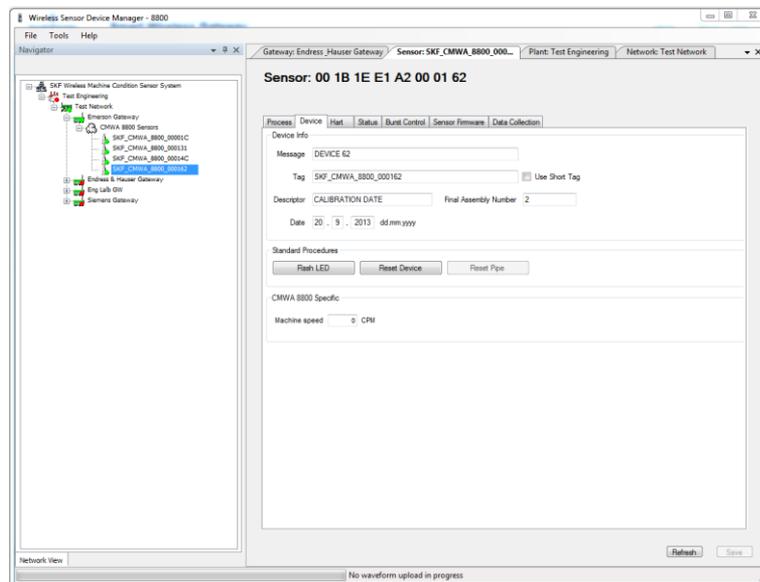


Wireless Sensor Device Manager

Software Supporting the SKF Wireless Machine Condition Sensor



User Manual Part No. 32286200-EN
Revision F

⚠ WARNING! - Read this manual before using this 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.

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US 6,437,692 • US 6,489,884 • US 6,513,386 • US 6,633,822 • US 6,789,025 • US 6,792,360 •
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Introduction

IMPORTANT: Your Wireless Sensor Device Manager software (Device Manager) requires a Permanent License Key. Please reference the Wireless Sensor Device Manager user manual, Chapter 3 section 'How to Acquire your License Key'. Contact our customer service group at csg-lulea@skf.com to obtain a Time Limited License Key that enables the use of up to 50 sensors until you receive your Permanent License Key that is specific to your computer and number of sensor licenses. If you experience any license key issues, please email our customer service group at csg-lulea@skf.com.

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Use safety equipment. Always wear eye protection. You must use non-skid safety shoes, a hard hat, or hearing protection for appropriate conditions.

Do not repair or adjust energized equipment alone, under any circumstances. Someone capable of providing first aid must always be present for your safety.

To work on or near high voltage, you should be familiar with approved industrial first aid methods.

Always obtain first aid or medical attention immediately after an injury. Never neglect an injury, no matter how slight it seems.

Device Safety

Use only accessories that the manufacturer recommends.

Do not attempt to open the device.

Device service must be performed only by qualified SKF repair personnel.

Use only accessories recommended or provided by SKF USA Inc.

Energized Equipment

Never work on energized equipment unless authorized by a responsible authority. Energized electrical equipment is dangerous. Electrical shock from energized equipment can cause death. If you must perform authorized emergency work on energized equipment, be sure that you comply strictly with approved safety regulations.

Hazardous Locations

Instructions for use in hazardous locations are included with this product.

⚠ WARNING! Do not twist plastic top; doing so voids warranty and hazardous area certification.

No Submersion / Immersion

This equipment is IP66 rated, dust-tight, and resistant to powerful jets of water. Do not immerse in any liquid. If the instrument is subjected to these conditions, adverse operation may result, and there is a risk of serious injury or damage should fire occur.

Avoid Damage and Injury

To avoid costly damage to the instrument or injury from a falling instrument, place the instrument on a solid stable surface when not in use and do not place any heavy objects on it.

Use a damp, clean cloth for cleaning. Do not use cleaning fluids, abrasives, or aerosols.

⚠ WARNING! *Contact with aggressive chemicals may cause severe damage to the sensor's mechanical construction. Sensors that have mechanical damage should be removed from hazardous areas as soon as possible.*

Do Not Open Device

Unauthorized personnel shall not open the device.

Do not twist plastic top; doing so voids warranty and hazardous area certification.

Assumptions

- It is assumed that the reader is familiar with vibration monitoring technologies, computer network technology, and WirelessHART networks.
- The SKF Wireless Machine Condition Sensor system collects overall vibration, temperature and time waveform measurements. FFT spectra are automatically post processed by the Wireless Sensor Device Manager (Device Manager) and @ptitude Analyst applications. Therefore, you may assume that all references to “dynamic” and “waveform” data collection also refer to post processed FFT spectrum data.
- **Important** - At this time, you should have already used the SKF Wireless Machine Condition Sensor – System Setup Guide to complete the network connection between your wireless sensors and their respective gateway(s).

System Overview

The SKF Wireless Machine Condition Sensor system automatically forms or joins a mesh network of wireless vibration / temperature sensors – ideal for expanding condition based maintenance into plant areas where costs to install wired systems are prohibitive.

The wireless sensor uses the WirelessHART* communication protocol, which offers a simple, reliable and secure means of transmitting machine vibration, bearing condition and temperature data wirelessly back to a host computer network.

The system provides:

- Automatic, wireless collection of vibration measurements (velocity and enveloped acceleration measurements) and temperature data.

- Automatic export of overall vibration readings, waveform vibration data, temperature readings, and battery condition data to SKF @ptitude Analyst software.

- System integration with plant control systems and asset monitors over OPC using the OPC server software V 3.2 or later (separately offered from the HART Communication Foundation). The HART OPC server is not included in the SKF product offering.

Optimizing the performance of WSDM

It is recommended that the Wireless Sensor Device Manager GUI is closed during normal unattended operation. This will prevent computer system resources being used to update the user interface during automatic polling of the gateway/s and sensors by the SKF Wireless Sensor Device Manager - 8800 Service (also referred to as 'batch service').

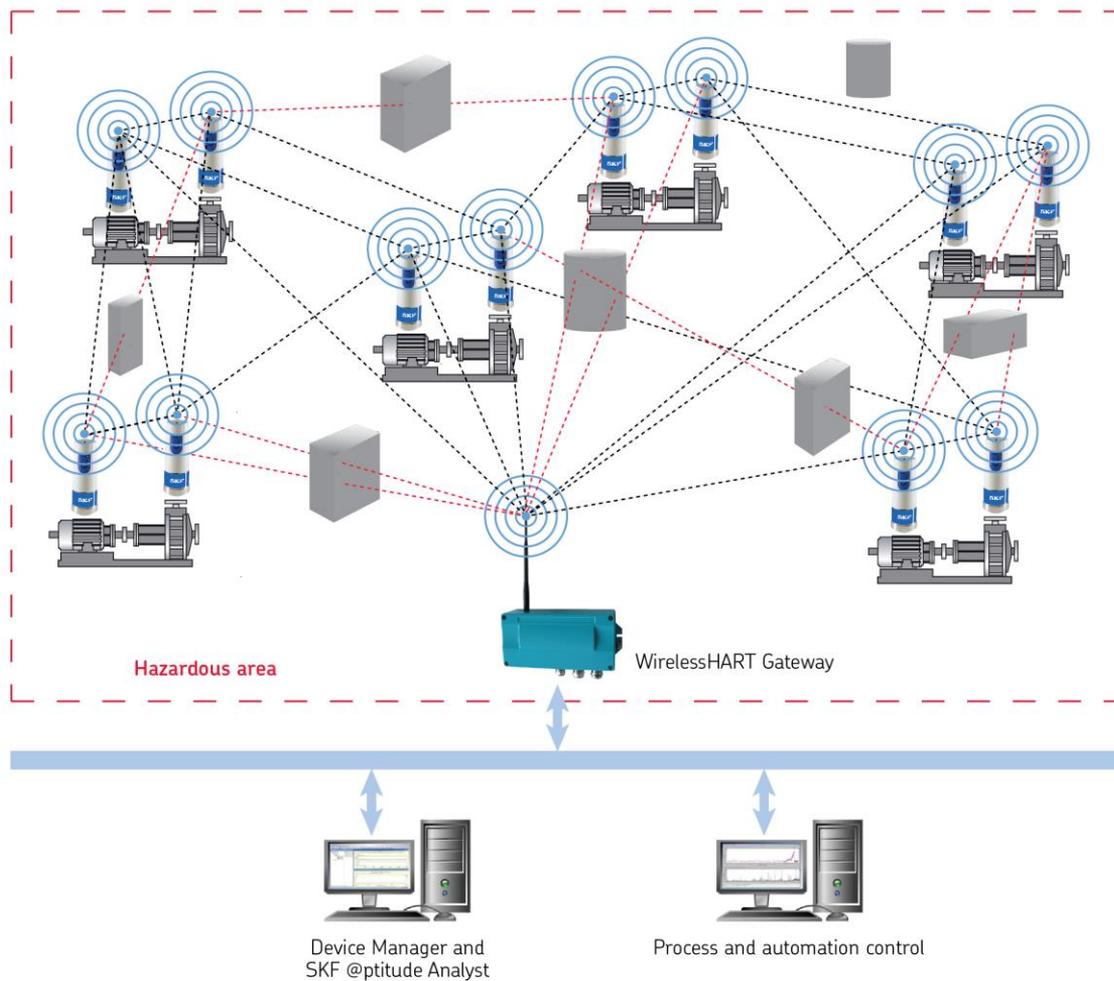


Figure 1 - 1.
An Example SKF Wireless Machine Condition Sensor System.
Red Lines Indicate Communication Paths Blocked by Obstacles.

The system consists of the following components:

SKF Wireless Machine Condition Sensors - CMWA 8800 – Wireless sensors that measure vibration velocity (general purpose vibration measurement), SKF band 3 enveloped acceleration vibration (bearing vibration measurement) and temperature values on rotating machinery.

SKF Wireless Machine Condition Sensors may also be configured as router nodes, enabling wireless communication access to difficult locations.

- The term “node” denotes a WirelessHART field device (e.g., CMWA 8800 wireless sensors are nodes in the WirelessHART network).

WirelessHART Gateway - The device is the gateway between the wired and the wireless (WirelessHART) domains. The following brands and types are supported:

- Pepperl+Fuchs [both Ethernet and EthernetIP versions]
- Endress+Hauser WirelessHART Fieldgate SWG70
- Emerson Smart Wireless Gateway 1420
- Siemens IE/WSN-PA LINK

These gateways also provide wired Modbus connectivity, enabling simple integration to most control systems. Modbus access is not included in the scope of this manual, please refer to the relevant gateway manual.

Wireless Sensor Device Manager Software - The application used to configure, commission, and operate the 8800 wireless system - supporting:

- Wireless sensor setup.
- Trending of measurement overall values (vibration velocity, enveloped acceleration vibration, and temperature).
- Upload and display of velocity and enveloped acceleration vibration waveforms and spectral data.
- Performance of regular, automatic upload and export of waveforms / spectral data and overall measurement values, temperature values, and battery condition data to SKF @ptitude Analyst, etc.
- Performance of system maintenance tasks (e.g., sensor firmware upgrades).

SKF @ptitude Analyst Software - A comprehensive software solution with powerful diagnostic and analytical capabilities, SKF @ptitude Analyst provides fast, efficient and reliable storage, analysis, and retrieval of complex asset information and makes the information accessible throughout your organization.

HART Server from HART Communication Foundation - Provides OPC access to vibration overalls and temperature data in the system.

Vibration Measurement Overview

A multi-parameter approach to condition monitoring utilizes multiple methods for monitoring machinery condition (for example, measuring overall machine vibration, bearing vibration, and machine temperature). This monitoring approach allows for early detection of specific machinery problems, provides more ways to measure deviations from normal conditions, and provides more accurate and reliable data upon which to base maintenance decisions.

The wireless sensor measures vibration velocity, enveloped acceleration vibration (bearing vibration), and machine surface temperature.

Velocity - Vibration velocity is considered the “general purpose” vibration measurement for detecting machinery problems. This is because most machinery problems generate low to mid frequency sinusoidal type vibration signals (problems like unbalance, misalignment, bent shaft, and looseness), and velocity measurements focus on detecting sinusoidal vibration signals occurring in this frequency range.

Enveloped Acceleration - Rolling element bearing faults cause low amplitude impulsive type vibration signals at a regular repetitious rate. When monitored with velocity measurements, these low energy impulsive signals are typically lost in surrounding machinery vibration noise caused by unbalance, misalignment, looseness, etc. Enveloped acceleration measurements filter out surrounding machine vibration noise and enhance the impulsive nature of repetitious rolling element bearing or gear fault vibration signals, allowing much earlier and accurate bearing fault detection. Not used for overall machine vibration monitoring, enveloped acceleration measurements provide consistent early detection of bearing and gear type faults.

Important Security Considerations

Wireless Sensor Device Manager does not use password authentication. It is therefore assumed that all users who have access to the host computer also have access to the WirelessHART network ID and join key. Therefore, you should restrict the access to the host computer to only the users who use or maintain the WirelessHART system.

Related Documentation

Document	Part No.
SKF Wireless Machine Condition Sensor – System Setup Guide	P/N 32257600-EN
Pepperl+Fuchs WirelessHART Gateway - WHA-GW User Manual	
Emerson™ Smart Wireless Gateway 1420 Reference Manual	
Endress+Hauser WirelessHART Fieldgate SWG70 Manual	
Siemens Industrial Ethernet/WirelessHART IE/WSN-PA Link Manual	

Before setting up the system, we recommend copying the following files from the Product CD to your hard drive to make it easier to reference the documents during the installation / commissioning process:

- Wireless Sensor Device Manager - User Manual (this document)
- Pepperl+Fuchs WirelessHART Gateway WHA – GW - User Manual (or the manual appropriate for the gateway in your network)
- SKF Wireless Machine Condition Sensor - System Setup Guide

Wireless Sensor Device Manager Overview

- **IMPORTANT:** At this time, you should have already used the **SKF Wireless Machine Condition Sensor - System Setup Guide** to complete the network connection between the sensors and their respective gateways.

Wireless Sensor Device Manager Software

The Wireless Sensor Device Manager software uses a Microsoft Windows type graphical interface that provides the wireless sensor network hardware hierarchy on the left side of the display, and context sensitive tabs corresponding to the active (selected) hierarchy item on the right side.

- In this user manual, the Wireless Sensor Device Manager software is generally referred to as “Device Manager.”

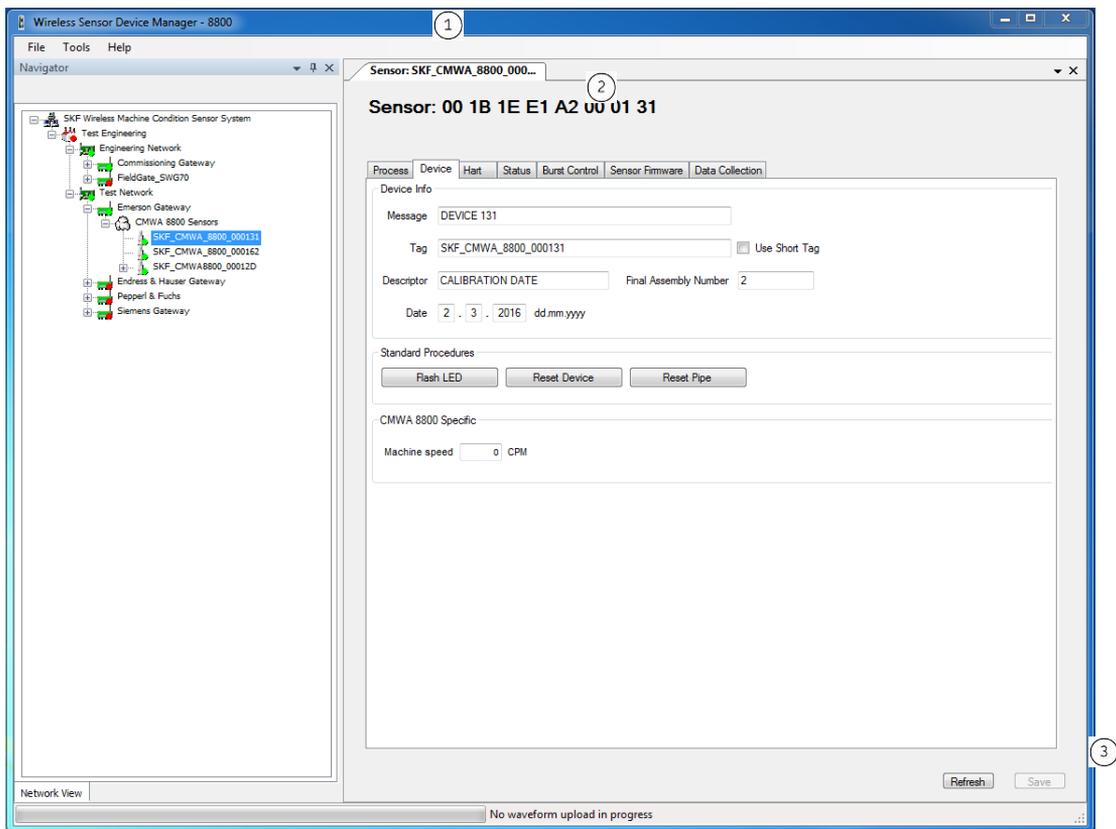


Figure 1 - 2.
An Example Device Manager Display.

- ① Main tabs
- ② Sub tabs
- ③ **Save** button – Saves changes to fields in the current tab. Updated fields display with a yellow highlight until the **Save** button is clicked.

The Device Manager Hierarchy

The hierarchy is an organized list of components in your wireless sensor network. In the hierarchy, your wireless sensors branch from their gateway's hierarchy item, which branches from a network level hierarchy item, which branches from the plant level hierarchy item, which branches from the hierarchy's root node.

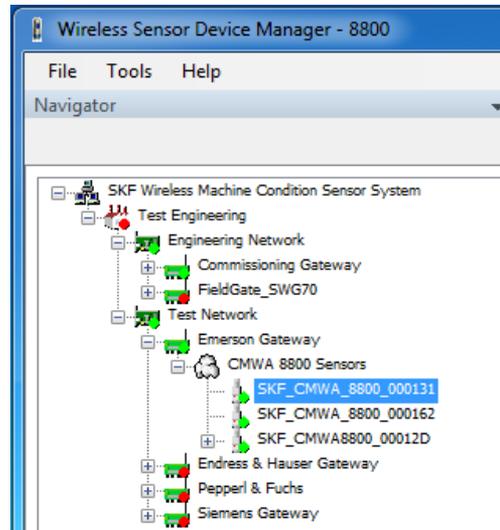


Figure 1 - 3.
An Example Hierarchy.

Root node – A root node named “SKF Wireless Machine Condition Sensor System” begins the hierarchy.

Plant level – A plant level hierarchy item branches from the root node and is used to organize wireless sensor networks in the plant.

Network level – Network level hierarchy items branch from the plant level hierarchy item and are used to set up and organize network connection with the gateways. Different physical networks can be connected to different network cards in the host computer.

Gateway level – Gateway level hierarchy items branch from network level hierarchy items and are used to set up and organize WirelessHART gateways within the parent network. The Gateway hierarchy item contains all wireless sensors which are connected to this gateway.

Sensor level – Sensor level hierarchy items branch from a **CMWA 8800 Sensors** group item which branches from the parent gateway level hierarchy item. Only CMWA 8800 sensors will be shown in the hierarchy; other devices connected to same gateway will not. Sensor level items are used to set up and view data collected by wireless sensors communicating with the parent gateway.

Display Element	Description
Hierarchy	Click on a hierarchy item to select it. The right pane updates to display tabs applicable to the selected hierarchy item.
Hierarchy Right Click Menu	Right click on a hierarchy item to display its context sensitive menu options.
Main Tabs	In the right pane, main tabs allow quick navigation between dialogs for the hierarchy levels.
Sub Tabs	Context dependent tabs for the selected hierarchy item. Note that some options are only accessible from the hierarchy item's right click menu.
Save button	Saves the information in the current tab.

Constraints

Capacity

The current version of the Device Manager software maintains one communication thread. If an action is issued against a WirelessHART device, commands to other devices will not start until the first command sequence is completed. However, commands can be initiated and placed into a queue.

- The progress bar that shows progress for each action temporarily displays in a scanning mode until the action initiates, at which time it changes to progress mode.

Device Manager database access (e.g., accessing trend plots) can occur independently of ongoing communication.

Gateway

The device is the gateway between the wired and the wireless domains. The following brands and types are supported:

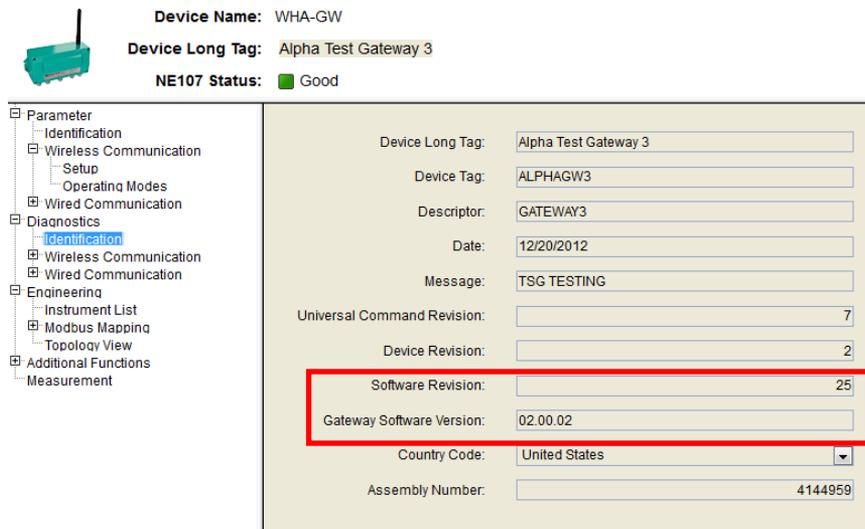
- Pepperl+Fuchs [both Ethernet and EthernetIP versions]
- Endress+Hauser WirelessHART Fieldgate SWG70
- Emerson Smart Wireless Gateway 1420
- Siemens IE/WSN-PA LINK

These gateways also provide wired Modbus connectivity, enabling simple integration to most control systems. Modbus access is not included in the scope of this manual, please refer to the relevant gateway manual.

When using a Pepperl+Fuchs gateway, the Device Manager software offers a gateway/admin tab that offers certain functionality that is not made available on the gateways' web site. Mainly this concerns the functionality to change the Network Id and Join Key of the gateway as well as the wireless field devices (sensors) connected to it. This functionality is required to change the Network Id and Join key of the wireless sensors, in order to configure them for operation on a target network that (most likely) does not use default Network Id and Join Keys. The functionality offered in the gateway/admin tab makes use of a direct connection by the Device Manager to the

Network Manager residing inside the Pepperl+Fuchs gateway. Because none of the other supported brands of WirelessHART gateways allow this direct connection to their internal Network Manager, the admin tab is not made available for those. These gateways however make this functionality available on their website, contrary to the Pepperl+Fuchs gateway.

The SKF Wireless Machine Condition Sensor system requires the Pepperl+Fuchs WHA-GW WirelessHART Gateway to run software release 2.5, version 2.00.02 or later to support all functionality. (SKF model number CMWA 8850-PF-SS). If you do not have version 2.00.02 or later, you may use the SKF technical support web page to contact one of our Technical Support Groups.



Device Name: WHA-GW
Device Long Tag: Alpha Test Gateway 3
NE107 Status: ■ Good

Parameter
 Identification
 Wireless Communication
 Setup
 Operating Modes
 Wired Communication
 Diagnostics
 Identification
 Wireless Communication
 Wired Communication
 Engineering
 Instrument List
 Modbus Mapping
 Topology View
 Additional Functions
 Measurement

Device Long Tag:	Alpha Test Gateway 3
Device Tag:	ALPHAGW3
Descriptor:	GATEWAY3
Date:	12/20/2012
Message:	TSG TESTING
Universal Command Revision:	7
Device Revision:	2
Software Revision:	25
Gateway Software Version:	02.00.02
Country Code:	United States
Assembly Number:	4144959

Figure 1 - 4.
Gateway Software Version.

- Note that the software release number appears without a period –as 25– in the **Software Revision** field.

Administrative Rights

To operate the software, the Microsoft Windows user account must have Administrative privileges on the local PC.

If you are using @ptitude Analyst (optional), @ptitude Analyst 2012 release MR1 Version 7.0.1007.1 or newer is required.

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Device Manager Software Installation

The Wireless Sensor Device Manager software consists of two cooperating applications:

The Wireless Sensor Device Manager software – This is the system’s user interface that allows you to set up, commission, operate and maintain the SKF Wireless Machine Condition Sensor system.

The Wireless Sensor Device Manager - 8800 Service – This is a Windows “service” application that runs in the background. After sensors are set up and their data collection schedules are configured and stored in the system’s database, you start this “batch” service. The batch service then uses the stored data collection schedules to collect measurements and save to the database. As long as the batch service is running, data collection occurs, even if the Device Manager software (user interface) is not running and the user logs off the computer.

- Both applications are installed from one installation application.

System Requirements

Requirements for installing the Wireless Sensor Device Manager software are:

Hardware

Available disk space:	20 Gbyte or more
RAM Memory:	2 Gbyte or more
Minimum monitor resolution:	1600 x 900 pixels

IMPORTANT: *The minimum monitor resolution for Device Manager is 1600 x 900. Device Manager does not permit scrolling and some vital functions will be hidden at lower resolution.*

Software

Administrative Rights - To install and operate the software, the Microsoft Windows user account must have Administrative privileges on the local PC.

Microsoft SQL Server 2008 R2 / SQL Server 2008 Express R2 (Express version is available from the @ptitude Analyst installation DVD)

Microsoft .NET 4.5 (included as file NDP451-KB2858728-x86-x64-AllOS-ENU.exe on the CD provided)

Microsoft Windows XP / Windows 7

If you are using @ptitude Analyst (optional), @ptitude Analyst 2012 release MR1 Version 7.0.1007.1 or newer is required.

How to Install the Wireless Sensor Device Manager Software

IMPORTANT: Prior to installing the Wireless Sensor Device Manager software, you must first install Microsoft .NET 4.5 (included as file dotNetFx45_Full_setup.exe on the CD provided), and then install the Microsoft SQL Server 2008 R2 / SQL Server 2008 Express R2 (available from the @ptitude Analyst installation DVD).

To install the Device Manager software:

- From the product CD's main menu, select the **Install Wireless Sensor Device Manager** option. The Setup Wizard's **Welcome** screen displays.



Figure 2 - 1.
The **Welcome** Screen.

- Click **Next** to advance to the End User License Agreement.



Figure 2 - 2.
The **End User License Agreement** Screen.

- Read and accept the license agreement, and then click **Next**. The **Destination Folder** screen displays.

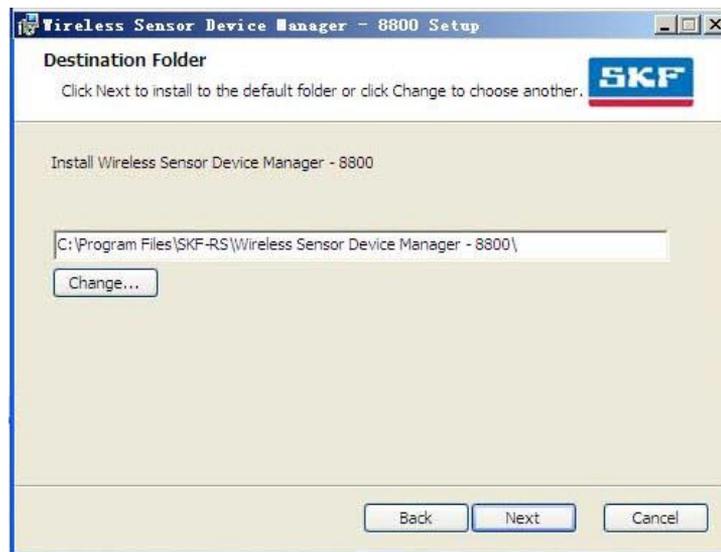


Figure 2 - 3.
The **Destination Folder** Screen.

- Choose the folder in which to install the application files, and then click **Next**.

At this point, the next screen displayed depends on the system language on the host computer. If, and only if, the language/country combination on the host computer is not on the list of supported language/country combinations (listed at the end of this chapter), then the **File Permission** screen will display before the **Database Configuration** screen.

- If the **File Permission** screen displays, enter the group name corresponding to the English 'Everyone' user group, and then click **Next**.



Figure 2 - 4.
The **File Permission** Screen.

- The **Database Configuration** screen displays.

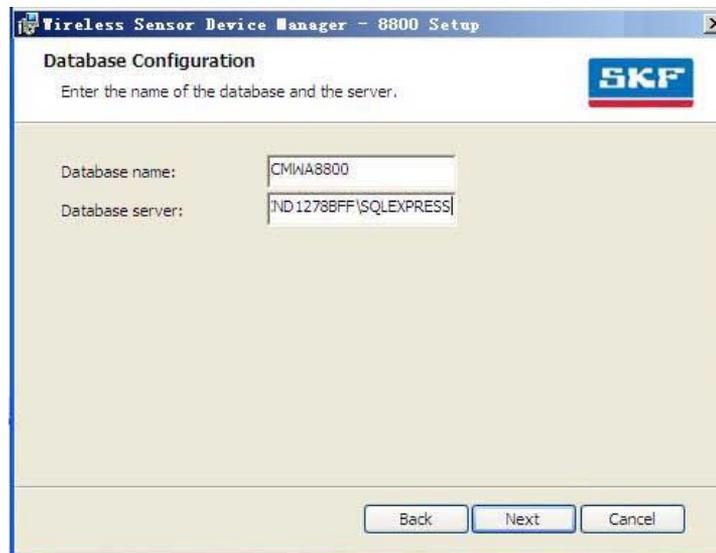


Figure 2 - 5.
The **Database Configuration** Screen.

Specify the database in which the 8800 wireless system data will reside. Enter the **Database's name** and the **Database server** on which the database resides.

Database name - Specify a database name in which the data is to reside.

- The database name must not include any spaces.
- When upgrading the Device Manager software, you must use the same **Database name** that was provided for the initial installation, or else a new database will be created.

Database server - The name of the computer on which the database resides, appended by /SQLEXPRESS. If the database resides on the local computer, from which this installation program is executed, then you may either enter ./SQLEXPRESS (the dot indicates this PC) or you may specify the ComputerName/SQLEXPRESS.

If the database resides on another computer or server accessible through the network, then specify its name and append by /SQLEXPRESS.

To locate the database server name:

- From the Windows **Start** menu, select **Programs / Microsoft SQL Server 2008 R2 / SQL Server Management Studio**. The following dialog displays the **Server name**. Copy the **Server name** to your Windows clipboard, and then press **Cancel**.



Figure 2 - 6.
The **Server name**.

To continue with the installation:

- After entering the **Database server** name on the **Database Configuration** screen, click **Next**. The **Ready to install** screen displays.

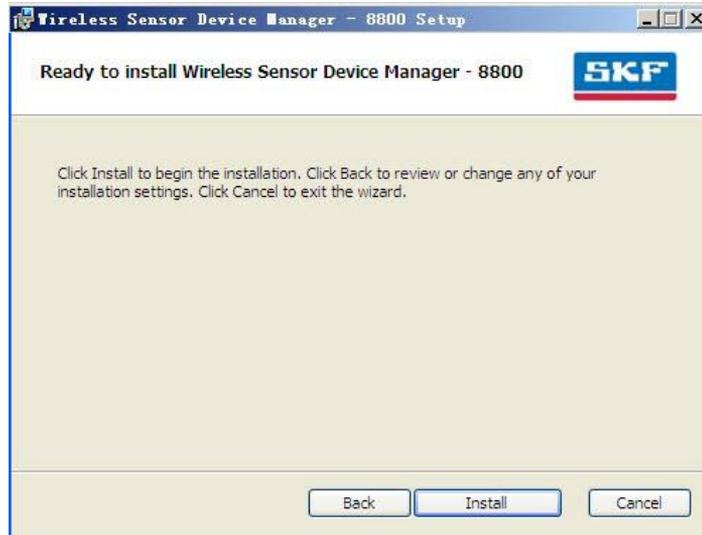


Figure 2 - 7.
The **Ready to Install** Screen.

- Click **Install** to begin installing the Device Manager application. The installation proceeds and a progress bar displays installation progress.
 - The installation will fail on this step if **Database name** and **server** are not entered correctly.

After the installation successfully completes, the **Completed** screen displays.



Figure 2 - 8.
The Installation **Completed** Screen.

- Click the **Finish** button to complete the installation. The Windows **Start** menu now provides a link to the **Wireless Sensor Device Manager** software at:

Start / Programs / SKF @ptitude Monitoring Suite / Wireless Sensor Device Manager – 8800

- * The installation kit supports the following system languages on the host computer. If the language/country combination on the host computer is not listed below, an exceptional installation flow (which displays the **File Permission** screen) will be run to accommodate the non standard language.

German_Standard
German_Austrian
German_Swiss
English_United_Kingdom
English_United_States
English_Australian
English_Canadian
Spanish_Traditional_Sort
Spanish_Mexican
Spanish_Argentina
French_Standard
French_Canadian
French_Swiss
Dutch_Standard
Norwegian_Bokmal

Sensor Setup and Commissioning

In the Device Manager software, the three types of measurements the wireless sensors collect are labelled as:

- **Velocity and Envelope waveform** (velocity and enveloped acceleration waveform measurements and the resulting FFTs)
- **Envelope Pk-Pk and Velocity RMS** (overall enveloped acceleration and overall velocity vibration measurements)
- Temperature

In this user manual, we refer to these three measurement types as “waveform measurements,” “overall vibration measurements” or “vibration overalls,” and “temperature measurements.”

As you can deduce from their Device Manager labels, the velocity and enveloped acceleration overalls are collected together and the velocity and enveloped acceleration waveforms are collected together. For example, when we set up the data retrieval for “waveform” measurements, the settings apply to both velocity waveforms and envelope acceleration waveforms, hence their label “Velocity and Envelope waveform.” The same applies to the overall vibration measurements.

Before proceeding to set up your wireless network system, you should understand the various methods the system uses to set up, collect, and store wireless sensor vibration and temperature measurement data. Read the following overviews on:

- Polling Data Collection / Burst Mode
- The Batch Service
- The Commissioning Network

Polling the Sensors vs. Polling the Gateway (Burst Mode)

The wireless sensor’s data collection (i.e., when the sensor performs its measurements and stores the results in its memory) is primarily determined by its vibration cyclic update start time and interval settings (more on this in a minute).

After the measurements results are stored in the sensor, retrieving the measurement results from the sensor’s memory and storing them in Device Manager’s database can, and will, occur in two ways; Device Manager will retrieve some data from the sensor itself (this is called “polling the sensor”), and Device Manager will retrieve some data from the sensor’s gateway (this is called “polling the gateway” and is used with burst mode). You will use each of these data retrieval (polling) methods to retrieve specific types of data:

- Envelope Pk-Pk and Velocity RMS (vibration overalls) and temperature data will be retrieved from the gateway when the sensors are setup to use burst mode.
- Velocity and Envelope waveforms will always be retrieved from the sensor’s memory.

Each of these data retrieval methods is explained in the following sections. First we'll describe how waveform data is polled from the sensors, then we'll go on to describe burst mode, and how vibration overalls and temperature data are polled from the gateway.

Polling Waveform Data from the Sensors

Device Manager schedules and collects data from the WirelessHART Gateway (and thus from the wireless sensors) using a polling type data collection method. That is, the first scheduled waveform measurements are collected from the appropriate sensor, and then the next scheduled waveform measurements are collected from their sensor, then the next, and so on.

Here's how it works. First, during system setup, each sensor is configured for the measurements it is to perform, that is, velocity and enveloped acceleration readings, waveform data, and temperature. Each sensor's vibration cyclic update start time and update interval are established.

The sensor's vibration cyclic update start time and update interval specify when and how often the wireless sensor automatically performs its vibration measurements (again, velocity and enveloped acceleration - vibration overall readings and waveform data) and stores the resulting measurement data in its RAM memory.

- The sensor's temperature measurement update interval is five minutes and cannot be altered.

Next, each measurement's polling schedule is established (i.e., each measurement's data retrieval schedule). The waveform measurements' polling schedule determines when Device Manager retrieves the measurement results from the sensor's memory and stores them in the Device Manager database.

Then, when the system's batch service is started (more on this soon), polling data collection initiates, and as per the pre-defined measurement schedules, Device Manager polls the sensor for its most recent waveform measurement results, as defined below:

- The Device Manager batch service sends a command to the appropriate network gateway.
- The gateway, in turn, sends a "retrieve measurement results" command to the sensor.
- The sensor sends the most recent measurement results back to the gateway.
- The batch service immediately retrieves the data from the gateway and stores it in the Device Manager database.

Then, the same process happens for the next sensor whose waveform measurements become due for data collection, etc. If multiple measurements / sensors are scheduled for waveform data collection at the same time, the batch service forms a measurement queue, and still sends data retrieval commands to the gateways one sensor at a time.

- Note, from now on when we refer to "polling the sensor," understand that Device Manager actually sends the "retrieve measurement results" command through the gateway to the sensor, not directly to the sensor.

The following figure provides a graphical representation of the polling the sensor process.

According to their cyclic update intervals, all the sensors periodically perform their waveform and overall vibration measurements, and save the measurement results to their RAM memory. Each sensor's temperature measurement is updated every five minutes.

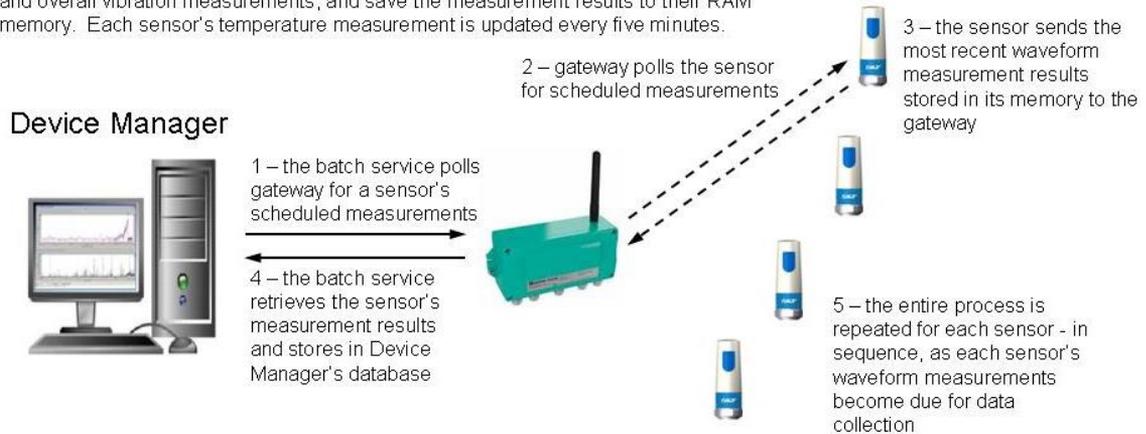


Figure 3 - 1.
Batch Service Polling from the Sensors.

As you may imagine, polling data from the sensors is a time consuming process as the wireless network must be used to command each sensor to upload its measurement results back to the gateway / Device Manager database before the software can move on to the next sensor. In addition to being time consuming, polling the sensors may cause excessive network loading when frequent data collection schedules are used. This is why we only poll the sensor for waveform data, whereas with vibration overalls and temperature data, we use the system's "burst mode" to alleviate these issues (see below).

Polling Vibration Overalls and Temperature Data from the Gateway (Burst Mode)

"Burst mode" describes an alternative data retrieval method that is *applicable only to so called HART variables, which contain the vibration overalls and temperature measurements* (i.e., waveform data cannot be collected using burst mode because it is too much data and does not fit in a HART variable). Therefore, to retrieve both overall vibration / temperature data and waveform data, burst mode is used along with polling from the sensors.

Burst mode is enabled on a sensor by setting the sensor's burst mode settings. These burst mode settings are saved in the sensor's memory, and in general they configure the sensor to automatically burst (publish) its most recent temperature and vibration overall measurement readings (HART variables) to its gateway's cache at a specified time interval. Thus, these measurement results are available from the gateway's cache.

Sensor Setup and Commissioning

Polling the Sensors vs. Polling the Gateway (Burst Mode)

When the measurements are due for Device Manager polling data collection, the Device Manager batch service polls the gateway's cache and quickly retrieves the vibration overalls and temperature measurement results for all due sensors / measurements that, by means of their bursting, have their most recent overall and temperature data stored in the gateway's cache. The following figure provides a graphical representation of the polling the gateway (burst mode) process.

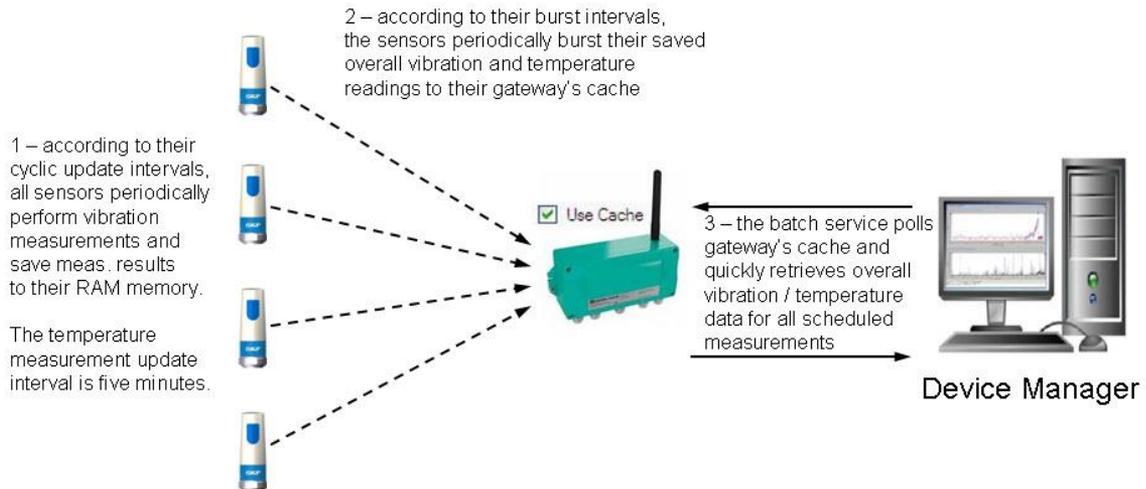


Figure 3 - 2.
Polling the Gateway - Burst Mode.

Burst mode enables much faster vibration overall and temperature measurement data retrieval by the software, and less wireless network loading since the gateway doesn't need to use the wireless network to poll the sensor for these measurement results. With less time required for retrieving vibration overalls and temperature data, there is more time available for retrieval of waveform data, which requires considerably more time and bandwidth than overall measurements.

In summary, using burst mode to poll overall vibration and temperature data directly from the gateway's cache is much faster than polling the same measurements from the sensor. Burst mode provides a faster, more robust wireless network system.

- **IMPORTANT:** HART systems offer a significant benefit over proprietary systems. That is, HART Process Information/Control systems can access the gateway's cache using HART, OPC or MODBUS process information systems working with OPC compliant host servers can access the gateway's cache to utilize wireless sensor overall vibration and temperature data. (Refer to the gateway's user manual for details.) Therefore, to integrate data from the SKF Wireless Machine Condition Sensor system into your existing OPC compliant process information system, you must utilize burst mode.

IMPORTANT: As you read through this chapter and proceed to set up your wireless sensor data collection, it is strongly recommended that you use burst mode to collect your overall vibration and temperature measurements, as doing so:

- * Greatly shortens the time required by Device Manager to collect overall vibration and temperature readings for all sensors in the network.
- * Reduces wireless network traffic, as no commands need to be transmitted from the gateway to the sensor for this data.
- * Provides a more robust wireless network system.
- * Allows you to integrate the overall vibration / temperature data into your existing process information system.

Batch Service Overview

The system’s batch service is a Windows “service” application that runs in the background. The batch service polls (retrieves) measurement result data from gateways / sensors and stores it to the Device Manager database.

After the sensors are set up, and their data collection schedules are configured and stored in the Device Manager database, you start the batch service. The batch service then uses the configured sensor data collection schedules to poll for measurements as they become due (both from the sensors, and from the gateway’s cache when burst mode data collection is used) and stores the retrieved data in the Device Manager database. As long as the batch service is running, polling occurs, even if the Device Manager software (user interface) is not running and the user logs off the computer.

The Device Manager batch service is Started or Stopped from the Device Manager **Plant / Batch Service Management** tab.

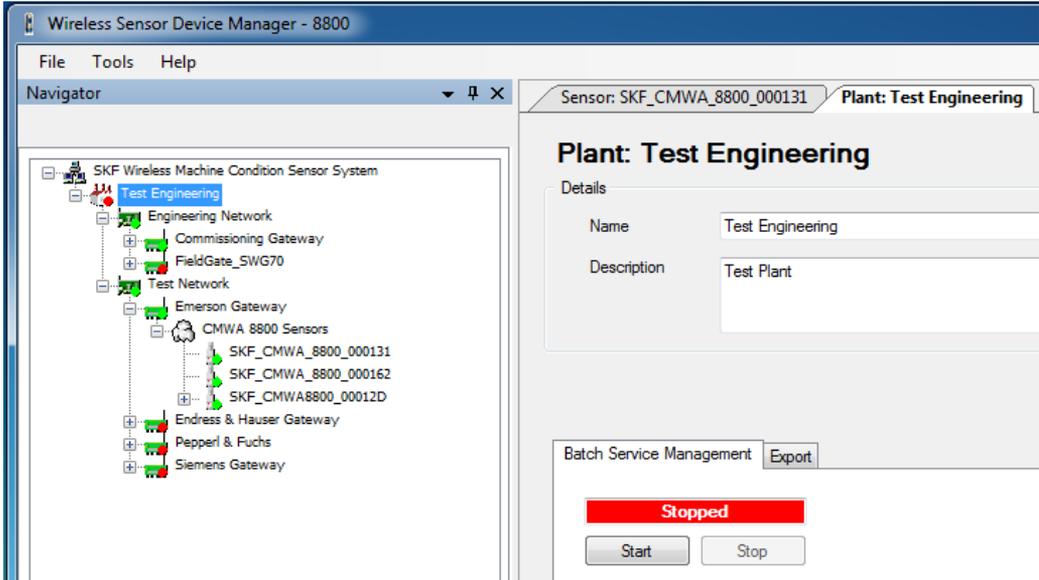


Figure 3 - 3.
The **Plant / Batch Service Management** Tab.

IMPORTANT: *The batch service must be stopped temporarily when you are making any revisions to the data collection schedule. Remember to start the service again when you are done.*

The batch service has three states:

Stopped

Pending (displays when the service is being started or stopped)

Running

- Click the **Start** or **Stop** button to start / stop the batch service.
 - The batch service maintains its previous status when the computer it is installed on is turned off and then turned on again (or rebooted). For example, if the batch service is stopped when the computer is turned off, then the batch service will be stopped when the computer is turned on.

In addition to polling data collection, the batch service also performs system diagnostics. Every 15 minutes, the system is checked for sensor communication status. In addition, every hour the sensors are checked for their diagnostic status, battery voltage, and battery charge status.

Commissioning Network Overview

WirelessHART network gateways, and devices connected to their respective gateways, identify each other using a “network ID” and “join key.” Meaning, both the gateway and the devices connected to the gateway must be configured with the same network ID and join key.

Typically, the SKF factory ships wireless sensors and gateways with a default network ID and join key

Default network ID: 1229

Default join key: 44555354-4E455457-4F524B53-524F434B

- When customers have an existing WirelessHART network to which they are adding wireless sensors, the SKF factory may configure the gateways and wireless sensors with the customer’s existing WirelessHART network’s network ID and join key prior to shipment.

When setting up a new wireless sensor network, typically you use a commissioning gateway (one set up with the factory default network ID and join key) to connect to, set up, and test the wireless sensors prior to mounting the gateway and sensors in the production environment. After commissioning is complete, *you should modify the gateway / sensors’ network ID so that it is NOT the same as the factory default.* This should be done for numerous reasons:

- If the gateway and sensors are configured with the SKF factory default network ID and join key and the gateway loses power, then the sensors will switch off permanently after 13 hours.

- For security reasons.
- For connecting to an established wireless network.

A Note about Gateway Power Loss

When a gateway is powered down, all its WirelessHART devices start searching for a network to join. Power consumption during this network search and join process is very high. When the SKF wireless sensor loses its gateway, its behavior depends on its configured network ID. Wireless sensors configured with the factory default network ID (1229) perform the following when a gateway is lost:

Hour 1 - search for a network to join with high intensity

Hours 2 through 12 - search for a network to join with low intensity before deactivation

Hour 13+ - deactivate to preserve sensor battery life. To reactivate the wireless sensor, you must use the sensor's push button.

The above is designed to safeguard against the sensor being inadvertently left on and continuously searching for a network to join, thus unnecessarily depleting sensor battery life. However, in your production environment, if a production gateway temporarily loses its power, you would not want to walk through the plant and manually press each sensor's button to have the sensors rejoin the network, thus you should not use the factory default network ID for your production network.

The commissioning gateway and wireless sensors being commissioned are typically located in an office or control room that is out of the existing production network's WirelessHART signal range, as you don't want the commissioning process to interfere with the production network when both temporarily have the same Network ID and join key.

The general idea is to use the commissioning gateway to set up and commission the sensors in an environment where all sensors have a direct connection to the gateway, and where signal strength and convenience are maximized while setting up the sensors.

- If you have not already done so, before using the Device Manager software to set up and commission your wireless sensor network, reference the **CMWA 8800 System Setup Guide** to set up the commissioning gateway and establish communications with the wireless sensors.

After the sensors are communicating with the commissioning gateway, general steps for completing your wireless sensor network setup and commissioning using the Device Manager software are overviewed below - and detailed later in this chapter.

⚠ WARNING! *Make sure the wireless sensors that you are setting up are out of the WirelessHART signal range of the existing production network when you follow the steps below, as during the commissioning process there will temporarily be two networks with the same network ID and join key.*

1. Using the Device Manager software, you will create a wireless network hierarchy with two “network” hierarchy items, one for the commissioning network hierarchy item and its commissioning gateway, and the other for your production network / gateways to which you will eventually be connecting the wireless sensors.
2. Make sure the sensors you want to eventually connect to your target gateway are turned on and connected to the commissioning gateway (this may take up to 15 minutes depending on the number of sensors, this is typical for WirelessHART networks). To speed up joining of new sensors to the network, make sure Active Advertising is enabled (for details, see the SKF Wireless Machine Condition Sensor System Setup Guide, Chapter 1).
3. Using the Device Manager software, from the commissioning gateway’s hierarchy item, perform a “Find sensors” command to automatically create the hierarchy sensor list for the connected wireless sensors. At this point, the Device Manager software’s commissioning gateway can communicate with the wireless sensors.
4. Using the Device Manager software, individually configure each connected wireless sensor with its desired tag name, data collection schedule, etc.
5. In the Device Manager software, manually collect overall and waveform data and verify that the data is successfully uploaded for all connected wireless sensors.
6. In the SKF @ptitude Analyst software, configure the XML Import utility to import wireless sensor data to the @ptitude Analyst database.
7. In SKF @ptitude Analyst, verify that the data is imported.
8. When all the sensors are confirmed to be operating correctly, change the commissioning gateway’s factory default network ID and join key to match the network ID and join key used by your target gateway, and perform a “Reform Network.” This changes the network ID and join key of all connected sensors to match that of the existing production gateway.
 - If you are not joining an existing network, you may assign your unique network ID (preferably 101 or 102, which are built-in network IDs) and join key. Network IDs 101 and 102 are preferred because, if necessary, you can use the wireless sensor’s push button to configure the sensor with the 101 or 102 network ID. Refer to the **SKF Wireless Machine Condition Sensor Setup Guide** for more on the wireless sensor’s manual operation.
9. Turn off the wireless sensors.
10. In the field, properly mount the wireless sensors on their respective machines.
11. Turn on the wireless sensors.
12. From the Device Manager software, connect to your first production gateway.
13. Verify on the P+F gateway’s Operating Modes web page that the mounted sensors are connected.

14. Right click the production gateway hierarchy item to open the pop-up menu, and then select **Find Sensor**.
15. In the Device Manager software, verify that the complete sensor list has moved from the commissioning gateway's hierarchy item to the first production gateway, and then manually collect overall and waveform data and verify that the data still appears correctly for all connected wireless sensors.
16. In SKF @ptitude Analyst, verify that the imported data appears correct.
17. In the Device Manager software, confirm the data collection schedule setup. Then, start Batch Service Processing (the batch service) to initiate polling data collection.
 - Repeat the above steps for each production gateway and their respective wireless sensors. However, before repeating the above steps, use the Device Manager software to first set the commissioning gateway's network ID and join key back to the SKF factory defaults.

Building Your Wireless System's Hierarchy

- You must have Microsoft Windows "Administrator" privileges to open the Device Manager software.

To open the Wireless Sensor Device Manager application:

- From the Windows Start menu, select Programs / SKF @ptitude Monitoring Suite / Wireless Sensor Device Manager – 8800. The Device Manager main screen displays.

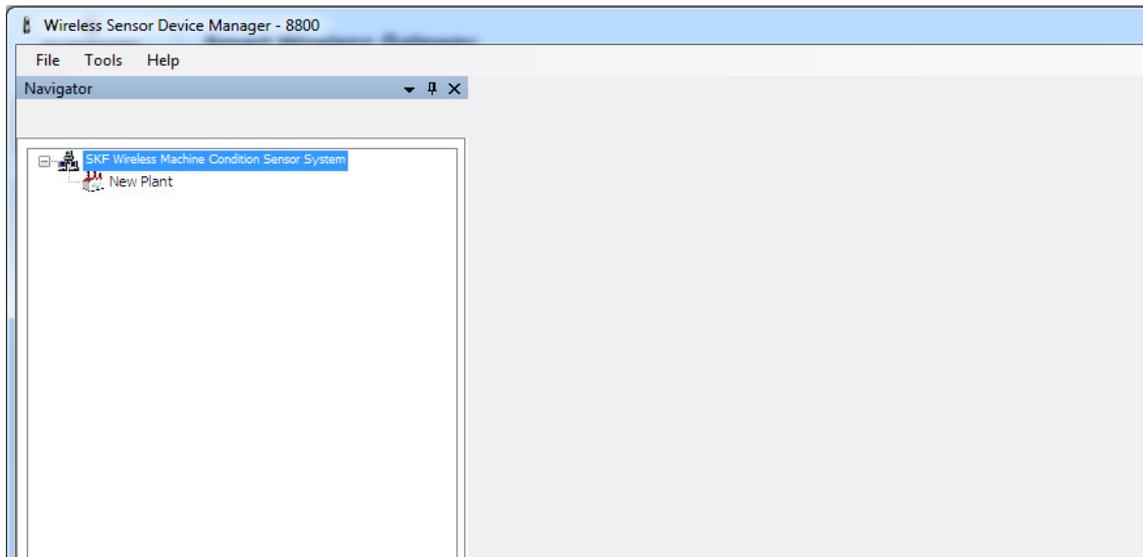


Figure 3 - 4.
The Main Screen.

The first time you start the application, the main screen appears blank. The hierarchy contains only the hierarchy's root node, **SKF Wireless Machine Condition Sensor System**. Your next step is to create and configure your Plant level hierarchy item to start building your wireless sensor network's hierarchy.

- There can only be one plant hierarchy item.

How to Create and Configure the Plant Hierarchy Item

IMPORTANT: This step must be completed before you are able to obtain your Permanent License Key from SKF Customer Service.

To add the plant level hierarchy item:

- Right click the root node hierarchy item. A context sensitive pop-up menu appears, providing a **New Plant** option.
- Select the **New Plant** option. A new plant hierarchy item is created and the right pane displays the **Plant** tab, allowing you to enter the new plant's **Name** and **Description**.

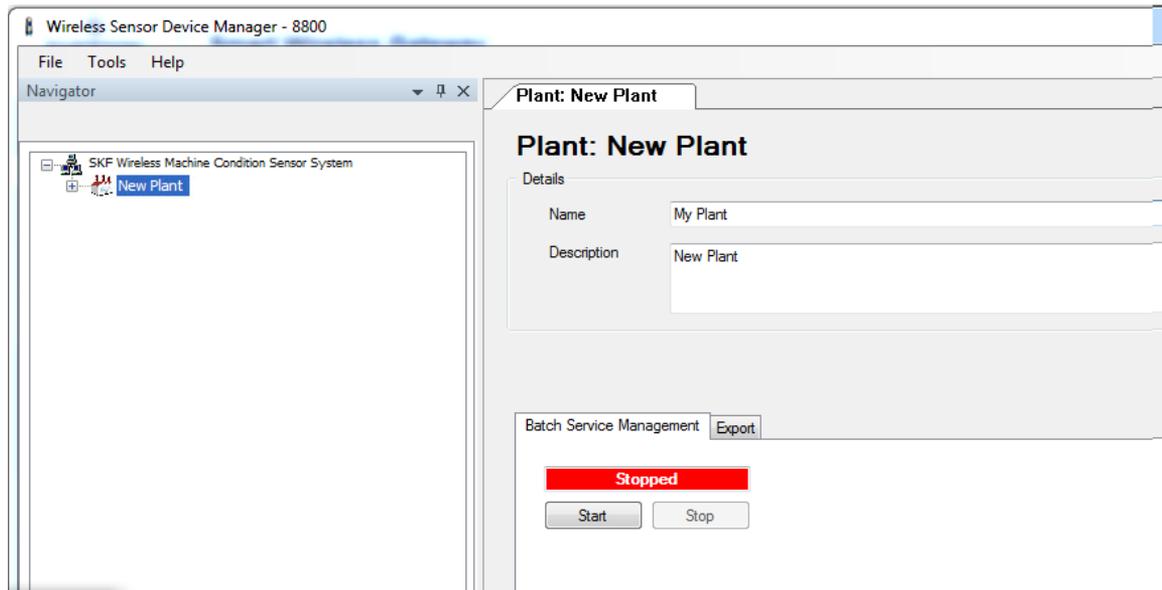


Figure 3 - 5.
The **Plant** Tab.

- Enter the new plant's **Name** and **Description** (optional), and then press the **Save** button at the bottom of the display. The new plant hierarchy item displays in the hierarchy pane.
 - Make sure you press the **Save** button to save the new plant prior to proceeding to the next step.
 - For now, disregard the **Batch Service Management** and **Export** sub tabs, they are described later in this manual at their appropriate place in the system's setup, commissioning, and operating process.

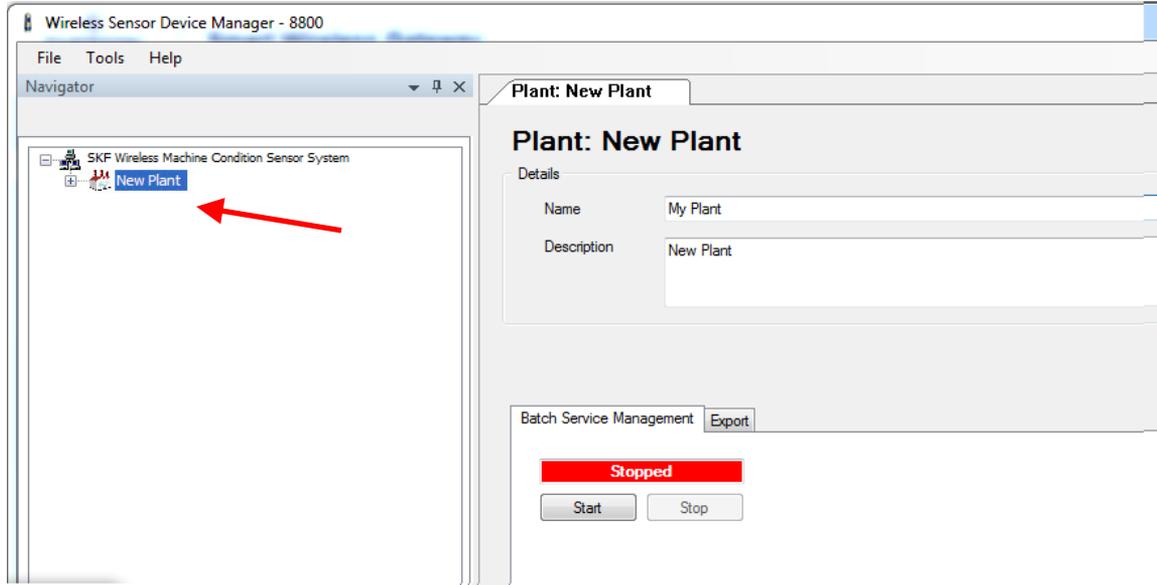


Figure 3 - 6.
The New Plant's Hierarchy Item.

Your next step is to request and enter your Device Manager software's license key.

How to Acquire Your License Key

IMPORTANT: You must create a plant level hierarchy item to enable the license key process. Reference the previous **Building your Wireless System's Hierarchy** section for instructions.

Your Wireless Sensor Device Manager software (Device Manager) was shipped from the factory with a Temporary License Key that has a specific expiration date. This temporary license is good for up to 50 sensors only and allows you to set up the system while the permanent license key is being processed. The Temporary License Key and its expiration date are located on the inside of the Device Manager CD's case. Note that, prior to the Temporary License Key's expiration date, you must complete the license key process to obtain your Permanent License Key. If you experience any license key issues, please email our customer service group at csq-lulea@skf.com.

The Wireless Sensor Device Manager software is licensed for the computer on which it is installed and according to the number of wireless sensors in your system. The general process for obtaining a license key is as follows:

- Use Device Manager's License Management dialog to generate a License Application Code.
- When prompted for the number of sensors to be supported by the software, select the (category matching the) number of sensor licenses you purchased and generate the License Application Code.
- Use Device Manager's License Management dialog to enter your Temporary License Key.
- Email the generated License Application Code to your SKF sales representative.

- Your SKF sales representative will, in return, communicate with SKF Condition Monitoring Customer Service and then email you your Permanent License Key.
- Enter your Permanent License Key in the License Management dialog and press the Save button.

IMPORTANT: *The Permanent License Key is specific for the computer on which the Wireless Sensor Device Manager software is installed. If you change computers, you will need to reapply for a new Permanent License Key.*

To generate a License Application Code:

- After creating a plant hierarchy item, select the **Tools** menu's **License Management** option. The **License Management** dialog displays.

The screenshot shows the 'License Management' dialog box. It has a title bar 'License Management'. Inside, there are two columns of controls. The left column is titled 'Sensors supported' and has 'Actual' (50) and 'Wanted' (50) fields. The right column is titled 'Export utilities' and has checkboxes for 'ABB Analyst' and 'SKF @ptitude'. Below these is an 'Expiration date' field with '22 July 2016'. A 'License Application Code' field contains a long alphanumeric string. Below that is a 'License Key' field. At the bottom, there are buttons for 'Copy to clipboard', 'Paste from clipboard', 'Save', and 'Exit'.

Figure 3 - 7.
The **License Management** Dialog.

Select options in the **License Management** fields as described below:

- **Number of sensors supported** – In the **Wanted** column, select the number of wireless sensors in your wireless system.

After specifying the above information, the **License Application Code** field contains an appropriate license application code for your computer and wireless sensor system.

- Highlight the **License Application Code**, and then use the **Copy to clipboard** button to copy the license application code to the Windows clipboard.
- In the **License Key** field, enter the Temporary License Key provided on the inside of the Device Manager CD's jewel case. The **License Key** field is case sensitive.
- Press the **Save** button to save the Temporary License Key. The Temporary License Key's expiration date appears in the **Expiration date** field. *Note, it is important to complete the rest of this process prior to the displayed expiration date.*
 - Temporary License Keys are limited to 50 sensors.
- Next, open your email and paste the license application code into a new email and send to your SKF sales representative. Your sales representative will then acquire

your Permanent License Key and send you a reply email containing your Permanent License Key.

- In the reply email, highlight the Permanent License Key, and then use the **Edit** menu's **Copy** option to copy it to the Windows clipboard.
 - Make sure no extra blank spaces are copied at the end of the license key when pasting into the License Key box.
- In the Device Manager software, re-open the **License Management** dialog, click the **License Key** field to locate the cursor, and then use the **Paste from clipboard** button to paste the license key into the **License Key** field. Please ensure that there are no leading or trailing whitespace characters included when pasting the key into the **License key** field.
- Press the **Save** button to save the Permanent License Key. Note that the license key only works on the computer from which the License Application Code was generated. Also note that it will work for all future software updates. The number of wireless sensors licensed is now specified in the **Current** column. The **Expiration date** field is no longer displayed.
- Press **Exit** to close the **License Management** dialog.

How to Add a Network Hierarchy Item

Your next step is to create network hierarchy items branching from the plant hierarchy item.

IMPORTANT: *Batch processing should be stopped prior to adding new items to the hierarchy. If necessary, to stop batch processing, on the **Plant / Batch Service Management** tab, press the **Stop** button.*

You should create a wireless network hierarchy with two “network” hierarchy items, one for the commissioning network hierarchy item and its commissioning gateway, and another for your production wireless network and its gateways (reference the **Commissioning Network Overview** section).

To add a network level hierarchy item:

- Right click the plant hierarchy item. The context sensitive pop-up menu appears, providing a **New Network** option.
- Select the **New Network** option. The right pane displays the **Network** tab, allowing you to enter the new network's **Name** and **Description**, and also provides additional sub tabs that allow you to configure the network connection in your computer for this new network.

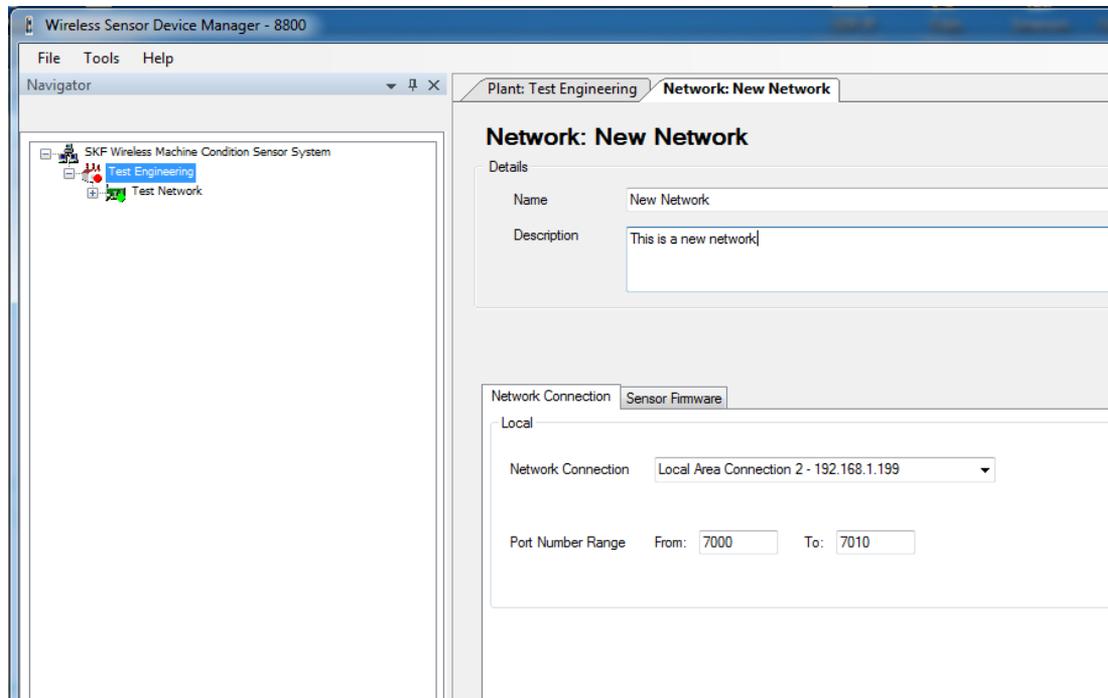


Figure 3 - 8.
The **Network / Network Connection** Tab.

- Enter the new network's **Name** and **Description** (optional).
- On the **Network Connection** sub tab's **Network Connection** drop down list, select the **Local Area Connection** option.
 - If the Device Manager computer has more than one network card, the **Network Connection** drop down list displays an option for each card. From the list, select the appropriate card that you will use to connect to the gateways.
- On the tab's **Port Number Range** field, a network port range from 7000 – 7010 is pre-selected. Check with your IT department to make sure that this range is available for the computer running the Device Manager software. Note that two ports are required per gateway (one for the Device Manager User Interface, and one for the batch service). If more than five gateways are to be installed, extend the range accordingly.
 - If the port number range is changed, you must restart the Device Manager software for the change to become permanent.
- Press the **Save** button at the bottom of the display. The new network hierarchy item displays in the hierarchy pane.

If the software is connected to gateways in multiple networks, repeat the procedure to create the number of network hierarchy items accordingly.

- For now, disregard the **Sensor Firmware** sub tab, it is described later in this manual at its appropriate place in the system's setup, commissioning, and operating process.

How to Add a Gateway Hierarchy Item

Your next step is to create a gateway hierarchy item branching from the network hierarchy item.

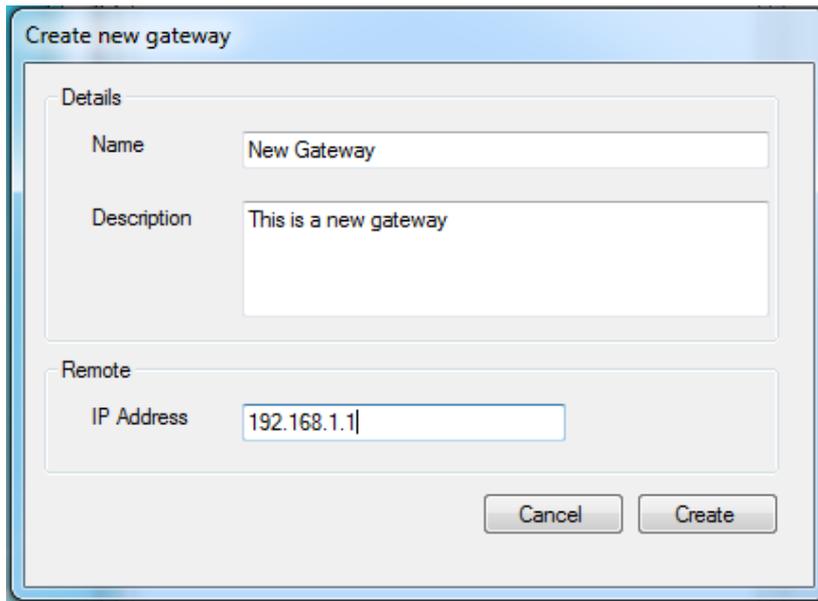
IMPORTANT: *Batch processing should be stopped prior to adding new items to the hierarchy. If necessary, to stop batch processing, on the **Plant / Batch Service Management** tab, press the **Stop** button.*

You will need to create a commissioning gateway hierarchy item for the commissioning network hierarchy item, and other gateway hierarchy items for your production wireless network and its production gateways (reference the previous **Commission Network Overview** section).

To add a gateway hierarchy item:

- Right click the network hierarchy item. The context sensitive pop-up menu appears, providing a **New Gateway** option.

Select the **New Gateway** option. A **Create new gateway** dialog displays.



The screenshot shows a dialog box titled "Create new gateway". It is divided into two main sections: "Details" and "Remote". In the "Details" section, there is a "Name" field with the text "New Gateway" and a "Description" field with the text "This is a new gateway". In the "Remote" section, there is an "IP Address" field with the text "192.168.1.1". At the bottom right of the dialog, there are two buttons: "Cancel" and "Create".

Figure 3 - 9.
The **Create new gateway** Dialog.

- Enter information into fields as described below:
 - Name** – Enter the new gateway's name.
 - Description** – (optional) Enter a description to help identify the new gateway.
 - Gateway Type** – Select your WirelessHART Gateway type. Currently only the **Pepperl+Fuchs gateway** type is available.
 - IP Address** – Enter the gateway's IP address using the IPv4 format (aa.bb.cc.dd).

- Click **Create**. The **Gateway / Properties** tab is created and provides a button to connect to the gateway. The connection status displays red if disconnected or green if connected.

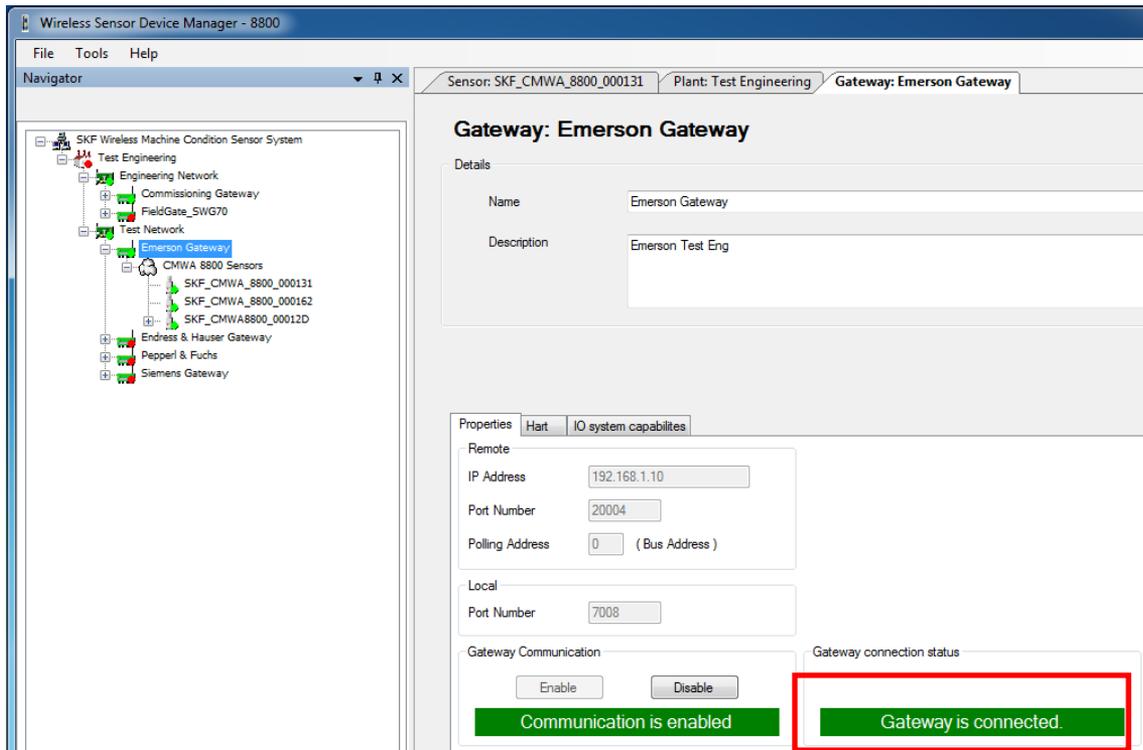


Figure 3 - 10.

The **Gateway / Properties** Tab Showing the **Gateway is connected** Message.

- Click the **Enable** button to connect the Device Manager software to the gateway.

The **Gateway / Properties** tab includes the following fields:

Remote IP Address –Displays the gateway's IP address. The gateway IP address can only be updated when the gateway's communication is disabled and the batch service is not running.

Remote Port Number - Displays the gateway's port number. The default port number is 20004. The port number can only be updated when the gateway's communication is disabled and the batch service is not running.

Remote Polling Address – Displays the gateway's polling address. The default polling address is 0. This polling address must match the Bus address of the P+F WHA-GW gateway. The polling address can only be updated when the gateway's communication is disabled and the batch service is not running.

Local Port Number - Displays the host computer's port number used by the Device Manager software for this gateway. The Device Manager's batch service reserves the next free number in the port range. The range of ports is defined in the network hierarchy item.

Enable / Disable buttons – Click to connect or disconnect the Device Manager software to / from the gateway. The connection status of the gateway displays to the right of the **Enable / Disable** buttons.

- If **Gateway Communication** is enabled, but the **Gateway Connection Status** is not connected, fix the gateway connection. Then, disable **Gateway Communication** and re-enable **Gateway Communication** to connect to the gateway.
- For now, disregard the **Admin** and **IO system capabilities** sub tabs, they are described later in this manual at their appropriate places in the system's setup, commissioning, and operating process.

How to Populate the Device Manager Hierarchy with Wireless Sensors

A WirelessHART gateway automatically detects any WirelessHART devices that are within range and configured with the gateway's network ID and join key. Within 15 minutes after WirelessHART devices are activated, the gateway builds an internal database of all WirelessHART devices that are connected to the gateway.

Once the gateway has detected the wireless sensors, your next step is to connect the Device Manager software to the gateway.

- First, make sure that the sensors to which you want to connect with the Device Manager software are turned on and within range of the gateway. Do this by confirming that the sensors appear in the P+F gateway's Operating Modes web page in the **Com. Status** column and that the status is green.

Device Name: WHA-GW Device Revision: 2
Device Long Tag: WHA-GW Descriptor: ??????????????????
NE107 Status: Good Timestamp of Status: 14:32:57

Parameter
 Identification
 Wireless Communication
 Setup
 Operating Modes
 Wired Communication
Diagnostics
Engineering
Additional Functions
Measurement

Operating Modes

Long Tag	IO-Card	Channe...	Device Type	Com. Stat...	Dev. Status	Routing Device...
WHA-GW	251	1	WHA-GW			
WHA-ADP Router	1	0	WHA-ADP	✓	✓	
SKF_CMWA_8800_00...	2	0	E1A2	✓	✓	
...	3	0	WHA-ADP	✓	✓	✓
SKF_CMWA_8800_00...	4	0	E1A2	✓	✓	
SKF_CMWA_8800_00...	5	0	E1A2	✓	✓	

Figure 3 - 11.
The P+F Gateway's Web Page Showing **Com.Status**.

To have Device Manager import the list of sensors stored in the gateway:

IMPORTANT: *The batch service must be stopped prior to using the **Find sensors** option. (The option is unavailable when the batch service is running.)*

- Right click the gateway hierarchy item. The context sensitive pop-up menu appears and displays the **Find sensors** option.
- Select the **Find sensors** option. The wireless sensors stored in the gateway are uploaded and stored in the Device Manager software's database. The connected wireless sensors display in the hierarchy under the gateway item.

To view the connected wireless sensors in the hierarchy:

- Click the + (open) next to the gateway and **CMWA 8800 Sensors** hierarchy icons to expand the sensor list.

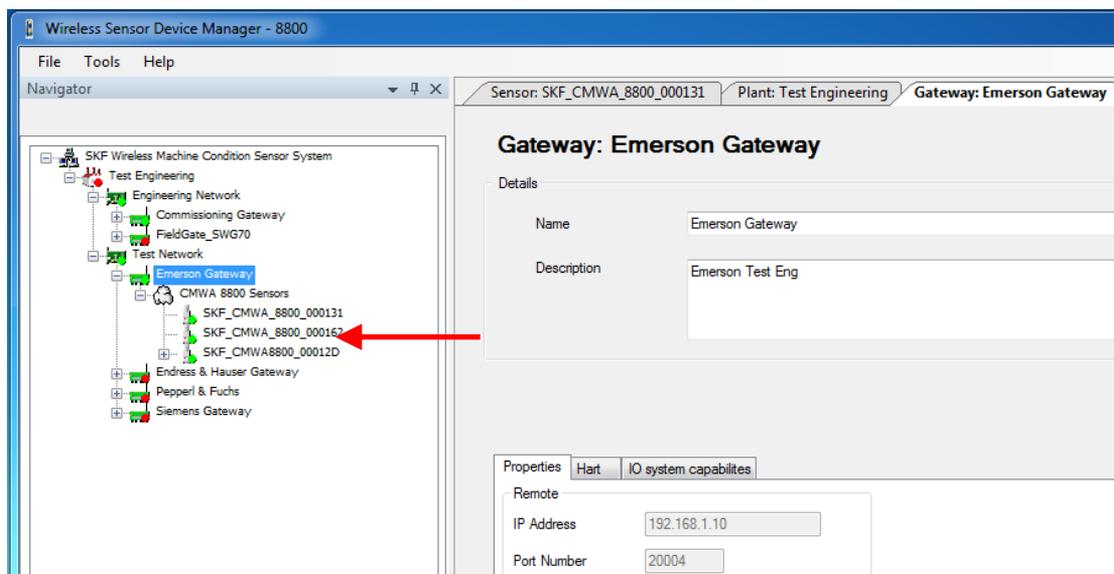


Figure 3 - 12.
Three Wireless Sensors Displayed in the Hierarchy.

- The first time the hierarchy structure is built, the Device Manager software also uploads the current configuration data from all wireless sensors branching from the gateway. This may take several minutes to complete.

The following icon color codes are used to indicate communication status:

Green – Indicates that the sensor is available and no active communication is taking place.

Yellow – Indicates that the Device Manager software and sensor are communicating with each other.

Blue – Indicates that the Device Manager software's batch service and the sensor are communicating, and the sensor is not currently available from the Device Manager user interface.

Red – Indicates that the sensor cannot be reached.

Non SKF WirelessHART Field Devices

There are no restrictions for installation of registered WirelessHART field devices from other manufacturers under the same gateway as the SKF wireless sensors. However, the Device Manager software is designed for commissioning and managing SKF wireless sensors only. The Device Manager software will not display other types of field devices that are part of the same network.

Generic functions under the **Gateway / Admin** tab (i.e., **Network ID**, **Join Key**, **Get Network Status** or **Get Network Statistics**, etc.) will apply for all wireless field devices connected to this gateway.

Data Collection Schedule Setup Overview

Before proceeding to describe specific Device Manager setup tabs and fields, it's useful to reiterate some important points.

- Batch service polling controls scheduled data retrieval from the gateway / sensors to the Device Manager database.
- The batch service uses two data collection methods; polling the sensors and polling the gateways (burst mode).
- Waveform measurement data (and the resulting FFT) must be polled from the sensor.
- Burst mode is used to retrieve vibration overalls, temperature, and battery measurements. It speeds data collection, helps alleviate wireless sensor network activity, and thus creates a more robust wireless network system. It also facilitates wireless sensor data integration into existing HART process information systems. *As such, it is recommended that you always configure your sensors to use burst mode.*

Sensor Setup Tab Overview

Gateway and sensor setup tabs are overviewed below, and then described in detail later in this section.

Gateway / Admin tab – enable the **Use Cache** check box. This setting is a prerequisite for using burst mode. It specifies for Device Manager to retrieve the vibration overalls / temperature measurement results from the gateway's cache. *The use of burst mode is always recommended.*

Sensor / Device tab – set the sensor's general device information (the important fields are **Tag** and **Machine speed**).

Sensor / Data Collection tab – set the sensor's **Vibration Cyclic Update** interval (how often the sensor automatically performs its vibration measurements to update the readings in its memory). How often temperature measurements are uploaded and stored in the database depends on the burst and polling settings.

Also specify which measurements the sensor performs and the polling schedule to retrieve them and store them in the Device Manager database.

- The sensor automatically performs its temperature measurements every five minutes; this interval cannot be changed.

Sensor / Burst Control tab – for use with burst mode, specify whether the sensor bursts vibration overalls, temperature, and battery measurements to its gateway's cache, and the burst intervals.

Sensor / Status tab – set the sensor's router node setting (**Full Routing** is the recommended setting)

After reading the above setup tab overviews, it's obvious that coordination between settings on various setup tabs is required to properly set up your wireless sensor data collection. For this purpose, we've provided setup guidelines in the following table, which indicates the recommended wireless sensor setup for monitoring standard machinery running at standard speeds (between 1500 and 3600 RPM). Reference this table when reading about the various setup tabs and fields, and when configuring your wireless sensors.

- This recommended setup assumes that you are collecting vibration overalls, temperature, and battery measurements using burst mode.

Recommended Wireless Sensor Settings for Standard Machinery (1500 – 3600 RPM)					
Sensor / Device	Specify the sensor's identification (long tag name) and machine speed.				
	Sensor / Device tab fields identify the sensor and the machine that it is monitoring. Therefore, some settings are unique for each sensor. Follow instructions in this chapter's Sensor / Device Tab section to configure each sensor's Sensor / Device settings.				
Sensor / Data Collection	Specify the sensor's vibration cyclic update interval and the trending command to use; and specify which measurements the sensor performs and the polling schedule to retrieve and store them in the Device Manager database.				
	Vibration Cyclic Update	Enable	1 hour	Start time – 00:00 (midnight)	
	Trending Command	Command 93 (CMD93)			
	Velocity and Envelope Waveform	Enable	Reference time – user preference	Period – 24 hours	
	Envelope Pk-Pk and Velocity RMS (vibration overalls)	Enable	Reference time – not configurable when CMD93 is selected	Period – not configurable when CMD93 is selected	
	Temperature	Enable	N/A	Period – 1 hour	
Gateway / Admin	When using burst mode (recommended), specify for Device Manager to retrieve vibration overalls, temperature, and battery measurement results from the gateway's cache.				
	Use Cache	Enable			
Sensor / Burst Control	When using burst mode (recommended), specify which measurements the sensor bursts to the gateway's cache, and their burst interval.				
	Burst Mode	Message 0 - On	Message 1 - On	Message 2 - On	Message 3- Off
	Update Period	20 minutes	60 minutes	60 minutes	N/A
	Command / Slot	Command 93	Command 9 Slot 0 – Battery Life Slot 1 – Battery Voltage Slot 2 – Battery Charge Slot 3 - None	Command 3 (optional) for HART OPC systems only	N/A
Sensor / Status	Each sensor's power profile should be set to Full Routing.				
	To preserve sensor battery life, disable the routing capability on the gateway's Operating Modes web page, in the Routing Device column.				

Note that in the preceding table we recommend a setup that polls the sensors every 24 hours for waveform data, and that polls the gateway's cache every hour for vibration overalls and temperature data (using burst mode). Collecting overalls and temperature data hourly on non-critical machinery may seem excessive to those familiar with traditional vibration monitoring technologies. However, it is important to realize that HART process information systems working with OPC compliant host servers typically update their data in minutes, and that vibration / temperature data stored in the gateway's cache may be used by these existing process information systems. Bursting the overalls to the gateway cache hourly makes sense in these scenarios. If you want to extend your trend intervals, you may choose to extend the **Sensor / Data Collection** tab's **Vibration Cyclic Update** for the Envelope Pk-Pk and Velocity RMS / Temperature measurements up to 24 hours. (Reference the following *Sensor / Data Collection Tab* section.)

How to Configure Wireless Sensors

This section details Device Manager tabs and fields used to configure sensor data collection, to configure bursting of measurement results to the gateway, and to configure polling schedules for retrieving measurement results to the Device Manager database.

Sensor / Device Tab

Each WirelessHART device is individually identified using its HART address and its long tag. In the Device Manager software's hierarchy, by default, each wireless sensor's long tag displays for identification of the wireless sensor, as it offers more characters to help identify the sensor.

The sensor's identification (long tag name) and other general configuration parameters are specified on the **Sensor / Device** tab.

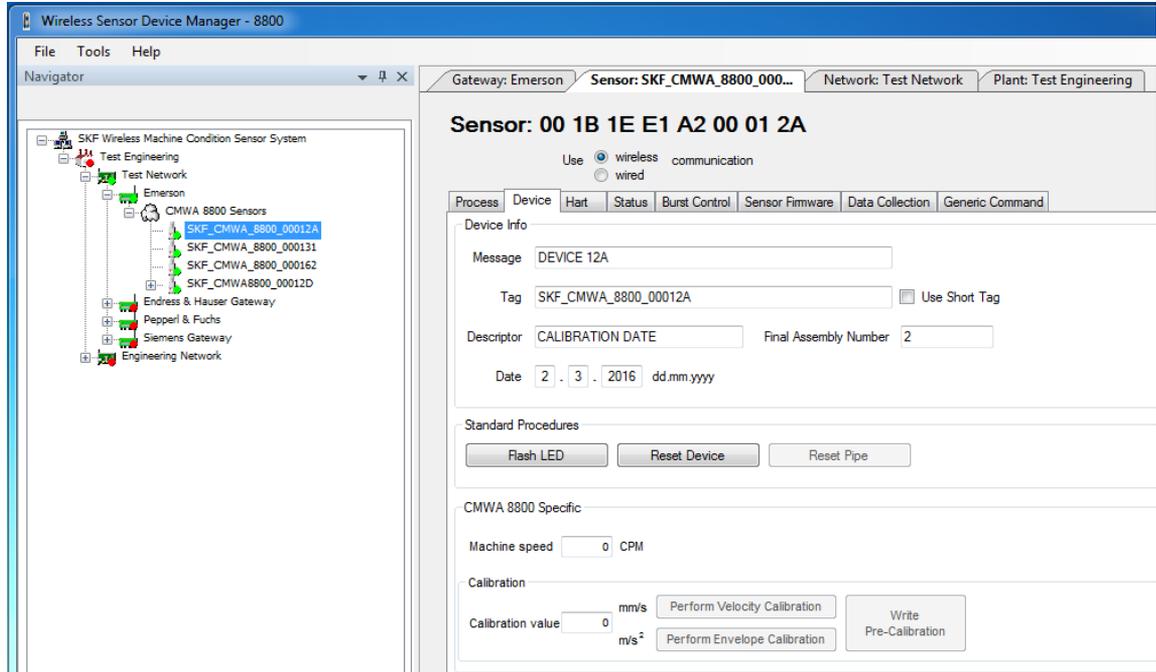


Figure 3 - 13.
The **Sensor / Device** Tab.

The **Sensor / Device** tab displays the following fields:

Device Info Area

Message – (not applicable at this time) Displays message information stored, or to be stored, in the device.

Tag – Initially, displays the sensor’s factory default long tag name. The factory default long tag displays the sensor’s manufacturer, sensor model, and the sensor’s device ID. You should change the sensor’s long tag so it reflects the machine upon which the sensor will be mounted, while adhering to company naming conventions. WirelessHART allows 32 characters maximum. SKF @ptitude Analyst restricts the length to 20 characters.

Use Short Tag – (not applicable at this time) This field is applicable for older, legacy HART devices. Do not use this with wireless sensors.

Descriptor – (not applicable at this time) Displays the calibration date.

Final Assembly Number – Displays 1 for Rev A and B hardware, 2 for Rev C hardware. Do not change this field’s value.

Date – Displays the most recent calibration date.

Standard Procedures Area

Flash LED – Click this button to cause the connected wireless sensor’s LED to flash ten times. This can be useful if you need to identify a device in the network or check communication.

Reset Device – Click to reset the sensor. If the sensor is connected to the Device Manager software, resetting the sensor is similar to rebooting a computer; it helps clear issues with the device. Note that the sensor will drop off the network, and then rejoin the network, which takes some time – more time the larger the network.

Reset Pipe – If the network manager fails to reassign the fast pipe, click this button to de-allocate the fast pipe from this sensor so the gateway can reassign the resource to other sensors as needed.

- You can verify a sensor's fast pipe assignment on the P+F gateway's web page. A failure of fast pipe assignment is indicated when a sensor collecting a waveform takes more than 2 minutes to complete when it is directly connected to the gateway.

CMWA Specific Area

Machine Speed – Enter the rotating speed of monitored machine. The entered machine speed displays as the 1X RPM indicator in @plitude Analyst spectral displays and is used as speed reference by other frequency indicators.

IMPORTANT: Entering the Machine Speed for the sensor is recommended. The value is exported to Analyst for the FAM overlay so that it does not have to be entered in each FFT plot in Analyst.

- Click the **Save** button to write your edited **Sensor / Device** tab information to the wireless sensor and the Device Manager database.

Sensor / Data Collection Tab

Use the **Sensor / Data Collection** tab to specify which measurements are collected from the sensor, the sensor's vibration cyclic update interval, and the polling schedule for Device Manager to retrieve and store the sensor's measurement results in its database.

To configure data collection for the wireless sensor:

- In the hierarchy, highlight the sensor you want to configure and select the **Sensor / Data Collection** tab.

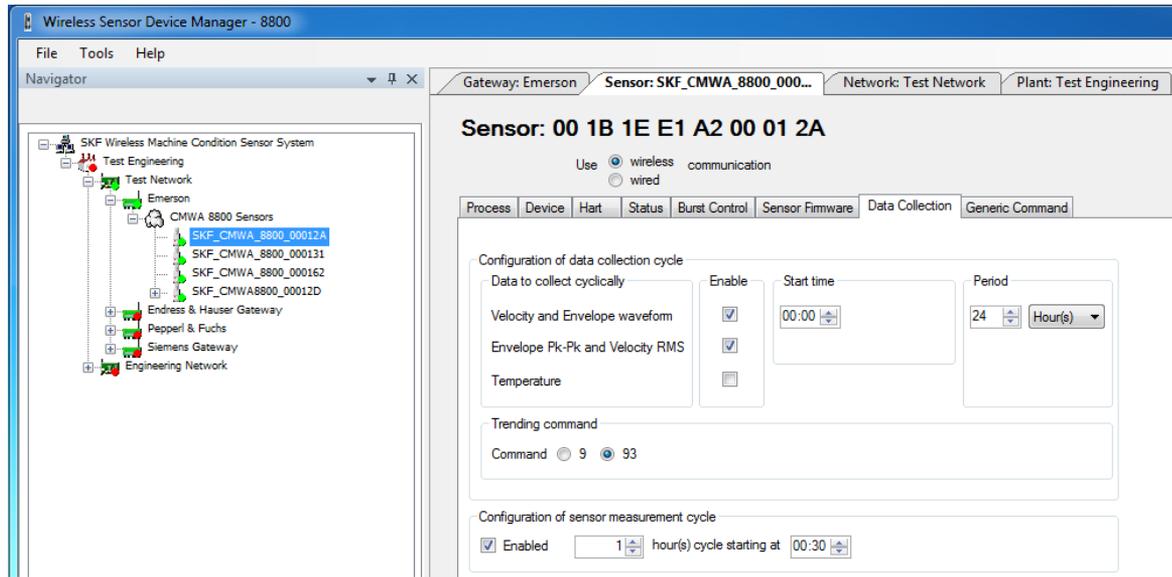


Figure 3 - 14.
The **Sensor / Data Collection** Tab with Recommended Settings.

Setting the Vibration Cyclic Update

IMPORTANT: Each sensor's **Vibration Cyclic Update** setting must be **Enabled** for the sensor to sample vibration data. This applies for both polling sensor data retrieval and for burst mode.

As mentioned earlier, the sensor's **Vibration Cyclic Update** start time and update interval (from 1 to 24 hours) specify when and how often the wireless sensor automatically performs its vibration measurements (velocity and enveloped acceleration - waveforms and overalls) and stores the resulting measurement data in its RAM memory.

To set the sensor's vibration cyclic update interval:

- In the **Vibration Cyclic Update** area, enable the check box and set the update interval and start time.

The start time must be selected in the first interval past midnight and the allowed start time must be within the cycle setting (the interval setting).

Example 1 - if the hourly cycle is set to 1 Hour(s), the start time must be within 00:00 to 00:59 minutes after midnight.

Example 2 - if the hourly cycle is set to 4 Hour(s), the start time must be within 00:00 to 3:59 AM.

The recommended settings for standard machinery monitoring are a **1 hour cycle starting at 00:00**. A one hour cycle provides trend data for vibration overalls, and by starting the measurements at midnight, you know that your vibration measurements are being performed near the top of the hour, depending on network activity.

- When cyclic data collection by the sensor coincides in time with data retrieval by Device Manager, if the request for data retrieval

precedes the scheduled cyclic update measurement (but overlaps), then the cyclic update measurement is skipped.

Choosing a Trending Command

The Device Manager software can use either of two HART commands to trend the overall data and temp, as explained below.

- Dynamic data (waveforms) are retrieved using block transfer.

Command 9

Typically, Command 9 is used only with burst mode, and then only for non P+F gateways that do not support Command 93. Command 9 is also used when getting current values in the **Sensor / Process / Process Data** tab (this is discussed in detail in **Chapter 4, Sensor Network Operation**). Command 9 retrieves only the last overall vibration / temperature measurement results stored in the sensor. For example; the last velocity overall, the last enveloped acceleration overall, and the last temperature reading that were stored in the sensor.

Note that only the last results are retrieved and that the date / time stamps may be off by as much as the cyclic update interval.

Command 93

Command 93 (recommended) retrieves the last twelve velocity overalls, the last twelve enveloped acceleration overalls, and the last twelve temperature readings stored in the sensor. Command 93 provides accurate date / time stamps for the measurement results.

Command 93 does not use the **Envelope Pk-Pk and Velocity RMS** measurements' **Reference Time** and **Period** settings to retrieve the vibration overalls measurement results (and thus, these setup fields are unavailable and appear dimmed), instead it automatically retrieves the vibration overalls once per hour, and this interval is fixed. In your trend plots, the interval between the overall vibration measurement results is determined by the sensor's **Vibration Cyclic Update** interval.

With Command 93, the sensor's temperature measurements are also automatically retrieved every hour. However, trend intervals for temperature measurements results are determined by the temperature measurement's **Period** setting.

For example, with Command 93 and vibration overall measurements:

Vibration Cyclic Update Interval	Data Retrieval Interval	Trend Interval
1 Hour	Always 1 Hour	1 Hour
2 Hours	Always 1 Hour	2 Hours
3 Hours	Always 1 Hour	3 Hours

In situations where the sensor's **Vibration Cyclic Update** interval is longer than one hour, overall vibration readings retrieved with Command 93 that have the same date / time stamp as the previously retrieved data are not written into the Device Manager database.

For example, with Command 93 and temperature measurements:

Temp. Measurement Update Interval	Data Retrieval Interval	Period Setting	Trend Interval
Always 5 minutes	Always 1 Hour	60 minutes	60 minutes
Always 5 minutes	Always 1 Hour	30 minutes	30 minutes
Always 5 minutes	Always 1 Hour	20 minutes	20 minutes

Aside from accurate date / time stamps, another advantage of using command 93 occurs with historical data collection. If your Device Manager computer becomes unavailable for some reason (e.g., it is turned off or loses the network), then because command 93 retrieves the last twelve readings for each measurement type, these last twelve readings are available when Device Manager's batch service resumes.

- In the **Trending Command** area, select to use **Command 93** (recommended) for your polling the sensor data retrieval.

Setting the Polling Schedule (Retrieval)

Fields at the top of the **Sensor / Data Collection** tab allow you to specify which measurements to retrieve to the Device Manager database, and their polling schedule.

To set up a measurement's polling schedule:

- For each measurement listed in the **Data to Collect Cyclically** area:
 - Velocity and Envelope waveform** (waveform data and the resulting FFTs)
 - Envelope Pk-Pk and Velocity RMS** (overall vibration data)
 - Temperature**
 Use check boxes in the **Enable** area to enable data collection as desired.
- After enabling a measurement's data collection, use fields in the **Period** and **Reference Time** areas to specify its polling schedule (i.e., when data retrieval and storage into the Device Manager database occurs, and the interval at which the polling repeats). Note applicable ranges as specified in the table below.
 - If **Trending Command 93** is selected, the **Envelope Pk-Pk and Velocity RMS** measurement's **Period** and **Reference Time** fields are not available, as Command 93 automatically retrieves this overall vibration data every hour.

Schedule	Configurable Polling Interval	Polling Type
Velocity and Envelope waveform (dynamic data)	1 hour to 24 weeks	Polling the sensor
Envelope Pk-Pk and Velocity RMS (overall vibration data)	1 hour to 24 weeks	Polling the gateway (burst mode)
Temperature	5, 10, 15, 20, 30, 60 minutes	Polling the gateway (burst mode)

Period – Works with the measurement's **Reference Time** setting. For each measurement, specify the polling interval at which Device Manager retrieves the measurement's results and stores them in its database. Select the polling interval in **Hour(s)** or **Week(s)** (or **Minutes** for the temperature measurement).

- If the measurement's **Period** is set to "X" **Week(s)**, the measurement is polled at the **Reference Time** and day every "X" weeks.
- If the measurement's **Period** is set to "X" **Hour(s)**, the measurement is polled at the **Reference Time** and repeated every "X" hours until the day is over. Then, on the next day, the measurement is polled again at the specified **Reference Time**, etc. This facilitates readings being repeated at the same time every day, even if the specified **Period** does not multiply to 24 hours.

In this scenario, the **Reference Time** must be selected in the first interval past midnight and the allowed **Reference Time** must be within the **Period** setting.

Example 1 - if the **Period** is set to 1 **Hour(s)**, the **Reference Time** must be within 00:00 to 00:59 minutes after midnight.

Example 2 - if the **Period** is set to 4 **Hour(s)**, the **Reference Time** must be within 00:00 to 3:59 AM.

- If the **Period** is set to 24 hours, the measurement is polled at the **Reference Time** every day.

Reference Time – Works with the aforementioned **Period** setting. Specify the day and time for the measurement's polling schedule to begin. Note that the **Reference Time** setting must be selected in the first interval past midnight and is restricted to be within the **Period** setting. For example, if you select a **Period** setting of 4 **Hour(s)**, the **Reference Time** can only be set from 0:00 to 3:59 AM.

- The day setting is not available if **Hour(s)** is selected in the measurement's **Period** area.
- For consistent data collection, you should set the **Reference Time** and **Period** settings to collect data on a day/time when the machine is running at its nominal speed and operating conditions.

Note that for measurements that are polled from the sensor through the gateway, Device Manager adds sensors to a queue to be read according to their **Reference Time** settings. As Device Manager is single threaded, there may be a time difference between the sensor's **Reference Time / Period** settings and when a measurement is actually retrieved. The time difference between scheduled and actual data collection time will depend on the sensor's place in the queue as well as network conditions and other running processes, such as background diagnostics. If poor communication conditions cause the reading of one sensor to take a long time, this may delay the reading of other sensors in the queue.

Recommended Settings

Velocity and Envelope Waveform - the recommended **Period** setting for waveform measurements (velocity and enveloped waveforms) polled from the sensor is **24 Hours**. The setting may be longer for non-critical balance of plant machinery (e.g., 1 Week, 2 Weeks, 4 Weeks).

- Uploading waveform readings consumes much more energy than uploading (bursting) overall readings. To optimize battery life, do not upload waveform readings more frequently than the application requires.

Envelope Pk-Pk and Velocity RMS (overall vibration data) – typically **Trending Command 93** is used, therefore the **Period** and **Reference Time** settings are unavailable (i.e., with Command 93, vibration overalls are automatically retrieved once per hour).

Temperature – typically set the **Period** to **60 Minutes**.

- If you want to poll temperature measurements on the most frequent time interval possible, set the **Temperature** measurement's **Period** to 5 minutes.

For example, in the above figure, Device Manager will poll the sensor's waveform data (**Velocity and Envelope waveform**) from the sensor every 24 hours at midnight. Device Manager will poll the sensor's vibration overalls (**Envelope pk-pk and Velocity RMS**) once per hour using Trending Command 93 (typically from the gateway's cache using burst mode), and poll **Temperature** readings every 60 minutes (also typically from the gateway's cache using burst mode).

- When cyclic data collection by the sensor coincides in time with data retrieval by Device Manager, if the request for data retrieval precedes the scheduled cyclic update measurement (but overlaps), then the cyclic update measurement is skipped.
- Click the **Save** button to save your **Sensor / Data Collection** tab information to the Device Manager database.

Sensor / Burst Control Tab

(For burst mode data collection only.) Specify which measurements the sensor bursts to the gateway's cache, and their burst interval; (enable and configure up to four burst messages for each sensor).

When setting up sensors for burst mode, which data the sensors burst to the gateway's cache and how often they burst the data are specified using the **Sensor / Burst Control** tab.

IMPORTANT: *As previously stated, it is strongly recommended that you use burst mode to collect your overall vibration and temperature measurements, as doing so:*

- * *Greatly shortens the time required by Device Manager to collect overall vibration and temperature readings for all sensors in the network.*
- * *Reduces wireless network traffic, as no commands need to be transmitted from the gateway to the sensor for this data.*
- * *Provides a more robust wireless network system.*
- * *Allows you to integrate the overall vibration / temperature data into your existing process information system.*

To specify a sensor's burst mode settings:

- In the hierarchy list, select the sensor to configure and select the **Sensor / Burst Control** tab.

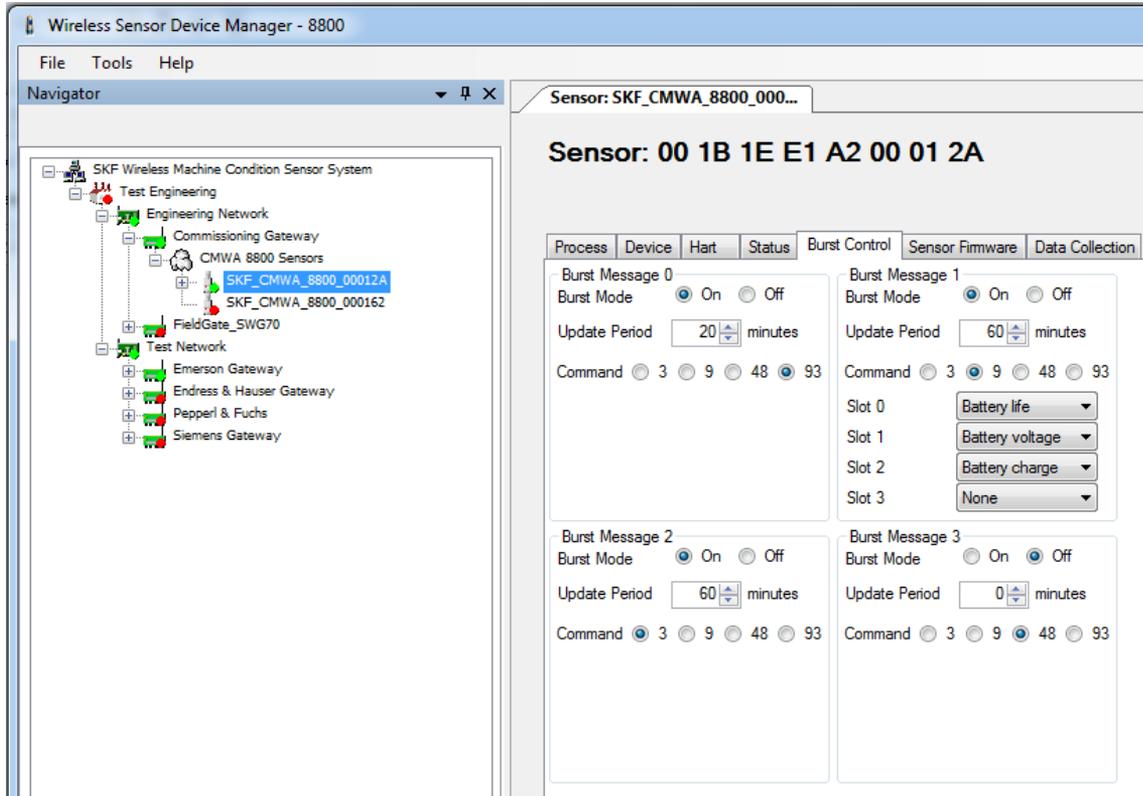


Figure 3 - 15.

The **Sensor / Burst Control** Tab Showing Default (and Recommended) Settings.

For each sensor, you may configure up to four **Burst Messages**, each with an individual burst interval (**Update Period**). Each burst message identifies which data is contained in the burst to the gateway's cache, and the **Update Period** setting specifies how often the data is burst to the gateway's cache.

You determine which data is contained in the burst by specifying one of four **Commands** for each burst message. Each command specifies which data is included in the burst. The four commands are:

Command 93

For uploading data to Device Manager / SKF @ptitude Analyst systems.

With burst mode, Command 93 works the same as previously described for polling the sensor data retrieval. As such, it is the recommended burst command for use with Device Manager / SKF @ptitude Analyst systems as it provides accurate measurement date / time stamps.

For a detailed description of Command 93 data retrieval, reference the previous **Sensor / Data Collection Tab / Choosing a Trending Command** section.

In short, Command 93 bursts the sensor's most recent twelve temperature and overall vibration measurement results (with accurate date / time stamps) once per hour to the gateway. It is important to note that there is a twenty minute time interval between each measurement's burst (i.e., the temperature measurement's last twelve readings burst to the gateway, then there is a 20 minute interval, then the Envelope Pk-Pk measurement's last twelve readings burst to the gateway, then there is a 20 minute interval, then the Velocity RMS measurement's readings burst to the gateway, another twenty minute interval, and so on). Therefore, with a Command 93 burst message, the burst message's **Update Period** should be set to **20 minutes**.

⚠ WARNING! *Some gateway manufacturers do not support Command 93 caching (e.g., Emerson and Siemens gateways). If you are using non P+F gateways, you must use a Command 9 burst message to burst your vibration overalls and temperature measurement results for use with Device Manager / SKF @ptitude Analyst systems.*

Command 9

For uploading data to Device Manager / SKF @ptitude Analyst systems.

Uses the Burst Message's four command Slots (Slot 0 to Slot 3) to specify which device variables (measurement data) are burst to the gateway's cache. Available device variables include; Velocity RMS, Envelope Pk-Pk, Temperature, Battery life, Battery voltage, and Battery charge.

It is recommended that you use a **Command 9** burst message to burst the sensor's battery status information (i.e., battery life, voltage, and charge).

In addition, as mentioned above, if your gateway does not support **Command 93** caching, you must use a **Command 9** burst message to burst the sensor's most recent Envelope Pk-Pk, Velocity RMS, and Temperature measurement results to the gateway's cache (with less accurate date / time stamps). Again, reference the previous section, **Sensor / Data Collection Tab / Choosing a Trending Command** for more information.

Command 3

For uploading data to HART process control systems.

The wireless sensor's most recent Envelope Pk-Pk, Velocity RMS, and Temperature measurements are burst to the gateway's cache.

If the OPC server used is a HART OPC Server, then burst mode must be configured with a **Command 3**.

Command 48

Bursts the sensor's extended sensor status. Not applicable at this time.

Recommended Settings

Recommended burst settings (these are also the sensor default burst mode settings) are exemplified in the preceding figure;

Burst Message 0 is configured to burst vibration overalls and temperature data to the gateway for upload into the Device Manager database using Command 93,

Burst Message 1 is configured to burst battery information to the gateway using Command 9,

Burst Message 2 is configured to burst vibration overalls and temperature data to the gateway for use in a HART OPC server using Command 3, and **Burst Message 3** is disabled, as command 48 is not applicable at this time.

To configure a Burst Message:

- **Burst Mode (On or Off)** – Select **On** to enable the burst message.
- **Command** – Select the type of command to burst; **93**, **3**, **9**, or **48** (N/A at this time), as described above.
- **Update Period** – The defaults for each command are also the recommended settings (Command 93 – 20 minutes, Command 9 – 60 minutes, and Command 3 – 60 minutes). Specify the burst interval in minutes. The range is from 1 – 60 minutes.

IMPORTANT: For Command 93 Burst Messages, do not set the Update Period interval to anything other than 20 minutes, or else there is a risk of missing some trend data.

- Click **Save** to save the sensor's burst control settings.

IMPORTANT: You must configure and save burst message settings for all the gateway's sensors before enabling the Use Cache check box / batch service to ensure that all parameters are stored in the sensors and Device Manager's database before the batch service starts to poll the gateway for burst data. After configuring burst messages for all the gateway's sensors, proceed to the next section, **Gateway / Admin / Use Cache**.

Gateway / Admin / Use Cache

As a prerequisite to using burst mode, you must enable the **Gateway / Admin** tab's **Use Cache** check box. Doing so instructs the gateway to respond to the batch service with vibration overall / temperature measurement results stored in the gateway's cache, instead of by polling the sensor. Therefore, when burst mode is enabled on any sensor (burst mode is recommended for all sensors), **Use Cache** must be enabled on the **Gateway / Admin** tab.

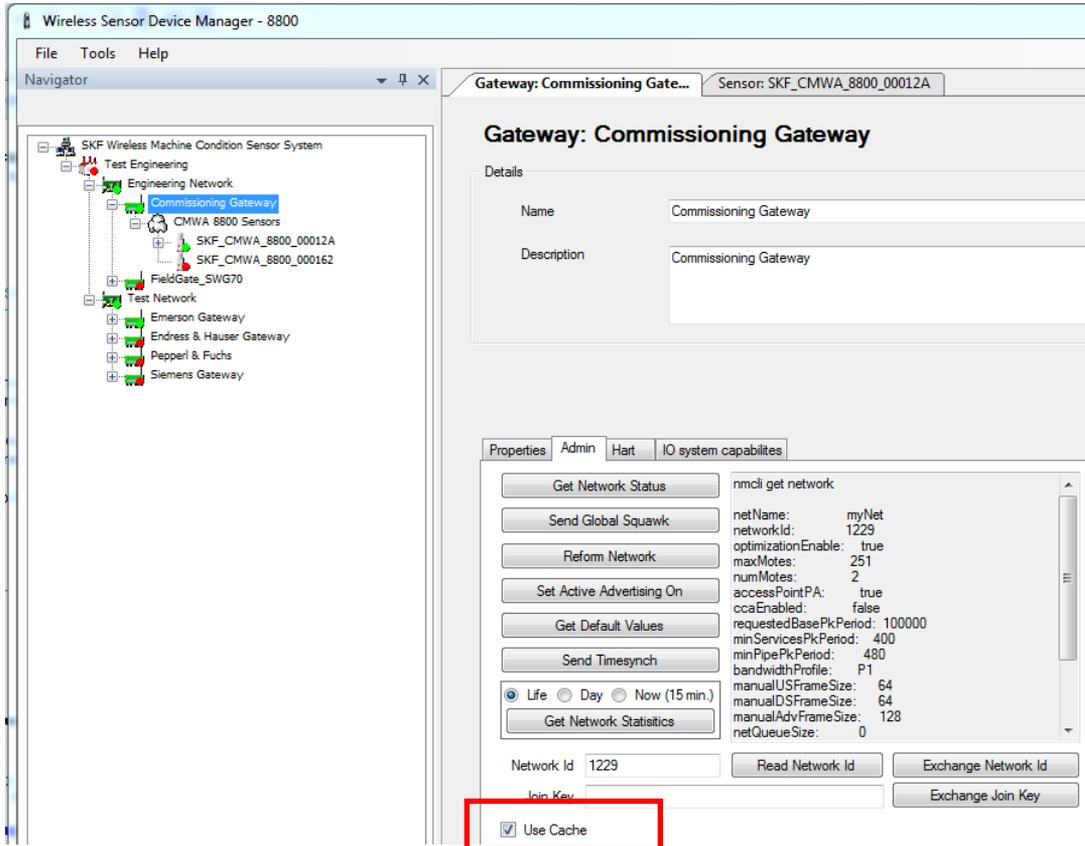


Figure 3 - 16.
The **Gateway / Admin** Tab's **Use Cache** Check Box.

To instruct the gateway to respond with overall vibration / temperature data stored in its cache:

- On the **Gateway / Admin** tab, enable the **Use Cache** check box.

⚠ WARNING! Clicking the **Send Timesynch** button on this tab may cause the gateway to shut down. At the time of this writing, P+F is working to resolve the issue. The gateway timesynch can be enabled/disabled by selecting the 'Enable/disable timesynch. of gateways' check box located in the **'Tools', 'Settings'** dialog box. The preferred setting the 'timesynch. of gateways' option is unchecked.

Sensor / Status Tab

In addition to its vibration and temperature data collection / publishing duties, the wireless sensor can also be set up to work as a router node that helps route measurement data from other wireless sensors in the mesh network. Whether it does so is specified on the **Sensor / Status** tab.

To continue configuring the wireless sensor:

- Select the **Sensor / Status** tab and specify the sensor's **Power Profile**.

A wireless sensor's **Power profile** options are **Leaf node**, **Some routing**, and **Full routing**. When setting up the mesh wireless network, the WirelessHART gateway considers **Power profile** settings for all its connected sensors before it decides how to route the data through the mesh network.

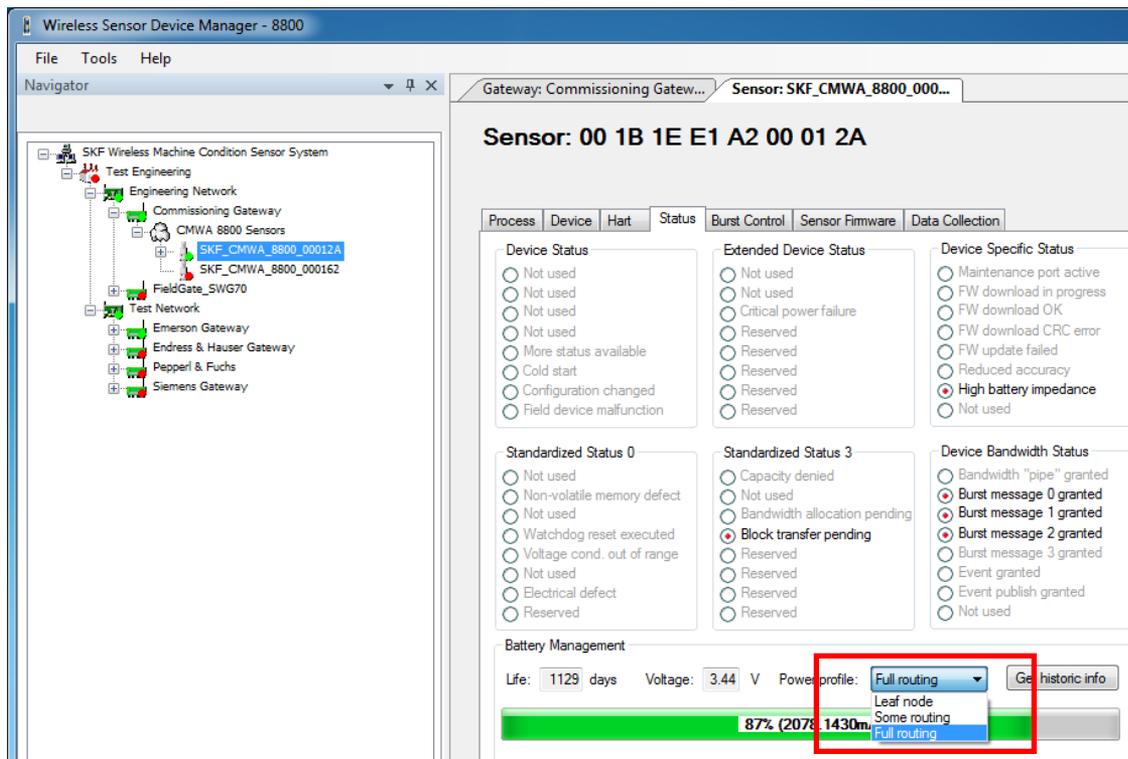


Figure 3 - 17.

The **Sensor / Status** Tab, Displaying **Power Profile** Options.

Leaf Node – Default setting – With this lowest **Power profile** setting, the gateway does not allow the wireless sensor to route traffic from other nodes. This setting provides the longest sensor battery life.

- For P+F gateways, when the leaf node setting is selected, the gateway's network manager will not grant fast pipe to the low power profile device.

Some Routing – (Not active at this time) With this intermediate **Power profile** setting, the gateway allows the wireless sensor to route traffic from two to three wireless sensors (or other WirelessHART nodes).

Full Routing – (recommended for fast waveform data transfer and firmware updates)
With this highest **Power profile** setting, the gateway does not restrict the wireless sensor as to the number of nodes for which it can route traffic. It allows the gateway's Network Manager to decide what devices will route through this device. Sensor power consumption is higher as it is proportional to the number of connections being maintained.

When you select the **Full Routing Power Profile**, the P+F gateway's Network Manager provides the sensor fast pipe(s) for block transfer. You typically want the fast pipe(s) to acquire waveform data, but you don't want every sensor to act as a router for other sensors, as this depletes sensor battery life.

There is a solution to this situation. In Device Manager, set every sensor's **Power Profile** to **Full Routing** - every sensor is provided a fast pipe for waveform data collection. Then, using the P+F gateway's web page, uncheck the **Routing Device** option to disable routing for those sensors you want to use as leaf nodes (no routing capability). Reference the following figure.

- The velocity / envelope waveform upload is subdivided in 104 packets. Depending upon availability of a communication fast pipe, the transfer rate will be approximately one packet per second (with a fast pipe), or approximately one packet every four seconds (without a fast pipe) for a single hop node. This depends on other usage of the available WirelessHART bandwidth (e.g., by cyclic data capture). For multi hop nodes, the upload time is proportionally longer.

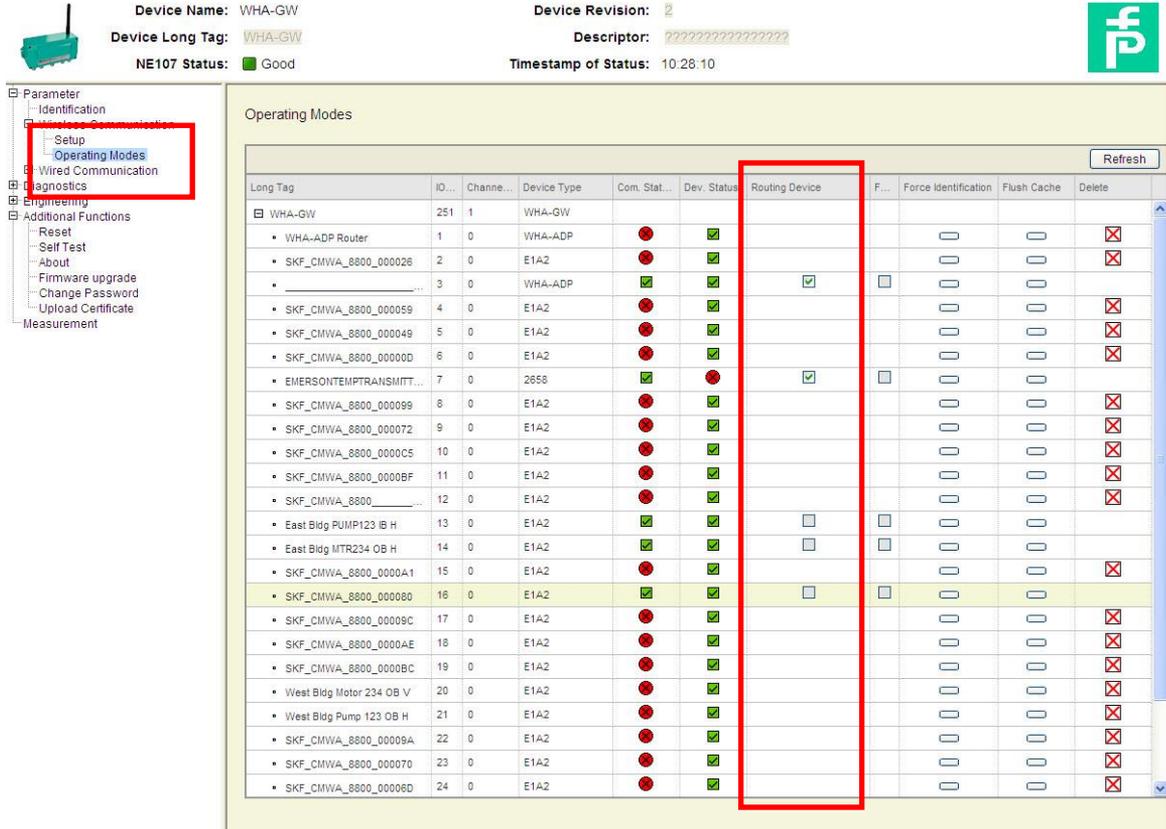


Figure 3 - 18. The P+F Gateway's Web Page Showing Routing Device Check Boxes.

- Click the **Save** button to write your edited **Sensor / Status** tab information to the wireless sensor and the Device Manager database.

How to Delete Sensors from the Hierarchy

- You must stop the batch service before performing deletions in the hierarchy.

To delete a sensor in the hierarchy:

- In the hierarchy, right click the sensor you want to delete, and then from the pop-up menu, select **Delete Sensor**. After you confirm the deletion in the resulting dialog box, the sensor (and its underlying datasets) will be deleted from the gateway's sensor list.

You may delete other items (plant, networks, gateways) from the hierarchy in the same manner; all items branching from that hierarchy level will be deleted as well. Note that the gateway must be disconnected before it can be deleted.

How to Flush the Gateway's Command Queue

On very rare occasions, a bottleneck may occur with commands sent to the gateway, and the gateway may become non-responsive. When this occurs, you can flush (clear) the gateway's command queue to clear the bottleneck.

To flush the gateway's command queue:

- In the hierarchy, select the gateway whose command queue you want to clear.
- Right click the gateway's hierarchy item, and select **Flush** from the pop-up menu.

Update Device Information

An **Update Device Information** option is available when you right click on a sensor's hierarchy item. When this option is selected, Device Manager commands the sensor to send its current settings back to Device Manager, and Device Manager saves the sensor's current settings in its database.

If a sensor is updated while off the network, and then placed back on the network, use the **Update Device Information** option to synchronize the Device Manager database with the sensor's new settings.

How to Change a Gateway's / Sensor's Network ID and Join Key

After commissioning the gateway and its connected sensors, you will need to change the commissioning gateway's network ID and join key (e.g., to match the network ID and join key of your existing production gateway) and then reform the network to change the network ID and join key for the gateway's connected sensors.

To change the commissioning gateway's network ID and join key:

- In the Device Manager hierarchy list, select the gateway hierarchy item whose network ID and join key you want to change (i.e., the commissioning gateway), and then select the right panel's **Gateway / Admin** tab.

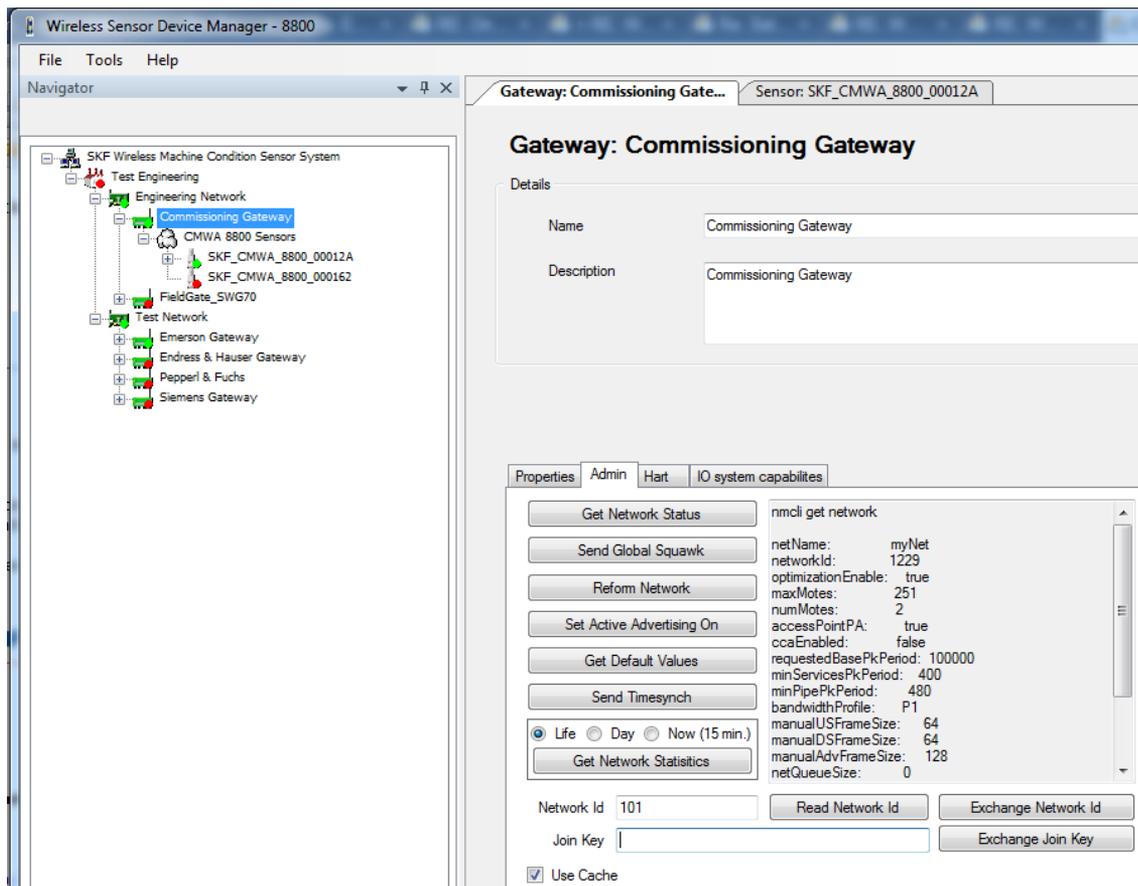


Figure 3 - 19.
The **Gateway / Admin** Tab.

- The gateway's current **Network Id** and **Join Key** display in their respective fields toward the bottom of the display. Use the following buttons / fields to change the gateway's network ID and join key.

Read Network Id – Click this button to display the gateway's current network ID.

Network Id - Enter the gateway's new network ID, and click the **Exchange Network Id** button to send the new network ID to the gateway and its connected wireless sensors.

Join Key - Enter the gateway's new join key and click the **Exchange Join Key** button to send the new join key to the gateway and its connected wireless sensors..

- The **Join Key** field is not case sensitive.
- You do not need to click the **Save** button to save **Admin** tab settings.

IMPORTANT: *The time it takes for all the wireless sensors to update with the new network ID and join key varies depending on the number of sensors and the number of hops of the sensors to the gateway. In a commissioning setup, when the gateway and sensors are less than twenty feet from each other (and no obstructions in between), and there are less than 30 sensors being updated, you must wait at least an hour for all the sensors to update with the new network ID and join key before taking the next step. This is typical for WirelessHART networks.*

- After having waited the appropriate time, and the new network ID and join key has propagated to all the connected sensors, click the tab's **Reform Network** button to command the gateway and sensors to begin using the new network ID and join key.
- After clicking the **Reform Network** button, wait a couple of minutes for the gateway to reset the connection status for all the sensors.
- Next, wait a couple of minutes and then select the commissioning gateway's hierarchy item and right click to select the **Find sensors** option. Each sensor's hierarchy icon status indicator should turn red to indicate the network is being reformed.
- Start the system's batch service (**Plant / Batch Service Management** tab). The batch service will query the gateway for sensor status every 15 minutes and update each sensor's hierarchy icon status indicator to green as the sensors reconnect to the gateway.
 - Reforming the network takes some time as the complete network goes down and all devices (sensors) need to reconnect to the network.

⚠ WARNING! *If you click the **Reform Network** button prior to all the sensors being updated with the new network ID and join key, sensors that have not yet been updated will be orphaned. If this happens, you must reset the gateway and sensors' network ID and join key back to the original factory default network ID and join key (allowing two hours this time for the sensors to update prior to clicking the **Reform Network** button). A quick way to do this is to use the **Gateway / Admin** tab's **Get Default Values** button.*

If this scenario occurs, note that you can manually turn off all the sensors whose hierarchy icon displays a green status as they have been properly updated and reconnected to the production gateway. This will shorten your waiting time. You must then repeat the process to update the gateway / orphaned sensors with the new network ID and join key, but again allowing the appropriate amount of time for the orphaned sensors to update.

- After the commissioning gateway and its sensors have been updated with the new network ID and join key, turn off the wireless sensors and properly mount them on their respective machinery in the production environment.
- After mounting the sensors, turn them on again. The wireless sensors will connect to their production gateway.

The Device Manager's batch service will update their status in the hierarchy's sensor list and the wireless sensor hierarchy items are moved from the commissioning gateway to the production gateway.

- Any existing trend data or waveform data are preserved during the transfer. Therefore, data collected while the sensor was being commissioned will appear at the beginning of the sensor's trend plot, and should be ignored.

How to Verify Communications

- Options on the **Gateway / IO system capabilities** tab are optimized for the time outs in the gateway and the sensors. It is recommended that you do not change these settings.

The final step in commissioning the WirelessHART network is to verify the communication quality.

To verify the communication quality:

- The easiest way to verify quality is through the **Topology** view on the P+F gateway's web page. On first use, refer to the Pepperl+Fuchs user manual's Configuration / Engineering section for details on how to configure the Topology View. .
- The other way to verify quality, which provides more detail but is harder to interpret, is through Device Manager. On the **Gateway / Admin** tab, click the **Get Network Statistics** button. The communication statistics for the previous 24 hours are stored to a network statistics report file (\CMWA 8800Log\CMWA 8800StatisticLog – from the root of the drive on which the software is installed).

Sensor Setup and Commissioning

How to Verify Communications

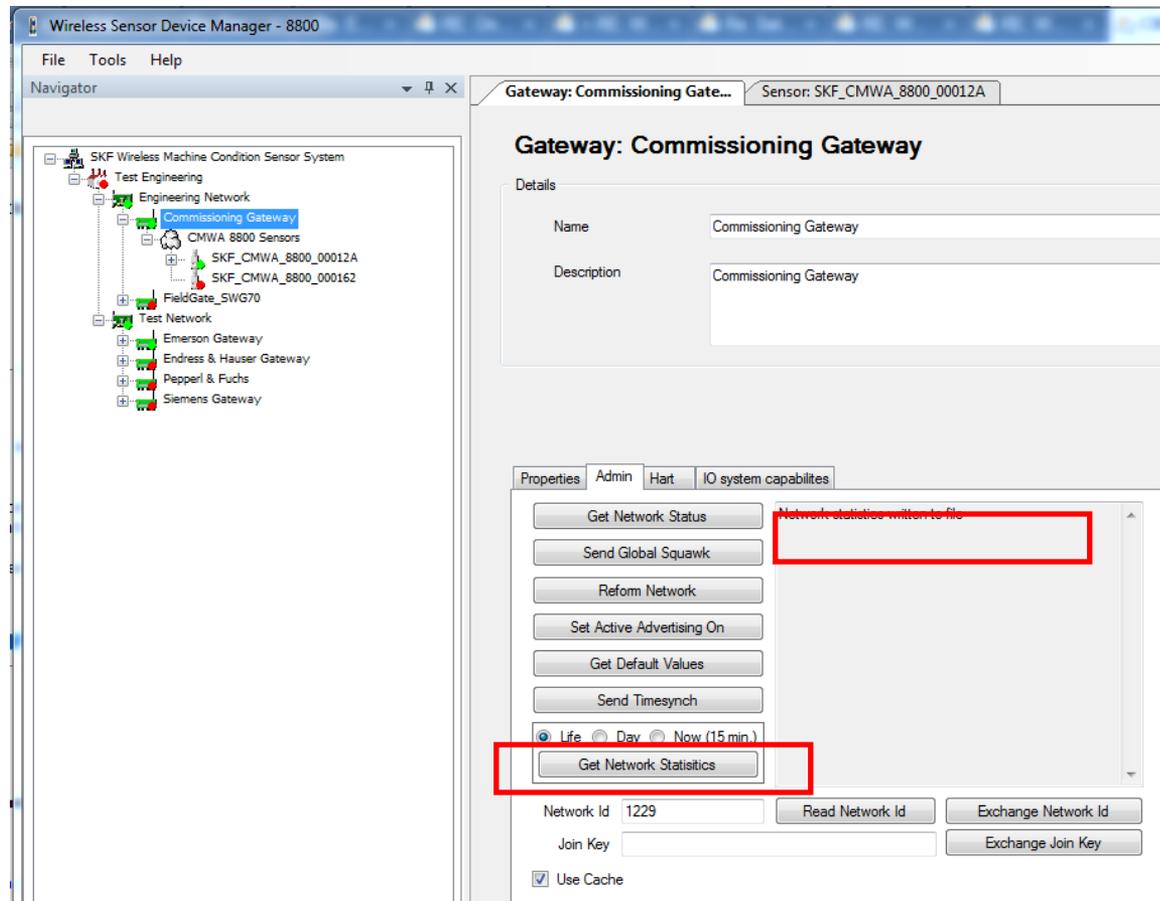


Figure 3 - 20.
The **Gateway / Admin** Tab Displaying the **Network Statistics** Message.

The network statistics report documents the communication quality in terms of traffic, retransmissions, stability, and received signal levels between all connected nodes in the network. An example network statistics report follows.

```

=====
It is now ..... 09/28/11 00:28:31.
This interval started at ... 09/27/11 00:00:00.
There are 6 valid one day intervals stored.

-----NETWORK STATS-----
PkArr  PkLost  PkTx(Fail/ Mic/ Seq)  PkRx  Relia.  Latency  Stability
3283    0    45k( 153/  0/  0)    75k    1001%   1.9s    99.66%

-----MOTE STATS-----
Id  PkArr  PkLst  PkGen  PkTer  PkFwd  PkDrp  PkDup  Late.  Jn  Hop  avQ  mxQ  me  ne  Chg  T
2   288    0    190    944    420    3      1    2.24  0  1.4  0    3  0  0  0  0
4   217    0    119    40    1787   1      0    1.46  0  1    0    3  0  0  18k 23
5   207    0    108    32    0    1014   0    3.08  0  1.7  0    2  0  0  09466 24
6   206    0    108    32    0    1018   0    1.99  0  1.4  0    1  0  0  09396 24
7   233    0    135    59    0    1018   0    1.69  0  1.4  0    1  0  0  09470 24
8   204    0    107    32    0    1007   0    1.77  0  1.3  0    1  0  0  09469 25
9   0       0    --     --     --     --     0    --    0    -    -    -  -  -  -  -
11  206    0    108    32    0    1015   2    1.67  0  1.3  0    1  0  0  09392 25
15  1516   0    1156  1087  0    849    4    1.8   5  1.5  0    2  0  0  22051 25
27  206    0    108    32    0    1932   1    1.95  0  1.2  0    1  0  0  09514 24

-----PATH STATS-----
MoteA  MoteB  ABPower  BAPower  ABTx(Fail)  ABRx  BATx(Fail)  BARx  Stab.
1       2     -57     -51        0( 0)    4472  2881( 12)  3013  99.58%
1       4     -54     -52        0( 0)    4446  3349( 27)  3461  99.19%
1       5     -61     -56        0( 0)    2588  2755( 12)  2880  99.56%
1       6     -56     -52        0( 0)    2587  2775( 10)  2918  99.64%
1       7     -58     -52        0( 0)    2630  2759(  2)  2911  99.93%
1       8     -50     -45        0( 0)    2591  2730(  1)  2909  99.96%
1      11     -57     -52        0( 0)    2602  2804( 43)  2924  98.47%
1      27     -54     -47        0( 0)    2591  2772(  9)  2922  99.68%
2       4     -18     -19    2543( 17)  2747    0( 0)    171  99.33%
2       5     -33     -33        0( 0)    49    2462(  0)  2624  100%
2       6     -40     -40        0( 0)    48    2446(  0)  2625  100%
2       7     -25     -25        0( 0)    48    2459(  0)  2641  100%
2       8     -50     -51        0( 0)    48    2425(  0)  2610  100%
2      11     -56     -56        0( 0)    48    2454(  5)  2629  99.8%
2      15     -53     -52        0( 0)    11    1674(  0)  1791  100%
2      27     -47     -45        0( 0)    0    2445(  0)  2616  100%
4      15     -59     -53        0( 0)    669    1914(  1)  2024  99.95%
4      27     -50     --         --( -)    968    0( 0)    --    --
    
```

Figure 3 - 21.
 An Example Network Statistics Report.

Note – Mote is another term for node.
 A list that maps MAC (Media Access Control) addresses with Mote IDs is also included in the report:

MAC	MoteID	Jn	Nbrs	WDev	State
00-17-0D-00-00-18-1C-41	ap 1	1	0	[Gateway] Oper	
00-1B-1E-1A-9A-00-00-99	2	1	7	[8 ,0]	Oper
00-1B-1E-1A-9A-00-00-96	4	1	3	[9 ,0]	Oper
00-1B-1E-1A-9A-00-00-93	5	0	0	[4 ,0]	Idle
00-1B-1E-1A-9A-00-00-91	6	1	2	[2 ,0]	Oper
00-1B-1E-1A-9A-00-00-9F	7	1	2	[7 ,0]	Oper
00-1B-1E-1A-9A-00-00-87	8	1	2	[3 ,0]	Oper
00-1B-1E-1A-9A-00-00-8C	11	1	2	[6 ,0]	Oper
00-1B-1E-1A-9A-00-00-9A	15	0	0	[0 ,0]	Idle
00-1B-1E-1A-9A-00-00-90	27	1	2	[5 ,0]	Oper

The table below describes each column header that displays in the Network Statistics Report.

Column header	Description
ABPower	The average RSSI values for transmissions from mote A to mote B.
ABRx	Number of packets mote B received from mote A.
ABTx(Fail)	Number of packets transmitted by mote A to mote B, and the number of packets for which mote A failed to receive acknowledgement. Packets may fail for a number of reasons, including RF interference or bit errors.
avQ	Average number of packets in the mote's queue waiting to be transmitted.
BAPower	The average RSSI values for transmissions from mote B to mote A.
BARx	Number of packets mote A received from mote B.
BATx(Fail)	Number of packets transmitted by mote B to mote A, and the number of packets for which mote B failed to receive acknowledgement. (Not currently implemented. Acknowledgements are not sent for downstream data transmission.)
Chg	Charge consumption, in millicoulombs.
Hop	Average number of hops (number of jumps from mote to mote before reaching the gateway) for this mote's data packets to arrive at manager.
Id	Mote ID number.
Jn	Number of times the mote joined since the gateway's network manager was last reset.
Late	Data latency. The average time (in seconds) for a data packet to travel from the mote to the gateway manager. The gateway manager calculates data latency for each packet by subtracting the time the packet was received at the gateway manager from the packet time stamp, indicating when the packet was generated by the mote. The gateway manager averages the data latency of all packets from a mote to provide the values for network statistics.
Me	MAC-layer MIC (message integrity check) errors.
MoteA MoteB	Describes the path from mote A to mote B.
mxQ	Maximum number of packets in the mote's queue waiting to be transmitted.
Ne	Network-layer MIC (message integrity check) errors.
PkDrp	Number of data packets dropped by the mote. Packets may be dropped because the mote's buffer was full and the mote was unable to generate a packet.
PkDup	Number of duplicate packets received. A duplicate packet is sent if no acknowledgement is received for any hop in the packet's journey to manager. A high number of duplicate packets indicates problems with the mote-to-mote communication.
PkFwd	Number of data packets forwarded by the mote to a neighbor.
PkLst	Number of data packets that manager expected, but did not receive.
PkRx	Total number of packets received by network motes.
PkTerm	Number of data packets terminated by the mote.
PkTx(Fail)	Total number of packets transmitted by network motes, and total number of packets for which no acknowledgement was received.
Reliability	Mote or network reliability

The network statistics report shows an aggregated number for reliability, stability and latency. In addition, detailed communication information is listed for each sensor, including relative received signal strength values between communication nodes (ABPower / BAPower) measured in dBm.

The wireless network's stability is a result of received signal level and background noise level (that is, from a WLAN). In addition, traffic by people and/or vehicles may cause temporary loss of stability.

As a general rule, if the stability percentage for a node is above 95%, the operational margin is OK. If it is lower, you should consider installing additional router nodes to increase signal to noise ratio, or investigate ways to reduce background noise by moving WLAN routers or changing WLAN channel usage.

Software Settings and Log Functionality

The Wireless Sensor Configuration Manager configuration/logging features are contained in the '**Tools**', '**Settings**' dialog.

Logging Features:

- Enable/disable communication logging. Text description here
- Enable/disable info mode. Enables information level debugging
- Enable/disable DB info mode. Enables database access information in log files
- Enable/disable batch info mode. Enables batch related information in log files
- Enable/disable learn info mode. Enables learn related information in log files
- Enable/disable command info mode. Enables command related information in log files
- Enable/disable voltage logging. Enables voltage related information in log files
- Enable/disable debug mode. Enables debug information in log files
- Enable/disable UDP info mode. Enables UDP related information in log files
- Enable/disable queue info mode. Enables queue related information in log files
- Enable/disable BDT info mode. Enables BDT related information in log files

User Control:

- Enable/disable SuperUser. Defaults to disabled on restart of application

Default/global gateway parameters:

- Gateway port: Default setting 20004
- Delayed response retry count. Set to 2000
- Port pool start Set to 7000
- Enable/disable timesynch. of gateways Disabled. Synchronize the time of the gateway
- Command sending delay Typically 0.5 seconds
- Gateway response timeout Typically 2 seconds

Wireless Communication:

- Pipe grant timeout Set to 180 seconds
- Pipe cancel delay Set to 1 minute

The screenshot shows a 'Settings' dialog box with the following sections and options:

- Logging features:**
 - Enable/disable communication logging
 - Enable/disable info mode
 - Enable/disable DB info mode
 - Enable/disable batch info mode
 - Enable/disable learn info mode
 - Enable/disable command info mode
 - Enable/disable voltage logging
- Hart communication cut-off:** 7 days
- Enable/disable options (unchecked):** debug mode, UDP info mode, queue info mode, BDT info mode
- Voltage logging period:** 1 hours
- User control:**
 - Enable/disable SuperUser
- Default/global gateway parameters:**
 - Gateway port:** 20004
 - Delayed response retry count:** 200
 - Port pool start:** 7000
 - Enable/disable timesynch. of gateways
 - Command sending delay:** 0.5 seconds
 - Gateway response timeout:** 2.0 seconds
 - Gateway retry limit:** 5
 - Gateway reconnect delay:** 60 seconds
 - Keep alive period:** 1 minutes
- Wireless communication:**
 - Pipe grant timeout:** 180 seconds
 - Pipe cancel delay:** 1 minutes

Buttons: Save, Cancel

Figure 3 - 22.
Settings Dialog (Typical Configuration).

Sensor Network Operation

Overview

This chapter describes methods for manually collecting and viewing wireless sensor data. Manual data collection helps with system commissioning and verification of data, and also allows you to collect readings on demand, between scheduled measurements. This is helpful if you'd like to view current machine conditions, (e.g., take a quick look at a problem machine). Once the automatic export process to @ptitude Analyst is set up, manually collected data are automatically exported along with your scheduled measurement data.

Note that analysis of collected overall and dynamic wireless sensor data is best accomplished using SKF's @ptitude Analyst software.

Manually Collecting and Displaying Overall Vibration Data and Trends

Current overall measurement values are manually collected and trended from the **Sensor / Process** tab.

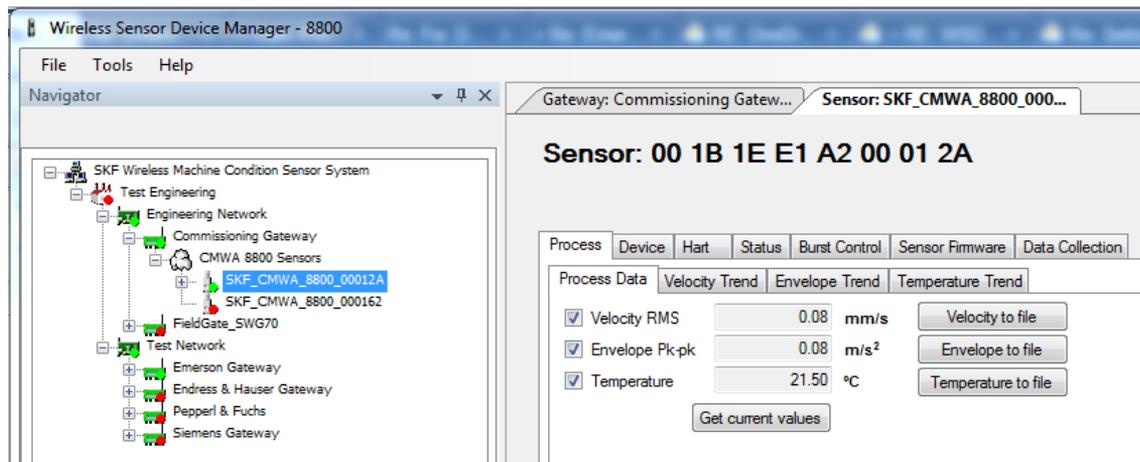


Figure 4 - 1.

The **Sensor / Process / Process Data** Tab.

Sensor / Process / Process Data Tab

For the selected sensor, options on the **Process Data** tab allow you to manually collect overall data, and to display collected overall data trend plots.

⚠ WARNING! *You must turn off Use Cache temporarily when you are collecting process data manually. Remember to enable it again for normal operation when you are done.*

- **Velocity RMS, Envelope Pk-pk, and Temperature** check boxes - work in conjunction with the following **Get current values** button. Enable all three check boxes to enable manual data collection for all three measurements when the **Get current values** button is clicked.
 - **IMPORTANT:** Each measurement's enabled / disabled status applies to all the sensors connected to the gateway / network.
- **Get current values** – click to collect enabled overall vibration and temperature measurements and upload the data to the Device Manager database. The new measurement results display. This may take about 20 seconds.
 - If the gateway's burst mode is enabled (i.e., the **Gateway / Use Cache** check box is enabled), the readings are retrieved from the gateway's cache, no new measurements are performed.
 - If the **Sensor / Data Collection** tab's **Trending Command** setting is set to **Command 9**, manually collected measurements are included in overall trend plots. However, if the **Trending Command** setting is set to **Command 93**, then manually acquired data is not included in the trend. (In other words, in order to collect and save manual data, the **Use Cache** check box must be unchecked and the **Trending Command** must temporarily be switched to **Command 9** in the **Data Collection** tab)
 - Manually collected measurements are stored in the Device Manager database, and from there, exported to @ptitude Analyst. However, to enable this export, the Envelope Pk-Pk, Velocity RMS, and Temperature measurements must be enabled on the **Data Collection** Tab.
- **Velocity / Envelope / Temperature to file** – For the specified measurement, create a file that contains all the measurement's collected overall data in the Device Manager database in CSV format. File location is \CMWA 8800Log\Trends on the drive on which the software is installed. This CSV file can be used with other applications.

Velocity / Envelope / Temperature Trend Tabs

- Select the **Velocity Trend**, **Envelope Trend**, or **Temperature Trend** tabs to display trend plots for each overall measurement.

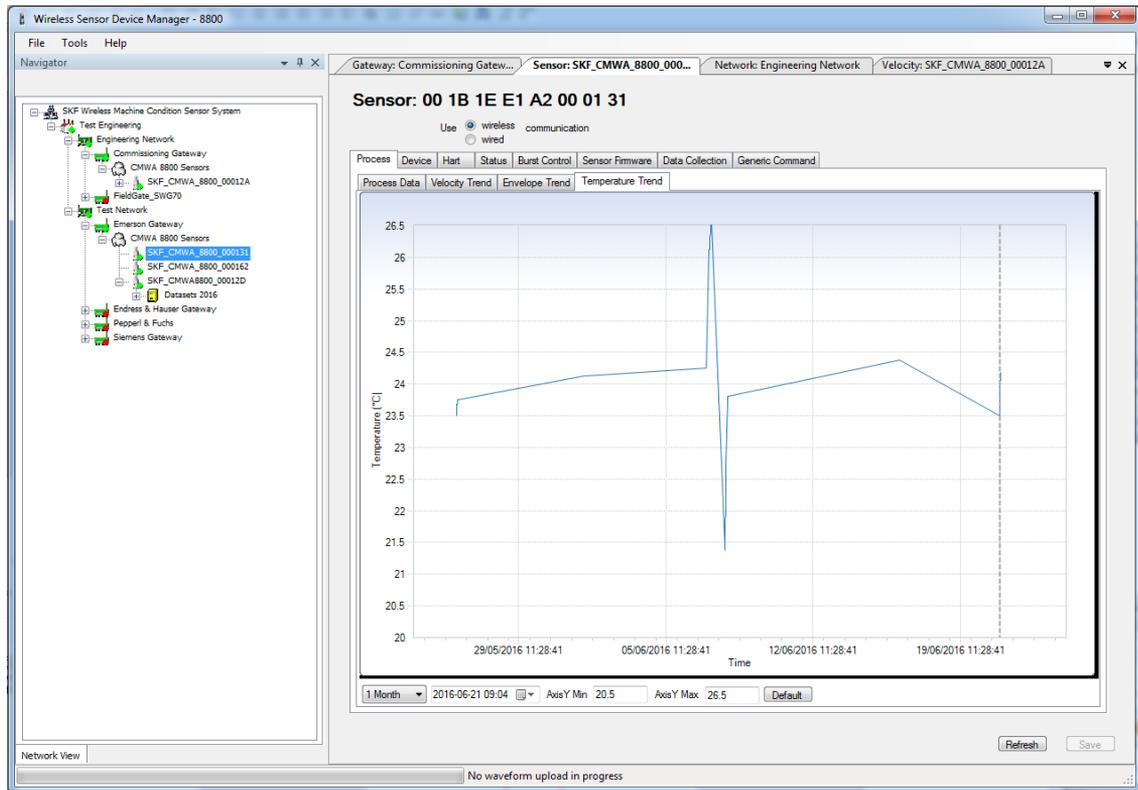


Figure 4 - 2.
A Sensor / Process / Temperature Trend Display.

To expand / compress the x axis time scale:

- Press and hold the Ctrl key while using the mouse's scroll wheel / bar to expand or compress the plot's x axis.

To pan left and right on the plot:

- Press the right and left arrow keys, or use the mouse's scroll wheel / bar to pan left and right on the plot.

To manually set the plot's X and Y axes scale:

- Use the two drop down list boxes on the bottom left of the plot to specify the time / date range for the plot's x axis. The date field positions data collected on that date/time in the middle of the trend plot. On the left, a period pull down list provides time periods (ranges) to display in the trend. Half of the selected period displays to the left of the selected date/time, the other half to the right of the selected date/time.
- Use the **Axis Y Min and Axis Y Max** fields to specify the plot's y axis.
- Use the **Default** button to display the trend for the last 24 hours, with the current value to the right.

Manually Collecting Vibration Time Waveform Data

In addition to batch service scheduled data collection, dynamic vibration data can also be collected / uploaded manually.

- Analysis of collected overall and dynamic data is best accomplished using SKF's @ptitude Analyst application. Device Manager's data displays are primarily for commissioning and verification of data collection.

To manually collect vibration time waveform data:

- In the hierarchy, right click the sensor's hierarchy item and select **Collect Waveform** from the context menu. The vibration measurement is performed, and measurement data is uploaded for the selected sensor.

During the upload, time waveform vibration data is uploaded in 104 packets. The time it takes for the waveform data upload to complete depends on the sensor's location. Sensors that require routing of their data take longer than sensors that connect directly to the gateway. For every hop in the network, transfer time is doubled.

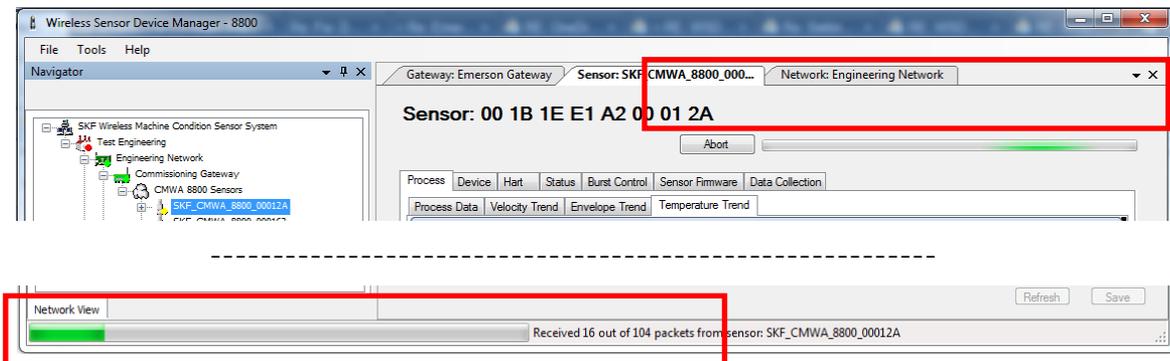


Figure 4 - 3.
Examples of the Upper and Lower Progress Bars.

The upper progress bar shows progress for the transfer of each individual packet, while the lower progress bar shows overall progress of all packets to be transferred.

Displaying Dynamic Vibration Data (FFTs and Waveforms)

To display collected dynamic data:

- Expand the sensor's hierarchy item, and then expand the sensor's **Datasets** hierarchy item. Each dataset is sequentially listed according to the time the dynamic data collection was initiated.
- Expand the dataset for which you want to display data, its two "waveform" measurements display (velocity and enveloped acceleration).
- Select the measurement you want to display. The measurement's FFT and waveform plots display on the right in the **ResultWaveForm** tab.

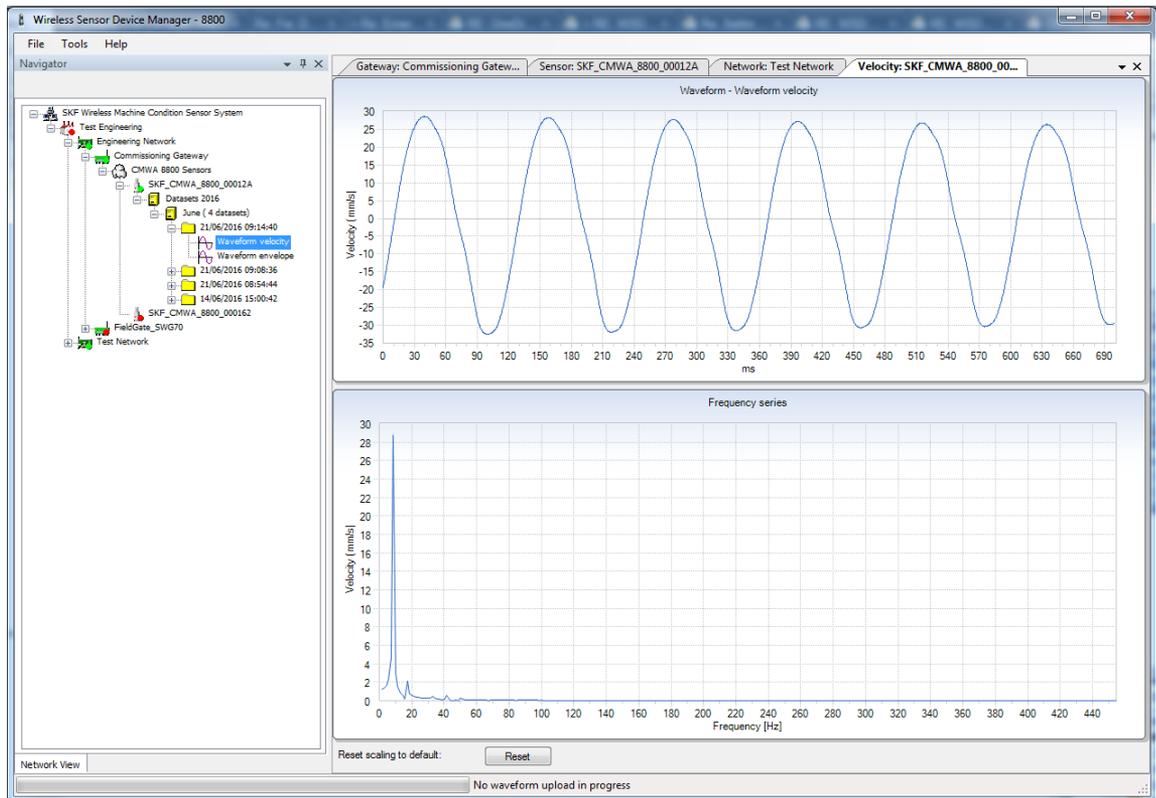


Figure 4 - 4.
Example of a Waveform / FFT Display.

To expand / compress the x axis time / frequency scale:

- Press and hold the Ctrl key while using the mouse's scroll wheel / bar to expand or compress the plot's x axis.

To pan left and right on the plot:

- Press the right and left arrow keys, or use the mouse's scroll wheel / bar to pan left and right on the plot.

Exporting Data to SKF @ptitude Analyst

Device Manager Data Export Overview

Data export is performed using the Device Manager **Plant / Export** tab. The Device Manager software exports overall measurement data (velocity, enveloped acceleration, and temperature), time waveform vibration data, and the battery conditions.

The **Plant / Export** tab provides multiple methods to export wireless sensor data:

- Manually export the hierarchy's sensor list(s).
- Manually export current waveform data for all sensors.
- Set up automatic export of overall and waveform data every time new data is collected (manually or batch service scheduled data collection).

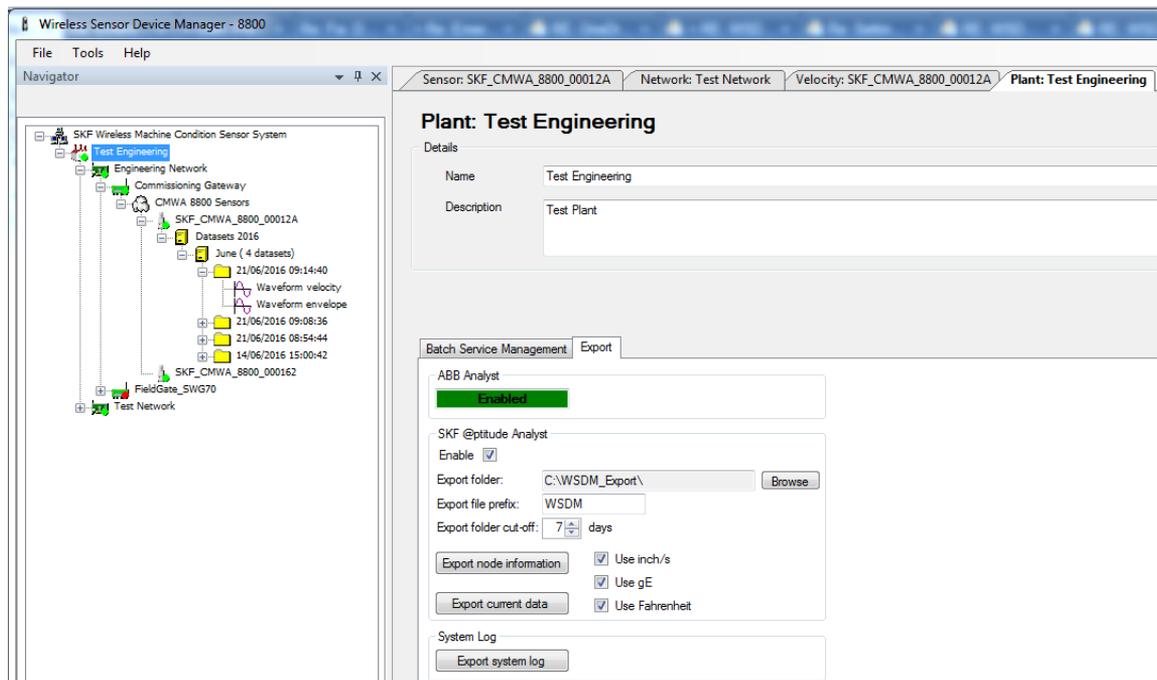


Figure 5 - 1.
The **Plant / Export** Tab.

- The ABB Analyst export option allows export to ABB Analyst software.

The Export Process

When you export data from Device Manager, Device Manager exports the data in XML format and stores the XML files in a '**WSDM_Export**' folder on the drive on which Device Manager is installed.

- If you choose to store the XML files in another folder, you may do so by modifying Device Manager's **'Export Folder'** edit field.

In SKF @ptitude Analyst, you configure how often the SKF @ptitude Transaction Service inspects the \WSDM_Export folder and determines whether new files have been stored. Upon finding new files, the Transaction Service reads the files and imports the data into @ptitude Analyst's database. After importing the XML files into @ptitude Analyst, @ptitude Analyst deletes the XML files from the \WSDM_Export folder.

IMPORTANT: *If export to SKF @ptitude Analyst is enabled, the Device Manager software exports the XML files in the \WSDM_Export folder. If SKF @ptitude Analyst's Transaction Service is running and correctly configured, data from the files are automatically imported into SKF @ptitude Analyst database, and the files in the \WSDM_Export folder are automatically deleted after having been processed. If SKF @ptitude Analyst's Transaction Service is not running, the files are not processed and hence not deleted from the \WSDM_Export folder. This means data is not lost when the Transaction Service is not running, and provides an automatic mechanism allowing Transaction Service to catch up when it is back online.*

When files are not processed and not deleted for a long time, eventually they will fill up the computer's hard drive (depending on the number of sensors and frequency of measurements). To avoid this, export should be disabled if SKF @ptitude Analyst's Transaction Service is not active for a long period of time (more than a week).

The general steps to complete automatic export of Device Manager data into @ptitude Analyst are:

1. In Device Manager, on the **Plant / Export** tab, select the **SKF @ptitude Analyst / Enable** check box to enable automatic data export when new data is collected.
2. In Device Manager, on the **Plant / Export** tab, manually export the Device Manager sensor list(s). This allows @ptitude Analyst to automatically create six measurement POINTs in the @ptitude Analyst hierarchy (database) for each sensor listed (i.e., a velocity POINT, an enveloped acceleration POINT, a temperature POINT, a battery % level POINT, a battery life remaining POINT, and a battery voltage POINT).
3. In CMSW 7400 @ptitude Analyst, configure how often the Transaction Service reads the exported files. We recommend setting to the shortest supported interval; Period of 0.017 hours (once a minute).

Before describing specifics on how to set up automatic export when new data is collected, we'll first explain the **Plant / Export** tab's buttons and options.

Plant / Export Tab

SKF @ptitude Analyst buttons and options on the **Plant / Export** tab include:

Measurement Unit (Important! Set meas. units before exporting.)

- Use inch / s
- Use gE
- Use Fahrenheit

(For exporting data to @ptitude Analyst only.) By default, Device Manager exports vibration and temperature data using the sensor's native metric units (mm/s, m/s², and Celsius). Enable the provided check boxes if you want to export in imperial units to @ptitude Analyst. After nodes are exported to @ptitude Analyst, you should not change the measurement units, as @ptitude Analyst trends will be affected. See the section **Changing Measurement Units in Device Manager** in this manual if you do need to change the units.

- Data used by HART process information systems working with OPC compliant host servers is always in metric units.
- Data read directly from the gateway by process information systems is always in metric units.

Manual Export Buttons

Export node information - Exports the Device Manager hierarchy's wireless sensor list(s), but does not export data. Each sensor is exported as a separate XML file that consists of six measurement POINTs (velocity, enveloped acceleration, temperature, battery % level, battery life remaining, and battery voltage).

Export current data - For all sensors in the plant hierarchy, manually exports a user configurable period of data, stored in the Device Manager database for each sensor. Each sensor's current waveform is exported as a separate XML file.

Enable Automatic Export Check Box

Select the **Enable** check box to enable automatic export of each measurement's overall and waveform data to an XML file, which is then imported into SKF @ptitude Analyst.

Battery Condition Data Export

In addition to vibration and temperature data export, Device Manager automatically exports each sensor's battery condition data once every 24 hours. This export automatically occurs at 01:00 AM.

Battery level is the theoretical remaining charge (a percentage, with 100% for a new sensor) according to the tracked energy consumption history. This is calculated, not measured.

Battery life is how long (in days) the battery is expected to last under sustained energy consumption at the current level of usage. This is calculated, not measured.

Battery voltage is the actual voltage measured under load. You should set the overall out of window danger alarm for this point at 3.3 Volts. If 3.3 Volts is reached, then turn off the sensor and arrange for battery replacement with SKF.

How to Set Up Automatic Data Export to SKF @ptitude Analyst

Step 1

In Device Manager, select the units for the data to be exported.

Three Measurement Unit check boxes are provided to convert the sensor's native units used for data exported to @ptitude Analyst:

Use inch / s
Use gE
Use Fahrenheit

- The units should be selected BEFORE enabling export to SKF @ptitude Analyst.

By default, Device Manager exports vibration and temperature data using metric units (mm/s, m/s², and Celsius). Enable the provided check boxes if you want to export in imperial units. After nodes are exported to @ptitude Analyst, you should not change the measurement units, as @ptitude Analyst trends will be affected. See the section **Changing Measurement Units in Device Manager** in this manual if you do need to change the units.

- Data used by HART process information systems working with OPC compliant host servers are always in metric units.

Step 2

In Device Manager, select the SKF @ptitude Analyst / Enable check box to enable automatic data export when new Device Manager data is collected.

- In Device Manager, select the plant hierarchy item, and on the **Plant / Export** tab, select the **Enable** check box.

Step 3

In Device Manager, manually export the Device Manager sensor list(s).

Manually export the sensor list(s) to allow @ptitude Analyst to automatically create six measurement POINTs in the @ptitude Analyst hierarchy (database) for each sensor listed (i.e., a velocity POINT, an enveloped acceleration POINT, a temperature POINT, a battery % level POINT, a battery life remaining POINT, and a battery voltage POINT).

To manually export the Device Manager sensor list(s):

- In Device Manager, select the plant hierarchy item, and on the **Plant / Export** tab, click the **Export Node Information** button. In the \WSDM_Export folder, a file is created for each sensor, although no feedback displays to confirm the action. These files specify the six measurement POINTs for the sensor (i.e., velocity,

enveloped acceleration, temperature, battery % level, battery life remaining, and battery voltage).

Step 4

From @ptitude Analyst, configure how often the @ptitude Analyst's Transaction Service reads the exported files.

@ptitude Analyst's XML Import interface allows you to specify a common directory in which XML data from the Device Manager database is stored (i.e., the \WSDM_Export folder created by Device Manager). The @ptitude Analyst software periodically processes files in the folder to update its data and hierarchy information.

@ptitude Analyst's XML Import functions include:

- Transferring the Device Manager hierarchy and measurement data to @ptitude Analyst software.
- Adding event log messages to the @ptitude Analyst software.

General configuration for the XML Import Interface is documented in the *SKF @ptitude Analyst / Introduction* manual that accompanied your Analyst software. This section details the settings specific to communication with Device Manager.

If your wireless sensors are monitoring machinery that was previously monitored with an SKF portable monitoring device, you can use your existing @ptitude Analyst hierarchy to import the wireless sensor data, or you can set up a new hierarchy for the wireless sensor data.

To create a hierarchy in @ptitude Analyst:

- In @ptitude Analyst, select the **File** menu's **New** option, the **New** dialog box displays.
- Enter a **Name** for your hierarchy and click OK.

To configure the @ptitude Analyst / XML Import Interface for use with the Device Manager database:

- In @ptitude Analyst, select the **Customize** menu's **Configure XML Import** option. The **XML Import Configuration** dialog displays.

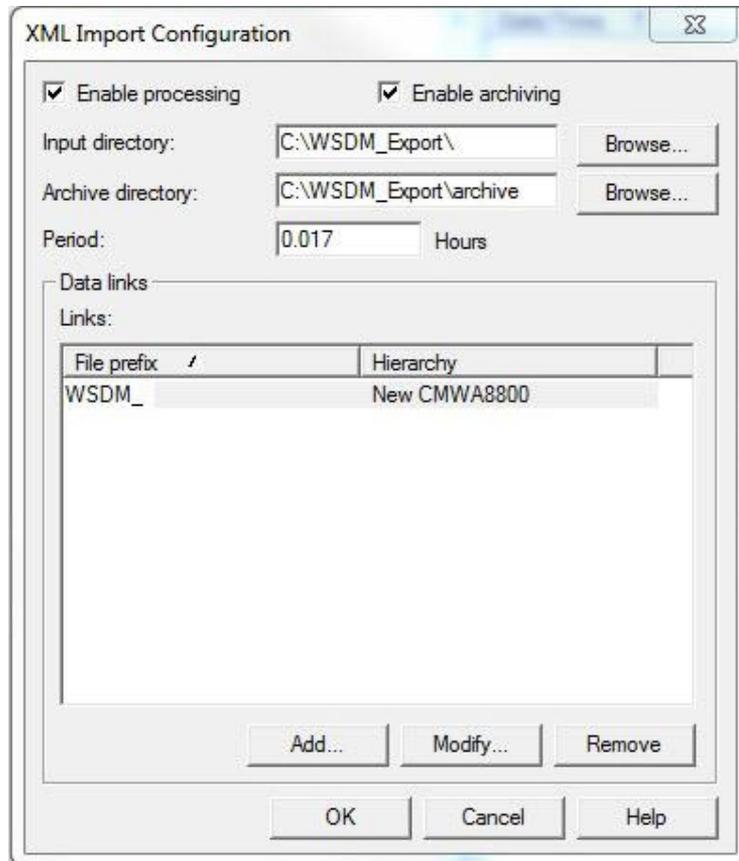


Figure 5 - 2.
The **XML Import Configuration** Dialog.

- In the **Data links** area, click **Add** to launch the **Data Links** dialog.



Figure 5 - 3.
The **Data Links** Dialog.

- From the **Hierarchy** drop down list, select the hierarchy in which you want to store the wireless sensor data.
- In the **File Prefix** text entry box, enter “**WSDM_**” as the prefix.
 - The file prefix is configurable by the user in the Settings.config file in Device Manager (example shown in **Chapter 3, Sensor Setup and Commissioning**). The default prefix for a single instance of WSDM is “WSDM_” as shown above. For installations that use

multiple WSDM instances, each instance of WSDM must have a different prefix, for example, "WSDMA_", "WSDMB_" and so on.

- Click **OK** to return to the **XML Import Configuration** dialog.

The following additional fields are available on the **XML Import Configuration** dialog:

Enable Processing - Enables automatic import for @ptitude Analyst. After configuring XML Import, enable this check box to enable @ptitude Analyst automatic import.

Enable Archiving- (optional) Specify whether XML files in the \WSDM_Export folder should be deleted or archived after being processed. When enabled, the XML files are moved from the \WSDM_Export folder to the specified folder. This should only be necessary during commissioning and troubleshooting.

- While archiving is enabled, you periodically need to delete older files in the Archive directory to ensure that the archiving of data does not result in a disk full condition.

Archive Directory (if specified) - The directory where processed files are stored. Type the directory's path name in the text entry box or click the **Browse...** button to browse for it.

Period (in hours) - The frequency that the @ptitude Analyst application checks for new XML import files. The shortest period is 0.017 hr (1 minute). We recommend setting the **Period** to 0.017 hr to attain data quickly.

Data Links - Lists the XML system file prefix / hierarchy link. This link stores data supplied by the external XML system that is identified by the file prefix in the designated @ptitude Analyst hierarchy.

- The prefix includes all characters up to the first character representing the date (year) of the file. The XML file prefix is configurable by the user in the Settings.config file for the wireless sensor Device Manager.

Edit - Allows you to modify any existing highlighted link.

Delete - Allows you to delete any existing highlighted link. You will be asked to confirm the deletion.

OK - Saves the settings and acts as a "Process Now" function and resets the time of next processing to Now + Period.

Cancel - Exits the dialog without saving the changes.

Help - Launches the context-sensitive help.

Processing of XML files continues so long as the @ptitude Analyst transaction service remains running.

This concludes Device Manager's export to @ptitude Analyst setup. From now on, automatic export of overall and waveform data will occur every time new data is collected either manually or by using the batch service's scheduled data collection.

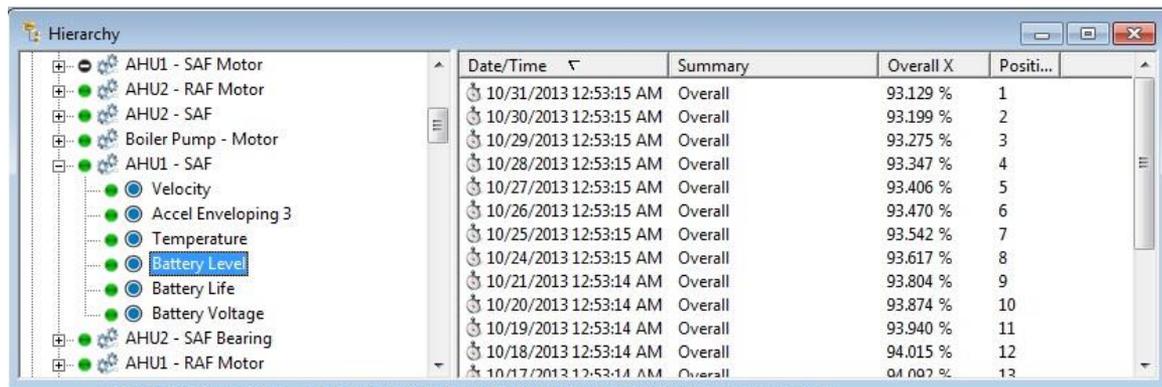
Viewing the Device Manager Hierarchy in SKF @ptitude Analyst

Once the XML Import is configured and Device Manager collects new data, the sensors and their measurement data are transferred up to Analyst software.

To view the 8800 sensor hierarchy in @ptitude Analyst:

- In the @ptitude Analyst software, select **File / Open**. The **Open** dialog displays with a list of your hierarchies.
- Select the hierarchy that was specified during XML configuration and click OK. The wireless sensor hierarchy displays.

➤ Alarms for wireless sensors are set up in @ptitude Analyst.



Date/Time	Summary	Overall X	Positi...
10/31/2013 12:53:15 AM	Overall	93.129 %	1
10/30/2013 12:53:15 AM	Overall	93.199 %	2
10/29/2013 12:53:15 AM	Overall	93.275 %	3
10/28/2013 12:53:15 AM	Overall	93.347 %	4
10/27/2013 12:53:15 AM	Overall	93.406 %	5
10/26/2013 12:53:15 AM	Overall	93.470 %	6
10/25/2013 12:53:15 AM	Overall	93.542 %	7
10/24/2013 12:53:15 AM	Overall	93.617 %	8
10/21/2013 12:53:14 AM	Overall	93.804 %	9
10/20/2013 12:53:14 AM	Overall	93.874 %	10
10/19/2013 12:53:14 AM	Overall	93.940 %	11
10/18/2013 12:53:14 AM	Overall	94.015 %	12
10/17/2013 12:53:14 AM	Overall	94.007 %	13

Figure 5 - 4.

Example of a Wireless Sensor Hierarchy in @ptitude Analyst.

When importing sensor lists from Device Manager, each sensor is brought into @ptitude Analyst as a “machine” hierarchy item, from which the sensor’s six measurement POINTs branch. Data records for each measurement are displayed in the right pane when the measurement POINT is selected in the hierarchy.

- If necessary, you may rearrange the imported hierarchy items in a manner that is most useful to you.

You can work with **Group** and **POINT Properties** in the same manner as you would items created in @ptitude Analyst, with a few exceptions:

The settings on the **General** and **Setup** tabs in **POINT Properties** cannot be modified. The sensor’s MAC address is imported into the machine and sensor’s **Description** field. **IMPORTANT:** Ignore **Setup** tab settings as they do not reflect how the sensor is configured in Device Manager.

The settings on the **General** tab in **Group Properties** can, but should not, be modified.

Adding and removing items from a wireless sensor hierarchy is performed in the Device Manager application, as discussed earlier in this manual. Any additions or deletions you make in @ptitude Analyst will not be reflected in the Device Manager database and will be overwritten the next time hierarchy information is imported.

Changing Measurement Units in Device Manager

You may modify the export data measurement unit settings, if needed. With the desired measurement units selected in the **Plant / Export** tab and the **Enable** check box also selected, Device Manager will export the new measurements to the same points in @ptitude Analyst that were created using the old units. Since this is not the desired result, the old points in @ptitude Analyst will first need to be deleted. Then, click the **Export node information** button to create new points in @ptitude Analyst again so that the new measurements will be displayed with the new units. (Note that @ptitude Analyst does not allow changing the engineering units of existing points that have data.)

- The newly selected measurement unit is not automatically effective. It becomes effective only after the batch service has been restarted.

If you want to save the measurement data before you delete the old XML points, create new points with the same engineering units using other DAD types, for example, CMU, etc. and then move the measurements to these new points manually before deleting the old XML points. (Select the newest measurements and press Ctrl+Shift+End. Then drag and drop all measurements onto a new point with same engineering unit.)

Export Node Information re-exports the complete hierarchy so this will also lead to a message in the @ptitude Analyst Event log stating “duplicate POINT” for all POINTs that already exist in Analyst; this is normal and these messages may be ignored.

Device Manager / SKF @ptitude Analyst Operations

How @ptitude Analyst operates when specific Device Manager events occur is detailed below.

Device Manager Start / Stop Events – When the Device Manager application is started or stopped, the event is logged in @ptitude Analyst’s Event Log.

Device Manager Batch Service Start / Stop Events – When Device Manager’s Batch Service is started or stopped, the event is logged in @ptitude Analyst’s Event Log.

Adding a New Wireless Sensor in Device Manager – When the new sensor is found in Device Manager, it is automatically exported to the \ExportSKFFolder, and a new machine representing the new sensor is automatically created in the @ptitude Analyst hierarchy.

Editing a Sensor’s Long Tag Name in Device Manager – The sensor’s new name is automatically updated in the @ptitude Analyst hierarchy.

Editing a Sensor’s Data Collection Period in Device Manager – When a sensor’s data collection period is modified in Device Manager, the most frequent data collection schedule (i.e., either the waveform schedule or the overall data schedule) is updated in @ptitude Analyst’s **POINT Properties / Schedule** tab. For example, if the sensor’s Device Manager data collection settings are changed to once per week for collecting the waveform and once per 24 hours for collecting the overall, @ptitude Analyst’s **POINT Properties / Schedule / Take data every** setting is updated to 24 hours. Note that changing the POINT’s **Schedule** settings in @ptitude Analyst has no effect.

Deleting a Sensor from the Device Manager Hierarchy List, or Turning Off a Sensor by Using its Push Button – The sensor’s corresponding machine in the @ptitude Analyst hierarchy is disabled from data collection. It will automatically be re-enabled when the sensor is switched back on, or a new sensor with same Tag name joins the network.

Replacing an Existing Wireless Sensor – If an existing sensor needs replacement (e.g., battery life ends), in a commissioning network, you must commission the replacement sensor with the same long tag name as the sensor it is replacing. First turn off the old sensor, and then turn on the replacement sensor. After the replacement sensor is turned on and joins the production network, the sensor’s data will be stored under the same machine in @ptitude Analyst as the old sensor, and the machine in @ptitude Analyst is automatically re-enabled for data collection.

- If ordering replacements sensors, consider using SKF’s pre-configuration service. Ask your SKF representative for details.

Moving a Sensor to Monitor a Different Machine – From a commissioning gateway, change the sensor’s long tag name to reference the new target machine. Then, rejoin the production network, the sensor’s corresponding old @ptitude Analyst machine is disabled from data collection, and a new machine hierarchy item is created for the sensor.

- Do not change the sensor’s long tag name from the production gateway, as this will only change the sensor’s name in Device Manager and its corresponding machine name in @ptitude Analyst (i.e., no new hierarchy item will be created), and data collected from the new target machine will be stored under the same POINT, and mixed with data collected on the old machine.

Follow general guidelines in your *SKF @ptitude Analyst* user manual for help with alarming, viewing, and analyzing wireless sensor data.

System Maintenance

Communication Log Files

The Device Manager software stores records of its execution and communication events in log files on the host computer's hard drive. These log files are useful for debugging purposes.

IMPORTANT: Both log files continue to grow larger the longer you use Device Manager and/or the batch service. Therefore regular cleanup of the files is necessary on a periodic basis, or else you will compromise hard drive space.

Execution Log

The execution log is stored as: \CMWA 8800Log\CMWA 8800Log.txt on the hard drive on which Device Manager is installed. The execution log stores Device Manager and batch service activity. By default, only error messages are logged for the execution events. However, the execution log's content is user determined by enabling specific commands in Device Manager's **Tools, Settings** dialog.

The longer you run Device Manager or the batch service, the larger the execution log file size grows. Therefore, you should periodically delete the file.

Communication Log

A communication log that stores commands sent from Device Manager to the gateway and the gateway's response back to Device Manager is created for each gateway for each day. The communication log is stored as:

\CMWA 8800Log\GatewayIPAddress\CMWA 8800CommLogYYYYMMDD.txt.

Since these files are continuously being stored, it is recommended that you regularly delete historical files unless they are necessary for examining system problems.

Device Manager Database Backup

Device Manager allows the user to perform a backup of the WSDM database or switch to a pre-existing database. Note: you must enable the **Tools, Settings, Enable/disable SuperUser** check box option, as shown below, to perform the database backup action. .

- Open the **Tools > Settings** dialog.

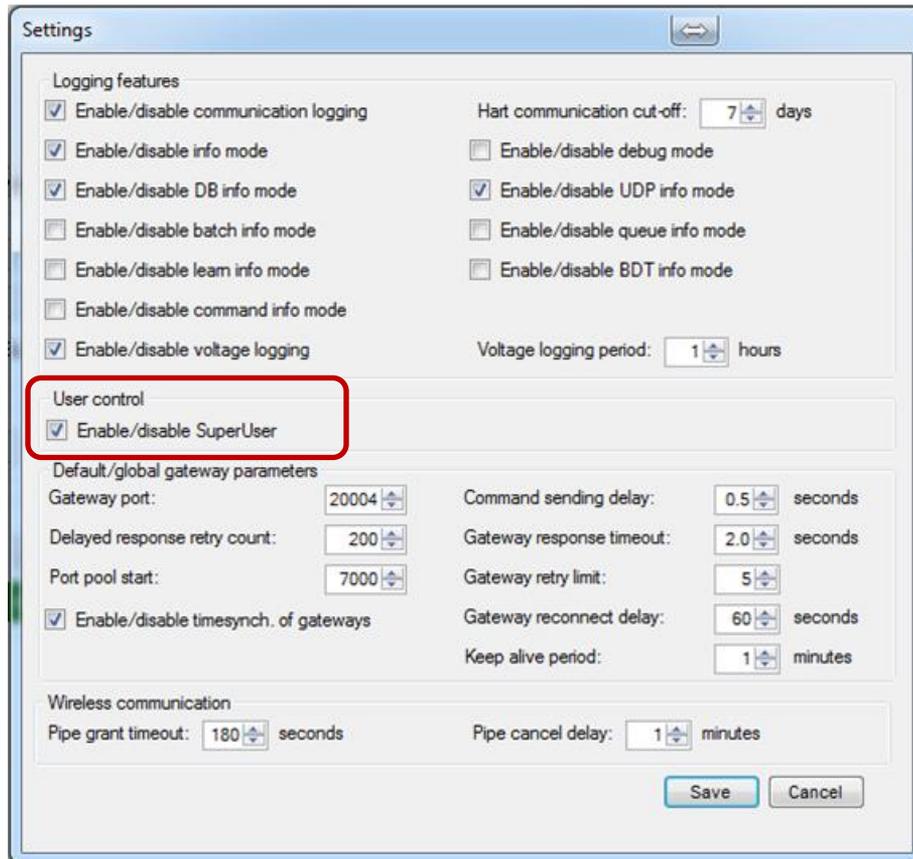


Figure 6 - 1.

Tools > Settings Dialog, SuperUser Control.

- Enable the Enable/disable SuperUser check box.
- Click **Save**.

Creating a Backup

- Select the **Tools, Database maintenance** menu item on the device manager's menu bar.

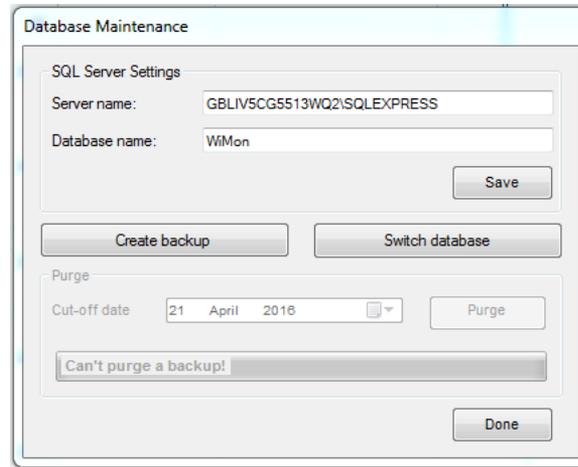


Figure 6 - 2.
WSDM Database Dialog.

- Select the appropriate Server name and Database name. These fields should be populated with the current instance of the WSDM database.
- Click the **Create backup** button. A message will display when the backup is complete.
- Click **Done** to close the dialog.

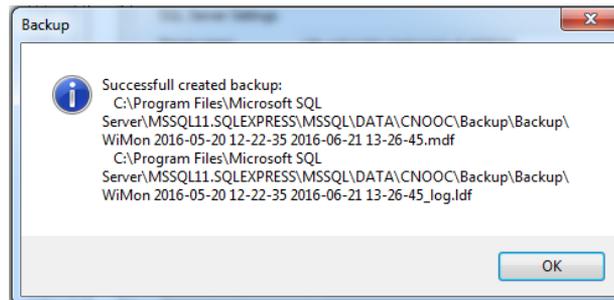


Figure 6 - 3.
Backup of WSDM Has Completed Successfully.

Switching the Database

- To switch the database, select the **Tools, Database maintenance** menu item on the device manager's menu bar (refer to Figure 6-1).
- Click the **Switch database** button.
- In the Windows 'Open' dialog that displays, browse to and select the appropriate database file and then click the **Open** button.

Device Manager loads the selected database for viewing.

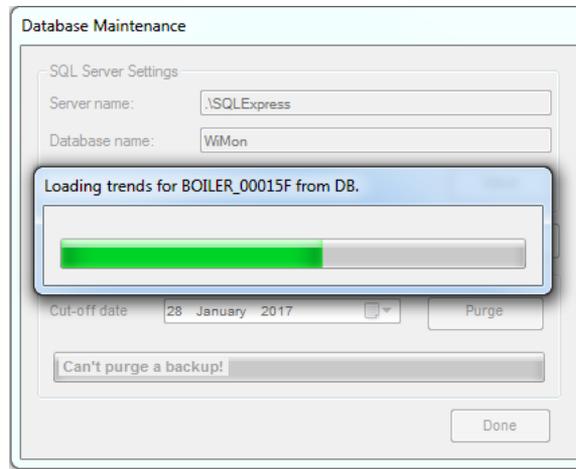


Figure 6 - 4.
Device Manager Loading the Selected Database.

Maintaining the Hierarchy

Adding a Sensor

Commissioning network – If the sensor is joining a commissioning network, simply switch on the sensor and it should be ready to join the network using the default settings.

Production network with Network ID 101 or 102 – If the production network uses one of the built-in network IDs, Network ID 101 or 102, and the default join key, simply switch on the sensor and set the network ID by using the sensor's push button and the LED flash sequence to configure the sensors to join the production network. (Count seven blinks for Network ID 101; eight blinks for 102.)

Production network with customized Network ID – If the production network uses a customized network ID and join key, you need a commissioning network to configure the new sensor's network settings before it can be put into service in the production network. Follow the steps below.

- The alternative is to use SKF's pre-configuration service.

To add a sensor to a production network with customized security settings:

- Go to the **Plant / Batch Service Management** tab and **Stop** the batch service.
 - The **Find sensors** command is unavailable when the batch service is running.
- Turn on the new sensor within the range of the commissioning network.
- Open the **Operating Modes** web page. A yellow icon with a small wrench will display while the new sensor is joining the network.

Operating Modes				
Long Tag	IO...	Channe...	Device Type	Com. Stat...
WHA-GW	251	1	WHA-GW	
WHA-ADP Router	1	0	WHA-ADP	✓
SKF_CMWA_8800_000026	2	0	E1A2	✓
SKF_CMWA_8800_000059	4	0	E1A2	✓
SKF_CMWA_8800_000072	9	0	E1A2	⚠

Figure 6 - 5.

The Yellow Icon Indicates the Sensor Is Joining.

- Wait until the sensor joins the commissioning network. The sensor's yellow icon in the **Com. Status** column will turn green when it joins.

Operating Modes				
Long Tag	IO...	Channe...	Device Type	Com. Stat...
WHA-GW	251	1	WHA-GW	
WHA-ADP Router	1	0	WHA-ADP	✓
SKF_CMWA_8800_000026	2	0	E1A2	✓
SKF_CMWA_8800_000059	4	0	E1A2	✓
SKF_CMWA_8800_000072	9	0	E1A2	✓

Figure 6 - 6.

The Green Icon Indicates the Sensor Has Joined.

- Right-click the gateway node and issue the **Find sensors** command to import the new sensor into the Device Manager hierarchy.



Figure 6 - 7.

Issue the Find Sensors Command from the Gateway.

- Wait until the sensor has completed the import process from the gateway to the Device Manager hierarchy (that is, the sensor's status indicator appears green).
- In the Device Manager **Gateway > Admin** tab, enter the production network ID in the **Network Id** field.

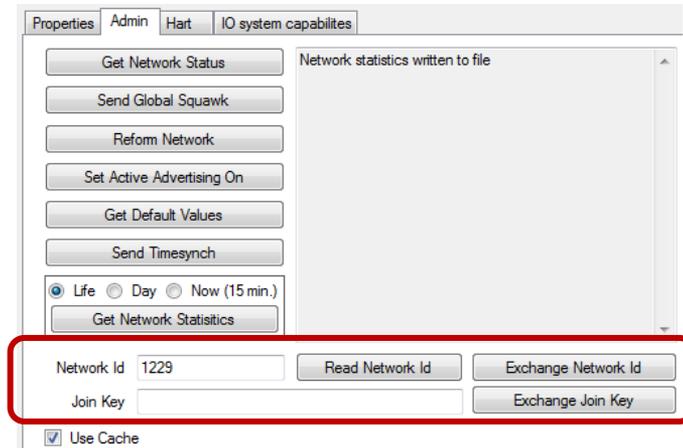


Figure 6 - 8.

Network ID and **Join Key** Fields and Buttons.

- Click **Exchange Network Id** to send the production network ID to the gateway network manager and its connected sensors.
- Next, enter the production network join key in the **Join Key** field.
- Click **Exchange Join Key** to send the production join key to the gateway network manager and its connected sensors. Wait a few minutes for the gateway network manager to propagate the production network settings to the new sensor.
- Go to the gateway's **Additional Functions > Reset** web page. Click **Reform Network** to tell the sensor and gateway to start using the production network ID and join key. The **Com. Status** indicators for the sensors will immediately turn red in the **Operating Modes** page.
 - If you click the **Reform network** button in Device Manager, the gateway does not know the sensors were disconnected and the **Com. Status** indicators will remain green.



Figure 6 - 9.

Additional Functions > Reset Web Page – Reform Network.

- Verify the sensor has joined the network by viewing the gateway’s web page.
- Turn off the sensor and move it out to the production network.
 - **Tip:** Activate the sensor next to the production gateway to verify that is able to join the network before mounting the sensor to the machine.

⚠ IMPORTANT: Be sure to turn on the batch service again for normal operation.

Removing a Sensor

After switching off a sensor, the gateway will determine it has lost connection with the sensor in approximately 15 minutes. You can force the sensor icon in the Device Manager hierarchy to turn red by right-clicking on the sensor to be removed and executing an **Update Device Information** command. The status of the corresponding machine in Analyst will switch to disabled once the status has been exported by Device Manager.

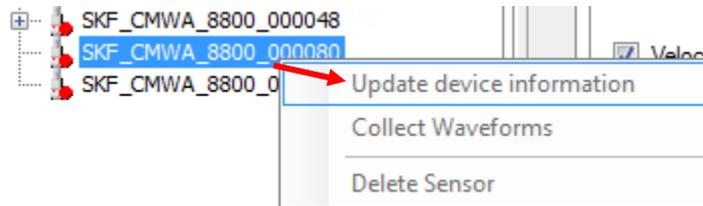


Figure 6 - 10.

Update Device Information Command.

Replacing a Sensor

You may replace an existing sensor with a new sensor or a sensor that is already active in the system. In either case, the sensor would first be commissioned in a commissioning gateway, if one is available. Procedures are provided below to show how to:

- Replace a sensor with a new sensor that has the factory default network ID and join key with a commissioning network available.
- Replace a sensor with a sensor that is active in the production system with a commissioning network available.
- Replace a sensor when a commissioning network is not available.

Never give a sensor the same Long Tag name as an existing tag under the same gateway. The Long Tag name is a unique identifier, and Device Manager cannot handle duplicate Long Tag Names (unless replacing an old sensor with a new one, in which case you should make sure to switch the old sensor off before switching the new sensor on).

To replace a sensor with a new sensor that has the factory default network ID and join key, commissioning network available:

This procedure is the same as adding a new sensor to a production network, except in this case the name of the new sensor must be changed to match the long tag of the sensor to be replaced. Make sure the commissioning gateway's coverage area and the wireless sensor's coverage area are both outside the production gateway and its wireless sensors' coverage area.

- In Device Manager, go to the **Plant / Batch Service Management** tab and **Stop** the batch service.
 - The **Find sensors** command is unavailable when the batch service is running.
- Switch off the sensor to be replaced in the production network.
- In the system hierarchy, select the sensor to be replaced. Force the sensor's status indicator to turn red by right-clicking the sensor and executing an **Update Device Information** command from the menu. After the sensor's status indicator has turned red in Device Manager, the corresponding machine should be disabled in Analyst.
- Locate the replacement sensor within the range of a commissioning gateway that is set up with factory default network ID and join key.
- Switch on the replacement sensor to join the commissioning network. Open the **Operating Modes** web page. A yellow icon with a small wrench will display while the new sensor is joining the network.

Operating Modes				
Long Tag	IO...	Channe...	Device Type	Com. Stat...
WHA-GW	251	1	WHA-GW	
WHA-ADP Router	1	0	WHA-ADP	✓
SKF_CMWA_8800_000026	2	0	E1A2	✓
SKF_CMWA_8800_000059	4	0	E1A2	✓
SKF_CMWA_8800_000072	9	0	E1A2	⚠

Figure 6 - 11.

The Yellow Icon Indicates the Sensor Is Joining.

- Wait until the sensor joins the commissioning network. The sensor's yellow icon in the **Com. Status** column will turn green when it joins.

Operating Modes				
Long Tag	IO...	Channe...	Device Type	Com. Stat...
WHA-GW	251	1	WHA-GW	
WHA-ADP Router	1	0	WHA-ADP	✓
SKF_CMWA_8800_000026	2	0	E1A2	✓
SKF_CMWA_8800_000059	4	0	E1A2	✓
SKF_CMWA_8800_000072	9	0	E1A2	✓

Figure 6 - 12.

The Green Icon Indicates the Sensor Has Joined.

- Right-click the gateway node and issue the **Find sensors** command to import the replacement sensor into the Device Manager hierarchy.



Figure 6 - 13.

Issue the **Find Sensors** Command from the Gateway.

- Wait until the sensor has completed the import process from the gateway to the Device Manager hierarchy (that is, the sensor's status indicator appears green under the commissioning gateway node). Then, select the sensor and go to the **Sensor / Device** tab.
- Modify the **Tag** of the new sensor to match exactly the sensor that it is replacing. Update the **Machine speed**, as needed, and then click **Save**.
 - Do not change the **Descriptor**, the **Final Assembly Number** or the **Date**.

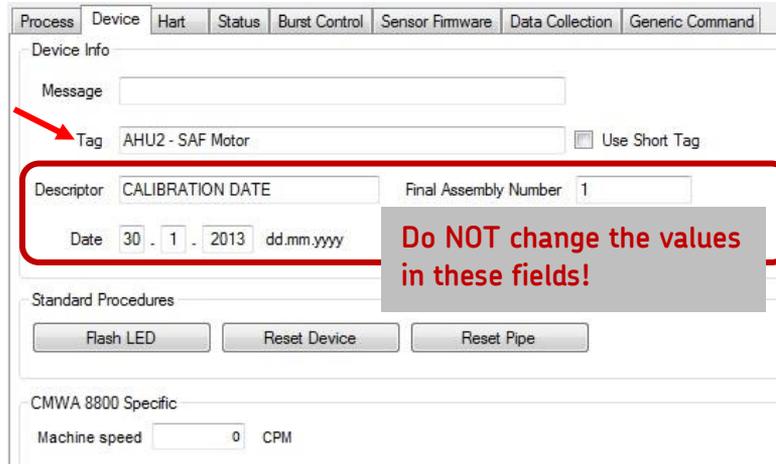


Figure 6 - 14.
The Long **Tag** Identifier.

- From the **Gateway / Admin** tab of the commissioning gateway in Device Manager, enter the **Network ID** and **Join Key** of the target production gateway and click the corresponding **Exchange Network Id** and **Exchange Join Key** buttons to update the sensor with the production gateway's network ID and join key.

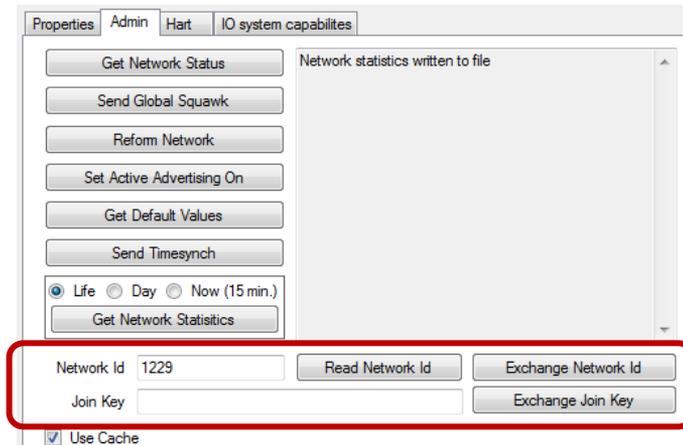


Figure 6 - 15.
Network ID and **Join Key** Fields and Buttons.

- Wait a couple of minutes for the replacement sensor to update with the new network ID and join key.
 - Unfortunately, the gateway does not provide feedback for when and whether all sensors have received the new network ID and join key.
- Go to the gateway's **Additional Functions > Reset** web page. Click **Reform Network** to tell the sensor and gateway to start using the production network ID and join key. The **Com. Status** indicators for the sensors will immediately turn red in the **Operating Modes** page.

- If you click the **Reform network** button in Device Manager, the gateway does not know the sensors were disconnected and the **Com. Status** indicators will remain green.



Figure 6 - 16.

Additional Functions > Reset Web Page – Reform Network.

- Verify the sensor has rejoined the network by viewing the gateway's **Operating Modes** web page to see when the **Com. Status** turns to green.
- Turn off the sensor and properly mount it in the production environment.
- Turn on the sensor and let it join the production network.
 - Tip: You may want to activate the sensor next to the production gateway before mounting the sensor to the machine. In this way, you can verify that is able to join the production network.
- Once the sensor has joined the gateway, use the **Find sensors** command to turn the status of the replaced sensor's node to green in the hierarchy. The corresponding machine in Analyst will be re-enabled.
- Perform a **Collect Waveforms** command on the replacement sensor, and then verify the measurements are correctly collected at the corresponding sensor in Analyst.

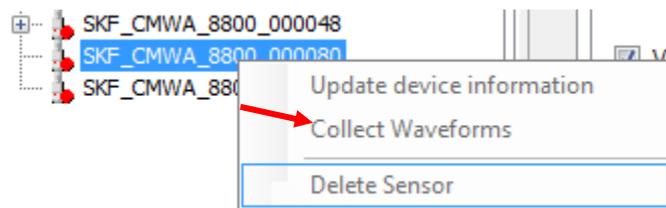


Figure 6 - 17.

Collect Waveforms Command.

⚠ IMPORTANT: *Be sure to turn on the batch service again for normal operation.*

To replace a sensor with an existing sensor from the production environment that is already configured with the production network ID and join key, commissioning network available:

In this case, you must update the commissioning gateway with the production network security settings. Make sure the commissioning gateway's coverage area and the wireless sensor's coverage area are both outside the production gateway and its wireless sensors' coverage area.

- Go to the **Plant / Batch Service Management** tab and **Stop** the batch service.
 - The **Find sensors** command is unavailable when the batch service is running.
- Switch off the sensor to be replaced in the production network.
- In the system hierarchy, select the sensor to be replaced. Force the sensor's status indicator to turn red by right clicking the sensor and executing an **Update Device Information** command from the menu. After the sensor's status indicator has turned red in Device Manager, the corresponding machine should be disabled in Analyst.

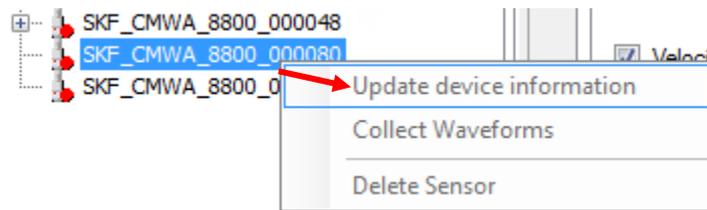


Figure 6 - 18.
Update Device Information Command.

- From the gateway's **Wireless Communication > Setup** web page, configure the commissioning gateway with the production network's **Network ID** and **Join Key**. Click the **Write Join Information** button.



Figure 6 - 19.
Wireless Communication > Setup Web Page - Network ID and Join Key.

- Go to the gateway's **Additional Functions > Reset** web page. Click **Reform Network** to tell gateway to start using the production network ID and join key.



Figure 6 - 20.

Additional Functions > Reset Web Page – Reform Network.

- Switch on the replacement sensor to join the commissioning network, which now has the production network security settings.
- Locate the replacement sensor within the range of the commissioning gateway.
- Verify the sensor has joined the network by viewing the gateway's **Operating Modes** web page to see when the **Com. Status** indicator turns to green.
- Right-click the gateway node and issue the **Find sensors** command to import the new sensor into the Device Manager hierarchy.



Figure 6 - 21.

Issue the Find Sensors Command from the Gateway.

- Wait until the sensor has joined the network (that is, the sensor's status indicator appears green under the commissioning gateway). Then, select the sensor and go to the **Sensor / Device** tab.
- Modify the **Tag** of the replacement sensor to match exactly the sensor that it is replacing. Update the **Machine speed**, as needed, and then click **Save**.
 - Do not change the **Descriptor**, the **Final Assembly Number** or the **Date**.

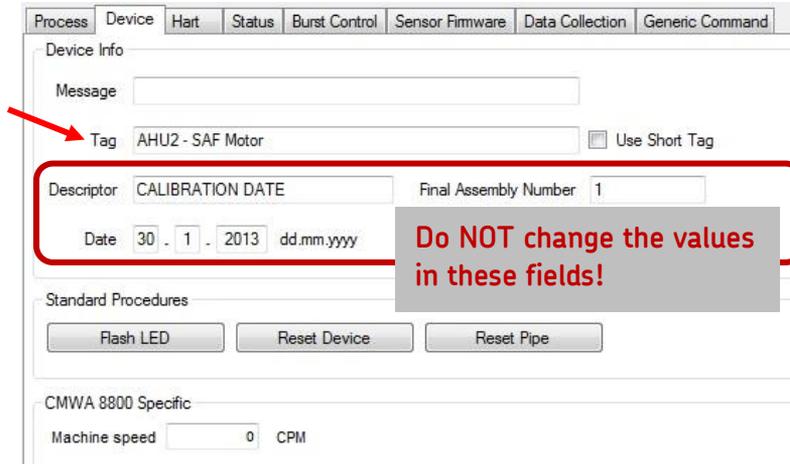


Figure 6 - 22.
The Long **Tag** Identifier.

- Turn off the sensor and properly mount it in the production environment.
- Turn on the sensor and let it join the production network.
 - Tip: You may want to activate the sensor next to the production gateway before mounting the sensor to the machine. In this way, you can verify that is able to join the production network.
- Once the sensor has joined the gateway, use the **Find sensors** command to turn the status of the replaced sensor's node to green in the hierarchy. The corresponding machine in Analyst will be re-enabled.
- Perform a **Collect Waveforms** command on the replacement sensor, and then verify the measurements are correctly collected at the corresponding sensor in Analyst.

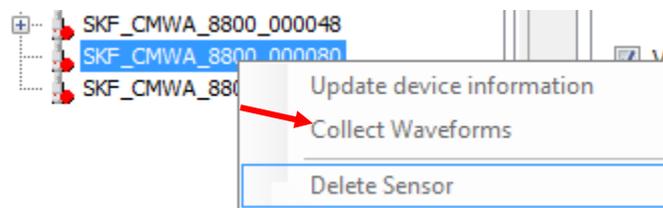


Figure 6 - 23.
Collect Waveforms Command.

IMPORTANT: Be sure to turn on the batch service again for normal operation.

To replace a sensor when a commissioning network is not available:

⚠ IMPORTANT: A customized sensor must be ordered with the pre-configuration service to join the network.

- Go to the **Plant / Batch Service Management** tab and **Stop** the batch service.
 - The **Find sensors** command is unavailable when the batch service is running.
- Switch off the sensor to be replaced in the production network
- In Device Manager, go to the **Plant > Batch Service Management** tab and **Stop** the batch service.
- In the system hierarchy, select the sensor to be replaced. Force the sensor's status indicator to turn red by right clicking the sensor and executing an **Update Device Information** command from the menu. After the sensor's status indicator has turned red in Device Manager, the corresponding machine should be disabled in Analyst.

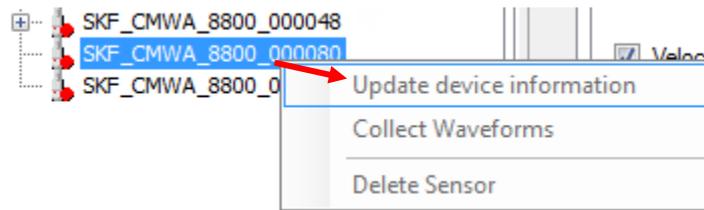


Figure 6 - 24.
Update Device Information Command.

- Disable the XML export on the the **Plant > Export** tab by unchecking the **Enable** check box.

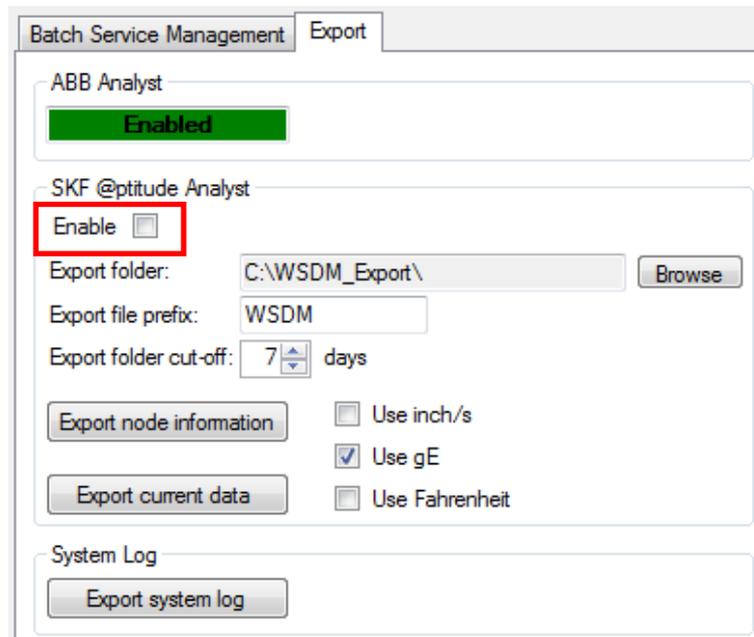


Figure 6 - 25.
Enable Check Box for the XML Export.

- Switch on the replacement sensor to join the network. After the replacement sensor has joined the network, it will show up in the device list on the gateway's **Operating Modes** web page.
- Right-click the gateway node and issue the **Find sensors** command to import the replacement sensor into the Device Manager hierarchy.



Figure 6 - 26.
Issue the **Find Sensors** Command from the Gateway.

- Wait until the sensor has completed the import process from the gateway to the Device Manager hierarchy (that is, the sensor's status indicator appears green under the commissioning gateway node). Then, select the sensor and go to the **Sensor / Device** tab.
- Modify the **Tag** of the new sensor to match exactly the sensor that it is replacing. Update the **Machine speed**, as needed, and then click **Save**.
 - Do not change the **Descriptor**, the **Final Assembly Number** or the **Date**.

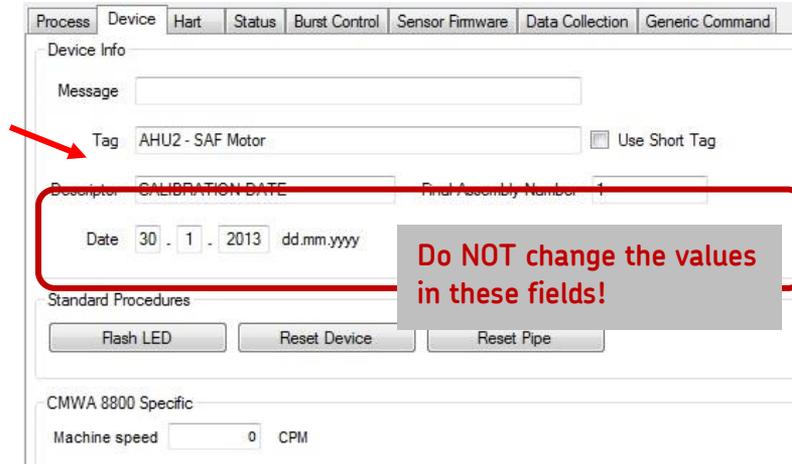


Figure 6 - 27.
The Long **Tag** Identifier.

- Switch off the replacement sensor. Force the sensor's status indicator to turn red by right-clicking the sensor to be replaced and executing an **Update Device Information** command from the menu.
- After the status of the sensor has turned red, delete it from Device Manager by right-clicking the sensor and selecting the **Delete Sensor** command.

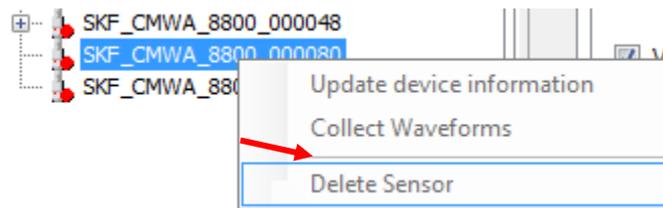


Figure 6 - 28.
Delete Sensor Command.

- Close Device Manager and then re-launch it.
- Activate the new sensor with the modified Long Tag and verify that it has re-connected to the gateway.
- Enable the XML Export in the **Plant > Export** tab by selecting the **Enable** check box.
- Right-click on the gateway in Device Manager and perform a **Find sensors** command again. The replacement sensor's status indicator will now return to green in the Device Manager. In Analyst, the status of the replaced sensor should return to enable (green).
- Perform a **Collect Waveforms** command on the replacement sensor, and then verify the measurements are correctly collected at the corresponding sensor in Analyst.

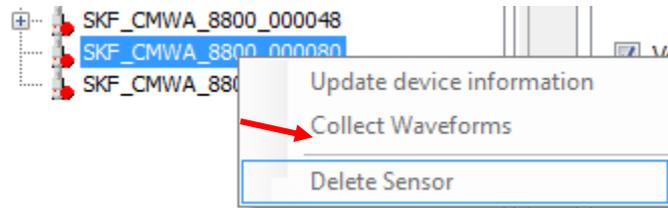


Figure 6 - 29.
Collect Waveforms Command.

⚠ IMPORTANT: *Be sure to turn on the batch service again for normal operation.*

CMWA 8800 Firmware Upgrade

The wireless sensor firmware upgrade file may be obtained via SKF Technical Support. The firmware file's extension is .hex. After obtaining the firmware upgrade file, use one of the methods described in this document to upgrade the firmware.

You can upgrade firmware on a single sensor or all sensors in the network sequentially, or you can upgrade firmware in parallel on all sensors at once by using broadcast mode. Broadcast mode is recommended when you are upgrading more than five sensors. Note that with broadcast mode, sensors that have weak signal reception will miss too many packets and will not upgrade successfully. A rebroadcast of missing packets is performed, up to a total of three attempts to upgrade all the sensors.

Each of the three processes is described in detail below.

[Firmware Upgrade of an Individual Sensor](#) (sequential)

[Firmware Upgrade of Multiple Sensors](#) (sequential)

[Firmware Upgrade of Multiple Sensors by Broadcast Mode](#) (parallel)

IMPORTANT: As new functionality is added to the CMWA8800 product, it is recommended that the end user also upgrade the Device Manager system software before sensor firmware is upgraded or new sensors with new firmware are put into operation.

To prevent data loss, ensure that the CMWA8800 MicrosoftSQL database has been backed up before upgrading.

Firmware Upgrade of an Individual Sensor

IMPORTANT: You must stop the system's batch service during firmware upgrade.

First, you must stop the batch service. This is required in order to keep the high bandwidth pipe available for firmware download to the sensor. There can only be one pipe in use at a time and the batch service uses it to upload time waveforms from sensors.

To stop the batch service:

- Select the plant level icon in the Device Manager hierarchy.
- On the Batch Service Management tab, click the **Stop** button.
 - To restart the batch service after firmware upgrade, return to this tab and click the **Start** button.

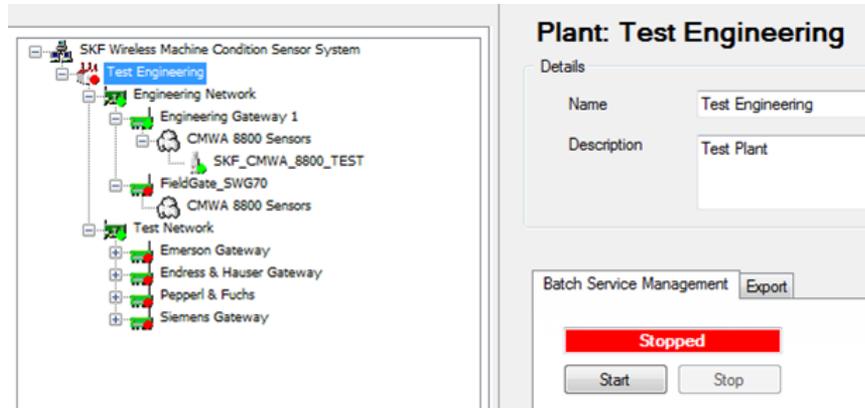


Figure 6 - 30.
Stop the Batch Service Before Upgrading the Firmware.

To upgrade an individual wireless sensor's firmware:

- In the hierarchy, select the active sensor that you want to upgrade with the new firmware.
- Select the **Sensor / Sensor Firmware** tab and verify the sensor node's current **Software Revision**.

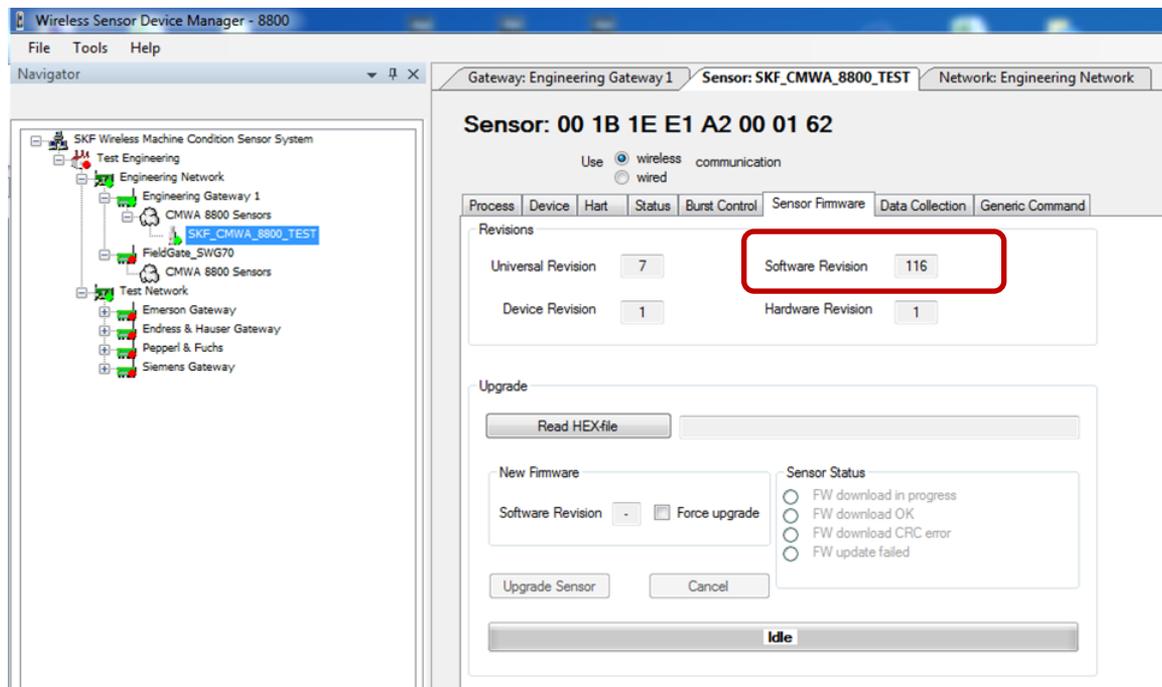


Figure 6 - 31.
The Firmware Upgrade Candidate.

- Click the **Read HEX-file** button.
- A browse dialog displays. Browse to the location of the firmware .hex file and then click **Open**. The path to the .hex file displays adjacent to the **Read HEX-file** button. For the purpose of this procedure we have used 'WiVib_main_123.hex' as an example.

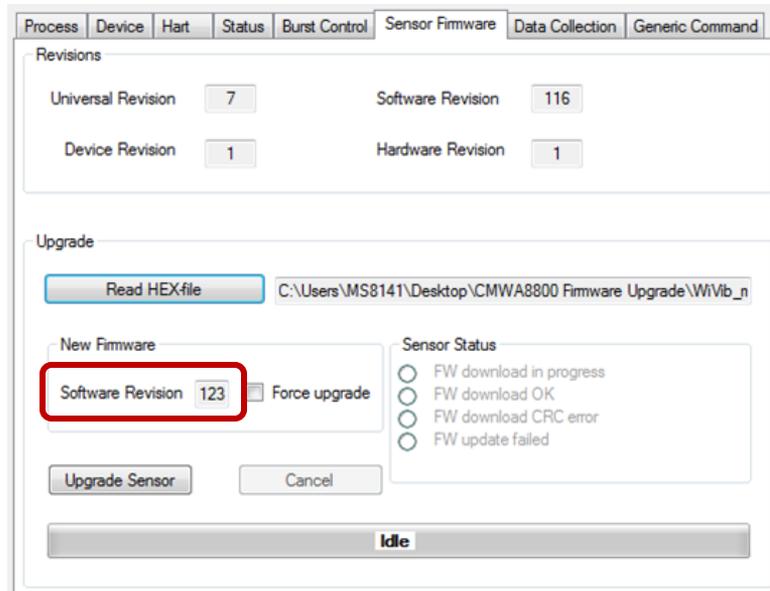


Figure 6 - 32.
The Firmware Upgrade Path and New Software Revision.

- In the New Firmware area, the **Software Revision** displays the revision of the firmware to be loaded onto the sensors.
- Click the **Upgrade Sensor** button to initiate the firmware upgrade on the selected sensor. The **Sensor Status** area updates to show the current upgrade status, the **FW download in progress** option is automatically selected, and the download starts.

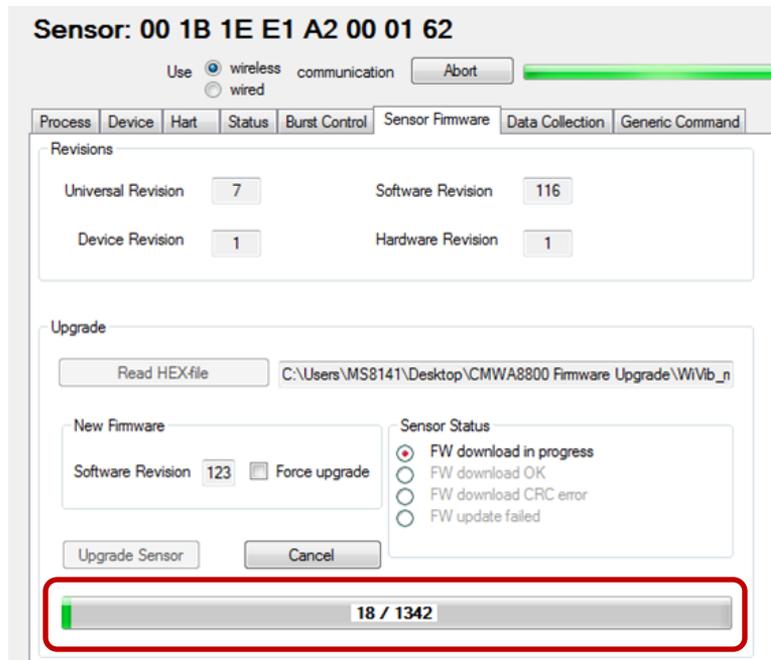


Figure 6 - 33.
Firmware Upgrade Initiated.

The progress bar at the bottom of the tab displays the download's progress. Because this process requires the sensor to receive and acknowledge receipt of each data packet, the time required to upgrade a sensor depends on the latency of the connection between the gateway and this sensor. It takes approximately 60 minutes to upgrade the firmware in each sensor, if it is in direct contact with the gateway. This time is doubled with each hop/router between sensor and gateway.

- The **Abort** button can be clicked to cancel the upgrade action at any point during the transfer process.

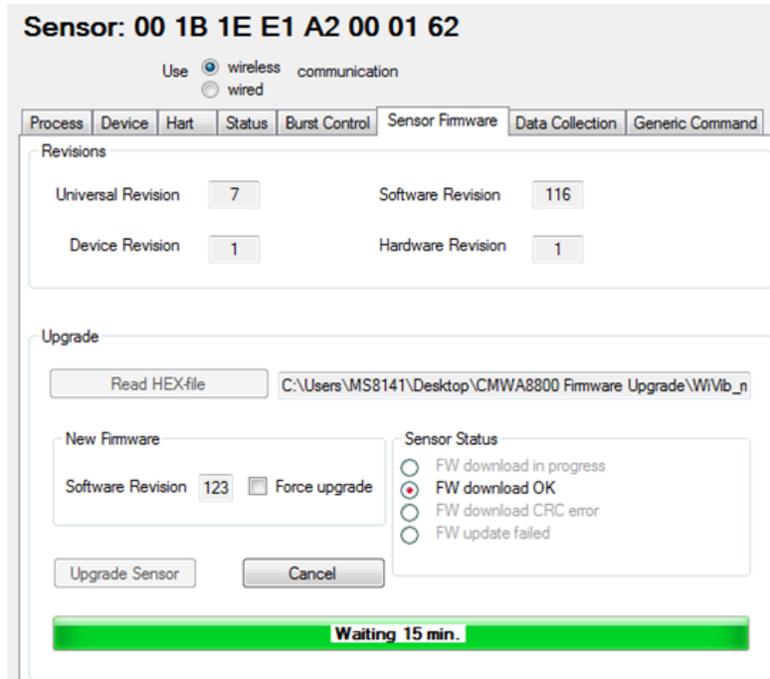


Figure 6 - 34.
Installing the Firmware.

- During this install period, the sensor may show as offline in the Device Manager hierarchy.

When the firmware download is successful, the **Sensor Status** changes to **FW Download OK** and the wireless sensor automatically restarts. Upon restart, the wireless sensor checks the validity and accuracy of the new firmware. If it is found to be OK, the new firmware is accepted as the current version and the previous version is deleted. The wireless sensor restarts again with the new version of the firmware.

The status bar shows 'Waiting 15 min'. After a 15 minute delay, the Device Manager software checks if the sensor has joined the network again (the sensor status bar indicates 'Re-learning network'). Device Manager reads the new firmware version from the sensor, and flags any errors. If the firmware upgrade is successful, all **Sensor Status** options are cleared.

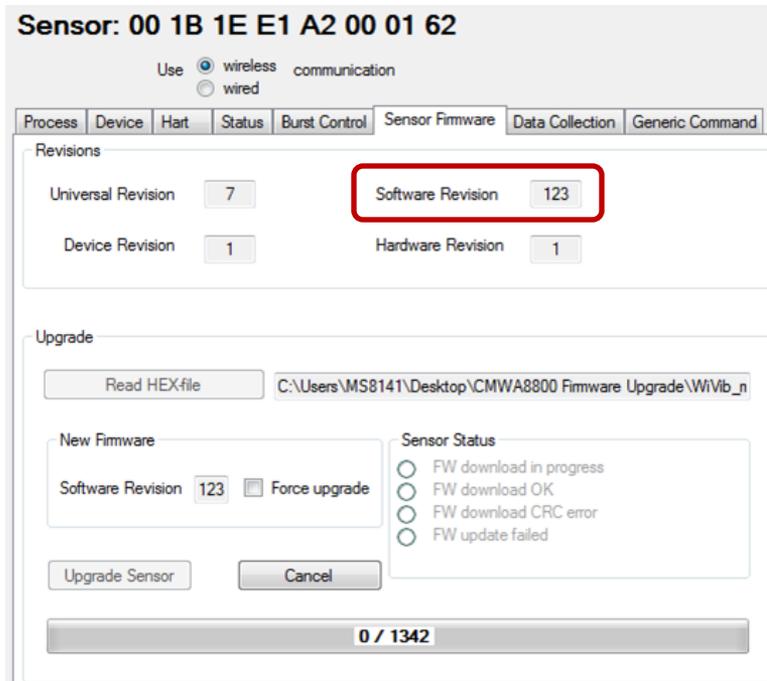


Figure 6 - 35.

Successful Firmware Upgrade of the Selected Sensor.

The updated firmware revision number displays in the **Software Revision** field. The sensor shows as being online in the hierarchy.

If the upgrade was not successful, one of the last two **Sensor Status** options will be selected:

- If the downloaded firmware is corrupted, a failure flag is set, the downloaded firmware version is deleted, and operation continues with the previous firmware version. The **Sensor Status** updates to **Firmware download CRC error**.
- If Device Manager flags any errors when reading from the sensor, the **Sensor Status** updates to **Firmware update failed**.

IMPORTANT: Remember to start the system's batch service after firmware upgrade.

Firmware Upgrade of Multiple Sensors

One sensor at a time is upgraded with the sequential firmware upgrade of multiple sensors, or global firmware upgrade. During the firmware upgrade of multiple sensors, the new firmware is downloaded sequentially only to those sensors that have an older firmware version. Depending on how many sensors are present in the network, the upgrade process can take several hours to complete. For large systems, it is therefore advisable to begin the procedure before leaving at the end of the day and then inspect the results the next day.

It is recommended that you let Device Manager run until the upgrade is completed. If, for any reason, a sensor temporarily is not responding during upgrade, Device Manager skips to the next sensor in its list. After completing the list, a new attempt to upgrade the firmware on skipped sensors is performed. When the **Overall progress** bar indicates 100% complete, the firmware upgrade is complete.

Do not enable the **Force Upgrade** check box when upgrading firmware. It is used only when downgrading firmware or re-uploading firmware of the same version.

- With **Force upgrade** enabled, firmware will be downloaded to all connected sensors irrespective of their current firmware version.
- If, for some reason, you are downgrading to an older version of the firmware, you must enable the **Force upgrade** check box to perform the downgrade. Before doing so, you should check with the SKF factory to make sure the downgraded firmware does not cause the sensors to malfunction.

IMPORTANT: <i>You must stop the batch service before firmware upgrade.</i>

To perform the firmware upgrade of multiple sensors:

- In the hierarchy, select the sensor network that you want to upgrade with the new firmware.
- On the **Network / Sensor Firmware** tab, click the **Read HEX-file** button.
- A browse dialog displays. Browse to the location of the firmware .hex file and then click **Open**. The path to the .hex file displays adjacent to the **Read HEX-file** button. For the purpose of this procedure we have used 'WiVib_main_123.hex' as an example.

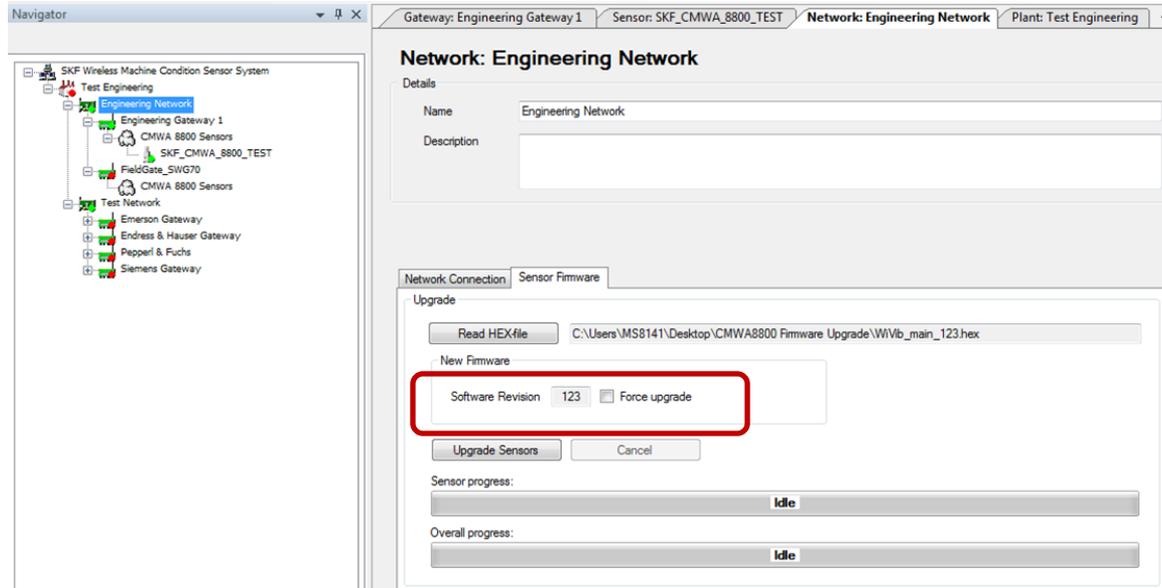


Figure 6 - 36.
The **Network / Sensor Firmware** Tab.

- Check the **New firmware** area, **Software Revision** field to verify that the correct firmware version will be loaded to the sensors.
- Click the **Upgrade Sensors** button to initiate the sequential firmware upgrade. The software will check the version of the operational firmware in each active sensor and upgrade only those sensors that have an older version of firmware than the version to be uploaded.

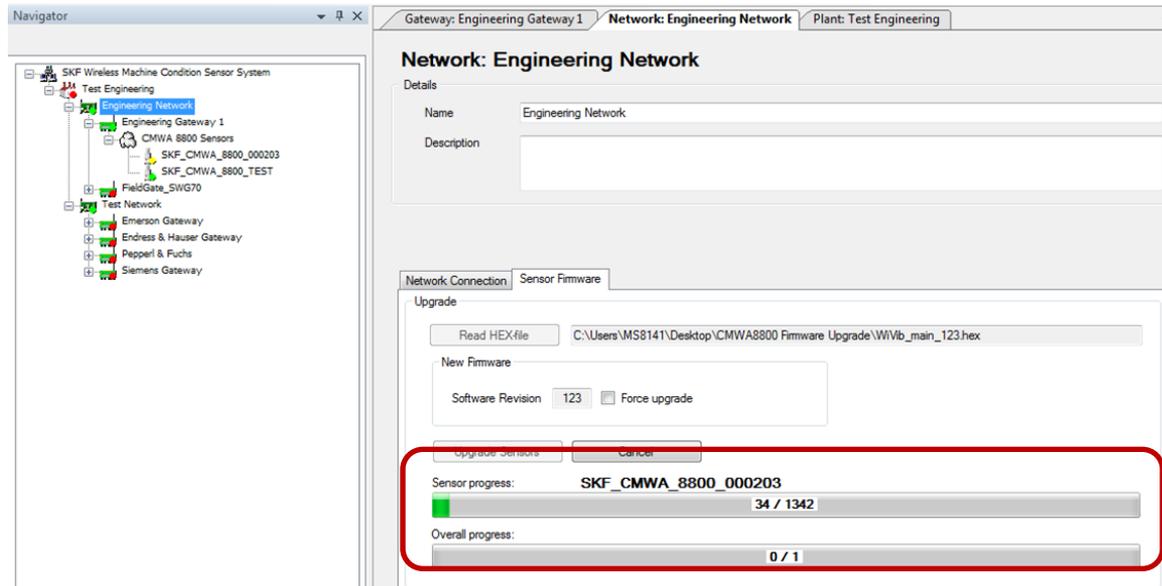


Figure 6 - 37.
Multiple Sensor Upgrade Progress Bars.

The upper **Sensor progress** bar displays the progress of an individual sensor, showing the current quantity of information packets sent to the sensor so far / the total number

of packets. The lower **Overall progress** bar displays the quantity of sensors that have been successfully upgraded / the total sensors to be upgraded in the network.

- In the hierarchy, if you select the sensor being upgraded and select the **Sensor / Sensor Firmware** tab, the sensor's **Sensor Status** area updates as described above for an individual sensor upgrade.

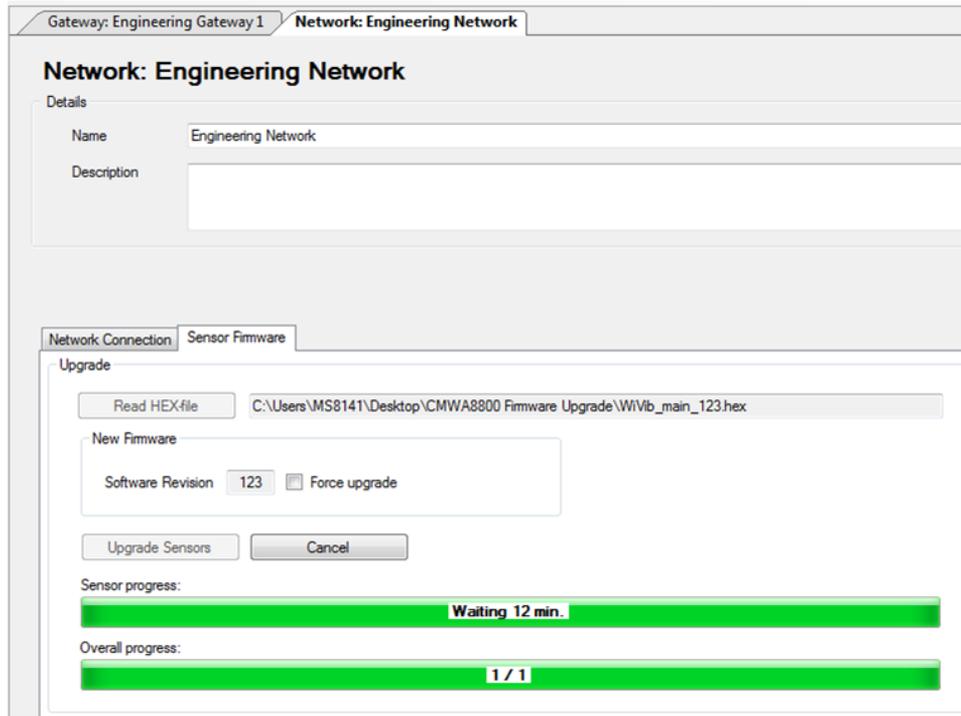


Figure 6 - 38.
Installing the New Firmware.

Once Device Manager has completed uploading the new firmware to all of the sensors, it will instruct all sensors to restart in order for them to install and use the newly received firmware. Consequently, the sensors will drop from the network and a waiting period of 15 minutes is used by the software to allow the sensors time to re-join the network.

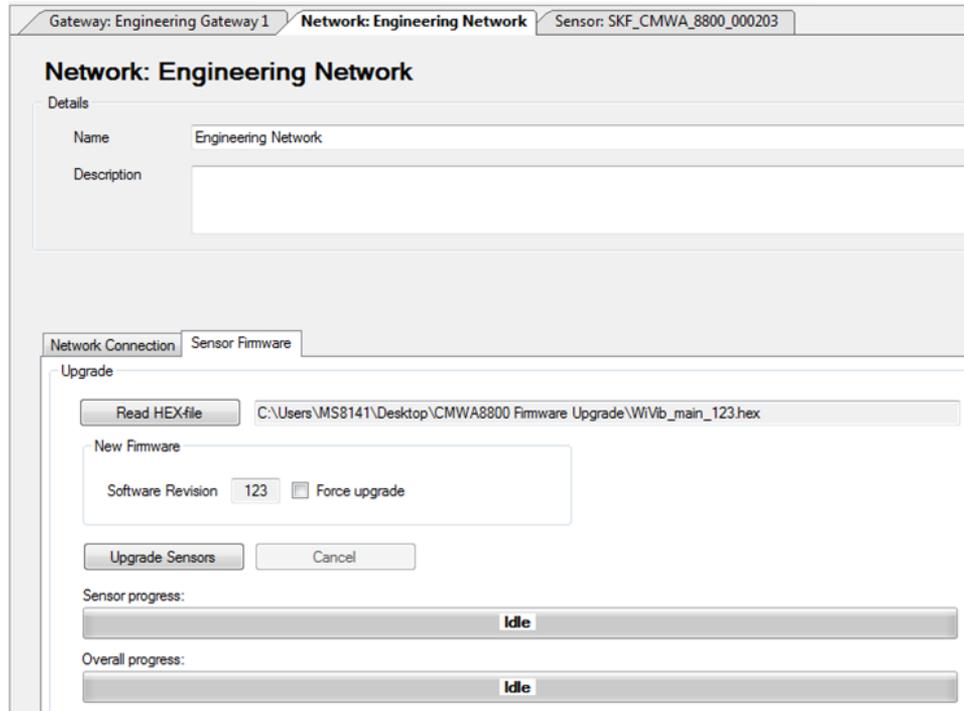


Figure 6 - 39.
Multiple Sensor Upgrade Completion.

When the rejoin process is complete, the progress bars show 'Idle'.

To determine if the firmware upgrade has been successful, check an individual sensor's Sensor Firmware tab for the Software Revision, or investigate the Device Manager system logfile.

Saving and viewing a logfile:

- Select the Plant level icon in the Navigator hierarchy tree.
- On the Plant's tab, open the **Export** sub tab.

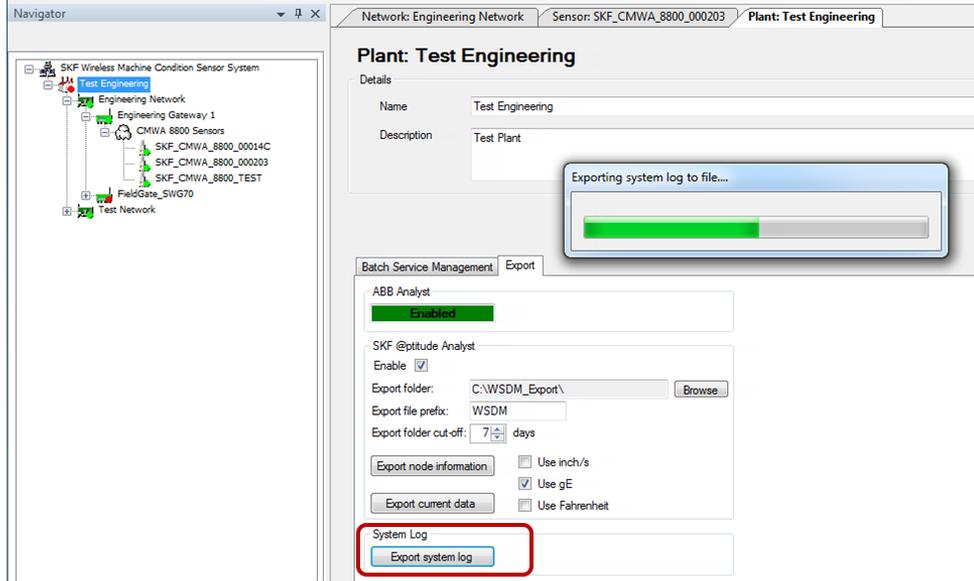


Figure 6 - 40.
 Exporting the System Log.

- In the system log area, click the **Export system log** button. A standard Save As dialog appears to prompt you to save the system logfile. The logfile is saved to a local folder as an Excel spreadsheet.
- Open the saved system logfile and search the spreadsheet for sensors that have had their firmware upgrade reported as successful.

25.08.2016 08:34:25.140	Wireless Sensor Device Manager - 8800 GUI	Info	Firmware Upgrade: SKF_CMWA_8800_000203 upgraded OK.
----------------------------	---	------	---

Figure 6 - 41.
 Example of System Logfile Information about the Firmware Upgrade of a Sensor.

- Review the logfile information to confirm that the firmware upgrade of multiple sensors was successful.

IMPORTANT: Remember to start the system's batch service after firmware upgrade.

Firmware Upgrade of Multiple Sensors by Broadcast Mode

When the firmware upgrade of multiple sensors is performed in broadcast mode, the information packets are broadcast at once to all sensors in the selected network. No acknowledgment from a sensor is required in return. Broadcast mode saves considerable time over the sequential upgrade method described above. After all of the information packets have been broadcast once, Device Manager queries the sensors to determine whether any sensors missed information packets, and which particular packets were missed. Then, Device Manager broadcasts just those information packets, one at a time, again to the network. This query and rebroadcast will be repeated one more time, for a total of three attempts to upgrade all the sensors.

IMPORTANT: You must stop the batch service before firmware upgrade.

To upgrade the firmware of multiple sensors by broadcast mode:

- Select the desired **Plant** level icon in the Device Manager hierarchy.
- Open the **Tools, Settings** dialog.

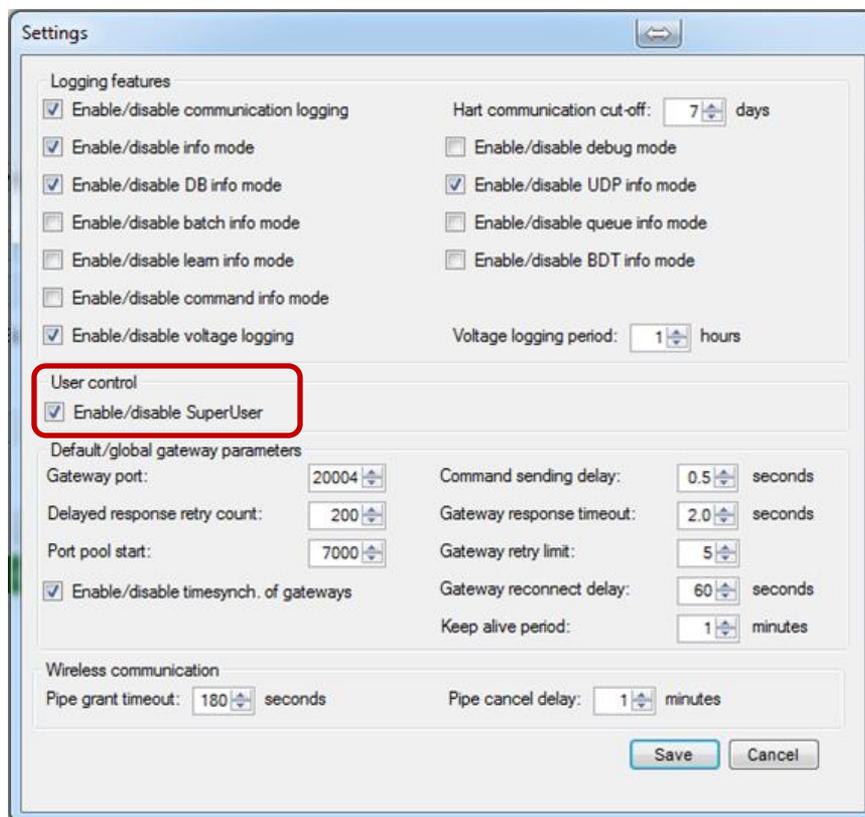


Figure 6 - 42.
Enable the SuperUser Functionality.

- Enable the **Enable/disable SuperUser** check box.
- Click **Save**.

- From the Device Manager hierarchy, select the network over which the firmware broadcast will take place.
- On the **Network / Sensor Firmware** tab, click the **Read HEX-file** button.
- A browse dialog displays. Browse to the location of the firmware .hex file and then click **Open**. The path to the .hex file displays adjacent to the **Read HEX-file** button. For the purpose of this procedure we have used 'WiVib_main_123.hex' as an example.



Figure 6 - 43.
Sensor Firmware Tab, Broadcast Enabled.

- Check the **New firmware** area, **Software Revision** field to verify that the correct firmware version will be loaded to the sensors.
- Enable the **Broadcast** check box.
- Click the **Upgrade Sensors** button to initiate the upgrade.
- At this point, two progress bars display on the tab, indicating the status and progress of the firmware broadcast by sensor and overall progress.
- Once the firmware update via broadcast is complete, the software checks for missing packets.

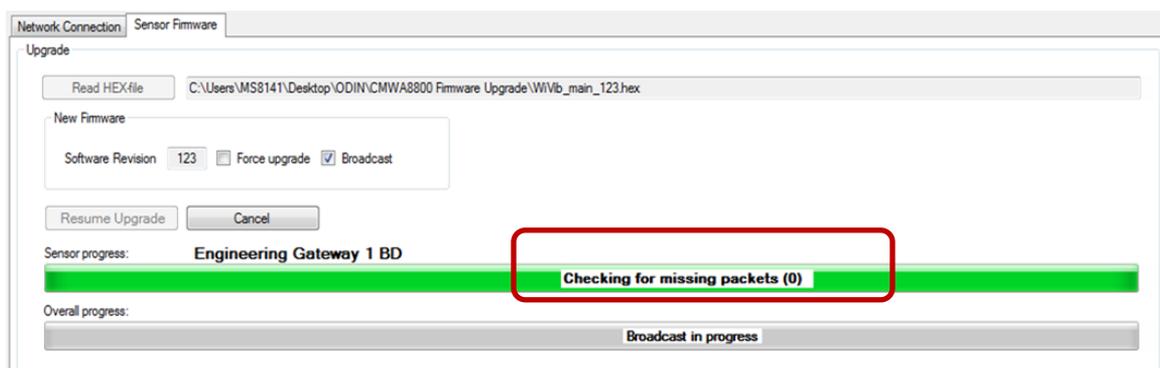


Figure 6 - 44.
Sensor Firmware Tab, Checking for Missing Packets.

- If some packets are missing, click the **Resume Upgrade** button. Sensors that have missed transmitted packets are given another opportunity to acquire them through the sequential mode of firmware upgrade.

Once the firmware update has completed successfully, Device Manager will re-learn the network.

IMPORTANT: Remember to start the system's batch service after firmware upgrade. Remember to disable the SuperUser functionality.

Known Issues During Firmware Upgrade

The following issue has occurred with WSDM Version 2.0.2.61.

After performing a sensor firmware upgrade, Device Manager can report additional repeated measurement values at a 1 hour interval if the sensor measurement cycle was not set to once per hour before the firmware upgrade. As a result of the firmware upgrade, the sensor reverts to the default setting for the measurement cycle of once per hour whereas the software assumes the measurement cycle used by the sensor is the value set prior to the firmware upgrade. The effect of this mismatch can be seen in the graph below where duplicate measurements are reported.



Figure 6 - 45.
Example of Duplicate Measurement Entries.

To correct the mismatch in settings used by sensor and software:

- From the Device Manager hierarchy, select an active sensor that has had its firmware upgraded.
- Select the sensor's **Data Collection** tab.

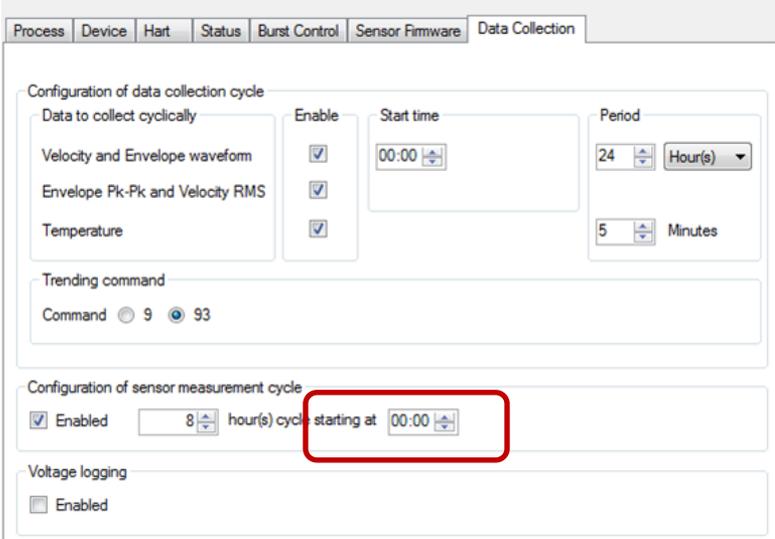


Figure 6 - 46.
Example of the Sensor's **Data Collection** Tab.

- The duplicate entries will cease when the data collection parameters are saved to update the data. However, the **Save** button is disabled until a parameter is modified. See the warning below.

WARNING! Care must be taken when modifying data collection parameters because a change can cause the system to operate in an unusual fashion. We recommend modifying only the measurement cycle 'starting at' time by 1 minute to avoid unusual behaviour.

- Change the measurement cycle 'starting at' time by 1 minute. The **Save** button is enabled.

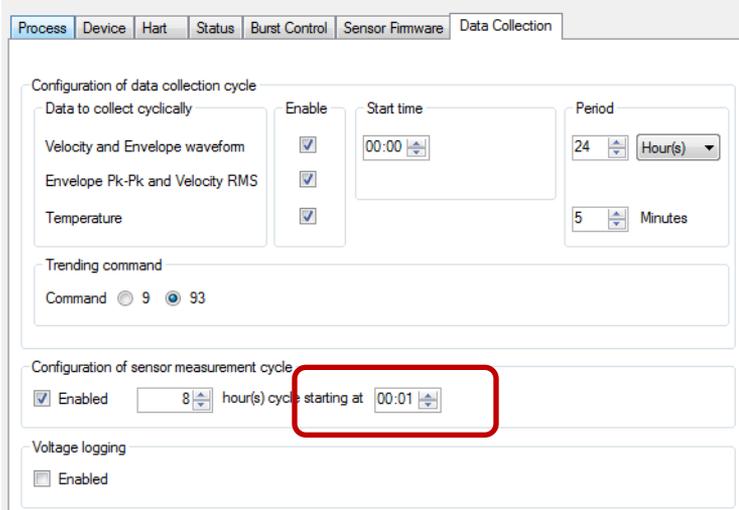


Figure 6 - 47.
Example with "Starting at" Time changed.

- Click **Save**.

All measurement cycle parameters will be updated in the sensor and the duplicate entries of measurements in the database will no longer occur. The figure below shows the measurement reporting restored to normal.



Figure 6 - 48.
Duplicate Measurement Entries No Longer Occur.

- Repeat this process for each sensor that was part of the firmware upgrade procedure.

CMWA 8800 Sensor Status Indicators

This tab displays the implemented status bits in the **Device Status** byte, **Extended Device Status** byte, and the **Standardized Status 0** byte and **Standardized Status 3** byte, as specified in the HART protocol.

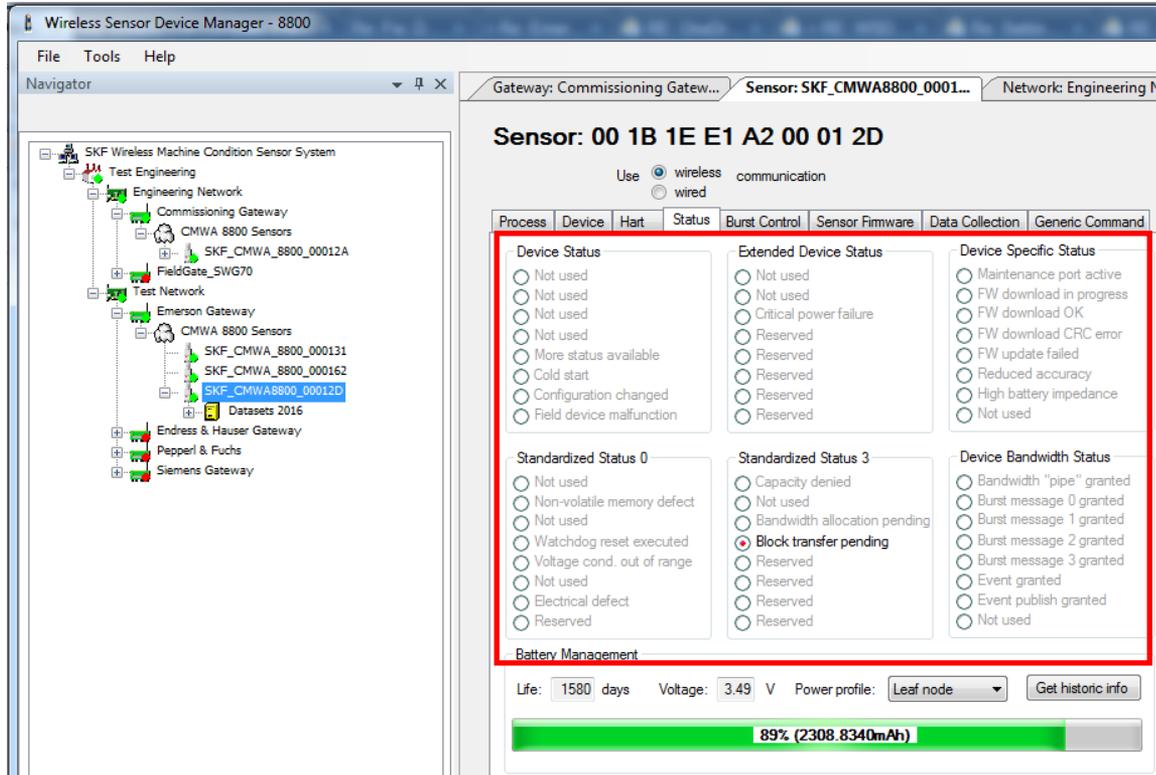


Figure 6 - 49.
 The **Sensor / Status** Tab Showing **Device Status**.

For troubleshooting purposes, status flags on the **Sensor / Status / Device Status** tab indicate the sensor's status as follows:

Device Status

Specified in the HART Command Summary Specification

Bit No	HART definition	Device Manager Implementation
0	Primary Variable Out of Limits	Not used
1	Non-Primary Variable Out of Limits	Not used
2	Loop Current Saturated	Not used
3	Loop Current Fixed	Not used
4	More Status Available	Set upon any change of status variables, cleared when new status is read.
5	Cold Start	Set upon a device reset
6	Configuration Changed	Set upon a configuration change, cleared when new configuration is stored to flash.
7	Device Malfunction	Set if memory error detected at restart

Extended Device Status

Specified in the HART Common Tables

Bit No	HART definition	Device Manager Implementation
0	Maintenance required	Not used
1	Device Variable Alert	Not used
2	Critical Power Failure	Set if battery voltage is measured below 3.3 V
3	Undefined	Reserved
4	Undefined	Reserved
5	Undefined	Reserved
6	Undefined	Reserved
7	Undefined	Reserved

Additional Device Status (device specific information)

Device Specific Status byte 0: Not used
Device Specific Status byte 1: Not used
Device Specific Status byte 2: Not used
Device Specific Status byte 3: Not used
Device Specific Status byte 4: Not used
Device Specific Status byte 5: Bits used as detailed below.

Additional Device Status (device specific information)

Bit No	Definition	Description
0	Maintenance port active	Internal port used during manufacturing & repair only.
1	Firmware download in progress	Set when a firmware download is started, reset at completion or device reset.
2	Firmware downloaded OK	Set when a firmware download is completed, reset at device reset.
3	Firmware download bad CRC	Set if a CRC error is detected during firmware check after transfer of the new firmware. (Can happen if flash is not cleared before a new firmware image is downloaded).
4	Firmware update failed	Set if new current firmware version does not match expected (takeover failed)
5	Reduced accuracy	Set when sensor diagnostics suspects waveform measurement to be influenced by high battery impedance in combination with high current drain related to radio transceiver activity. Measurements stamped with reduced accuracy are deleted in trend and marked red in the waveform dataset.
6	High battery impedance	Sensor makes a battery voltage measurement during each vibration waveform measurement. If battery voltage drops below a threshold for an internal voltage regulator, the "High battery impedance" bit is set. This limit is dependent on HW version. High battery impedance is normally associated with end of battery lifetime. However, also low temperatures have big influence on impedance. Most battery types do also suffer from "passivation" at high temperatures, which causes the battery impedance to permanently increase.
7	Not used	

Device Bandwidth Status

Specified in the HART Common Tables

Bit No	Definition	Description
0	Bandwidth "pipe" granted	Bandwidth "pipe" granted
1	Burst message 0 granted	Bit set when network manager has responded.
2	Burst message 1 granted	Bit set when network manager has responded.
3	Burst message 2 granted	Bit set when network manager has responded.
4	Burst message 3 granted	Bit set when network manager has responded.
5	Event granted	Capacity granted from generation of events.
6	Event publish granted	Capacity for publishing events granted.
7	Not used	

Standardized Status 0

Specified in the HART Common Tables

Bit No	HART Definition	Device Manager Implementation
0	Simulation Active	Not used
1	Non Volatile Memory Defect	Set if flashing of new firmware version fails.
2	Volatile Memory Defect	Not used
3	Watchdog Reset Executed	Set if watchdog reset is executed, reset if Get Historic Info is executed.
4	Voltage Conditions Out of Range	Not used
5	Environmental Conditions Out of Range	Not used
6	Electronic Defect	Set if flashing of new firmware version fails.
7	Undefined	Reserved

Standardized Status 3

Specified in the HART Common Tables to support WirelessHART

Bit No	HART definition	Device Manger Implementation
0	Capacity Denied	Set if device unable to acquire communication bandwidth required to support the burst messaging specified or network manager reduces the bandwidth allocated to the device.
1	Duplicate Master Detected	Not used
2	Bandwidth allocation pending	The device has asked for bandwidth from the Network Manager and is awaiting Network manager response.
3	Block Transfer Pending	The device has a data set (waveform) awaiting transfer to the host or gateway. The Gateway should open the block transfer port and transfer the data.
4-7	Undefined	Reserved

Sensor Battery Status

Successful operation of the SKF Wireless Machine Condition Sensor system is dependent on good battery management. Sensor battery status displays on the **Sensor / Status** tab.

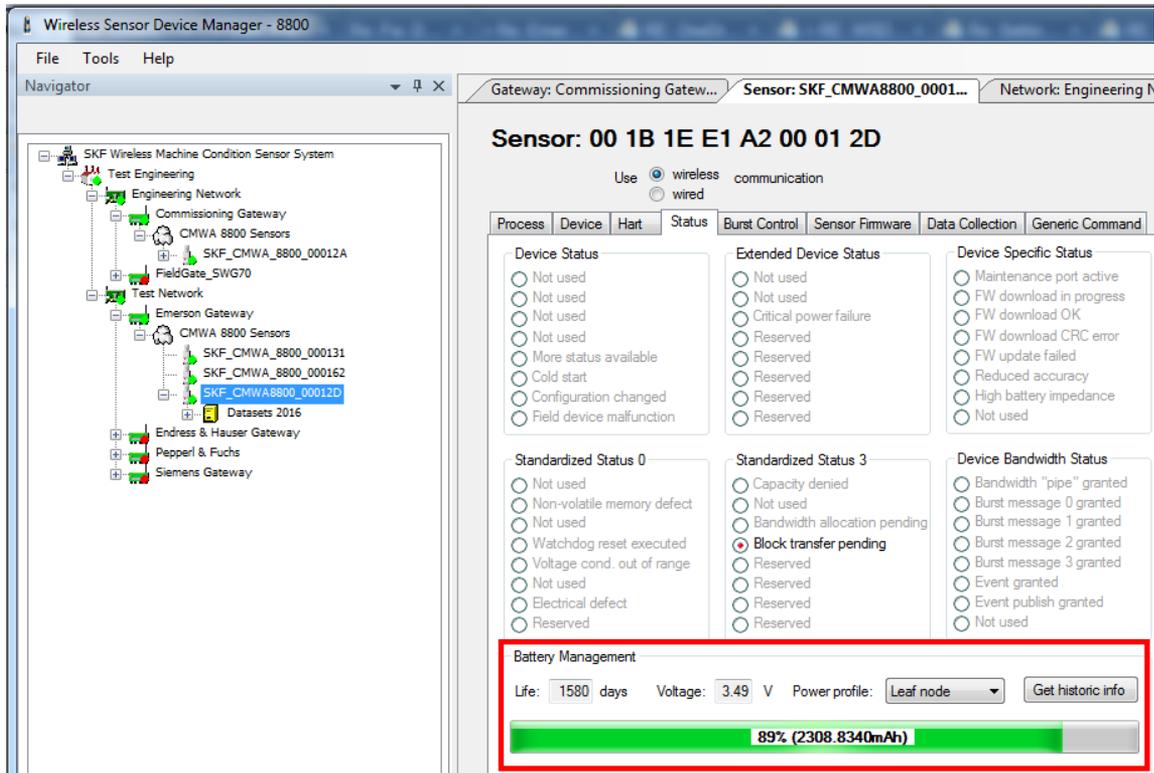


Figure 6 - 50.
The **Sensor / Status** Tab's **Battery Management** Area.

The **Battery Management** area displays the following battery information:

Life – Displays the estimated remaining battery life in days. The estimate is based on an initial battery charge of 2400 mAh and the assumption that future sensor charge consumption will be similar to past sensor charge consumption.

- The battery's **Life** rating is based on calculated average past energy consumption over the battery's history and extrapolation into the future. Therefore, when the battery has a very short history, a short period of increased consumption will cause a drop in remaining Life, after which it returns to the nominal rating. As time passes, the average energy consumption rate reflects more history and therefore the Life rating will not react so strongly to brief changes. In fact, when the battery has a long history, the effect of a measurement schedule change will not immediately be evident but will require some time to become clear.
- Battery life estimates are based on operation at room temperature (25 °C, 77 °F). Operation at very high or very low

temperatures will decrease battery life and lead it to be less than the calculated life.

Voltage – Displays the battery voltage. Nominal unloaded voltage is 3.67 V. As unloaded voltage is minimally influenced by remaining battery charge, battery voltage is measured loaded. This means that the voltage is measured during a waveform measurement only (i.e., is not updated unless a waveform measurement is executed). A healthy battery voltage ranges from 3.5 to 3.6 V.

Toward the end of the battery’s life, the voltage starts to decrease. When a loaded battery voltage lower than 3.3 V is measured, a **Critical power failure** message is reported on the tab’s **Extended Device Status Bit 2**.

Battery charge bar – The battery charge bar displays the calculated remaining battery charge in 0.1 μ Ah resolution. Battery charge information is updated in wireless sensors once an hour.

To display historical battery power records:

- Click the **Get historic info** button. The **Historical power info records** dialog displays.

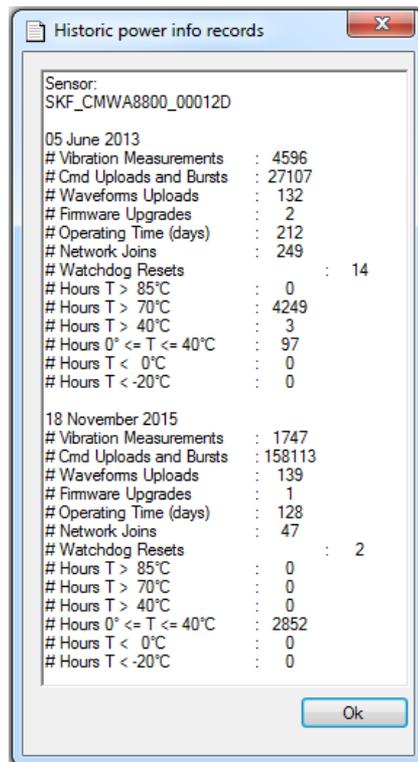


Figure 6 - 51.
The **Historic power info records** Dialog.

History from the last five battery replacements displays. The displayed dates indicate the date for the first time the sensor joined a network after a battery replacement. The **#** fields indicate the number of occurrences for each event. The **# Operation Time** field refers to the number of operation days (sensor activated) since the most recent battery replacement.

Battery End of Life

When the **Extended Device Status bit 2, Critical power failure** status flag is set on its **Sensor / Status** tab, replacement will be needed in a short term (weeks or days).

- Contact your SKF Representative to arrange for battery replacement at the authorized SKF service center.
- When a wireless sensor reaches its end of service, return it to SKF or to a company approved for return of electronic materials.

Servicing the Wireless Sensor

The wireless sensor is certified for use in ATEX Zone 0 environments. Therefore, wireless sensors must be serviced at an authorized SKF service center to remain ATEX Zone 0 compliant.

Battery Conservation

Overview

Each sensor's battery life depends on the conditions in which it operates. Conditions that affect battery life include:

- Whether the sensor operates as a router
- Frequency of data collection
- Temperature extremes
- The number of times the gateway is powered down, or the network is rebuilt
- Path stability to gateway or router node (decreases with distance and obstructions)

Battery Life vs. Gateway Power Down

When the gateway is powered down, all WirelessHART devices in the network start searching for a network to join. Power consumption during this network search and join process is very high. Therefore, gateway power downs should be minimized to avoid rapid battery discharge.

When the wireless sensor loses its gateway, its behavior depends on the configured network ID:

Factory default network ID - Wireless sensors configured with the factory default network ID (1229) perform all of the following when a gateway is lost or missing (or when the sensor is manually turned on using its push button):

Hour 1 - search for a network to join with high intensity

Hours 2 through 12 - search for a network to join with low intensity before deactivation

Hour 13+ - deactivate to preserve sensor battery life. To reactivate the wireless sensor, you must use the sensor's push button.

All other networks IDs

Hour 1 - search for a network to join with high intensity

Hours 2 through 12 - enter a deep sleep mode

Hour 13 - search for a network to join with high intensity

Hour 14+ - repeat previous steps

Note that, if power is returned to the gateway after more than one hour, wireless sensors do not rejoin the network until after the 12 hour mark.

Network Bandwidth Profile

For P+F gateways, on the **Wireless Communication / Setup** web page, make sure the **Active Bandwidth Profile** setting is set to **Normal Bandwidth Profile**. Configuration of higher performance profiles will significantly decrease battery life for all battery powered devices in the wireless network.

The screenshot displays the configuration interface for a P+F gateway. At the top, device information is shown: Device Name: WHA-GW, Device Revision: 2, Device Long Tag: WHA-GW, Descriptor: ??????????????, NE107 Status: Good, and Timestamp of Status: 10:43:51. A left-hand navigation menu includes options like Identification, Wireless Communication (Setup), Wired Communication, Diagnostics, Engineering, and Additional Functions. The main configuration area includes fields for Network Tag (Alpha Network 2), Network ID (101), and four Join Key parts (all masked with asterisks). It also features Real Time Clock Date and Time, Network start date and time, and an 'Allow new Devices' dropdown set to 'all'. A red box highlights the 'Active Bandwidth Profile' dropdown, which is currently set to 'Normal Bandwidth Profile'. Below this, there are fields for 'Global Advertising Timeout' and 'Activate Global Advertising'. The 'Channel Blacklist' section shows a grid of 15 channels (CH1 to CH15) with frequency labels (2.405 GHz to 2.475 GHz) and checkboxes for 'Active' and 'After restart' status, all of which are checked. A 'Send to Device' button is located at the bottom right of the configuration area.

Figure 7 - 1.
The Active Bandwidth Profile Option on the P+F Gateway's Web Page.

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