

Battery-Powered
Wireless
Condition
Monitoring
Solutions
Now
Available on
Standard
WiFi
Networks



Wireless
Monitoring



Wireless Vibration Measurement

Icon Research Ltd

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The **WiVib** family of vibration acquisition units from Icon Research provides wireless multi-channel vibration monitoring on standard wireless networks.

The **WiVib** range communicates via the WiFi 802.11 standard and is fully compatible with all low-cost access points and accessories used on this popular medium, including full security. The **WiVib** links into the network in exactly the same way as any other wireless device. Simply mount it on your machine, insert the batteries and you are ready to receive full vibration information over your network.

"I think it's great that the data comes to me, rather than me having to go and fetch it."



Wireless Data Acquisition Explained

Why go wireless?

Monitoring of the condition of plant machinery is done in one of two ways, with walk-around data collectors or with an on-line system. For reasons of regular monitoring and reliability of data, an on-line system is usually preferred, but the cost is often prohibitive. Wireless data acquisition can help in both instances. By attaching small wireless units directly to machinery, or replacing existing switch boxes, reliable data can be obtained regularly and at significantly less expense than with walk-around systems. This allows for more efficient deployment of valuable manpower resources. In the case of on-line systems, huge costs are saved in installation, and the savings don't end there. No cabling means increased reliability together with making the job of removing machinery for servicing so much easier. Lower cost means that less critical, but still important, machinery can be monitored.

Is it reliable?

The acceptance of wireless technology is now universal. Icon has employed the global 802.11 WiFi standard as its networking medium and its proven immunity to external noise and interference means that you will be using the same standard that is used for wireless internet and many other high-integrity applications. Data rate is up to 54Mbps/sec and ranges up to hundreds of feet are possible, depending on the environment. Full encryption of data is available and the WiVib family operates using off-the-shelf

access points that can be purchased from your local computer store or your preferred networking supplier.

The diagram below shows a typical installation. WiVibs are installed on the machinery and these communicate with a local access point that resides on the plant network. Each WiVib has its own IP address that is defined in the device at the time of installation. The network handles a WiVib in the same way that it would handle any wireless or cabled device connected.

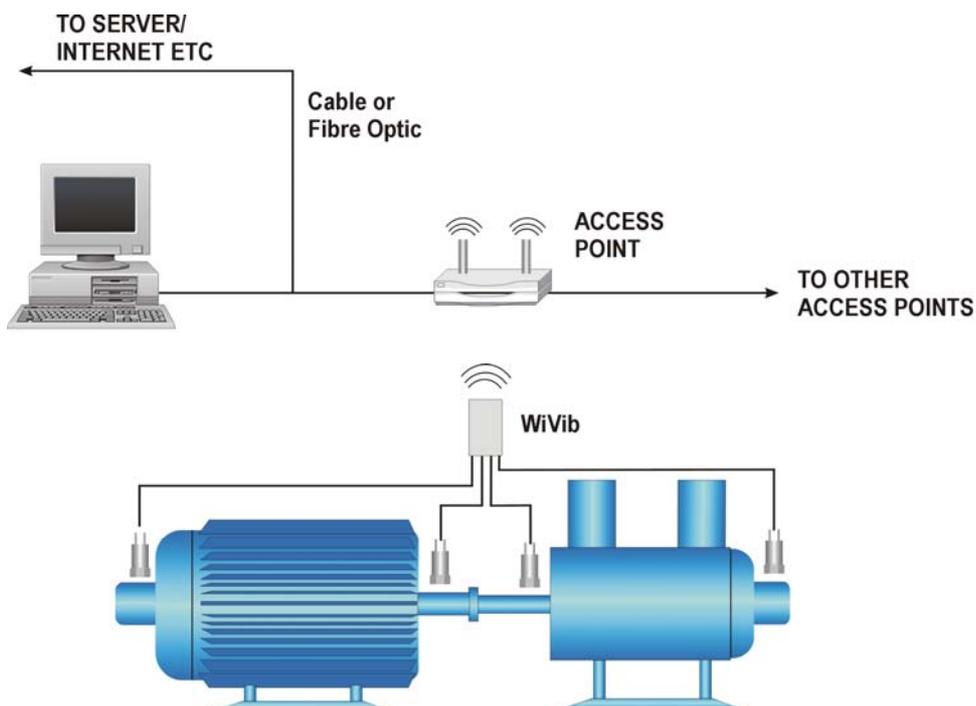
How are measurements made?

When taking measurements, WiVibs can operate in one of two modes, namely *continuous* and *wakeup*. In continuous mode, the device is permanently on and is powered by a DC supply in a range from 10V to 30Vdc. So measurements can be taken at any time.

However, when using batteries, it is important to conserve power to maximise battery life. This is where wakeup mode is used. Each WiVib contains a real-time-clock which can be instructed to wake the WiVib up at any interval varying from one minute to one day. The WiVib takes its measurements as instructed by the application and then "goes to sleep" until woken at the next interval. However, the unit can be instructed to remain on if prolonged machinery diagnostics are required.

How long will my batteries last?

In a typical installation where a set of measurements is taken every six hours in wakeup mode, a battery life of around one year can be expected between battery changes.



WiVib-4/4 Pro

Simultaneous Channel Wireless WiFi 802.11b/g Acquisition Unit

FEATURES

- Four Accelerometer + Four DC Inputs**
- Simultaneous Acquisition on ICP Inputs**
- Measures Acceleration, Velocity,
and Bearing Condition**
- DC Inputs Measure Volts or 4-20mA**
- Communicates on WiFi Standard
802.11b/g**
- Full WEP, WPA and WPA2 security**
- Up to 40kHz Bandwidth and 12800 Lines**
- Flexible Trigger Functions**
- Battery or 10 - 30Vdc Power Options**

The **WiVib-4/4 Pro** from Icon Research is a wireless multi-channel vibration monitoring device that operates on the universal WiFi 802.11b/g standard. This new device offers simultaneous sampling on its four dynamic channels at 24-bit resolution and up to 102.4kHz sample rate with 12800 spectral line resolution. The additional four DC channels are ideal for measuring process parameters. For example, accelerometers with temperature output can be connected directly to the unit enabling vibration, bearing condition and bearing temperature to be measured.

The **WiVib-4/4 Pro** incorporates an ICP power supply on each of its four dynamic channels so that any standard compatible accelerometer can be connected. Alternatively, the inputs can be AC coupled to interface with buffered signals from other systems. High-resolution acceleration and velocity measurements can be made, together with bearing condition using the built-in demodulator or "enveloper" as it is sometimes called. Accelerometer bias voltage checking is incorporated.

The dynamic inputs are also compatible with standard eddy current (proximity) probes allowing direct measurement of displacement, including gap voltage.

The two digital trigger inputs offer flexible triggering options allowing synchronised readings to be taken. The triggers can also be configured to operate as tachometer inputs, PLL's for ordered spectra, and gates for conditional initiation of measurements. One of



the triggers can be configured to act as an analog trigger input.

The **WiVib-4/4 Pro** operates on the universal WiFi 802.11b/g standard and offers full WEP, WPA and WPA2 security. Network configuration is straightforward by connecting to the on-board USB port and running the **WiVibConfig** software utility supplied on any laptop or PC.

Power is provided by two internal 'C' size batteries or a DC supply in the range 10 to 30V. Under battery power, the device requires no connections apart from the sensors and it can be powered up and down by its internal real-time-clock.

The unit has been designed for operation in hazardous locations and is approved for use in ATEX Zone 2 areas. It is currently going through Class 1 Div 2 certification for use in North America.

The unit is housed in a compact rugged enclosure and is sealed to IP67. It is fitted with stainless steel brackets for easy mounting. The twelve sealed glands allow cables of varying diameter to be routed to the unit.

The **WiVib-4/4 Pro** is supplied with a comprehensive suite of support software enabling the device to be configured on your network and useful measurements to be taken right away.

Refer to the specification overleaf for full details of the **WiVib-4/4 Pro**.

WIVIB-4/4 PRO TECHNICAL SPECIFICATION

MEASUREMENT

Dynamic Channels (1-4)

No of Channels:	4
ICP Interface:	2.4mA at 20Vdc
Other Coupling:	AC, jumper configurable
Input Voltage Range:	+/-5V
Bias/Gap Measurement:	+/-25V range for ICP bias voltage and eddy probe gap measurement
Measurements:	acceleration, displacement, bearing demod, (velocity by s/w integration)
Gain Ranges:	gain steps 1, 2, 5, 10, 20 and 50
Amplitude Accuracy:	±2% typical in passband
Demodulation Function:	digital demodulator (HP and LP bandpass filter edges programmable steps from 50Hz to 40kHz)

DC Channels (5-8)

No of Channels:	4
Ranges:	0 to +3V and 0 to +10V, jumper selectable
4-20mA Input Option:	100 ohm load, jumper selectable

PROCESSING

ADC:	24 bit simultaneous on channels 1-4 16 bit multiplexed on channels 5-8
Sampling Rate (chans 1-4):	64Hz to 102.4kHz
Bandwidth Ranges:	0.5Hz-25Hz to 0.5Hz-40 kHz
Data Block Lengths:	256 to 32768
Spectral lines:	up to 12800

TRIGGERS

No of Channels:	2 (one analog/digital, one digital)
Coupling:	5V to 24V digital pulse, or analog in range +/-20V
Available Functions:	external trigger, tacho speed, ordered data (by phase-lock-loop), gated acquisition, pre- and post-trigger delay to 32768 samples

COMMUNICATIONS

Wake-up Mode:	programmable from one minute to one day via internal RTC
Network:	802.11b/g WiFi compatible, FCC and IC certified
Addressing:	static IP or DHCP
Speed:	up to 54 Mbits/sec
Encryption:	WEP (64, 128 bit) and WPA/WPA2 PSK (TKIP, AES)
Interface Port:	USB user port

MECHANICAL

Enclosure:	glass reinforced polyester, NEMA 4, IP67
Dimensions:	22cm (8.5") x 12cm (4.6") x 9cm (3.5")
Weight:	1.4kg (3 lbs)
Cable Entries:	12 glands, IP68 rated
Cable Diameter:	3mm to 6.5mm

ENVIRONMENTAL

Operating Temperature:	-10°C to +60°C (14°F to +140°F)
Compliance:	CE, RoHS
ATEX Zone 2 Hazardous Locations:	ATEX Directive 94/9/EC, Certificate Number Baseefa08ATEX0294X Battery powered:  II 3G Ex nAnL [ib] IIC Externally powered:  II 3G Ex nAnL IIC T4 (-10 °C ≤ Ta ≤ +60 °C) T5 (-10 °C ≤ Ta ≤ +60 °C) T6 (-10 °C ≤ Ta ≤ +49 °C)

CSA Class 1 Div 2 *pending*

POWER

Input Power:	battery, or DC power (10 to 30Vdc)
Battery Type:	two x lithium 3.6V 'C' cell type LSH 14 (unrestricted transportation version available)
Battery Monitor:	internal battery monitor and critical battery shutdown
Isolation:	1500V from DC power input

Subject to change without notice

Application Software for **WiVibs**

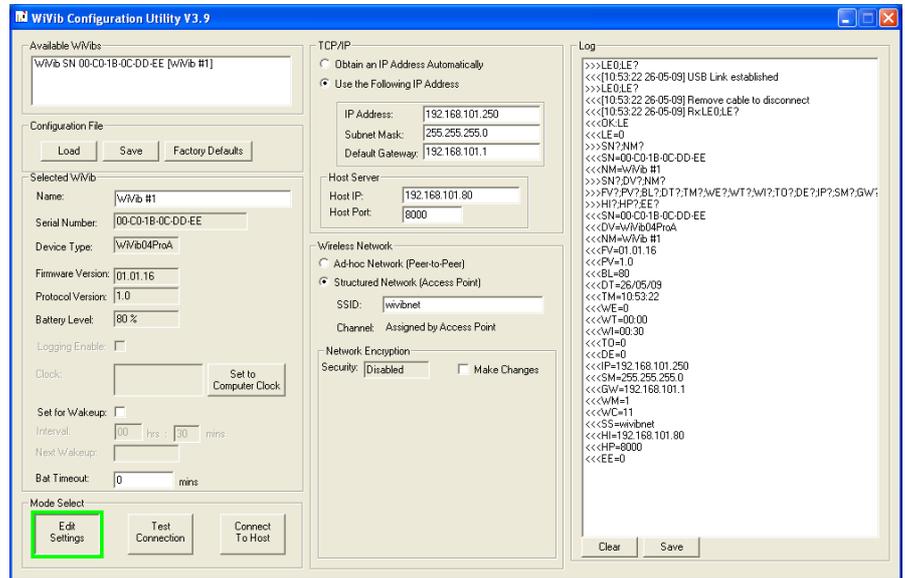
WiVibConfig

Easy-to-use tool for configuring your WiVib to work on a wireless network

Configuring your WiVibs to communicate on a wireless network is made easy with the *WiVibConfig* utility. Simply edit the network settings (eg. IP address, SSID etc) and then click Connect to enable the WiVib onto your network. The panel on the right monitors network activity so you can quickly see if the WiVib has connected to your network, or if further editing of the settings is required. Security settings can be entered and modified as required.

Configurations can be saved to file and reloaded so you don't have to re-type all of your settings each time you introduce a new WiVib onto your network.

Communication is via a cable from any USB port on your laptop or PC.



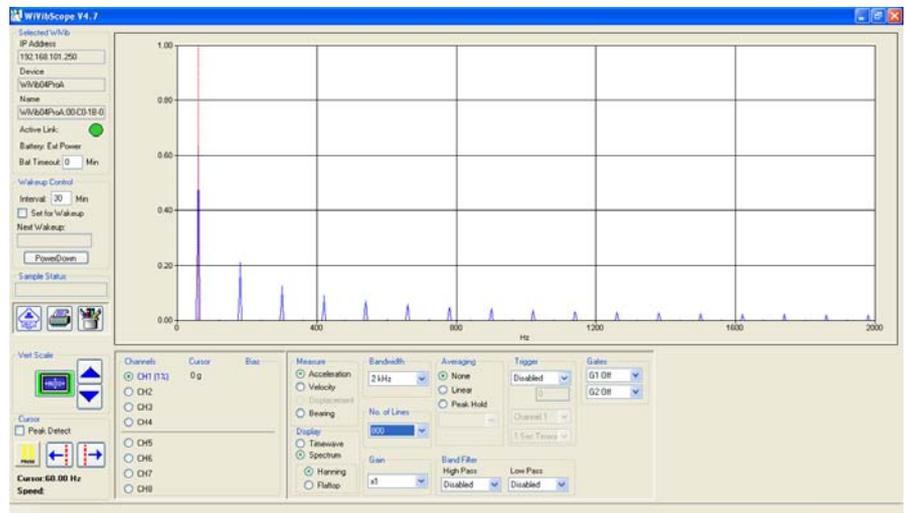
WiVibScope

Turns your WiVib into a fully featured spectrum analyser

WiVibScope enables both time and spectrum graphs to be displayed from any selected channel of a WiVib. Measurements can be displayed in standard engineering units such as g and ips as well as user-defined units. Simply select the WiVib and the channels that you want to monitor and live traces stream to the high-resolution display. Zoom and cursor with readout function are provided.

Settings such as number of spectral lines, bandwidth etc are easily changed with drop-down menus. Any acquisition setting (eg. gain, integration to velocity etc) can be adjusted also.

WiVibScope is ideal for detailed analysis, system checks and installation setup. Both continuous and wakeup modes are supported.



Application Software for **WiVibs**

WiVibTrend Lite Easy plant monitoring and analysis for smaller systems

WiVibTrend Lite provides the core functionality of on-line monitoring systems with features such as trending, alert/alarm indication and full analysis capability. It can support typically up to 40 channels with multiple measurements (for example, velocity vibration and bearing condition) being available on each channel.

Its straightforward setup-and-go interface means that you can be logging and trending within minutes of loading the application.

A moving chart-recorder updates current measurements while historical pan and zoom functions let you examine previously measured data.

This application is perfect for smaller wireless on-line monitoring systems or getting familiar with wireless monitoring.

WiVibTrend Lite supports a simple *Plant ... Machine ... Point ... Measurement* hierarchy. Alerts and alarms are indicated on the hierarchy and summarised in the table underneath. For a quick check, the red/yellow/green traffic light summary lets you know the status of your plant at a glance.

The application supports wakeup and continuous modes on the WiVibs, so you can choose how often you want to scan your machinery. This can be from several times a minute to once a day.

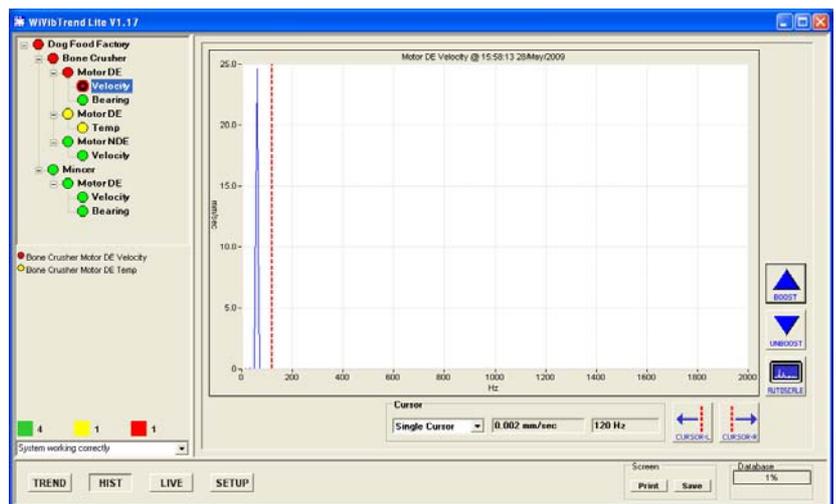
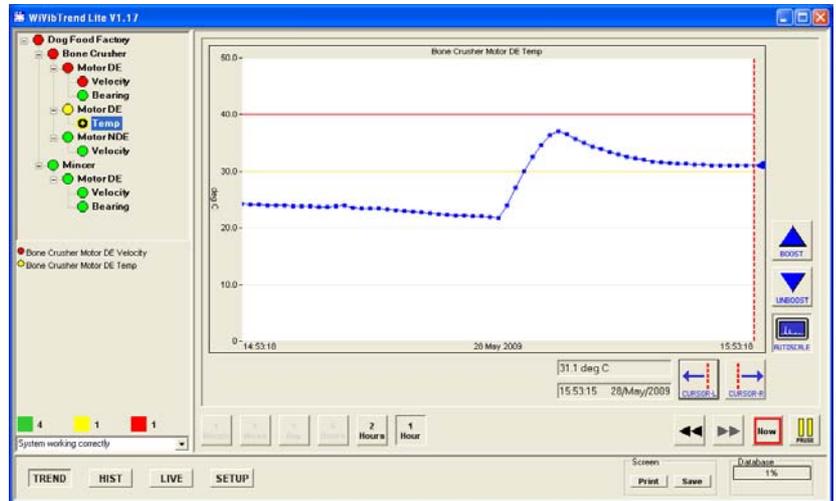
A historical trace, such as a spectrum, can be viewed by selecting the time at which it was gathered on the trend graph. Alternatively, live/latest spectra can be viewed with full cursor readout.

Setting up the machine hierarchy is very straightforward. First, use *WiVibConfig* to connect your WiVibs to the network and then use the single screen setup in *WiVibTrend Lite* to specify what you want to measure and when.

Hardcopies of trends and traces can be printed, or traces can be written to file for emailing or inserting in reports.

WiVib hardware and *WiVibTrend Lite* software combine to produce a powerful machinery monitoring package that is low-cost, quick to install and easy to use.

WiVibTrend Lite has been specially developed by Icon Research to show the advantages that wireless monitoring can bring to industry. You can get started with a single WiVib and be monitoring your plant within minutes.



The screenshot displays the 'Setup' view of the software. The interface is divided into several sections:

- Available W/Vib:** A table listing connected devices.

Device Name	Serial Number	IP Address
wVib 81	00C018-0C-0D-EE	192.168.101.250
- Point:** Configuration for the selected device, including 'Connect to W/Vib' (wVib 81), 'AC Channel' (1, 2, 3, 4), 'Transducer' (Accelerometer), 'Sensitivity' (100 mV), and 'DC Channel' (5, 6, 7, 8).
- Measurement:** Configuration for the measurement, including 'Trace Configuration' (Display: Spectrum, Units: mm/sec, Pk), 'Sampling Configuration' (Lines: 400, Bandwidth: 2 kHz, Gain: x1), 'Window' (Hanning, Averages: Off), 'High Pass Filter' (Disabled), and 'Low Pass Filter' (Disabled).
- Trigger Configuration:** 'Mode' (Disabled), 'Channel', and 'Timeout'.
- Gate Configuration:** 'Gate 1 Ignored' and 'Gate 2 Ignored'.
- Trend Value:** 'Overall' (Fmin: 10 Hz, Fmax: 2000 Hz), 'Alarm' (3.00 mm/sec), and 'Alert' (5.00 mm/sec).

 The interface also includes a left-hand menu, a status bar at the bottom indicating 'System working correctly', and various control buttons like 'TREND', 'HIST', 'LIVE', 'SETUP', and 'Print'.

Integrating **WiVibs** With Your System

System Integration

WiVib users may wish to interface their WiVib devices to applications other than those supplied by Icon Research. There are three basic methods by which a systems integrator can gain access to a WiVib and the measurements that it takes, namely:

1. Accessing the *WiVibTrend Lite* OPC Server
2. Controlling the WiVib Server
3. Programming the WiVib directly

The options are listed by ease of implementation (easiest first). The trade-off is usually the flexibility of the solution versus the time and effort to implement it. However, Icon Research is always available to assist regardless of which interface method is chosen.

1. Accessing the *WiVibTrend Lite* OPC Server

WiVibTrend Lite provides the user with the means to configure measurements, and provides a simple display of the data that has been taken. It makes use of an embedded copy of the WiVib Server to control the sampling process.

The OPC Server component of *WiVibTrend Lite* allows the contents of the samples taken to be easily exported to external systems by means of the standard OPC interface.

When enabled, the OPC server runs in the background of *WiVibTrend Lite*, and provides OPC tags for the information that is provided by *WiVibTrend Lite* locally.

Using this method the integrator has just to configure his existing OPC clients to request the required tags from the *WiVibTrend Lite* OPC Server.

The structure and contents of these tags can be found in the *WiVibTrend Lite OPC DA Server Data Dictionary*, and include:

- Status information for all levels of the system hierarchy;
- Values, and alarm status, for all of the trends;
- Traces for both time domain and spectrum measurements;
- Status information for the WiVibs and sensors to detect failures in the monitoring equipment.

2. Controlling the WiVib Server

The WiVib Server provides the means to control a network of WiVib devices and thus realise a surveillance system by performing the following tasks:

- Scheduling when the WiVib is to be sampled.
- Controlling the sampling of the required measurements.
- Processing the samples by scaling them to the correct units and performing post sampling processes such as FFTs and integration.
- Testing the sensors and checking the sampled data for validity.
- Deriving trend values from the samples.
- Determining alarm conditions.

Using this method enables the integrator to concentrate on the user interface for the setup of the measurements and the display of the results, without having to have a detailed knowledge of how to control the WiVib.

The Server is controlled by means of an XML document which contains the definitions of the measurements and the order in which these measurements are to be taken. Once the route of measurements has been sampled, the same document is returned to the application with these definitions and the results of the sampling process.

The Server can operate in a number of different ways, which allow for wide variety of design options.

Firstly, the Server can be provided either as a .NET assembly for direct linking to the designers application, or as a self contained Windows Service which may run on the same machine as the application or on a remote machine as required.

Secondly, the XML document can be passed to the server either across an open TCP socket connection, through a defined Message Queue, or into a shared folder.

These configuration options, along with the description of the XML document can be found in the *WiVib Server Programmer's Manual*.

3. Programming the WiVib Directly

When using this method, individual instructions are sent to the device using the specified WiVib command set. This therefore offers the most flexible and efficient interface to the WiVib devices but it also involves the integrator with the most amount of effort to implement and verify.

The protocol that is required to control the WiVib is contained within the document *WiVib-4/4 Pro Wireless Acquisition Unit Programmers Manual*.

We suggest this method should only be used if the WiVib Server does not provide the specific functionality that you require for your system.

ORDERING INFORMATION

Device Type	Order Code
WiVib-4/4 Pro Acquisition Unit (4 x ICP Channels and 4 x DC Channels)	WiVib-4/4 Pro
Accessories	
USB Interface Cable for WiVib-4/4 Pro (Type A to Mini-B)	UC-3
Ferrite Sleeve for CE Compliance	FS-1
Lithium Battery 3.6V Type LSH 14 for WiVib-4/4 Pro (manufacturer Saft) - two required	LSH14
Lithium Battery 3.6V Type LSH 14 for WiVib-4/4 Pro (manufacturer Saft) - two required (no transportation restrictions)	LSH14 Light

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