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ABB

# ABB Ability™ Smart Sensor

Instruction Manual

## Table of contents

# 1 Introduction

## 1.1 General information

This instruction manual contains information on the installation, operation and maintenance of ABB Ability Smart Sensor. To ensure that the sensor unit will provide proper functionality and a long lifetime, carefully study the contents of this manual and other related documentation before taking any action.
The instructions in this manual are only to be implemented by trained personnel with appropriate experience, and with the authorization of the equipment owner.
This document and parts thereof must not be reproduced or copied without the express written permission of ABB, and the contents thereof must not be imparted to a third party nor be used for any unauthorized purpose. ABB strives to further improve the quality of the information it provides in its publications, and will welcome any suggestions for improvements to this manual.
These instructions must be followed to ensure safe and proper installation, operation and maintenance of the solution. They should be brought to the attention of anyone who installs, operates or maintains this equipment. Ignoring the instructions will invalidate the warranty.

## 1.2 Important note

The information in this document may sometimes be of a general nature and applicable to various products supplied by ABB. Where a conflict exists between the contents herein and the actual product supplied, the user must either make an informed engineering judgement as to the necessary course of action or, if any doubt exists, contact ABB.
The safety instructions shown in Section 2 must be followed at all times.
Safety is dependent on the awareness, concern and prudence of all those who operate and service machines. It is important to observe all safety procedures and to take care near machinery - always be on your guard.
To avoid accidents, safety measures and devices required at the installation site must be in accordance with the instructions and regulations stipulated for workplace safety. This applies to general safety regulations of the country in question, specific agreements made for each work site, safety instructions included in this manual, and separate safety instructions supplied with the motor and sensor unit.

## 1.3 Limitation of liability

In no event shall ABB be liable for direct, indirect, special, incidental or consequential damages of any nature or kind arising from the use of this document, nor shall ABB be liable for incidental or consequential damages arising from the use of any software or hardware described in this document.
The warranty issued covers manufacturing and material defects. The warranty does not cover any damage caused to the sensor unit, personnel or third party by improper storage, incorrect installation or operating of the motor or sensor unit. The warranty is provided in accordance with the terms and conditions of Orgalime S2000.
The warranty issued is invalidated if the operation conditions of the sensor unit are changed, or any changes are made in the construction of the sensor unit, or repair work is done to the sensor unit without the prior written approval of ABB.

**NOTE:**
**Warranties provided by local ABB sales offices may differ from the above. Please see the product's sales terms and conditions, or warranty terms.**

## 1.4 Preparations for installation

### 1.4.1 General

Effective planning and preparation will result in correct installation, and assure safe running conditions and maximum accessibility.
During installation, general as well as local safety instructions must be followed.

### 1.4.2 Tools and materials

Suitable materials for set-up as well as other auxiliary tools for installation are normally not included in ABB's scope of supply. Auxiliary tools for installation are to be supplied by the customer.

### 1.4.3 Safety precautions

Before working on any electrical equipment, general electrical safety precautions must be taken into account, and local regulations must be complied with in order to prevent any injuries. This must be done according to instructions issued by personnel responsible for safety and security.
Personnel performing maintenance on electrical equipment and installations must have appropriate qualifications. The personnel must be trained in, and familiar with, the specific maintenance procedures and tests required for rotating electrical machines.

For general safety instructions, see Section 2.
Please read this section before you familiarize yourself with the sensor unit, initial product set-up, and registration process.

# 2 Important instructions

## 2.1 General instructions

**Caution: Do not open the cover of the sensor unit at any time. Opening the cover will void all guarantees and warranties and invalidate safety assurances.**

- Failure to observe and follow the instructions provided with the equipment and accompanying manuals could cause permanent damage to the equipment and could lead to property damage, personal injury and/or death.
- Before attempting to use the equipment, you should review this instruction manual in its entirety, including all caution and danger indicators.
- If the equipment is used in a manner not specified by the manufacturer or functions abnormally, proceed with caution. Otherwise, the protection provided by the equipment may be impaired and could result in improper operation and injury.

**Caution: Hazardous voltages can cause shock, burns or other injuries, including death.**
**Caution: Rotating equipment can cause injuries.**

- Installation and service personnel must be familiar with general device test practices, electrical awareness and must take proper safety precautions when installing and/or servicing the equipment.
- Before performing installation, inspections, tests or maintenance on a motor or associated circuits, all live circuits and sources of electric power to said motor and circuits must be isolated or disconnected.
- Failure to shut off equipment prior to removing power connections could expose you to dangerous voltages that could cause injury or death.
- All electrical equipment should be properly grounded and must have a reliable and uncompromised grounding path. Equipment grounds should be properly bonded and connected to the facility's primary ground system for primary power.
- At all times, equipment must be properly grounded during device operation, maintenance and service.
- All electrical connections and grounds must comply with all applicable laws, regulations and electrical codes.

For more information regarding ABB Ability Smart Sensor, please visit https://www.smartsensor.desk.com/. For information not found on the support center website, or for product assistance, please contact support.smartsensor@abb.com.

## 2.2 Safety instructions

These instructions are for all personnel who work on the motor or sensor unit. Personnel performing maintenance on electrical equipment and installations must have appropriate qualifications. The personnel must be trained in, and familiar with, the specific maintenance procedures and tests required for rotating electrical machines.

Motor repair and maintenance should be performed following the motor's own instruction and safety manuals. If a variable frequency drive (VFD) unit - also known as a variable speed drive (VSD) unit - is included in the motor set-up, please follow also the VFD unit's additional safety and instruction manuals.

### 2.2.1 General safety during sensor unit installation, start-up, and maintenance

- The sensor unit contains sensitive electronic circuits and should be handled carefully at all times.
- Use safety footwear with metal toe caps during installation work.
- Do not install or perform maintenance on the sensor unit on a running motor.
- Make sure that the motor has cooled enough for the installation or maintenance of the sensor unit.

### 2.2.2 Electrical safety during sensor unit installation, start-up, and maintenance

Installing the sensor unit does not require any wiring, but when the motor or connected drive is energized, do not work on the sensor unit, VFD unit, motor cable, motor, control cables or control circuits.

General points to be observed when working around the motor:

- Do not step on the motor.
- Be careful because the temperature of the outer casing of the motor will be high during normal operation and especially after shut-down.
- Pay attention to specialized instructions for special motor applications (e.g. when supplied by a VFD).
- Observe rotating parts of the motor and take care during installation.
- Do not open terminal boxes while they are energized.

## 2.3 USA & Canada compliance

**Caution: FCC and IC RF Radiation Exposure Statement**

This device complies with FCC Part 15 and Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Attention: FCC et IC Déclaration d'exposition aux radiations RF**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

- Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorité de l'utilisateur à utiliser cet équipement.

# 3 Getting started

## 3.1 Quick summary of Smart Sensor

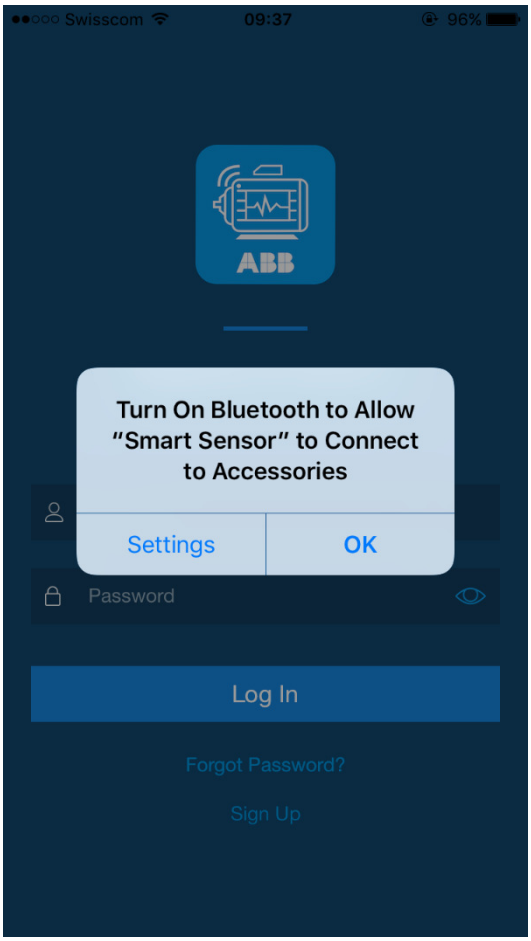
- The sensor unit is a battery-operated device. It is attached to an LV motor and programmed to pick up signals relating to the motor's health and operating parameters. The collected data is then transferred via Bluetooth Low Energy® to the Smart Sensor app which further transfers it to a secure ABB-designated server.
- The data is processed by algorithms, developed by ABB, and turned into meaningful information for the user to view and manage using either the app or portal.

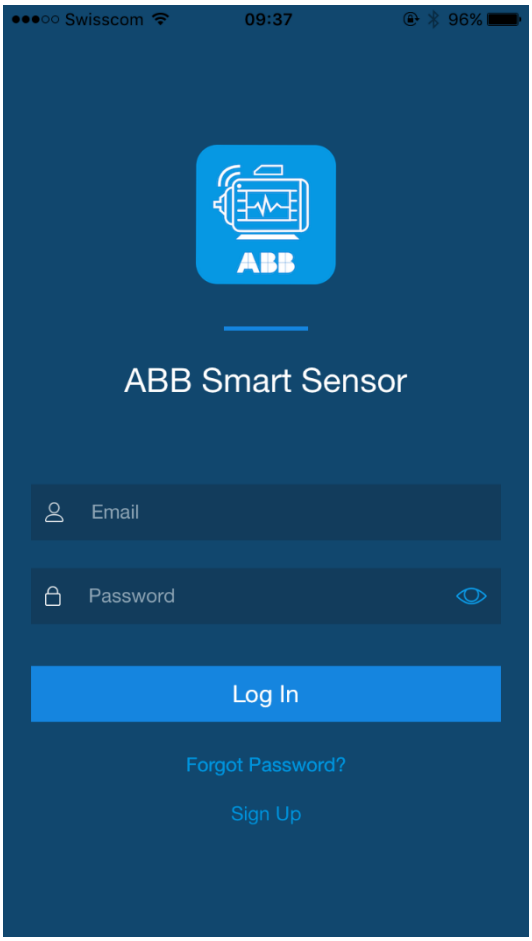
**Note: Smart Sensor is meant for condition monitoring and not for protection purposes.**

## 3.2 Requirements for use of Smart Sensor

- A smartphone (or tablet) with:
  - Android™ 4.4 or higher operating system
    or
    iOS™ 8 or higher operating system
  - Bluetooth® version 4.0 or higher

**Note: On Android 6.0 and up, GPS Location must be turned on.**




- MyABB account (see section 3.3)
- Sensor unit
- Smart Sensor app
  The app can be downloaded from the Google Play Store for Android or Apple App Store for iOS
- Internet access
  The expected data upload volume from the sensor unit to the ABB-designated server is about 1 MB per motor per month.

  **Note: The upload volume and data usage will vary for each motor. The customer is responsible for monitoring and maintaining a sufficient data allowance with the mobile carrier for timely and uninterrupted upload.**

- Motor
  Both ABB and non-ABB motors can be monitored.

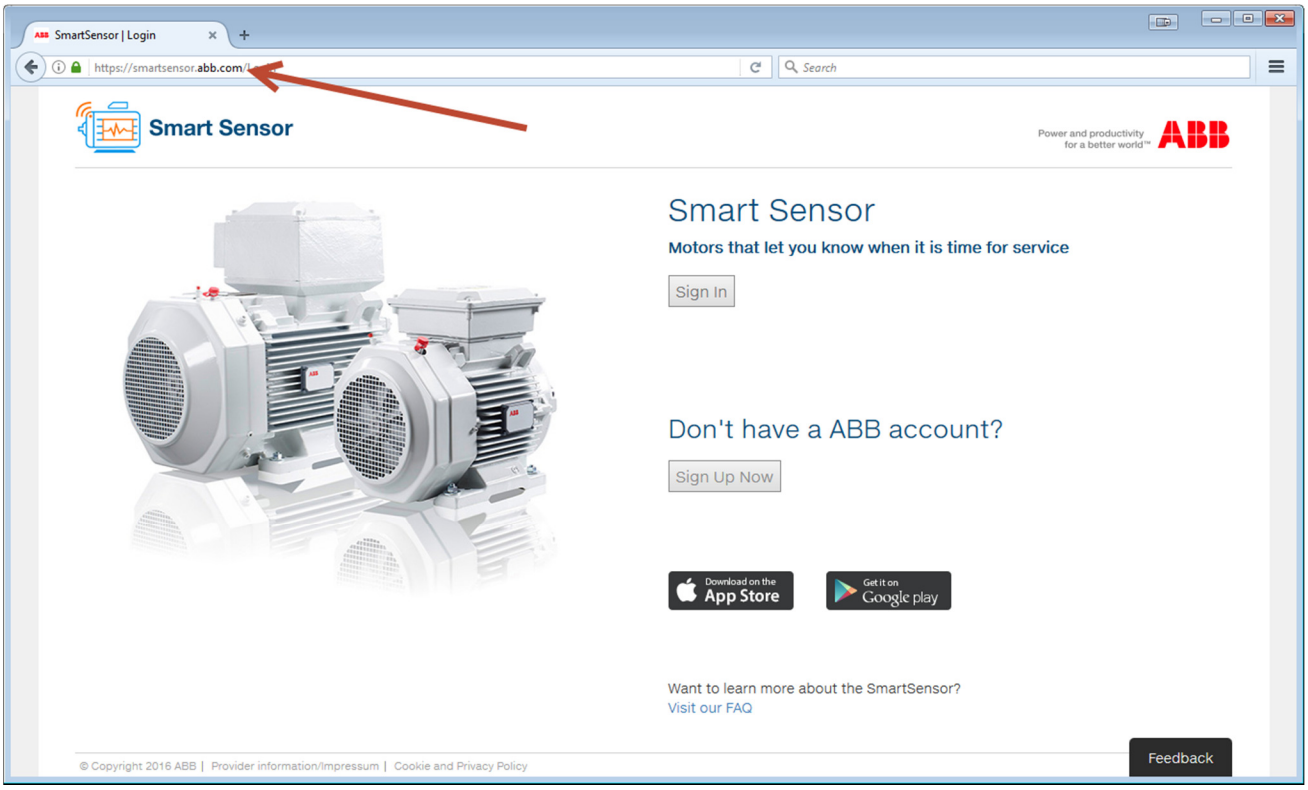
  **Note the motor specifications supported by Smart Sensor:**
  - Standard 3-phase LV squirrel cage induction motors
  - Cast iron or cast aluminum, rib cooled frame
  - 140-440 NEMA frames, 160-450 IEC frames
  - DOL S1 operation
  - Motor surface temperature should not exceed 80 °C

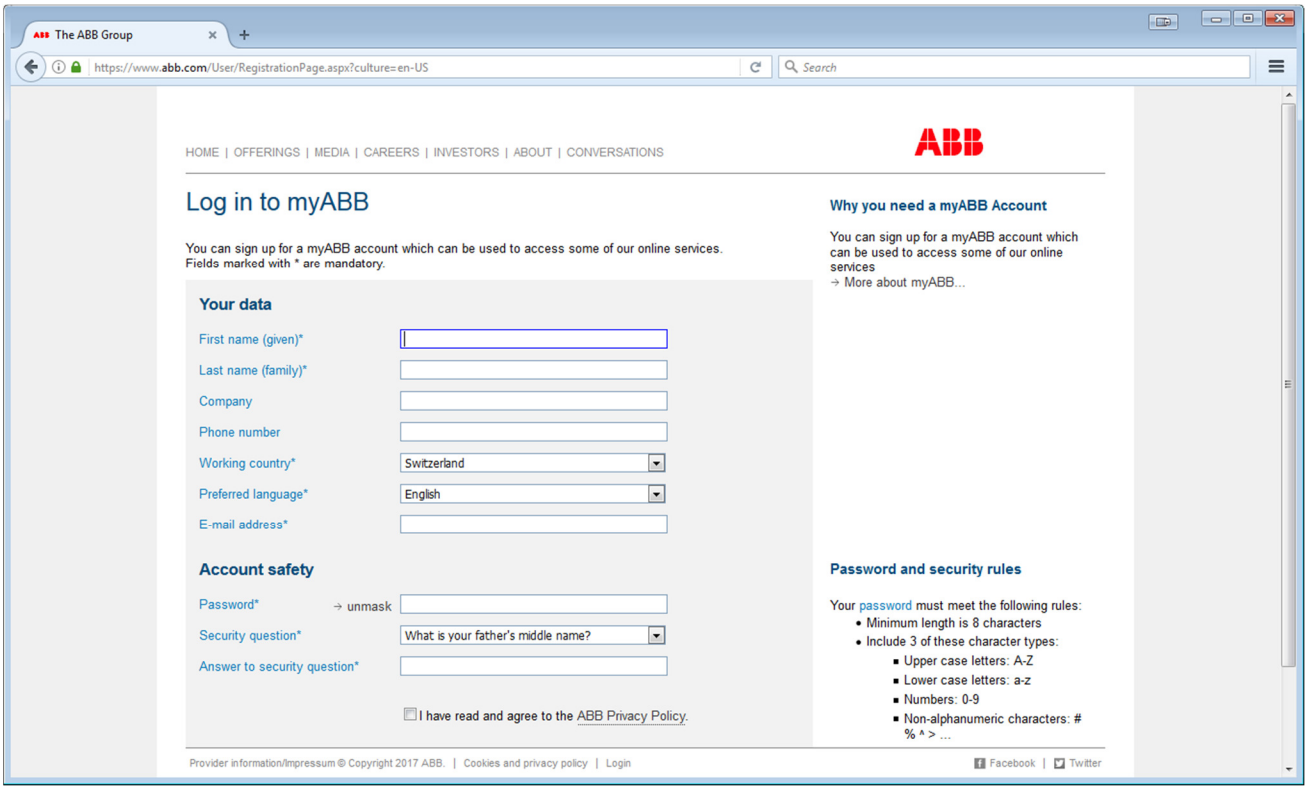
## 3.3 Creating / logging in to MyABB account

- Your MyABB account is the account you use for almost everything you do with Smart Sensor — including access to the Smart Sensor app and Smart Sensor portal.

- The MyABB business portal provides ABB customers and business partners with secure access to information and several services. For more information, visit www.myportal.abb.com
- If you already have a MyABB account, use it to log in to the Smart Sensor app and portal.
- If you do not have a MyABB account, you can create a new account by downloading the Smart Sensor app, then opening the app. This will open a login screen with options to log in with your existing MyABB account or create a new account. Alternatively, this can be done in the Smart Sensor portal https://smartsensor.abb.com/
- If you have trouble logging in or creating a new account, please contact your local ABB representative or support.smartsensor@abb.com
- Recovering a lost password is also possible in the Smart Sensor portal at https://smartsensor.abb.com/ or in MyABB www.myportal.abb.com

**Note: By creating and using a MyABB account, and using the Smart Sensor app and/or the Smart Sensor portal, you are confirming that you will comply with all ABB website terms and conditions of use, as well as ABB's Cookie and Privacy Policies.**






# 4 Sensor unit

## 4.1 Dimensions

The size of the sensor unit is 130×77×16 mm. It is mounted on a baseplate that can be directly mounted on the motor using a mounting bracket and mount. Please refer to the installation instructions supplied with the package.

## 4.2 Ratings

The sensor unit has IP66 rating and is suitable for use in NEMA class 1, Div 2 / IEC Ex iA IIC T4 -40 °C to +80 °C according to EN 60079-15.

## 4.3 Installation instructions

The installation instructions are supplied with the sensor unit. Follow the installation instructions carefully.

## 4.4 Temperature limits

The sensor unit is designed to operate with motor surface temperatures up to 80 °C. If the motor surface temperature exceeds 85 °C, the sensor unit's electronics are designed to switch off and only re-start when the motor surface temperature falls below 85 °C. The batteries used in the sensor unit are tested to withstand motor surface temperatures up to 100 °C.

## 4.5 Identification

The serial number of the sensor unit can be found in the bottom left corner of the baseplate, as seen in figure 1.

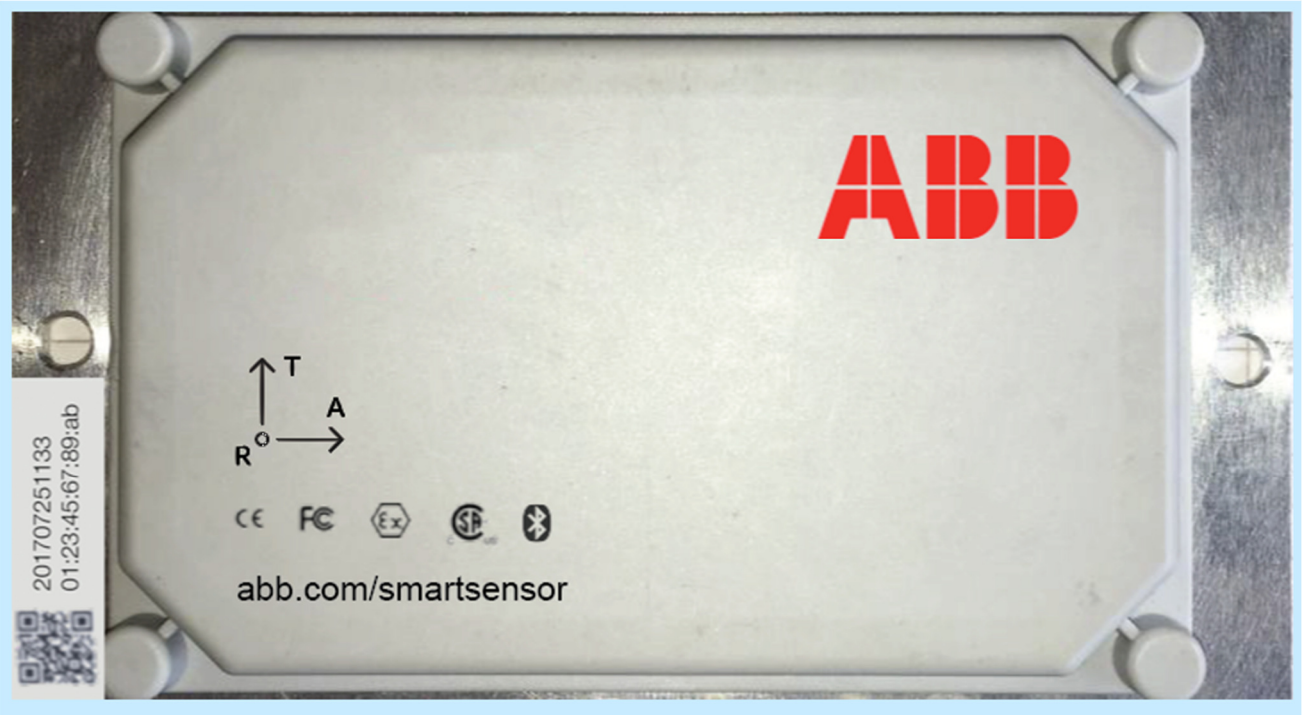



**Figure 1: Sensor unit - front view.**

If you use the Smart Sensor portal to contact our online helpdesk, please provide the serial number if possible. This will help us to identify the sensor unit and resolve your problem faster.
Each sensor unit also has a MAC (media access control) address, which is also shown in the bottom left corner, along with a QR code. A MAC address is a unique identifier assigned to network interfaces for communications on the physical network segment.

## 4.6 Data accuracy and usage

- The solution is meant for condition monitoring and not for protection purposes. ABB'S SERVICES, SYSTEMS AND EQUIPMENT DO NOT CAUSE AND CANNOT ELIMINATE OCCURRENCES OF THE EVENTS THEY ARE INTENDED TO DETECT OR AVERT. ABB MAKES NO GUARANTEE OR WARRANTY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, THAT THE SERVICES, SYSTEM OR EQUIPMENT SUPPLIED WILL DETECT OR AVERT SUCH EVENTS OR THE CONSEQUENCES THEREFROM.
- The data supplied by Smart Sensor depends on the quality of several factors (such as mounting) and as such it should be treated as indicative. All of the alerts and alarms supplied by Smart Sensor in the app or portal must be evaluated by the customer who shall determine whether additional intervention or maintenance is necessary. Any maintenance procedures should be performed by the local ABB Service Team or local ABB partner.
- It is essential that the correct motor information (which will be described in detail below) is input to ensure data accuracy and quality. ABB is not responsible for any error, damages or injuries resulting from incorrect reporting or incorrect input of motor information.

## 4.7 Batteries

- The sensor unit is supplied with lithium batteries built in.

**Note: As the sensor unit cover must not be opened, the batteries cannot be replaced. When the batteries reach the end of their life, the sensor unit must be removed from the motor and recycled.**

### 4.8 Reading periodicity and battery life

- If required, you can use the app to change the periodicity of the readings taken by the sensor unit (this functionality is not available in the first release). Please note that adjusting the periodicity may extend or reduce the lifetime of the sensor unit's batteries.

### 4.9 Recycling

ABB is committed to meet the requirements of the Waste Electrical and Electronic Equipment (WEEE) directive (2012/19/EU). The WEEE directive requires the manufacturers of electronic or electrical equipment who sell it in EU countries: (1) label their equipment to notify customers that it needs to be recycled, and (2) provide a way for their products to be appropriately disposed of or recycled at the end of their product lifespan.

NOTICE: This symbol indicates this product cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling return this product to your supplier or to a designated collection point. For more information go to www.recyclethis.info.

- The packaging materials are harmless to the environment and can be recycled.
- Please dispose / recycle the sensor unit's electronic, metal, and plastic parts as appropriate and as required by applicable laws, rules and regulations.
- WEEE directive requires the batteries to be removed from the electronic equipment which after they are expected to be recycled under Battery Directive 2006/66/EC.

More information on environmental aspects and detailed recycling instructions can be provided by local ABB representatives.

## 5 Smart Sensor app

### 5.1 Downloading

The Smart Sensor app can be downloaded from the iOS App Store and Google Play Store.

**Note: Downloading and use of the Smart Sensor App are subject to an End User License Agreement.**

### 5.2 Connecting to sensor unit

To connect the Smart Sensor app to a sensor unit, you need to have Bluetooth connection enabled in the phone.
If  appears on the circle next to the motor image on the screen, you are connected to the sensor unit. The sensor unit will reconnect to the phone whenever you are close to it. If connection does not happen automatically, then you need to connect manually from the Bluetooth menu.
For best results, connection should be attempted within a range of five meters from the sensor unit. The range can extend to 10 meters, depending on the phone's capabilities.

If a blue ball appears next to the motor image on the screen, there is a sensor unit in range.
There is a connection symbol inside the blue ball. The size of the connection symbol indicates the connection quality. A small dot inside the blue ball means the connection is weak, and a full-size icon inside the blue ball means the connection is strong.

| Symbol | Bluetooth range indication | Connection strength |
| --- | --- | --- |
| (((●))) | immediate/nearest | strongest |
| ((●)) | near | strong |
| (●) | far | weak |

**Figure 2: Bluetooth signal strength indicator**

## 5.3 Verifying connection

The color of the ball indicates the freshness of the data. A connection is established when the indicator symbol changes to a Bluetooth symbol.

## 5.4 Adding sensor unit to app and website

After successfully connecting your phone to the sensor unit, press the “Add new Motor” button

### 5.4.1 Keying in motor information

In the “Add new Motor” section you need to key in the motor information. Most of the information can be found on the motor’s nameplate.
The required information is:

- Motor Name
  It is recommended that you give the motor a clear, descriptive name based on its usage or location, for example "Oil pump motor 15".
- Serial Number
  This is the serial number of the motor where the sensor unit is installed. It should be shown on the nameplate.
- DE Bearing (i.e. drive-end bearing type)
  Select the bearing manufacturer and type from the lists provided. The bearing type and manufacturer can generally be found on the nameplate. If this information is not shown on the nameplate, please contact the motor manufacturer for details.
- NDE Bearing (i.e. non drive-end bearing type)
  Please see instructions for DE Bearing.
- Voltage
  This is the motor’s nominal voltage, which is generally shown on the nameplate. The value is given in volts [V].
- Current
  This is the motor’s nominal current when operating with nominal power, and it can generally be found on the nameplate. The value is given in amps [A].
- Power
  Nominal power when operating with nominal frequency and voltage. This is generally shown on the nameplate, and the value is given in kilowatts [kW].
- Frequency
  Nominal supply frequency. This is the same as the grid frequency for DOL motors and the frequency at the field weakening point for motors with a VFD supply. It is generally found on the nameplate and the value is given in hertz [Hz].
- Speed
  Exact rotation speed when operating with nominal power. This is generally found on the nameplate and the value is given in revolutions per minute [rpm].
- Power factor (cos φ value on nameplate)
  This value is not expressed in units.

**Note!**
**Motor nameplates commonly show several different voltage and current ratings. Use only those values which correspond to your grid voltage.**
**If some of the motor information is missing, please contact the motor manufacturer for details. Failure to provide the correct data may result in inaccurate readings and/or reports.**

The following information is not required, but please provide it if available:

- Class: IEC or NEMA
- Shaft Height (mm)
- Duty: S1, S2 or S3
- Type: Direct on line (DOL) or variable frequency drive (VFD) supply
- Load (driven equipment): Compressor, Crusher, Fan, Pump, Roller, Others

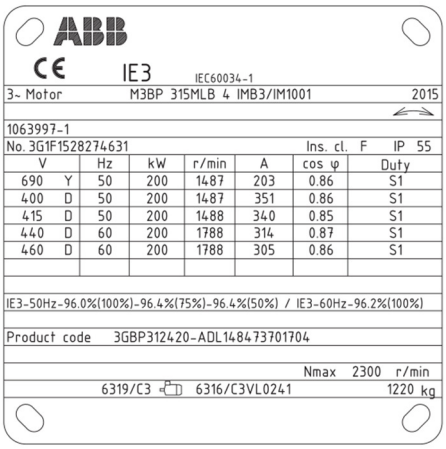



**Figure 3. Nameplate on ABB IE3 low voltage motor.**

## 5.5 Motor condition indicators

Please note that Smart Sensor data should be regarded as indicative only, and all alerts and alarms should be investigated by trained personnel with experience in condition monitoring of electrical motors.

The traffic light indicator in the top left of the motor dashboard shows the current overall condition of the motor:

- Green – No issues detected.
- Yellow – No issues detected that require immediate attention, but it is recommended that the equipment is inspected at the next available maintenance opportunity/planned maintenance (e.g. driven equipment or plant shutdown). Ensure that “yellow” motors are taken care of within three months. Failure to address “yellow” motors may lead to permanent damage to equipment, and could lead to property damage and/or personal injury.
- Red – An issue has been detected that could affect the functionality or operation of the motor. You should confirm the information provided by the Smart Sensor by other diagnostic means and take the necessary corrective action within a month.
- Gray – The app or the portal has not received any data yet and no information can be provided on the motor at this time.

**Notifications**

This section contains notifications concerning the condition of the motor, classified as follows:

- Recommendations
- Alarms
- Alerts
- Comments

**Health**

This tab contains two sections:

- Health indicators
- Operating information

**Health indicators**
The health indicators show the condition of the motor based on the last reading taken by the sensor unit and synchronized with the Smart Sensor app. The indications are given in traffic light format.

- Loading [%] (not part of first release)
- Cooling condition (not part of first release)
- Eccentricity [%] (not part of first release)
- Bearing Condition
- Rotor winding (not part of first release)
- Overall vibration

**Operating information**

- Skin temperature [℃ or ℉]
- Vibration (Axial) [mm/s]
- Vibration (Vertical) [mm/s]
- Vibration (Horizontal) [mm/s]
- Motor Supply Frequency [Hz]
- Speed [rpm]
- Operating Power [kW] (not part of first release)

**History**
The history section contains old notifications concerning the motors that are being monitored.

## 5.6 Loading measurements

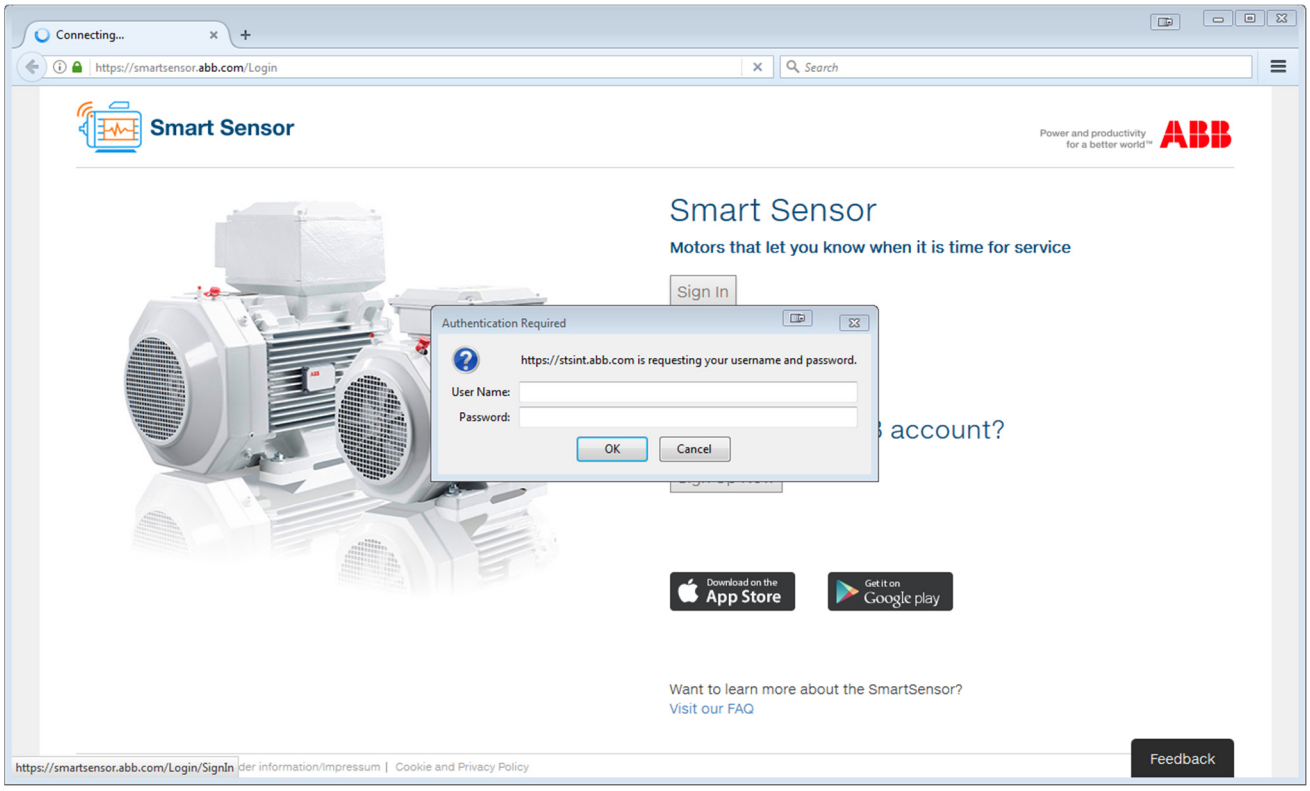
To load measurements, there must be a connection between the sensor unit and Smart Sensor app.
When the connection is established click the “three-dot” symbol in the top right corner and then click “Load measurement”.
The sensor unit is programmed to collect and analyze data once per hour. Up to one month’s processed data can be stored in the sensor unit.
It is recommended that the data is transferred from the phone to the secure ABB-designated server at least once per week.

## 5.7 Uploading measurements/package drop

If there is a connection between the sensor unit and the Smart Sensor app, the measurement data will be transferred to the app. After the measurements are transferred to the app, it will automatically synchronize the data with the secure ABB-designated server, provided that an internet connection is available.
Note that you may also load measurements and store them in your phone (i.e. turn off the phone’s mobile data). Later you can upload them to the secure ABB-designated server via a Wi-Fi connection. When you get access to Wi-Fi, go to the app and select package drop. This will upload the measurements that are stored in the phone.

# 6 Smart Sensor portal

The Smart Sensor portal can be found at https://smartsensor.abb.com/




## 6.1 Dashboard (future release)

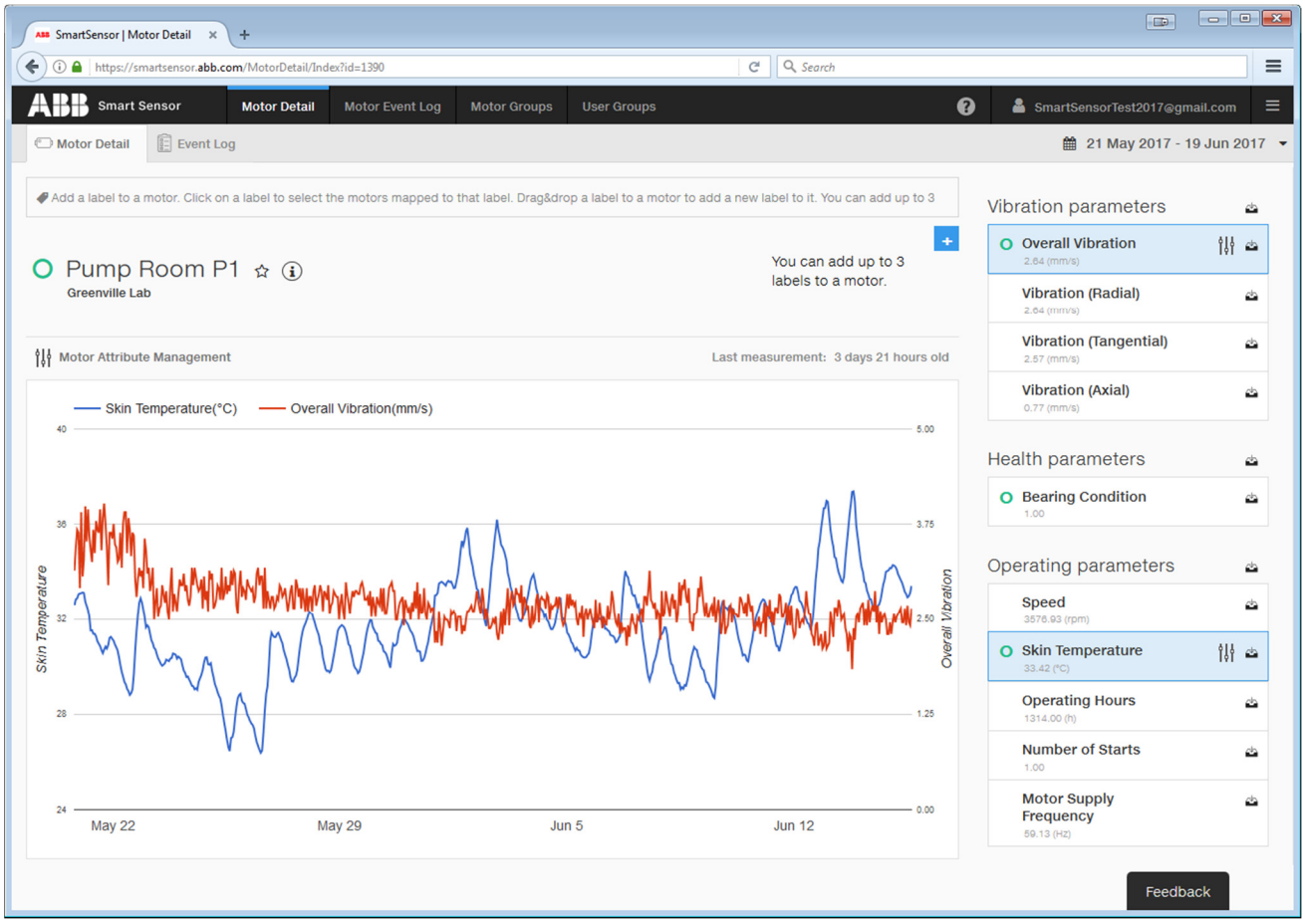
The Dashboard provides an overview of the installed base of motors equipped with sensor units. Users can also get information on their motors' condition and recommendations on how to optimize maintenance and save costs.

## 6.2 Motor detail

The Motor Detail tab gives a detailed view of parameters for individual motors.

Click the ☰ icon in the upper right corner of the browser to open search bars where you can choose the plant and motor to be examined.
Click the parameters you want to view in the list on the right.

In Motor Attribute Management you can set thresholds for some of the parameters. For example, you can set an alarm to trigger if the skin temperature exceeds a certain level.




## 6.3 Event log (future release)

The Event log page gives an overview of events for the selected motor, such as alerts or recommendations. You can also add comments to specific events.

## 6.4 Group admin

The Group admin page provides an overview of the plant groups you belong to and have rights to.
By clicking the desired group, you can see other group members and their status. If you are the group admin you also have additional options as described below.

### 6.4.1 User and admin rights to specific sensor units

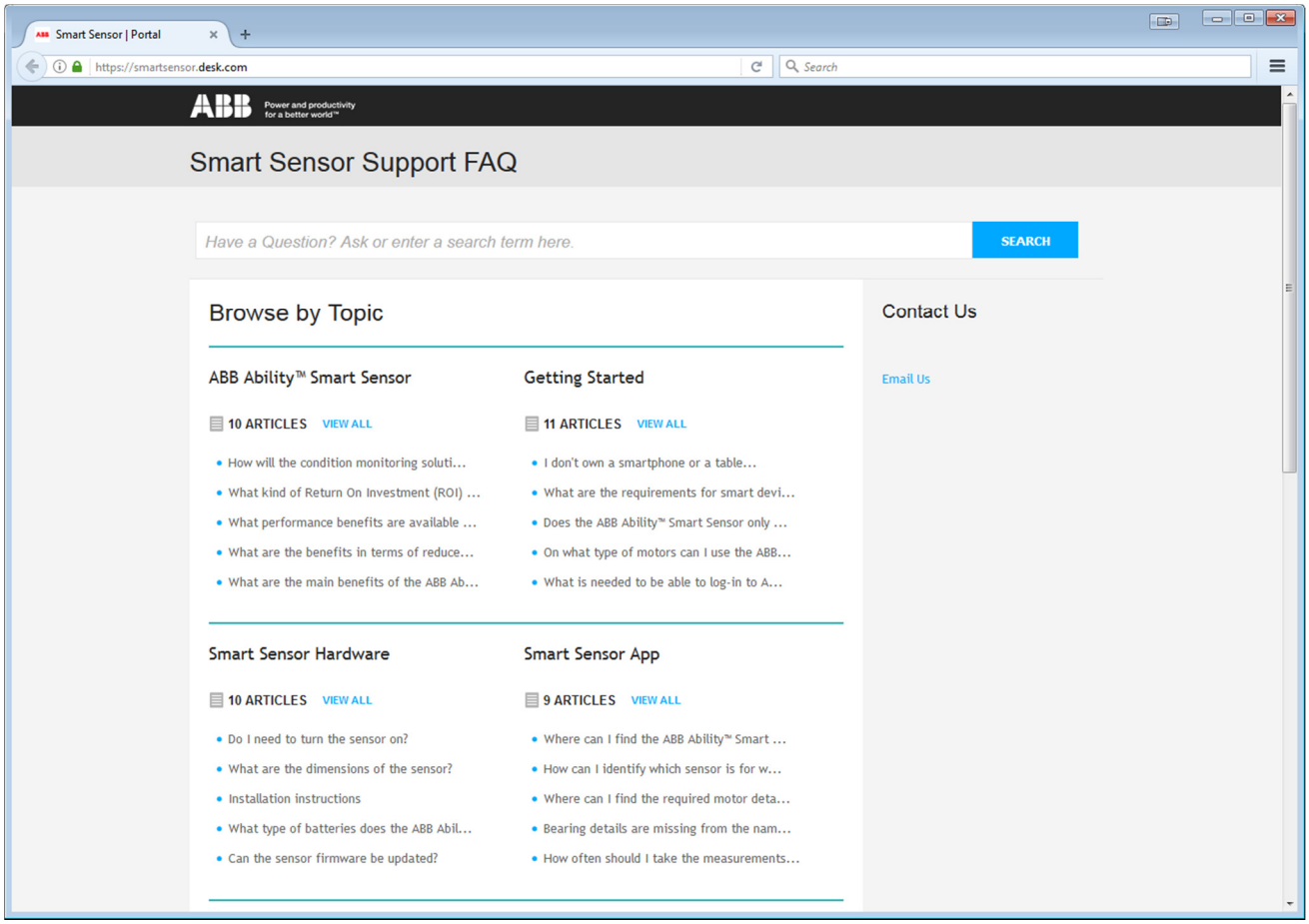
There are two tiers of rights in the Smart Sensor portal and app: basic user rights and group admin rights.
Basic user rights - enable the user to add a motor in the app, take measurements from it, and upload the data to the Smart Sensor portal and inspect it there. It is recommended that user rights are shared with all trusted co-workers who might need access to the data, or are often in the vicinity to upload it to the ABB-designated server.
Group admin rights - give additional rights on top of basic user rights. Group admins can delete motors (for example, a motor that is being replaced during maintenance), add a factory/plant/site, add a group whose members have rights to certain motors, and confer user/admin rights on other users. It is recommended that admin rights are shared with some trusted superiors and co-workers. This is to avoid situations where no-one with group admin rights is available.
Currently the first person to add a motor in the portal will be granted group admin rights.

### 6.4.2 Sharing sensor units with other persons or groups (not for all users)

The Group Admin page in the Smart Sensor portal allows sensor units to be shared. Please note that you need to have group admin rights to grant users access to sensor units in the form of groups. These groups pair specific sensor units and motors.

## 6.5 Support

The Support page provides access to the FAQ section.




## 6.6 Feedback

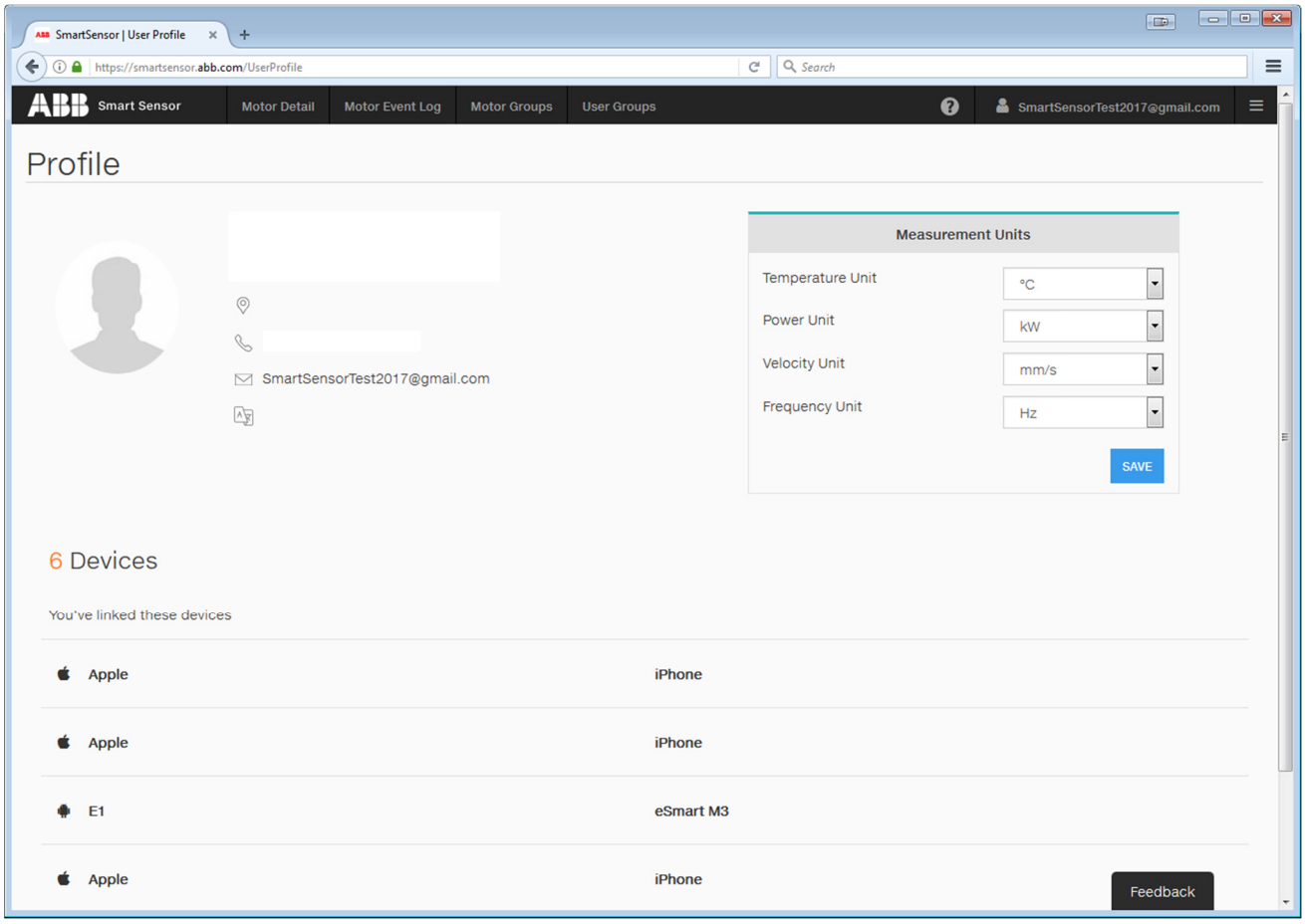
At the bottom of the page you can find the online help. In case of a problem that requires our assistance, please submit a complete description of the issue, your email address and any files relating to the problem or possible solutions.
To ensure that the problem is dealt with efficiently, please include the sensor unit serial number in the problem description for any problems relating to a sensor unit, the app or a specific motor.

## 6.7 Subscription Management (future release)

To be added. Please contact support.smartsensor@abb.com

## 6.8 Profile

Here you can view the email that you have provided, and a list of the phones you have used to access the solution.
There is also an option to change the units between imperial and metric.




### 6.9 Data usage by ABB

ABB holds the rights to access and use the data provided by Smart Sensor for development and data analysis purposes.

## 7 Other sources of support

- Installation instructions (included with the sensor unit delivery)
- Support in the Smart Sensor portal (here you can find this manual, installation instructions and FAQ)
- Feedback in the Smart Sensor app (available after logging in)
- Online help in the Smart Sensor portal https://smartsensor.abb.com/ (in the bottom right corner, labeled Online help)

## 8 Motor condition analysis

### 8.1 Primary channel in motor maintenance

When Smart Sensor indicates that critical issues might be developing, it is recommended that further investigations are undertaken. The ABB Service Team and ABB authorized service providers can be contacted to help with any queries or further analysis.
To find your local contact or for any other information, check www.abb.com/motors&generators.

## 8.2 Measured variables

### 8.2.1 Skin temperature

The skin (surface) temperature is the sensor unit's temperature value, not that of the motor winding or bearing. It therefore indicates the general loading of the motor, but does not take into account any hot spots in certain areas (bearings, windings). The sensor unit's usable measurement range is from -40 °C to +80 °C.

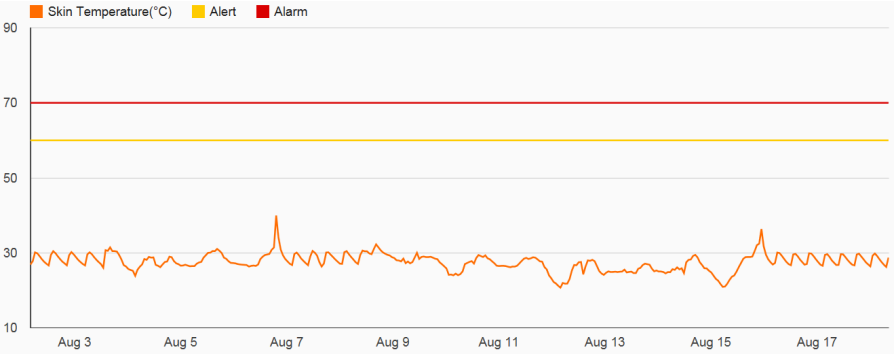



**Figure 4: Skin temperature display**

The following alert and alarm values have been preset:

- Yellow: if the motor is ON and temperature exceeds +60 °C.
- Red: if the motor is ON and temperature exceeds +70 °C.

These limits can be adjusted in the Motor Attribute Management page.

It is recommended that the trend value of the surface temperature is monitored and compared to the motor's loading. If the temperatures are increasing even though the load remains at the same level, it is advisable to investigate the following points:

- Ambient temperature - does it exceed the maximum ambient temperature shown on the nameplate?
- Cooling arrangements - is there an external object blocking the cooling air circulation?
- Overall cleanliness of the motor frame and fan - is there excessive dirt or dust between the cooling ribs?
- Running direction - is the motor running in the right direction, as shown on the nameplate?

### 8.2.2 Vibration (Axial, Radial and Tangential)

Vibration is measured by an accelerometer in three directions. It measures +/- 16 g acceleration within the bandwidth of 10 Hz – 1000 Hz. The measured acceleration value is integrated over the measurement time and therefore actual velocity values are presented in mm/s.

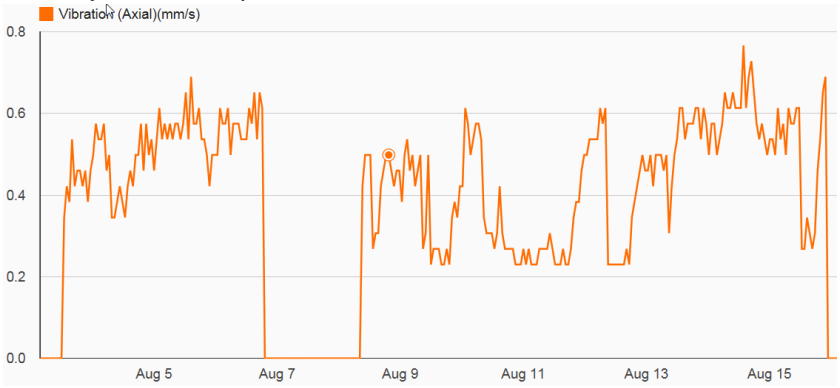



**Figure 1: Axial vibration display**

It is recommended that the trend value of the vibration is monitored and compared to the motor loading and speed. If vibrations are increasing even though the load remains at the same level, it is advisable to investigate the following points:

- Is there a loose fastening in the motor's flange or foot?
- Is there misalignment between the driven equipment and motor?
- Is the foundation or motor base frame rigid enough?

### 8.2.3 Motor Supply Frequency

Smart Sensor measures the motor supply frequency from the magnetic flux. Depending on the motor type, typical accuracy is 0.1% of the nominal frequency.

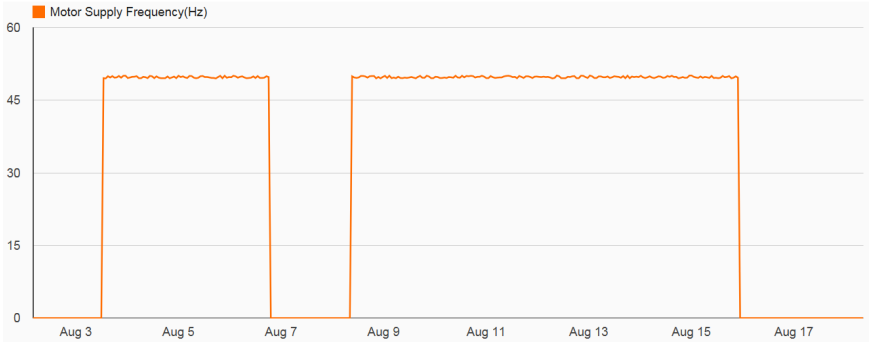



**Figure 2: Supply frequency display**

### 8.2.4 Rotation speed

The actual speed of the motor is determined by several different measurements. Depending on the motor type, the typical accuracy of the speed measurement is 0.2%.

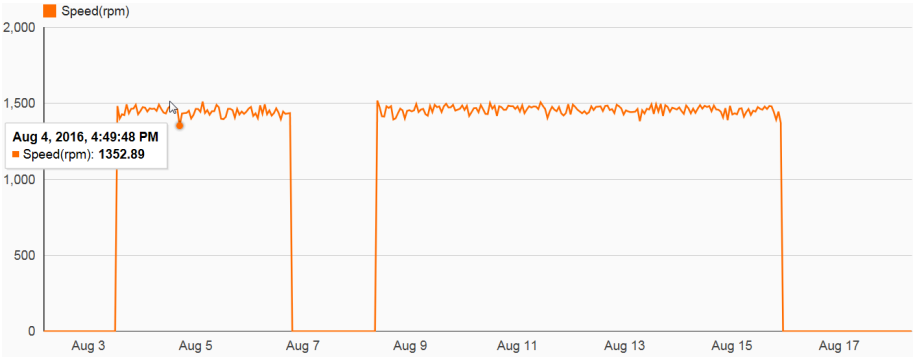



**Figure 3: Motor actual speed display**

### 8.2.5 Operating power (not part of first release)

The operating power of an induction motor is related to the slip frequency. Therefore it can be calculated based on the speed and supply frequency measurements. Motor nameplate information is used as a base reference, which means that it is important to input exactly the right nameplate values for each motor.

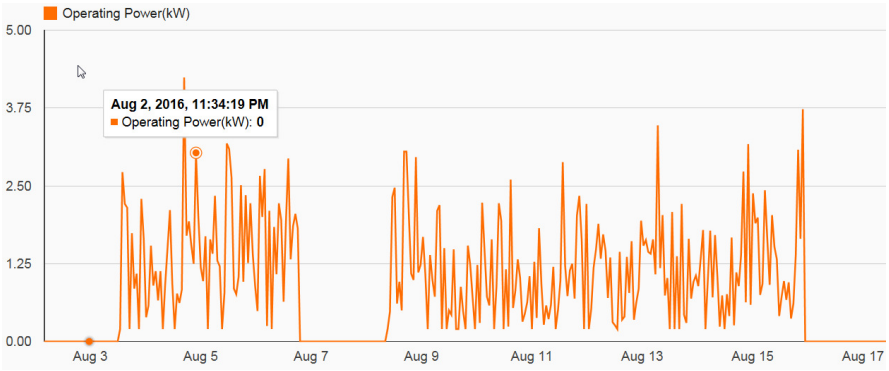



**Figure 4: Motor operating power display**

### 8.2.6 Bearing Condition

Smart Sensor evaluates bearing condition based on acoustic measurement. The measured data are post-processed and then kurtosis analysis is performed.

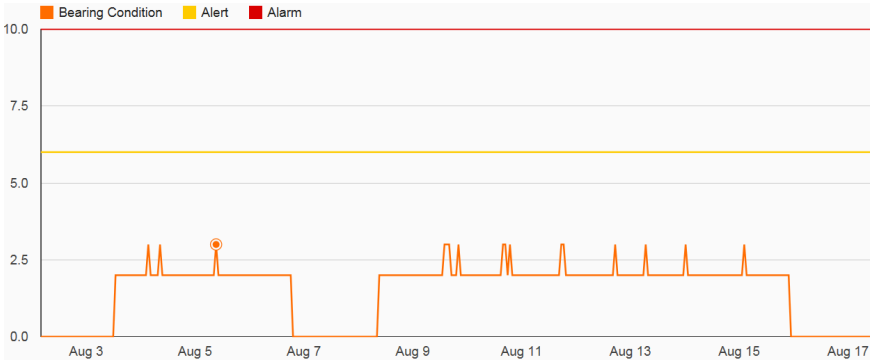



**Figure 5: Bearing condition display**

The following alert and alarm values have been preset:

- Yellow: Confirm with detailed bearing analysis if the level exceeds 6.
- Red: Change bearing immediately or at the earliest opportunity if the level exceeds 10.

### 8.2.7 Overall Vibration

Vibration is measured by an accelerometer in three directions. It measures +/- 16 g acceleration within the bandwidth of 10 Hz – 1000 Hz. Overall vibration is a vector sum of all three (axial, horizontal, and vertical) vibration values.

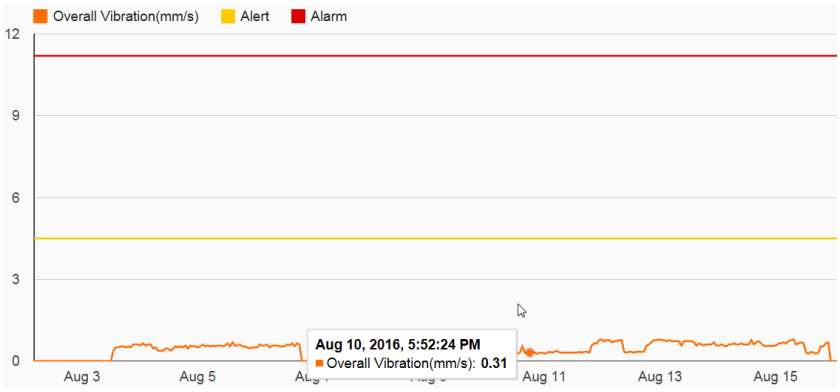



**Figure 6: Overall vibration display**

The following alert and alarm values have been preset:

- Green: ≤ 2.8 mm/s.
- Yellow: 2.8 mm/s < x ≤ 4.5 mm/s.
- Red: > 4.5 mm/s.

These limits can be adjusted in the Motor Attribute Management page.
It is recommended that the trend value of the vibration is monitored and compared to the motor loading and speed. If vibrations are increasing even though the load remains at the same level, it is advisable to investigate the following points:

- Is there a loose fastening in the motor's flange or foot?
- Is there misalignment between the driven equipment and motor?
- Is the foundation or motor base frame rigid enough?
- Is the driven equipment working as expected?
- Alert: Wait and watch.
- Alarm: Confirm with detailed vibration analysis.

# 9 Warranty

Contact your warranty supplier or your local ABB Service unit. Contact details for ABB Service can be found at www.abb.com/searchchannels

# 10 Disclaimers

## 10.1 Generic disclaimer

The manufacturer shall have no obligation hereunder with respect to any product which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence or accident; (iii) has been used in a manner contrary to the manufacturer's instructions; or (iv) has failed as a result of ordinary wear and tear.

## 10.2 Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network as the case may be. Customer shall establish and maintain any appropriate measures such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc. to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

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