



***WiVib X Series  
Wireless Acquisition Unit  
Operating Manual***

***Revision 1.1  
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### CHAPTER 1 - Overview

#### 1.1 The *WiVib X*

The *WiVib X* is a battery powered device that measures vibration and temperature from machinery and other mechanical systems. The *WiVib X* combines latest MEMS sensor technology with low power wireless communication to provide a versatile and easy-to-use monitoring device.

The *WiVib X* contains a tri-axial accelerometer and a temperature sensor. The basic operation is that analog signals are digitised by the on-board sensors and stored in internal memory. This data is then passed over a standard Bluetooth link to a smart device, or via a gateway to a host computer for processing and display. The devices operate on the Bluetooth Low Energy standard and are 'always on'. That is to say, they are permanently advertising so can communicate with a host device at any time. Refer to the *WiVib X* brochure for details of the device.



Single value tri-axial vibration measurements, called *Surveillance Overalls*, can be taken or, alternatively, time records can be acquired to provide high resolution vibration spectra. Anti-aliasing of the incoming dynamic signal prevents unwanted undersampled frequency components. Single value temperature measurements are also available.

#### 1.2 Communication

The *WiVib X* is controlled by a set of commands sent from a smart device or host computer. All commands issued are asynchronous and force a reply from the device, either as an item of data or as a simple acknowledgement. In this way, the controlling device should always know the activity and status of each *WiVib X* on its network.

Multiple *WiVib X* sensors can communicate to a host computer via one or more gateways in the vicinity. Where a *WiVib X* is in range of more than one gateway, each gateway will add the sensor to its list of known sensors and monitor its signal strength. The controlling application will then specify which gateway controls a particular sensor, based on its signal strength and the number of sensors on its list.

## Chapter 1 – Overview

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If a gateway loses power or is disabled for any reason, the controlling application will re-allocate the sensors that were connected to that gateway to another that has the sensors on its list. Any number of *WiVib X* sensors can exist on a network though it is suggested a maximum number of *WiVib X* sensors communicating with a single gateway is 20.

No user intervention is required for a *WiVib X* to link to a smart device or gateway. The sensor advertises its presence and automatic pairing then takes place.

### 1.3 Types of Measurement

The *WiVib X* can take two types of measurement, namely:

1. *Surveillance Overall* – the sensor measures single value parameters ie. overall vibration level (in acceleration or velocity) and temperature at defined intervals;
2. *Dynamic Trace* – when requested, the sensor measures high resolution time data that can be processed to acceleration or velocity spectra.

It is possible for the sensor to operate measuring surveillance overalls only. But high resolution spectra are indispensable when analysing machinery problems. Overall vibration and temperature measurements are indicative of a machine's overall condition and act as the threshold as to when a full trace is taken. Surveillance overalls also save battery power due the reduced amount of data being transmitted by the sensor. Typically, both types of measurement will be taken, with surveillance overalls being taken regularly to monitor overall machine condition, and traces being taken less often but to maintain an ongoing baseline of spectra. Trace data can then be requested immediately when surveillance overall levels exceed predefined values.

### 1.4 Restart Control with Magnet

The *WiVib X* is a completely sealed unit. If for any reason it is desired to restart a device, this can be done by the application of a magnet to the top of the unit which activates the internal magnetic sensor.

A start-up due to a magnet tap resets internal settings to factory defaults (ie. clears any stored configurations). The battery gas gauge is not affected. The LED flashes green while the magnet is applied to the sensor.



## CHAPTER 2 - Network Configuration

### 2.1 Configuring Your *WiVib X*

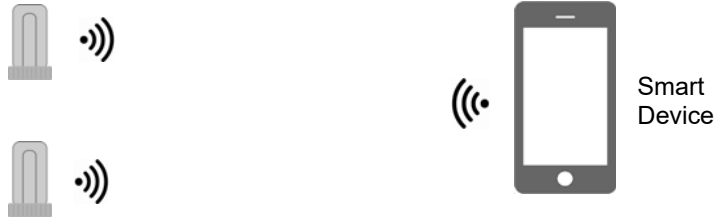
Once a battery is installed, the *WiVib X* is 'always on' in that it continually advertises itself to its controlling device or network. Therefore, no device configuration is required as, once the *WiVib X* is detected, the controlling device sets it up as required.

The *WiVib X* can communicate to a host application in one of two ways, namely:

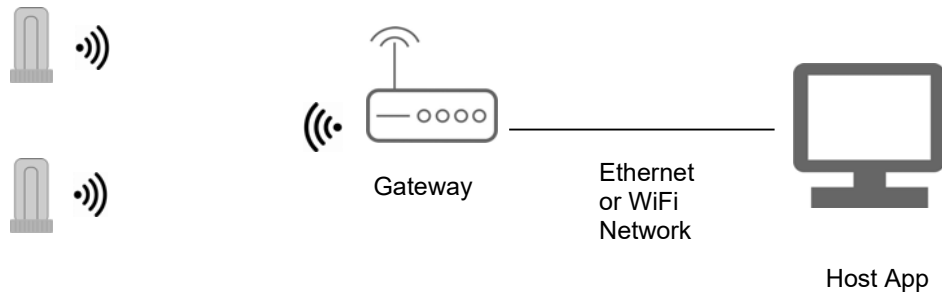
- a) directly to a smart device using its sensor protocol, or
- b) via a dedicated gateway, or network of gateways which, in turn, communicate to the host application via the REST API resident in each gateway.

These options are shown below:

#### Communication with Smart Device



#### Communication with Gateway and REST API



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## CHAPTER 3 - Guidance Notes

### 3.1 Restart Control with Magnet

The *WiVib X* is a completely sealed unit. If for any reason it is desired to restart a device, this can be done by the application of a magnet to the top of the unit which activates the internal magnetic sensor. Green, red and blue LED's visible through the top surface indicate the activity of the device. Refer to next section for further details.

### 3.2 LED Status

The green, red and blue LED's at the top of the device indicates device status. The table below summarises the conditions.

CONDITION	LED STATUS	ACTION
<b>Start-ups</b>		
Battery change	Two green flashes	Start-up due to battery change resets internal settings to factory defaults (ie. clears any stored configurations) and resets battery gas gauge to 100%
Restart with magnet	Single green flash when magnet presented, or repeated green flash while magnet present	Start-up due to magnet tap resets internal settings to factory defaults (ie. clears any stored configurations). Battery gas gauge is not affected.
Internal watchdog	Two red flashes	Start-up due to internal watchdog resets internal settings to factory defaults (ie. clears any stored configurations). Battery gas gauge is not affected.
Hardware Failure	Four red flashes	Unable to perform sampling operations – replace with new device.
<b>Firmware Download</b>		
Firmware download initiated	Solid green	Over-the-air firmware download process has started
Firmware download	Solid blue	Download in progress

## Chapter 3 – Guidance Notes

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Download fail	Solid red	Download has failed – LED remains red until the download application closes
<b>Operational</b>		
Device Identified	Three cycles of blue, red and green flashes	In response to network identify command

### 3.2 Axes

The *WiVib X* incorporates a tri-axial vibration sensor. The axes are defined as per the table below:

<b>AXIS</b>	<b>DIRECTION</b>
X	Vertical axis through vertical line of sensor ie. primary machine radial vibration axis
Y	Horizontal axial direction, parallel with shaft of machine. Y-axis is designated by a horizontal line in the top surface of the sensor. Y-axis can be rotated using the SWIVEL Lock mount.
Z	Third axis, orthogonal to X and Y.

### CHAPTER 4 - Battery Changing

#### 4.1 Types of Battery

The recommended battery is the CR123A or equivalent. This is a 2/3 AA size lithium cell. For operation in low temperature environments, the LS17330 from SAFT is recommended. Do not use alkaline batteries. If in doubt about battery types, check with Icon Research.

#### 4.2 Changing the Battery

To change the battery, follow these steps:

1. Remove the outer cover by unscrewing in an anti-clockwise direction. Once the cover is clear of the threads, keep a rotary motion until the cover is clear of the battery chassis.
2. Remove the battery from its location. As the battery is a tight fit, it may be easier to use a small screwdriver to prise it from its locating tabs. Put the used battery aside for recycling.
3. Battery replacement is the reverse operation. Position the battery between the gold clips and press it downwards into place. A click will be felt as the battery slots into place. **IMPORTANT:** Note the polarity of the battery as marked in the battery recess ie. the POSITIVE terminal is towards the BOTTOM of the unit.



4. Refit the cover ensuring that the notch on the bottom of the cover cover lines up with the corresponding notch in the stainless steel base. This is to ensure that the Y-axis line on the top of the cover aligns with the corresponding axis on the internal sensor.



When fitting the cover, it is a good idea to apply a small amount of silicone grease or similar to the rubber seal as this helps with lubricating the join and assisting with water-tightness.

## CHAPTER 5 – Installing the *WiVib X*

### 5.1 Types of Mounting

There are two types of mounting available on the *WiVib X* as follows:

MOUNTING	MODEL NO.
SWIVEL Lock mount	<i>WiVib-X33S</i>
Fixed mount	<i>WiVib-X33F</i>

Both require a stud to be mounted on the machine using a hard-setting adhesive or a tapped hole. With a height of a little over 3” and a diameter of just over 1”, the *WiVib X* can be fitted into the tightest of locations. The type of mounting required should be specified at time of ordering.

### 5.2 SWIVEL Lock Mount

The SWIVEL lock mount enables the sensor to be rotated in situ until the Y-axis aligns with the shaft of the machine being monitored.

A stud with a thread on the periphery is fitted to the machine. The sensor is slotted onto the stud and a knurled ring is fitted over the sensor. The sensor is then rotated so that the Y-axis line marked on the top of the sensor aligns with the shaft of the machine. The ring is then tightened to hold the sensor in this orientation.

SWIVEL mounting studs are available from Icon Research. They can be glued onto the machine with a hard-setting epoxy or can be fixed using the standard 1/4-28” UNF threaded hole in the base of the stud.



### 5.3 Fixed Mount

The fixed-mount version is smaller diameter and fits onto a standard mounting stud using the 1/4-28" UNF threaded hole in the base of the sensor.



### CHAPTER 6 – Compliance Information

#### 6.1 Radio Compliance

The WiVib X contains the BMD-380 Bluetooth Low Energy module from Ublox. It carries a range of compliances as detailed below.

##### 6.1.1 FCC Compliance

The WiVib X contains RF module with FCC ID: **XPYBMD380**.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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

##### 6.1.2 Canadian (ISED) Compliance

The WiVib X contains transmitter module IC: **8595A-BMD380**.

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

##### 6.1.3 European Union Regulatory Compliance

The BMD-380 module complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.


Information about regulatory compliance of the European Union for the BMD-380 module is available in the BMD-380 Declaration of Conformity on the Ublox website.

##### 6.1.4 Australia / New Zealand (RCM)

The BMD-380 has been tested to comply with the AS/NZS 4268:2017, Radio equipment and systems – Short range devices – Limits and methods of measurement.


6.2 CE Compliance

The WiVib X has been tested in accordance with European regulatory standards and carries the **CE** mark. The Declaration of Conformity is displayed below.

 3 Raw Holdings, East Calder West Lothian EH53 0HY, UK Tel: +44 (0) 1506 885000	
<b>DECLARATION OF CONFORMITY</b>	
<b>Relevant Directives</b>	
The Directives relevant to this Declaration are as follows: Electromagnetic Compatibility Directive 2014/30/EU	
<b>Description of Products</b>	
The following Products are included in this Declaration: <b>WiVib X Wireless Vibration / Temperature Sensor</b>	
<b>Declaration</b>	
We, Icon Research Ltd, certify that the above Products conform to the essential requirements of the EMC Directive as applied. The products have been tested to the following standards:	
EN IEC 61326-1:2021	Electrical equipment for measurement, control and laboratory use. EMC requirements - general requirements
EN 301 489-17 V3.2.4 (2020-09) referencing EN 301 489-1 V2.2.3 (2019-11)	Electromagnetic compatibility (EMC) standard for radio equipment and services
<b>Authorised Signatory</b>	
Name:	James P Edgar
Title:	Managing Director
Signature: _____	Date: <u>6th September 2022</u>



### 6.3 UKCA Compliance

The WiVib X meets the UK Regulations as defined in the relevant Statutory Instruments for UKCA compliance and carries the  mark.

### 6.4 Environmental

#### 6.4.1 RoHS Compliance

As a manufacturer of electronic and electrical equipment, Icon Research is covered by European directive 2011/65/EU of 8th June 2011 together with Amending Directive 2015/863/EU, restricting the marketing and use of the following hazardous substances:

mercury (Hg), cadmium (Cd), hexavalent chrome, polybrominated biphenyls, polybrominated diphenylethers, lead (Pb), Bis(2-Ethylhexyl) phthalate (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), diisobutyl phthalate (DIBP).

Icon Research Limited confirms that the WiVib X is compliant with the above directives in restriction of concentrations of the above substances to within the allowed limits.

#### 6.4.2 REACH

Icon Research Ltd certifies that, to the best of its knowledge, the WiVib X does not contain any SVHC (Substance of Very High Concern) candidate list substances as defined by Directive EC/1907/2006 Article, REACH Annex XVII.