



Installation Guide pureFAMILY



Content

Installation guide and description of the pureFAMILY product platform. Covers functionality, detailed technical description and a complete description of how to install the system.

pureSignal

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Installation Guide – pureFAMILY

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General description of pureFAMILY product platform

General description

The pureFAMILY platform is a collection of sensors, gateways and software services provided by pureSignal of Sweden AB.

The platform consists of:

- Sensors – pureMEMS three-axis accelerometer with temperature. purePULSE for machine speed measurement.
- Lubrication – Integration of STAR VARIO Long Range (LoRa) devices developed by perma-tec GmbH & Co. This product is named as pureALUBE on the pureSignal platform.
- pureGATE (Gateway) – LoRa to Ethernet, WiFi or LTE
- Application Software – pureCloud. Mobile and desktop app for presentation of data and configuration as well as integration to open API.

New products and additional sensors are continually being developed to complement the pureFAMILY. The pureGATE, pureMEMS and purePULSE products can be remotely updated with later released features on request to service@puresignal.se.

For more information about our products, please contact your local distributor or email info@puresignal.se.

Data sheets and other general information are published on the website www.puresignal.se.

Support and service enquiries can be sent to service@puresignal.se and sales enquiries to info@puresignal.se.

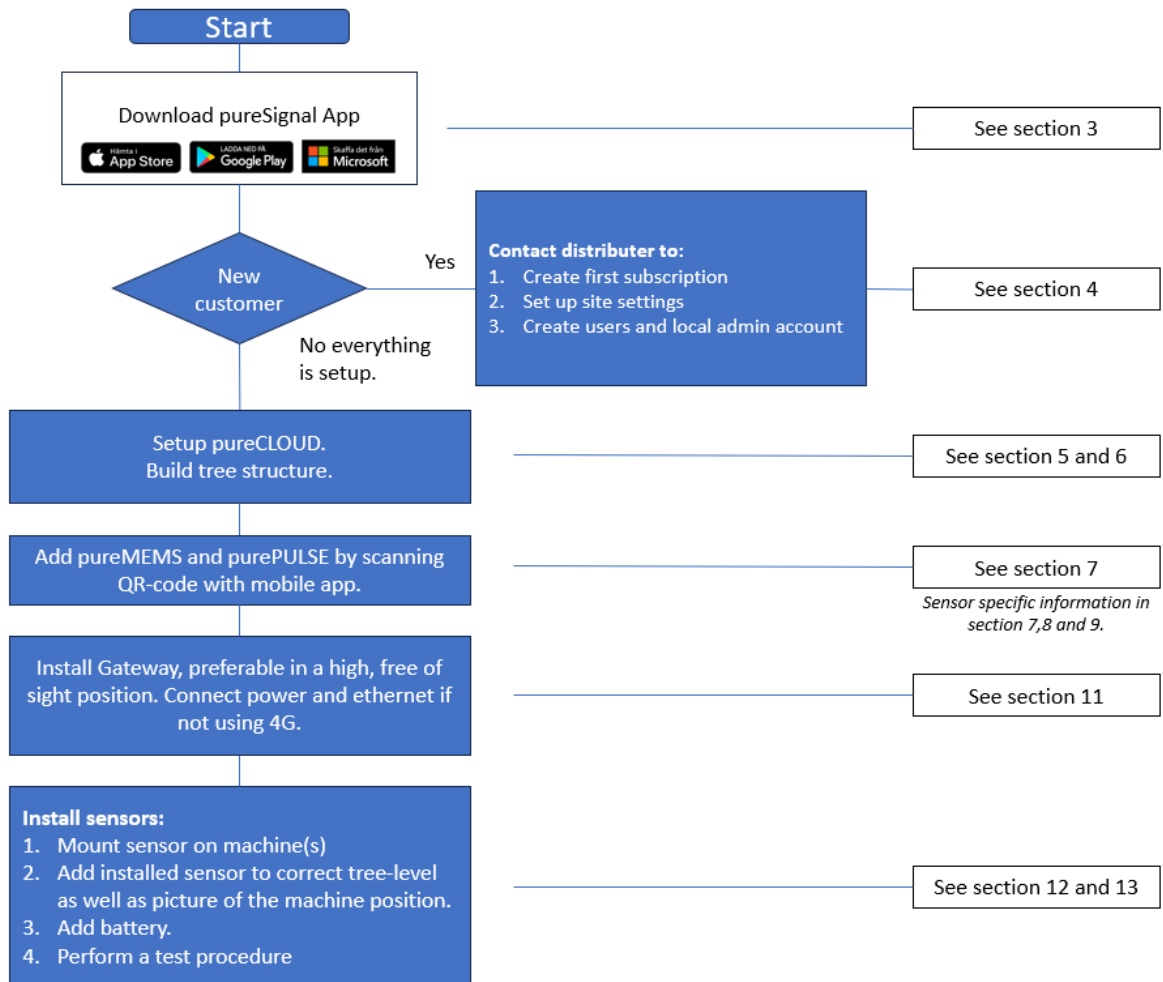
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1. Installation - The big picture

Below is an overview of the different installation steps needed to get started with wireless monitoring of your facility.



2. Wireless Data Communication

2.1 LoRa radio

Data is transmitted from sensors to the gateway using LoRa radio communication. LoRa (Long Range) is the radio signal that carries the data, and LoRaWAN is the communication protocol that controls and defines how the data is communicated across the network.

The key benefits of LoRa radio are that it provides low-power, long-range, low-cost connectivity for devices that don't require high data rates and is a great option when cellular is too expensive or Wi-Fi coverage is not available.

Some of the best uses are

Agriculture: With a long range that provides reliability in rural applications for devices that do not have a high data rate, LoRaWAN perfectly supports agricultural use cases.

Assets and logistics: Network-based positioning and tracking capabilities at low cost and optimised battery life make LoRaWAN suitable for assets and logistics.

Smart metering: LoRaWAN's ability to reach sensors that monitor underground utilities makes it a good connectivity choice for smart metering.

Smart home: The ability to pass through obstructions such as walls and the ability to support battery-powered, low data-consumption applications that can be used in smart homes make this connectivity option attractive.

Healthcare: IoT solutions using LoRa-based hardware can monitor high-risk patients or systems 24/7, ensuring that health and medical safety are managed comprehensively.

Industrial: Industrial IoT is transforming operations by digitising legacy processes and equipment, increasing profits, reducing costs and maximising efficiency. LoRa-enabled devices and sensors capture real-time data to provide critical insights into predictive maintenance, machine health, efficiency, reduced downtime and more.

pureSignal sensors must use a pureSignal gateway for full functionality and to manage sensor settings such as alarm levels, transmit time waveform, create tree structures, etc. The pureGATE, pureMEMS and purePULSE products can be manually switched (from the app) between a private LoRa network frequency and a public network frequency (868MHz). The private network is useful when other public LoRa sensors from other manufacturers interfere with the data transmission of pureSignal sensors. The public frequency is preferred when STAR Vario (pureALUBE) sensors need to transmit data to pureCLOUD through the same gateway. The functionality in pureCLOUD is the same in both networks. By default, pureSignal delivers sensors on public frequency.

A third party gateway limits features such as time waveform transmission, configuration of sensor settings and the inability to update firmware on all products.

The sensors (pureMEMS and purePULSE) can also be set to hybrid mode. In hybrid mode, the sensors operate in private mode by default, but send trend values in public frequency in parallel.

The upload request starts with the sensor asking for permission to upload to pureCLOUD via the gateway. If permission is granted, the upload continues, otherwise the attempt is stopped and a new attempt can be made later. This is the normal way, but the gateway has an option to work

with local storage, which makes the gateway less sensitive to network problems with pureCLOUD and can store data locally until the connection is re-established.

The next step is for the device to send test packets in different radio modes to test reception, and the gateway will ask for the mode with the optimised signal strength. The three different modes used are (1) DR7 (also known as FSK), which is the fastest but has a much shorter range; (2) DR6, which is slower but has a better range; and (3) DR5, which is the slowest rate but has a much better range. In good outdoor conditions (open air or line of sight) the range can be up to 20km. If none of the radio modes are good enough, the radio transmission is interrupted to conserve battery power until a gateway is available within range.

The sensor uploads all data and the gateway may ask for increased transmission strength and/or lower DR if signal strength appears to be poor. If contact between the sensor and the gateway is lost for too long, the upload is aborted completely.

If the upload is successful, the data is stored in pureCLOUD and visualised in the application or accessed via an open API. If the upload is interrupted or fails, it will be retried with an adjustable delay (default 5 minutes) and adjustable number of retries (including the first one, default 12).

An upload with default settings (measuring three axes, time waveform 2 seconds and 12800 sampling rate) takes approximately 1 minute in DR7, 2 minutes in DR6 and 4 minutes in DR5.



At the moment pureSignal sensors can ONLY be installed in the LoRa radio network in Europe using the 863-870 MHz frequency band. For sensors with frequency ranges for other markets, please contact info@puresignal.se.

Radio channels

pureSignal primarily uses standard LoRa channels, with some modifications. The relevant legal text is document 2017/1483/EU, specifically bands 47, 48, and 54.

Channel	MHz	DR
0	868,1	0 – 5
1	868,3	0 – 5
2	868.5	0 – 5
3	867.1	0 – 5
4	867,5	0 – 5
5	867,7	0 – 5
6	867,7	0 – 5
7	867,9	0 – 5
8	868,3	6 (250 kHz BW)
9	866,9	7 (FSK)
Fallback	869,525	0

2.2 OpenAPI integration

For those customers who wish to read data from their own sensor, pureSignal offers an openAPI implementation directly from pureCLOUD. This makes it possible to create a customised visualisation or integrate into an existing system. Both pureCLOUD and the optional add-on software pureCLOUD expert read in the same way via the open API. Accessible data includes trends, time waveforms, machine images and more. Full API documentation is available to authorised users.



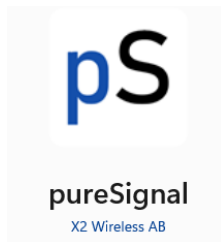
In order to establish an API connection, a special user account must be created. Please contact pureSignal for API documentation. Send an email to info@puresignal.se.

3. Download pureSignal application

pureCLOUD application is available on following platforms:

- iOS - App Store
- Microsoft Store - Microsoft Apps
- Android Apps on Google Play

Search for: pureSignal



iOS - App Store



<https://apps.apple.com/se/app/puresignal/id6470798306>

Microsoft Store - Microsoft Apps



<https://www.microsoft.com/store/productId/9P2R6CC11XDD?ocid=pdfshare>

Android Apps on Google Play



https://play.google.com/store/apps/details?id=com.x2wireless.PureSignal&pcampaignid=web_share

4. New subscriptions, sites and first user accounts

pureSignal recommends that all new subscriptions/ customer accounts and local administrator users are created either by the local distributor or by contacting the pureSignal sales team. Additional users can then be created by the local customer administrator account. At least one customer account should have local administrator authentication. The administrator account can change settings and create and manage other local users. The local administrator can also configure software settings such as sensor configuration, building the tree structure and creating new sites within subscription.

The following customer information is required in order to create a new customer:

- Subscription/ customer name.
- Subscription/ customer site name/-s.
- Local administrator's full name.
- Local administrator's email.
- Local administrator's phone number.

Push notifications, such as alarms or other related notifications, can be sent to the mobile application as push to app, SMS and/or email. This information must be entered for the account to be able to receive push notifications.



The user password can be reset on logon page.

5. Setup of pureSignal app - Subscription

Log in to the pureSignal application using your credentials. To make changes to the application, your account must have administrator rights. See section 4 for more information. If you require a local administrator account please contact your local distributor. A subscription is the top of the hierarchy in the application and it is possible to add multiple sites, gateways, sensors and users underneath them. Users can join more than one subscription with invitation code. This is a useful if a user needs be able to administrate or “own” more than one subscription otherwise it's more common that users only join sites in other subscriptions.

User accounts can also have different permissions on each subscriptions and sites.

5.1 Subscription description

Subscription can be compared to “Company/ Customer”. In this manual, both names are used depending on the content. To access the subscription settings, click on the cogwheel icon in the top right-hand corner of the main application view.



Customer and user settings



Next, scroll down to Subscriptions (Manage subscriptions). For those subscriptions that your user has joined to will be presented in first view as “shortcut” else you will find all subscription from manage subscription menu. Click on this button and select the subscription that you would like to edit.

From this page, you can edit the settings for your current subscription. At the top of the page, you can edit details such as your address and contact information. In the middle, you can see the “Reseller” (distributor/parent node) for the current subscription. Administrators from the parent node can join subscriptions below their own if they wish.

5.2 Manage gateway and sensors

From the “Equipment” menu, you can manage gateways and devices/sensors. The “Manage devices” menu can also be found under site settings and may be easily confused with the “Equipment” menu. There are more options for managing devices here, but it will also require the highest level of administrative rights. The option to move devices to and from sites is also accessible from “Site Settings” menu, the rest is only accessible from here.

Equipment

-  **Manage gateways** >
-  **Manage devices** >

Equipment

Manage Gateways

The initial setup of gateways is done in the “Manage gateways” menu and is usually carried out by someone with expertise, such as your local distributor. Most gateways are preconfigured at the point of delivery by pureSignal, so no changes are required.

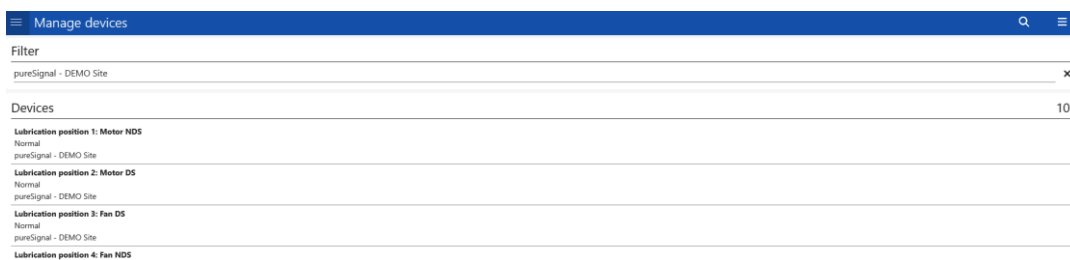
Manage Devices

Click the “Manage devices” button to access the device administration centre. First, click on the text “Select site” to filter out the sensors you are interested in. From this view, you can view sensors that are “not assigned to any site”, gateways, or sensors from a specific site. By default the “Manage devices” administration view is active, and the other administration options can be accessed via the options menu in the top right-hand corner.

Administration option -> Manage devices

In this view you can:

- Rename sensors.
- See technical data for sensors.
- Inherit data from another sensor. The icon is located in the top right corner.
- Add/ move sensors between sites in same subscription.



Manage devices		Q	≡
Filter			
pureSignal - DEMO Site			x
Devices			10
Lubrication position 1: Motor NDS			
Normal			
pureSignal - DEMO Site			
Lubrication position 2: Motor DS			
Normal			
pureSignal - DEMO Site			
Lubrication position 3: Fan DS			
Normal			
pureSignal - DEMO Site			
Lubrication position 4: Fan NDS			

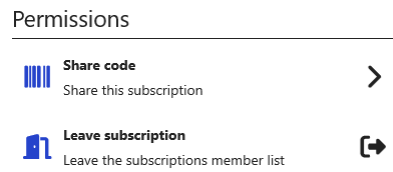
Manage devices

Administration option -> Export to email

Send technical information about the sensors to an email address.

5.3 Permissions to subscription

A user can be included in more than one subscription, but this doesn't automatically grant them access to all the sites below that subscription. From this view, you can join or leave subscriptions.



Permissions

5.4 Under Subscriptions

From here, you can access other subscriptions and sites below your own subscription. The application is built like a pyramid, with parent-child relationships continuing until the bottom of the pyramid. Depending on the number of children, the bottom will appear first when there are no more children present.



Under subscriptions

5.5 Sites

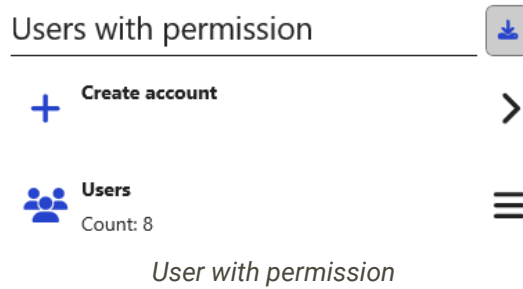
Here you can access create new sites and access settings for other sites. Sensors and user are usually connected to a specific site.



Under subscriptions

5.6 Users with permission

Here, you can create new users and manage those belonging to your subscription. Users created in this way are not automatically included in all sites within the subscription, but they can join any site in the same subscription if they wish. Ideally, users should only be added to one subscription, but they can join any other site using an invitation code.



Permission levels

There are three different user levels to which a new user can be assigned. These are *admin*, *standard user* and *simply user*. A user can change their own credential level if they have access to a higher level within the same subscription, so please be careful when selecting user levels. This installation guide will refer to these user levels in the following sections. The differences between each level are summarised below.

Admin: This is the highest possible level for end users. At this level, it is possible to change nearly all settings and view all technical details.

Standard user: This is a limited version of the admin level. Special settings are hidden and cannot be changed.

Simply user: This level only displays the most important data and features. Users can't change anything but can view trends and data sent from sensors.



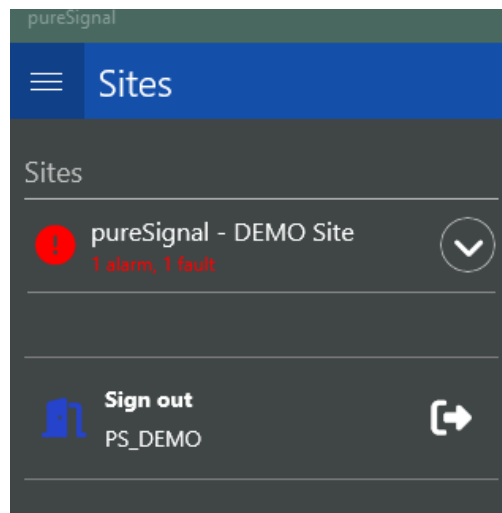
A user can change their credential level by them self if they have access to a higher level in the same subscription.

6. Setup of pureSignal app - Site

A site is a location or plant assigned to a subscription. Most subscriptions only have one assigned site, but second sites can be added for various reasons, such as to separate sensors/users, to differentiate between geographical locations, or to allocate to another department. The name of the site will appear in many places in the application, it is important to choose a good name that can include both company name and site location.

6.1 Site description

In the application, you will see a list of all your sites in the top left corner. This includes both your local sites, which are assigned to your subscription, and sites to which you have been invited. To access sites outside your subscription, you will need an invitation code created by someone with access to those sites. The subscription name is not visible in this view.



List of examples of your own sites

6.2 Customer and user settings

The customer and user settings can be accessed by clicking on the cogwheel icon on the main page. See the image below. Use the back arrow button to go back in the application.







Customer and user settings

All general settings are made here. Sensor and gateway settings are made directly at the sensor.













Account

User settings: These are the settings for your own account such as email, phone number, language and password. Click on *User settings* to find all the settings for your own account. It's important to enter your phone number and email if you want to receive alarm notifications.

Account

-  **User settings** >
-  **Alarm settings** >
pureSignal - DEMO
-  **Weekly reports** >
Choose what sites to receive weekly reports from
-  **Roles** >
Display all your roles

Account

-  **Username**
[Redacted]
-  **Email** [Redacted] 
-  **Phone number** [Redacted] 
-  **Password** >
Change password
-  **Language** 
English
-  **Show temperature in** 
Celsius
-  **Delete account** 
Delete your account and data

User settings

Alarm notification: Alarm notifications are configured manually for each account and have several different options. Please note the name of the selected site before a new alarm notification is created. If you want to add an alarm from another site, please select that site first before going to the alarm settings. The name of currently selected site will appear next to the text. Alarm notifications can be sent to the application (push), email and/or SMS. Note that each customer has a maximum number of sent SMS and email per month included in their pureCLOUD subscription.

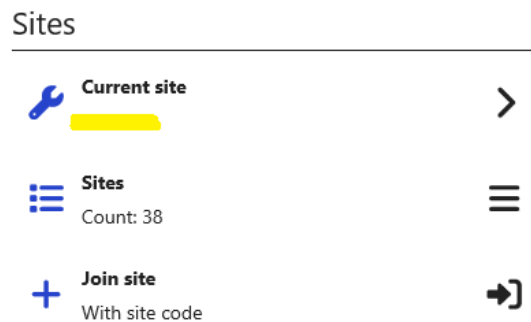
The image below shows an example of an alarm notification.



Example of alarm notification.

Sites

Current site: This is the currently selected site. Here you can edit information such as site name, address, and GPS location. It's also possible to add or remove sensors and create the tree structure for this site.



Sites

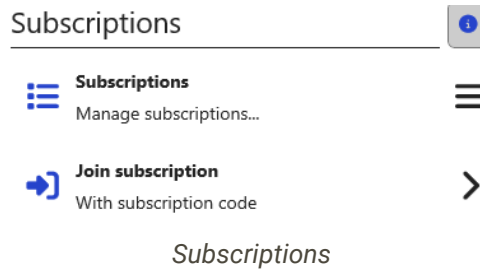
Sites: Quick link to another site/-s that your account has access to. The same sites can also be accessed via the subscriptions menu. See more info in section 5.

Join site: Join new sites. This requires a site code created by someone who has access to the requested site.

Subscriptions (*Subscription has the same functionality as Customer in pureCLOUD app*)

Subscriptions: Edit any subscriptions that your account has access to. Sites can also be accessed from here.

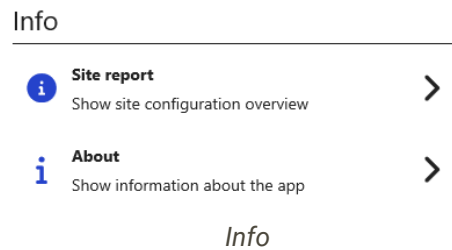
Join subscription: Join other subscriptions to your account. This requires a subscription code created by someone who has access to the subscription you are requesting. This won't give your account access to any sites in the newly joined subscription.



Info

Site report: A quick summary of actual selected site.

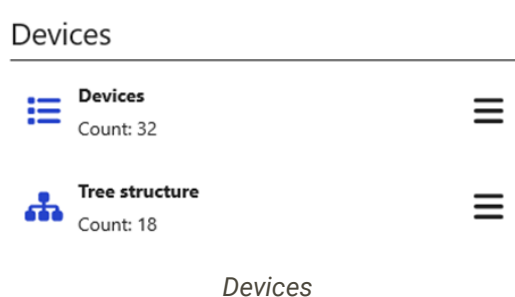
About: See actual version of installed pureSignal application.



6.3 Customer tree structure

First you need to select a site. Either via menu “Current site” or menu *subscriptions* (select another subscription) and continue to these sites (see section 5.4).

Devices: This menu displays all the sensors for the selected site. From this menu, you can manually move sensors to and from the current site. If you remove them, they will be moved to the customer sensor “pool” and can be moved to the same or other sites within the same subscription.



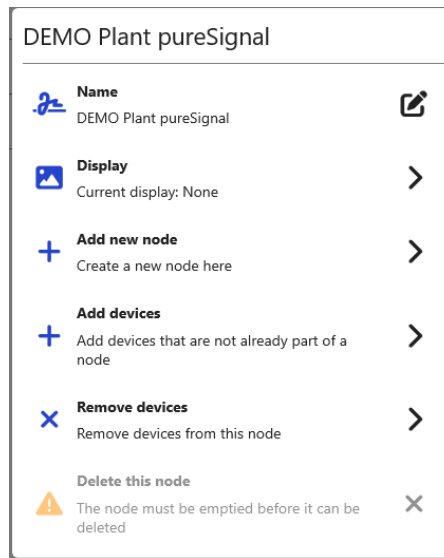
Only users with permissions to a subscription can scan new sensors into a site and remove sensors from subscriptions.

Tree structure: This is where you can configure the tree structure. The first time you click on “Tree structure”, you will only have one line at the top. Click on the options menu to the right to create a node underneath. This new node can represent a specific level in the tree, such as a

location or a machine name. Each new level can contain other nodes next to or below it. In the application, the node can be associated with a point on a map or an image uploaded by a user. See the image (Node settings) showing the options available for a node.

Only sensors that have been scanned at the site can be attached to the tree structure.

All devices must be removed from a node before it can be deleted.



Node settings

Sensors and nodes can be added in this view.

7. pureMEMS sensor

New sensors must first be “scanned” before they can be found in the pureSignal application. Once they have been scanned, they will be located in the top level of the customer’s structure, also known as the customer pool. The very first step is to scan the QR code with a mobile camera using the pureSignal application.

On your mobile device, go to Settings and select the current location where you want to add the sensors. Go to “Devices” and select “Scan QR Code”. The “Scan QR Code” option is only available on mobile devices and a QR code can be found on pureGATE, pureMEMS and purePULSE sensors.

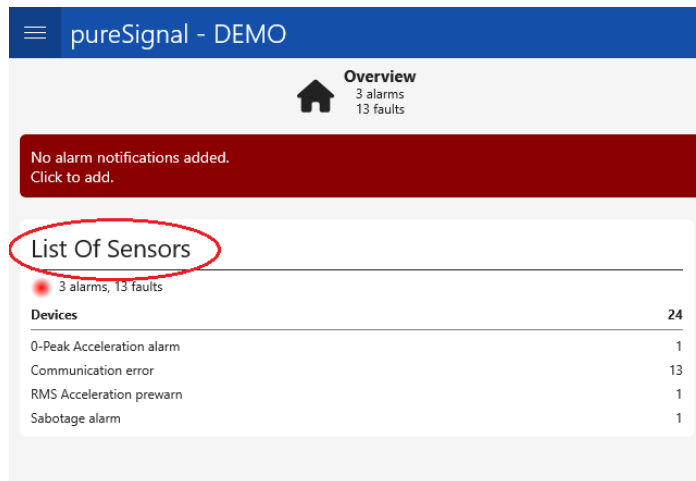
Sensors can be scanned one at a time or you can use the multi-scan option to add more sensors at the same time. For each sensor that is scanned, a green box will appear next to the scanning square along with a low pitched beep. If the box doesn’t turn green, the sensor cannot be added for some reason. This could be because the sensor is already connected to same or another subscriptions. Locate the sensor by searching for it and manually move it to the location where it belongs. It’s a good idea to give the sensor a name when you add it. If no name is entered, the sensor will have the same name as its serial number (MAC ID). The name can be changed later in the software. Note that the shortest name is 3 characters.

All newly added sensors are initially placed in the top structure level of the selected customer. If you have mixed sensors, use the standard mobile camera over the QR code and the serial number will appear on the screen.

Continue from section 6.3 and select “Add devices”. Add Device means that the sensor is moved to the desired location in the tree. Other pureSignal products like pureGATE can also be moved in the tree structure. It’s recommended to move gateways to a location close to the other sensors in the structure for better understanding.

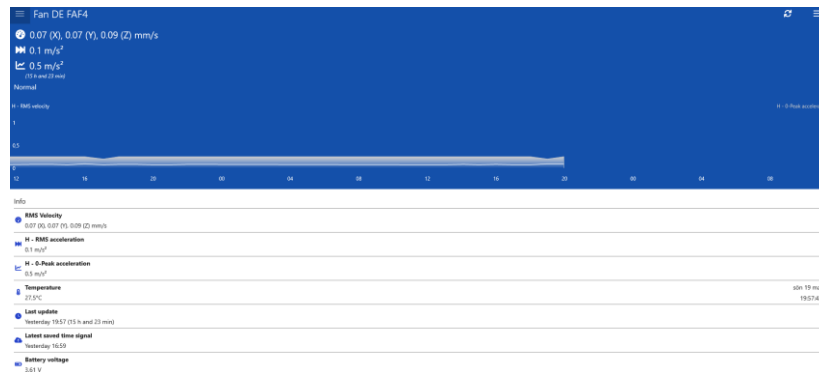
7.1 Sensor settings

Go to the main top view of the application. The tree structure, for all sensors is present below the text “List Of Sensors” in this picture. This text is possible to change in the site settings named “description”.



List of sensors

Click on the text “List of sensors”. After that, select a sensor from the list of sensors anywhere in the tree structure. The sensor page will display a trend graph at the top of the page and some of the measurement values and prioritised sensor information below depending on your account privileges.



Sensor view

Click on the icon in the top right corner of the page with three horizontal lines. This menu allows you to name the sensor and set the sensor settings depending on your account privileges.

The initial value of the sensor is shown inside the brackets, e.g. [-10°].

Lines marked with * are settings that can be linked using the “Linked Settings” menu. Linked settings are useful if you want sensors to measure at the same time stamp. This menu is located at machine level.

General

Name Name of the sensor

Location

Location	Free text for the placement.
Measurement position	A list that follows the ISO standard name of different sensor positions. This information is used by API integrations such as Artificial Intelligence.
Z-axis direction	Selection of the real sensor mounting direction (horizontal, vertical, or axial). The mounting direction will be present in pureCLOUD expert or other API integrations for all directions.
X-axis direction	Selection of the real sensor mounting direction (horizontal, vertical, or axial).
Y-axis direction	Selection of the real sensor mounting direction (horizontal, vertical, or axial).

Trends

Trend interval *	[180 min] Time interval for trend measurements of purePULSE and pureMEMS. After fulfilled measurement data will be transferred. (purePULSE can also store the data locally between these intervals).
HP-filter trend meas. velocity	[10 Hz] High pass filter for velocity trend. 2Hz or 10Hz.
HP-filter trend meas. acc.	[10 Hz] High pass filter for acceleration trend. 10Hz or 500Hz.
Trend measurement direct.	[XYZ] Measurement direction. XYZ, X, Y or Z.
Trend value settling time	[1000ms] Settling time before start of measurement.
Trend value measuring time	[1000ms] Measurement time.
Start time for trend meas. *	Start time stamp for trend measurement and is used when a specific time stamp is required.

Time signals (only present for pureMEMS)

Time signal interval *	[0 h] Time interval between raw time waveform measurements.
Start time for time signal.. *	[12:00] Time stamp used to start measuring the raw time signal.
Time Waveform length	[2000ms] the length of the measured raw time waveform.
Time waveform mea.. direction	[Z] Measurement direction for time waveform. XYZ, X, Y or Z.
Sampling frequency	[12800Hz] Sampling frequency of time waveform. 12800, 16384 or 25600Hz. Maximum sampling frequency is 25600Hz. (12800Hz and 16384Hz resampling is performed within the sensor to save data transfer time.)
Upload attempt interval	[5 min] Time between every attempt to upload time waveform to gateway.
Upload attempts	[12] Number of attempts to upload time waveform before it's cancelled.

RPM (Rotation Per Minute) (this is only present for purePULSE sensor)

The purePULSE has an interrupt function to wake at the first registered pulse when the machine starts rotating. Minimum recording speed for purePULSE is 5 RPM.

Interval between mea.	[600 sec/ 10 min] Time between each time the sensor wakes up and takes a measurement. All recorded measurements within the
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	same interval are transferred together, see "Trend measurement interval" setting.
	This interval time is also the first possible time at which the sensor can register that the machine has stopped. A shorter interval time will result in a more accurate trend and calculation of operating time, but will also result in a shorter battery life.
Required duration for RPM..	[30 sec] One of settings for "Required duration for RPM measurement" or "Required pulse amount for RPM measurement" must be met to complete a measurement.
Required pulse amount..	[25 pulses] See explanation of the setting just above (Required duration for RPM..). Depending on the speed of the machine, this can be changed for greater accuracy.
Number of mea. points per rev.	[1 trigger point] Number of trigger points generated by the magnet(s) per shaft revolution.
Deviation level for RPM mea.	[5 RPM] Minimum RPM deviation between two recordings that must be met in order to save the history data. If the deviation is less than the threshold, the data won't be processed in the sensor and won't appear in the history trend in pureCLOUD.

Alarms

purePULSE sensor Unic:

Upper alarm limit RPM	[Disabled] Upper alarm limit RPM.
Lower alarm limit RPM	[Disabled] Lower alarm limit RPM.

pureMEMS sensor Unic:

Automatic time s. triggering	[OFF] Triggers for time waveform recordings. Triggers can be set from alarm level pre-warning, warning and alarm.
Alarm thresholds	[Not Set] Trigger thresholds based on trend tasks. Thresholds levels can be set based from pre-warning, warning and alarm. See more information in section 5.6.
Lower alarm limit temperature	[-10°] Lower alarm limit for temperature alarm.
Upper alarm limit temperature	[85°] Upper alarm limit for temperature alarm. 85° is the highest acceptable temperature for pureMEMS and purePULSE.

Included in both sensors:

Alarm limit battery voltage	[3,2] Lower alarm threshold for battery voltage. A voltage around 3,0V is recommended.
-----------------------------	--

Interval:

Timeout	[1440 min/ 24h] Sensor communication timeout. Specified in minutes and will result in a communication error notification in pureCLOUD.
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Technical info

This is only part of the technical information about the sensor. More information can be found in the LoRa Network section in Chapter 2.

Latest configuration data	Latest transmitted time stamp for sensor data configuration.
Latest frequency	Latest used frequency of the sensor.
Latest SF	Latest used SF (spread factor) value. Larger spreading factors mean larger processing gain. So, a signal modulated with a larger spreading factor can be received with less errors compared to a signal with a lower spreading factor and therefore travel a longer distance. For example, a signal modulated with the SF12 can travel a longer distance than a signal modulated with the SF7.
Measurement blocked	Number of time waveforms blocked by PureCloud
Resends	Number of resent time waveforms.
Signal Strength	0-100% GW: How well the sensor can hear the gateway. Dev: How well the sensor can hear the gateway.
Upload pending	Upload pending of time waveform.

7.2 Configuration of alarm threshold

Explanation of the automatic time waveform and alarm thresholds.

It's possible to configure three different settings for each trend measurement: "Prewarm + Warn + Alarm", "Warn + Alarm" or "Alarm". If a trend measurement is above the threshold, the sensor will automatically measure a time waveform. The sensor will stop measuring if the "Measurement blocked" time hasn't been reached. If sensors are linked in a group with other sensors, the measurement will be taken at the next possible time together with all the other sensors.

Automatic trigger of time waveform

The following table is used to set the appropriate alarm level. You can either use the ISO 10816-3 template or enter the values manually.

	Pre-warn	Warn	Alarm
H			
RMS Velocity (mm/s)	1,4	2,8	4,5
A			
RMS Velocity (mm/s)	1,4	2,8	4,5
V			
RMS Velocity (mm/s)	1,4	2,8	4,5
RMS Acceleration (m/s ²)	10	20	30
0-Peak acceleration (m/s ²)	10	20	30

Alarm thresholds

7.3 Sensor status

The software can display text notifications depending on the sensor status. These notifications can be found in different views in the application. Depending on the severity of the message, it will have different font colours.

Active status - list of examples that can be presented:

- **Everything is normal/ normal:** Sensor works in normal condition based on last measurement.
- **Communication error:** The sensor is currently not sending any data.
- **Temperature alarm:** Temperature alarm.
- **RMS Velocity pre-warn/ warning/ alarm:** RMS Velocity pre-warn/ warning/ alarm from last measurement compared to threshold limits.
- **RMS Acceleration pre-warn/ warning/ alarm:** RMS Acceleration pre-warn/ warning/ alarm from last measurement compared to threshold limits.
- **0-Peak Acceleration pre-warn/ warning/ alarm:** RMS Acceleration pre-warn/ warning/ alarm from last measurement compared to threshold limits.
- **Lubrication disabled:** Lubrication disabled of pureALUBE units.
- **Battery fault:** Battery below alarm threshold.

7.4 Presentation of measurement result

The pureSignal application includes the presentation of graphs of one or more measurements in the same graph. Alarm thresholds and averages can be shown or hidden in the graph. As an add-on software, pureCLOUD expert can present measurement data from pureSignal sensors as a higher-level expert software, including FFT, time waveform and cross-selection of data. Please contact your distributor to get access to pureCLOUD expert.

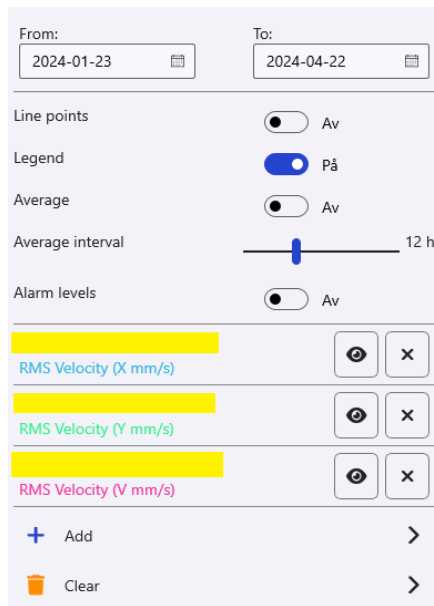
View sensor data:

Go to a freely selected sensor or click through the software to the main view. The trend display icon is shown in the image below. Different trends from the current sensor can be displayed in the graph.



Trend icons

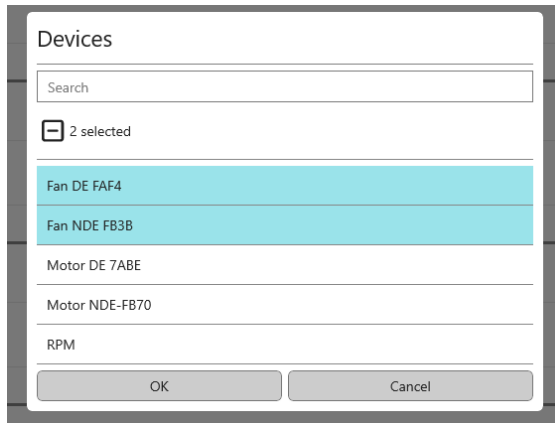
Locate the three horizontal lines in the top right corner. A new view will appear showing filters for the graph view. All selected measurements are listed one by one under the filter options. Any measurement can be temporarily hidden and other measurements from other machines can be included in the graph view.



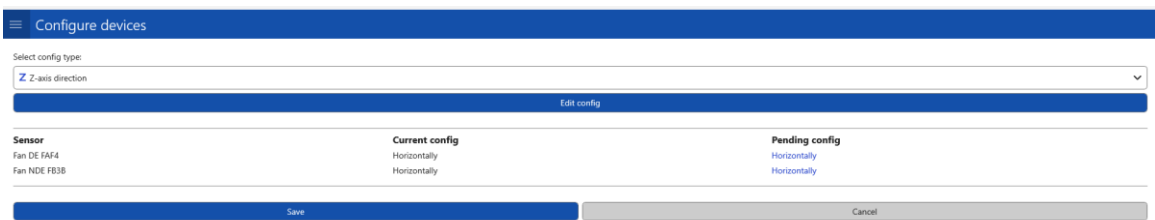
Graph filter

7.5 Multi-edit of sensors

Multi-edit is a feature in the software that allows you to edit the sensor settings for more than one sensor at a time. All the settings for the selected sensors will be in “Edit Config” and therefore some of the settings won't be applicable. This function can be found in the sensor list in the top right corner. The icon looks like two gears. The images below show examples of this configuration. Remember that all sensor settings will be transferred the next time the sensor wakes up. Don't forget to save your settings. Pending setting will be displayed in blue and settings that are transferred to sensors in black.



Select devices for multi edit



Multi edit view

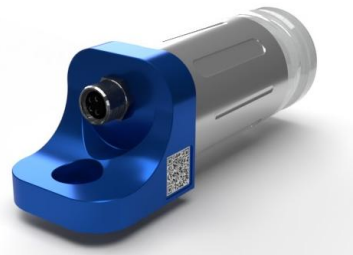
8. purePULSE sensor

The purePULSE sensor measures a true RPM value based on the shaft speed. The purePULSE sensor package includes the purePULSE sensor, sensor cable and trigger magnet. The purePULSE sensor has a built-in magnet that can be easily attached to a magnetic surface. Alternatively, the sensor can be attached with a screw. The outer diameter of the sensor trigger is 8 mm. The package also includes a trigger magnet embedded in a sled, this sled must be mounted somewhere on the rotating shaft.

The maximum distance between the sensor trigger and the rotating magnet is up to approximately 15mm, depending on the strength of the magnet. Other types of magnets can also be used.



The sensor settings are described in the previous section 7 of this manual.



purePULSE sensor



Sensor trigger

purePULSE features

- Measure a true RPM value based on shaft speed.
- Calculate machine uptime in the pureSignal application.
- Upper and lower alarm thresholds for notification in application/email/SMS.
- Speed ratio calculation of number of trigger points per revolution.
- Part of linked sensors in collaboration with other products in pureFAMILY.

- Wake up function on the first rotation of the shaft.
- Minimum speed limit to control other sensors in pureFAMILY.
- Adjustable delta value for data reduction.
- Local sensor storage of history data between transmission polling intervals.
- Synchronised trend measurement at the same time as other pureMEMS sensors in the same group.
- Easy installation and replaceable battery. Easy mounting and changeable battery.

9. pureALUBE unit

Automatic lubrication units from perma-cec GmbH & Co. (PERMA STAR VARIO Long Range) can be integrated into the pureSignal application. These units are designed to purge a small amount of grease every hour for a selectable period of time, such as 12 months, until the cartridge is empty. The electronic unit is fitted together with a grease cartridge. These come in fixed sizes of 60 cm³, 120 cm³, 250 cm³ and 500 cm³. Depending on the machine's speed and temperature, the discharge time and cartridge size will vary according to the machine's characteristics.

One of the features of the pureCLOUD application is that the Perma units can be paused when the machine is not running (see section 10 for further information). When the unit is paused, the display will show "--". The dispense time will be displayed if the unit is in automatic mode.

If the unit is manually forced to start automatic lubrication and the linking settings is enabled either directly on the unit or in the application, the unit will automatically switch off the next time the machine reports that it's not running.

Perma-Tec has complete documentation on its homepage. For more specific information, please visit <https://www.perma-tec.com/en>.

9.1 Installation and function

It is not possible to add the units to a site using the same scanning function as pureMEMS and purePULSE. The units are manually attached to specific customers by pureSignal personnel or your distributor at the time of delivery. For full integration into the application, a pureSignal gateway must be used; otherwise, the data from the Perma unit will not appear in the application. The gateway needs to be in "public" mode; see sections 2 and 11 for more information. While the Perma units do not have to be purchased directly from pureSignal, an administrative task must be completed for integration and visualisation into the application. Each unit has a unique security key that must be known in the pureCLOUD application. Please contact PureSignal if you need help installing the units; see the contact details at the beginning of this manual.

All sensors, including permanent units purchased elsewhere, incur a monthly cost to enable data presentation and control.

All Perma units have a fixed communication interval of one hour, during which the unit will 'sleep'. During this time, the application will send and update parameters such as cartridge size, last motor current, temperature and remaining lubricant. This data will be displayed and analysed in pureCLOUD in the same way as data from other sensors. Settings such as cartridge size and dispense time can be configured either directly on the unit or in the pureSignal application. If there are differences between the settings on the unit and in the application, you can always press the SET-button on the Perma unit (1 second) to force an upload of the settings from the unit to the application. This command is also an effective way to check connectivity between the unit and the gateway. Please note that this command will pause the unit so remember to activate the automatic lubrication afterwards.

Scan the QR code on the cartridge container to upload this information about the cartridge, such as its lubrication type and size, to the application.

The motor current will be measured each time the unit performs a purge. This is a good way to understand how the unit performs. A high current (the maximum is 250 mA) indicates a problem with the pipes between the unit and the bearing housing. Low current can indicate a broken pipe. Please follow this procedure to ensure secure automatic lubrication.

New batteries and new filled cartridges can be ordered from pureSignal or your distributor, see contact information in the beginning of this manual.

9.2 Commands

The device can receive two different commands: “extra purge” and “actual fill level”. These commands can be found in the application on the sensor view. You will find the icon (like an arrow) in the bottom right corner. Both commands will be sent at the next possible opportunity. The manual purge command performs an additional purge unit of 3+3+3 CM³. This command has the same function as holding the button (directly on the unit) down for 10 seconds.

If the battery is removed, the actual fill level in the unit will automatically be reset to 100%. Use the command “set actual fill level” if the cartridge is not full.

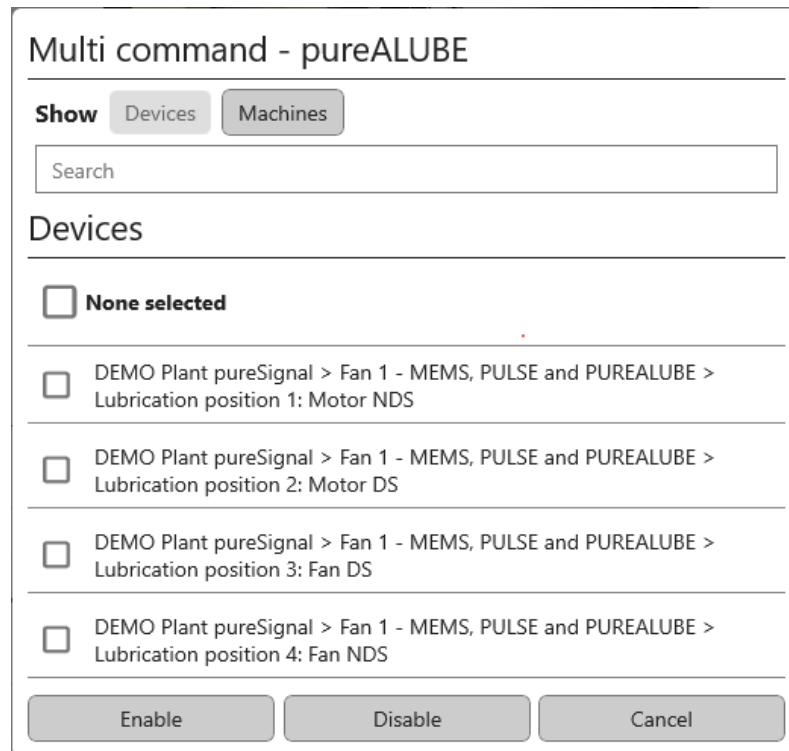
9.3 Multi command - pureALUBE

The Perma units can be switched on or off from a central location in the application. This is called “Multi Command – pureALUBE” and can be accessed via the “oil can” icon in the top right-hand corner. All Perma units on the current site can be configured in this view. The units can be selected either from a machine perspective or one by one.



Note that selecting “Multi command – pureALUBE” will override the settings in the ‘Linked sensors’ menu.

This command will permanently set the units to either automatic mode or paused. Note that all settings, such as “Verify operation machine” in the “Linked sensors” menu in section 10, will be overridden. This means that even if the machine is running, the units will be paused until they are enabled again.



Multi command - pureALUBE

9.4 Perma unit alarm thresholds

The Perma units have their own alarm thresholds and those in the PureCloud application. The application's alarm thresholds relate to temperature, motor current and remaining lubricant, and can be seen in the first picture below. These thresholds can be configured to provide early-stage warnings, and custom thresholds. The unit's alarms include error messages relating to motor current and remaining lubricant.

Alarms	
	Upper alarm limit temperature 50,0°C
	Lower alarm limit temperature 10,0°C
	Upper alarm limit motor current 150 mA
	Lower alarm limit motor current 20 mA
	Remaining lubricant level warning threshold 50 %
	Remaining lubricant level alarm threshold 10 %

Alarm threshold – pureCLOUD application

List of alarms from the perma unit itself is presented in the table below.

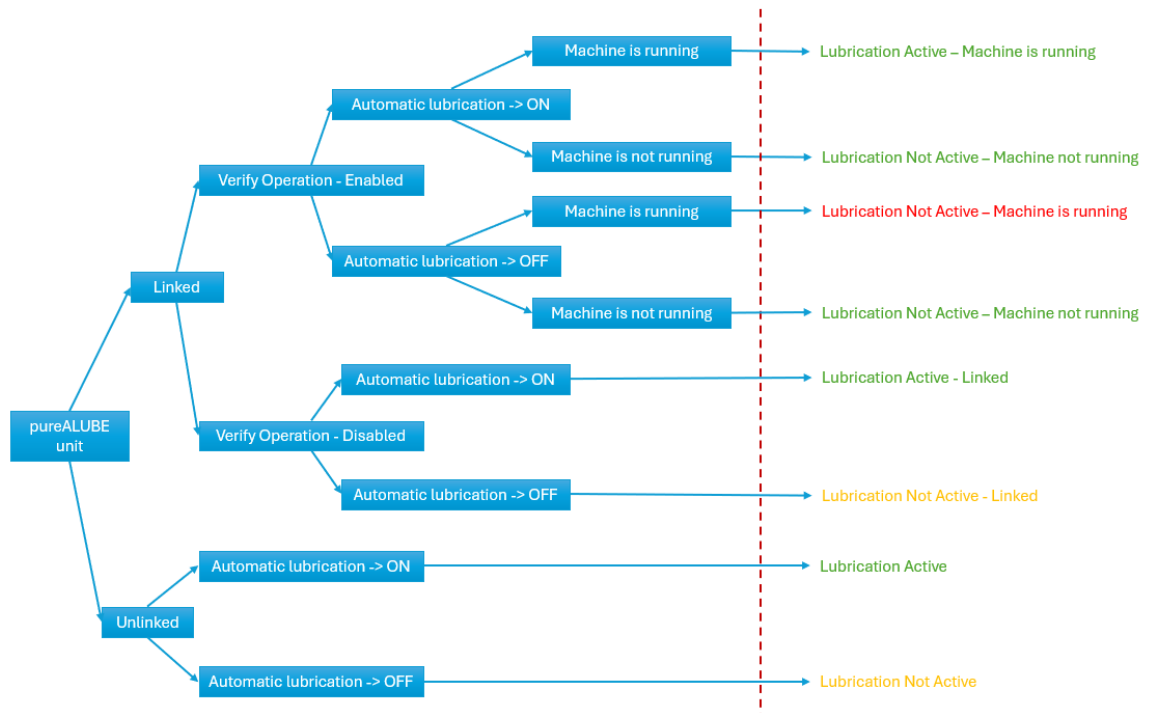
Error message	Description
Overload	Maximum motor current excided
Empty	Empty cartridge
Low battery	Low battery
Low temperature	Low temperature
LC mismatch	Cartridge does not match the unit.
No LC	No cartridge information available
Low motor current	Low motor current

Alarm – perma unit

9.5 Perma unit status text

In the pureCLOUD application, the Perma units display the current status of the automatic lubrication system. Find the actual status on the “Sensor View” page. Error messages from the unit itself will override this information.

The diagram below explains the process behind status text:



9.6 Perma unit sensor settings and technical information

You can access the unit's settings and technical information from the sensor view by clicking on the options menu in the top right-hand corner.

General

Name Name of the sensor

Location

Location Location text.

Lubrication settings (will be transferred to the unit at the next opportunity for communication)

Dispense time Select the dispense time until the container is empty. This is calculated by the unit itself and is proportional to the time and cartridge size.

Container Container/ cartridge size.

Alarm

Upper alarm limit temperature	[50°] Upper alarm limit temperature
Lower alarm limit temperature	[10°] Lower alarm limit temperature
Upper alarm limit motor current	[150mA] Upper alarm limit motor current
Lower alarm limit motor current	[20mA] Lower alarm limit motor current
Remaining lubricant level warning	[50%] Remaining lubricant level warning
Remaining lubricant level alarm	[10%] Remaining lubricant level alarm

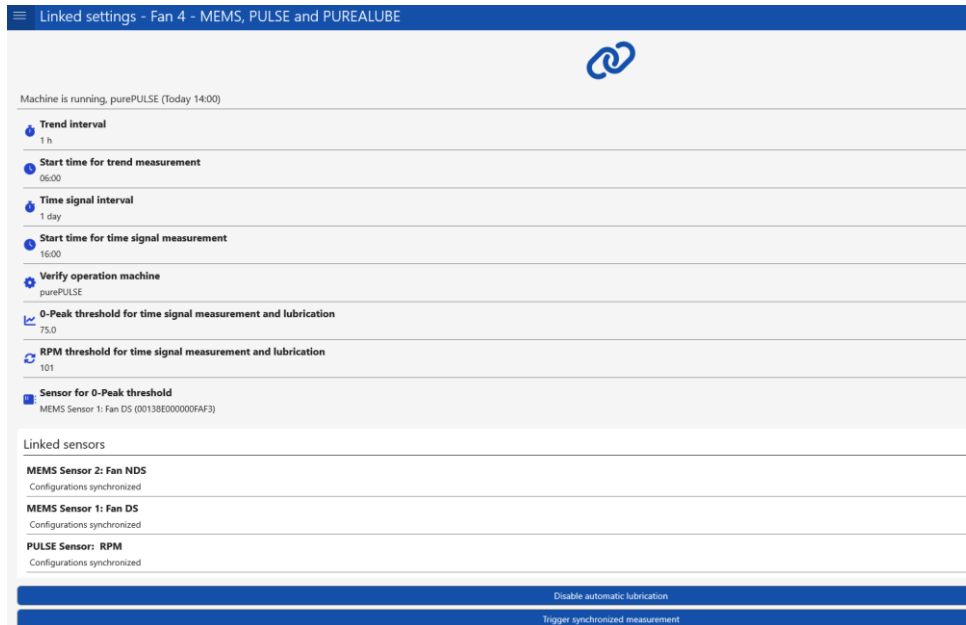
Technical information

Latest SF pureALUBE units always using SF12.

Signal strength 0-100% GW: How well the unit can hear the gateway. Dev: How well the unit can hear the gateway.

10. Linked sensors

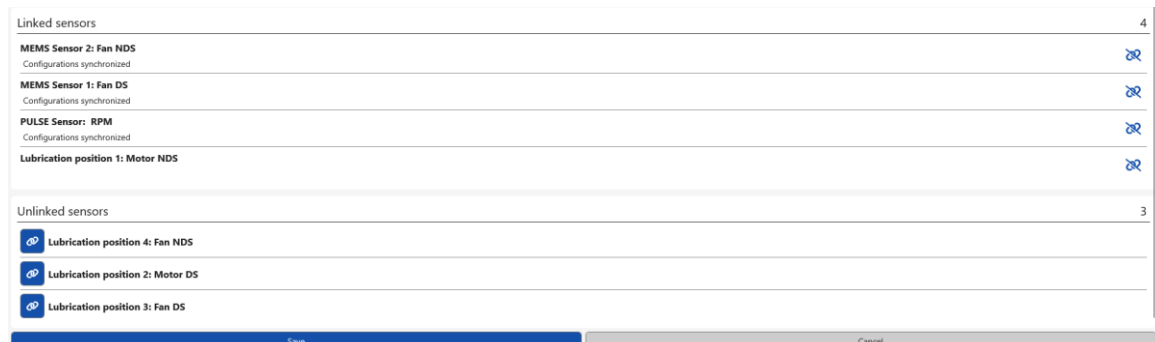
Sensors at the same level in the application can be grouped together. The icon, symbolised by two chain links and is located in the top right corner. This is referred to as “linked sensors” in the manual. New sensors imported into the application will operate as individual sensors by default.



Linked settings

The sensors to be linked must first be added to the group. To do this, click on the icon just before the sensor name in the “Unlinked sensors” list. To unlink a sensor, click on the icon to the right of its name. Save when you have finished.

A yellow chain icon will be displayed for sensors with a pending setting that hasn't been activated, otherwise it will be blue.



Linked sensors

Features of linked sensors

- Status text showing whether the last detected machine is running or not.
- Choice of PurePulse or 0-Peak Trend to check whether the machine is running.

- Ignores time waveform measurements.
- Pause lubrication of pureALUBE units.
- A triggered alarm from a sensor alarm threshold will trigger a time waveform measurement for all sensors within the group. Please note that all sensors will “sleep” between each task, meaning that the trigger will occur at the next possible time. This timestamp will be displayed at the top of the linked settings view.
- If a purePULSE sensor is included in the group, the pulse sensor will always take a measurement just before the pureMEMS sensors trigger their time waveform measurements. If the machine is not running, the pureMEMS sensor will ignore the measurement. When the machine is running, the measured RPM value is added to the time waveform data, which can be read in the API and visualised in third-party software. pureMEMS and purePULSE will always measure trend values independent of the threshold.

Settings of linked sensors

At the top of the page indicates whether the machine is running or not (if the operating settings are active).

Trend interval	A common trends interval for linked purePULSE and pureMEMS sensor.
Start time for trend mea..	A common start time for purePULSE and pureMEMS sensor.
Time signal interval	A common time waveform interval for all purePULSE and pureMEMS sensor.
Start time for time signal..	A common start time for time waveform for all purePULSE and pureMEMS sensor.
Verify operation machine	To activate “verify operation machine”, select one of the two options: purePULSE or 0-peak. If 0-peak is selected, a specific sensor must be chosen in the subsequent settings.
0-peak threshold for..	The 0-peak threshold value to detect if the machine is running or not.
RPM threshold for..	The RPM threshold value to detect if the machine is running or not.
Sensor for 0-Peak threshold	Select the sensor to be used to detect whether the machine is running or not. Only current if this option is selected earlier in this description of settings.

Buttons

Disable automatic lubrication	This command stops automatic lubrication even if the operating condition is met. This command can also be carried out in multiple selection of Perma units.
Trigger synchronized mea..	Manual trigger of all sensors inside the group. The measurement is triggered within approximately 1 second next possible time stamp. This time stamp will be displayed at the top of this view of linked settings.

11. Setup of pureGate

A special gateway called pureGATE from pureSignal is required to transfer data between sensors and the cloud. The package includes the gateway, LoRa antenna and a USB-C power adapter (5VDC 3A) suitable for most power outlets.

It's important to find a suitable location for the gateway to ensure good communication for both the LoRa radio network and the WiFi or LTE network. The LoRa network is a long-range network and data can be transmitted up to 5 km in the open air. A recommended installation position is high up in the building. In larger buildings, we recommend installing two gateways to achieve the best possible coverage of all sensors. One gateway at each end of the building. Sensor data is transmitted freely through any installed gateway.

The gateway can also be supplied in an industrialised cabinet (IP65) on request from your distributor.

If the sensors are mounted behind metal or concrete walls, the gateway needs to be placed closer to the sensors. An external LoRa antenna with higher strength may also be required in some cases (extension antenna can be ordered from your local distributor). The LoRa network is a long-range network and can transmit signals over much greater distances than Bluetooth or WiFi, at a slower transmission rate. A time waveform packet is transmitted in approximately 20-180 seconds, depending on the amount of data and the distance to the gateway. The standard data transmission time for a sensor with default settings is around 45 seconds.

pureSignal sensors don't need to be connected to a specific gateway. Communication is automatically routed through an available gateway. This allows the LoRa network to ensure high availability of data transmission. The number of sensors communicating through a specific gateway can be monitored in pureCLOUD.

It is recommended to add a second gateway when the number of sensors exceeds 50. This is to ensure high availability of data transmission with redundancy between gateways and also in case of system maintenance if one gateway has technical problems. There is no upper limit of the number of sensors that can be transmitted by a single gateway, the gateway will do its best to transmit the data. If the gateway doesn't have enough time to transfer data, the result will be missed data in pure cloud, especially if a large amount of time waveforms should be transferred. Trend data has much less data and can achieve higher availability with less number of gateways, so it depends on the specific installation of machine types and their characteristics. It also depends on the signal strength for faster data transfer in the LoRa network.

11.1 How to setup the pureGATE

In most cases, the gateway is prepared in the delivery package from your distributor. LTE or local LAN network (DHCP) is the easiest way to connect the gateway to pureCLOUD. Plug the gateway into the power socket, connect the LAN cable and it should be ready to use. If a SIM card is used, it may take up to 10 minutes for the gateway to connect to the Internet.

SIM cards supplied by pureSignal are securely protected behind a private network (VPN) and automatically provide roaming data within the EU. pureSignal personnel will also monitor these SIM cards monthly to ensure high connectivity and security.

In the next release of the pureCLOUD application, some of the settings will be configurable by authorized users. More information will follow, until then please contact your distributor.

General

Name	Name of the gateway
Description	Description of the gateway

Location:

Location (text)	Name of the gateway
Location (map tag)	Description of the gateway

Technical info (only the most important information is listed)

Gateway ID	Mac ID of the gateway. Same as the QR code on the back of the gateway.
LoRa Devices	Number of connected LoRa devices.
LoRa network mode	Public or private. See the information earlier in this document.
Signal strength	4G signal strength.
SIM card ID	SIM card ID.

12. Installation of pureMEMS sensor

The pureMEMS sensors are either screwed directly into the surface of the machine or into an adapter which is then screwed or glued to the surface of the machine. It is recommended that the sensor is screwed to the machine for best signal transfer to the pureMEMS. The pureMEMS is supplied with a M6x35 stainless steel screw. 1/4" 28 UNF x 1 1/2" is also available as an option.

Mounting in a flat surface

Find a surface on the machine that is flat enough to mount the sensor. The surface of the machine must be approximately 10mm in diameter for adequate signal transmission. If the surface is smaller, this will result in poorer signal performance.

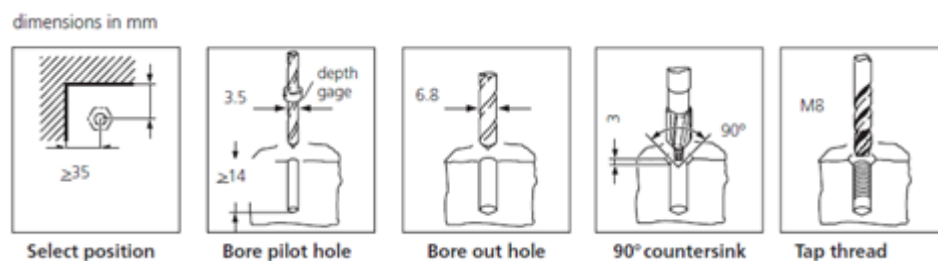
Use the supplied M6 threaded bolt. Start by drilling a pilot hole to a minimum depth of 8mm using a 5mm drill bit. Thread the hole with an M6 set screw. Clean the thread.

Fasten the sensor with the M6 screw and note the X, Y and Z directions to be entered in the pureSignal application.

Adapter mounting of M8x1,25 90° male conical

Mount the sensor using an M8 90° countersink to ensure good signal transmission. These holes are often pre-drilled on some machines and can be used for quick and easy installation. An adaptor can be ordered from your distributor to fit between the M6 screw and an M8 countersink hole.

The pictures show how to drill an M8 90° countersink hole.



M8 90° countersink hole

Extension adapters

Extension adapters are also available in 50mm and 100mm lengths. Using an extension adapter may be the only way to mount a sensor in a particular position. Note that an extension adapter can adversely affect vibration results. For example, trends may show higher levels than the actual values from the machine, depending on the conditions. In the pureSignal application, you can manually turn off the X, Y and Z directions if desired to avoid misleading data.

12.1 Battery installation / Battery replacement instructions

The battery type is 17330 and can be purchased from your distributor or from a local retailer.

Unscrew the tube from the sensor head. Carefully remove the old battery from the battery holder. Insert the new battery as shown. Check the condition of the seal before reinstalling the tube. Use hand force to screw the tube all the way in.

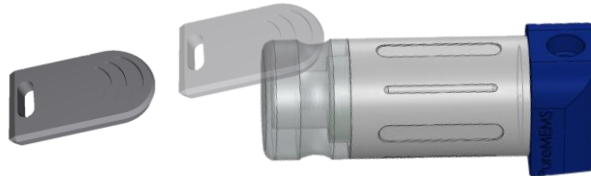


Battery orientation

The sensor will operate differently when the battery is inserted for the first time or when the battery is replaced. When the battery is inserted for the first time, the sensor immediately goes into “sleep mode”. Wake the sensor by manually triggering a measurement with a magnet or wait three hours with the battery inserted. The sensor will then start sending data to pureCLOUD. If the sensor has already been activated, the sensor will automatically perform a trend measurement and simultaneously update any new sensor settings from pureCLOUD. The result is displayed in the pureSignal app a few seconds after the measurement is completed.

13. Installation verification to verify installation

The easiest way to check the installation is to trigger a manual measurement using a magnet, as shown below. This will perform a standard trend measurement and a test to verify the connection of the sensor to the cloud. This works for both purePULSE and pureMEMS sensors. The values from the sensor should be displayed in the pureSignal application.



Test procedure

Hold the magnet against the end of the tube on the sensor. When the magnet is within the sensing range, the LED will illuminate solid blue. The magnet must be held for at least 5 seconds to trigger the trend measurement and the time waveform simultaneously. If the magnet is held for less than 5 seconds, the manual measurement is limited to trend measurement only (purePULSE can only perform trend measurement).



pureMEMS:

Number of triggered time signals per day may vary depending on sensor settings. This is a limitation of the allowed transmission time on the LoRa network. Trend measurements can always be triggered manually.

The time waveform (by default) is measured for 2 seconds in Z direction with a sampling rate of 12,8kHz.

The default setting for trend measurement is set to:

- *X direction: RMS velocity 10-1000Hz*
- *Y direction: RMS velocity 10-1000Hz*
- *Z direction: RMS velocity 10-1000Hz*
- *Z direction: RMS acceleration 10-6000Hz, 0-Peak acceleration 10-6000Hz.*
- *Temperature*

Evaluation of LED pureMEMS

If the magnet is held for at least 5 seconds, the diode will flash blue 3 times to indicate that the sensor has received the time waveform command. If the magnet is held for less than 5 seconds, the diode will turn off and the measurement will be limited to trend measurement.

If the LED flashes red, it indicates that the maximum number of triggered time waveform signals has been reached, based on the radio rules for the maximum transmission time per day on the LoRa network.

The LED is solid white during the time that time waveform data is being transmitted to the gateway. The transmission time varies depending on the sensor settings and the distance to the gateway. The LED starts flashing white when the sensor has either lost contact with the gateway or when data transmission is pending.

If alarm levels are configured, the LED will flash as appropriate:

Green = Ok

Yellow = Warning

Red = Alarm

The LED flashes green if no alarm levels are configured.



Configuration of sensor properties like alarm levels and facility machine tree structure is done by using pureSignal app. See separate chapter.

Evaluation of LED indications pureMEMS

The LED on the device is an RGB LED and different colours and patterns are used to indicate actual status.

COLOR	STATE	DESCRIPTION
Blue	Solid	The sensor has detected a magnet that is held close to tube.
Blue	Three flashes	A new time signal measurement is being performed.
Purple	Solid	Measurement in progress.
White	Solid	Upload in progress.
White	Three flashes	Upload successful.
White	Slowly flashing	Waiting for re-upload attempt.
Green	Flash 10 sec	Trend values below the configured thresholds.
Yellow	Flash 10 sec	Trend values above the warning and below the alarm threshold.
Red	Flash 10 sec	Trend values were above alarm threshold.
Red	Three flashes	Measurement is blocked.
Red	Six flashes	Upload failed.
Red	Short flash	Sensor failure. Flashes approximately every 4 seconds.

Evaluation of LED indications purePULSE

The LED on the unit is an RGB LED, and different colours and patterns are used to indicate the current status.

COLOR	STATE	DESCRIPTION
Blue	Solid	The sensor has detected a magnet that is held close to the tube.
Purple	Solid	Measurement in progress.
Green	Flash 10 sec	Trend values were below set thresholds.

14. List of accessories/ spare parts

List of accessories that are compatible with pureSignal products. If the products you are looking for are not listed, please contact pureSignal directly.

ARTICLE NR	TITLE	DESCRIPTION
PS1028	Manual Trigger	Original trigger magnet with plastic cover
PS1011	High-performance battery	SAFT LS17330, 3,6V. High-performance battery
PS1040	Loctite 454	Glue for attachment of flat studs etc.
PS1031	Omnidirectional antenna	Long Range (LoRa) omnidirectional antenna for indoor or outdoor use. 500x20mm including fastening brackets. SMA connection direct to gateway. Frequency band 865-870 MHz and 915 MHz.
PS	Gateway cabinet IP65	Built-in cabinet. Gray plastic case. Size 200x300x132 (mm). IP65. Connection to terminal 240VAC. External antenna for LoRa and 4G.
PS1038	Screw M6 A4 M6x35	Standard screw M6 A4 M6x35 for pureMEMS. Stainless steel.
PS1019	Screw M6 A4 M6x40	Extra-long screw M6 A4 M6x40. Stainless Steel.
PS1022	M6 -> M8x1,25. 90° Male conical studs	Standard stud for pureMEMS. M8x1,25 90° Male conical. Suitable with M6x35mm screw.
PS1027	M6 -> Flat Glue studs	Standard stud for pureMEMS. M6 Flat studs for glueing. Suitable with M6x35mm screw.
PS1035	Extension 50mm. Conical M8x1,25 90°	Standard extension for pureMEMS. Suitable with M6x35mm screw. M8x1,25 90° Male conical. Total extension length is 50mm.
PS1036	Extension 100mm. Conical M8x1,25 90°	Standard extension for pureMEMS. Suitable with M6x35mm screw. M8x1,25 90° Male conical. Adapter total extension length is 100mm.
PS3010	RPM, Read Switch Sensor	RPM trigger sensor (M8) including 1m cable. Suites for purePULSE and includes M8 straight connector.
PS3017	Mounting set for switch read sensor	Installation bracket set for easy installation of switch read sensor.
PS3014	M8 Straight Connector	Mini 4-pin connector. Spare part for purePULSE and suitable together with PS3010.
Not set	Flat magnet	Flat magnet for temporary use together with pureMEMS. Dimensions ø25x15 mm. Suitable with M6x35mm screw.