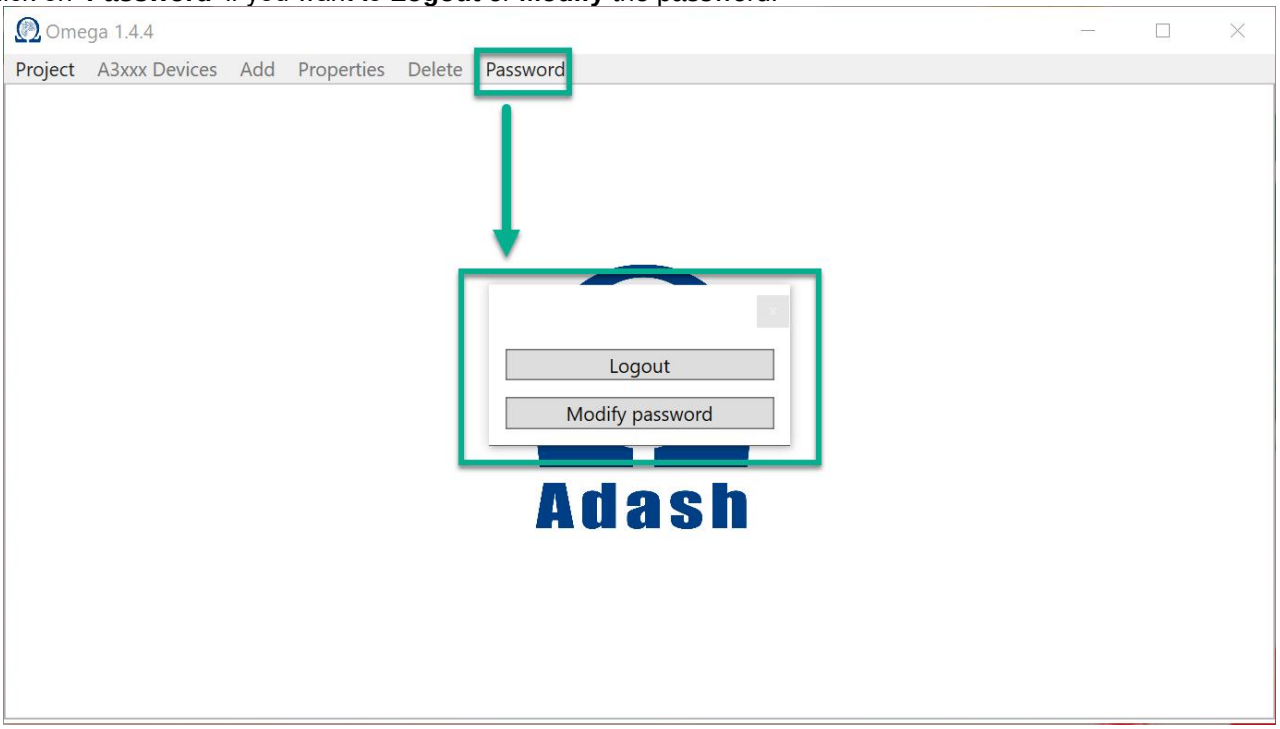
But it is possible to create password for Omega. If the **password is created**, you always need to login to create or modify the projects. Otherwise, you can only open the project with Omega graphs.

Password creation

Click on **'Password'** to create Omega password. New window appears. Enter new password and confirm. You are automatically logged in when the password is created.



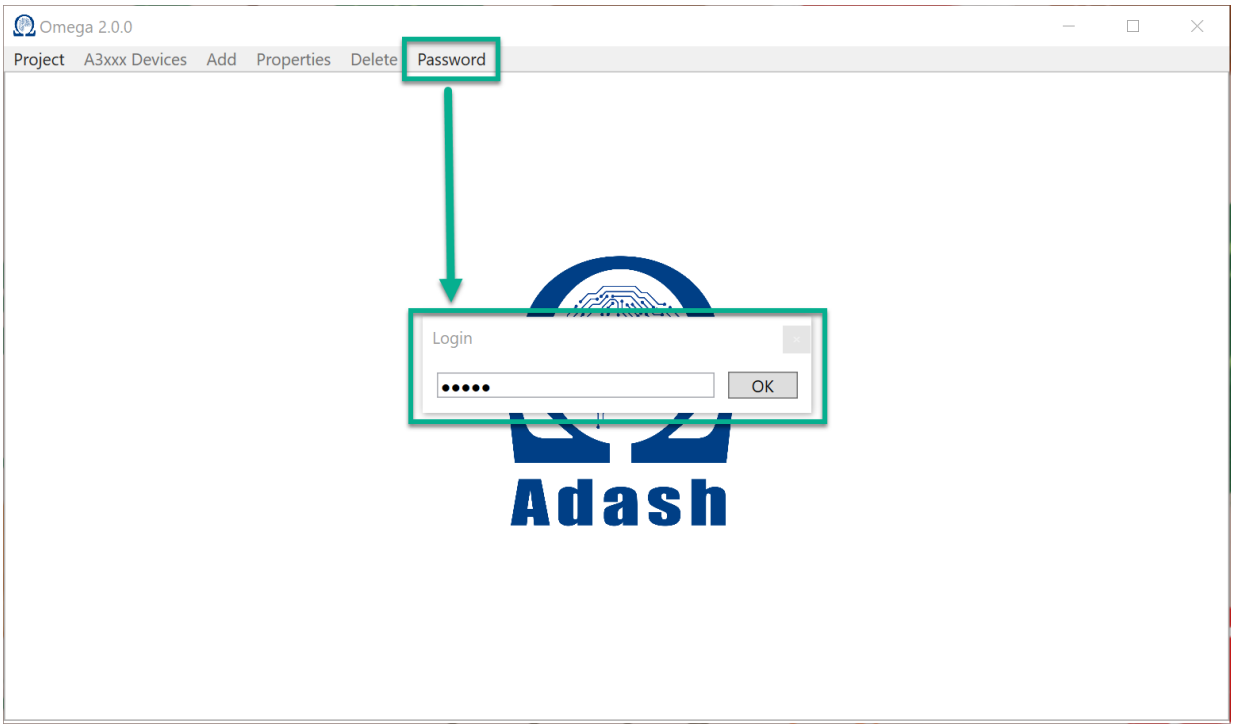
Click on '**Password**' if you want to **Logout** or **Modify** the password.



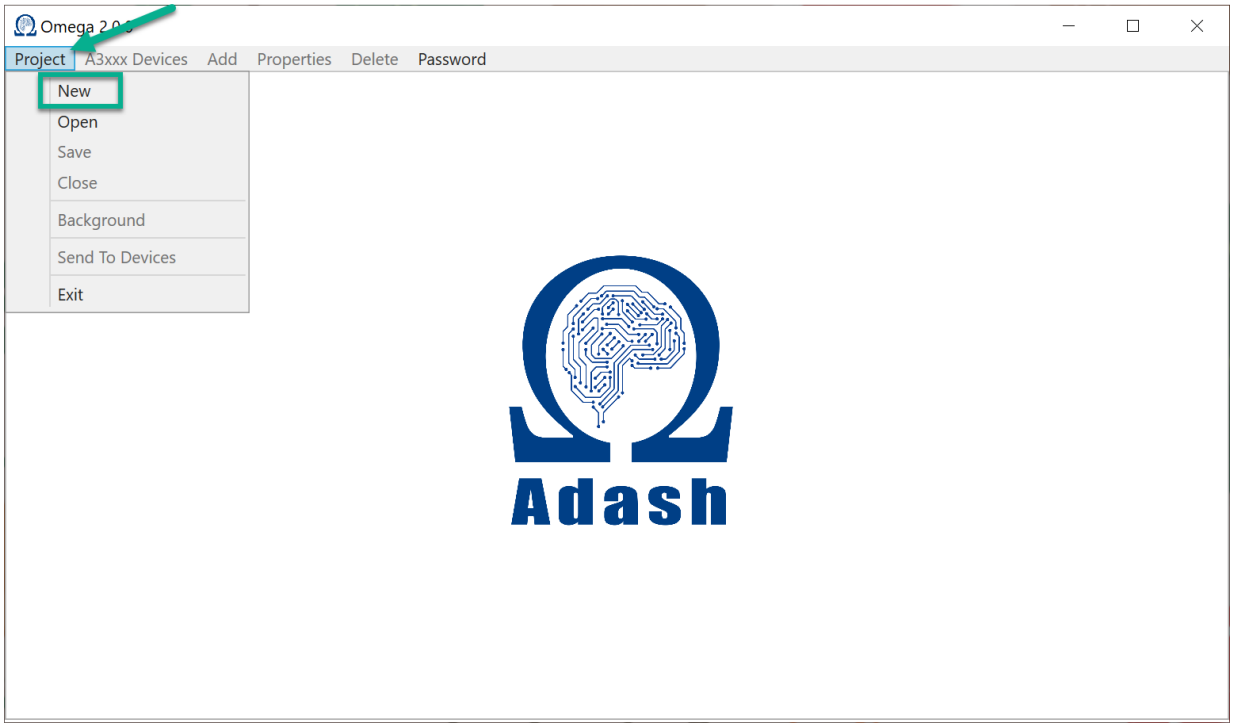
New project creation

If you set the password for Omega, you need to login as below to create new project. Click on '**Password**' menu item. Login window appears.

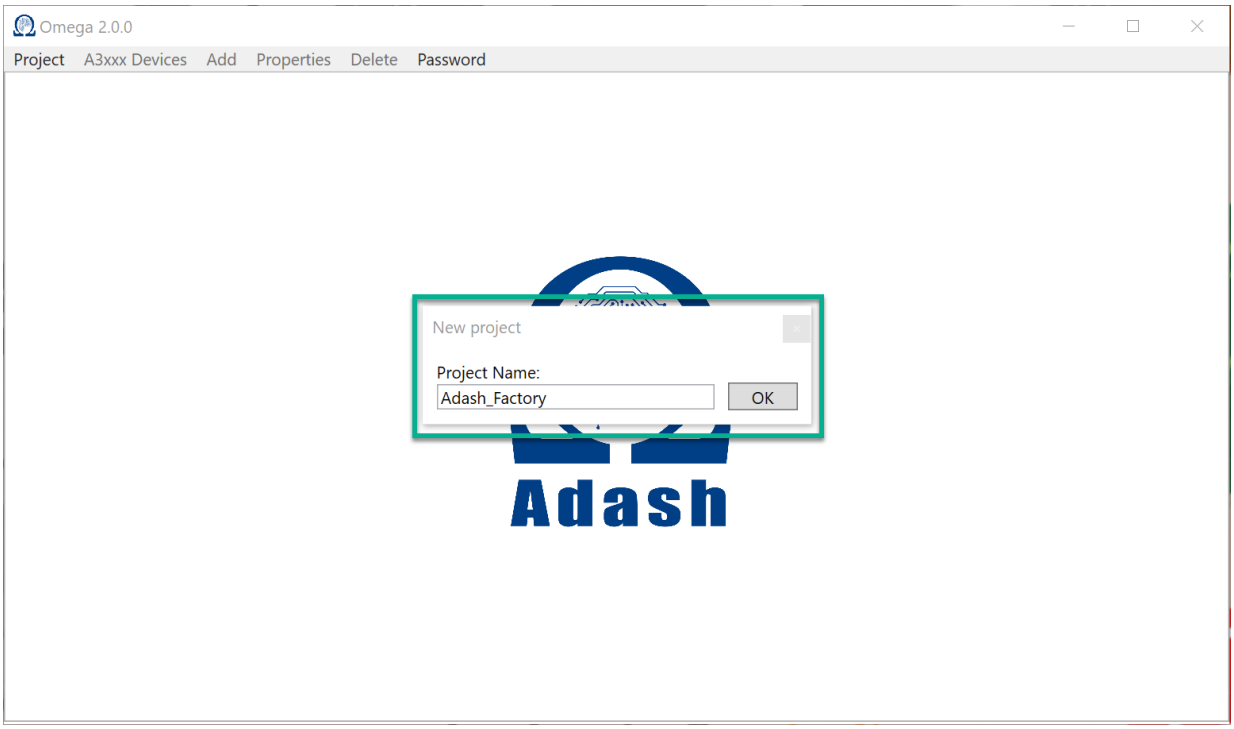
Note! If no password was set for Omega, just skip this step.



Click on '**Project**' and select '**New**'.



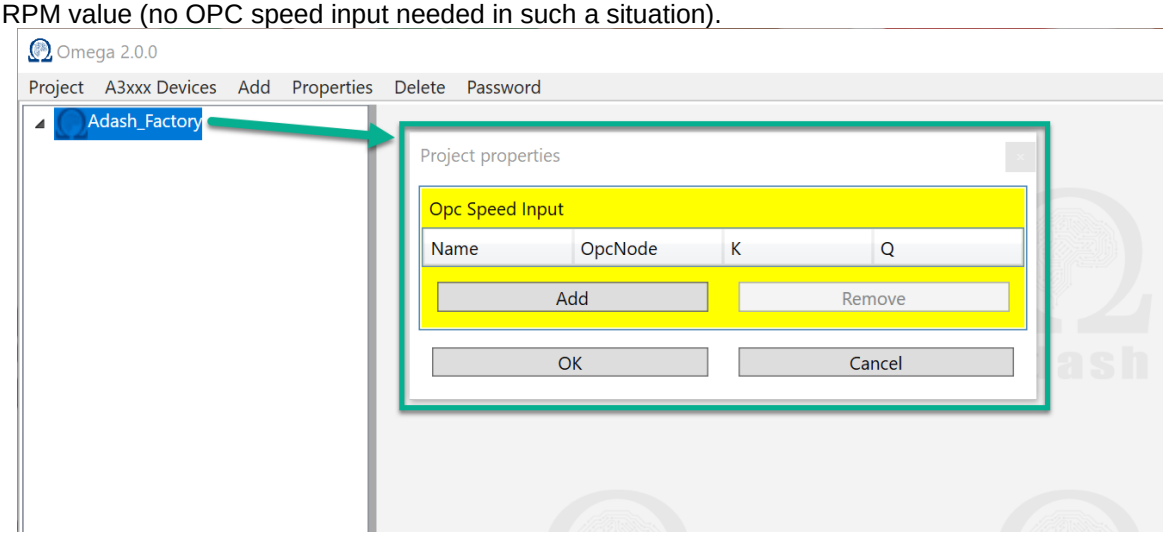
Enter the name and press **OK**.



New project is created.

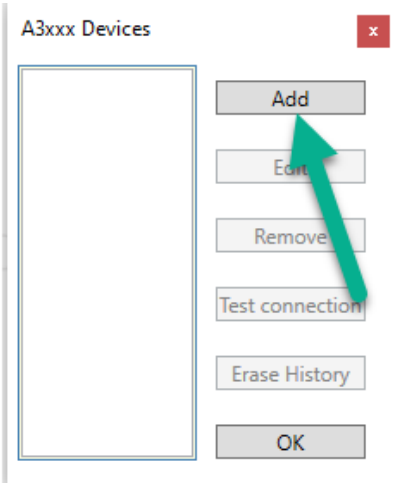
Project properties

Once the project is created you can set its properties. Click on Project name with right mouse button. You get window to set OPC speed input. For more information about OPC speed input see chapter **Appendix A – OPC speed input**. It is not mandatory to set OPC speed input for each project. Speed can be taken from tacho input or set RPM value (no OPC speed input needed in such a situation).

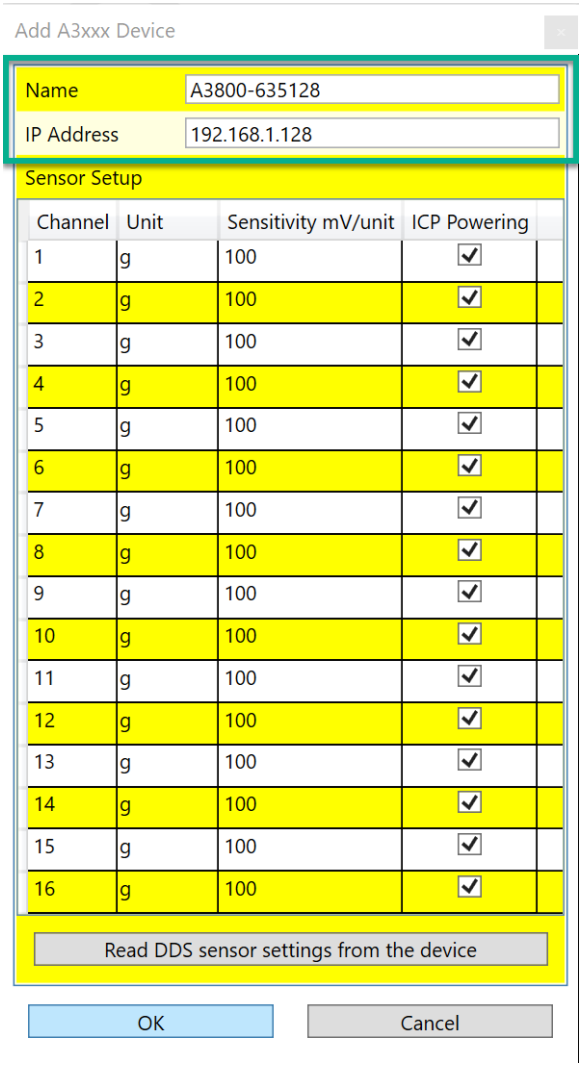


A3xxx devices

This menu item is used for working with online units. You need to add online units (A3716 and A3800) here. Then you can read data from them. Just click on '**A3xxx Devices**' and you can see the following window.

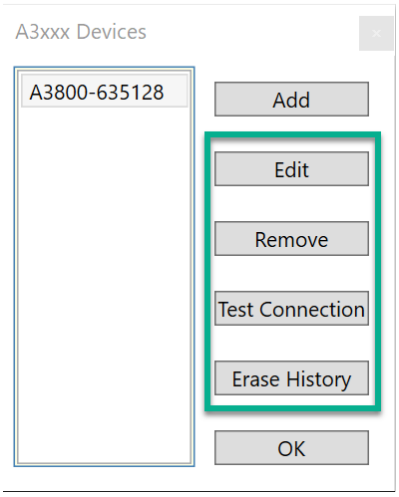


Press '**Add**' button. Enter units name and its IP address. You can set used sensors here. Press '**OK**' button.



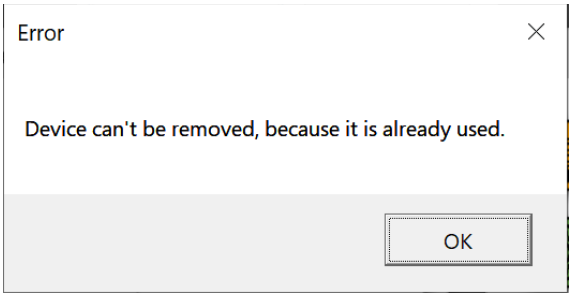
Note! You can also use the sensor settings from DDS – '**Read DDS sensor settings from the device**'. This is described later in **Sensors** chapter.

The unit appears in the list. Select online unit from this list (click on it). All buttons are ready to use now. It means that buttons Edit, Remove, Test connection and Erase History are available.

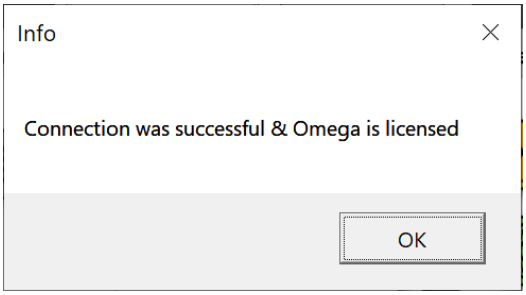


Edit – You can edit parameters of online unit – name, IP address, sensors.

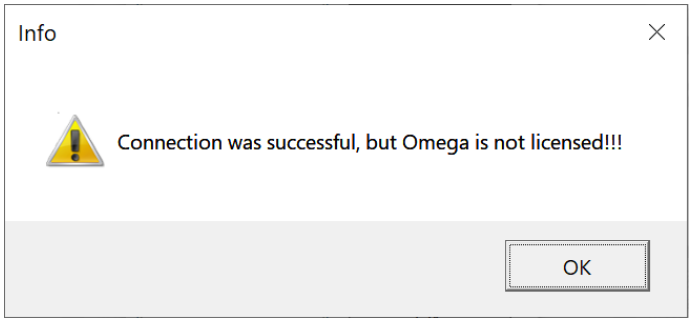
Remove – Removes the online unit from the list. If online unit is used in some measurement point, you get the error message with this information.



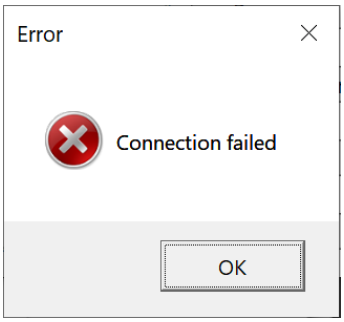
Test connection – Connection test between Omega and online unit. Click on 'Test connection' button and connection test will be performed. If everything is working fine you get message '**Connection was successful & Omega is licensed.**' (see below).



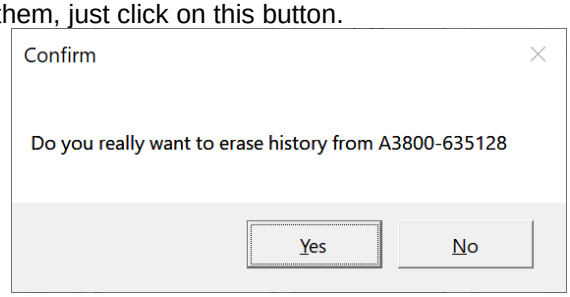
If connection is working well but there is no Omega license, you get '**Connection was successful, but Omega is not licensed!!!**'.



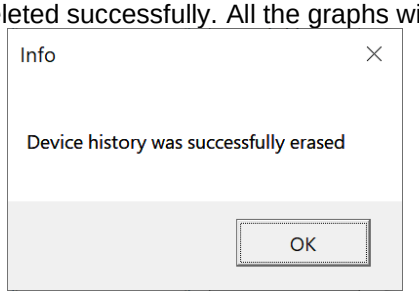
The last result you can get with connection test is '**Connection failed**'. It means that the connection between Omega and online unit is not working.



Erase history – Erases data history from online unit. All data from graphs are saved to history (online units memory). If you want to delete them, just click on this button.

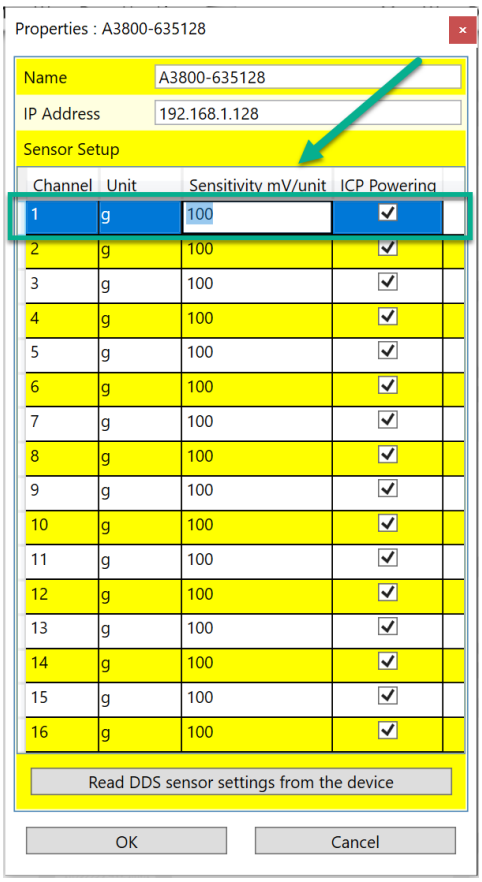


You get the information if data were deleted successfully. All the graphs will be blank when the history is erased.

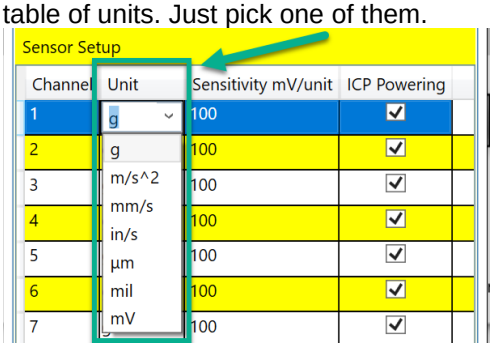


Sensors

Sensor properties are set by default to sensitivity 100 mV/g with ICP on for each channel in Omega. You can change these properties in the moment you add online unit or modify it later. If you want to change the sensitivity, double click on the value and enter the new value according to the used sensor. Mark/unmark the checkbox for ICP Powering.

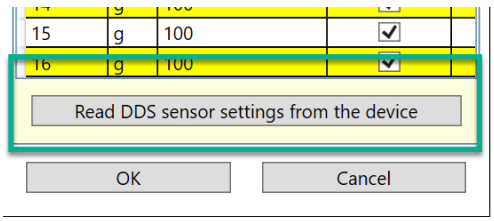


Click on **'g**' unit – you get following table of units. Just pick one of them.



You can also edit the properties **later** (menu item **A3xxx Devices** – select the device – Edit).

There is also the button '**Read DDS sensor settings from the device**'. Basically, it means if you set the sensor properties in DDS then you can copy them to Omega.
It works like this: you set the sensor properties in DDS. Then you started the DDS data collection – in this moment the sensor properties are sent to online unit. To use these sensor properties also in Omega just click on button 'Read DDS sensor settings from the device'. You don't have to set it manually for each channel in Omega.

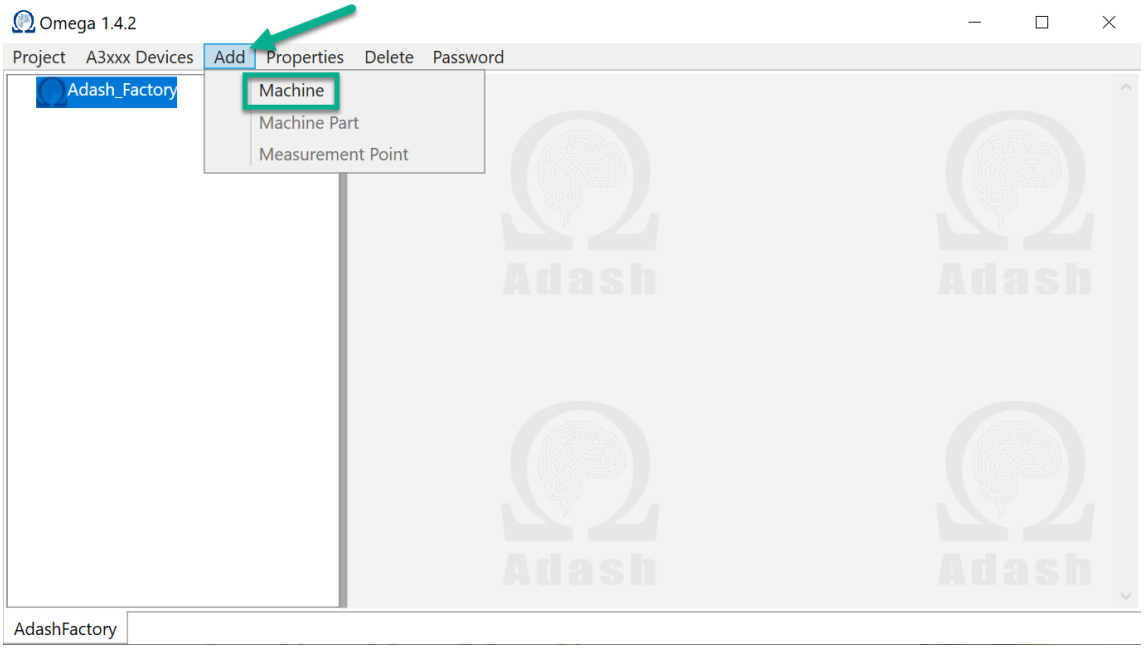


Project structure

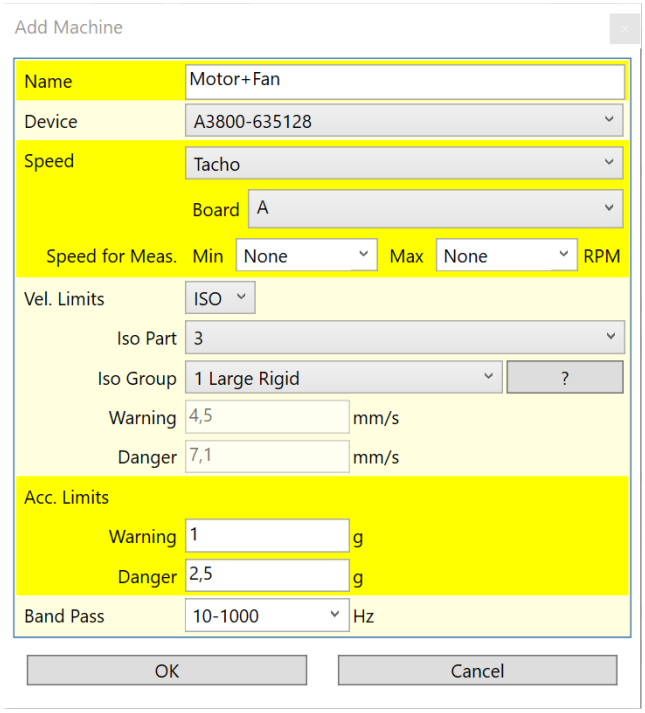
When the project is created (see **New project creation**) you need to create also its structure. It is very similar like tree structure in DDS. You add machines, machine parts and measurement points here.

Machine

Use '**Add**' menu item to add the machine.



Enter the machine name and set its parameters.



Parameters description:

Name The name of your machine.
Device Select online unit from the list.
Speed Set the machine speed settings. You can choose **RPM**, **Tacho, OPC Input**. Each option has more settings included.

- **RPM –** speed defined by rotations per minute. You need to enter RPM value. Use it for machines with stable speed. There is no need to use tacho.

- **Tacho –** speed is measured by tacho probe.

Board: Choose measurement board where tacho probe is connected. Tacho input 1 is for board A (it means for channels 1-4), tacho 2 for board B (channels 5-8), tacho 3 for board C (channels 9-12), etc. For more information about boards and tacho input see manual for online monitoring systems.

- **OPC Input** – You can also read the speed value from OPC server. It means some other software are sending it to OPC in online unit. This option is available only when you define OPC input value in project properties (more information in chapter **Appendix A – OPC speed input**).

Speed for Meas.: You can define the speed interval, in which you want to analyze the vibration. It is excellent solution for machines, which changes speed. It is good to set the speed interval, where the vibrations reach the biggest value. Such high values are much better for analysis then some "noise" values. If speed is out of this interval, then 'Speed out of bounds' information is shown in the graphs.

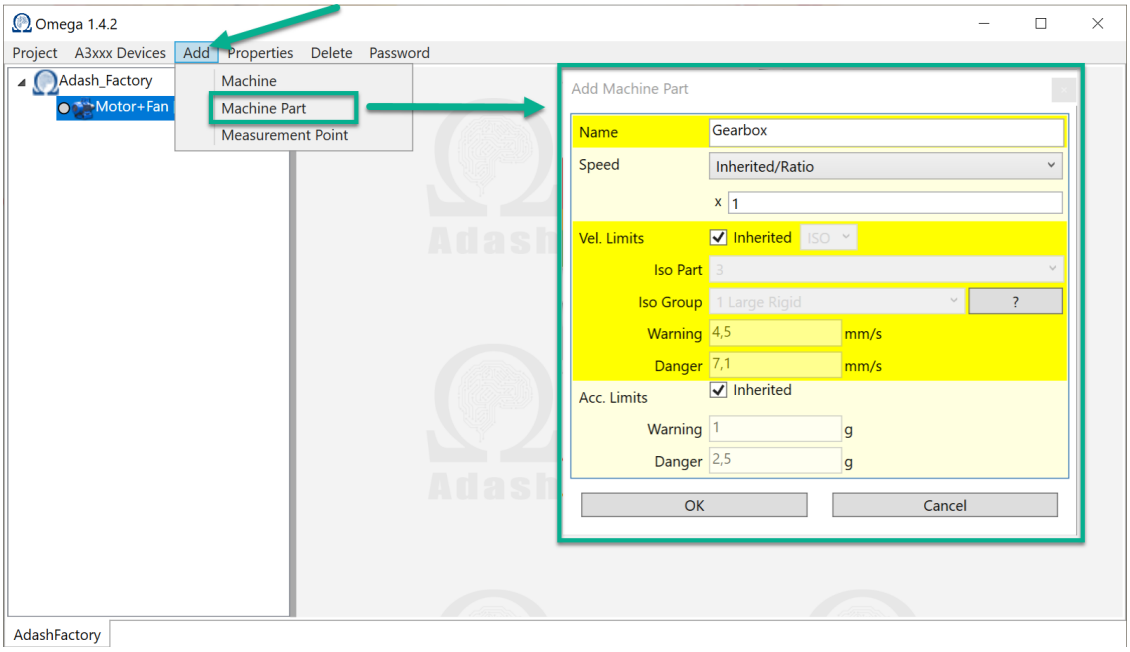
Vel. Limits You can use velocity limits according to ISO 20816-3 or you can set your own user limits. Press button **'?'** for more information about ISO machine groups.

Acc. Limits You can set acceleration limits.

Band Pass Frequency band of interest according to ISO 20816-3 or your experience.

Machine part

You can add particular machine parts (but we think this item will be used just in special cases). Click on '**Add**'. Select '**Machine Part**'.



Parameters description:

Name The name of the machine part.

Speed Speed options are similar to speed settings for machine above (Tacho, RPM, OPC input). But there is one more option: **Inherited/Ratio**. Speed can be inherited from the upper machine level with the ratio. You can define the ratio. It is the multiplicator "X" of inherited value. For example, there is gearbox which change the speed to 20% of input speed. You set the X=0.2.

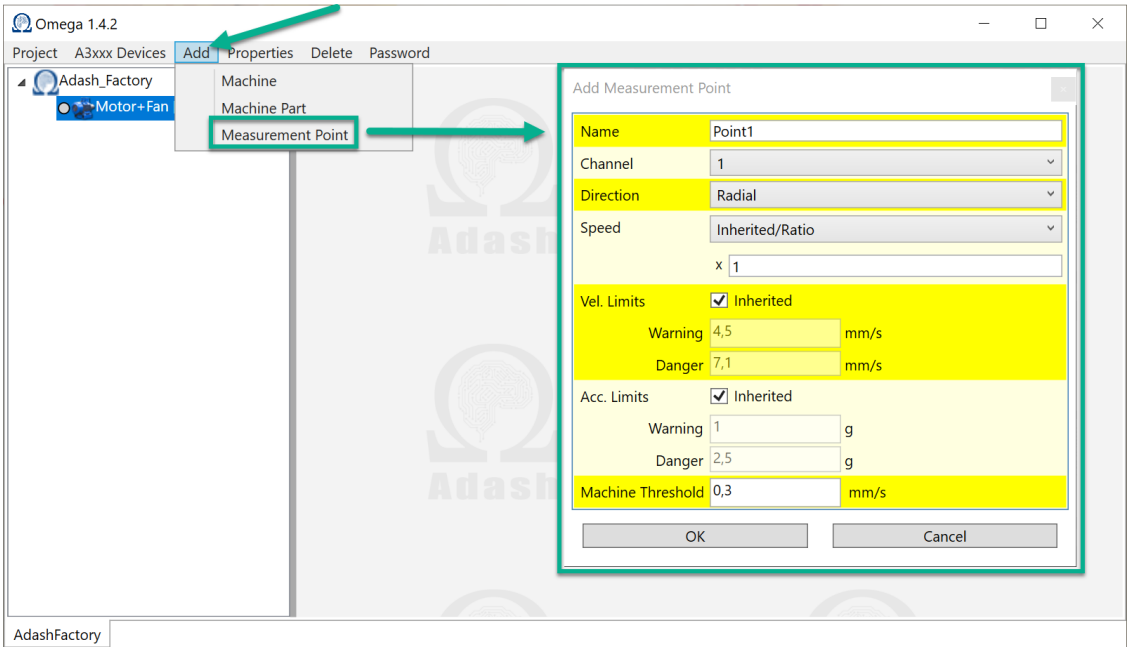
Vel. Limits Velocity limits can be inherited from the machine level or you can set others.

Acc. Limits Acceleration limits can be inherited from the machine level. Or you can define others.

Measurement Point

Click on '**Add**'. Select '**Machine Point**'.

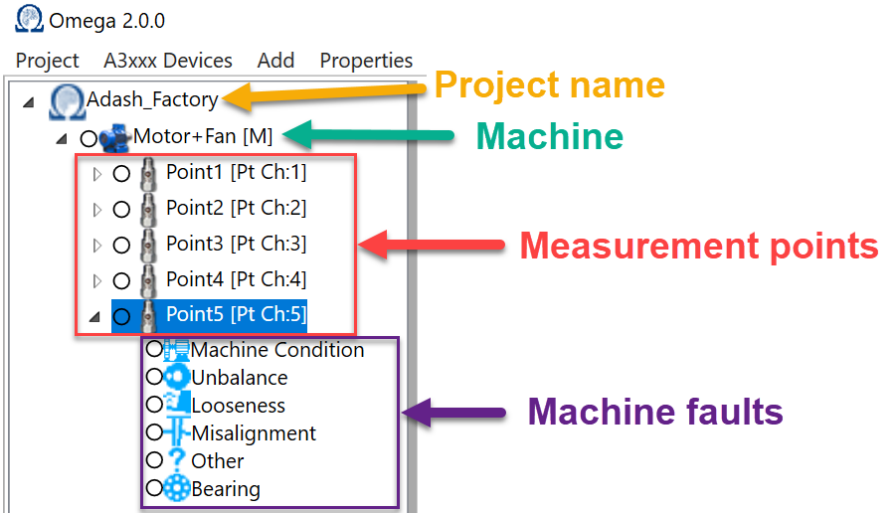
Note! Measurement point can be added directly to the machine. Machine part is not mandatory item in the project structure. It actually depends on you, if you will use it or not.



Parameters description:

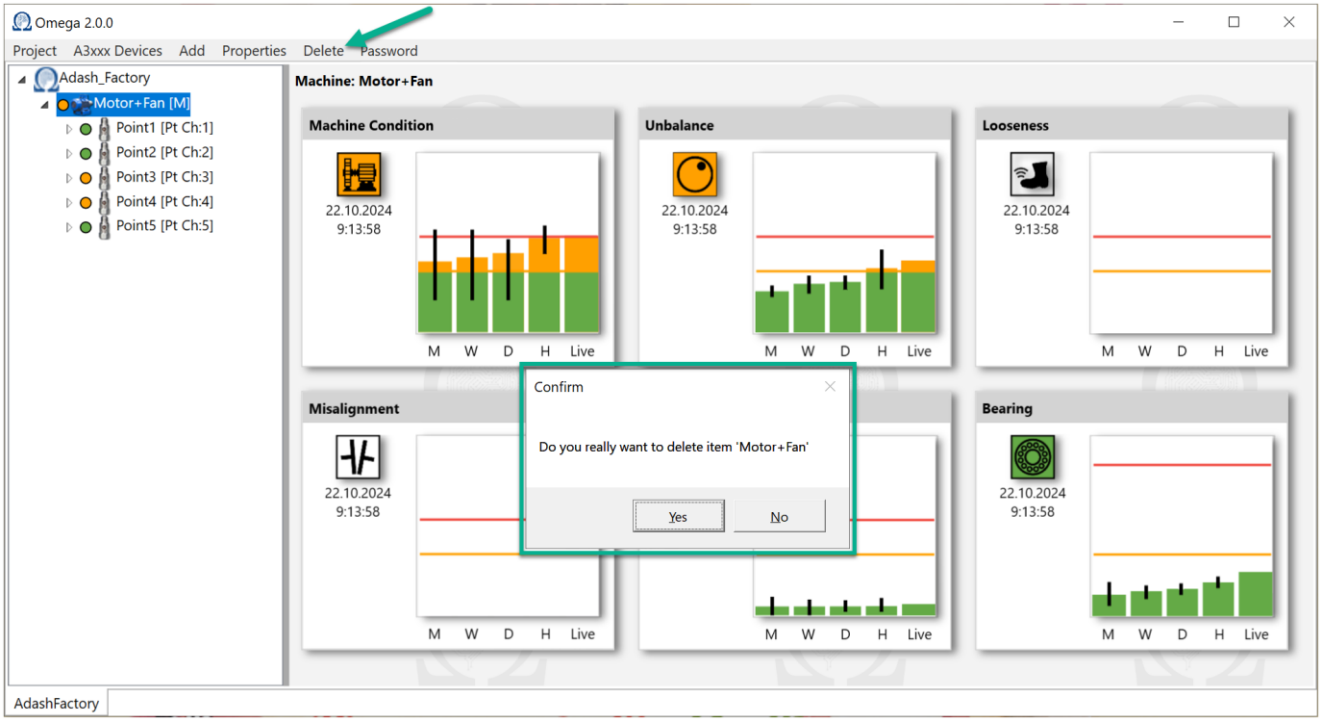
Name Enter the name of the point.
Channel Select the channel for this point measurement.
Direction Select one from the options **Radial/Axial.**
Speed Set the machine speed settings.
Vel. Limits Velocity limits can be inherited from the machine level. You can also define velocity limits according to ISO 20816-3 or you can set your own user limits differently.
Acc. Limits Acceleration limits can be inherited from the machine level. Or you can define new.
Machine Threshold For machines, which is not running continuously, we offer this option. In one point you can define Machine Threshold value. We recommend to select point with highest vibration level. This Machine Threshold enables to measure just, when machine is running. It means the vibration level is over the Machine Threshold value.

The final structure looks like this. You can see that machine level is marked with **[M]** in the structure. Points are marked like this **[Pt Ch:xx]**.



Delete structure item

There are two ways how to delete the project item. First is to use '**Delete**' in main menu. Click on the part of the project structure you want to remove. Then click on '**Delete**' menu item. Press '**Yes**' to delete the selected item.

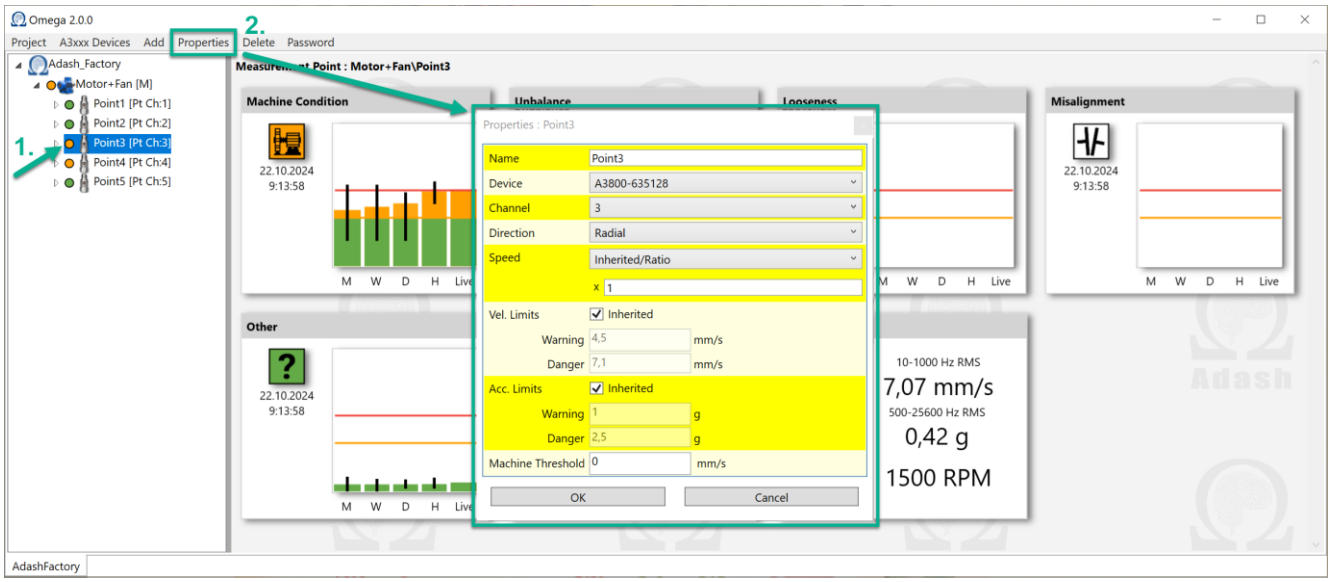


Second one is to delete the item with key '**Delete**' on the keyboard. Just click on the item in the structure (point, machine, etc.) and press 'Delete'. You get the same window as with 'Delete' item in Omega menu.

Note! It works the same way for any level of the structure. It means that the same way you delete machine, machine part and also the measurement point.

Properties

You can set the properties of particular items in Omega application. Select the measurement point (1.) and then click on '**Properties**' in main menu (2.). Now you set the properties of this measurement point.

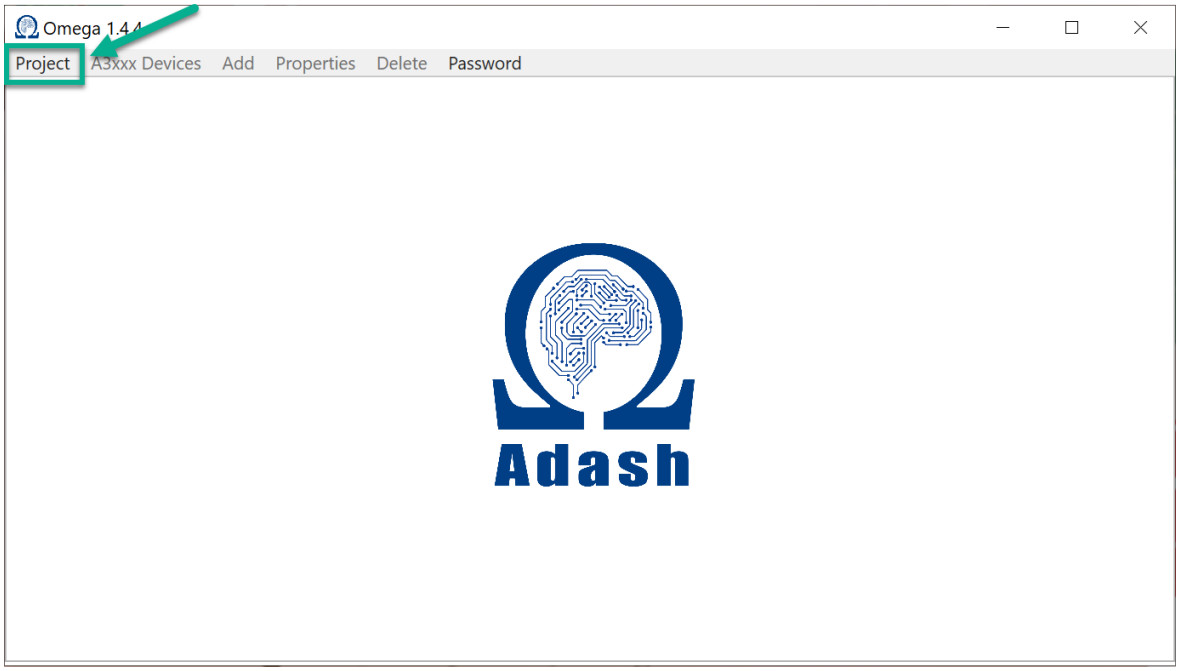


You set the properties with the same menu item also for machine and machine part.

Note! It is also possible to click on the tree item directly (machine, point) with right mouse button. You get the same properties window immediately for that item.

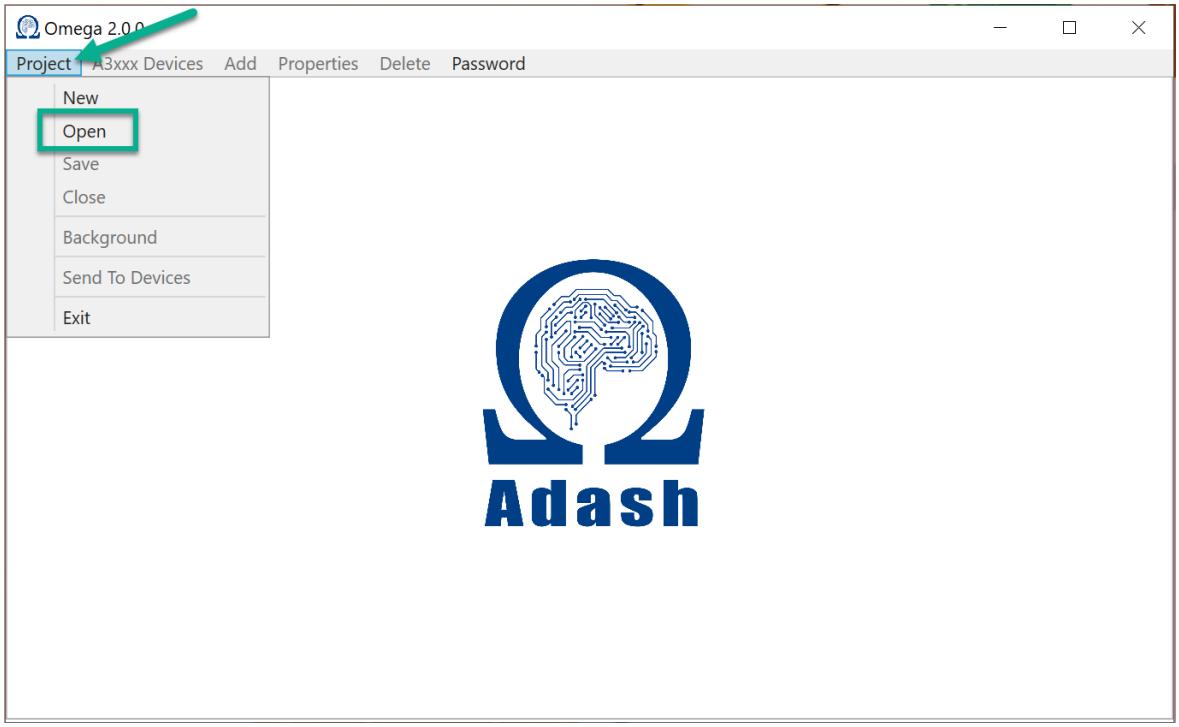
Project menu

We described how to work with '**Project**' menu item in this chapter.

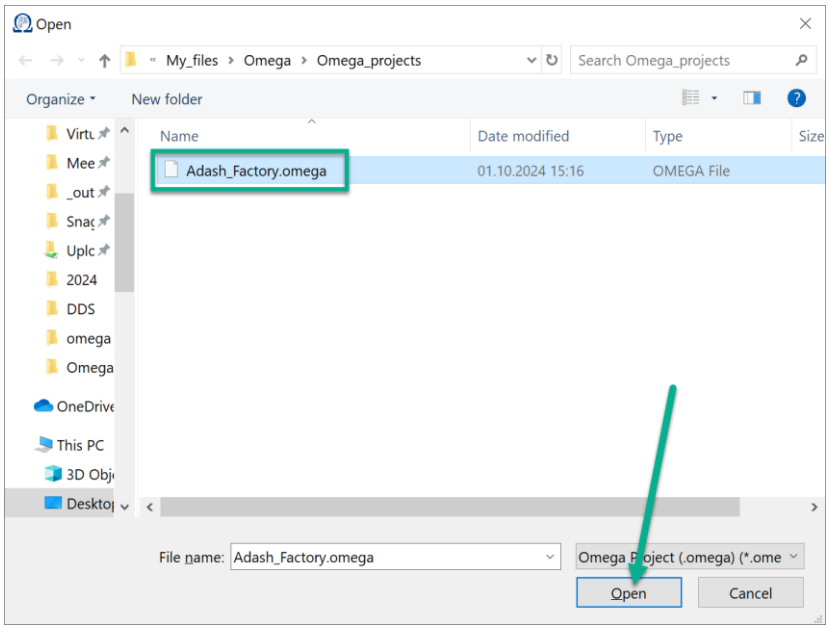


Project opening – OPEN

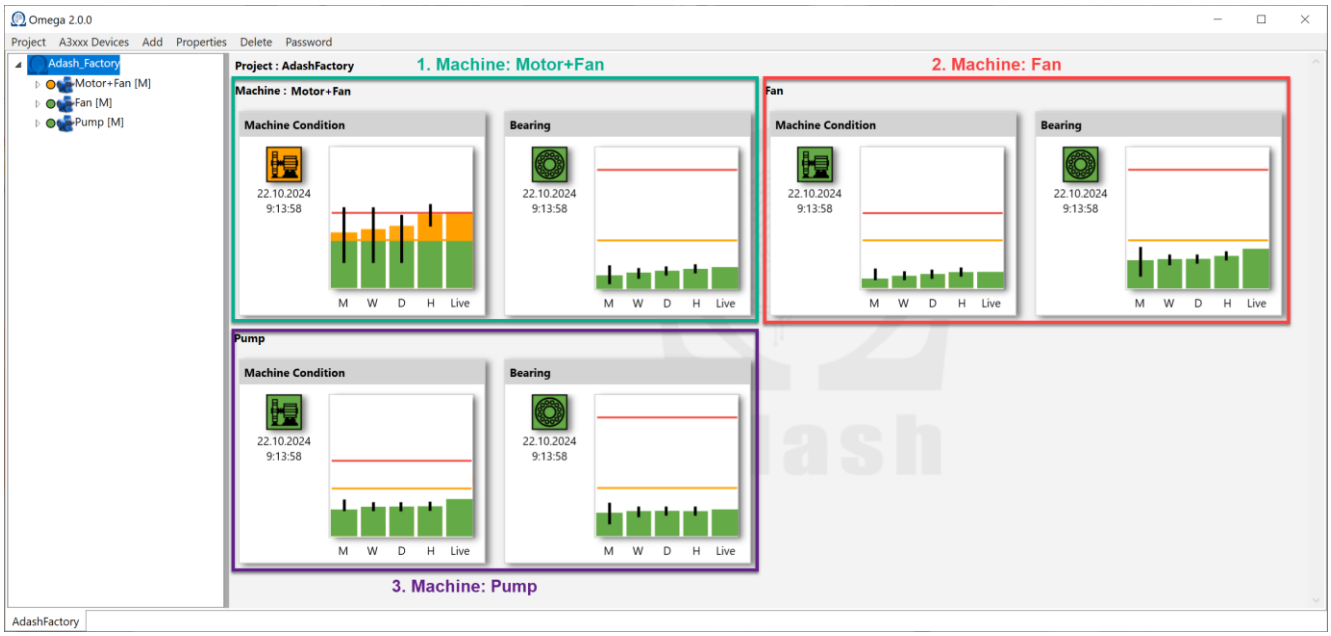
Click on '**Project**'. Press '**Open**'.



You get window to find where the project is located in your PC. Select the project which you want to open and confirm with '**Open**' button.



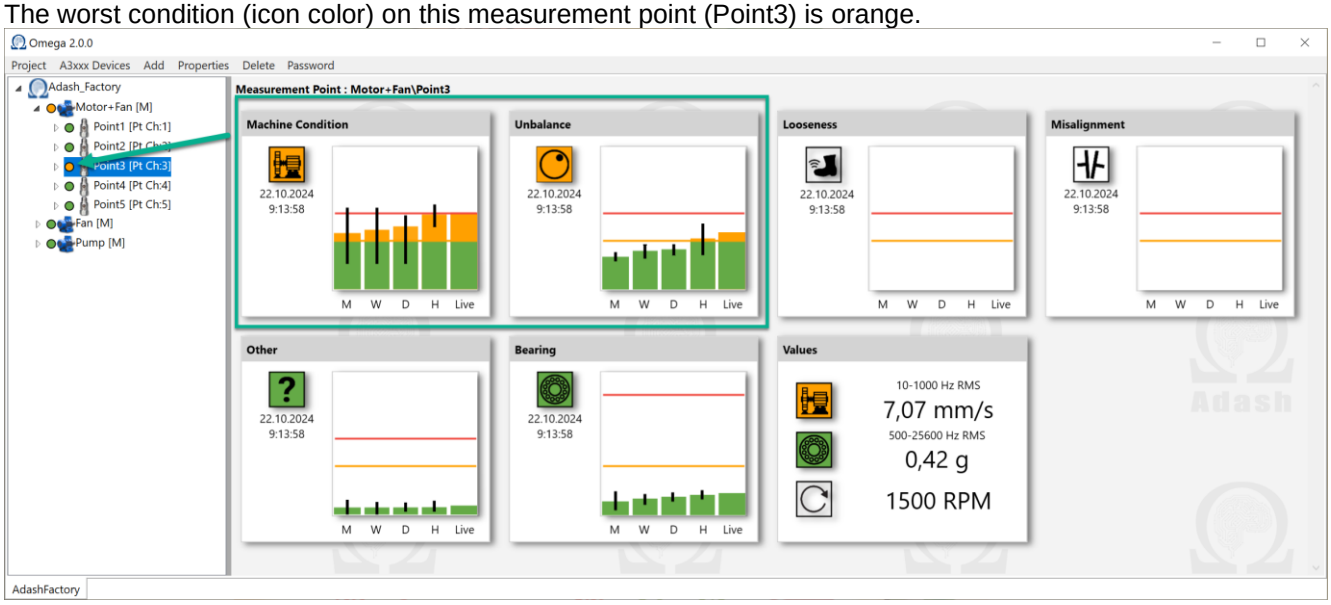
The chosen project is opened. You can see the following overview.



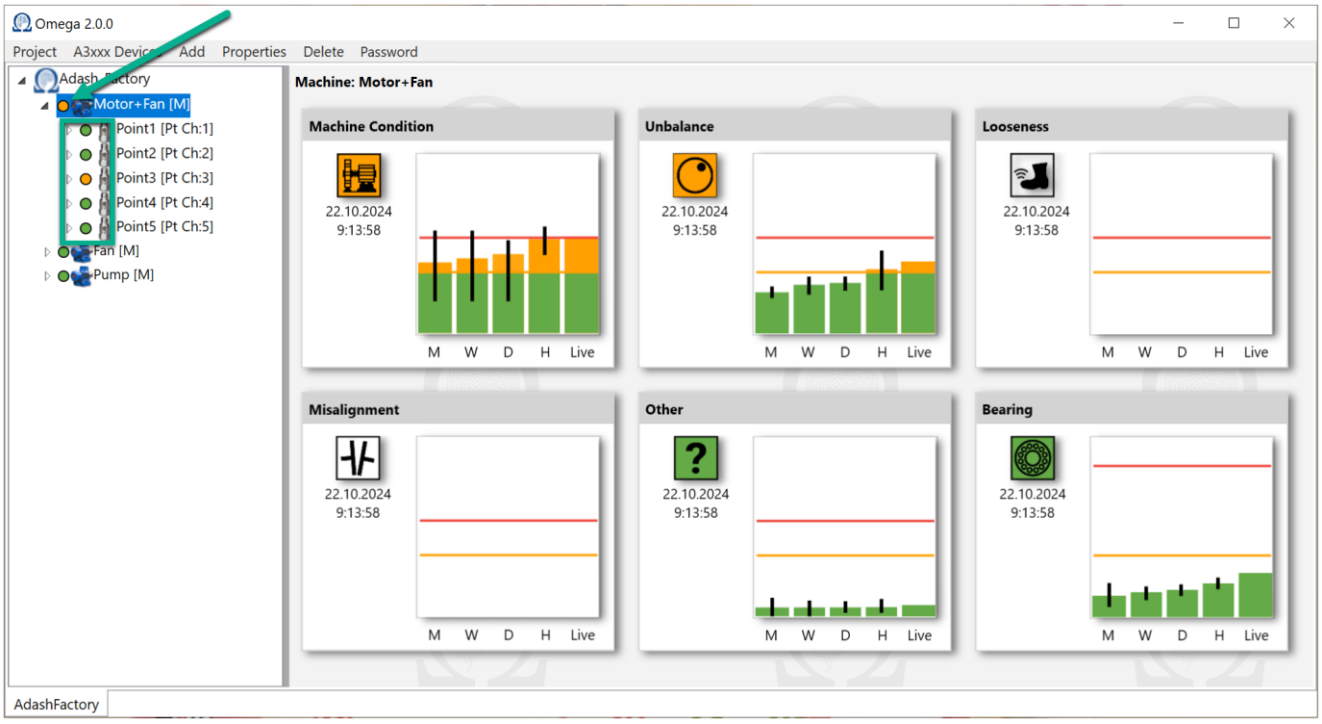
All machines (included in this project) are shown here. You can see the machine condition and the bearing condition for each machine. Let's explain how the color works for the project structure items and the icons.
There is clear relation between the colors and the levels of the project structure. The worst color is copied from the 'lowest' structure parts to the 'higher'.

The lowest part of the structure is the measurement point. The vibrations are measured here with the sensor. Each measurement point includes 6 fault graphs. Each fault's color (severity) is evaluated here. It is based on the last measured value – Live. The worst fault's color is copied to the measurement point color in the structure (see below).

The worst condition (icon color) on this measurement point (Point3) is orange.



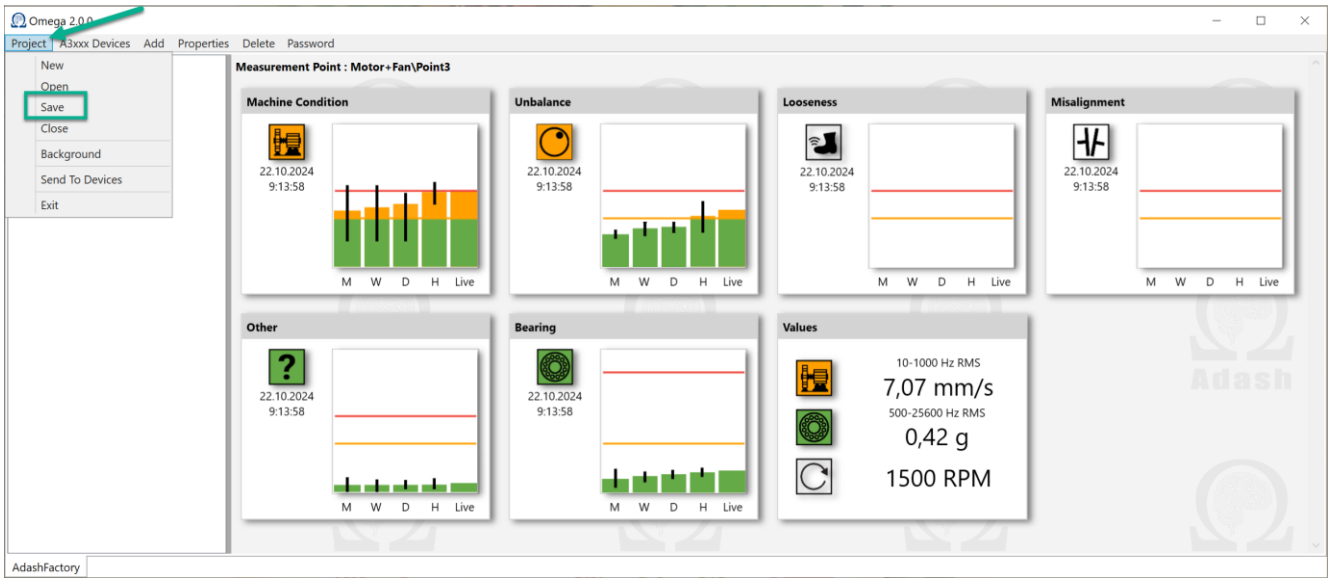
In this moment, orange color is the worst color of all measurement points on machine Motor+Fan. So, it is copied to the machine level (one level higher in the structure).



This is basically how the tree items work with the colors.

Project saving – SAVE

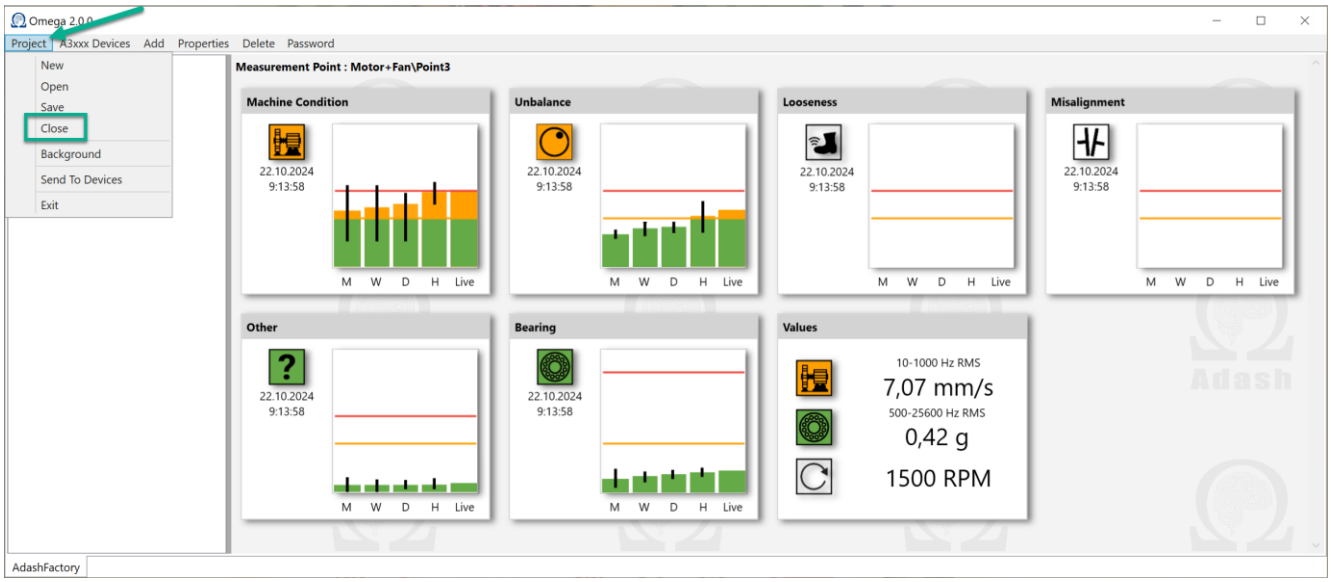
Go to menu item '**Project**'. Press '**Save**' to save your Omega project.



Note! It's up to you where you want to save Omega projects. Once you press '**Save**' you get window to choose location for saving. Confirm it with '**OK**' button.

Project closure – CLOSE

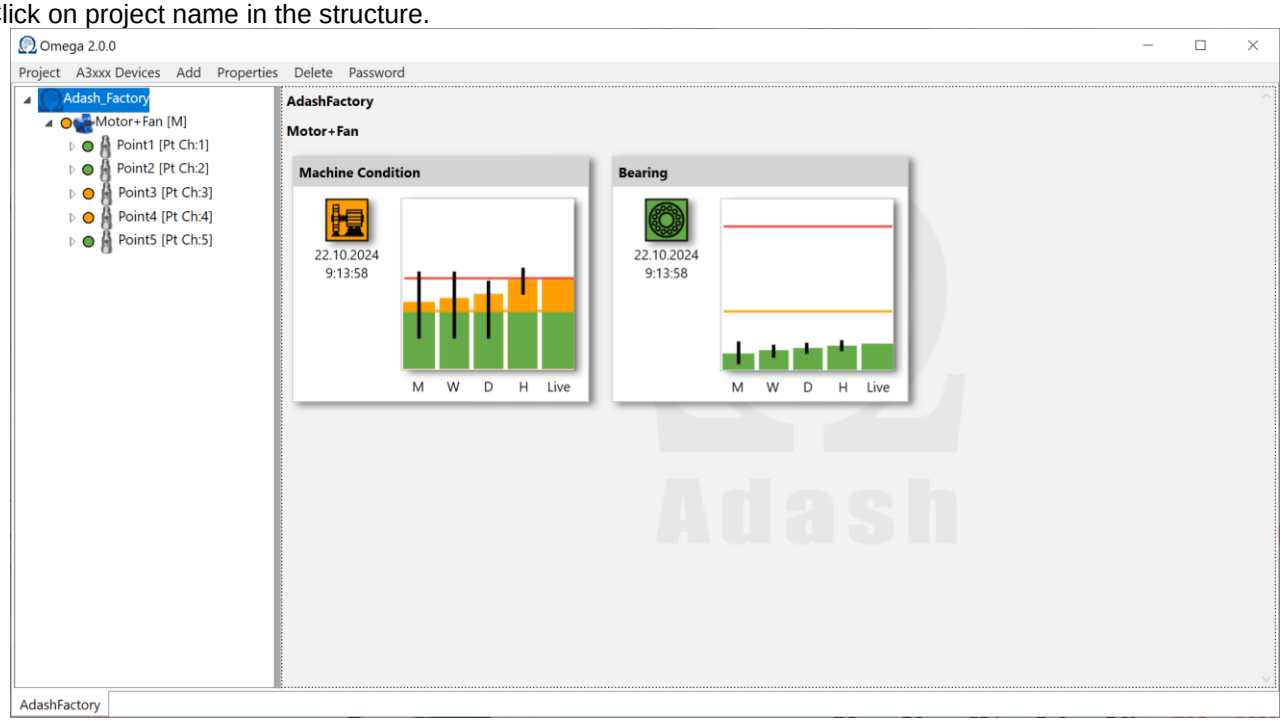
Select '**Project**'. Press '**Close**'.



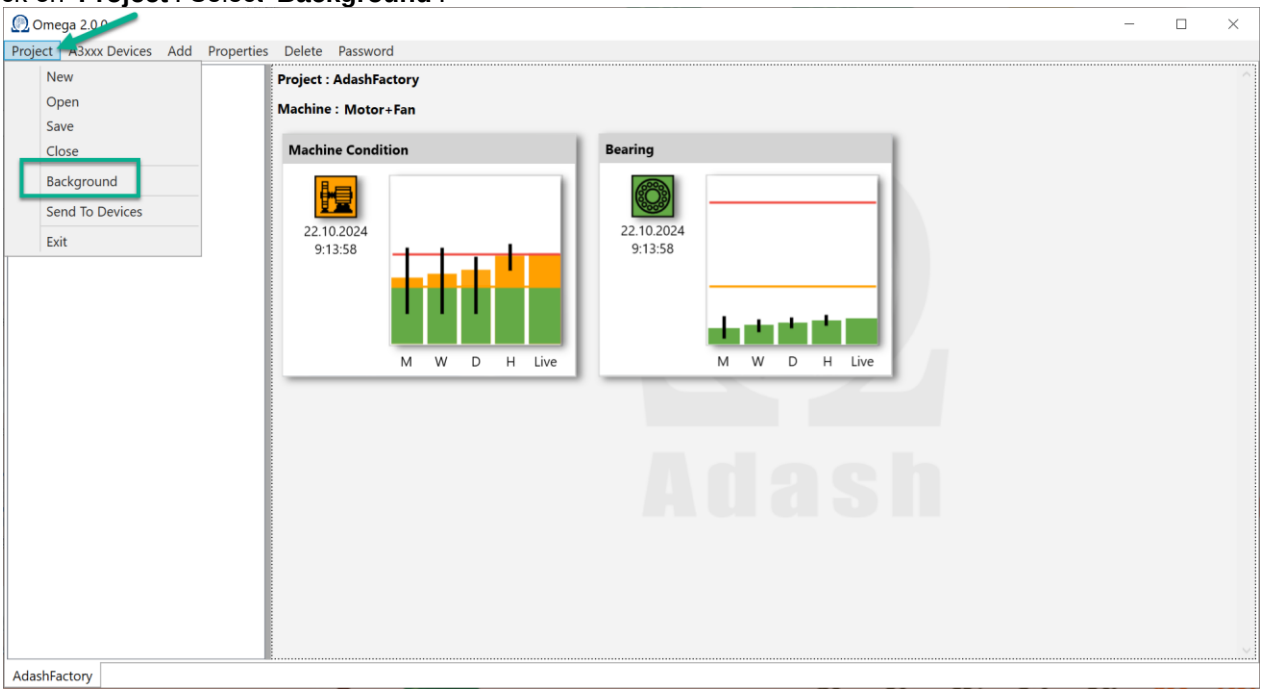
Background

You can set the background of Omega application. Image needs to be in one of following formats: **.jpg**, **.jpeg**, **.png**, **.bmp**.

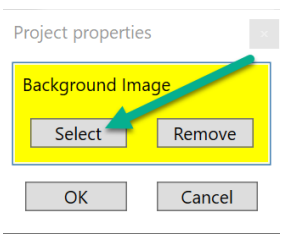
Click on project name in the structure.



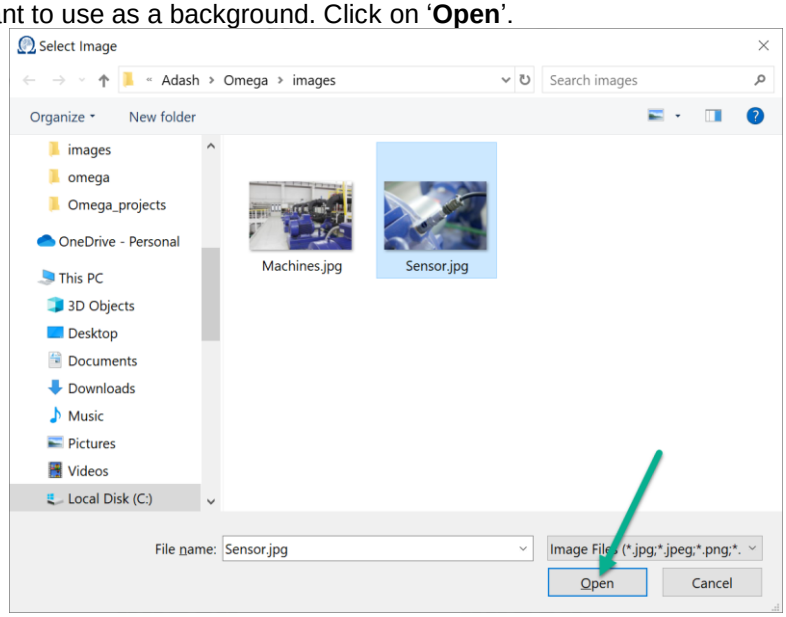
Click on '**Project**'. Select '**Background**'.



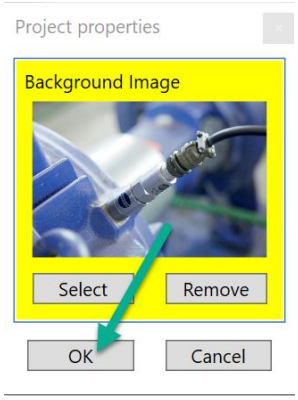
Click on '**Select**' in next window.



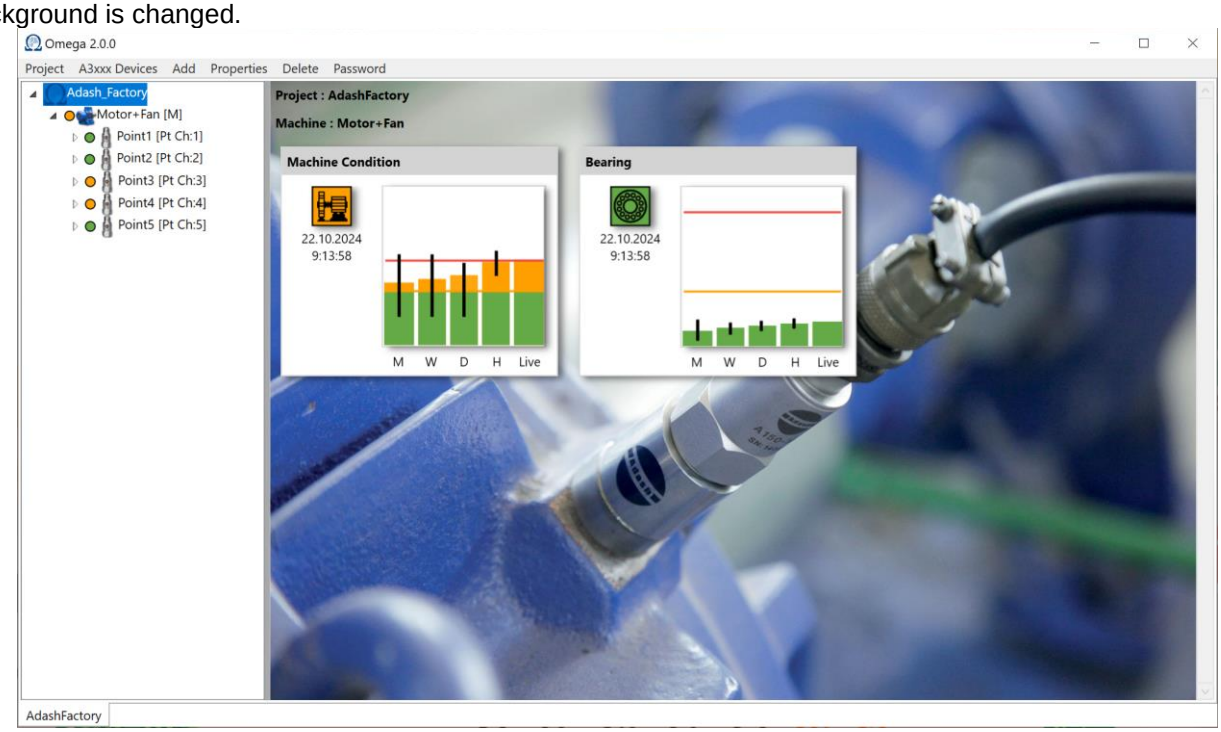
Find the image you want to use as a background. Click on '**Open**'.



You can see its preview here. Confirm with **OK**.



Background is changed.



Note! You have to save the project with change of the background. Otherwise, the change will not be permanent. If you changed the background and you want the default image again – just use the 'Remove' button. Click OK.

Machine faults

Machine condition

It contains velocity RMS value in set interval.

Unbalance

Looseness

Misalignment

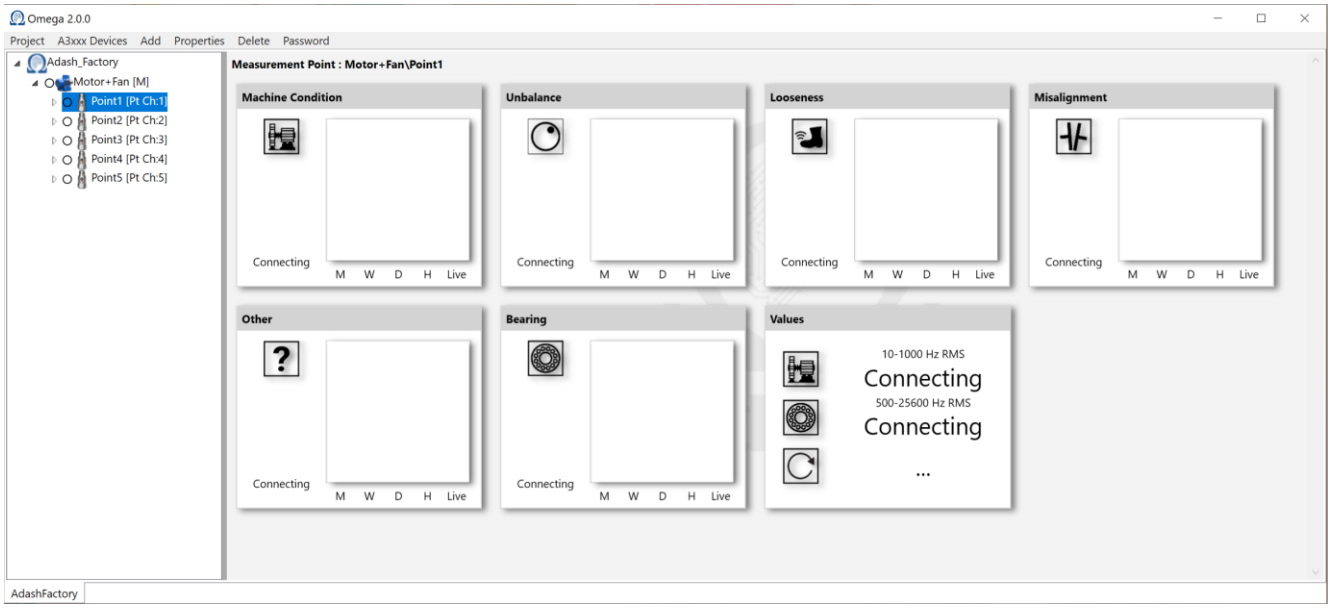
Other

Vibration can occur on other frequencies then speed and speed harmonics. Then the other fault is displayed. The machine spectrum has to be analyzed to find out the source of these frequencies

Bearing condition

Send project to online unit

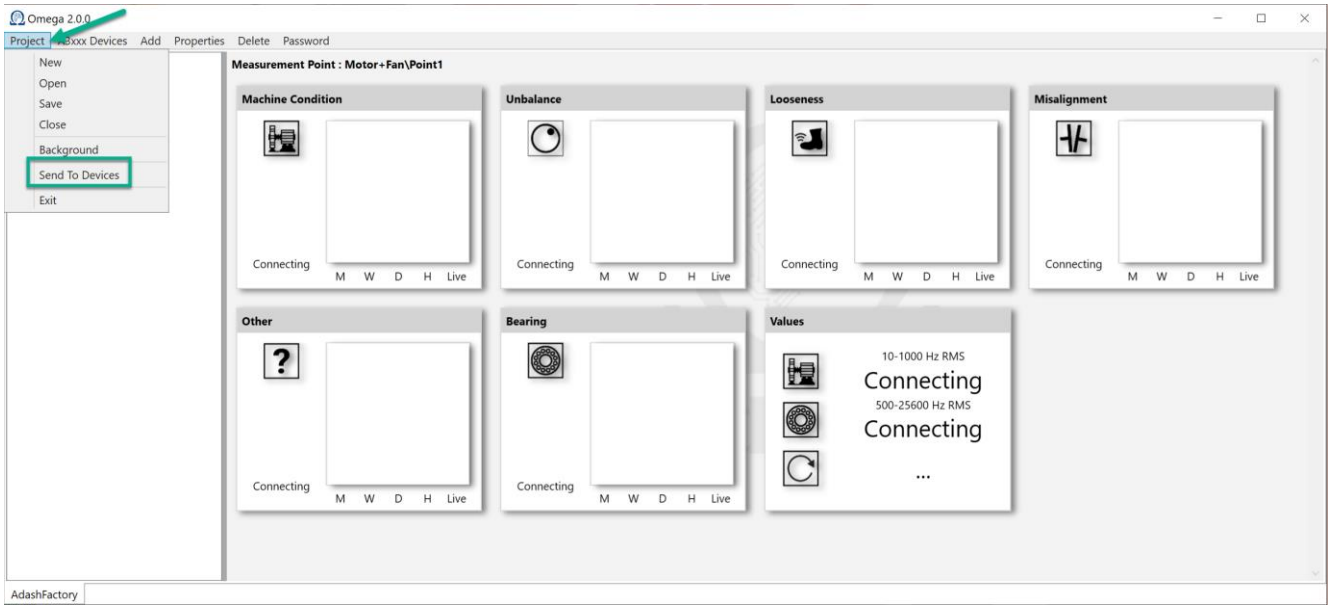
When you have project structure created, you need to send it to device. Firstly, you can see this screen (when you click on the measurement point in the project structure).



You can see that there are graphs showing information about overall machine condition, unbalance, looseness, misalignment, other and bearing values. But no bar will be shown in graphs at this moment.

The project has been created BUT it was not sent to device (to online unit). See following steps how to send Omega project to online unit.

Go to '**Project**' menu item. Press '**Send To Devices**'.

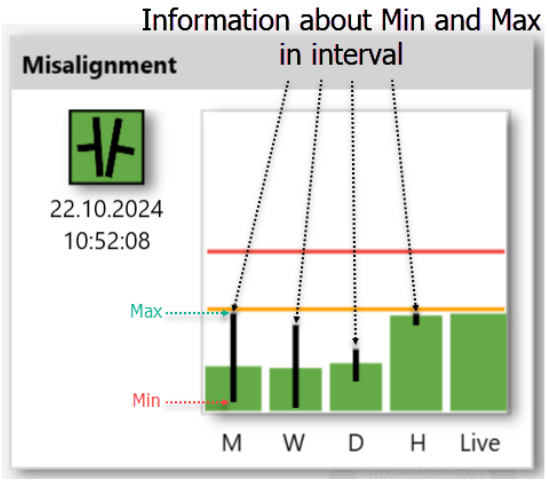


Graph description

Omega graph includes trend of measured values. This trend shows faults development in the last month. Every measurement point has its own graphs for particular faults. It means that every measurement point includes six graphs – every fault has its own graph.

But what exactly means letters **M**, **W**, **D** and **H** below the graph? And what you can see in column '**Live**'? It will be explained in this part of manual.

Misalignment graph has been chosen for explanation. Imagine this situation. **It is Friday, 15:30**. What values are included in particular columns?



Date and time (under icon) … When the last value was measured for this fault.

Live … Last measured value is shown. It is refreshed **every 1s**.

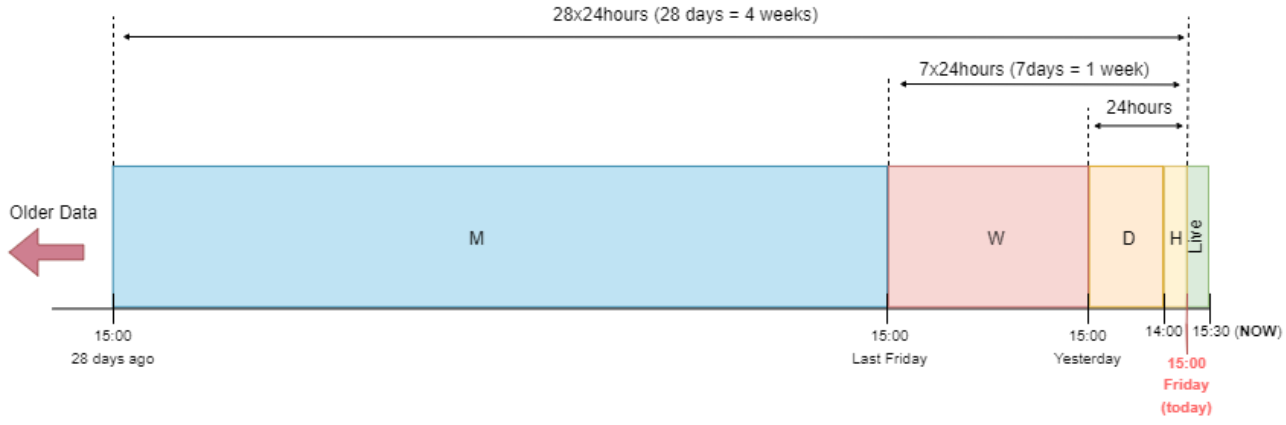
H is for the last 'closed' **Hour** of the measurement. It shows averaged value from the last 'closed' hour. In this case it is average from measured values between **14:00 to 15:00**. The black line in the column shows **Min** and **Max** for values measured in the last 'closed' hour. **Min and Max are minimum and maximum value in interval 14:00 to 15:00**.

D is for the last **Day** of measurement. **D + H = 24hours.** It shows averaged value from the last measured day BUT without the last 'closed' hour (this value is shown in H column). In our case it is average from measured values between **yesterday 15:00 to today 14:00**. It is the **same time interval for Min and Max** values.

W is for the last **Week** of measurement. **W + D + H = week**. It shows averaged value from the last week BUT without the last day + hour (it is shown in different columns). In our case it is average from values between **last Friday 15:00 to yesterday 15:00**. It is the **same time interval for Min and Max** values.

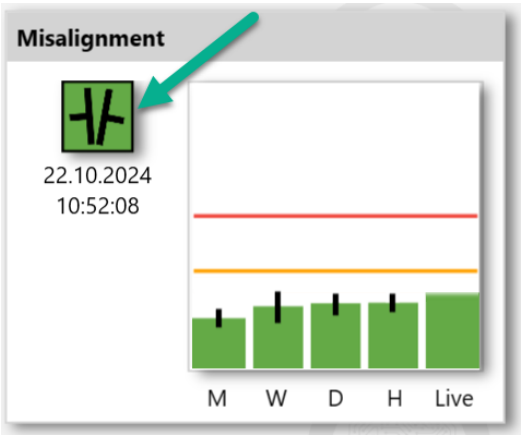
M is for the last **Month** of the measurement. **M + W + D + H = month**. It shows averaged value from the last month BUT without week + day + hour (it is shown in different columns). In our case it is average from values between **15:00 28 days ago to last Friday 15:00**. It is the **same time interval for Min and Max** values.

For better understanding see the following timeline of our example.

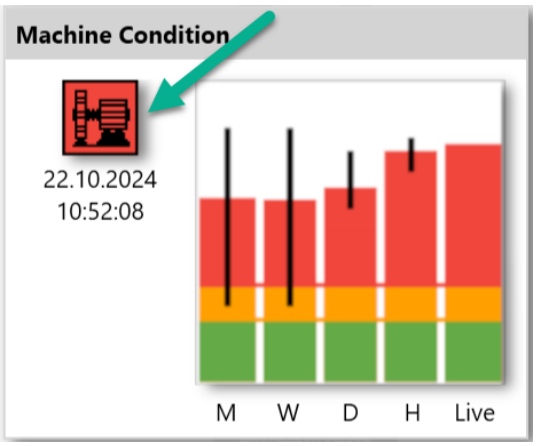


The graph bars and the icon of every machine fault is shown with the color. The icon has its color based on the live values. Graph bars have its colors based on the average values (see graph description above). These values are evaluated based on ISO 20816 standards (or your user limit values). According to these standards, the color is assigned to values based on the severity (green is the color without the faults, orange is warning – medium fault, red is danger – dangerous fault).

You can see that fault icons are filled with color. It means, if value is good, the icon is green like in the picture below. **The icons color is based on 'Live' value.**



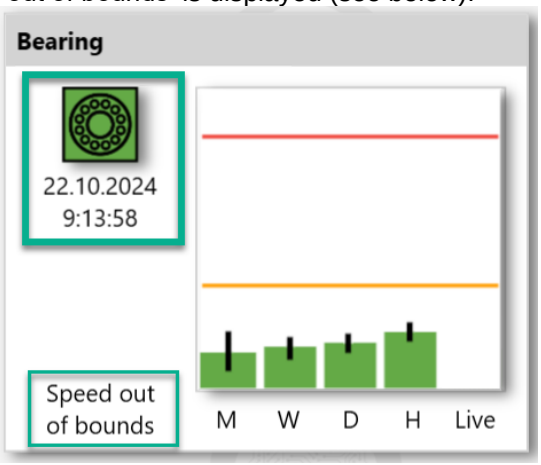
If the measured value is above the 'danger' limit, you can see that icon is red. It is dangerous fault on the machine.



Note! Icon is changing color based on the last measured value.

Date and time of the icon color

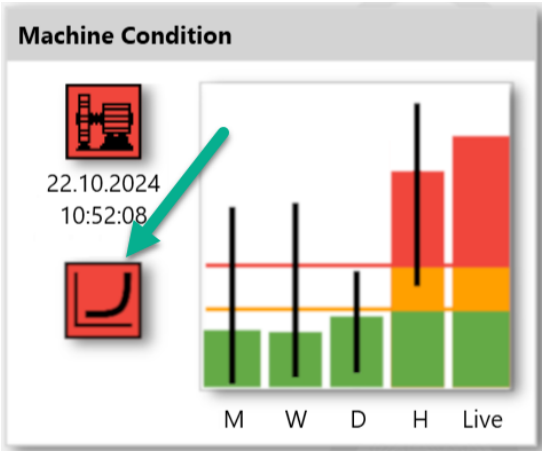
Look at following example. I set the speed interval, in which I want to analyze the vibration. Minimum speed is set to 1000 RPM. Maximum speed is set to 1800 RPM. If speed is outside this interval, you can see that Live column is blank and the message 'Speed out of bounds' is displayed (see below).



The icon color is defined by the live value. Now there is no live value but icon is still green. Why?
When you see information **'Speed out of bounds'** values for Omega are not saved and shown in the graph. But the icon keeps the color based on the **last** measured value. In this case, it was green color. The date and time give you information **when** this last value was measured.

FASTCHANGE

When hour value in the graph is at least two times higher than day value, then fast change icon is shown in the graph. It indicates that this machine may need your attention as its condition is getting quickly worse. Icon is orange or red (it depends how big the difference between H column and D column is).



Relations in graphs

Faults are divided into two groups.

Faults which are not speed related

Faults which are not related to speed are machine condition, bearing faults and other. These fault values are directly compared to set limits.

Speed related faults

Speed related faults are unbalance, misalignment and looseness. We need to know the speed value for evaluation of these fault's severity. There is one important rule – these 3 faults are mutually exclusive. Their common property is that the vibrations are excited by unbalance. Omega will display the fault where the Live value is the highest and therefore this fault should be removed first. The other two fault icons are white.

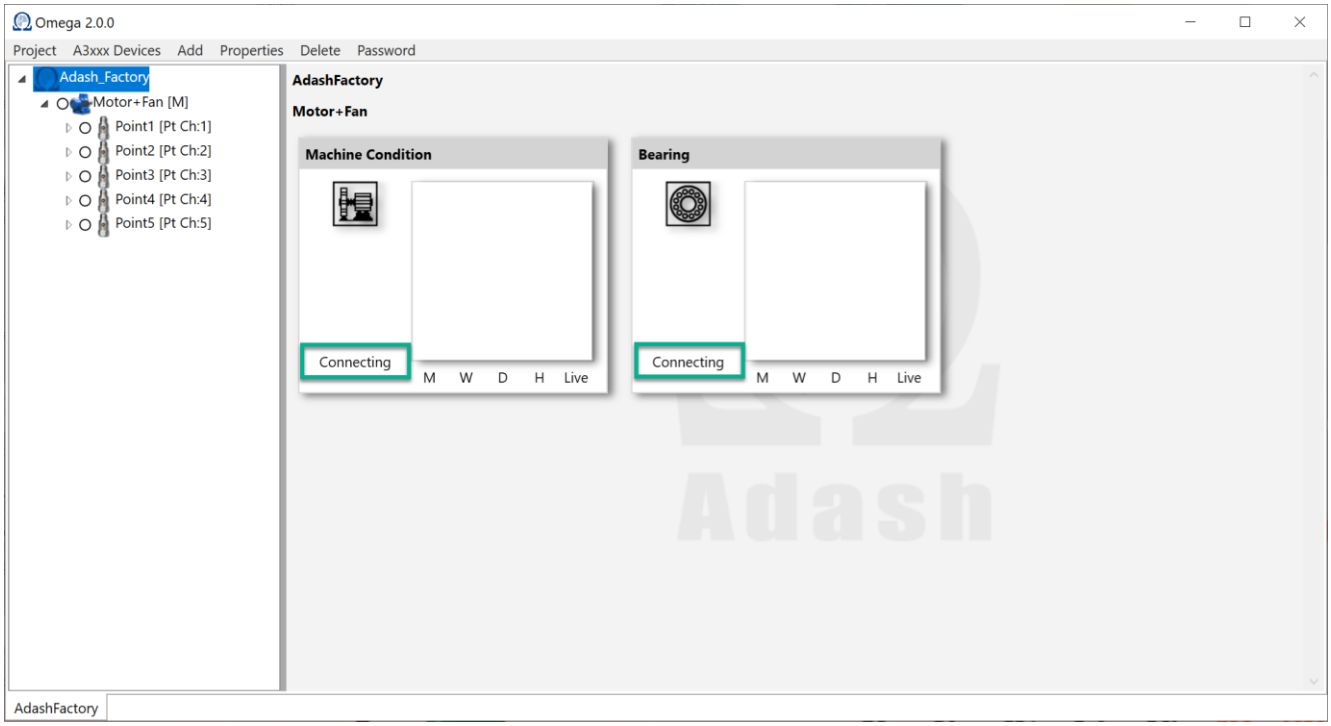
Example: misalignment icon was red. Icon for unbalance and looseness were white. Misalignment was repaired. Now the icon of looseness was orange (because the worst red fault has been repaired). After the looseness was fixed, the looseness orange changed to green. Also, the unbalance was green. No further fix is required.

Icon colors

All possible icon colors are described below.
White: Initial state of the icon color. This color is shown when no data was measured yet or if the fault is not presented on the point/machine.
Green: Fault status is good. Fault severity is low. Machine is running in standard condition.
Orange: Fault severity is medium. Value is above the warning limit set in Omega.
Red: Fault severity is dangerous. Value is above the danger limit set in Omega.

Statuses

Under the graphs may also appear additional statuses. See the list of them below the picture.



List of these statuses is:

Connecting – Omega is connecting to an OPC server and tries to find the values.
Project? – Different project is already running on this A3xxx.

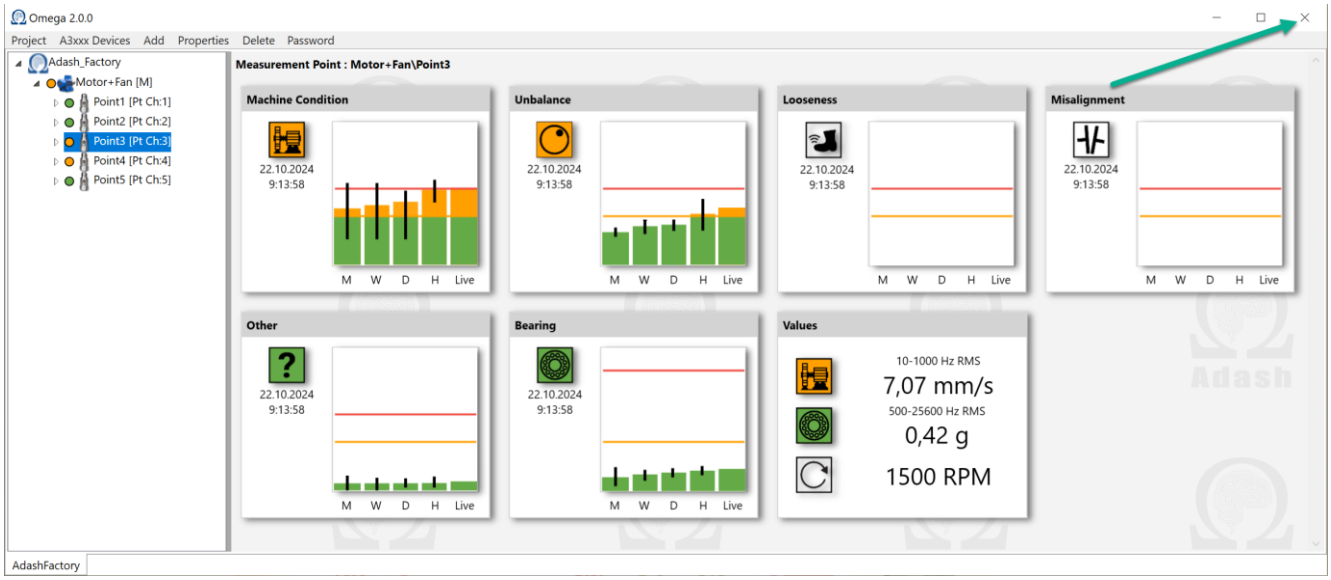
ICP error – Sensor error. Probably the sensor was disconnected or cable is cut.
Overload – Signal overload appeared on this channel.

No Speed – No speed available. It means no speed set or measured.
Speed out of bounds – Speed is not in a required interval for measurement.
Not running – Values are lower than “Machine Threshold” set in a measurement point.

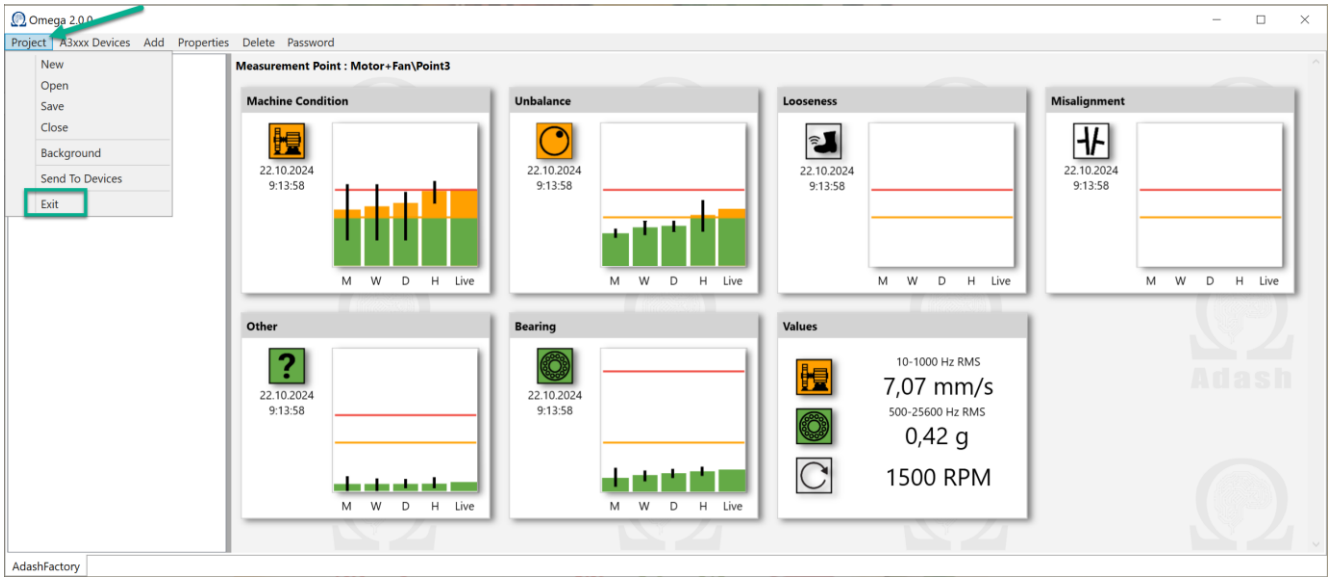
Hw Error – Measurement board outage/error.

Application closure

First way to close the application is the standard way – click on the '**Exit**' button in the right upper corner.



Second way is to use '**Exit**' in Omega menu. Go to '**Project**' and press '**Exit**'.



Note! Keep in mind that button '**Close**' under '**Project**' in menu is used only for project closure. Not to close whole Omega window.

OPC interface

OPC UA Interface

OPC UA is a standardized communication protocol. It allows exchanging of data from devices to applications. Each A3xxx device provides OPC UA server. Measured values can be downloaded to company control system (e.g. SCADA). Omega application is basically just visualizing these values.

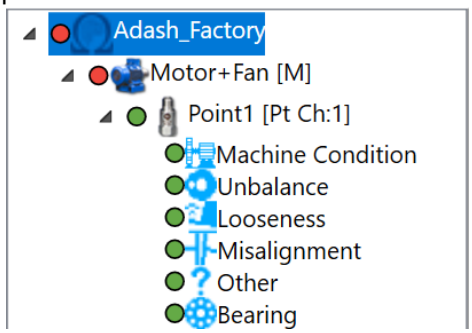
Connection

Server is running on „opc.tcp://**a3xxx device ip adress**:37162" (so this endpoint URL may look like this: **opc.tcp://192.168.1.143:37162**). User is "Anonymous" and no encryption is needed. You can use any OPC client.

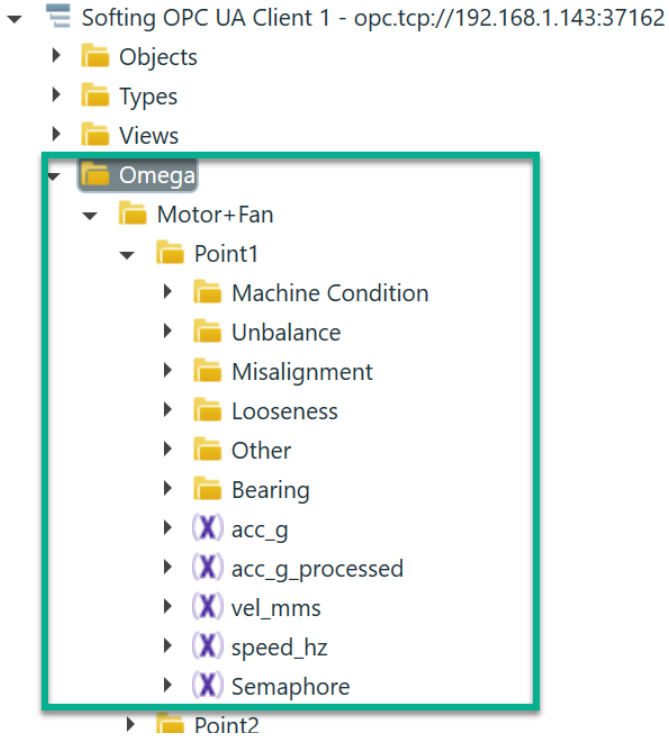
Structure

There is available an object node "Omega" on OPC server. This node contains basically a same tree as you created in a project.

Example of the project in Omega application:



Such project will create following structure on an OPC server:



In every object node with the fault name are available following variables.

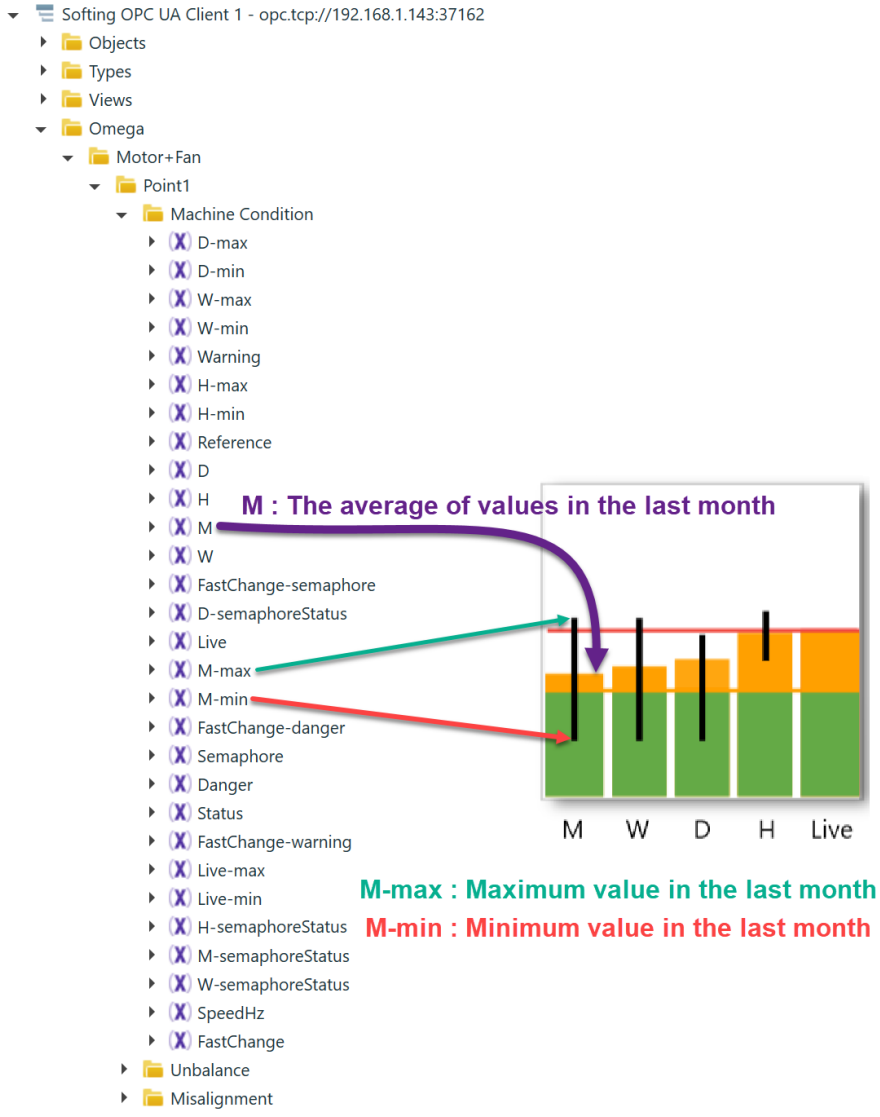
Reference – reference value for percent evaluation (e.g. ISO 20816/3/A – 7,1 mm/s) [mm/s]
Warning – warning level in percent (e.g. ISO 20816/3/A – 4,5 mm/s = 63,3% of Reference)
Danger – danger level in percent (7,1 mm/s = 100% of Reference)
Semaphore – **0** = Transparent, **1** = Green (OK), **2** = Orange (Warning), **3** = Red (Danger)

FastChange = the detection of fast change of machine fault
FastChange-warning = warning level
FastChange-danger = danger level
FastChange-semaphore = same as “semaphore” above

Live = actual value [%]

H = average from the previous Hour values [%]
H-min = minimum in the previous hour [%]
H-max = maximum in the previous hour [%]
H-semaphoreStatus = state of H bar; **0** = no value, **1** = green bar (measurement completed, OK), **2** = orange (warning), **3** = red (danger)

D = average from the last Day values (without previous hour – H) [%]
D-min = minimum from the last day (without previous hour – H) [%]
D-max = maximum from the last day (without previous hour – H) [%]
D-semaphoreStatus = state of D bar; **0** = no value, **1** = green bar (measurement completed, OK), **2** = orange (warning), **3** = red (danger)



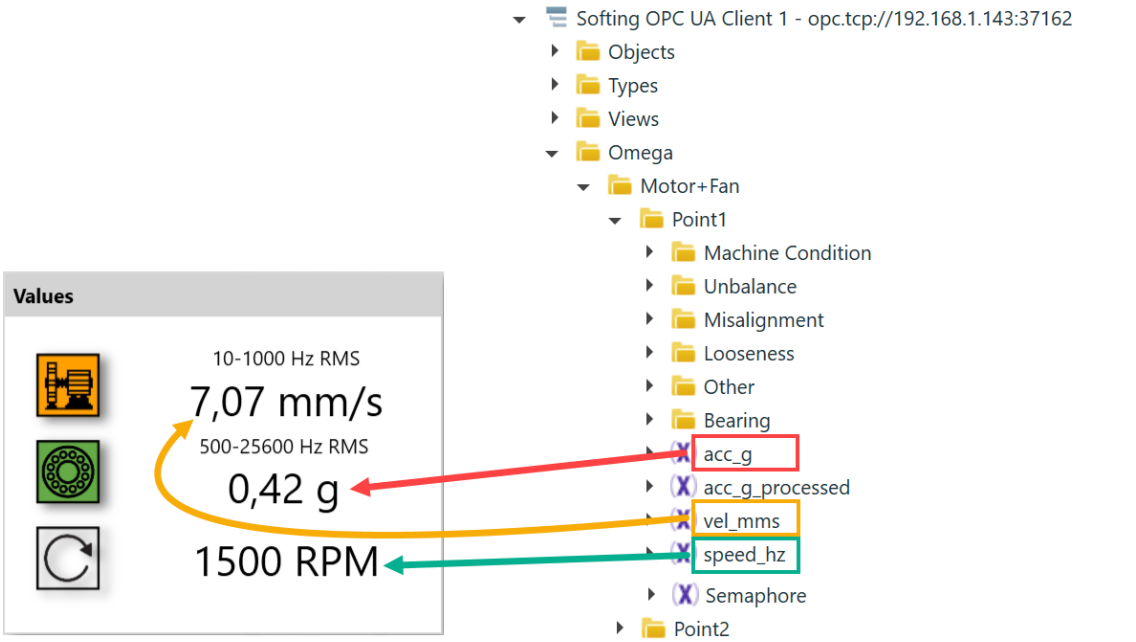
W = average from the last Week values (without actual day – D) [%]
W-min = minimum from the last week (without the last day – D) [%]
W-max = maximum from the last week (without the last day – D) [%]
W-semaphoreStatus = state of W bar; **0** = no value, **1** = green bar (measurement completed, OK), **2** = orange (warning), **3** = red (danger)

M = average from the last Month values (without actual week – W) [%]
M-min = minimum from the last month (without week – W) [%]
M-max = maximum from the last month (without week – W) [%]
M-semaphoreStatus = state of M bar; **0** = no value, **1** = green bar (measurement completed, OK), **2** = orange (warning), **3** = red (danger)

SpeedHz = speed in Hz

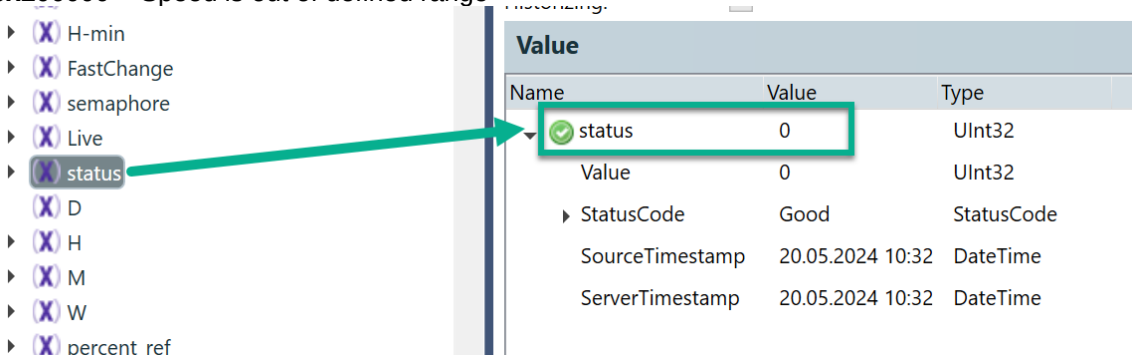
acc_g = this is the acceleration value shown in 'Values' window to see the bearing condition
vel_mms = this is the velocity value shown in 'Values' window to see the machine condition
speed_Hz = this is the RPM speed value shown in 'Values' window to see the speed

You can see the 'Values' window on the left – window from Omega. You can see OPC rows on the right.
Note! These OPC rows are located under each point (not under every fault on this point!).



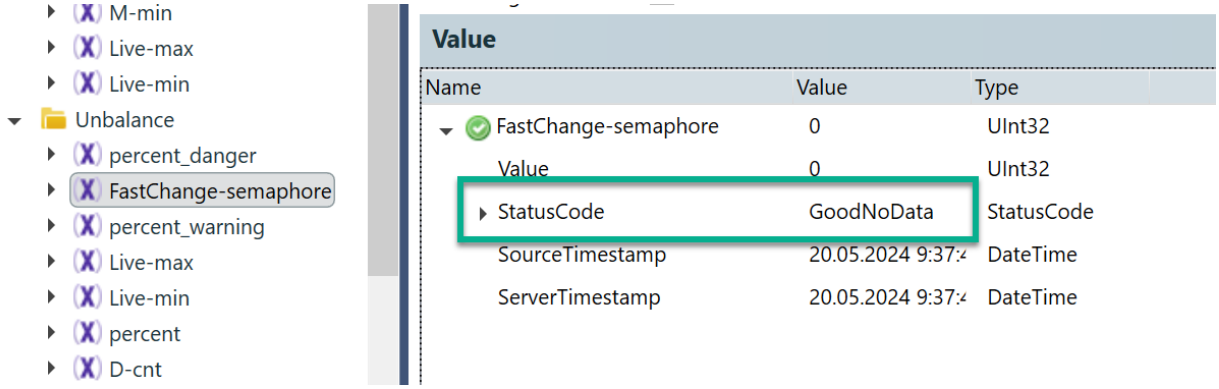
Status = binary indication of system state on this channel, following options can be shown in status row (you will always see these combinations of numbers or zero, not the text):

0 = OK
0x000001 = Sensor Overload
0x000004 = Sensor ICP Error
0x000080 = No Speed
0x002000 = Measurement initialization, value not available yet
0x008000 = Hw error
0x020000 = Machine Not Running (Value below threshold)
0x200000 = Speed is out of defined range

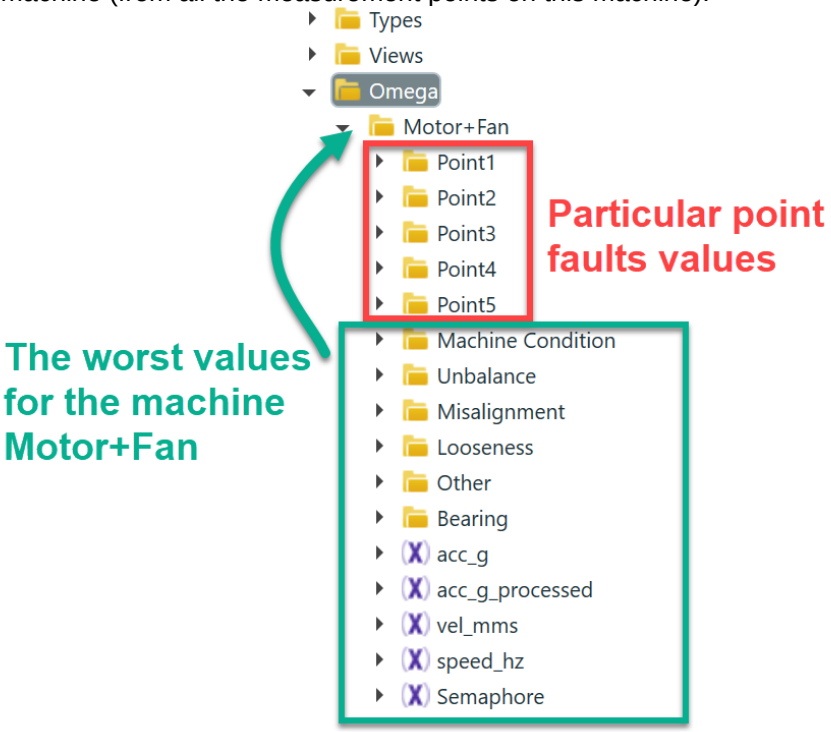


Possible UA statuses are (it can be found as StatusCode):

Good – Data are valid
GoodNoData – Data are unavailable or not complete

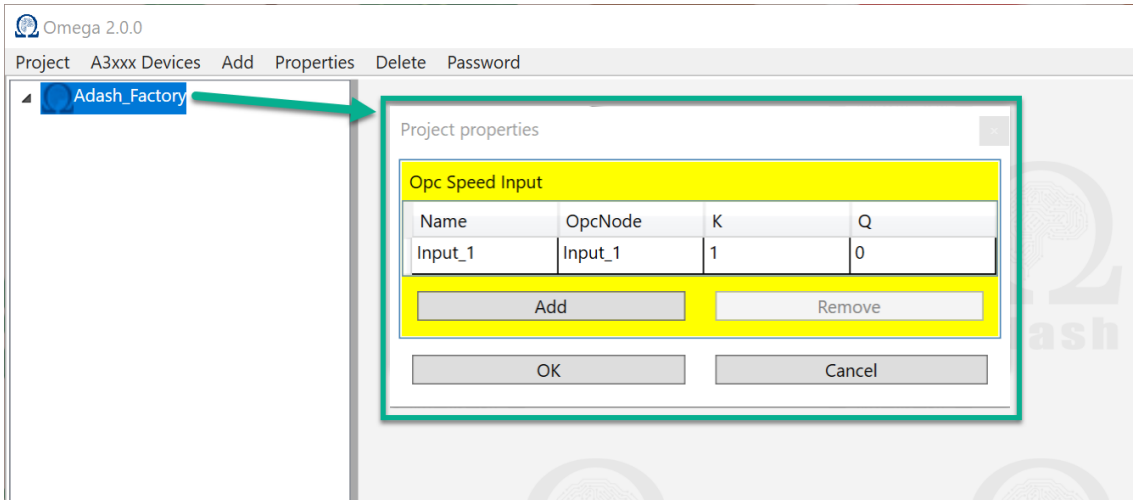


Every machine includes the same fault folders as points (see picture below). There is always shown the worst fault value on this machine (from all the measurement points on this machine).



Appendix A – OPC speed input

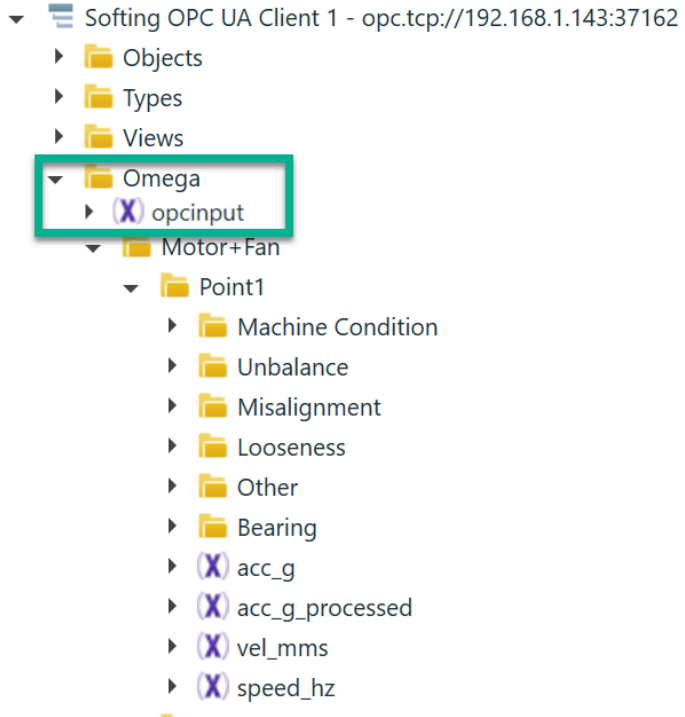
OPC speed input is set in project properties. Click on the project name in the structure with right mouse button. You can set OPC speed input here. Imagine the situation when you cannot connect tacho probe to the machine. It means that online unit do not have information about speed value. This information is important for Omega. But the speed value can be available on other control system in the factory. And such system can save the speed value to the OPC server on online unit.
You just need to create OPC row for it. This is created with OPC Speed Input in Omega project properties. Click on Add button to create new OPC row.



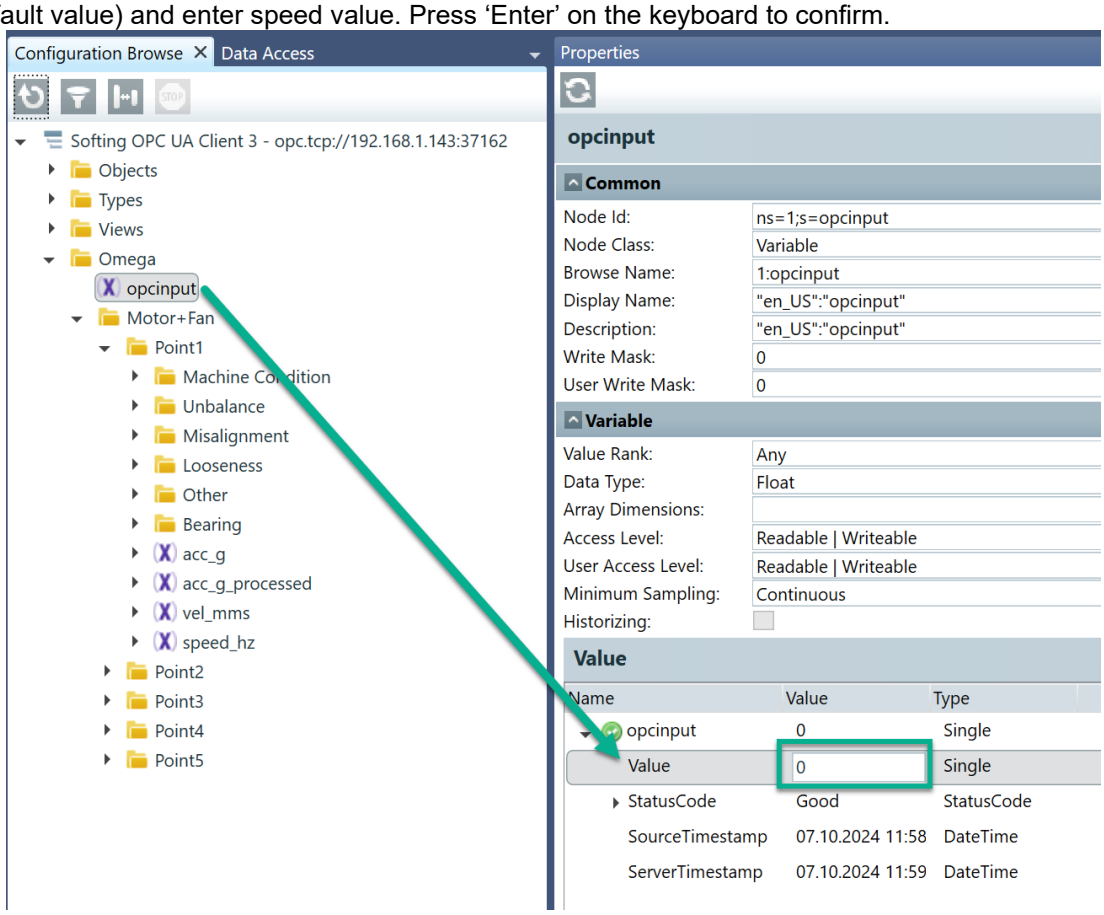
Name name of this OPC input shown in Omega
OpcNode name of this OPC input shown in OPC server
K, Q coefficients

If you enter speed value in Hz to OPC, keep the coefficient K=1 and Q=0. These coefficients are used to recalculate different input units to Hz based on this formula **k·X + q** (see later in this chapter).

Run some OPC client (e.g. Softing). OpcNode is created directly under Omega folder in OPC.

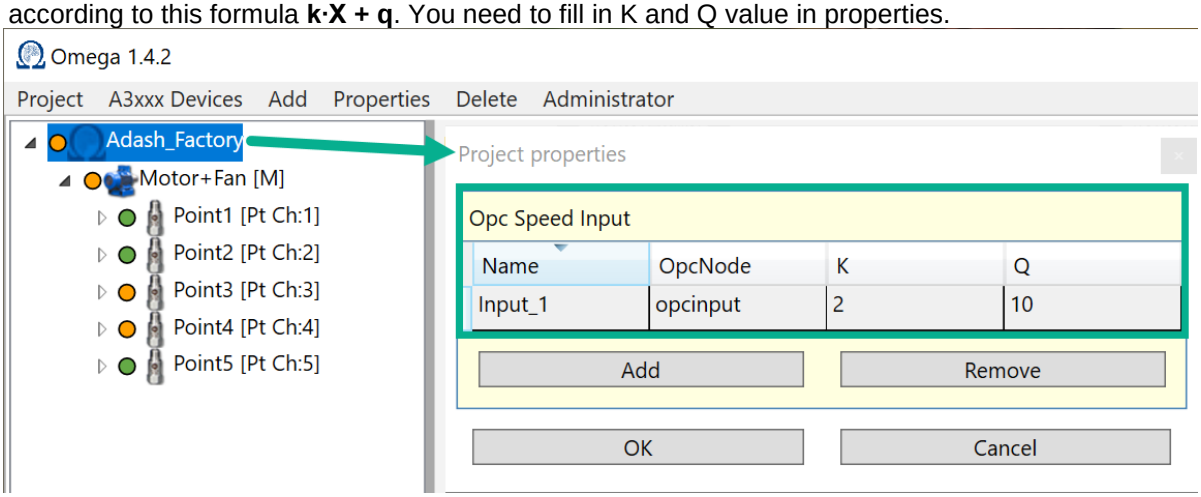


Click on '**opcinput**' in structure (directly under Omega). Double click on value 0 (green frame in the picture below – 0 is default value) and enter speed value. Press 'Enter' on the keyboard to confirm.



Speed value is now sent to online unit.
Note! Speed value is sent to OPC most probably from some other system (e.g. SCADA, etc.). You don't need to enter it manually when speed is changing.

As mentioned above, this project property is also useful when you have different unit of speed on the input. There is always expected Hz unit on the input. So, if different unit is there (e.g. RPM, mV, mA…), it can be recalculated to Hz according to this formula **k·X + q**. You need to fill in K and Q value in properties.



Here it is shown in OPC. Opcinput is the input value. Speed_hz is recalculated value to Hz from the input unit.