WiVib
Wireless
Monitoring

WiVibXTrend
User's Manual

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CONTENTS

CHAPTER 1 – *WiVib X* Overview

1.1 *WiVib X System*

WiVibXTrend is a comprehensive monitoring software package that operates with the *WiVib X* wireless vibration sensors from Icon Research. Sensors communicate via gateways back to a host computer where the *WiVibXTrend* application and associated SQL database are installed.
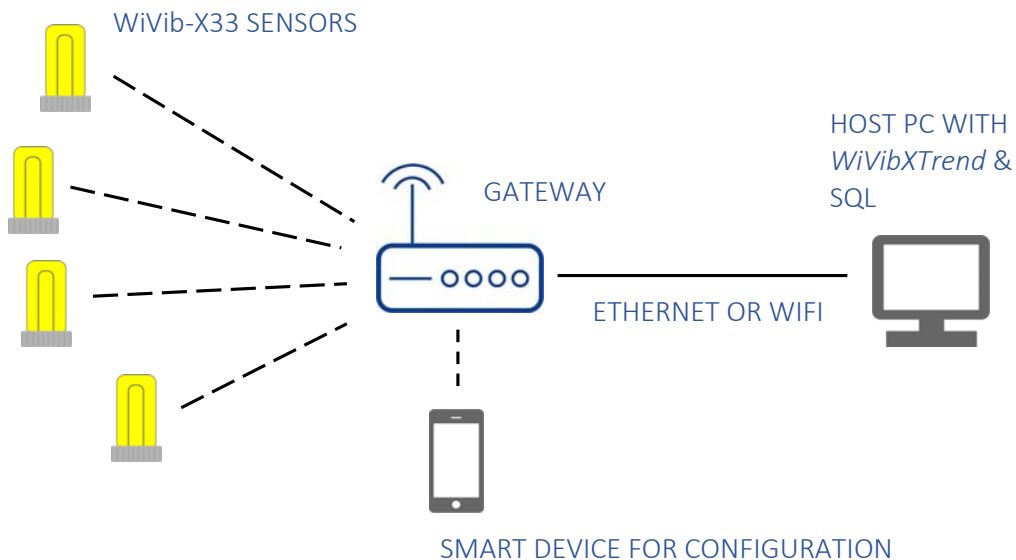

WiVib-X33 SENSOR

GATEWAY

The diagram below shows a typical arrangement. Virtually any number of sensors and gateways can be added to a network, and the application helps to decide the optimal topology of which sensors communicate with which gateway.

WiVib-X33 SENSORS

GATEWAY

HOST PC WITH
WiVibXTrend &
SQL

ETHERNET OR WIFI

SMART DEVICE FOR CONFIGURATION

The primary functions of *WiVibXTrend* are:

- acquire dynamic and static measurements from one or more *WiVib X*'s;
- trend the measured data and allow viewing of historical data;
- compare with preset alert/alarm limits and advise operators of out of limit conditions;
- allow display of current and historical spectral traces and other time data.

The features of the *WiVibXTrend* application are:

- simple step-by-step setup of measurement hierarchy;
- measurements can be taken from multiple *WiVib X* sensors via multiple gateways;
- straightforward user operation – just one main screen for all viewing;
- two modes of data acquisition - timed or on-demand;
- comparison of all measurements against preset alert and alarm levels;
- clear alarm displays, both on hierarchy, in tabular format and in 'traffic lights' summary;
- overlays of trended data;
- ability to view historical trended data with simple pan and zoom timebase functions;
- view of detailed time domain and spectral data, both current and historical with full cursor readout.

This manual will explain how to set up and run a system measuring a variety of different parameters.

1.2   Types of Measurement

Before starting, it is important to understand the types of measurement that the W*iVib X* devices can be programmed to carry out. These are:

1. *Overall Measurement* – this provides a single overall RMS value of the vibration level measured by the device. This can be acceleration or velocity. To cater for machines with high and low running speeds, acceleration can be *acceleration normal* and *acceleration fast*, and velocity can be *velocity normal* and *velocity slow*. The frequency bands of each type of measurement are shown in the table below. Note that the *Bearing Overall* is the demodulated overall value derived from the enveloped processing of the high frequency band filtered signal.

Measurement	Bandwidth
Acceleration Overall	10Hz – 1000Hz
Acceleration Fast Overall	10Hz – 10000Hz
Velocity Overall	10Hz – 100Hz
Velocity Slow Overall	2Hz – 1000 Hz
Bearing Overall (demodulated)	7.5Hz – 500 Hz

2. *Time/Spectrum Measurement* – the device gathers time domain traces of pre-determined length and sample rate that can be displayed in the time domain or processed to provide high-resolution spectra in the *WiVibXTrend* application. Time and spectral traces can be displayed simultaneously.

3. *Bearing Measurement* - the *WiVib X* contains a software HFE (high frequency enveloper) function that provides demodulated waveforms for bearing condition assessment. The HFE time domain record is usually processed to the spectral domain.

4. *Temperature Measurement* – the *WiVib X* contains a temperature sensor for measuring bearing temperature, or the surface temperature of where it is mounted.

1.3   Measurement Intervals

Typically, the system will be configured to take measurements at pre-determined intervals. Measurements are trended on the *WiVibXTrend* display. The usual approach is to take overall measurements more often than spectra in order to save battery life and minimise build-up of repetitive data records in the database. A typical scenario might be to measure overall vibration levels and temperature every two hours, and take a spectrum measurement twice a day.

To enable instant measurements (which is useful for service personnel or if a machine is showing issues), the system can take 'on-demand' vibration measurements at any time outwith the pre-determined schedule.

In summary, the *WiVib X* system allows for continuous 24/7 monitoring together with instant measurements when required.

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CHAPTER 2 – Installation

2.1　Software Installation

To get started, the application needs to be installed on a computer. The operating system on the computer should be Windows 10™ or Windows™ 11, 64-bit, and the screen should be full HD with display scaling set to 100%.

Installation is initiated from a single executable file either provided on USB flashdrive or downloaded from the Icon Research website. In either case, run the application *WiVibXTrendSetup.msi* and follow the instructions. The default location for the application and all support files is *C:\Program Files\WiVibXTrend* though you can modify this at installation time if you wish. It is recommended, however, to use the default location.

If your computer does not have a *.net* framework installed, you will be prompted to install this as below.
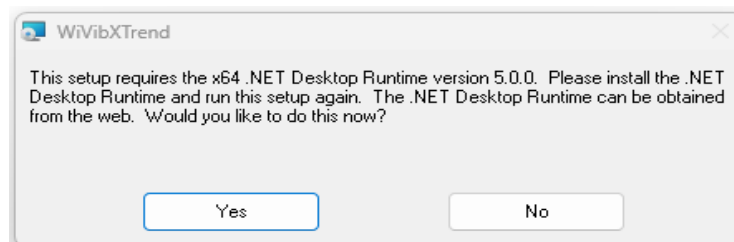
Clicking **Yes** will take you to the Microsoft website page *Microsoft Download .NET 5.0*. Look for the screen below and click on the x64 option.

If you were supplied with a USB flashdrive from Icon Research, run file *windowsdesktop-runtime-5.0.17-win-x64.exe* to install the framework. You will not need internet access in this case.

Note that Microsoft will update *.net* framework versions from time to time so do not be concerned if the *.net* version is updated from that quoted here.
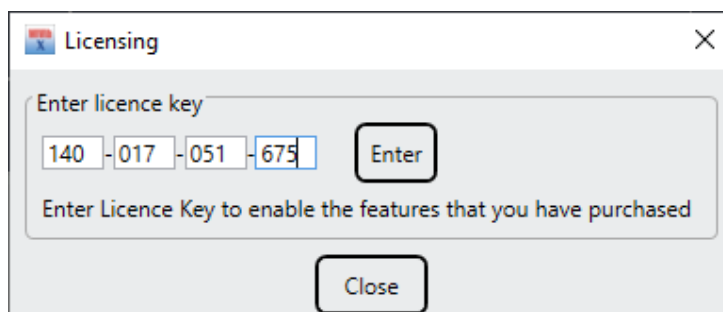
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A shortcut will be placed on your desktop. Click on the shortcut to launch *WiVibXTrend*.

You will also need to set up your database. Follow the steps in the next section.

2.2   Licensing

WiVibXTrend allows different levels of licence depending on the number of points in your system. The application is licence-free for small systems up to 10 points, thereafter a one-off fee is payable at two licence fee levels depending on number of points. You will be prompted to activate a licence if you attempt to add more than 10 points, or if you open a database that already has more than 10 points defined.

If you have more than 10 sensors in your system, or if you exceed 10 sensors as your system expands, a warning message appears informing you that a licence is required. Click on **About … Licensing … Enter licence** in the top menu bar and the following box will appear:

Enter your licence key and click **Enter**. On successful entry of your License Key you will see a screen similar to the one below – the *Enter activation code* field will be blank.

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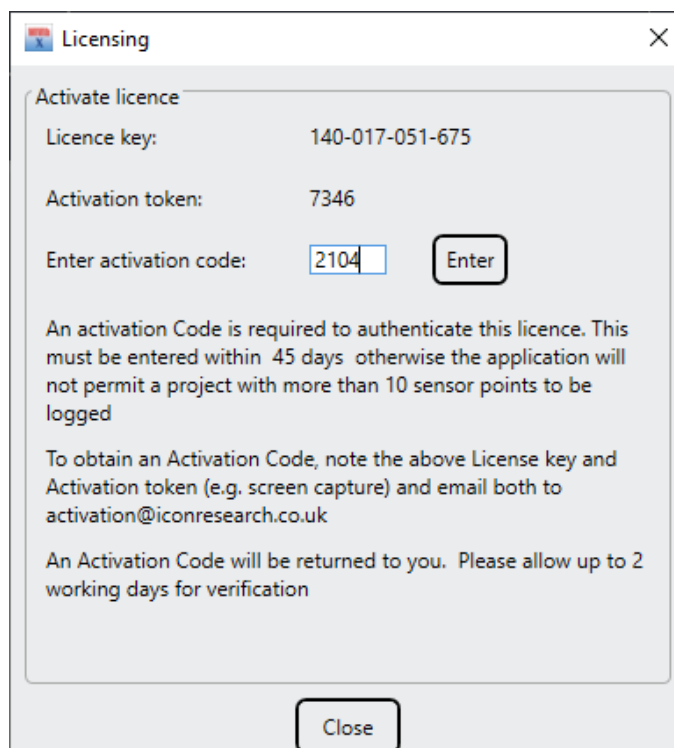
Make a note of the Licence key and Activation Token and send this to activation@iconresearch.co.uk. An activation code will be sent to you to activate the licence. Note that you can use the software for 45 days before an activation code has to be entered.   Once you have received your activation code, click **About … Licensing … Activate licence** to enter your code.

You can check your Licence Key., licence level and activation status at any time by clicking **About … Version** in the top menu bar, as below.

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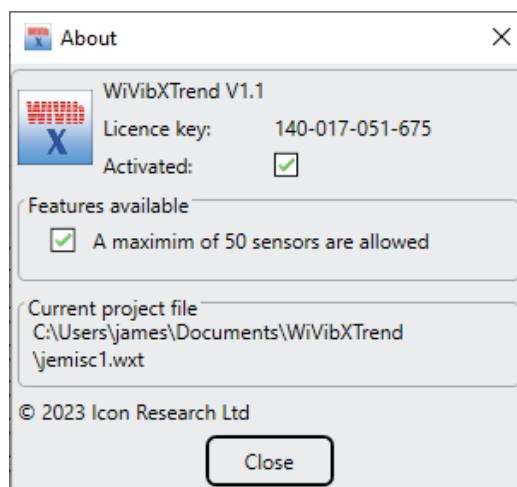
If you exceed the number of sensors allowed, or if you load a database that has more points specified than your licence allows, a warning will appear similar to below.
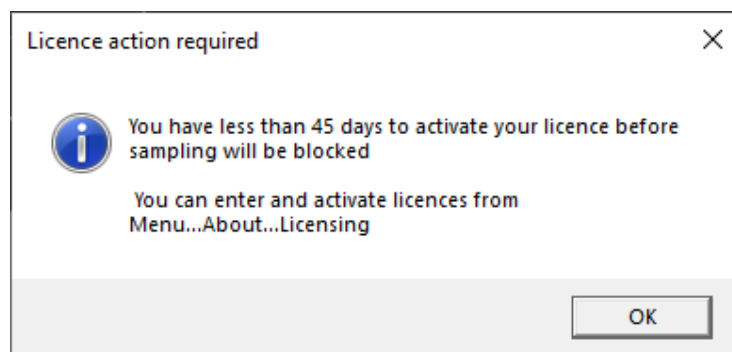
If you have lost your license key, contact Icon Research who can provide you with it.

2.3   Setting Up the Database

When you launch *WiVibXTrend* for the first time, you will be asked whether you wish to open an existing database that you may have access to, or if you wish to start with a new one. If you have database already installed, Click **File ... Open** to open it.
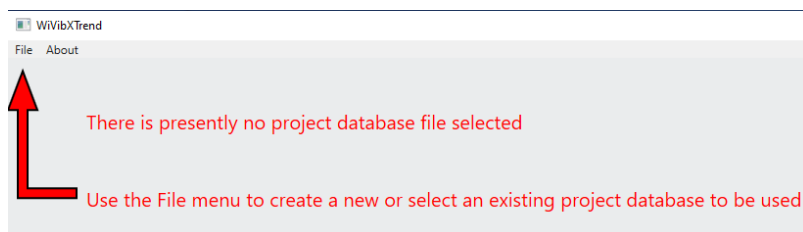
In most cases, you will be starting from fresh, in which case click **File … New**. The default database location *…\Documents\WiVibXTrend* will be shown but you can change this to any location you wish. Enter an appropriate file name and click **Save** to save the new database (suffix *.wxt*) in its chosen location. The screen below will appear.

There is also a folder called *Logging* which stores latest files of system activity for debug purposes. This folder automatically removes files to prevent it growing too large.

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You can check the name of the database currently in use by clicking **About … Version** in the top menu bar. A window similar to the one below will appear and you can check the file name and location under *Current project file*.
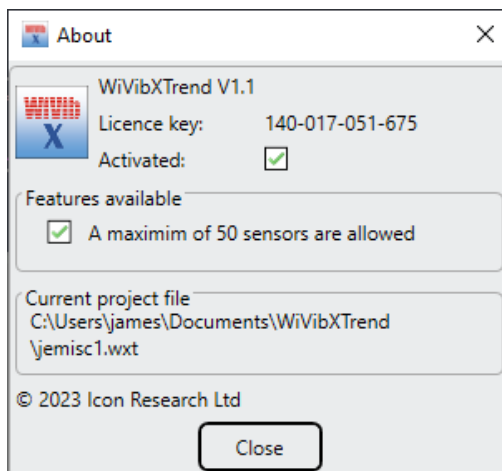
2.4   Backing Up the Database

You can back up your database at any time by clicking **File … Backup …** in the top menu bar.   There are two configuration options that you can click on:

Config only: This saves the configuration setup information only (ie. no measurements) and is useful if you are preparing a database at a location different from where application will be running

Config and data: configuration and measurements (ie. the contents of the database) are backed up.

In both case, a *.wxt* file is created.

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CHAPTER 3 – Gateway Configuration

3.1   Configuration Overview

Prior to running the system, it is necessary to configure the following:

1. Network topology (network settings for gateways and allocation of sensors to gateways) – refer to chapter 2;

2. Definition of points in hierarchy (details of machine areas and point names on those machines) – refer to chapter 3;

3. Setting of alert and alarm limits for measurement points (manual or ISO10816) – refer to chapter 3;

4. Specifying sample rates (how often overall and spectral measurements should be taken) – refer to chapter 3.

It is recommended that the system password is changed early to one of your choice (refer to section *Changing Password*). Additionally, refer to the chapter *System Maintenance* for database management and software/firmware updating.

3.2   Gateway Layout

The *WiVib X* gateway provides a number of interfaces as shown in the following diagrams. Note that the left panel comprises several optional interfaces so not all interfaces shown may be present.

Front Panel
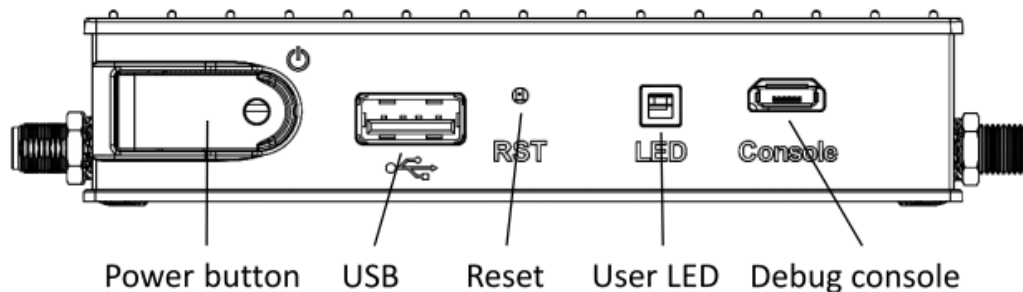
Notes:
The Power button needs to be held in for a short time to operate. This is to prevent accidental switch off.

Rear Panel
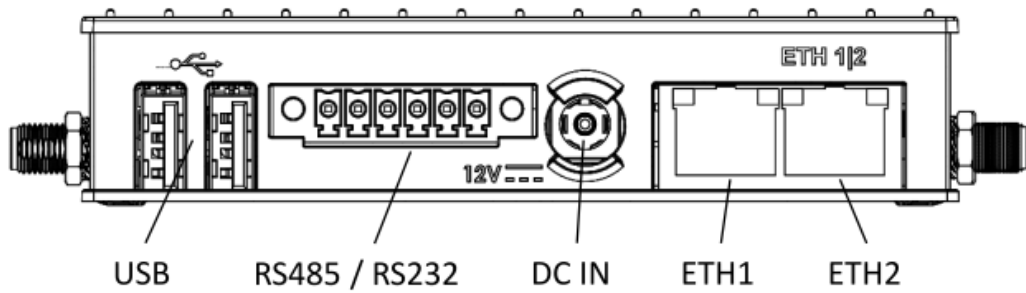
Notes:

The DC IN power connector is inserted then twisted to lock in position in order to prevent accidental disconnection by pulling.

ETH1 is a 1000Mbps auto negotiating Ethernet port, while ETH2 is a 10/100Mbps auto negotiating Ethernet port.

Left Panel
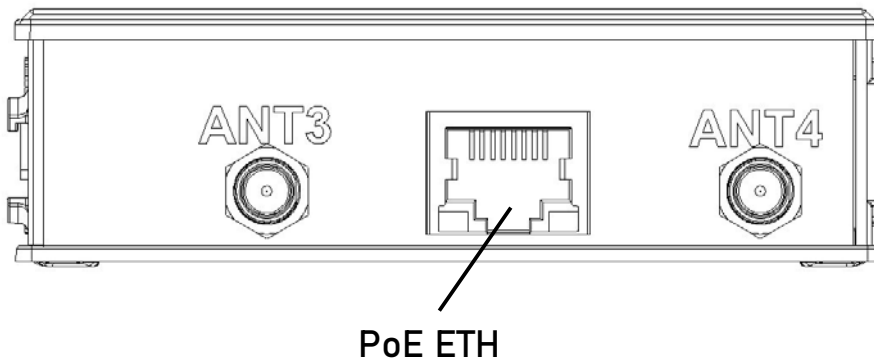
PoE ETH

Notes:

The PoE ethernet port is the preferred port for network connection.

ANT 3 is for GPS/GNSS and is not currently used.

ANT4 is for the optional cellular network link (currently not implemented).

Right Panel

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Notes:

ANT 1 is required for the Bluetooth network and must be connected.

ANT2 is only required if a WiFi network is in use, otherwise it should be left disconnected.

The gateway is supplied with all the latest software pre-installed and with a license already registered with Icon Research. It will need to be configured before deployment.

In order to perform the configuration, the power adapter should be connected to the DC IN socket and the unit switched on. An ethernet cable on the network you wish to use should be connected to the PoE port. The ethernet port is auto negotiating so it can be either directly connected to a computer or onto a local network via a hub/switch.

3.3   Configuring Gateway Communication

The gateway incorporates a web server interface which allows configuration using any IoS or Android smart device such as a mobile phone or tablet. As delivered, the gateway acts as an access point so that it will appear in the list of available networks on your smart device. Note that ANT2 on the gateway is used for wifi communication and will need to have an antenna connected.

The wifi network you see will be *WiVibXGateway_ABCDEF* where *ABCDEF* is the last 6 characters of the MAC ID label on the gateway itself. Connect to this network - no password is required. It may report as not having internet access but this can be ignored.

On Android, tap on the *Settings* icon next to the network name (cog wheel) and tap *Manage Router.*
On IoS, open browser and enter the URL 10.42.0.1.
In either case, you will be presented with the *Home* screen.

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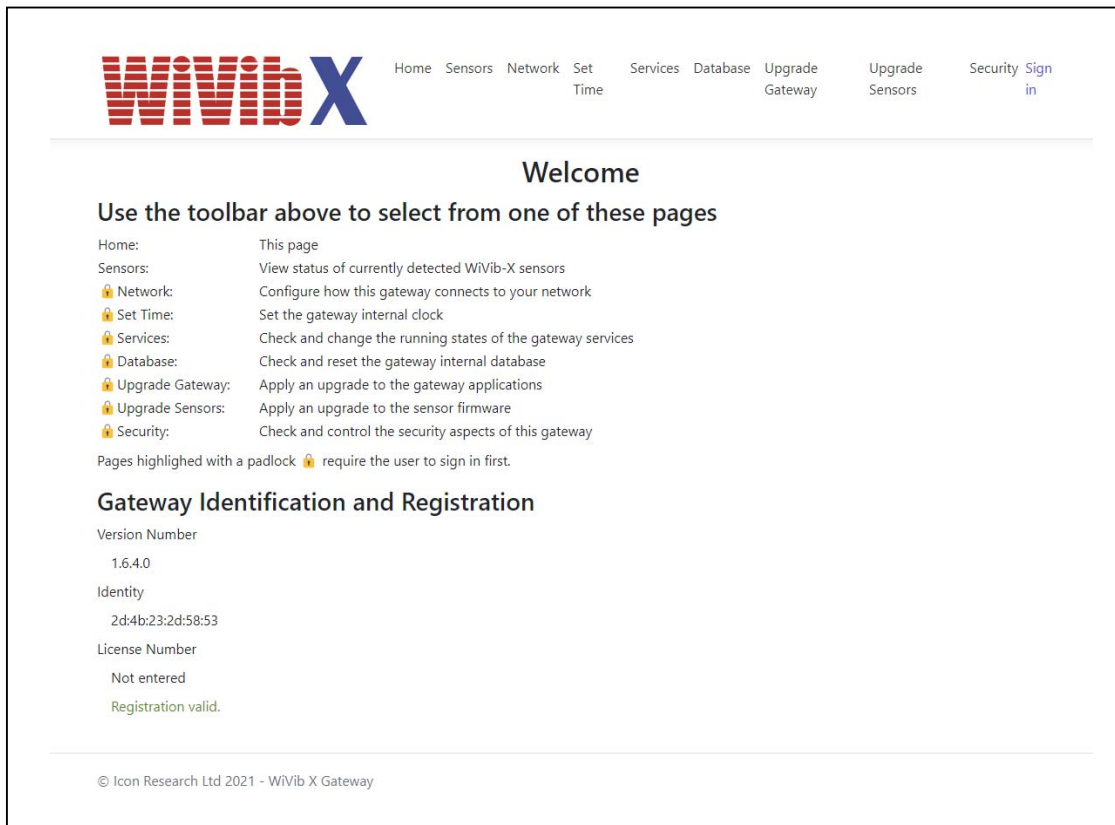
The pages break down into four main categories:

Monitoring
       Sensors – List the sensors currently detected
Configuration
       Network – Configure the gateway for your network
       Set Time – Configure the gateway for your time zone
       Security – Change the password for the gateway
Maintenance
       Services – Restarting the internal gateway services
       Database – Monitor and maintain the internal database size
Upgrading
       Upgrade Gateway – Upgrade the gateway application software
       Upgrade Sensors – Upgrade the sensor firmware

At the top of each page is the navigation toolbar which allows any page to be selected regardless of which page is currently being viewed.

Note that all the pages other than those for monitoring are protected and require the user to *Sign in*.

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SIGNING IN

First you will need to sign in. Click *Sign in* and you will then be presented with the Sign In page as below. Use the word *compulab* for both username and password to sign in.

Sign in

Sign in using an approved account for the gateway

Permissions will be granted for 30 minutes

UserName

Password

Sign in

If the application computer is not in the UTC time zone, then the gateway needs to be set to the same time zone as the *WiVibXTrend* app. If this needs to be changed, refer to the *Setting the Time* section later in this chapter.

CONNECTING TO AN ETHERNET NETWORK

Next the gateway needs to be configured to work on the required network. Click on *Network* and the following screen will appear. If you are connecting to an ethernet LAN, it is recommended always to use the *Ethernet PoE* port, so click on this. Leave the other ethernet ports in their default state.

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Network Configuration

All of the network ports can be configured at the same time.

Gateway Network Name

[wivibxgateway]

This is the network name that can be used to identify the gateway without knowing any of its network IP addresses
This requires a name server to be operating on the network to operate correctly

| Ethernet PoE | Ethernet 10/100Mbps | Ethernet 1000Mbps | WiFi |

Ethernet PoE

○ No network detected

◉ Obtain an IP address automatically
○ Use the following IP address:

    IP address: [   ]
    Subnet mask: [   ]
    Gateway: [   ]
    DNS Server: [   ]

It is recommened to use this ethernet port for the gateway connection even if not using PoE to power the gateway
This leaves the remaining ethernet ports unchanged to ensure a connection for later reconfiguration purposes

[Set to defaults]

Clicking this button will reset all the network settings to the factory defaults
Note you have to still click the Update button below to apply these settings to the gateway

[Update Network]

Clicking whis button will update the gateway for the currently selected settings
If you have changed the network you are currently using you may have to manually reconnect your browser using thhese new settings

It is recommended to use a static IP compatible with your network. Select the *Use the following IP address* option and enter the *IP address*, *Subnetmask* and *Gateway.* An entry for the gateway is required even if there is no router present, in which case enter the IP address of the computer. Click *Update Network* to apply the settings.

CONNECTING TO A WIFI NETWORK

If you wish to connect to an existing WLAN wifi network, click on WiFi and the screen below will appear. Note that ANT2 on the gateway is used for wifi communication and will need to have an antenna connected.

The gateway can operate as an Access point where it enables its own private wireless network. This is useful for small systems, or where no wifi network is present. In this case, select *Access Point Mode*. If you wish to connect to an existing wireless network, select *Client Mode*.

In *Access Point Mode*, a screen similar to the one below will appear.

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Ethernet PoE   Ethernet 10/100Mbps   Ethernet 1000Mbps   **WiFi**

WiFi

- ◉ Access Point Mode
- ○ Client Mode
  - SSID: `WiVibXGateway_30cdfb`
  - Password: [ ]
  - Channel: [Channel 7 ⌄]

The WiFi port can be used in either Client Mode to connect to an existing WiFi network

Or in Access Point Mode to provide its own WiFi network and provide a private connection to the gateway

The password can be left blank (ie. unsecured) as there is no other access available to this network.

When joining in an existing network, select *Client Mode* and a screen similar to the one below will appear.

Ethernet PoE   Ethernet 10/100Mbps   Ethernet 1000Mbps   **WiFi**

WiFi

- ○ Access Point Mode
- ◉ Client Mode
  - SSID: [Other network ⌄] `WiVibXGateway_30cdfb`
  - Password: [ ]
  - Channel: [Channel 7 ⌄]
- ◉ Obtain an IP address automatically
- ○ Use the following IP address:
  - IP address: [ ]
  - Subnet mask: [ ]
  - Gateway: [ ]
  - DNS Server: [ ]

The WiFi port can be used in either Client Mode to connect to an existing WiFi network

Or in Access Point Mode to provide its own WiFi network and provide a private connection to the gateway

Either select the network that you want to connect to from the SSID dropdown list or select *Other Network* and type in the SSID in the adjacent box manually followed by the password if it is a secured network.
It is recommended to use a static IP compatible with your network. Select the *Use the following IP address* option and enter the *IP address*, *Subnetmask* and *Gateway*.

Note that once WiFi is set for *client mode*, the "Update Network" will mean you can no longer connect to the device as has been done in this example, any further web page access would need to use the IP address entered into the gateway.

Your gateway is now ready for use. The next step is to connect *WiVib X* sensors. This is explained in the next section.

3.4   Connecting Sensors

Click on the *Sensors* tab on the *Home* page and a list of sensors that the gateway has detected will be displayed. Each sensor has a variety of characteristics shown.

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WiVib X Sensors

N/S indicates the device has not been seen recently by this gateway

N/C indicates the device is not configured to be used by this gateway (but may be configured by another)

Serial Number	BSID	Battery Percent	Firmware Version	RSSI (dBm)	Surveillance Overalls	Route Traces	Details	Remove
000042	FB:28:61:6D:A3:60	100 %	01.03.04	N/S	2	1	Details	
000103	FC:DB:D3:94:42:48	100 %	01.03.04	N/S	2	1	Details	
000104	FC:F8:78:F9:1D:0C	100 %	01.03.04	N/S	2	1	Details	
000105	D1:7F:1D:2E:7B:2A	100 %	01.03.04	N/S	2	1	Details	
000106	DB:7E:A4:8F:10:3A	100 %	01.03.04	N/S	2	1	Details	
000107	F6:43:B9:E5:8B:A2	100 %	01.03.04	N/S	2	1	Details	
000108	D4:A3:B0:C2:62:C7	98 %	01.03.04	N/S	2	1	Details	
000109	F3:B8:89:58:B6:C7	85 %	01.03.04	N/S	2	1	Details	
000110	C6:B3:AC:1B:2F:93	98 %	01.00.00	N/S	N/C	N/C	Details	🗑
000115	E7:CA:8F:58:34:BF	100 %	01.03.04	N/S	2	1	Details	

Note the following:

- Even though a sensor can be seen by a gateway, the gateway may not be in control of that sensor. If a sensor is not being controlled by the gateway both its *Surveillance Overalls* and *Route Traces* will be indicated as *N/C* (not connected).

- If a sensor has not been seen recently, the RSSI value (signal strength) will be displayed as *N/S* (not seen). A sensor will remain as *N/S* until seen initially for up to 15 minutes.

- Any sensor that is not controlled by the gateway can be deleted by clicking the 🗑 icon in the *Remove* column. Note that if the sensor is subsequently re-seen it will be added to the list.

3.5   Setting the Time

If the gateway is going onto an established network with an internet router then this will supply an accurate time clock.   Otherwise, a manual time setting may be required

The gateway can automatically obtain the correct time from a local network clock server. If this has been selected, then the status of the gateway's clock synchronisation will be displayed as *Yes* or *No*. If this is *No,* then it may be that such a server does not exist and the time should be manually set instead, in which case

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select *Manually set to current time*, ensure the time shown is correct and click *Change Time*.

The default time zone for the gateway is UTC and, regardless of time zone, all data is stored using explicit UTC references to avoid any confusion as to when data was read.

3.6   Changing Password

Because all gateways are shipped with the same default settings, to prevent unauthorised access, the password should be changed. The password is changed instantly so will be required for the next security login.

Note that if the changed password is forgotten, there is no way to recover it using remote access to the gateway and a direct USB console link will be required.

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CHAPTER 4 – Setting Up Measurements

4.1   Steps Required to Set Up Your Measurements

There are a number of steps that should be followed to configure your system, and these are summarised below:

1.   Decide on the global preferences for your system (units, resolutions etc);
2.   Decide what measurements you want to make on your machinery and define your hierarchy accordingly;
3.   Assign *WiVib X*'s to the measurement points;
4.   Set up measurement parameters for each measurement together with how often you want to take measurements.

We will now look at each of these steps in detail, referring to the example discussed in the previous chapter.

4.2   System Preferences

Before starting, it is necessary to set your global preferences for the system. Launch WiVibXTrend and the following screen will appear.
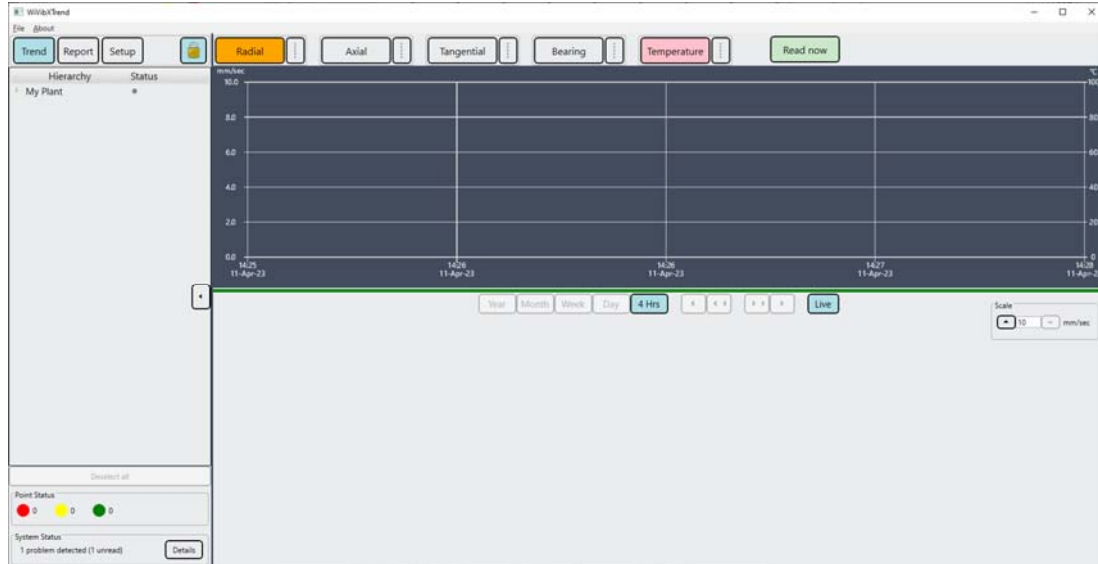
Now click on **File … Preferences** and the screen below will appear.

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The following settings need to be specified:

Units: select whether measurements are in metric or imperial units for vibration or temperature.

Spectrum resolution: when taking spectral measurements, these can be specified as standard resolution or high resolution. The number of lines is set globally for the system. Use the dropdown lists to specify your choices.

Spectrum display: the type of spectral window is selected here, together with the option of RMS or peak spectral display.

Frequency units: the x-axis on spectral graphs can be displayed in Hertz or RPM.

Battery checking: enter a value in percent for the percentage of battery life remaining when you wish to be warned.

Note that these parameters are password protected. To make changes, you have to unlock the system. You can do this by clicking on the padlock symbol 🔒 which will bring up the following screen. The default password is *wivibxtrend* (all lower case) but you can change this if you wish. Click **OK** to confirm.

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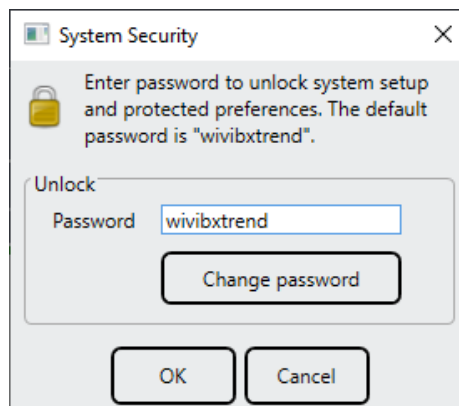
To lock the system, click on the open padlock symbol.

Note that, if you forget your password, you will have to contact Icon Research for an application that resets the password. This application is not downloadable from the website to protect security.

4.3   Editing the Hierarchy

WiVibXTrend uses a hierarchy as the basis for navigating around the measurement points in a plant. The simplest hierarchy is *Plant .. Machine .. Point*. *WiVibXTrend* allows for multi-level hierarchies (as will be described later) but, for now, we will proceed with the simple one as described.

The hierarchy is found in the left panel as in the picture above. On opening the database, it is at the plant level, in this case the plant being called *My Plant*.
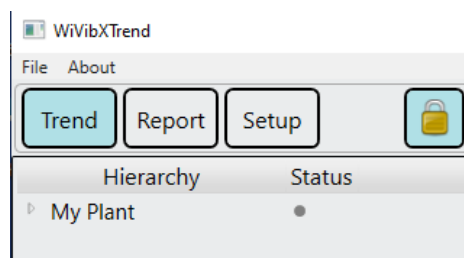
By clicking on the horizontal arrow on this level (to the left of *My Plant*), the hierarchy is expanded to machine level. Clicking on the arrow at machine level expands to point level as shown in the picture below.
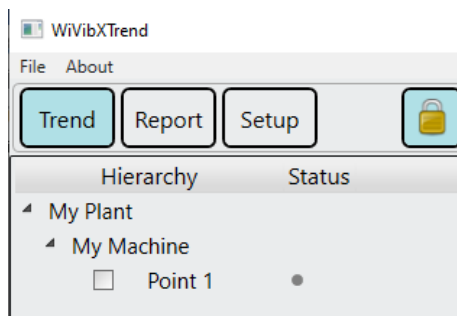
The names are default and can be changed but you first have to unlock the system. You can do this by clicking on the padlock symbol [🔒] which will bring up the following screen. The default password is *wivibxtrend* (all lower case) but you can change this if you wish. Click **OK** to confirm. To lock the system, click on the open padlock symbol.

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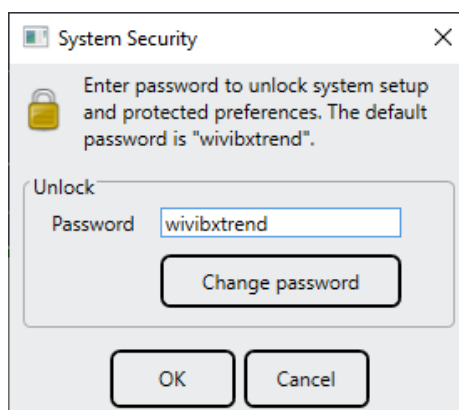
Note that the padlock is now 'open'. Now click on **SETUP** and right click on *My Plant*. The screen below will appear enabling you to change the name by clicking on *Rename*.
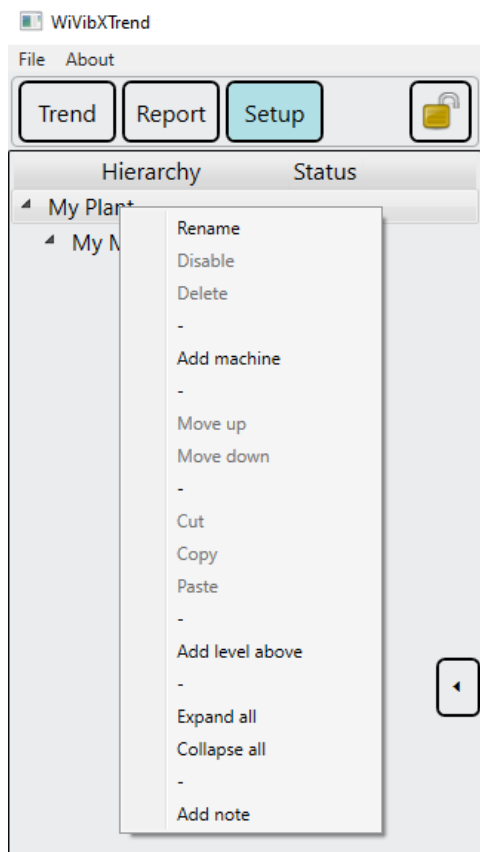
In this panel, you can also add a machine to your plant by clicking *Add machine*. You can also add another level to your hierarchy by clicking *Add level above*. Refer to section *Adding a Hierarchy Level* for details – DO NOT add a hierarchy level until you have read this section.

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4.4   Example Measurement Setup

In this manual we will go through the steps required to set up a simple example logging application. The configuration will be fairly concise, but will illustrate all the features of *WiVibXTrend*. The number of points being measured can be expanded as required.

What we have is a plant called the *Fast Food Factory*. On the plant we are taking measurements on two machines, namely *Mixer A* and *Conveyor Motor A*. On *Mixer A*, we are measuring the velocity vibration overall, velocity spectrum, bearing condition overall and temperature of the Motor Drive End *(Motor DE)*, together with the velocity overall and temperature of the Motor Non-Drive End (*Motor NDE*). On *Conveyor Motor A*, we are measuring the velocity overall, velocity spectrum, bearing overall and temperature of the Motor Drive End (*Motor DE*).

Therefore, in total we are taking <u>ten</u> measurements and we are using three *WiVib X* sensors, one to be mounted on each of the *Motor DE* and *Motor NDE* of *Mixer A*, and one on the *Motor DE* of *Conveyor Motor A*. The serial numbers of the three *WiVib X*'s are assigned in the right hand column.

The hierarchy below summarises the configuration.

Measurement Hierarchy			Measurement	WiVib X Assigned
Plant	**Machine**	**Point**		
Fast Food Factory				
	Mixer A			
		Motor DE	*Velocity Overall*	*WiVib X 000108*
			Velocity Spectrum	
			Bearing Overall	
			Temperature	
		Motor NDE	*Velocity Overall*	*WiVib X 000110*
			Temperature	
	Conveyor Motor A			
		Motor DE	*Velocity Overall*	*WiVib X 000203*
			Velocity Spectrum	
			Bearing Overall	
			Temperature	

Note the following points from the table above:
- The measurement hierarchy sequence is *Plant … Machine … Point*.
- One *WiVib X* is assigned to each *Point*.
- A *WiVib X* can take several different measurements from one *Point*.

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- Several different types of measurement are possible – vibration overalls/spectra, bearing overalls/spectra, temperature – we will specify these next.

DEFINING THE HIERARCHY

We'll go ahead and create our hierarchy by adding machines, adding points and renaming (by right clicking on the appropriate hierarchy item). Note that, when adding a point, you must choose the type of vibration you want to measure (acceleration, velocity etc) as in the screen below by clicking, for example, *Add velocity point*.
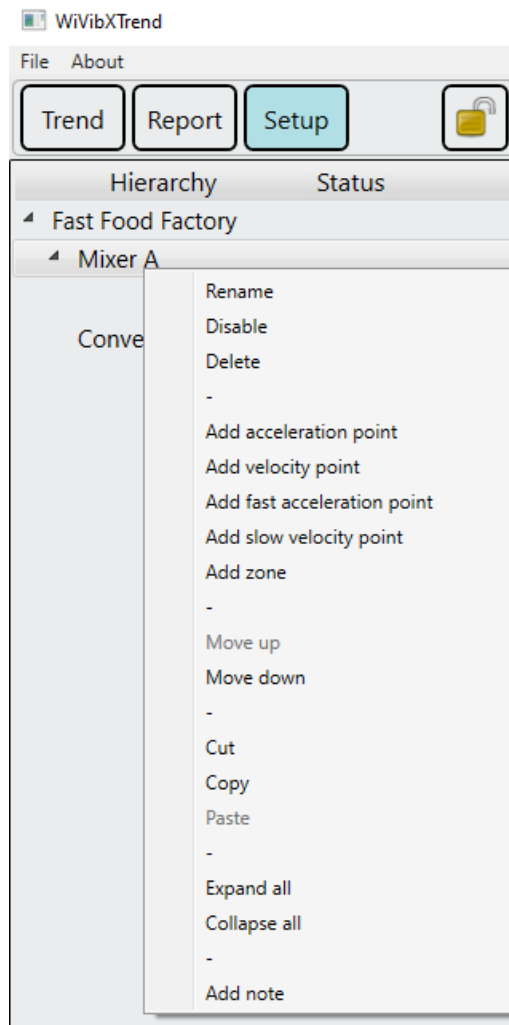
Once complete, our hierarchy should look like this.

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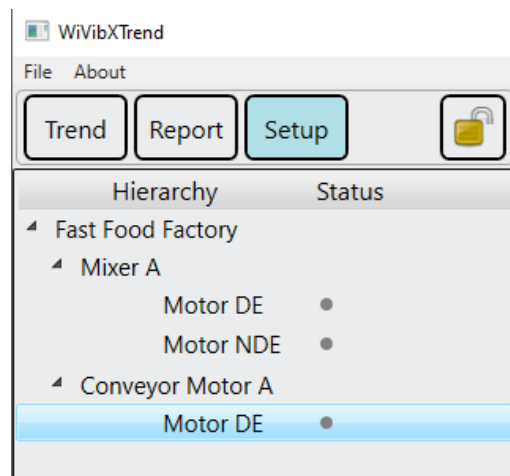
The previous table is a useful template when designing your own system configuration. You can add further information in additional columns eg. your measurement parameters, gateways assigned etc.

TIPS

Here are some useful tips to make the setup process easier …
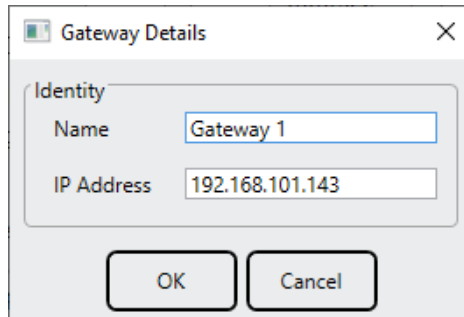
Tip 1: You can change the position of an entry of the hierarchy using the *Move up* and *Move down* commands. You can also delete any level of the hierarchy, and its sub-levels, using the *Delete* command.

Tip 2: For larger systems, you can use the *Copy* and *Paste* commands to save repeating entries for machines that have the same configuration. For example, you can copy an entire machine (and its sub-levels), paste it and then rename it to make a duplicate machine.

ASSIGNING GATEWAYS AND SENSORS TO POINTS
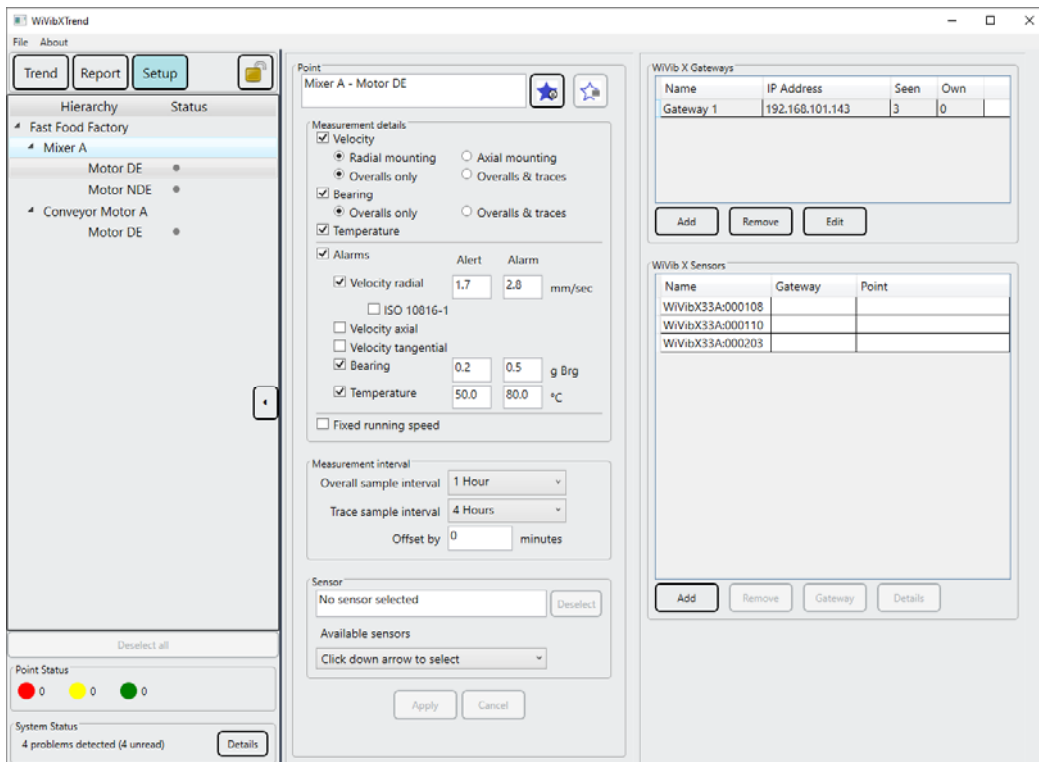
Now that we have our hierarchy defined, we will add sensors to the points, specify the measurements that we want to take and define the measurement parameters and alert/alarm levels. As we have already setup our gateway (as in chapter 2) and the sensors assigned to it, we can access it now. Looking at the SETUP screen, on the *WiVib X Gateways* panel on the right side, click *Add* and the box below will appear. Give the gateway a name of your choice by typing it in the field *Name* and enter the *IP Address* that you assigned to this gateway in chapter 2 (this will identify this gateway uniquely). Click **OK**.

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The gateway will appear in the *WiVib X Gateways* list and the *WiVib X Sensors* list will populate with the sensors associated with that gateway. In this example, the number of sensors *Seen* is 3.

We are now ready to assign sensors to measurement points. In the screen below, in the *Available sensors* dropdown in the centre panel, select the measuement point in the hierarchy, then select the sensor from the dropdown list. Click **Apply**. The measurement point appears under *Point* at the top of the centre panel and the senor appears in the *Sensor* field. Do the same for the other points. The *WiVib X Sensors* field will populate with your selections as shown in the screen below.

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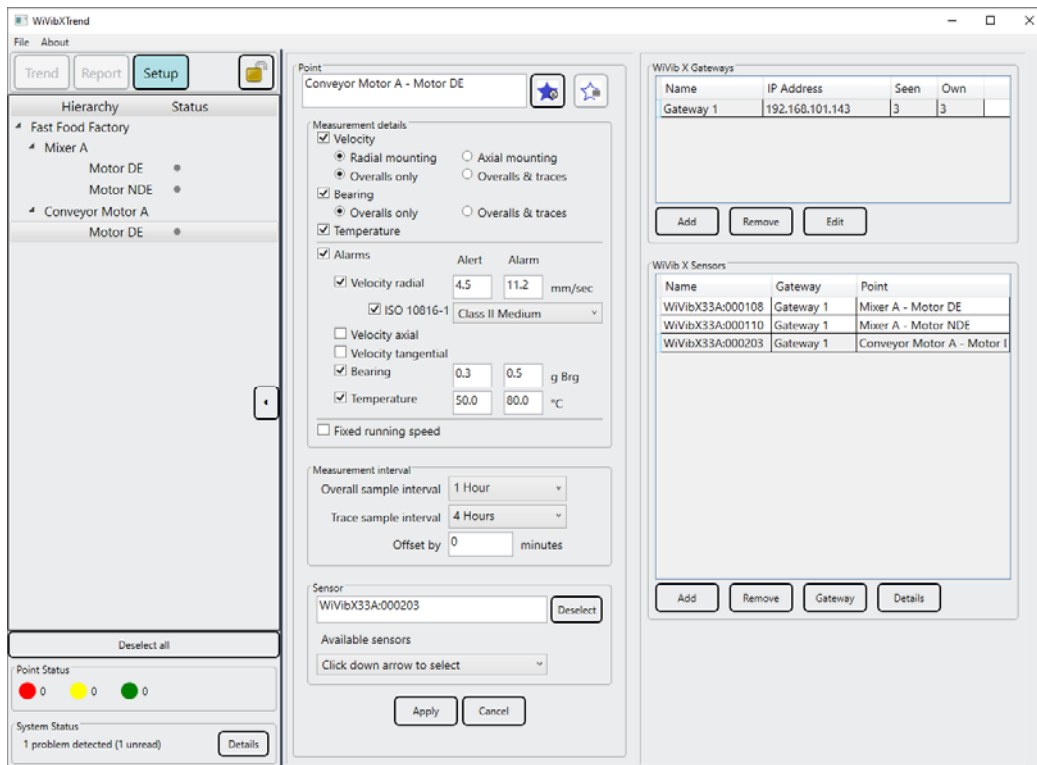
If you wish to change the sensor you have assigned to a point, you can click on **Deselect** and select another available sensor.

If you have multiple gateways, you will have to allocate which gateway you wish each sensor to connect to. In this case, select the sensor in the list and click the **Gateway** button. The signal strength as seen by the gateway will be shown as in the picture below. You will usually select the gateway with the highest signal strength. Select the gateway with the best signal strength from the dropdown list and click **Select Gateway**.

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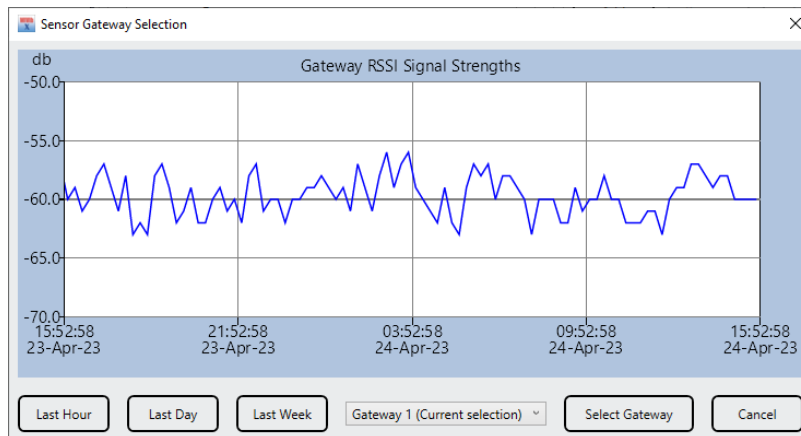
It is possible to assign sensors to points and to gateways without any hardware being present. In this case, click the **Add** button in the *WiVib X Sensors* panel and you will be prompted for a serial number.

DEFINING MEASUREMENT PARAMETERS AND ALARM LIMITS

We are now ready to specify the measurements that we want to take and the alert/alarm levels associated with those measurements. This is done on a point-by-point basis in the centre panel of the SETUP screen.

First, click on a point in the hierarchy that you want to set up. The procedure is the same for all points. In the example below, we have clicked on *Conveyor Motor A – Motor DE* and this appears in the field at the top of the panel. Note that we had already defined this point as a velocity point when we added it to the hierarchy, so *Velocity* is selected under *Measurement details*.

Mounting: First we select if the sensor is radially or axially mounted – this orientates the X, Y, Z axes of the sensor correctly. In most cases, the sensor will be radially mounted (ie. looking into the shaft of the machine, and this will be the X axis). In practice, you don't have to be concerned about which axis is which.

Overall and Traces: you now decide whether you wish to measure overall vibration levels only or overall values and traces (ie. time and spectral traces). Select with the radio buttons appropriately. Note that the number of spectral lines in the *Standard Resolution* and *High Resolution* options are globally set in *Preferences*. The same applies to *Velocity* and *Bearing* in this example.

Temperature: Select if you wish temperatures to be measured by setting the tick box appropriately.

Alarms: You can select whether you want to turn alarming on or off by clicking the *Alarms* tick box appropriately. If you turn alarms on, alarm setting options will appear for the measurements you have specified. Alert and alarm levels can be set in the appropriate fields.

Alternatively, alert and alarm levels can be automatically set according to the ISO10816-1 standard by clicking on the *ISO10816-1* tick box. The desired class of machine can be selected and the equivalent levels are specified. These can be modified manually if desired. The table below shows the vibration severity levels according to the standard.

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Vibration Severity Per ISO10816-1					
Velocity (RMS)		Machine Class			
mm/sec	in/sec	Class I Small (< 15kW)	Class II Medium (15 to 75kW)	Class III Large Rigid (> 75kW)	Class IV Large Soft (> 75kW)
0.28	0.01				
0.45	0.02				
0.71	0.03		Good		
1.12	0.04				
1.80	0.07				
2.80	0.11		Satisfactory		
4.50	0.18				
7.10	0.28		Unsatisfactory (Alert)		
11.20	0.44				
18.00	0.70				
28.00	1.10		Unacceptable (Alarm)		
45.00	1.77				
To convert Velocity (RMS) to Velocity (Peak), multiply value by 1.414					

Note that yellow and red lines appear on the *TREND* graph showing the alert and alarm levels specified.

Fixed running speed: if this option is selected, the nominal running speed of the machine can be specified. Lines can optionally be shown in the time domain traces equivalent to each revolution, and spectra are shown in orders.

DEFINING MEASUREMENT INTERVALS

The last item that needs to be specified is how often measurements are taken. These intervals can be defined separately for overall and time/spectrum readings as in the *Measurement interval* panel. Time/spectrum measurements can be offset in time by a number of minutes to prevent all the sensors in a system coming on at the same time and flooding the network. It is suggested to stagger sensor measurement times in groups by applying different numbers of minutes in the *Offset by* field.

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4.5   Adding a Hierarchy Level

WiVibXTrend uses a hierarchy as the basis for navigating around the measurement points. For larger systems, it might be desirable to add another level to the hierarchy. For example, instead of the *Plant..Machine..Point* hierarchy that we have used in our example so far, it might be desirable to have *Plant..Room..Machine..Point*. To add a new level, right click on the top level of the hierarchy and click on *Add level above*. This will add a new level *My Plant* above the existing one and you are invited to rename the level below. In other words, the hierarchy is pushed down one level.

4.6   Helpful Hints

DISABLING A POINT

One final point to note is that settings are automatically checked when leaving the *SETUP* screen. If an error is reported, no measurements will be taken for that point.

If you have defined a point but have not yet allocated a *WiVib X* sensor to it, you can disable the point by right-clicking on it and selecting *Disable*. The system can gather data from allocated points and you can re-enable the disabled point when you have allocated a device at some time in the future.

FAVOURITE CONFIGURATIONS

At the top of the measurement setup panel, you can specify a configuration as a favourite and recall it in a similar way to an internet browser. This saves having to enter the same measurement settings repeatedly.

COPYING AND PASTING HIERARCY ITEMS

To save repeatedly configuring the same items in a hierarchy, you can copy and paste levels. This will be useful if you have a lot of the same machines in a plant or room, or if you wish to duplicate a room, for example. You can simply copy, paste and rename.

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CHAPTER 5 – Using WiVibXTrend

5.1   TREND Screen

Clicking on the **TREND** button brings up the *TREND* screen. This is the main viewing screen of *WiVibXTrend*. A typical screen is shown below.
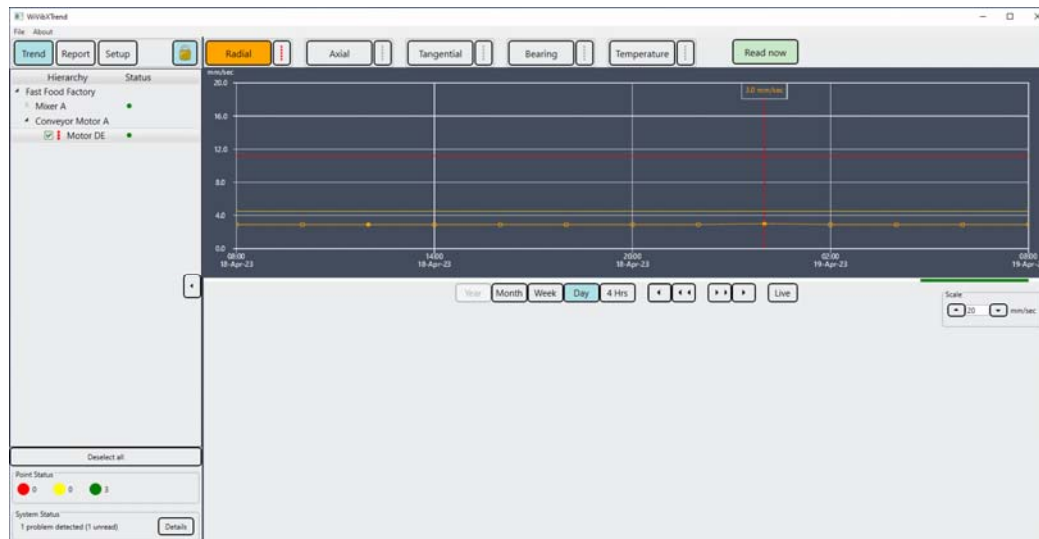
The display features of the *TREND* screen are described below.

5.2   Trend Display

The main upper display shows a trend of amplitude versus time for points selected on the hierarchy. First, a point is selected in the hierarchy in the left panel by clicking in the tick box, and then the measurements can be selected in and out in the main trend graph. Typically, these will be triaxial vibrations, bearing and temperature. The measurements that can be displayed are shown in the picture below.

Clicking on a measurement type (eg. **Radial**) displays the radial measurements for that point. Multiple measurements can be displayed on the same graph – the colour of each line matches the colour of the button (eg. the radial trace will appear as orange). A measurement that is an overall only, or temperature, is shown as a hollow circle whereas, if there is a time/spectral trace associated with a measurement, the circle is solid. When multiple traces are being displayed, only one trace will have the circle identifiers – this trace is identified by a vertical dashed red line in the hierarchy.

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Cursor readout is available, and the trace that the cursor is valid for is selected by clicking in the box next to the measurement type, confirmed by the red vertical dashed line.

Clicking **Read Now** initiates an on-demand reading for the <u>whole machine</u> associated with the point(s) selected. This can take some time and the button will display *Waiting…* until the operation is complete (with a 30 minute timeout). The number of points read is updated in the *System Status* panel as the operation proceeds.

Buttons for panning and zooming in time are under the trend graph, as shown below. The time period of the graph can be selected and panned left and right in small or large increments using the arrow buttons. **Live** takes you back to current time.
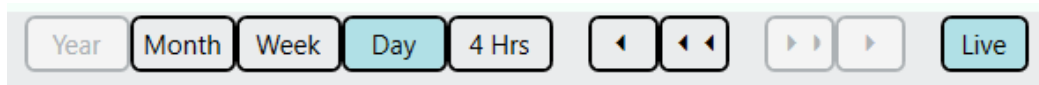
For comparison purposes, multiple traces can be displayed on the trend graph. These are selected by ticking in the appropriate tick boxes on the points in the hierarchy. If, for example, a temperature trace is selected with a vibration trace, the temperature units appear on the Y-axis on the right. Cursor readout is shown for one trace only, and this is identified by the dashed line next to the point in the hierarchy.
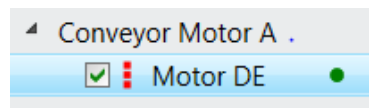
Vertical scaling can be adjusted in the Scale box under the trend graph. Click the up and down arrows to adjust the scale.

Alarm limits are shown on the trend graph (yellow for alert and red for alarm) only when one trace is selected (as alert/alarm limits can be different for any measurement).

The status of any point is shown as a coloured dot next to the point in the hierarchy (green, for good, yellow for alert and red for alarm). Note that, before any measurements have been taken, all coloured buttons will appear grey as their status is unknown.

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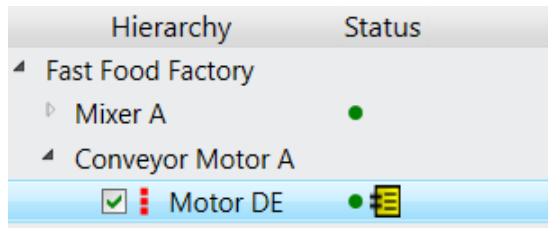
A note can be added to a point at any time. Right -click on the name of the point in the hierarchy and select **Add note**. Add your note and click **OK**. A yellow document symbol will appear next to the point, as shown in the picture above. You can edit an existing note by clicking on the note symbol.
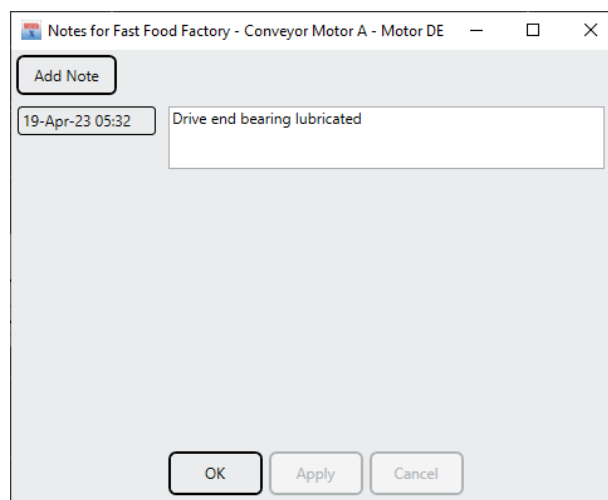
A summary of the plant is shown at the bottom of the hierarchy panel. The summary is useful for viewing overall plant status without having to scroll through a lengthy hierarchy structure.
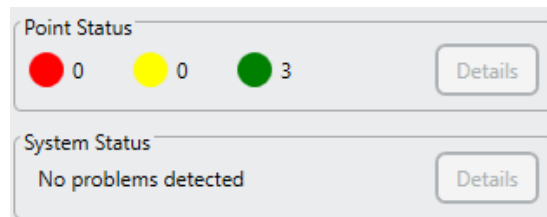
In the event of an alert or alarm being active, clicking **Details** will provide further information. Alerts and alarms can be acknowledged here so that they no longer appear as unread. Likewise, details of system problems can be expanded here. An example is shown below.

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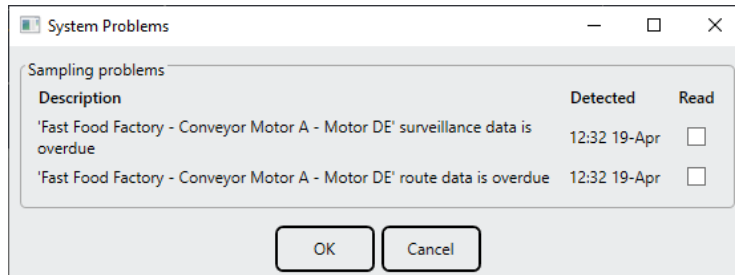
5.3 Trace Displays

As mentioned earlier, a solid circle on the trend graph indicates that a time/spectral trace is available for this measurement. Double-clicking on the solid circle brings up trace graphs for that point in the area below the trend graph, as shown in the picture below.
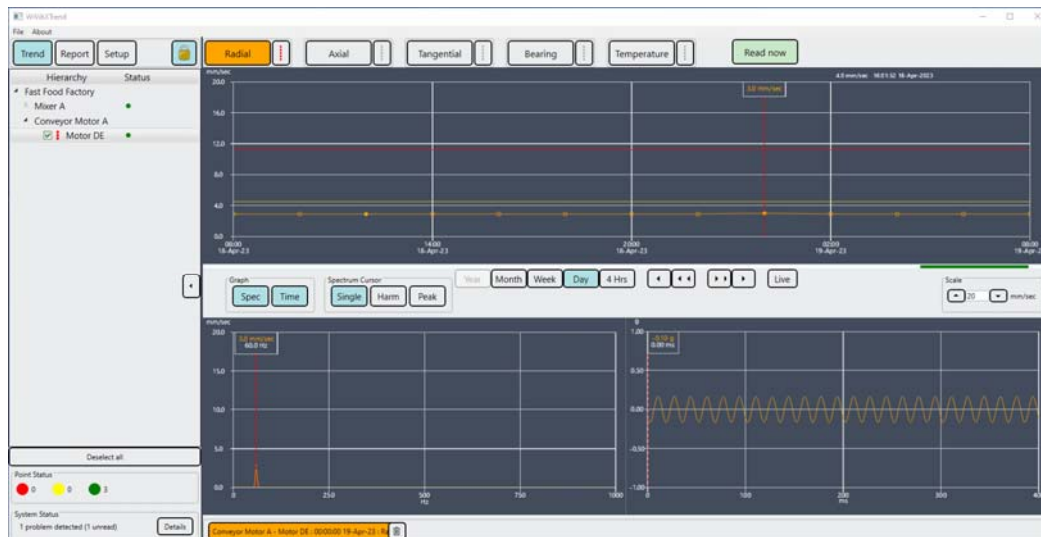
Multiple traces can be selected and a description of each is shown as colour-coded text below the traces screen. To remove a trace, click on the trash symbol.

Time and spectrum traces can be displayed individually or both side by side by clicking in the **Spec** and **Time** buttons. Various harmonic cursor options for spectrum graphs are available by clicking on the appropriate selection.

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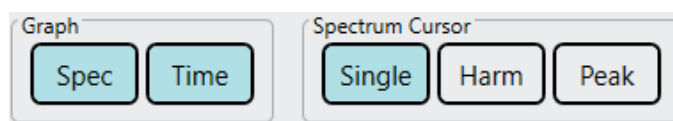
5.4   Reports

Summary reports can be generated at any time by the system by clicking on the **Report** button. A screen similar to the one below will be displayed.
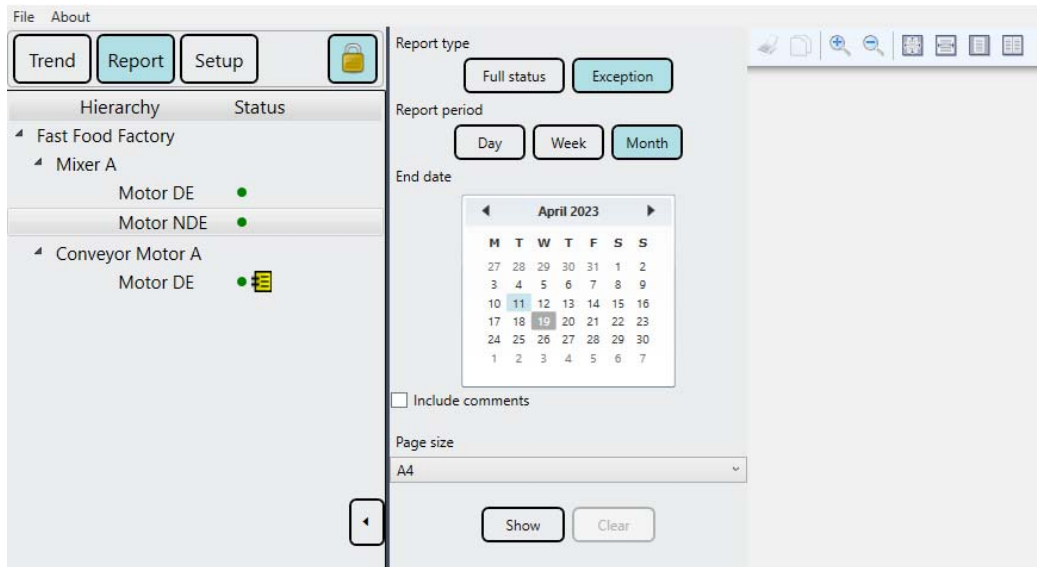
Two types of report are available, namely
Full status: a complete summary of all points is displayed, including those that are not in alert or alarm.
Exception: only points that are in alert or alarm are displayed.

Reports can be generated on spanning a day, week or month. The sequence to generate a report is:
1.   Select whether you wish a *Full status* or *Exception* report.
2.   Select the time span under *Report period* (*Day*, *Week* or *Month*) and click on the *End date* for your report. This will normally be today's date but you can generate retrospective reports. The report is generated from the end date going back in time.
3.   Decide if you want to *Include comments* and the Page size for your report.
4.   Click on **Show**.

If you change any of your choices, click **Refresh** to regenerate the report.

Examples of *Exception* and *Full status* reports are shown below.

ICON RESEARCH

Exception Report
Fast Food Factory

Start date   20-Apr-2023
End date   20-Apr-2023

Summary   0   2   1   0

POINT	Type	Alert Level	Max Value	Max Percent	Time	Average	End Status
Conveyor Motor A							
Motor DE	Vel Rad	4.5 mm/sec	4.6 mm/sec	102%	14%	3.3 mm/sec	Alert

ICON RESEARCH

Full Status Report
Fast Food Factory

Start date   20-Apr-2023
End date   20-Apr-2023

Summary   0   2   1   0

POINT	Type	Alert Level	Max Value	Max Percent	Time	Average	End Status
Mixer A							
Motor DE	Vel Rad	4.5 mm/sec	0 mm/sec	1%	0%	0 mm/sec	Good
	Vel Axial	Off					Good
	Vel Tang	Off					Good
	Bearing	0.2 gBrg	0 gBrg	12%	0%	0 gBrg	Good
	Temp	50 °C	20.8 °C	41%	0%	19 °C	Good
Motor NDE	Vel Rad	4.5 mm/sec	0 mm/sec	0%	0%	0 mm/sec	Good
	Vel Axial	Off					Good
	Vel Tang	Off					Good
	Bearing	Off					Good
	Temp	50 °C	18.4 °C	36%	0%	17 °C	Good
Conveyor Motor A							
Motor DE	Vel Rad	4.5 mm/sec	4.6 mm/sec	102%	14%	3.3 mm/sec	Alert
	Vel Axial	4.5 mm/sec	0.6 mm/sec	13%	0%	0.4 mm/sec	Good
	Vel Tang	Off					Good
	Bearing	0.3 gBrg	0 gBrg	8%	0%	0 gBrg	Good
	Temp	50 °C	18.9 °C	37%	0%	18.2 °C	Good

The column headings are as follows:

POINT: a description of the point as in the hierarchy

Type: the type of measurement eg. velocity, temperature etc.

Alert Level: the alert level specified for that measurement

Max Value: the maximum value recorded in the report period

Max Percent: the maximum value of the measurement <u>as a percentage of the alert level value</u>. The alert level value is 100%, so a good reading will always be below 100% and an alert/alarm value will always be above 100%. This gives an indication of how far a measurement is above or below the alert level threshold.

Time: the percentage of the time in the report period that the point was in alert/alarm.

Average: the average value of the measurement in the report period. This enables a comparison of an alert/alarm value with the average value for the period.

End Status: the status of the measurement at the end of the report. You can therefore see if a point had gone into alert/alarm, even though its status is good at the end of the period.

Printing and scaling options are available at the top of the screen. Reports can be printed as pdf's or to hardcopy.

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CHAPTER 6 – Gateway System Maintenance

6.1   Maintenance – Services

The internal services that provide the gateway's facilities should operate without any user interaction, however there may be occasions in which they need to be manually stopped or restarted.

Services

Name	Status	Stop	Start	Restart
BLE Module	Running	Stop	Start	Restart
Logic Module	Running	Stop	Start	Restart
REST API Module	Running	Stop	Start	Restart
WEB Server Module	Running			Restart
Bluez Bluetooth	Running	Stop	Start	Restart
Gateway		Switch off		Restart

Each of the applications displays its current running status along with buttons to **Start**, **Stop** or **Restart** its actions.

There are also options to **Restart** or **Switch off** the entire gateway.

Note that restarting the Web Server module or the gateway will require a short delay before the web browser will be able to reconnect and so repeated refreshes of the web browser may be required.

6.2   Maintenance – Database

All of the sensor configuration and sampled data is held within a database. The sampled data is only kept for a limited number of days but, depending on the sampling configuration and the number of sensors, it may be required to ensure that the database is not getting too large.

This page allows for the current database size to be monitored and, if too large, allows manual removal of some of its contents. Note that deleting the data does not physically reduce the database size unless it is later compacted.

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Database

Size: 2.8 MB

Delete Readings	Warning: this will delete all the logged trace and overall data for each sensor
Delete RSSI	Warning: this will delete the RSSI history for each sensor
Delete Sensors	Warning: this will delete all of the sensors and their configurations
Compact Database	Unable to compact database as services are actively using it
Delete Database	Unable to delete database as services are actively using it

The database can also be completely removed to allow the gateway to operate afresh, in which case it will create a new one and start to populate it as sensors are detected.

Note that the compact and delete operation can only be performed if both the LogicModule and RESTAPIModule have been stopped via the **Services** page. Remember to restart these again once finished with the database, or simply restart the gateway.

6.3   Upgrading a Gateway

There will be times when new versions of one or more of the gateway services become available. These will be provided by means of a specially encrypted file that is uploaded into the gateway using this page.

Upgrade Gateway Firmware

Upload the file containing the new application update release, you will be able to review its contents before applying the update

Choose file | No file chosen

Upload

Once the file has been uploaded a further page will display its contents so they can be reviewed before the actual upgrade is performed.

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Upgrade Gateway Firmware

Version Numbers

Upgrade:	1.3.4
Valid from:	1.3.3
Current:	1.5.0.0
	Upgrade is not suitable for this gateway.

File verification

Checksum:	File checksum matches
Signature:	File signature verified

Release Notes

This version has a fully functional Web Server included. Note Gateway application firmware upgrades are not presently secure!

Upgrade

The **Upgrade** button will only be enabled if the uploaded file contains an image suitable for the current version of the gateway services, and the security checksum and signature have both been verified.

The upgrade process may take a short time after which the *Home* page will be displayed which contains the version number of the gateway application to allow confirmation that the upgrade has completed successfully.

6.4   Upgrading Sensors

There will be times when new versions of the *WiVib X* sensor firmware become available. These will be provided by means of a specially encrypted file that is uploaded into the gateway using this page.

Chapter 6 – System Maintenance
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Upgrade Sensor Firmware

Choose file | No file chosen

Start at: 05/01/2022 16:39 🗓

⦿ No Limit for upgrade duration
○ Limit upgrade duration
Limit upgrade to 1 hour ▾

○ Upgrade any sensor controlled by this gateway
⦿ Upgrade only those sensors selected below
Limit to 1 upgrade attempt ▾

Serial Number	BSID	Firmware Version	Upgrade
000042	FB:28:61:6D:A3:60	01.03.04	☐
000103	FC:DB:D3:94:42:48	01.03.04	☐
000104	FC:F8:78:F9:1D:0C	01.03.04	☐
000139	F9:76:D4:34:3B:61	01.03.00	☐

Start Upgrade | Stop Upgrade | View Report

Once the firmware file has been selected, the upgrade can be scheduled to start at a particular time. Note that this is related to the local time zone for the gateway and selecting a time that has already past will start the upgrade immediately. The duration of the upgrade can also be limited if desired.

The gateway can be instructed to upgrade all the relevant sensors that it controls or the user can limit which sensors should be upgraded.

Each sensor upgrade typically takes 3-5 minutes and only one sensor is upgraded at a time. Due to the Bluetooth network, the sensor may fail to upgrade and so a number of retries can be specified before any attempt is abandoned.

Once the upgrade process has been instructed to start by clicking the **Start Upgrade** button, it can be aborted by clicking the **Stop Upgrade** button.

Once the upgrade process has completed, the **View Report** button on this page will be enabled to allow the results of the upgrade to be reviewed as shown below. However, the progress of the upgrade process can also be followed using the **Sensors** page as this lists the current firmware version for each sensor and this will change as each sensor is upgraded.

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Upgrade Sensor Firmware Report

Firmware: 01.04.00
Started: Friday, 07 January 2022 15:07:01
Stopped: Friday, 07 January 2022 15:17:16 : User aborted

Serial Number	Upgrade Status	Start Time	Result
000042	Still in progress	Friday, 07 January 2022 15:10:35	Failed
000103	Required but not started		
000104	Required but not started		
000105	Required but not started		
000110	Not detected		
000115	Completed Ok	Friday, 07 January 2022 15:08:01	Success: Friday, 07 January 2022 15:10:13
000117	Required but not started		

The *Upgrade Status* can be one of the following values:

Completed Ok	Firmware upgrade was successful
Failed	Firmware failed for each of the attempts allowed
Not required	Firmware was already later than this release
Not detected	Sensor was not seen during upgrade period
Required but not started	Sensor could not be accessed during upgrade period
Still in progress	is still upgrading at end of upgrade period

For each upgrade attempt, the start time and, if successful, the completion time will be provided. If a sensor was currently still being upgraded when the upgrade process was stopped it will be indicated as *Still in progress*.

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