USER MANUAL

WIRELESS CONDITION MONITORING SYSTEM

Description

nmas Chess Soldier is a wireless condition monitoring system that consists of sensors, routers, cloud database and software. Cloud database and software is delivered as fully functional and introduction to them is provided separately.

Soldier is industrial quality battery-operated sensor is capable of demanding condition monitoring measurements such as high frequency vibration and surface temperature. Typical measured machines are pumps, motors and fans. Measured data helps maintenance staff to see the true mechanic condition of the machines and see early defects before they cause issues.

The router transfers all collected data to cloud using LTE-M network. This way the system can achieve low power consumption and long wireless range with cellular networks. It is also possible to read information directly from the sensor with an Android smartphone for example.
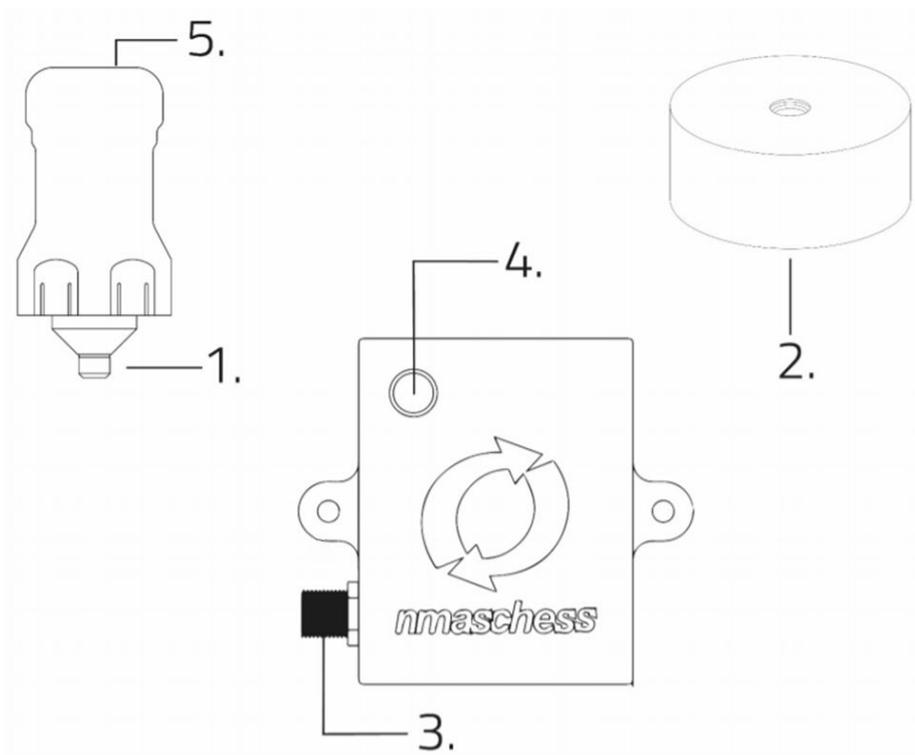
The start of using the sensor will be done with nmas Chess app. Instructions for installing and using the app are found in this manual.

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1. Parts

1. M8 fastener
2. Magnetic base (available as an accessory)
3. Power supply connector
4. Indicator light
5. Sensor indicator light

2. Activating the sensor

The sensor is always ready to use, and it can be activated with a little tap or shaking. The sensor will show on a list in Nmas Chess app when it is activated, and the app is installed. Activation of the sensor and changing of settings are done with Nmas Chess app. The app works on Android 8 and any newer versions.

At the end of this manual is a step-by-step guide for installing the sensor and using the app for the first time.

3. Downloading and installing Nmas Chess app

Downloading the app directly from website is done at: https://nome.fi/nmas-materials/. From this website you will choose nmas applications and from the next menu choose nmas_chess android application. Your device will ask if you want to download the file, in which you choose "Download" and again "Download" (it is possible to change the name of the file but that is not necessary). After the file has been downloaded, press on the loaded file, and the following message may appear.
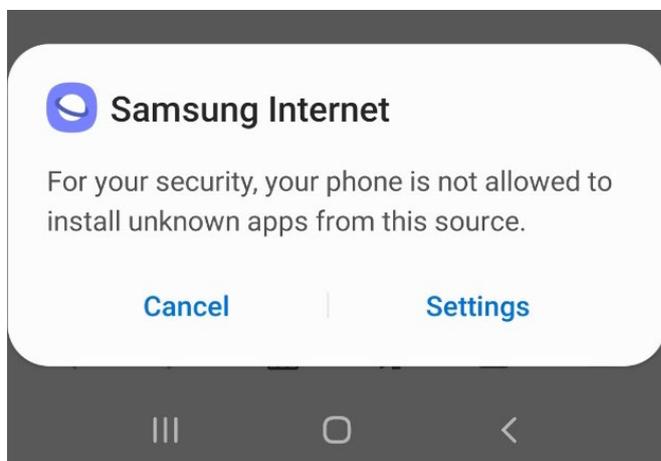
In this case, you will need to go to your device's settings and give the permission to install unknown apps from the location you are using, as shown in the next picture. This setting can be changed back after installing the app.
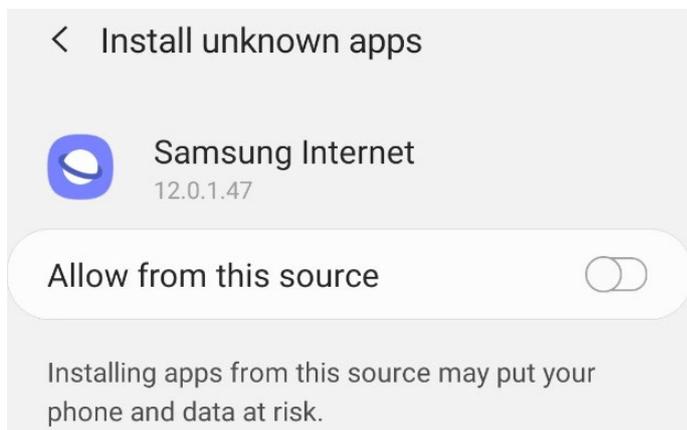
After the permission has been given (or if it was already), the app can be installed by pressing "Install" in the app installing file.
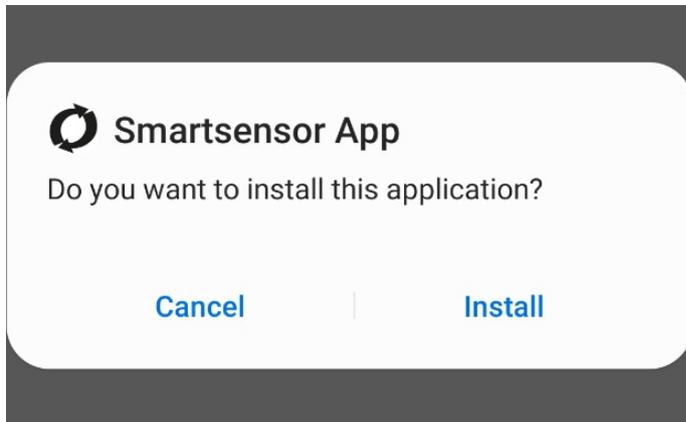
After these steps, the app has been installed and can be used.

4. First time using Nmas Chess app

When starting the app, your device will ask if you allow Nmas Chess to access your device's location. For the app to operate optimally this should be allowed. Bluetooth must be enabled to use the app. When starting the app, it will always ask to turn Bluetooth on if it is turned off. The login-page opens next. This is the front page which opens every time you use the app.
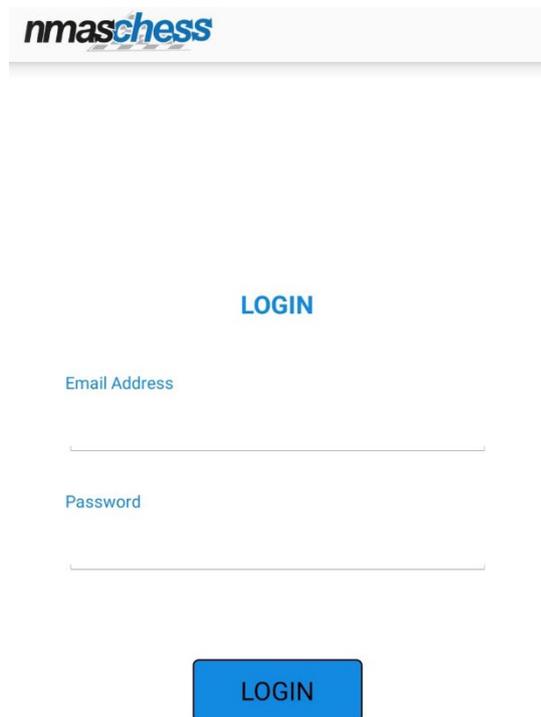
nmaschess

**LOGIN**

Email Address

Password

LOGIN

You can log in to the app with your account that has been generated. A secret key for generating accounts will be provided when the sensors are delivered. If you don't have an account yet, contact the person within your company who has the key. After logging in the app opens to the sensor page.

5. Sensors

On this page you can see all sensors that are connected to your device.

On the upper right corner is shown either "Stop" or "Scan". If the screen is showing "Scan" the device is not actively updating the information coming from sensors, but your screen is showing the sensors and results from last update. When you press "Scan" the device will start scanning for new sensors and results. Now the screen is showing "Stop" and a revolving circle.
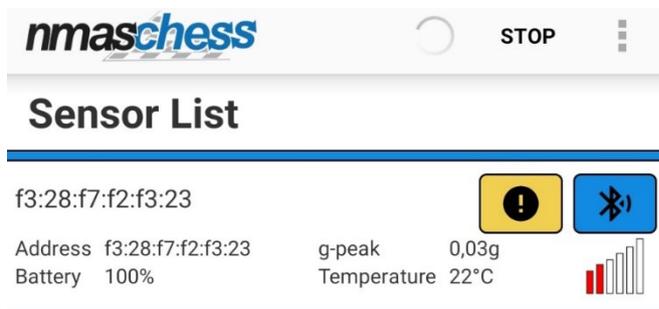
Below the sensor name following values are shown:

- Address: sensors unique MAC identifier
- Gpeak: vibration value, units are m/s^2
- Battery: Remaining percentage of battery charge*
- Temperature: Temperature value, units are °C
(*An estimate based on the time the battery has been in use. Results may not be accurate due to conditions)

Six bars are shown on the right side of the screen next to these values. The bars represent the strength of connection to the sensor. The color and number of bars change according to strength of connection. Sensors are shown in order of the quality of connection, except when a new sensor is found, it goes to the bottom of the list.

Above the bars is a blue Bluetooth-icon. By pressing that you can change settings for the sensor and do measurements. If there is a yellow exclamation mark next to the Bluetooth-icon, it means that sensor isn't registered to the owner this key. If the sensor belongs to you, press the yellow button. Next will open a window with this sensor's mac-address and current location. Press add here. This must be done once for every sensor. Once the sensor is registered to a key, it can't be done again.
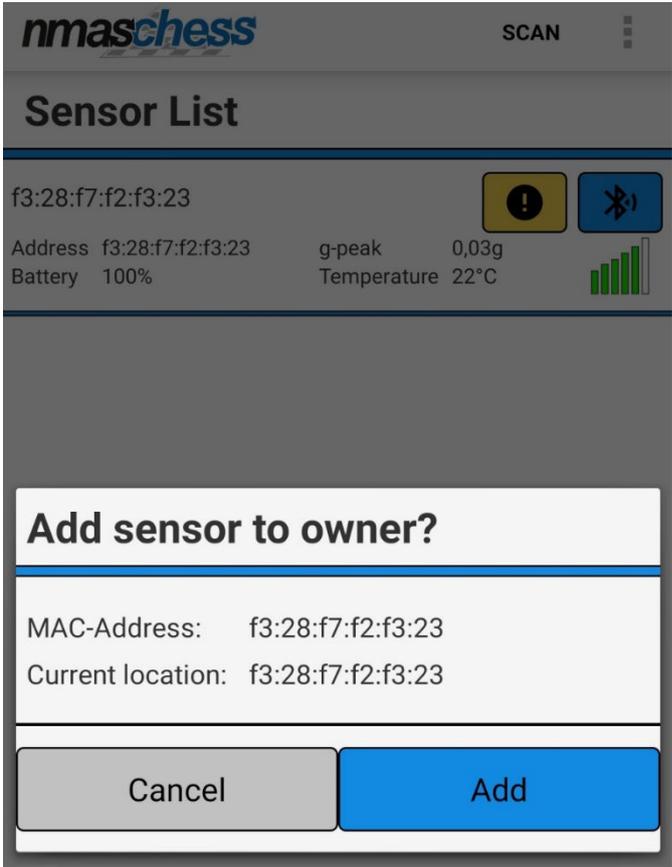
6. Sensor measurements

The sensors and the system is fully automated and users don't need the application to make measurements. Settings can be changed or measurements can be triggered manually if needed with the app using this guide.

The settings of a sensor can be changed from the Bluetooth-icon on the right side of a sensor's name. By pressing it you will be directed to a page which has the sensor's name, mac-address, a trend of the measurements done with the sensor and a time signal measurement plot. Trend value gathers data from the cloud to be shown in the graph. Arrow button besides is used to trigger measurements manually. The graph shows the recent manually triggered measurement. This measurement data will be sent to cloud as well.

The values shown on the trend are gpeak and the trend updates automatically as new measurements are done. The trend can also be updated manually with the button on the right side of the screen. Below the trend is latest database timestamp which shows the time of the last measurement that has been transferred to database. If there are warning- and alarm-limits set for this location, those will be shown on the trend.

A time signal measurement can be performed by pressing the button on the right side of the screen. A plot will be drawn on the graph shown in the picture, time is shown in the horizontal axis and amplitude of the movement on vertical axis. Values of a point chosen in the graph can be shown below the graph.

If there is no data in the database, message: "No data found in database" will appear on the screen. If there is no connection to the database, message:
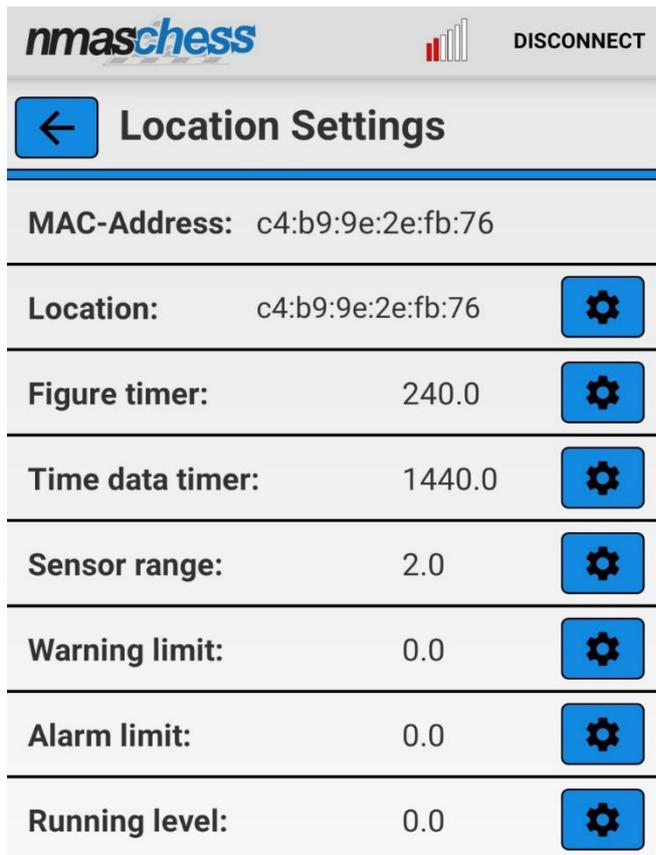
"Couldn't access database! Check connection and settings!" will appear on the screen.

When the measurement has been delivered to the database, message: "Data sent succesfully" will appear on the screen. If this message doesn't appear and the timestamp below the trend doesn't update, the measurement hasn't been transferred. In this case check your settings and contact the supplier if necessary. Is the transfer fails because of lack of internet connection, the app will store the measurements and send them automatically when the connection has been restored.

Name of the location and other settings can be changed by pressing the gear-button on the top of screen.

7. Changing the name of the location and other settings

Name of the sensor and other settings can be changed from the following window.

On this page you can see the sensor's mac-address, location name and settings for the measurements. Name and settings can be changed from the gear buttons on the right side of the screen. By pressing a gear-button, a field will appear where you can type the values. By pressing the location-field, a list of all the names already given in that database is shown. Other settings that can be changed are:

- Figure timer: Statistical max value measurement interval, in minutes
- Time data timer: Time signal measurement interval, in minutes
- Sensor range: Measuring range, units g*
- Warning limit: Warning limit, units g

- Alarm limit: Alarm limit, units g
- Running level: A threshold that must be exceeded for the sensor to make measurements, units g
*Choosable options are 1–4 (1=-2 - +2, 2=-4 - +4, 3=-8 - +8, 4=-16 - +16)

If there is difference in set limits between the sensor and database, following window will appear on the sensor measurement page.
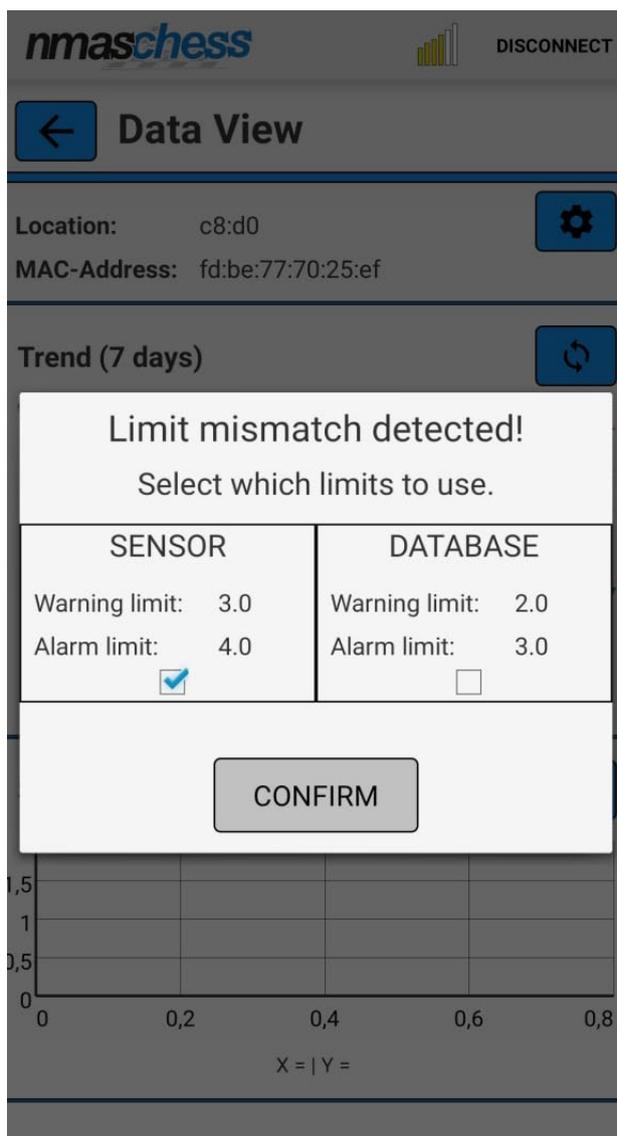
In this case you must choose which limits will be used. When a location is given limits, they will also update on the database. If a sensor is changed to other location, the limits will come from that locations database.

8. Gateway mode

You can enter gateway mode from the three dots on the top right corner of the sensor list page. There you can use your own device as a gateway to send measuring data. All sensors that you are connected to are shown on the gateway page, along the status of transfers at that point.
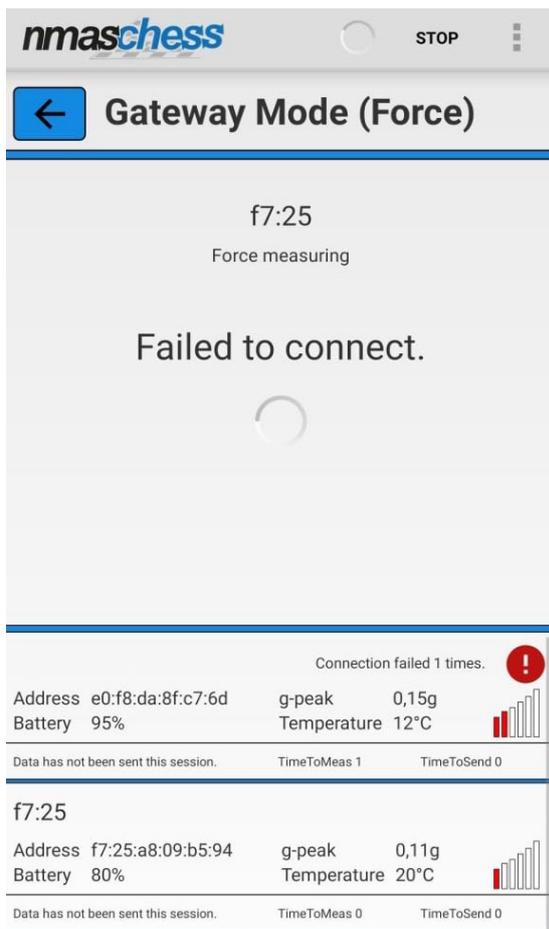
A red exclamation mark will show up if a sensor can't be connected to. Force-mode can be selected from the three dots on the top right corner, where the measuring interval can be changed to more frequent than in the normal settings page.

9. Mounting the sensor

When choosing the measuring point the properties of the machine and the best possible contact point for the sensor should be considered. The source of vibration may vary with different machines, which changes the best measuring point. The measuring point should be chosen so that the sensor is as close as possible to the source of vibration. High frequency vibration loses energy in every boundary layer and therefore there should be as few of them as possible between the sensor and the source of vibration. Bearing points are often good measuring points. Vibration measurements are usually done in radial direction but in some cases axial direction may be preferred.

To achieve best possible measurement quality, the contact surface in the machine should be completely flat and smooth and have larger area than the base of the sensor. The best way to mount the sensor is with the M8 fastener in the base of the sensor to a threaded hole in the body of the machine.

If it is not possible to drill a hole to the measuring point, adhesive mounting is a good alternative. In this way a mounting base disk is mounted to the body of the machine with adhesive, and the sensor is mounted to the disk with the M8 fastener.

The mounting disk and adhesive are available as accessories.
Other mounting techniques can be inquired when ordering the device.

9.1 Mounting the sensor with M8 fastener

Attaching the sensor directly to machine surface with M8 fastener minimizes the loss of vibrations to boundary surfaces, thus guaranteeing the best possible quality for measurements. A flat surface of at least 40 mm in diameter is needed and in the middle of the surface a 7 mm deep threaded hole for the M8 fastener.

Phases of mounting:

1. Make sure of the following: The surface is flat and smooth, enough area for mounting, dimensions and threading for the hole.
2. Clean the mounting surface.
3. Apply threadlocker to the sensor's fastener.
4. Install sensor to machine surface.
5. Tighten the sensor to a hand-tight position (4 Nm)
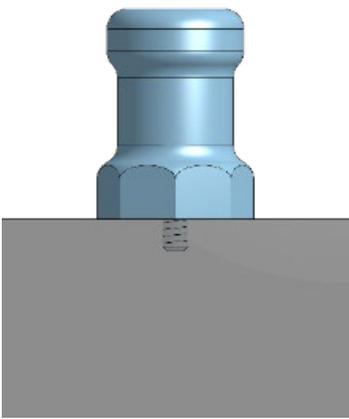
9.2 Mounting the sensor with adhesive

The use of adhesive mounting is advisable when it is not possible to drill a hole to the measuring point. A flat surface of at least 40 mm in diameter is needed for the installation.

Phases of mounting:

1. Make sure the surface is flat and smooth and has enough area for mounting.
2. Clean the mounting surface.
3. Place a small portion of adhesive on the underside of the mounting base.
4. Firmly press down the mounting disk to mounting area to force the adhesive out from under the disk.
5. Hold disk onto surface until the adhesive can support the weight of the mounting disk. Allow full cure for adhesive.
6. Apply threadlocker to the sensor's fastener.
7. Install the sensor to the mounting base with the M8 fastener. Tighten the sensor to a hand-tight position (4 Nm)
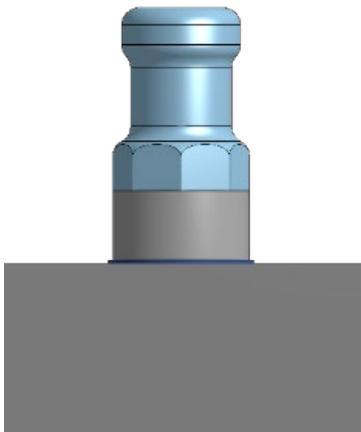
9.3 Mounting with base magnet

Attaching the sensor with a magnetic base may be advisable if there may be a need to move the sensor after initial installation. The quality of the measurements will not be quite as good with magnetic mounting, so it should be used only if necessary. A flat surface of at least 40 mm in diameter is needed for the installation.

Phases of mounting:

1. Make sure the surface is flat and smooth and has enough area for mounting.
2. Clean the mounting surface.
3. Apply threadlocker to the sensor's fastener.
4. Install sensor to magnetic base.
5. Tighten the sensor to a hand-tight position (4 Nm)
6. Place the magnet to the measuring point so that the magnet does not slam to the surface.
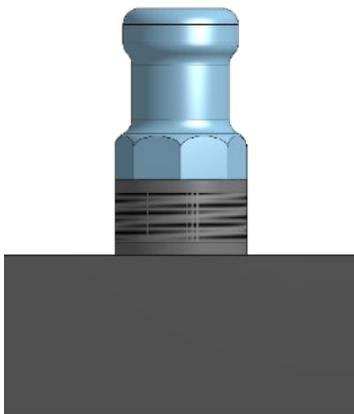
10. Router installation

The router is connected to sensors via Bluetooth connection and sends data to cloud database using cellular network (LTE-M).

The Bluetooth signal is functional up to 40m line sight but various circumstances such as weather and obstacles may reduce the signal.
The router is supposed to be plugged in to a power outlet with the provided power supply and usb-cable. Alternatively, you can connect the usb-cable straight to a 5 VDC power supply. Optional IP67 rated power supply 230 VAC -> 5 VDC is available. Ask for this alternative if you cannot use one of the other options.

Once powered on the router starts operating automatically.

Weak pulsating green light in the startup means the router is trying to connect to network. If the green light does not change to bright pulsating blue light, move the sensor to an area with better connection to cellular network.

Blue pulsating light in three second periods means that the router is connected to cellular network and is ready to transfer data from the sensors within range.

Red light means that the SIM card may be dislocated or the router has other malfunction. This kind of situation can happen if the router has had a major impact. Please contact the supplier.

10. A step-by-step guide for installing the sensor and using the app for the first time

Here is a step-by-step guide for installing the sensor and using the app for the first time. This example can't be used for every case, but it gives good guidelines for making the first installation.

Step 1
Download and install Nmas Chess app according to section 3 of this manual.

Step 2
Log in to Nmas chess app with the account that has been created for you. If you don't have an account, you can create one for yourself at chess.nome.fi if you have the key needed for creating an account. If you don't have the key, contact the person within your company who has the key.

Step 3
Take the sensor from its package and check if it appears on the sensor list in the app. Register that sensor to your company from the yellow exclamation mark according to section 5 of this manual.

Step 4
Go to that sensor's settings page by pressing the blue Bluetooth-icon and the gear-icon on Data View-page.

Step 5
On the settings-page, press the gear-icon at the right side of location. Fill the text field with the location you are going to use, for example Motor 1 De X. You can change other settings if you want, but all settings are preset so that the sensor can perform measurements without needing any changes.

Step 6.

Take the router, usb-cable and power supply from the package. Place the router as close as possible to the sensors and plug the power cable.

Step 8

Mount the sensor to the machine that is going to be monitored with a mounting method of your choice. The recommended methods are using the M8 fastener (manual section 9.1), or adhesive mounting (section 9.2) if the M8 fastener can't be used in your case.

Step 9

Now the sensor and router are ready for operation. The sensor will perform measurements and send them to your database, where you can see the results. Perform the same steps for your other sensors and you are finished. If problems occur in some step, check that you have performed the previous steps correctly. If needed, contact the supplier.