SKF Axios

User Manual
Part Number **15V-090-00097-100**
Revision **B – February 2023**

⚠️ Read this manual carefully before using the product. Failure to follow the instructions and safety precautions in this manual can result in serious injury, damage to the product or incorrect readings. Keep this manual in a safe location for future reference.

Product Registration

Please take a moment to register your product to receive exclusive benefits offered only to our registered customers, including technical support, tracking your proof of ownership and staying informed about upgrades and special offers. (Please visit our website for more details on these benefits.)

General Product Information

General information such as datasheets and catalogues are published on the Condition Monitoring Systems site on SKF.com. Supporting product information can also be downloaded from the SKF Technical Support self-service web portal.

Product Support Contact Information

Product Sales – For information on purchasing condition monitoring products, services and support on products out of warranty, please contact your local SKF sales office or distributor.

Technical Support – SKF's Technical Support Group can be reached during normal business hours via phone. Always check the self-service web portal before contacting your nearest Technical Support Group (TSG) to see if the answer is already published. You may search the vast knowledge base within the self-service web portal for answers to commonly asked questions (FAQ), how-to articles, technical specs, installation and user manuals, best practices and more.

If further assistance is needed, click on **Open a support case** from within the self-service web portal.

Otherwise, *TSG* can be reached during normal local business hours by phone, and live chat (login required).

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Customers in the Americas, Asia and all other locations:
- Phone: 1-858-496-3627 or toll-free (USA) 1-800-523-7514
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1 Product description

1.1 Introduction

SKF Axios is a machine-learning based end-to-end anomaly detection condition monitoring system that detects potential machine anomalies.

SKF Axios is used to implement a predictive maintenance program and reduce lost productivity from unplanned machine downtime. It includes purpose-built sensors to capture vibration and temperature data, as well as gateways to automatically transfer data to the AWS Cloud. It also comes with an application in two versions. The mobile application handles system setup, hardware commissioning, analytics, and notifications when tracking equipment conditions. The web application provides all the same functions as the mobile app, except hardware commissioning. Reliability and maintenance teams can quickly deploy SKF Axios to track the machine health of industrial equipment, such as bearings, motors, gearboxes, and pumps, without any development work or specialized training.

1.2 SKF Axios devices

SKF Axios includes two types of devices:

- Sensor - for collecting data from your equipment
- Gateway - for sending that data to the Cloud.

Sensors are mounted directly on the machines (or assets) to monitor.

Figure 1   SKF Axios sensor

Each sensor collects data from a location on the asset and sends it to the AWS Cloud using a gateway located nearby and powered by 100-240 VAC (Wi-Fi Gateway) or Power over Ethernet (Ethernet Gateway). You can add more sensors and gateways as needed.

Figure 2   SKF Axios Gateways

1.3   SKF Axios Software

SKF Axios mobile and web-based applications are used to access your company's project. Under the company project, users can add sites and assets. Once the sensors and gateways are installed, the mobile app is used to commission them and start the data collection. Technicians can use both apps to trend data, receive notifications and enter feedback to improve the accuracy of future alerts.

Status icons are displayed next to each asset to enable you to see its condition, at a glance.

Figure 3   Status icons

Figure 4   SKF Axios Software – App and Web example

As SKF Axios collects more data, it improves its machine learning (ML) model and learns to make more accurate estimates of potential machine abnormalities.

1.4 Benefits

SKF Axios provides the following key benefits:

- **Works out of the box** – SKF Axios sensors and gateways are pre-configured to work with SKF Axios software. Reliability and maintenance teams can install these devices easily and quickly using the app and start monitoring equipment in just a few hours. It's simple to set up and requires no development work, knowledge of Machine Learning, or integration.

- **Immediate notifications** in the SKF Axios app: SKF Axios sends users notifications in the app when it detects abnormal machine patterns. Technicians can view, track, and provide feedback on these abnormal machine states in the SKF Axios app.

- **ISO- and ML-based analytics** – SKF Axios automatically detects abnormal machine operating states. To do this, SKF Axios analyzes vibration and temperature signals and compares them to International Standards Organization (ISO 20816) standard thresholds and ML-enabled models.

- **Support for adding ML feedback in the app** – SKF Axios offers simple workflows for technicians to enter feedback on the accuracy of the alerts in the app. SKF Axios learns from that feedback and continually improves over time.

1.5 How it works
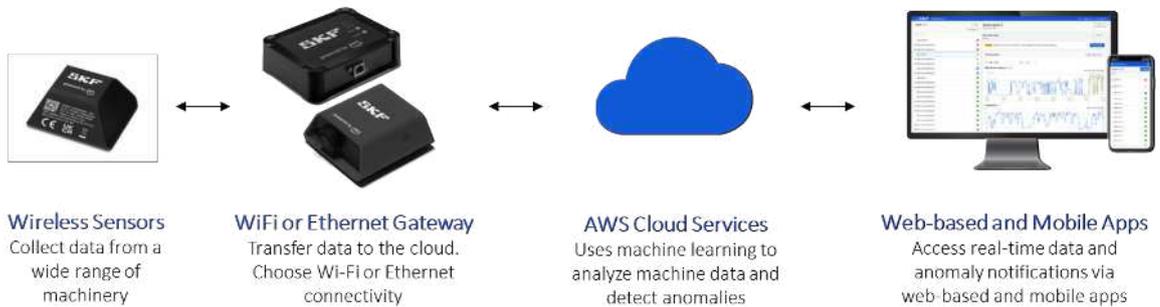
Figure 5   SKF Axios workflow

1. An SKF Axios sensor captures temperature and vibration data from the equipment (the asset) and transmits it to the gateway.
2. An SKF Axios gateway transmits the data to the AWS Cloud using the facility's internet connection.
3. The SKF Axios ML-based service in the AWS Cloud analyses the sensor data.
   a. SKF Axios looks for abnormalities in the data that could indicate developing faults.
   b. When SKF Axios detects abnormal machine behaviour, it notifies reliability and maintenance teams through the SKF Axios app so they can take appropriate action.
   c. Technicians investigate based on the alerts and resolve the developing issues. They enter feedback on the accuracy of the alerts, and report the failure mode, cause, and action taken in the app. SKF Axios learns from this feedback and continually improves.
4. The web and mobile apps display temperature and vibration data in charts that are easy to understand and can be used while investigating an issue.

2 Getting started

2.1 Account activation

To access the SKF Axios software, you will first receive an invitation email from no-reply@login.awsapps.com, that you must accept within 7 days. Click on "Accept invitation" and enter your password. Your account is now activated.
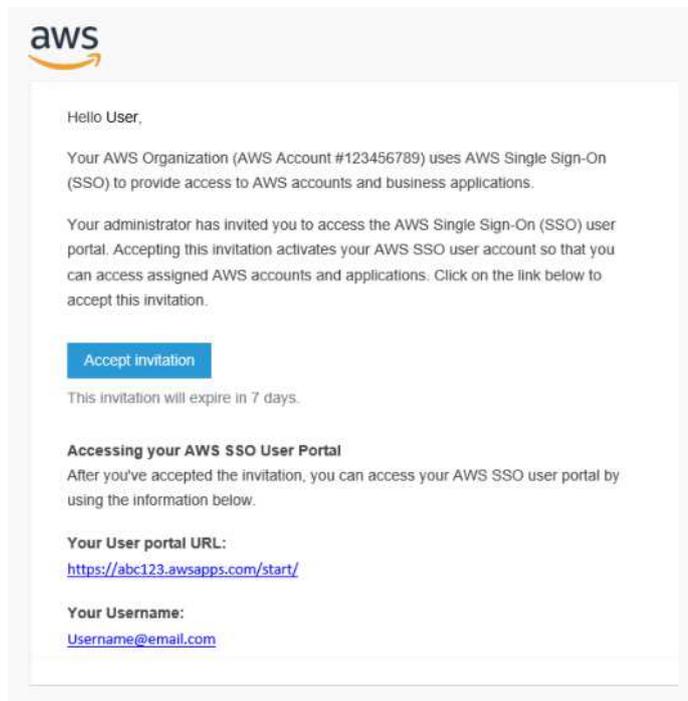
Figure 6   Invitation mail - example

2.2 Download the mobile app

For Android, get the mobile app from the Google Play Store:
https://play.google.com/store/apps/details?id=com.skf.axios&hl=en&gl=US

For iOS, get the mobile app from the App Store at:
https://apps.apple.com/us/app/skf-axios/id1659834627

Stay up to date

For access to the latest SKF Axios features, regularly check your mobile device for updates. Periodically, SKF Axios releases new application versions that you will need to update if you do not have automatic updates enabled. These notifications will be provided on the web app as they become available.

your computer's web-browser or the previously downloaded app on your mobile phone.

You've been invited to "Your Project" in the SKF web and mobile apps.

If you haven't installed the mobile app yet, use your phone to download it:
- For Android, go to the Google Play Store at Link to mobile app in Google Play Store
- For iOS, go to the App Store at Link to mobile app in App Store

To access "Your Project", tap this link from your computer or mobile phone: Link to "Your Project"

Thank you

Figure 7   Project invitation mail - example

2.4 Creating a Site

Note: You must be a project-level admin to create sites.

You can organize a project into sites based on your business needs. For example, you can organize a project in one of the following ways:

- No sites at all: Everything is contained in a project, without any sites. This option is best for projects with a few assets and users that you can easily keep track of because it provides the greatest simplicity.

- Sites based on geography: Group resources and users by locale, such as by city, building, or areas within a building. For example, you might set up a site for the equipment in a factory test lab.

- Sites based on function: Group resources and users by functionality, either by machine functionality or by how they're used in your facility. For example, you might set up a site for all the conveyor belts involved in moving an item from one side of the factory to the other.

- Sites based on organization. Sites represent a specific organizational structure in the company or facility. For example, you might want a single site that includes resources and users assigned to the shipping department.

Sites can be added in the web-based software or in the mobile application.

To add a site using the mobile app

1. Log into the mobile app on your smartphone. Make sure that the project name is shown in the upper left of the screen. It is visible on all screens in the mobile app.
2. Choose the menu icon (≡).
3. Choose Sites.
4. Choose Add site.
5. For Site name, enter a name.
6. Choose Add.

The Sites list displays the new site.

To add a new site using the web-based application

1. Open the project selector dropdown menu from the upper left part of the app window.
2. Choose Add a new site

The project-level admin user who creates a site is automatically a site-level admin user for that site.

2.5 Navigation through Sites

If you are a Project-level Admin user and need to navigate between sites for your account, you can check which site you are in by looking at the top of your screen. The name that you see will tell you which site you are looking, and the assets associated with that site.

To navigate between the Sites (if your account has them), select the arrow that is to the left of your Site and the list of the other Sites will appear in a drop-down menu for you to select from (example: Demo #1 and Demo #2 below).
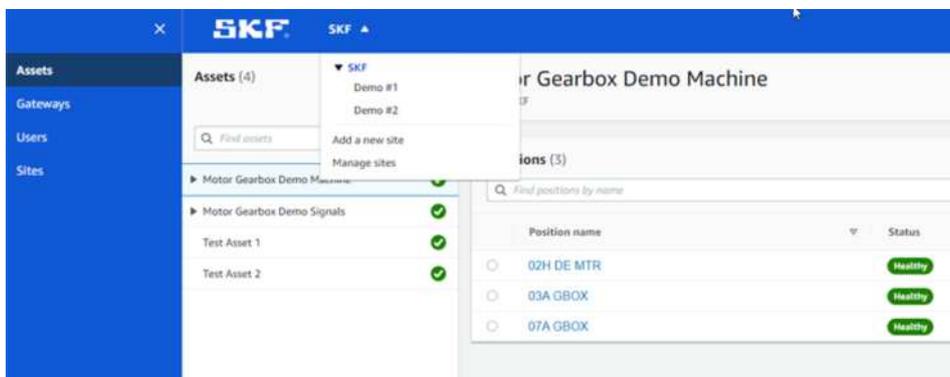
Figure 8   Site navigation - example

2.6 Managing users

To invite a new user to your project, contact SKF to setup their AWS account. Each new user will receive an account activation email. See Account Activation. Once the AWS account is activated, a project-level admin can add the new user to a project and/or site. A site-level admin can add the new user to their assigned site(s) only.

Users are assigned a role when added to a project and/or site: Admin, Technician, or Viewer. A user's role determines the access level and enables tasks in SKF Axios. The extent of their role permissions is determined by whether they are added at the project level or at the site level. If the user's role is set at the project level, the user will have permissions across all sites in that project. If the user's role is set at the site level, the user will have permissions within the site only.

2.6.1 User roles

When you add a new user, the role you choose determines the permissions that user has. The same procedure is used to add a new user to a project or to a site.

Users can have the following roles:

- **Admin**. An admin user has full access to all resources within the project or site to which they've been added. They can add or delete other users, create, or delete assets, pair sensors to assets, and so on. They can also monitor assets and acknowledge and resolve abnormalities. If they are added at the project level, these permissions extend through the entire project. If they are added at the site level, these permissions are limited to only that site.

- **Technician**. A technician user has read-only permissions to the project or site to which they've been added and permissions for monitoring assets and acknowledging and resolving abnormalities. If they are added at the project level, these permissions extend through the entire project. If they are added at the site level, these permissions are for only that site.

- **Viewer**. A user with read-only permissions. This means they cannot add, change, or delete details of any resources within the project or site to which they've been added. They cannot acknowledge or resolve abnormalities.

The table below describes the different tasks available to each user role:

	System Application Project Admin	System Application Site Admin	Technician	Viewer
Assign Roles	Yes	Yes (only on site level)	No	No
Commission Gateways	Yes	Yes (only on site level)	No	No
Commission Sensors	Yes	Yes (only on site level)	No	No
Create Assets	Yes	Yes (only on site level)	No	No
Create Positions	Yes	Yes (only on site level)	No	No
Create Project	No	No	No	No
Create Site	Yes	No	No	No
Create Users	Yes	Yes (only on site level)	No	No
Delete Assets	Yes	Yes (only on site level)	No	No
Delete Gateways	Yes	Yes (only on site level)	No	No
Delete Positions	Yes	Yes (only on site level)	No	No
Delete Project	No	No	No	No
Delete Sensors	Yes	Yes (only on site level)	No	No
Delete Site	Yes (if site has no data)	No	No	No
Disable User	Yes	Yes (only on site level)	No	No
Resolve Alarm	Yes	Yes (only on site level)	Yes (only on site level)	No
View Data	Yes (only on SKF Axios)	Yes (only on SKF Axios and site level)	Yes (only on SKF Axios and site level)	Yes (only on SKF Axios and site level)

2.6.2 Creating a user

In the mobile app:

1. Log into the SKF Axios mobile app on your smartphone.
2. Navigate to the project or site that you want to add a user to, and then to the **Users** list.
3. Choose **Add user**.
4. Enter the user's name.
5. SKF Axios searches the user directory for the user.
6. Choose the user from the list.
7. Choose the role that you want to assign the user: **Admin**, **Technician**, or **Viewer**.
8. Choose **Add**.
9. The new user appears on the Users list.
10. Send the new user an email invitation with a link for accessing the project and downloading the SKF Axios mobile app.
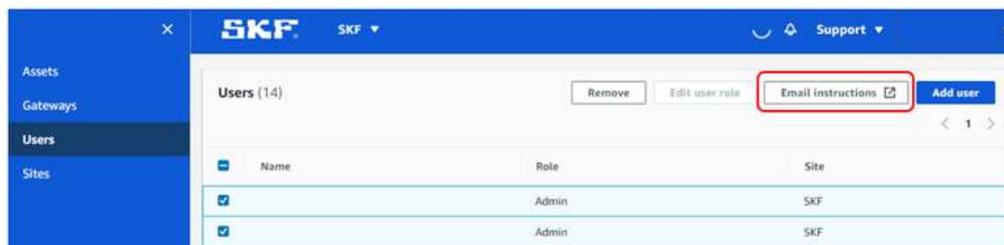
Figure 9   Users view – Email instructions

3 Setting up and managing Ethernet Gateways

SKF Axios uses SKF Axios Gateways to transfer the data collected by the SKF Axios Sensors to the AWS Cloud. Gateways are usually positioned within 20 to 30 meters (65 to 98 feet) of the sensors. They communicate with the sensors over Bluetooth Low Energy (BLE), and with the AWS Cloud over Wi-Fi or Ethernet.

This section explains how to install your Ethernet gateway. It also explains how to delete an Ethernet gateway.

To learn about using SKF Axios with Wi-Fi gateways, see Setting up and managing Wi-Fi gateways.

3.1 Understanding the Ethernet Gateway

SKF Axios Ethernet Gateway comes equipped with an RJ-45 socket, so you can connect it to your Ethernet network using a Cat 5e or Cat 6 Ethernet cable. You will power your gateway over the Ethernet cable, using Power over Ethernet (PoE). Therefore, you will need either a switch or router that supports PoE or a PoE power injector.

After you have inserted an Ethernet cable into your gateway, put the gateway in commissioning mode by pressing the **CONFIG** button.

Figure 10   SKF Axios Ethernet Gateway – Config button

3.2 Reading the lights on an Ethernet Gateway

The LED lights on the top of your SKF Axios Ethernet Gateway indicate the status of the gateway. Each gateway has one orange light, one blue light, and one green light. The green light indicates that the power is on. The orange light

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indicates that the gateway is connected to the ethernet. The blue light indicates that the gateway's Bluetooth is connected to the sensors.

The sequence that the lights display indicates the status of the gateway, as described in the following table.

	LED Sequence	Description
1	Solid green light	The Ethernet gateway is powered on.
2	Solid orange light	The gateway is connected to the Ethernet network.
3	Flashing orange light	The gateway is attempting to connect to the Ethernet network.
4	Solid blue light	At least one sensor is communicating with the gateway.
5	No blue light	No sensors are currently communicating with the gateway.
6	Orange and blue lights flashing (slowly)	The gateway is powered on, but not in commissioning mode.
7	Orange and blue lights flashing (rapidly)	The gateway is on and in commissioning mode, but not yet linked to any sensors. In commissioning mode, the gateway is discoverable and configurable by the SKF System, but no sensors can connect yet.
8	No lights	The gateway is not connected to a power source.
9	Solid orange and blue lights	The gateway is starting up.

Figure 11   LED Sequence description – SKF Axios Ethernet Gateway

3.3 Important network considerations

Note: Communicate these requirements to your IT Department to get started.

- Power Over Ethernet (PoE) or TP link PoE150S injector or equivalent is required to power the device
- Firewall rules:
  - Allow connection to amazonaws.com and subdomains
  - TCP Port: **8883** needs to be open
- DHCP or Static IP

3.4 Placing and installing an Ethernet Gateway

Unlike sensors, an Ethernet gateway doesn't need to be attached to the machines that are being monitored. However, it does need an available Ethernet network through which SKF Axios can connect to the AWS Cloud.

Where to place an Ethernet Gateway

You can install a gateway almost anywhere within your work area, depending on its layout. (For additional guidance, please see Appendix D Gateway Considerations) Typically, gateways are mounted on walls, but you can mount them on ceilings, pillars, or in almost any other location. A gateway must be within 20 to 30 meters (65 to 98 feet) of the sensors it will support, and an

Ethernet gateway must be close enough to an Ethernet cable to plug in. Note that an Ethernet gateway draws power from the Ethernet cable.

Consider these other factors when mounting a gateway:

- Mounting the gateway higher than sensors (2 meters (7 feet) or above) can improve coverage.
- Keeping an open line of sight between the gateway and sensors improves coverage.
- Avoid mounting the gateway on building structures, such as exposed steel beams. They can cause interference with the signal.
- Try to work around any equipment that might produce electronic interference with the signal.
- If possible, install more than one gateway within transmission distance of your sensors. If a gateway becomes unavailable, the sensors will switch their data transmission to another gateway. Having multiple gateways helps to eliminate data loss. There is no minimum required distance between two gateways.

Installing an Ethernet Gateway

Note: Install the gateway with the Ethernet cable going downwards.

Almost everything you need, to install your gateway in your work area is contained in the box that contains the gateway:

- The gateway
- A mounting bracket
- Double-sided tape
- Four mounting screws

To install the gateway, position the mounting bracket on the wall or on another location, then mount the gateway on the bracket, Ethernet cable on the downwards side.

There are three ways to mount the mounting bracket: screw mounting, tape mounting, and plastic-tie mounting. The method you use depends on whether you're mounting the gateway on a wall or another location, and on the surface material.

To mount the bracket, choose one of the following.

Screw mounting

Typically, you mount the bracket directly to the wall using the mounting screws included in the gateway box. Mount the bracket from the front. You might need to

use an expansion plug or toggle bolt (not included) to secure the screw in the wall.

Figure 12   Screw mounting

Tape mounting

A shaped piece of double-sided tape is included in the gateway box. Use it when you can't place a screw into the mounting surface. You can also use it in combination with the other methods of mounting for a more secure installation.

Remove the backing on one side of the tape and apply the tape to the back of the wall mounting bracket between the four raised sections.

Remove the remaining backing and apply the bracket to the mounting location. Press hard on the bracket to make sure that the tape firmly adheres to the surface.

Figure 13   Tape mounting

Plastic-tie mounting

To mount a gateway to a smaller non-wall location, such as a pillar or fence, use cable ties (also known as zip ties) to fasten the wall mounting bracket. Put the

ties through the holes in the four raised sections on the back of the bracket, wrap them around the mounting location, and pull tight.

After the bracket is mounted, attach the gateway to the bracket.

Figure 14   Plastic-tie mounting

Attach the gateway to the bracket

1. With the wall mounting bracket in place, place the gateway against the bracket, with the two plastic hooks on the back of the gateway inserted in the slots at the bottom of the bracket.
2. Press the top of the gateway against the bracket so that the plastic hooks on the back of the gateway latch into the top of the bracket.

3.5 Commissioning an Ethernet Gateway

Once the gateway is mounted in your facility, use the SKF Axios mobile app to commission it. SKF Axios supports only smartphones using Android 8.0+ or iOS 14+ with near field communication (NFC) and Bluetooth. For additional help with locating your gateway, see Placing and installing an Ethernet Gateway.

To commission a gateway

Note: If you are using an iOS mobile device and you have previously paired with this particular gateway, then you may need to make your device "forget" the gateway before re-pairing. For more information, see Troubleshooting Bluetooth pairing.

1. If Bluetooth isn't already turned on for your smartphone, turn it on.
2. Plug the Ethernet cable into the gateway and make sure the network light (orange) and the Bluetooth light (blue) on the front of your gateway are blinking alternately.
3. Push the Config button on the gateway to put it into commissioning mode. The Bluetooth and network LED lights will start flashing rapidly.
4. Stay within 5 meters (16 feet) of the Ethernet Gateway.

5. Open the mobile app on your smartphone.
6. Choose the menu icon (☰). Go to Gateways. Choose Add Gateway.
7. SKF Axios searches for the gateway. This can take a few moments. When SKF Axios finds the gateway, it displays it in the gateway list.
8. Choose the gateway.
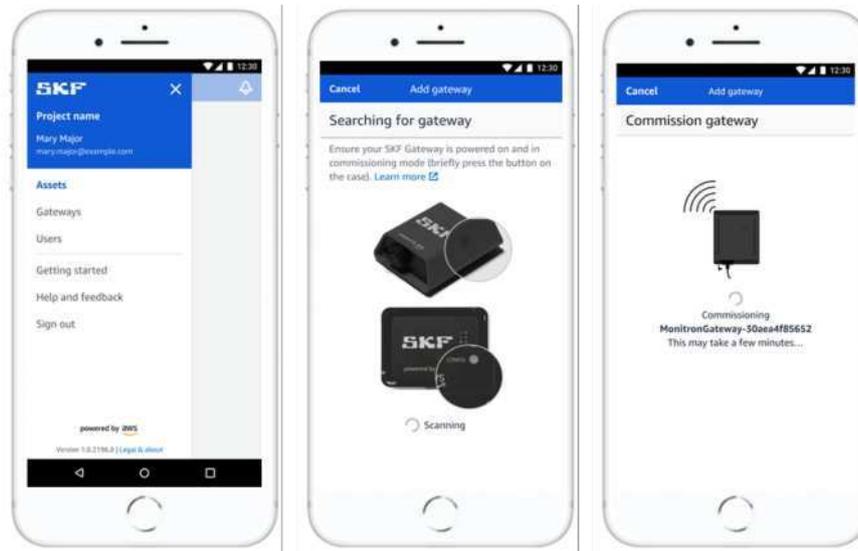
If the mobile app continues to try to connect to the gateway without success, see Troubleshooting Ethernet gateway detection.

9. After it connects to the gateway, SKF Axios mobile app will provide two options for you to configure the network connection for your gateway.
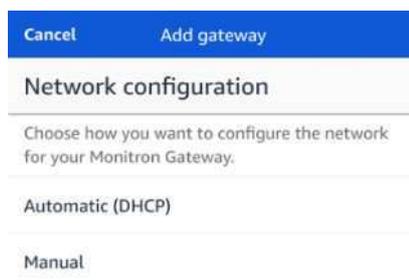
10. Choose your network configuration:
    a. It can take a few minutes for the gateway to be commissioned and to connect to the network.
    b. If you have further difficulties making the gateway work, it might be helpful to reset it. For more information, see Resetting the Ethernet gateway to factory settings.
        i. If you choose **Automatic** (DHCP), SKF Axios mobile app will automatically configure the network to connect to the gateway.
        ii. If you choose **Manual**, enter your IP address, subnet mask, router, preferred DNS server, and alternate DNS server (optional) information. Then choose **Connect**.
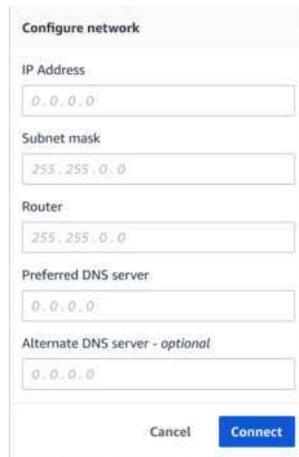
3.6 Troubleshooting Ethernet Gateway detection

When you add a gateway to your project or site, as soon as you choose **Add Gateway**, the SKF Axios mobile app starts scanning for the gateway. If the app can't find the gateway, try the following troubleshooting tips.

- **Make sure that the gateway is powered up.** Check the green light near the upper right corner of the gateway. If it's on, the gateway has power. If the gateway has no power (no solid green light), check the following:
    - o Is the switch or router at the other end of the Ethernet cable functioning properly?
    - o Is the Ethernet cable working? To test this, try using the cable with another gateway.
    - o Is the RJ-45 socket clean? Be sure to check the socket at the other end of the Ethernet cable.

- **Make sure the gateway is in commissioning mode**. The SKF Axios mobile app finds a new gateway only when it's in commissioning mode. When you turn a gateway on, the **Bluetooth** and **Network** LED lights blink slowly, alternating orange and blue. When you press the **Config** button to enter commissioning mode, the Bluetooth and Network LED lights blink rapidly, again alternating orange and blue.

1. If the LEDs show any sequence other than slow blinking before you press the button, the gateway might not go into commissioning mode. In this case, reset the gateway by pressing the **RESET** button.
2. **Ensure your smartphone's Bluetooth is working.** The gateway connects to your smartphone using Bluetooth, so it's a potential source of interruption. Check the following:
    a. Is your smartphone's Bluetooth on and working? Try switching it off and on. If that doesn't help, restart your phone and check again.
    b. Are you within your smartphone's Bluetooth range? Bluetooth range is relatively short, usually less than 10 meters (32 feet), and its reliability can vary significantly.
    c. Is there anything that might be interfering electronically with the Bluetooth signal?

If none of these actions resolves the issue, try the following:
- Log out of the mobile app and restart it.
- Perform a factory reset of the gateway by holding down **CONFIG** and pressing **RESET**.

3.7 Troubleshooting Bluetooth pairing

You may find yourself attempting to pair your iOS mobile device with a gateway that it has already paired with. This could happen because the gateway has changed locations, or because the general configuration of your SKF Axios site has been altered.
In that case, tell your iOS mobile device to "forget" its Bluetooth connection with the gateway.

To unpair a gateway from your device:

1. On your iOS mobile device, choose **Settings**.
2. On your **Settings** screen, choose **Bluetooth**.
3. On the **Bluetooth** screen, choose the information icon next to the name of your SKF Axios Gateway.
4. On the next screen, choose **Forget This Device**.

3.8 Resetting the Ethernet Gateway to factory settings

If you re-use a gateway that was deleted from SKF Axios mobile app, use the config button to reset the gateway to factory settings. This prepares the gateway to be used again for SKF Axios mobile app.

To reset an Ethernet gateway to factory settings (option 1):

1. Unplug the Ethernet cable from the gateway.
2. Hold down the **Config** button.
3. Plug the Ethernet cable back into the gateway.

When the LED lights start slowly blinking, alternating orange and blue, release the **Config** button. The gateway is reset.

To reset an Ethernet gateway to factory settings (option 2):

1. Hold down the **Config** button.
2. Press the reset button.
3. When the LED lights start slowly blinking, alternating orange and blue, release both buttons.

3.9 Viewing the list of Gateways

To list your Gateways in the mobile app

1. Use your smartphone to log in to the SKF Axios mobile app.
2. Choose the menu icon in the upper left corner of the screen.

3. Choose **Gateways**
    a. A list of all gateways associated with the project is displayed.

To list your gateways using the web app

1. Log into the SKF Axios web app
2. Choose **Gateways** from the left navigation menu.

3. The gateway list appears in the right pane.

3.10 Deleting an Ethernet Gateway

Sensors need a gateway to relay their data to the AWS Cloud. Deleting a gateway might cause some sensors to lose their connection. Exercise caution before deleting a gateway.

When you delete a gateway, sensors switch their connection to another gateway within range, if there is one, and data transmission from the sensor continues uninterrupted. If no gateway is within range, data transmission is interrupted, and the data might be lost.

To delete a gateway using the mobile app

1. Using the mobile app, navigate to the **Gateways** page.
2. Choose the vertical ellipses icon (⋮) next to the gateway that you want to delete.
3. Choose **Delete Gateway**.
4. Choose **Delete** again.

To delete a gateway using the web app

1. Navigate to the Viewing the list of Gateways.
2. Select the gateway from the table.
3. Choose Delete gateway.

4 Setting up and managing Wi-Fi Gateways

SKF Axios uses SKF Axios Gateways to transfer the data collected by the SKF Axios Sensors to the AWS Cloud. Gateways are usually positioned in facilities within 20 to 30 meters (65 to 98 feet) of the sensors. They communicate with the sensors over Bluetooth Low Energy (BLE) and with the AWS Cloud over Wi-Fi or Ethernet.

This section explains how to install your Wi-Fi gateway. It also explains how to delete a gateway.

To learn about using SKF Axios with Ethernet gateways, see Setting up and managing Ethernet gateways.

4.1 Understanding the Wi-Fi Gateway

The SKF Axios Gateway is easy to install and operate. After plugging in the power cable, you can put the gateway in commissioning mode by pressing the CONFIG button.
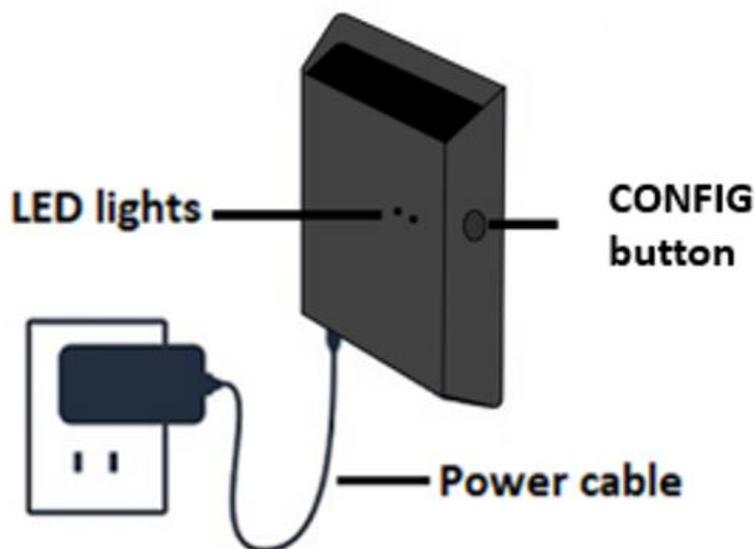
Figure 15   Wi-Fi Gateway overview

4.2 Reading the lights on a Wi-Fi Gateway

The LED lights on the top of your SKF Axios Wi-Fi Gateway indicate the status of the gateway. Each LED light has one orange light and one blue light. The orange light indicates that the gateway is connected to a Wi-Fi network. The blue light indicates that the gateway's Bluetooth is connected to the sensors.

	LED Sequence	Description
1	Solid orange light	The gateway is connected to a Wi-Fi network.
2	Flashing orange light	The gateway is attempting to connect to a Wi-Fi network.
3	Solid blue light	At least one sensor is communicating with the gateway.
4	No blue light	No sensors are currently communicating with the gateway.
5	Both lights flashing (slowly)	The gateway is powered on, but not comissioned.
6	Both lights flashing (rapidly)	The gateway is on and in commissioning mode. Therefore, it is discoverable and configurable. However, it is not yet linked to any sensors.
7	No lights	The gateway is not connected to a power source.
8	Solid orange and blue lights	The gateway is starting up.

Figure 16   LED Sequence description – Wi-Fi Gateway

4.3 Important network considerations

Communicate these requirements to your IT Department to get started

- Firewall rules:
    - Allow connection to amazonaws.com and subdomains
    - TCP Port: **8883** needs to be open
- DHCP is the operating mode
- 2.4 GHz frequency band
- Does not work with the captive portal; requires network name and password

4.4 Placing and installing a Wi-Fi Gateway

Unlike sensors, a Wi-Fi gateway doesn't need to be attached to the machines that are being monitored. However, it does need an available Wi-Fi network through which SKF Axios can connect to the AWS Cloud.

Figure 17   Wi-Fi Gateway

Choosing a location for your gateway

You can install a gateway almost anywhere within your facility, depending on its layout. (For additional guidance, please see Appendix D Gateway Considerations). Typically, gateways are mounted on a wall, but you can mount them on the ceiling, on pillars, or in almost any other location. A gateway must be within 20 to 30 meters (65 to 98 feet) of the sensors it supports. It also must be close enough to a power outlet that it can be plugged in.

Consider these other factors when mounting a gateway:

- Mounting the gateway higher than sensors (2 meters (7 feet) or more) can improve coverage.
- Keeping an open line of sight between the gateway and sensors improves coverage.
- Avoid mounting the gateway on building structures, such as exposed steel beams. They can cause interference with the signal.
- Try to work around any equipment that might produce electronic interference with the signal.
- If possible, install more than one gateway within transmission distance of your sensors. If a gateway becomes unavailable, the sensors will switch their data transmission to another gateway. Having multiple gateways helps to reduce data loss. There is no minimum required distance between two gateways.

Mounting the bracket

To install a gateway, position the wall mounting bracket on the wall or on another location, then mount the gateway on the bracket.
Almost everything you need comes in the box that contains the gateway:

- The gateway
- An AC adapter
- AC adapter plugs for the EU, UK, and US
- The wall mounting bracket
- Double-sided tape
- Two mounting screws
- One small screw to attach the gateway to the bracket

There are three ways to mount the mounting bracket: screw mounting, tape mounting, and plastic-tie mounting. The method you use depends on whether you're mounting the gateway on a wall or another location, and on the surface material. You can mount the gateway on the wall mounting bracket through the small screw hole in the center of one of the short sides.

To mount the bracket, choose one of the following techniques.

Screw mounting

Typically, you mount the bracket directly to the wall using the mounting screws included in the gateway box. Mount the bracket from the front. You might need to use an expansion plug or toggle bolt to secure the screw in the wall. An expansion plug or toggle bolt is not included.

Figure 18   Screw mounting

Tape mounting

A shaped piece of double-sided tape is included in the gateway box. Use it when you can't place a screw into the mounting surface. You can also use it in combination with the other methods of mounting for a more secure installation.

Remove the backing on one side of the tape and apply the tape to the back of the wall mounting bracket between the four raised sections.

Remove the remaining backing and apply the bracket to the mounting location. Press hard on the bracket to make sure that the tape firmly adheres to the surface.

Figure 19   Tape mounting

Plastic-tie mounting

To mount a gateway to a smaller non-wall location, such as a pillar or fencing, use cable ties (also known as zip ties) to fasten the wall mounting bracket. Put the ties through the holes in the four raised sections on the back of the bracket. wrap them around the mounting location and pull tight.

After the bracket is mounted, attach the gateway to the bracket.

Figure 20   Plastic-tie mounting

Mounting the gateway on the bracket

In the following procedure, we talk about the "top" and "bottom" of the gateway and the bracket. The two images below demonstrate this standard orientation. As noted below, the device does not have to be upright in order to function. This explanation is to help you understand the mounting instructions.

When the gateway is upright, the SKF logo on the front of the device is right-side up. The two holes that will reveal the LEDs are just above the logo, on the right side. The hole for the small screw that will attach the bracket to the gateway is at the top, in the center.

Figure 21   Wi-Fi Gateway

On the back of the device, there are two pairs of black plastic hooks. The large hooks, near the bottom of the device, point downward. The small hooks, near the top of the device, point upward.

1. With the wall mounting bracket in place, place the gateway against the bracket. The two large plastic hooks on the back of the gateway should be in the slots at the bottom of the bracket.
2. Press the top of the gateway against the bracket so that the two small plastic hooks on the back of the gateway latch into the top of the bracket.
3. Using the small screw that came with the gateway, fasten the gateway to the bracket through the hole at the top of the gateway.

4. Insert the appropriate AC plug into the AC adapter.
5. Plug the AC adapter into the bottom of the gateway and a power outlet.

When the LED lights on the gateway blink slowly, alternating orange and blue, the gateway is turned on and ready to be commissioned.

Note: The gateway is designed to be mounted with the small screw securing it at the top. However, installing it upside down does not affect its performance.

If you have problems connecting to your gateway, see Troubleshooting Wi-Fi gateway detection.

4.5 Commissioning a Wi-Fi Gateway

Once your gateway is mounted in your facility, use the SKF Axios mobile app to commission it. SKF Axios supports only smartphones using

- Android 8.0 or higher
- iOS 14 or higher with Near Field Communication (NFC) and Bluetooth.

To commission a gateway

1. If Bluetooth isn't already turned on for your smartphone, turn it on.
2. Position your gateway in the location that works best for communicating with your sensors. For additional help with locating a place for your gateway, see Placing and installing a Wi-Fi gateway.
3. Plug in the gateway and make sure the LED lights on top are blinking alternatively orange and blue.

4. Push the button on the side of the gateway to put it into commissioning mode. The lights will start rapidly blinking.
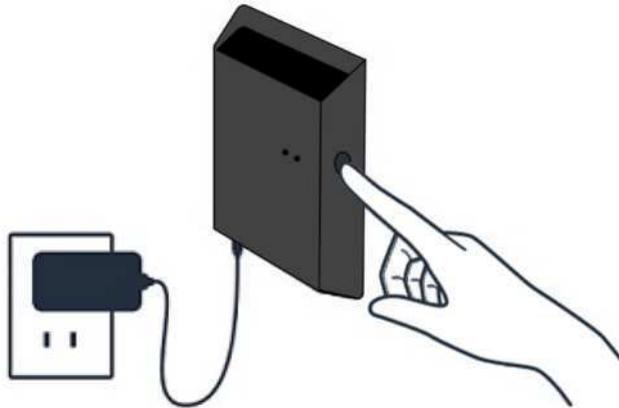
5. Stay within 5 meters (16 feet) of the Wi-Fi Gateway.
6. Open the mobile app on your smartphone.
7. Choose the menu icon (≡). Go to **Gateways**. Choose **Add Gateway**.
8. SKF Axios searches for the gateway. This can take a few moments. When SKF Axios finds the gateway, it displays it in the gateway list.
9. Choose the gateway.

    Note: If you are using an iOS mobile device, and you have previously paired with this particular gateway, you may need to make your device "forget" the gateway before re-pairing. For more information, see Troubleshooting Bluetooth pairing.

    It can take a few moments for SKF Axios to connect to the new gateway. If the mobile app continues to try to connect to the gateway without success, see Troubleshooting Wi-Fi gateway detection.
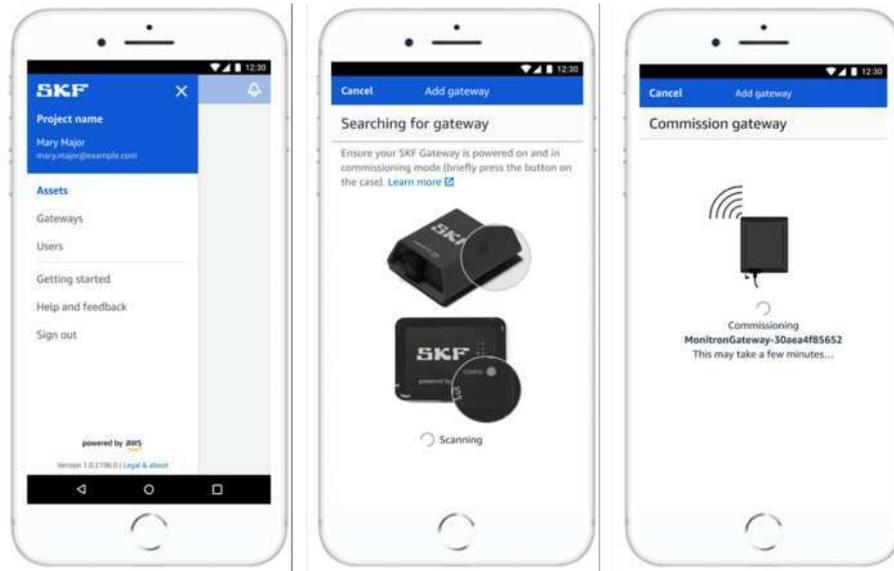
10. After it connects to the gateway, SKF Axios scans for Wi-Fi networks. Choose the Wi-Fi network that you want to use.
11. Enter your Wi-Fi password, and then choose **Connect**. It can take a few minutes for the gateway to be commissioned and connected to the Wi-Fi network. If you have further difficulties, see Resetting the Wi-Fi Gateway to factory settings.

4.6 Troubleshooting Wi-Fi Gateway detection

When you add a gateway to your project or site, as soon as you choose **Add gateway** the SKF Axios mobile app starts scanning to find it. If the mobile app can't find the gateway, try the following troubleshooting tips.

- **Make sure that the gateway is turned on.** Check the LED lights – the two small orange and blue lights next to the SKF symbol on the top of the gateway. If they're on, the gateway has power. If the gateway has no power, check the following:
    o Is the power cord firmly attached to both the back of the gateway and the power outlet?
    o Is the power outlet functioning properly?
    o Is the gateway power cable working? To test this, try using the cable with another gateway.
    o Is the outlet where the cable plugs into the gateway clean, with no debris stuck inside? Be sure to check both the outlet and the gateway and the connecting end of the cable.

- **Make sure that the gateway is in commissioning mode.** The gateway connects to your smartphone using Bluetooth.
    o Is your smartphone's Bluetooth on and working? Try switching it off and on. If that doesn't help, restart your phone, and check again.
    o Are you within your smartphone's Bluetooth range? Bluetooth range is relatively short, usually less than 10 meters (32 feet) and its reliability can vary significantly.
    o Is there anything that might be interfering electronically with the Bluetooth signal?

If none of these actions resolves the issue, try the following:

1. On your iOS mobile device, choose **Settings**.
2. On your **Settings** screen, choose **Bluetooth**.
3. On the **Bluetooth** screen, choose the information icon next to the name of your SKF Axios Gateway.
4. On the next screen, choose **Forget This Device**.

4.7 Resetting the Wi-Fi Gateway to factory settings

If you reuse a gateway that was deleted from SKF Axios, you use the commissioning button to reset the gateway to factory settings. This prepares the gateway to be used again for SKF Axios.

To reset a gateway to factory settings

1. Unplug the power cord from the gateway.
2. Hold down the commissioning button.
3. Plug the power cord of the gateway back in.
4. When the LED lights start slowly blinking, alternating orange and blue, release the commissioning button.
5. Unplug the gateway, wait 10 seconds, and then plug it back in. The gateway is reset.

4.8 Viewing the list of Gateways

To list your Gateways in the mobile app

1. Use your smartphone to log in to the SKF Axios System mobile app.
2. Choose the menu icon in the upper left corner of the screen.

3. Choose **Gateways**
   a. A list of all gateways associated with the project is displayed.

To list your gateways using the web app

1. Log into the SKF Axios web app.
2. Choose **Gateways** from the left navigation menu.

3. The gateway list appears in the right pane.

4.9   Deleting a Wi-Fi Gateway

Sensors need a gateway to relay their data to the AWS Cloud. Deleting a gateway might cause some sensors to lose their connection. Exercise caution before deleting a gateway.

When you delete a gateway, sensors switch their connection to another gateway that is within range, if there is one. Data transmission from the sensor continues uninterrupted. If no gateway is within range, data transmission is interrupted, and the data might be lost.

To delete a gateway using the mobile app

1. Navigate to the **Gateways** page.
2. Choose the vertical ellipses icon (⋮) next to the gateway you want to delete.
3. Choose **Delete gateway**.
4. Choose **Delete** again.

To delete a gateway using the web app

1. Navigate to the Viewing the list of Gateways.
2. Select the gateway from the table.
3. Choose **Delete gateway**.

5 Managing Assets and Sensors

In SKF Axios, the pieces of equipment in your facility are known as *assets*. Typically, assets are individual machines, but they can also be sections of a larger piece of equipment, part of an industrial process, or any element of your manufacturing model.

An asset is also the basis for viewing the health of your machines. To monitor machine activity, you pair one or more sensors to the asset that you want to monitor. Each sensor provides insight into how that part of the asset is functioning, and together they provide an overview of the entire asset.

The following diagram shows one asset, an electric motor pump set. It has four positions, each with a sensor, two on the motor and two on the pump. Each sensor collects data on the temperature and vibration levels of that specific position on the pump. SKF Axios then analyzes that data by comparing it to the baseline temperature and vibration levels of that position to determine when a change, or abnormality, occurs. When that happens, it sends a notification to the SKF Axios app.
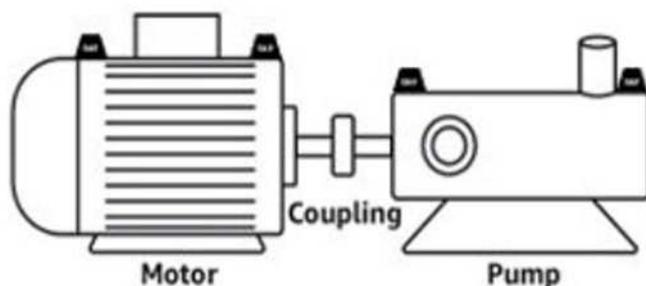
Figure 22   Electric motor pump asset

This section explains how to manage your assets with SKF Axios, and how to pair them to the sensors that monitor their health.

5.1 Managing assets

Use the SKF Axios app to list all the assets in your site or project. To make sure that you are at the correct site, please see Navigating through Sites.
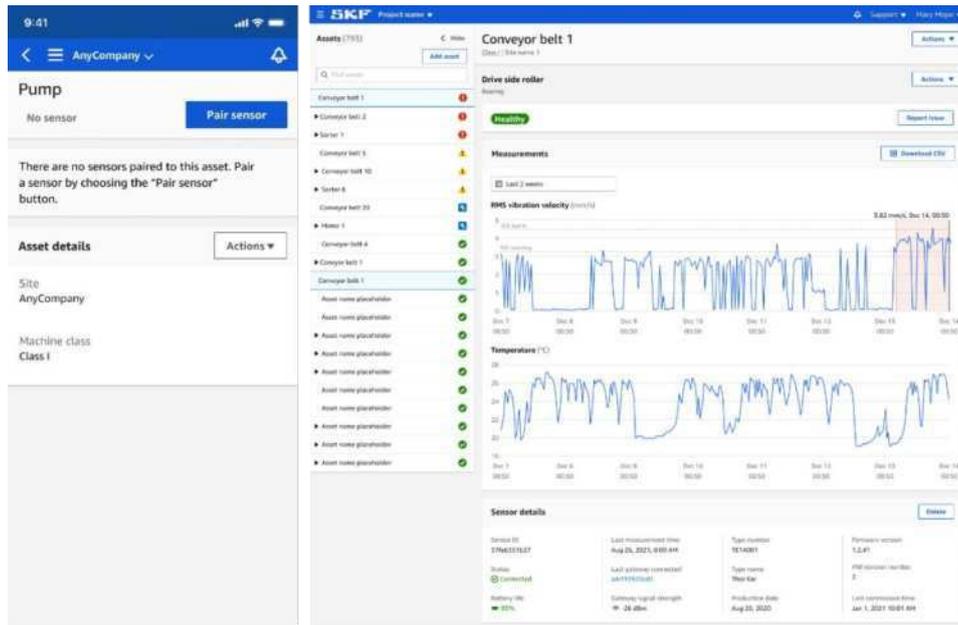
Figure 23   SKF Axios software – App and Web Assets managing

5.1.1 Viewing the list of Assets

The **Assets** page displays the list of assets. The **Assets** page is the app's main page. When you open the app, this is the page that you see. To return to the **Assets** page from another page in the app, use this procedure.

To open the Asset list

1. Choose the menu icon (≡).

2. Choose **Assets**.

Adding an Asset

1. Make sure you're on the correct site or project. The project or site name indicates that you are at that level in the app.
2. On the **Assets** page, choose **Add asset**.
3. For Asset name, enter a name for the asset. For help with naming assets, please see Appendix C Guidelines to help you name your Assets and Positions.
   If you have a QR code identifying the asset name, you can scan it by selecting the QR code button.
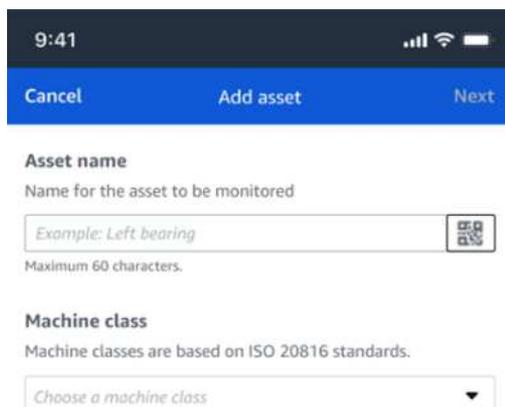
4. For **Machine class**, choose the machine class of the asset. Valid options are based on the ISO 20816 standards.

   Class I
   Individual parts of engines and machines, integrally connected to the complete machine in its normal operating condition, for example, production electrical motors of up to 15 kW (Up to 20 hp).

   Class II
   Medium-sized machines (typically electrical motors with 15 kW to 75 kW output [20 hp to 100 hp]) without special foundations, rigidly mounted engines or machines (up to 300 kW [up to 402 hp]) on special foundations.

   Class III
   Large prime-movers and other large machines with rotating masses mounted on rigid and heavy foundations that are relatively stiff in the direction of vibration.

   Class IV
   Large prime-movers and other large machines with rotating masses mounted on rigid and heavy foundations that are relatively soft in the direction of vibration measurement, for example, turbogenerator sets and gas turbines with outputs greater than 10 MW (13410 hp).

5. Choose **Add**.

The **Assets** list shows the new asset. Because you haven't paired a sensor with the asset yet, **No Sensor** appears next to it.

5.1.2 Changing an Asset name

After you add an asset, you can change only its name. You can't change the asset's machine class.

To change an asset's name in the mobile app

1. From the app's main menu, choose **Assets**.
2. For **Asset details**, choose **Actions**.
3. Choose **Edit asset**.
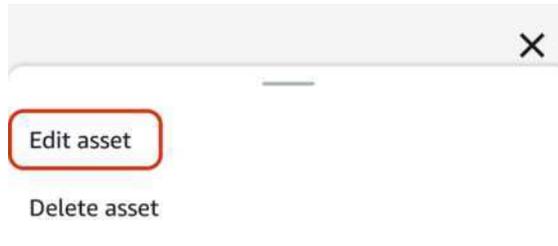
4. Enter a new name.
5. Choose Save.

To change an asset name in the web app

1. Select the asset.
2. In the large pane, choose the **Actions** button from the right end of the row containing the asset name.
3. Select **Edit asset name**.
4. Enter a new name.
5. Choose **Save**.

5.1.3 Deleting an Asset

Deleting an asset removes all associated sensors and their positions, as well as any historical data associated with them.

To delete an Asset

1. From the app's main menu, choose **Assets**.
2. Choose the asset that you want to delete.
3. For **Asset details**, choose **Actions**.
4. Choose **Delete asset**.

5. Choose one of the following options.

a. If there are no sensors paired with the asset, choose **Delete** and go to the next step.

> **Delete "Asset 6"?**
>
> Once you delete "Asset 6", all positions and historical measurements of this asset will also be deleted.
>
> Cancel   **Delete**

b. If there are sensors paired with the asset, delete them.

> **Delete "Asset name 5"?**   ✕
>
> You need to delete the sensors and positions in this asset before you can delete the asset.
>
> Once you delete the asset, all historical measurements of this asset will also be deleted.
>
> **Delete sensor & positions**
>
> Cancel   Delete
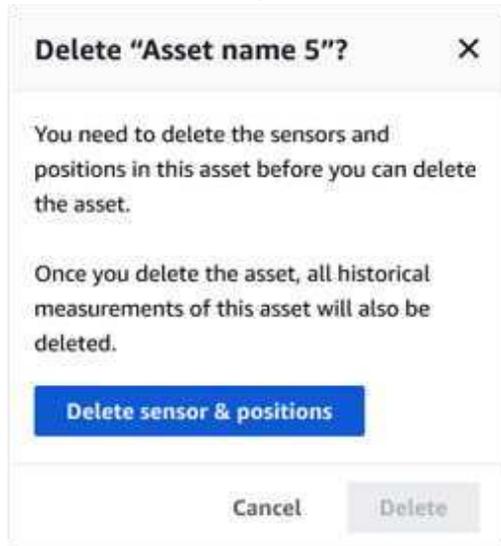
c. Choose Delete sensors and positions. When you delete a sensor or position, all historical measurements taken at this position will also be deleted. It can take a few moments for SKF Axios to delete all of the paired sensors and positions.

> **Delete "Asset name 5"?**
>
> You need to delete the sensors paired to this asset before you can delete the asset.
>
> Once you delete the asset, all historical measurements of this asset will also be deleted.
>
> ⊘ Sensors & positions deleted
>
> Cancel   **Delete**
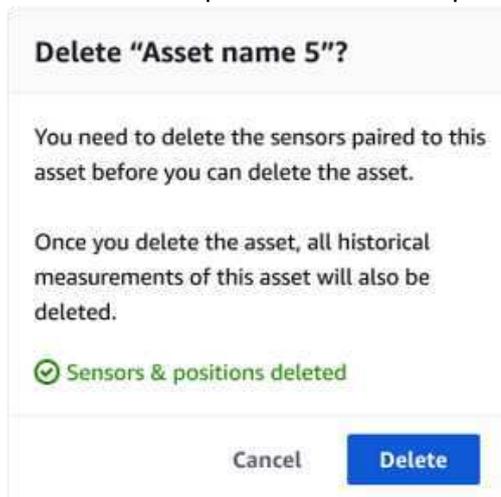
6. Choose **Delete**.

6 Managing Sensors and Sensor positions

Sensors collect the data from your equipment, then SKF Axios uses that data to detect developing abnormalities. Where you mount a sensor (the position) is extremely important for collecting and analyzing data.

To get a more detailed picture of your asset's health, you might need to collect data from multiple positions on your asset. You can place sensors on up to 20 positions on each asset. If you have complex machinery with more than one potential point of failure, we recommend that you collect data from multiple positions.

6.1 Positioning a sensor

To detect abnormalities in machine components, mount sensors in all locations where temperature and vibration can be measured effectively.

To achieve the greatest accuracy:
- Mount the sensor directly onto the housing of the target component.
- Minimize the length of the vibration transmission path (the distance between the source of vibration and sensor).
- Avoid mounting the sensor where its measurements may oscillate due to natural frequencies, such as on sheet metal covers.

Vibration will attenuate up to 30–36" (75–90 cm) from the source.

Attributes of the vibration transmission path that can reduce the transmission path length include:

- the number of mounting surfaces, which can cause signal reflection
- materials such as rubber or plastic, which can absorb vibration

Note: SKF Axios sensors are 3-axis vibration sensors. The X, Y, and Z marks indicate the directions of the 3 three axes. Therefore, it is not necessary to align any particular axis with the direction of the asset's vibration.

The following example of an electric motor pump set shows sensor locations, with four positions: two on the motor and two on the pump.
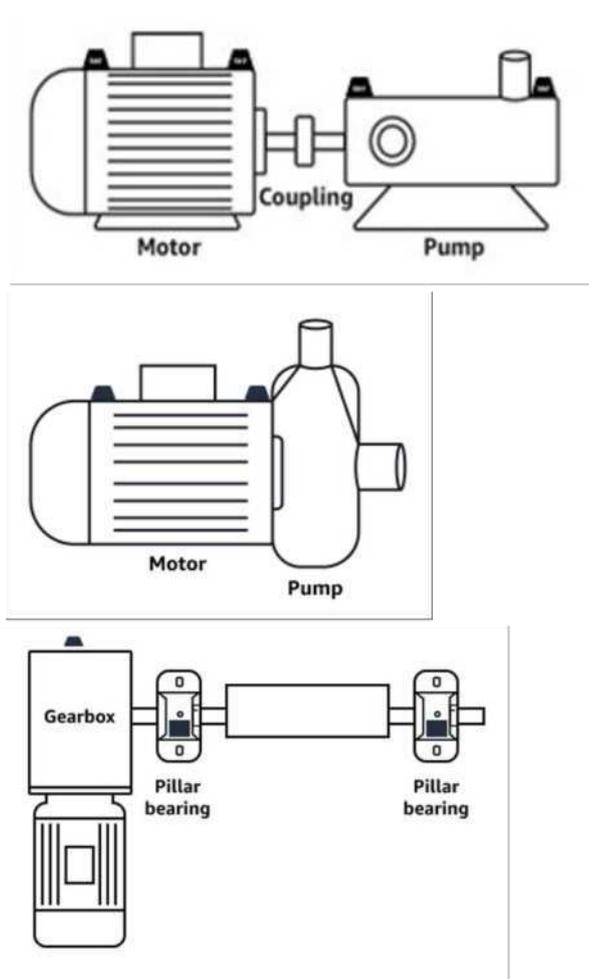
Figure 24   Two sensors example

For complex equipment with multiple moving parts (such as gearboxes), position the sensor to minimize the length of the transmission path from the primary vibration source. Note that vibration is reduced when it is transmitted between adjacent parts of equipment, so the shortest distance between the sensor and the source of vibration is not always the best option.

The following example of a gearbox shows how vibration can be transmitted through equipment in this way, along with a potential location for a sensor to detect this vibration.
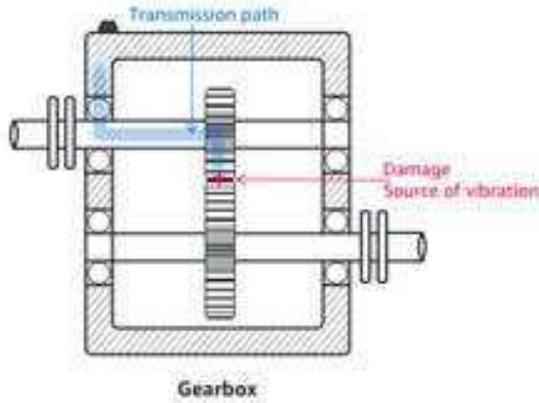
Figure 25   Gearbox vibration transition

For other types of equipment, the best position can be less obvious. For example, when placing a sensor to monitor bearings, position it close to the bearing's load zone, which is based on the direction of the load on the bearings as shown below.
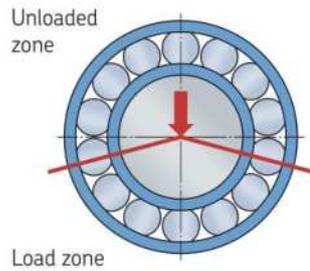
Figure 26   Load zone

Different types of loads on the bearings result in different load zones. Placing the sensor as close as possible to the center of the load zone is most likely to provide the best data.
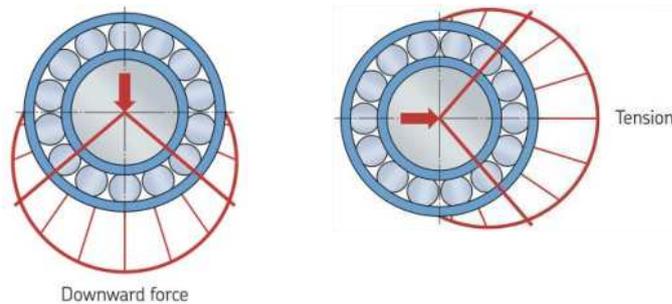
Figure 27   Different load zones

6.2 Mounting a sensor to an asset

The temperature and vibration detectors are located on the base of the SKF Axios sensors. Any area of the base is effective as a target contact area, but the contact area must be at least 30 x 25 mm (1 in x 1¼ in) for reliable detection. Center the target contact area over the mounting location for the most reliable results. The circular aluminium sensor (in the center of the target contact area) conducts heat directly from the asset's surface to the temperate sensing mechanism inside the SKF Axios sensor.
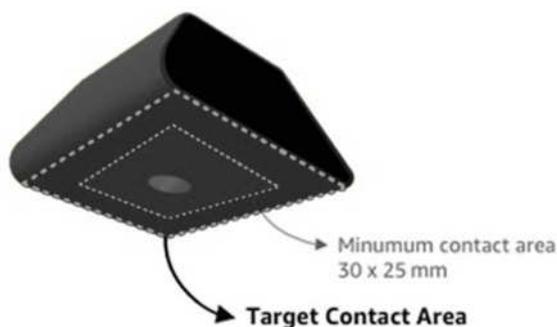
Figure 28   Target contact area

If you are uncertain of where to mount your sensor, see Positioning a sensor.

Important safety warning:

> ⚠ *When installing sensors, check and obey applicable safety regulations. You are solely responsible for safely installing the sensor on any equipment or machine part. To mount a sensor, use industrial adhesive. Always consult and obey the adhesive manufacturer's safety and handling instructions.*
>
> *For more information about the recommended adhesive, see Loctite 454 Technical Information or Loctite 3090 Technical Information, as appropriate.*

To mount a sensor

1. Remove all oil and grease from the position on the asset where you want to mount the sensor.
2. If the surface that you're mounting the sensor to is flat and relatively smooth, apply a thin layer of adhesive such as Loctite 454 to the bottom of the sensor, maximizing the area that will be in contact with the asset.

   If the surface is rounded or somewhat uneven, apply a slightly more liberal layer of adhesive such as Loctite 3090 to the bottom of the sensor. The layer

of adhesive can bridge distances of up to 5 mm (0.2 in) between the surface and the sensor if necessary.

3. Hold the sensor to the mounting location on the machine part for 30 seconds, pressing firmly.

If you're mounting the sensor on a curved surface, put a small amount of additional adhesive on each side for better contact between the sensor and the surface. Based on the surface and the adhesive used, your results should look like the following.
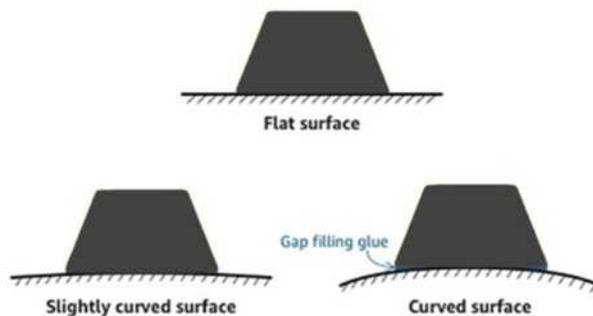
Figure 29   Different surfaces - example

6.3 Pairing a sensor to an asset

After you've added an asset, pair it to one or more of the sensors to monitor its health. Each sensor is mounted on the asset in its own position. When you pair a sensor to an asset, you record the type of position. You will often need to monitor multiple locations on a large asset to get a clear picture of its health. You can place up to 20 sensors at different positions on an asset. Less complex assets might require only one or two sensors.

Each sensor measures the temperature and vibration at its position. You can name a position anything you like, and you can change the name later if necessary. For guidelines that SKF recommends, please see Appendix C: Guidelines to help you name your Assets and Positions.

For more information on where to place sensors, see Positioning a sensor.

Important note: After you pair a sensor to an Asset, SKF Axios establishes a baseline for that position. The baseline tells SKF Axios how the asset performs under normal conditions. SKF Axios uses this information to identify abnormal conditions. During this time, SKF Axios assumes that conditions are normal and may produce alerts if the vibration or temperature levels are above ISO thresholds.

To pair a sensor to an asset

1. Ensure that near field communication (NFC) is turned on for your smartphone.

   TIP: For many smartphone models, NFC is turned on by default. The following resources might help you determine whether you need to turn on NFC, and how to do so:
   - About NFC (Samsung)
   - Models that support NFC Tag Reader (iPhone)

2. From the Assets list, choose the asset.

   a. If you just created the asset and haven't paired any sensors to it, choose **Pair sensor**.
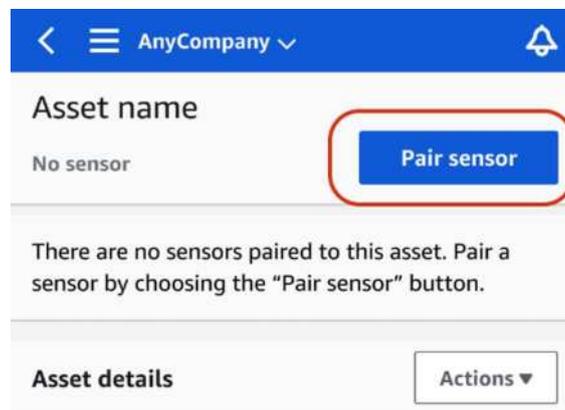
   b. If you previously created an asset and have already paired sensors to it:
      i. After you choose the asset, you will see a dropdown list of sensors associated with that asset. Choose the View option at the top of that list.
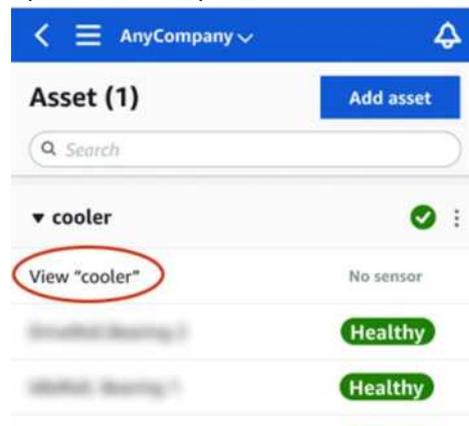
ii. Choose Pair Sensor.
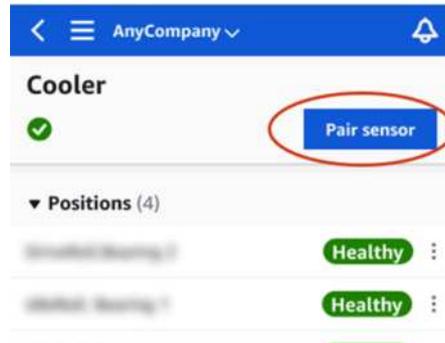
3. Place your sensor on the machine in the correct location. For more information about placing sensors, see Positioning a sensor and Mounting a sensor to an asset.

4. Name the position that the sensor will monitor.
    SKF recommends that you use a name that is clear and easy for you to work with. (See Appendix C Guidelines to help you name your Assets and Positions)

5. For Type of position, choose the position type:

    - Bearing
    - Compressor
    - Fan
    - Gearbox
    - Motor
    - Pump
    - Other

    Note: After you pair a sensor to an asset, you can't change the position type. If you need to change the type, you must delete the sensor to re-add it.

6. Touch your smartphone to the sensor to pair with it. Don't move your smartphone while you are pairing the sensor. It can take a few moments for SKF Axios to commission the sensor and pair with it.
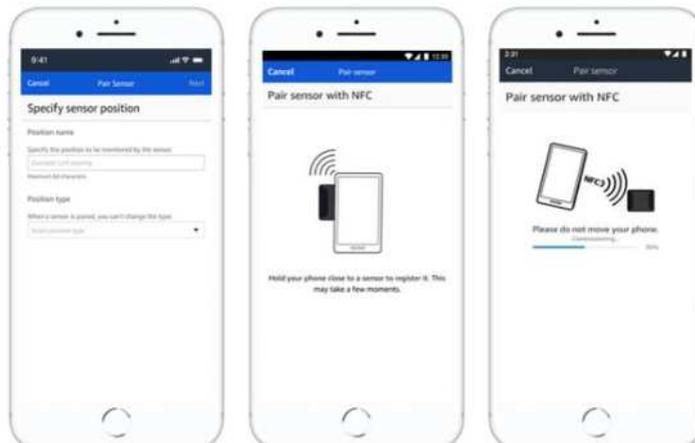
When more than one sensor is paired with a given asset, the Assets page shows each sensor position and its health status, but not the specific details about each position. To display the details, choose the position from the list. For more information about the data you can monitor with each asset, see Understanding sensor measurements.

Positions are displayed in status order. For example, a position that's in an alarm state is displayed above a position that's in an acknowledged state. Positions that are in a healthy state follow those in an acknowledged state.

6.4 Changing a sensor position name

You can change only a position's name. You can't change a sensor's type.

To edit a sensor position name in the mobile app

1. From the **Assets** list, choose the asset with the sensor position name you want to change.
2. Choose the sensor with the position name you want to change.
3. Under **Position details**, choose **Actions**.
4. Choose **Edit position details**.
5. For **Position name**, enter a new name.
6. Choose **Save**.

To edit a sensor position name in the web app

1. Select the position.
   Choose the **Actions** button in the **Positions** table.
2. Choose **Edit position details**.
3. For **Position name**, enter a new name.
4. Choose **Save**.

6.5 Deleting a sensor

Deleting a sensor prevents SKF Axios from collecting more data with it. It doesn't delete the data that it has already collected.

To delete a sensor in the mobile app

1. From the **Assets** list, choose the asset that is paired to the sensor that you want to delete.
2. Choose the sensor.
3. Under **Sensor**, choose **Actions**.
4. Choose **Delete** sensor.

5. Choose **Delete**.

After a sensor has been deleted, the status for that position says **No sensor**.

To delete a sensor in the web app

1. Choose **Delete** from the **Sensor details** pane.

6.6 Deleting a sensor position

Deleting a sensor position removes that data collection point from the asset. If a sensor is still paired to this position, you need to remove it before you can delete the position.

To delete a sensor position in the mobile app

1. From the **Assets** list, choose the asset that has the sensor position that you want to delete.
2. Under **Sensors**, choose **Actions**.
3. Choose **Delete** position.
4. If the position has a sensor paired to it, delete the sensor by choosing **Delete sensor**. Otherwise, skip to the next step.
5. Choose **Delete**.

To delete a sensor position in the web app

1. Select the position.
2. Choose the **Actions** button in the **Positions** table.
3. Choose **Delete position**.
4. If the position has a sensor paired to it, delete the sensor by choosing **Delete sensor**. Otherwise, skip to the next step.
5. Choose **Delete**.

6.7 Viewing sensor details

To check that a sensor is performing as expected, check its details page. The **Sensor details** page shows the following information:
- Sensor ID
- Sensor status
- Date the sensor was last commissioned
- Date of the last measurement
- Last gateway it connected to
- Current signal strength of the last gateway
- Sensor type
- Firmware version

7 Understanding measurements and machine abnormalities

SKF Axios collects temperature and vibration data from sensors and monitors asset conditions for abnormalities that might indicate developing faults. You monitor your assets either with the SKF Axios web app, or with the SKF Axios mobile app, which you download and install on your smartphone. SKF Axios supports only smartphones using

- Android 8.0 or higher
- iOS 14 or higher with Near Field Communication (NFC) and Bluetooth.

This section describes how to read sensor measurements, respond to notifications about machine abnormalities, and take one-time measurements.

7.1 Understanding sensor measurements

When a sensor is initially paired to an asset, SKF Axios will learn from the vibration and temperature data collected from the equipment, establishing a baseline to determine what is "normal" for that asset. It will use this learning to detect potential abnormalities in the future. Depending on the situation, operational scenario, use case, and various parameters like the asset's duty cycle, SKF Axios will take between 14 and 21 days to establish this baseline. During this learning phase, the asset is assumed to be healthy. (However, you may still receive a notification if measurements exceed ISO thresholds, as discussed below.) After that time, SKF Axios continues to fine-tune the baseline, building a better picture of "normal" as the sensor collects more data.

After establishing a baseline for the asset, SKF Axios monitors the data it collects, looking for an event or trend that indicates a potential abnormality. It specifically watches for increases in temperature, or vibration levels, or both. Increases in temperature and vibrations are two of the main indicators of a malfunctioning machine. Machine abnormalities often indicate that an asset is starting to fail.

SKF Axios uses temperature and vibration thresholds established by the International Organization of Standardization (ISO) for your class of machinery. It applies the ISO thresholds in combination with its self-training model to assess actual thresholds to fit your equipment. For example, if your machine's vibration or temperature fluctuates outside of normal ranges, SKF Axios adjusts the thresholds slightly so that it can more accurately identify when the machine is acting abnormally.

If temperature or vibration levels rise inconsistently (4 of 6 readings) above the modified threshold, SKF Axios sends a warning notification. If temperature or

vibration levels rise consistently above the threshold (6 out of 6 readings), SKF Axios sends an Alarm notification. When there is an Alarm notification, it is recommended to inspect the machine and determine the cause of the alert.

7.2 Understanding asset status

The Assets list displays the status of every asset in your site or project.

7.2.1 The Assets list

The **Assets** list displays every asset in your site or project, showing the assets for the site or project that you are currently viewing. For more information about sites and projects, see Navigation through Sites.

When you open the SKF Axios mobile app, it displays the list of assets associated with the site or project that you last worked with. To navigate to the **Assets** list from elsewhere in the app, use the following procedure.

To open the assets list in either the mobile app or the web app

1. Choose the menu icon (☰).
2. Choose **Assets**.
3. The assets list is displayed.

7.2.2 Asset and position status

The **Assets** list shows the status of each listed asset with an icon, as shown in the following table.

Status	Meaning
✔	**Healthy State.** The status of all sensor positions on the asset is healthy.
⚠	**Warning State.** A warning has been triggered for one of the positions of this asset, indicating that the System has detected early signs of potential failure. The System identifies warning conditions by analyzing equipment vibration and/or temperature, using a combination of machine learning and ISO vibration standards.
⛔	**Alarm State.** An alarm has been triggered for one of the positions of this asset, indicating that the machine vibration and/or temperature is out of the normal range at this position. We recommend that you investigate the issue at the earliest opportunity. An equipment failure might occur if the issue isn't addressed.
🔧	**Acknowledged State.** The warning or alarm state of the position has been acknowledged by a technician, but the asset has not yet been fixed.
No Sensor	**No Sensor.** At least one position for the asset doesn't currently have a sensor paired to it.

Figure 30   Asset Status and Meaning

To learn more about a problem, choose the asset and look at the status of underlying sensor positions.

SKF Axios uses icons similar to the asset status icons to show the status of sensor positions.

Status	Meaning
Healthy	The position is healthy. All measured values are within the normal range.
⚠️	A warning has been triggered for one of the positions of this asset, indicating that the System has detected early signs of potential failure. The System identifies warning conditions by analyzing equipment vibration and/or temperature, using a combination of machine learning and ISO vibration standards.
Alarm	An alarm has been triggered for one of the positions of this asset, indicating that the machine vibration and/or temperature is out of the normal range at this position. We recommend that you investigate the issue at the earliest opportunity.
Acknowledged	The warning or alarm state of the position has been acknowledged by a technician, but the asset has not yet been fixed.
No Sensor	No sensors are currently paired with the position.

Figure 31   Position Status and Meaning

7.2.3 Notifications

When a warning or an alarm alert is generated, SKF Axios sends a notification to the admin user and technician in the app. Authorized personnel can also see notifications by choosing the notification icon in the mobile app when it displays an alert symbol (🔔).

Choosing the notification icon opens the **Notifications** page, which lists all pending notifications.

7.3 Acknowledging a machine abnormality

After receiving a notification, the admin user or technician must acknowledge it. Acknowledging the notification lets other users know that the issue has been noted and that action will be taken.

To view and acknowledge a machine abnormality

1. From the **Assets** list, choose the asset that is reporting an abnormality.
2. To view the issue, choose the position with the abnormality.
   a. Sensor measurements that show the anomaly are displayed.
3. (Optional, mobile app only) To view the measurement chart in landscape mode, choose the expand icon (⤢).
4. Choose **Acknowledge**.
   The status of the asset changes to **Maintenance**

7.4 Resolving an abnormality

After an abnormality occurs, it needs to be acknowledged, and then addressed. You can do all of this within the mobile and web apps.

Resolving an abnormality returns the sensor to a healthy state. It also sends SKF Axios information about the problem so it can better predict similar abnormalities.

You can choose from among many common types of failures (called failure modes) and causes of failures. If none of the modes or causes apply to your situation, choose Other.

The following sections explain the answers available when selecting failure modes, failure causes, and actions taken. The explanations in Action taken describe how each response will affect the Machine Learning model.

For more information on determining failure modes related to bearings, please visit Bearing Damage & Failure Analysis.

7.4.1 Failure modes (types)

- **Fatigue**: Flaking, spalling, peeling, burnishing, microcracks
- **Wear**: Excessive wear, scratches, scores, seizing marks, smearing, hot runners
- **Corrosion**: Moist corrosion, fretting corrosion, false brinelling
- **Electrical Erosion**: Craters, fluting
- **Plastic Deformation**: Depressions, debris indentation, nicks, gouges
- **Fracture and Cracking**: Forced fracture, fatigue fracture, thermal fracture
- **Unknown**
- **Other**
- **No Issue Detected**

7.4.2 Failure causes

- **Operating Condition**: Overload, shaft/housing deflection, excessive frequency of load/speed changes, vibration
- **Environmental Factors**: Temperature too high or too low, dust and dirt, water, electrical leakage
- **Lubrication**: Wrong viscosity, additives selection, or consistency; lack of lubrication; excess lubrication; impurities
- **Mounting**: Incorrect handling (shock loads), incorrect mounting, fit too tight or too loose, tilting/misalignment, incorrect locating (clamping)
- **Incorrect Specifications**
- **External Forces**
- **Equipment Design**

- **Unknown**
- **Other**: Storage, transportation (vibration/shock), bearing selection, manufacturing concerns, material concerns

7.4.3 Action taken

- **Adjust**: Adjust a component or an asset by putting it in the right position, alignment and with the right tolerance.
- **Clean:** cleaning the asset from any pollutant (dirt, grease, oil, foreign object, etc.)
- **Lubricate**: Lubricating the asset/component using oil/grease or any other lubrication product for a more fluid movement with less vibration/overheating.
- **Modify:** Modifying the asset/component to reduce/eliminate vibration/temperature. This will trigger a new learning period to adapt for the new vibration levels of the modified components/parts.
- **No Action (keep monitoring):** This code is used when the user cannot pinpoint the cause of vibration and would like to keep monitoring the asset, this will close the alarm but not change the ML model, meaning that the alarm will be triggered again if the same level of vibration is measured again. This will also not mute ISO if the alarm was triggered by an ISO threshold.
- **Other:** Any other action that is not part of this list.
- **Overhaul:** to be used is case of disassembly and repair of parts/components. This will trigger a new learning period to adapt for the new vibration levels of the new components/parts.
- **Replace:** To be used when a component or part monitored by the sensors are replaced, this will trigger a new learning period to adapt for the new vibration levels of the new components/parts.
- **No Failure Detected:** The user has checked the asset and has detected no issue or failure, meaning that the levels of vibration/temperature that triggered the Alarms/warning correspond to normal running measurement/asset conditions. If the Alarm/warning was triggered by ISO, this will then stop ISO warning/alarms on that position as they are not representative of that asset normal running conditions. If the Alarm/warning was triggered by ML, then all measurement taken during the Alarm period will be added to the ML learning data sets and trigger a change in the ML baseline and thresholds.

To resolve a machine abnormality using the mobile app

1. From the **Assets** list, choose the asset that had an abnormality that you resolved.
2. Choose the position with the abnormality.
3. Choose **Resolve**.
4. For **Failure mode**, choose the type of failure that occurred.
5. For **Failure cause**, choose the cause of the failure.
6. For **Action taken**, choose which action you took.
7. Choose **Submit**.

7.5 Reporting an issue in the mobile or web app

In some cases, you may want to manually report an issue on an Asset or Position:

- During the learning period, for example, to report an issue that was not triggered by ISO thresholds but can be used to define the baseline of the ML model.
- If the failure mode "No Fault Detected" was wrongly used and the user wants to revert the ML back to lower temperature or vibration threshold.
- If the user wants to report an issue that has not triggered the ML or ISO Alarm/Warning thresholds.

How to report an issue in the mobile app/web app

1. Log into either the mobile or web app
2. Select the position you would like to update.
3. Choose **Report Issue**.
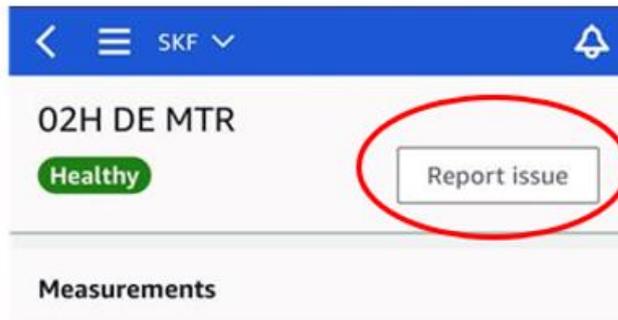
4. For **Failure mode**, choose the type of failure that occurred.
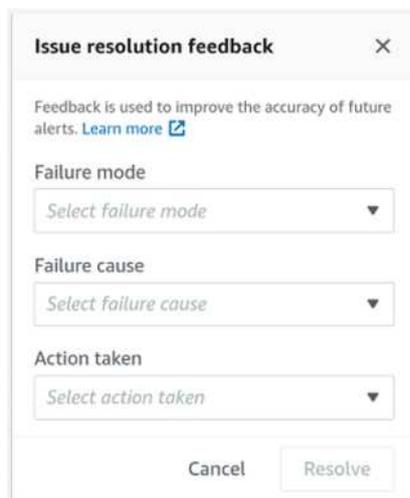
5. For **Failure cause**, choose the cause of the failure.
6. For **Action taken**, choose which action you took.
7. Choose **Submit**.

7.6 Taking a one-time measurement

In addition to the measurements normally acquired by a sensor, the user can acquire an on-demand measurement at any time.

To take a one-time measurement (mobile app only)
To take a one-time measurement, you need to be physically close to the sensor.

1. From the of assets, choose the asset paired to the sensor where you want to take a measurement.
2. Choose the sensor.
3. Under **Sensor**, choose **Actions**.
4. Choose **Take measurement**.
5. Hold your smartphone close to the sensor.
6. When the measurement has been taken, move your smartphone away from the sensor.

The new measurement is added to the data that the sensor has already collected.

8 Troubleshooting

If you have problems with one of your SKF Axios devices, use these suggestions to troubleshoot the problem. Then, if you're still having trouble, contact SKF Technical Support.

8.1 Troubleshooting issues with SKF Axios Sensors

8.1.1 If you can't commission your sensors

Consider the following questions:

- **Are you holding your smartphone close to the sensor**?
  When commissioning/pairing a sensor, your phone should touch the sensor. Don't move your phone while the sensor is being commissioned.

- **Does your smartphone have NFC activated**?
  Ensure NFC is activated and broadcasting on your phone. Refer to your phone manufacturer's user guide for NFC settings.

- **Does the commissioning progress bar show up**?
  If the commissioning progress bar (Android) or percentage complete (iPhone) doesn't appear, or resets to the beginning, the NFC communication between the sensor and your smartphone is weak or can't be established. Move your smartphone in a different position to try and establish the NFC connection. Smartphones often have different locations for transmitting NFC, depending on the brand. Check the hardware specifications of your smartphone and tap the sensor specifically with that part of your phone.

8.1.2 If your sensor is offline

Once a sensor has been paired to an asset, SKF Axios will make three attempts (over the course of 30 seconds) to take the initial measurement. If neither of those attempts is successful, then an alert like the one below will appear in the app.

If your sensor has stopped sending data, try the following:
- Try Taking a one-time measurement. If you can do so, then the sensor is working. If you cannot, then the sensor is not working, and may have run

out of battery power. Replace it with a new sensor.

- Confirm that an available gateway is within range. SKF Axios sensors and gateways communicate using Bluetooth Low Energy (BLE), with a typical range of 20 to 30 meters (65 to 98 feet). In a completely open space, a sensor and a gateway may communicate with each other at greater distances.

- Check for obstacles. Concrete walls and metal objects attenuate the signals.

- Check for signal interference. The Bluetooth signal that sensors and gateways use to communicate occupies the 2.4GHz ISM (industrial, scientific and medical) band. Other devices that may use that band include wireless headsets and mice, wireless cameras, microwave ovens, and garage door openers.

- If the measurement action starts (you see a loading bar), but does not complete, try to retake the measurement. If the same thing happens again, try to delete the sensor and recommission it.

- If the measurement action fails, or you are not able to commission the sensor, contact SKF Technical Support.

8.1.3 If your sensor falls off

- Verify you are using the correct adhesive/epoxy
    - Is the sensor on a curved or flat surface?
    - Is the adhesive/epoxy suitable for the environment condition?
        - Check temperature limits, etc.
    - Are you holding the sensor in place for the minimum required time?

    For more details on mounting your sensor, please see Mounting a sensor to an asset.

8.2 Troubleshooting issues with SKF Axios gateways

8.2.1 If your mobile app can't communicate with the gateway

If you choose **Add gateway** in your mobile app, but the app can't find the gateway, try the following.

- **Make sure that the gateway is powered on.** Check the lights on the front of the gateway. If at least one of them is on, then the gateway has power. If the gateway has no power, check the following:

- o Is the power cord firmly attached to the back of the gateway and the power outlet?
- o Is the power outlet functioning properly? Test this by trying a different outlet.
- o Is the gateway power cable working? To test this, try using the cable with another gateway.
- o Is the outlet where the cable plugs into the gateway clean, with no debris stuck inside? Be sure to check the outlet in the gateway and the connecting end of the cable.

- **Make sure that the gateway is in commissioning mode**.
  See Commissioning a Wi-Fi gateway or Commissioning an Ethernet gateway.

- **Make sure your smartphone's Bluetooth is working**.
  - o Try switching it off and on. If that doesn't help, restart your phone and check again.
  - o Are you within your smartphone's Bluetooth range? Bluetooth range is typically less than 10 meters (32 feet).
  - o Is there anything that might be interfering electronically with the Bluetooth signal? See If your sensor is offline.

If none of these actions resolves the issue, try the following:
- Log out of the mobile app and restart it.
- Reset your Wi-Fi gateway or reset your Ethernet gateway.

8.2.2 If your gateway goes offline

Your mobile or web app may tell you that your gateway is offline, or not connected to the network. In such cases, try the following:

- If you recently added the gateway to your configuration, wait for its status to update. A newly commissioned gateway may take up to 20 seconds to go online.
  - o Sensors send data once an hour. If you do not want to wait, consider taking a one-time measurement.

- Verify that you aren't trying to configure a Wi-Fi gateway with static IPs. The Wi-Fi gateway does not currently support static IPs. However, you can configure your network to always assign the same IP address to the same device.

- Verify that your firewall is not blocking the gateway. SKF Axios gateways use TCP port **8883**. You must allow connections to TCP port **8883** for amazonaws.com subdomains in order to provide firewall access to SKF Axios gateways.

- Confirm that the issue is not network congestion. There are two ways in which SKF Axios may notify you that a gateway is offline:
    o When looking at information about your gateways in the mobile or web app, you may notice that a gateway is listed as offline.
    o The timestamp for an offline gateway marks the last time SKF Axios received a signal from that gateway.

    In this case, you may not have received a notification about the gateway's offline status. SKF Axios will not issue a notification every single time a gateway appears to be offline. A newly commissioned gateway is considered offline until it connects to the internet. A gateway on a congested network is considered offline if SKF Axios hasn't heard from that gateway in 15 minutes.

- Confirm that your gateway is connected to a power source. If it is, unplug the gateway and then plug it back in.

- If it's a Wi-Fi gateway, check the Wi-Fi connection. If the password for the Wi-Fi network has been changed since the gateway was added, it won't be able to connect. To reconnect, you'll have to delete the gateway and add it again, connecting to the Wi-Fi network using the new password. For more information about how to add a gateway, see Commissioning a Wi-Fi gateway or Commissioning an Ethernet gateway.

- If it's an Ethernet gateway, check the network configuration.

- Delete the gateway using the SKF Axios mobile app, do a factory reset of the gateway, and then install the gateway again. For more information, see Resetting the Wi-Fi gateway to factory settings or Resetting the Ethernet gateway to factory settings.

If none of these suggestions helps to get your SKF Axios device working again, contact SKF Technical Support.

Appendix A Issue resolution feedback that modifies the ML Model

Type of feedback	Feedback	Meaning	Impact on ML Model
Failure Mode	No Failure Detected	The user has checked the asset and has detected no issue or failure, meaning that the levels of vibration/temperature that triggered the Alarms/warning correspond to normal running measurement/asset conditions.	-If the Alarm/warning was triggered by ISO, this will then stop ISO warning/alarms on that position as they are not representative of that asset normal running conditions. -If the Alarm/warning was triggered by ML, then all measurement taken during the Alarm period will be added to the ML learning data sets and trigger a change in the ML baseline and thresholds.
Failure Mode	Undetermined (Keep monitoring)	This code is used when the user cannot pinpoint the cause of vibration and would like to keep monitoring the asset	This will close the alarm but not change the ML thresholds, meaning that the alarm will be triggered again if the same level of vibration is measured again.
Action taken	No Action (keep monitoring	This code is used when the user cannot pinpoint the cause of vibration and would like to keep monitoring the asset.	This will close the alarm but not change the ML model, meaning that the alarm will be triggered again if the same level of vibration is measured again. This will also not mute ISO is the alarm was triggered by an ISO threshold.

Type of feedback	Feedback	Meaning	Impact on ML Model
Action taken	Modify	The part/component or asset was modified after the issue was found.	This will trigger a new learning period to adapt for the new vibration levels of the modified components/parts.
Action taken	Overhaul	The part/component or asset was modified after the issue was found.	This will trigger a new learning period to adapt for the new vibration/temperature levels of the new components/parts.
Action taken	Replace	The part/component or asset was replaced after the issue was found.	This will trigger a new learning period to adapt for the new vibration/temperature levels of the new components/parts.

Type of feedback	Feedback	Picture
Failure Mode	No Failure Detected	**Failure mode** No failure detected ▼ ⓘ After you choose Submit, the SKF System stops sending alerts based on ISO thresholds. Learn more 🗗
Failure Mode	Undetermined (Keep monitoring)	**Failure mode** Undetermined (keep monitoring) ▼
Action taken	No Action (keep monitoring	**Action taken** No action (keep monitoring) ▼
Action taken	Modify	**Action taken** Modify ▼ ⓘ After submitting your feedback, the SKF System will take 14-21 days to establish a new condition baseline.
Action taken	Overhaul	**Action taken** Overhaul ▼ ⓘ After submitting your feedback, the SKF System will take 14-21 days to establish a new condition baseline.
Action taken	Replace	**Action taken** Replace ▼ ⓘ After submitting your feedback, the SKF System will take 14-21 days to establish a new condition baseline.

Appendix B Issue resolution

When a sensor detects a machine abnormality, the status of the asset changes. When a problem occurs, you can see it in the **Assets** list in the SKF Axios app.

Below is a list of actions the user can take to analyze the issue, detect the root cause of the abnormality, and return the asset to a healthy state.

Example of Steps to Take:

1. Before acknowledging the Alarm/Warning, check what triggered it in the message banner of the app/webapp to determine if:

    a. The Alarm was caused by Vibration and/or Temperature
    b. The Alarm was triggered after exceeding the ISO Threshold or ML, or both.
    Note: In some cases, both vibration and temperature can be increasing, this can be indicative of a more critical situation as both are not necessarily separate indicators of worsening condition of your asset. Always review the graphs of both temperature and vibration.

2. Check the evolution of the vibration/temperature measurement over time to look for any increase of vibration or temperature that can be an indicator of change in condition. (see picture below). The apps can show up to 30 days' worth of data.

Note: In several cases, a clear increase over time (like the picture above) will not be visible, this means that the level of vibration/temperature triggering the Alarm were:

*   Higher than the vibration level measured during the learning period in 4 out of the 6 last running measurements.
*   Higher than the ISO threshold in 4 out of the 6 last running measurements.
*   Or the temperature measurement was 5°C (9°F) higher than the highest level measured during the learning period

3. You can also download the last 10,000 measurements from the webapp to measure the moving average of the vibration and temperature of your asset to check for any increase over time that might not be visible in the graph.

4. Once you have checked the level of vibration, you can acknowledge the alarm and start investigating the cause of the Alarm/Warning on the asset itself.

Note: Further input from additional condition monitoring technologies can help determine the root cause of the Alarm. For more information on how SKF condition monitoring solutions can help your facility, please visit www.skf.com

Example checklist

Feel free to add or remove action items based on the needs of your facility. This list is here to help you start analyzing your Asset and focus on your Root Cause Investigation

1. Visual inspection for damage, loose components, debris, alignment, tracking (Yes / No / NA)
2. Verify proper lubrication levels: (Yes / No / NA)
3. Inspect for any leaks: (Yes / No / NA)
4. Check belt for wear, damage, tracking, tension and joint: (Yes / No / NA)
5. Check drive chain components such as bearings, pullies, belts, and rollers for wear, alignment and tension: (Yes / No / NA)
6. Check all cabling is free from moving parts: (Yes / No / NA)
7. Handheld vibration measurement comparison against base line or comparative test completed? (Yes / No / NA)
8. Handheld vibration measurement records a high- or low-level Alarm? (Yes / No / NA)
9. Inspection required with Thermal imaging? (Yes / No / NA)
10. Thermal recording within tolerance? (5% of nominal reading) (Yes / No / NA)
11. Inspection required with Stroboscope? (Yes / No / NA)
12. Motor current within normal operating parameters? (Yes / No / NA)

Act based on the findings you see from SKF Axios and from the checklist, fix the abnormality then resolve it on the app/webapp.

Appendix C Guidelines to help you name your Assets and Positions

The following guidelines are provided to help you create a machine hierarchy that is easy and consistent to manage and navigate, if your company does not already have standards in place.

Guidelines for naming Assets

When naming assets, it is important to note that there is a 60-character limit. It is recommended to use this format in the name: **Physical Location / Driver or Functional Location ID / Name of the Machine or Asset Train**. This helps with creating uniformity within the hierarchy and allows for easily identifying assets

Example: Main Filter Rm/12-3456/Hyd Sup Pmp

The Asset will not be created if the character limit is exceeded.

Guidelines for naming a Position

The 60-character limit also applies to naming positions. The application will not create the position if you exceed the character limit. It is recommended to use a combination of two-digit numbers, and a single letter that indicates the orientation of the sensor installation. Even though the sensor is triaxial, it is helpful to indicate in the position name the angular orientation to maintain consistency if sensors are changed out, or a sensor is knocked down. Please see the example:
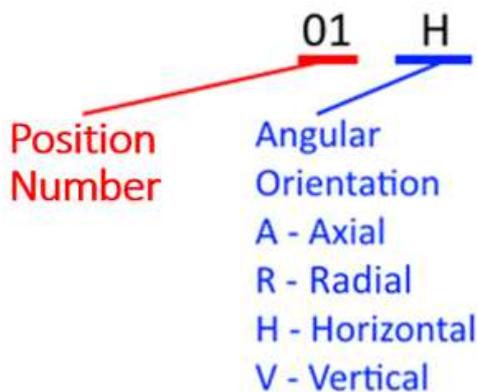
We recommend, as a guideline, numbering the positions to follow the asset train – starting with "01" at the Non-Drive End (NDE) of the driver asset, through to the NDE of the driven asset. The following image is an illustration of this practice applied to a machine with a motor, gearbox, and a pump:
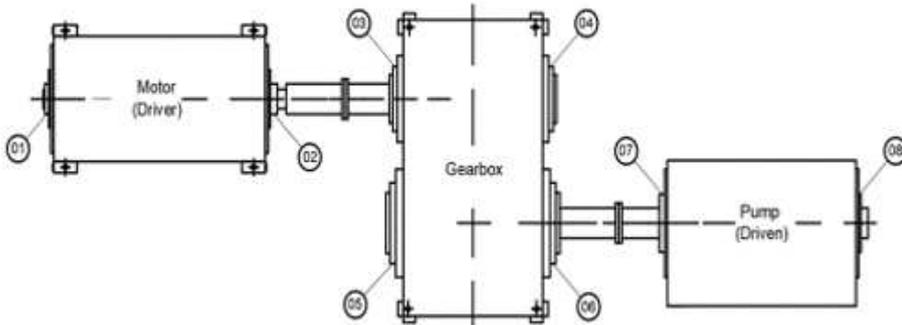
If it is not possible to take a measurement at a certain position, the number should be *skipped* – not applied to the next position. The following images show this practice applied on a motor-driven fan when the position at "03" is covered by guarding:
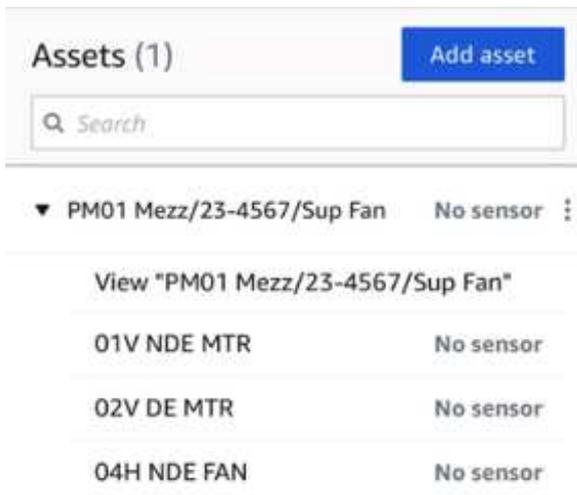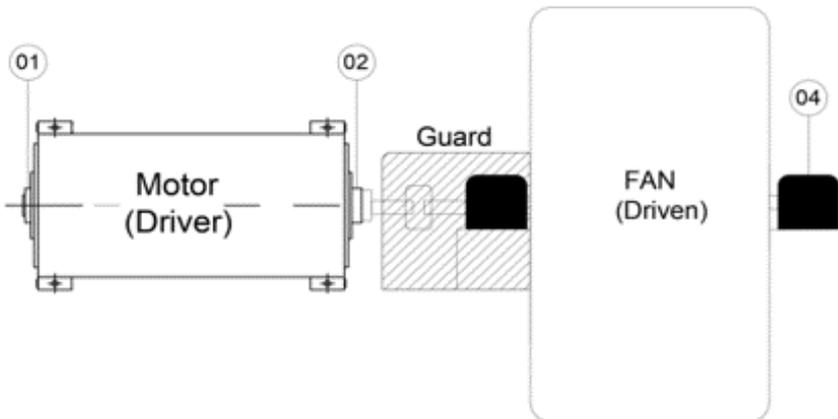
When naming the positions, it is also helpful to indicate the type of asset the sensor is installed on. For example, a sensor installed vertically (on top) on the NDE of a motor, would use: "01V NDE MTR". Using this practice ensures the ability to easily locate a Position created for an Asset.

For a machine that is a motor-driven pump, there may be two sensors on the motor, and two sensors on the pump, which would look like the following in a hierarchy:

Appendix D Gateway considerations

When implementing SKF Axios on site, the gateway's location is critical to ensure good communication with the sensors. The following information provides additional information to consider when determining the locations for gateway placement, and number of gateways needed.

Parameters that affect gateways

- The distance between the gateway and the sensors
- The number of sensors next to the gateway
- Position of the sensors on the asset

Distance between the gateway and sensors

- A maximum of 32 meters (104 ft) should be considered between the gateway and the sensors when determining the position of the gateways.
  - o This distance does not factor in the number of sensors in one area, or the possibility of an interference between the gateway and sensors.

Number of sensors per Gateway

- In areas where there are high numbers of sensors installed, it is advised to have multiple gateways.
- In general, the number of sensors connecting to one gateway is advised not to exceed 100.
  - o This provides a contingency for the sensors should a gateway go offline.

Other factors to consider

- Mounting the gateway higher than the sensors (2 m / 7 ft or above) can improve coverage
- Keeping an open line of sight between the gateway and sensors improves coverage
- Avoid mounting the gateway on building structures, such as exposed steel beams, as they can cause interference with signal
- If possible, install more than one gateway within transmission distance of your sensors. If a gateway becomes unavailable, the sensors will switch their data transmission to another gateway. Having multiple gateways helps eliminate data loss. There is no minimum distance required between two gateways

Gateway preparation

- When planning for gateways, consider possible work needed to install the gateways
    - o The number of sensors next to the gateway
    - o Possible Ethernet (RJ45) cabling, or Ethernet port to place at height
    - o Possible need for a PoE capable switch(s) or PoE injector(s)

Appendix E Scaling up at your facility

Where should SKF Axios be installed

- Install SKF Axios on any asset where you want to detect change in vibration and/or temperature levels.

- To detect abnormalities in machine components, mount sensors in all locations where vibration and temperature can be measured effectively Position of the sensors on the asset

- As rotating equipment develops issues (examples include, but are not limited to, misalignment, unbalance, looseness, debris accumulation, or lubrication issues), generally increased friction results. Excess friction results in increased vibration and leads to deteriorating operating conditions. By monitoring equipment, the SKF Axios helps identify changes over time, which may help prevent unplanned downtime.

How to determine he components where SKF Axios should be installed

The overall goal of SKF Axios is to identify changes in condition on your rotating equipment. These changes in condition may help with bringing attention to a developing issue with a machine or bring attention to a machine that will need planned maintenance.

Example of SKF Axios installed on a belt conveyor

- Specification of the belt conveyor - it has four rollers (drive roller, tension roller, driven roller, end roller), and a gearmotor.

- The components creating movement in a conveyor are the following:
    - The electric motor: in this case we will have a measurement point for each of the bearings in the motor (2 bearings in this case) ➔ 2 measurement points.
    - The coupling (if there is one) between the electric motor and the gearbox ➔ 1 measurement point.
    - The input and output of the gearbox at the least, in case of bigger gearboxes you can have measurement point for each bearing ➔ At least 2 measurement points.
    - The drive roller will have a measurement point for each bearing on each side ➔ 2 measurement points

o The tension roller will have a measurement point for each bearing as well ➜ 2 measurement points.
o The end roller will have a measurement point for each bearing ➜ 2 measurement points
o This means that for a standard belt conveyor, you should expect around 11 or more measurement points.
o When covering these points, you are monitoring the condition of the components that make your belt run, this gets you close to eliminating the causes of components that would stop the machine in case of breakdowns to worsening condition.
o This logic can also be used for Thermal routes, where we will focus on the motor, gearbox and the visible rollers and all electrical cabinets.

Considerations for building an Asset list where SKF Axios is installed

- Once the asset list file is filled, you can also create an installation SOP for your assets.
- Sensor position and name should be standardized from the beginning as shown in the Appendix C Guidelines to help you name your Assets & Positions

Possible information to track in an Asset list

- Asset designation.
- Position/location on site.
- Manufacturer.
- Model.
- Number of sensors.
- Sensor locations

Other useful information you may want to track

- Criticality of the asset.
- Is the asset hard to access or not? This information can prove useful to estimate amount of time needed for the sensor's installation.
- Asset description.
- Type of equipment: conveyor, sorter, elevator, HVAC, freezer, etc.

SKF Axios Quotas

Description	Quota
Maximum number of sites per project	50
Maximum number of assets per site	100
Maximum number of positions (or sensors) per asset	20
Maximum number of gateways per site	200
Maximum number of users per site	20

Appendix F Sensor safety and compliance

Use Responsibly. Before using SKF Axios Sensor, read all instructions and safety information. While using SKF Axios Sensor, follow all instructions and heed all warnings. Keep this document for reference.

PERSONAL SAFETY PRECAUTIONS

FAILURE TO FOLLOW THESE SAFETY INSTRUCTIONS COULD RESULT IN FIRE OR OTHER INJURY.

WARNING! The lithium metal batteries in this device cannot be recharged or replaced. Do not disassemble, bend, deform, puncture, or shred the device. Do not modify or immerse the device into water or other liquids. Do not expose the device to fire, explosion or other hazard. Promptly dispose of used device in accordance with applicable laws and regulations. If dropped and you suspect damage, take steps to prevent any ingestion or direct contact of fluids and any other materials from the battery with skin or clothes.

WARNING! This device is intended for commercial use only; it is not intended for household use.

WARNING! This equipment is not suitable for use in locations where children are likely to be present.

CAUTION! The SKF Axios Sensor devices can be placed on equipment outside; however, the SKF Axios Gateway must be located indoors as the power adapter is not intended for outdoor use.

CAUTION! Do not open the device. Do not modify, alter, reverse engineer, tamper with, or repair the device. Do not perform any servicing other than that contained in the installation guide.

CAUTION! Mounting. Check and obey the applicable safety regulations when installing the device. You are solely responsible for safely installing the device on any equipment or machine part.

This equipment is not suitable for use in places that may accommodate children. The material is not suitable for use in places where children are likely to be present.

The device is mounted using industrial adhesive. We recommend Cyanoacrylate types like Loctite © 454 and Loctite © 3090 or similar. Always consult and obey the safety and handling instructions of the adhesive manufacturer.

Consult Mounting a sensor Mounting a sensor for optimal placement of the device and commissioning.

DEVICE CARE PRECAUTIONS

FAILING TO FOLLOW THESE SAFETY INSTRUCTIONS COULD RESULT IN DAMAGE TO THE EQUIPMENT OR VOID THE WARRANTY.

Device Care and Use

Keep the SKF Axios Sensor dry.

This device has IP69 rating and should not be immersed in water or other liquids.

If the device is dropped or otherwise damaged, the device may be compromised when exposed to water.

Do not expose the device to pressurized water, high velocity water, or extremely humid conditions.

Do not spill any abrasive substances on the device.

Don't expose the SKF Axios Sensor to extreme temperatures**.**

Do not expose this device to extreme heat or cold. Store the device in a location where temperatures remain within the storage temperature ratings set forth in the technical data sheet. The device is designed to function within the operating temperature ratings set forth in the technical data sheet. If it is too hot or too cold, the device may not turn on or function properly until it has warmed or cooled, as the case may be, to within the applicable temperature ratings.

To reduce the risk of electrostatic discharge upon contact with this device, avoid such contact in extremely dry conditions.

Service Your Device

If you suspect the device is damaged, discontinue use immediately and contact SKF Technical Support. Contact details can be found here. Faulty service may void the warranty.

USING THE DEVICE AROUND OTHER ELECTRONIC DEVICES

The device generates, uses, and can radiate radio frequency (RF) energy. If not used in accordance with instructions, may cause interference to radio communications and electronic equipment. External RF signals may affect improperly installed or inadequately shielded electronic operating systems, entertainment systems and personal medical devices. While most modern

electronic equipment is shielded from external RF signals, if in doubt, check with the manufacturer. For personal medical devices (such as pacemakers and hearing aids), consult your doctor or the device manufacturer to determine if they are adequately shielded from external RF signals.

FCC Compliance
This product complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This product may not cause harmful interference, and (2) this product must accept any interference received, including interference that may cause undesired operation. Note: This product has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this product does cause harmful interference to radio or television reception, which can be determined by turning the product off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to a socket on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Pursuant to Section 15.21 of the FCC rules, changes, or modifications to a product by the user that are not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

The product meets the FCC Radio Frequency Emission Guidelines and is certified with the FCC under the FCC ID number found on the device.

Information Regarding Exposure to Radio Frequency Energy
The output power of the radio technology used in this device is below the radio frequency exposure limits set by the FCC. Install and operate the device with at least 20 cm (approximately 8 inches) between the device and your body.

RECYCLING OR DISPOSING OF DEVICE
In some areas, disposal of certain electronic devices is regulated. Dispose of or recycle the device in accordance with local laws and regulations.

TERMS AND WARRANTY
For legal terms and warranty information for **SKF Axios** Sensor, see SKF Reliability Systems General Conditions of Sales. SKF Axios device may not leave the country to which the SKF Axios device was shipped.

Appendix G Wi-Fi Gateway Safety and compliance

Use Responsibly. Before using SKF Axios Gateway device and its accessories, including the power adapter, read all instructions and safety information. While using SKF Axios Gateway, follow all instructions and heed all warnings. Keep this document for reference.

PERSONAL SAFETY PRECAUTIONS

FAILURE TO FOLLOW THESE SAFETY INSTRUCTIONS COULD RESULT IN FIRE OR OTHER INJURY.

WARNING! This device is intended for commercial use only; it is not intended for household use.

WARNING! This equipment is not suitable for use in locations where children are likely to be present.

WARNING! Do not use the power adapter if it appears damaged. Immediately stop using damaged equipment.

CAUTION! SKF Axios Gateway is shipped with a power adapter. The device is only intended to be powered using the adapter included with the device.

CAUTION! SKF Axios Gateway and its power adapter are only intended for indoor use. Do not use the device outdoors.

CAUTION! Do not open the device. Do not modify, alter, reverse engineer, tamper with, or repair the device. Do not perform any servicing other than that contained in the installation guide.

CAUTION! Placement. Check and obey the applicable safety regulations when setting up the device. You are solely responsible for safe placement the device. Consult Placing and installing a Wi-Fi Gateway for optimal placement of the device and commissioning.

DEVICE CARE PRECAUTIONS

FAILING TO FOLLOW THESE SAFETY INSTRUCTIONS COULD RESULT IN DAMAGE TO THE EQUIPMENT OR VOID THE WARRANTY.

Device Care and Use

Keep the SKF Axios Gateway dry.

Do not use the device near water or wet locations. Do not place objects filled with liquids, such as glasses or vases, on the device, or otherwise expose the device to liquids or moisture. Do not expose the power adapter or cable to any liquids or moisture.

If the device does get wet, carefully unplug all cables without getting your hands wet and wait for the device to dry completely before plugging it in again. Do not attempt to dry the device with an external heat source, such as a microwave oven or hairdryer.

Do not expose the device to pressurized water, high velocity water, or extremely humid conditions.

Take care not to spill any food or liquid on the device. Do not spill any abrasive substances on the device.

Don't expose the SKF Axios Gateway to extreme temperatures.

Do not expose this device to extreme heat or cold. Store it in a location where temperatures remain within the storage temperature ratings set forth in the technical datasheet. The device and the included accessories are designed to function within the operating temperature ratings set forth in the technical datasheet. If it is too hot or too cold, the device may not turn on or function properly until it has warmed or cooled, as the case may be, to within the applicable temperature ratings.

To reduce the risk of electrostatic discharge upon contact with this device, avoid such contact in extremely dry conditions.

Use the power adapter and cable correctly and safely.

Unplug the power adapter during lightning storms or when you don't plan to use the device.

Service Your Device

If you suspect the device is damaged, discontinue use immediately and contact SKF Technical Support. Contact details can be found here. Faulty service may void the warranty.

USING THE DEVICE AROUND OTHER ELECTRONIC DEVICES

The device generates, uses, and can radiate radio frequency (RF) energy. If not used in accordance with instructions, may cause interference to radio communications and electronic equipment. External RF signals may affect improperly installed or inadequately shielded electronic operating systems, entertainment systems and

personal medical devices. While most modern electronic equipment is shielded from external RF signals, if in doubt, check with the manufacturer. For personal medical devices (such as pacemakers and hearing aids), consult your doctor or the device manufacturer to determine if they are adequately shielded from external RF signals.

FCC Compliance

This product complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This product may not cause harmful interference, and (2) this product must accept any interference received, including interference that may cause undesired operation. Note: This product has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause
harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this product does cause harmful interference to radio or television reception, which can be determined by turning the product off and on, the user is encouraged to try to correct the interference by one
or more of the following measures:
Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver.
Connect the equipment to a socket on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.
Pursuant to Section 15.21 of the FCC rules, changes, or modifications to a product by the user that are not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

The product meets the FCC Radio Frequency Emission Guidelines and is certified with the FCC under the FCC ID number found on the device.

Information Regarding Exposure to Radio Frequency Energy

The output power of the radio technology used in this device is below the radio frequency exposure limits set by the FCC. Install and operate the device with at least 20 cm (approximately 8 inches) between the device and your body.

RECYCLING OR DISPOSING OF DEVICE
In some areas, disposal of certain electronic devices is regulated. Dispose of or recycle the device in accordance with local laws and regulations.

TERMS AND WARRANTY
For legal terms and warranty information for SKF Axios Gateway, see SKF Reliability Systems General Conditions of Sales. SKF Axios device may not leave the country to which the SKF Axios device was shipped.

Appendix H Ethernet Gateway safety and compliance

Use Responsibly. Before using SKF Axios Gateway (Ethernet) device and its accessories, read all instructions and safety information. While using SKF Axios Gateway (Ethernet), follow all instructions and heed all warnings. Keep this document for reference.

PERSONAL SAFETY PRECAUTIONS

FAILURE TO FOLLOW THESE SAFETY INSTRUCTIONS COULD RESULT IN FIRE OR OTHER INJURY.

WARNING! This device is a Class A device and intended for commercial use only; it is not intended for household and residential use.

WARNING! This equipment is not suitable for use in locations where children are likely to be present.

CAUTION! Do not open the device. Do not modify, alter, reverse engineer, tamper with, or repair the device. Do not perform any servicing other than that contained in the installation guide.

CAUTION! Placement. Check and obey the applicable safety regulations when setting up the device. You are solely responsible for safe placement the device. Consult Placing and installing an Ethernet Gateway for optimal placement of the device and commissioning.

DEVICE CARE PRECAUTIONS

FAILING TO FOLLOW THESE SAFETY INSTRUCTIONS COULD RESULT IN DAMAGE TO THE EQUIPMENT OR VOID THE WARRANTY.

Device Care and Use

Do not place objects filled with liquids, such as glasses or vases, on the device, or otherwise expose the device to liquids or moisture.

Do not attempt to dry the device with an external heat source, such as a microwave oven or hairdryer.

Do not expose the device to pressurized water, high velocity water, or extremely humid conditions.

Take care not to spill any food or liquid on the device. Do not spill any abrasive substances on the device.

Don't expose the SKF Axios Gateway to extreme temperatures.

Do not expose this device to extreme heat or cold. Store it in a location where temperatures remain within the storage temperature ratings set forth in the technical datasheet. The device and the included accessories are designed to function within the operating temperature ratings set forth in the technical datasheet. If it is too hot or too cold, the device may not turn on or function properly until it has warmed or cooled, as the case may be, to within the applicable temperature ratings.

To reduce the risk of electrostatic discharge upon contact with this device, avoid such contact in extremely dry conditions.

Service Your Device

If you suspect the device is damaged, discontinue use immediately and contact SKF Technical Support. Contact details can be found here. Faulty service may void the warranty.

USING THE DEVICE AROUND OTHER ELECTRONIC DEVICES

The device generates, uses, and can radiate radio frequency (RF) energy. If not used in accordance with instructions, may cause interference to radio communications and electronic equipment. External RF signals may affect improperly installed or inadequately shielded electronic operating systems, entertainment systems and personal medical devices. While most modern electronic equipment is shielded from external RF signals, if in doubt, check with the manufacturer. For personal medical devices (such as pacemakers and hearing aids), consult your doctor or the device manufacturer to determine if they are adequately shielded from external RF signals.

FCC Compliance

This product complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This product may not cause harmful interference, and (2) this product must accept any interference received, including interference that may cause undesired operation. Note: This product has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This product generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this product does cause harmful interference to radio or television reception, which can be determined by turning the product off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to a socket on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Pursuant to Section 15.21 of the FCC rules, changes or modifications to a product by the user that are not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

The product meets the FCC Radio Frequency Emission Guidelines and is certified with the FCC under the FCC ID number found on the device.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Information Regarding Exposure to Radio Frequency Energy
The output power of the radio technology used in this device is below the radio frequency exposure limits set by the FCC. Install and operate the device with at least 20 cm (approximately 8 inches) between the device and your body.

RECYCLING OR DISPOSING OF DEVICE
In some areas, disposal of certain electronic devices is regulated. Dispose of or recycle the device in accordance with local laws and regulations.

TERMS AND WARRANTY
For legal terms and warranty information for SKF Axios Gateway, see SKF Reliability Systems General Conditions of Sales. SKF Axios device may not leave the country to which the SKF Axios device was shipped.