Wireless
Monitoring

WiVib-8x8pro
Operating Manual

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CHAPTER 1 - Overview

1.1 The *WiVib-8x8pro* Acquisition Device

The *WiVib-8x8pro* is data acquisition device that measures vibration and process parameters from machinery and other mechanical systems. It can be powered from internal batteries or a low-voltage external power source.

There are two models of the *WiVib-8x8pro*. The *WiVib-8x8pro-E* has an ethernet interface only, and the *WiVib-8x8pro-EW* has the option of ethernet and wifi, selectable using the *WiVibConfig* utility. If you have the *–E* model, references to wifi setup and settings in this manual can be ignored.

The basic operation is that analog signals are digitised by the on-board analog-to-digital converter (ADC) and stored in internal memory. This data can be passed over a WiFi 802.11b/g/n network or a 100base-T ethernet cable to a host computer for processing and display. The device can be switched off under software control and woken up by the internal programmable real-time clock. *Wakeup Mode*, as it is called, helps to maximise battery life.

The *WiVib-8x8pro* is a sixteen channel device comprising eight dynamic inputs that can accommodate standard ICP type accelerometers or AC voltage signals for measurements such as vibration, together with eight DC signal inputs for process measurements such as temperature.

The eight dynamic channels allow simultaneous sampling on any or all of the channels. This enables orbits and simultaneous triaxial measurements to be made. The resolution of the ADC is 24 bits, and gains up to 100 are available. Spectra up to 32000 lines can be measured. Bearing demodulation is carried out by a software algorithm on the device. Anti-aliasing of the incoming signal is performed by continuous time analog pre-filters followed by digital filtering. Incoming data is therefore oversampled, but this process is entirely invisible to the user. The final data stream is buffered in internal memory and then transferred via the WLAN or LAN network under control of the host PC.

Accelerometers that provide temperature output can be accommodated by connecting the acceleration output to one of the ICP channels and the temperature output to the corresponding DC input channel. Alternatively, the eight DC channels can be used for measuring other DC coupled voltages in user selectable voltage ranges.

1.2 Communication

The *WiVib-8x8pro* is controlled by a set of ‘commands’ sent from a host computer or similar device via the network. 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 PC should always know the activity and status of each *WiVib-8x8pro* on its network.

The *WiVib-8x8pro* can communicate on any wireless network that is 802.11b, g or n compatible. Alternatively, an Ethernet cable can be connected to the internal RJ45 connector to implement a standard 10Base-T or 100Base-T connection. Auto-negotiation of speed selects the maximum speed according to the network and auto-mdix allows for straight-through and cross-over Ethernet cables.

1.3 Configuration

Network settings are programmed into the *WiVib-8x8pro* in one of two ways, namely

- direct cable connection to the on-board USB port using the *WiVibConfig* utility supplied by Icon Research, or
- network connection using the *WiVibConfig* utility (though this requires an initial connection already to have been made).

Status information relating to network communication is available on the on-board display. Data from the USB port can be displayed using the *WiVibConfig* utility.

1.4 LAN and WLAN Network

Any number of *WiVib-8x8pro* devices can exist on a network, and each is distinguished by its unique IP address. IP addresses can be allocated statically or can be allocated automatically by DHCP. Each *WiVib-8x8pro* exists on a network in a similar fashion to any other wireless or LAN device.

1.5 Important Safety and Operational Information

The *WiVib-8x8pro-EW* contains a certified transmitting device. Certification is subject to the following:

1. Only a single omnidirectional antenna with a maximum gain of 5dBi may be used.

2. The antenna must be installed to provide a separation distance of at least 20cm from all persons.

The *WiVib-8x8pro-EW* is supplied with a 5dBi antenna.

FCC warning statement:

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating

instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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

CHAPTER 2 – Configuring the WiVib-8x8pro

2.1 ON/OFF Pushbutton

The ON/OFF pushbutton is located on the right hand side of the enclosure. It is multi-function as follows:

a) To turn on the unit, press the pushbutton once.
b) While the unit is switched on, pressing the pushbutton cycles through the display screens, namely SYSTEM, STATUS, WIFI/LAN CONNECTION and WAKEUP (if enabled). Note that the first press illuminates the display backlight which turns off automatically after a few seconds.
c) To turn off the unit, press and hold the button, and watch the display count down 3 seconds to switch-off.
d) To restore factory defaults, with the unit switched off, press and hold the pushbutton and watch the on-screen countdown. Release the ON/OFF button as indicated. Factory defaults will now be set.

2.2 Configuration Methods

The *WiVib-8x8pro* can communicate on an ethernet (LAN) on a wifi (WLAN) network. (Note that the *WiVib-8x8pro-E* supports ethernet only). One or other connection mode is selected at one time ie. both types of connection cannot be enabled together. In wifi mode, encryption, which encodes the data passing to and from it, can also be set. The process of defining these settings is called “configuration”.

The *WiVib-8x8pro* is configured using the *WiVibConfig* programme supplied with the unit. There are number of ways of connecting to the device for configuration purposes, but it may be preferred to use the direct USB port connection as this saves having to change the settings on your computer or laptop to match the default settings on the *WiVib-8x8pro*. Refer to the manual entitled *WiVibConfig User's Manual* for information on how to use the configuration tool.

Before you start, ensure that a battery is fitted to the *WiVib-8x8pro* or that external power has been applied. See the section on ‘Powering the *WiVib-8x8pro*‘ for details.

2.3 Default Settings

On leaving the factory, the *WiVib-8x8pro* is configured with default settings. These are detailed in the table below.

Item	**Setting**
Name	*WiVibProA:<serial no>*
Network Type	LAN (Ethernet)
IP Address	192.168.101.250
Subnet Mask	255.255.255.0

Default Gateway	192.168.101.1
DHCP Enable	Off
Wireless SSID	*wivibnet*
Security	Off
Host IP Address	192.168.101.80
Host Port Number	8000
Timeout	5 minutes

LAN Connection

For a LAN connection, connect a LAN ethernet cable to the RJ45 socket on the unit. The green link light marked LINK will illuminate steadily and flash when data is passing. The orange SP100 light will illuminate if a speed of 100Mbits is detected.

To enable your *WiVib-8x8pro* onto your LAN network quickly, just ensure that your *WiVib-8x8pro* and host computer both have the same subnets. The default *WiVib-8x8pro* subnet is 192.168.101.xxx.

WLAN Connection

To establish a "quick-start" connection between a computer and *WiVib-8x8pro*, all you need to do is to program your access point to an SSID of "*wivibnet*" and an IP address of 192.168.101.xxx (where xxx is any unused address in the range 0 to 255), and assign a static IP to your computer of 192.168.101.80 (via **Control Panel … Network Connections**). For existing systems, you will need to use *WiVibConfig* to set up appropriate IP addresses for each *WiVib-8x8pro*, the SSID and associated settings of the wireless network (including security settings, if used) and the IP address of the host computer.

2.4 Restoring Factory Defaults

Factory default settings can be re-programmed at any time. To do this, press and hold the ON/OFF button at switch-on and watch the on-screen message. Release the ON/OFF button as indicated. Factory defaults will now be set.

CHAPTER 3 – Modes of Operation

The *WiVib-8x8pro* has two modes of operation, namely *Continuous Mode* and *Wakeup Mode*. These are explained below.

3.1 Continuous Mode

Continuous Mode is when the device remains powered under the control of the ON/OFF pushbutton. It will respond to commands received over the network as long as it is powered up.

When in *Continuous Mode,* if the timeout period is reached the *WiVib-8x8pro* will perform a self-instructed power cycle and attempt to reconnect. A timeout is reached if no command has been received from the host computer within the timeout period. The factory default is set to five minutes, but this can be altered in software. Note that the *WiVib-8x8pro* can still be powered down by a command from the controlling application and in this case can only be switched on by pressing the ON/OFF pushbutton.

There is a jumper on the device, labelled **PWR ON**, which overrides software and pushbutton control and allows the unit to be permanently powered. This enables the unit to be powered up and down solely by an external power source. Refer to chapter 5 for details.

3.2 WakeUp Mode

When the device is switched off, a real-time clock remains running and this can be used to power the device up at pre-determined intervals. This is called *Wakeup Mode*. *Wakeup mode* is typically used when the device is powered from batteries, in order to conserve power. It is simply a matter of telling the device, using the appropriate commands, at what time it should wake up for the first time followed by the interval at which repetitive wakeups should occur. A wakeup time can be overridden by pressing the ON/OFF pushbutton.

At wakeup, the device has a limit on the time that it will remain powered up if it is unable to make contact with the network. This is to reduce battery drain when, for example, the network is temporarily down. If the device wakes up and is unable to establish communication with its network, the sequence of retries occurs as per the table below:

Retry Strategy

Mode	Sequence
Wakeup	At its wakeup interval, the *WiVib* tries to connect continuously for 40 seconds. If no connection is made, it powers down, waits for 2 minutes and tries again for 40 seconds. If no connection is made at this second attempt, it powers down and waits for the next wakeup interval when it repeats the sequence.
Continuous	The *WiVib* tries to connect continuously until the timeout interval as specified by the **TO** command is reached. The device then restarts and tries again until the next timeout interval is reached. This sequence continues indefinitely.

In summary, when in *Wakeup Mode*, the *WiVib-8x8pro* can be turned on in one of two ways, namely

1. using the ON/OFF pushbutton, or
2. powering up on a preset wakeup time/interval.

It can be switched off in one of three ways:

1. using the ON/OFF pushbutton, or
2. powering down as commanded by the controlling application, or
3. powering down after a timeout (similar to *Continuous Mode*).

3.3 User Display

The status of the *WiVib-8x8pro* can be seen at any time on the user display on the front of the unit. It is particularly useful at commissioning time as it reports network status and monitors sensor connections.

Pressing the ON/OFF pushbutton rotates through the four screens:

SYSTEM
This toggles continuously between dynamic and process values for all channels. The bias or gap voltage is shown for each dynamic channel (indicating correct connection of sensor) and the process value as a voltage. Time, battery level and firmware revision are also shown in the lower and upper banners.

STATUS
This indicates the status of the measurements on each channel (ready/measuring/waiting) on all dynamic and process channels. Tacho RPM is also indicated on each trigger input (if enabled).

LAN/WIFI CONNECTION
This shows the network settings of the *WiVib-8x8pro* depending on which mode (LAN or WLAN) it is operating in. The display also indicates the host that the unit is connected to, or is attempting to connect to. For the wifi connection (-EW model only) the signal strength is shown as a percentage.

WAKEUP
Status of wakeup mode is displayed on this screen.

3.4 Commissioning

It is often helpful to be able to check sensor connections at installation time before a *WiVib-8x8pro* has been enabled onto a network. Placing a jumper in the position marked **SETUP** enables the commissioning screen on the user display. Values of BIAS/GAP voltage on the dynamic channels inputs and the voltages on the PROCESS channels are continually listed so that sensors can be checked for expected values. The status of the trigger inputs is also displayed.

CHAPTER 4 – Physical Connections

4.1 Analog Inputs

The *WiVib-8x8pro* has a total of sixteen input channels. There are two types of channel as detailed in the table below.

Analog Input Channels

Type	Channels	Typical Usage
ICP / AC	A1 - A8	ICP accelerometers or AC dynamic signals
DC	B1 – B8	DC coupled process signals

Each dynamic ICP/AC input is paired with a corresponding DC process on a three-way connector. This is to enable easy wiring of accelerometers that have three wires, namely ICP output (connect to SIG), temperature output (connect to AUX) and ground (connect to COM). Note that the DC process inputs can be wired independently of accelerometers for general purpose use.

The table below shows the input connection assignments and the jumper number associated with each channel.

Connection	Input	Jumper
CH1 - SIG	Channel 1 ICP/AC Signal	A1
CH1 - AUX	Channel 1 DC Proc Signal	B1
CH1 - COM	Channel 1 Common	
CH2 - SIG	Channel 2 ICP/AC Signal	A2
CH2 - AUX	Channel 2 DC Proc Signal	B2
CH2 - COM	Channel 2 Common	
CH3 - SIG	Channel 3 ICP/AC Signal	A3
CH3 - AUX	Channel 3 DC Proc Signal	B3
CH3 - COM	Channel 3 Common	
CH4 - SIG	Channel 4 ICP/AC Signal	A4
CH4 - AUX	Channel 4 DC Proc Signal	B4
CH4 - COM	Channel 4 Common	
CH5 - SIG	Channel 5 ICP/AC Signal	A5
CH5 - AUX	Channel 5 DC Proc Signal	B5
CH5 - COM	Channel 5 Common	
CH6 - SIG	Channel 6 ICP/AC Signal	A6
CH6 - AUX	Channel 6 DC Proc Signal	B6
CH6 - COM	Channel 6 Common	
CH7 - SIG	Channel 7 ICP/AC Signal	A7
CH7 - AUX	Channel 7 DC Proc Signal	B7
CH7 - COM	Channel 7 Common	
CH8 - SIG	Channel 8 ICP/AC Signal	A8
CH8 - AUX	Channel 8 DC Proc Signal	B8
CH8 - COM	Channel 8 Common	

Physical connection is by terminal connectors that can be removed from the board to make termination easier. Twelve IP67 glands are fitted to the enclosure.

Each type of input and jumper configurations are described in detail below.

ICP / AC Inputs

These eight dynamic inputs incorporate an ICP interface that can be enabled or disabled by jumper selection. Each input has its own ICP interface (ie. they are not multiplexed). If the appropriate jumper (A1 thru A8) is inserted, then ICP power is applied to that channel. If the jumper is not inserted, then an AC signal can be applied. The maximum input range of these inputs is +/-10V for both ICP and AC connection. This equates to a maximum input range of +/-100g for a 100mV/g accelerometer.

The nominal voltage of the ICP interface is 20V with a constant current of 2.4mA. Bias voltage checking is available and the bias voltage can be read for each channel by the application communicating with the *WiVib-8x8pro*.

ICP/AC Channel Jumper Selection (A1 thru A8)

Position	ICP Supply
Fitted	ICP enabled
Not Fitted	ICP disabled

DC Process Inputs

These eight inputs are DC coupled and are intended for accurate measurement of process signals. The signals do not pass through any of the filters or gain amplifiers that are on the ICP / AC signal paths.

The input range of these channels is 0-3V or 0-10V, depending on jumper position. The range can be set individually per channel. Jumper positions are shown in the table below.

DC Channel Jumper Selection (B1 thru B8)

Position	Range
Fitted	0 - 10V
Not Fitted	0 - 3V

4.2 External Trigger Inputs

The *WiVib-8x8pro* has two trigger channels. These inputs act as external trigger and the tacho inputs. They can also act as gates – refer to section Gated Inputs later in this section.

Trigger channel 1 (labelled **TRIG 1** on the main board) can have an analog signal (input label **ANA**) or a digital signal (input label **DIG1**) connected (but not both at the same time). Trigger channel 2 (labelled **TRIG 2** on the main board) can have a Namur sensor attached (input label **NAM**) or a digital signal (input label **DIG2**) connected (but not both at the same time). Trigger options are summarised in the table below.

Trigger Channel	Input Option	Label	Comment
TRIG 1	Analog	**ANA**	Analog level trigger set by trimpot
	Digital	**DIG1**	Optically-isolated digital trigger
TRIG 2	Namur	**NAM**	Namur sensor compatible
	Digital	**DIG2**	Optically-isolated digital trigger

On trigger channel 1, the three-way jumper labelled **ANA DIG** selects the trigger option as shown in the table below.

Channel TRIG1 Trigger Options
(ANA/DIG 3-Way Connector)

Position	Trigger Mode	Input Connection
ANA	Analog	**ANA** on **TRIG 1** Connector
DIG	Digital	**DIG1** on **TRIG 1** Connector

On trigger channel 2, triggering occurs from whichever input is connected (**NAM** or **DIG2**). No jumper settings are required to select the input type.

Analog Trigger (ANA)

The analog trigger input range is +/- 25 volts and is typically used to trigger off the signals from proximity probes and other repetitive analog signals. The signal source should be connected to pin **SIG** and the common of the signal to pin **COM**. This is regardless of the polarity of the signal.

Analog Trigger Connections

Terminal	Signal
SIG	Analog Signal
COM	Common

The trigger level is set by adjusting the potentiometer RV1 until the adjacent LED illuminates. For slow trigger rates (<10Hz approximately), the **TRIG1** LED will appear to flash whereas it will appear solid for faster rates. To optimise the adjustment of the potentiometer, wind it until the LED illuminates, and keep winding it until the LED extinguishes. Then wind the potentiometer in the opposite direction to half-way between these two points.

Note that jumper **ISOL1** must be fitted in analog trigger mode. This means that, for the analog trigger input, the trigger input is non-isolated ie. the common of the input signal is connected to the common of the *WiVib-8x8pro*.

Digital Triggers (DIG1 and DIG2)

External trigger inputs are identified by the labels **DIG1** and **DIG2**. These inputs can be isolated or non-isolated.

The signal source should be connected to terminal '+' and the common of the source to terminal '–'. When a trigger is detected, the corresponding LED (**TRIG1** or **TRIG2**) will illuminate. For slow trigger rates (<10Hz approximately), the LED will appear to flash whereas it will appear solid for faster rates.

Digital Trigger Connections

Terminal	Signal
+	Logic Signal
-	Common

An external trigger requires a logic pulse and is compatible with any voltage pulse input in the range 5-24Vdc. Logic '0' must be less than 0.5V. Drive current for the digital triggers is minimum 2mA.

The triggers can be isolated or non-isolated. By inserting a jumper in **ISOL1** (for **DIG1**) and **ISOL2** (for **DIG2**), the trigger is non-isolated from the ground of the unit. By leaving the jumper out, the unit remains isolated.

Namur Trigger (NAM)

A two-wire Namur sensor can be fitted to the terminals marked **NAM**. The polarity of the sensor connections are marked '+' and '–'.

Namur Trigger Connections

Terminal	Signal
+	Namur +ve
-	Namur -ve

A typical type of sensor is the NCB series from Pepperl & Fuchs (eg. the NCB1.5-8GM25-NO). These are very low power devices and so are good for battery-powered applications, though they are perfectly suitable also for when the *WiVib-8x8pro* is externally powered. These sensors operate at a nominal supply voltage of 8V and this is supplied by the *WiVib-8x8pro*.

When a trigger is detected on the Namur sensor, the **TRIG2** LED will illuminate.

Gated Inputs

The external trigger inputs can also act as gates to enable or disable sampling depending on the status of these inputs. This mode is set up as configured by the controlling host application. In gate mode, the application reads the logic level of one or both of the trigger inputs and makes a decision based on their status. The same logic level thresholds apply as for normal triggering.

4.3 Relays

The *WiVib-8x8pro* contains two relays that are under software control from the host. Relay types are user selectable, but recommended type is the G3VM series from Omron. For example, the G3VM-61A1 is a SPST-NO relay rated at 60Vac (ie. bidirectional) and 500mA.

The relays are 4-pin devices and fit into the socket. The positions are marked **REL1** and **REL2**. When fitting the relays, ensure that the orientation is correct ie. the dot on the relay must line up with the white dot on the pcb.

The relay output terminals are marked as **RELAYS 1** and **2** on the board.

4.4 Fault LED

In the event of a board fault, a red LED marked **FAULT** will illuminate at the top right side of the display on the main board. Cycling power will reset this.

4.5 USB Configuration Port 1

The USB port marked **USB1** can be used for a number of purposes, namely:

a) configuring the network settings on the unit using the *WiVibConfig* utility;
b) programming of the *WiVib-8x8pro* using the programming utility from Icon Research (contact the factory for details of this utility);
c) outputting of debug information.

Its main purpose is for configuring the device as in a) above.

4.6 USB Universal Port 2

The *WiVib-8x8pro* is fitted with a universal USB port marked **USB2**. This can be used for additional applications requiring such functions as additional mass storage (using a USB flashdrive). This is not currently supported but is available for future enhancements.

CHAPTER 5 – Powering the *WiVib-8x8pro*

5.1 Power Sources

The *WiVib-8x8pro* can be powered from internal batteries or from an external power supply in the range 10-30Vdc. The peak current drawn from the battery when transmitting with the wifi function is approximately 400mA. Peak current drawn from a power supply set to 24Vdc is about 125mA. At 12Vdc, it is about 250mA.

The toggle switch marked **PWR** selects which power source is used as per the table below. If the switch is in in the opposite position from the source connected, then the power is disconnected.

***WiVib-8x8pro* Power Switch position**

Power Source	Switch PWR
Battery	BAT
External 10-30Vdc	EXT

5.2 Battery Power

The batteries used must be two 3.6V lithium type 'D' cells capable of delivering high peak current. The LSH 20 from SAFT is recommended. Ensure that the batteries are inserted the correct way round in the battery holder.

The *WiVib-8x8pro* contains a battery "gas gauge" that can be read by the controlling application so that charge remaining can be monitored. The batteries cannot be recharged. In addition, there is an internal battery monitor that detects a very low battery level and turns the unit off before any corruption of data could occur.

The "gas gauge" is automatically reset when the batteries are changed, and the *WiVib-8x8pro* always assumes that fully-charged batteries have been inserted. To ensure that the "gas gauge" resets correctly, remove the exhausted batteries and wait at least 30 seconds before inserting fresh batteries.

5.3 External Power

Any dc power source in the range 10V to 30V can be used to power the *WiVib-8x8pro*. Simply ensure that it can supply the peak current required. Power is applied at the connector marked **EXT PWR**. The '+' and '–' terminals are clearly marked. The unit is reverse polarity protected and so cannot be damaged if the power source is temporarily connected the wrong way round. Peak current drawn from a power supply set to 24Vdc is about 125mA. At 12Vdc, it is about 250mA. Due to inrush current at switch-on, it is recommended that a supply with at least twice the required current is used.

5.4 ON/OFF Pushbutton

The ON/OFF pushbutton is located on the right hand side of the enclosure. It is multi-function as follows:

e) To turn on the unit, press the pushbutton once.
f) While the unit is switched on, pressing the pushbutton cycles through the display screens, namely SYSTEM, STATUS, WIFLI/LAN CONNECTION and WAKEUP (if enabled). Note that the first press illuminates the display backlight.
g) To turn off the unit, press and hold the button, and watch the display count down 3 seconds to switch-off.
h) To restore factory defaults, with the unit switched off, press and hold the pushbutton and watch the on-screen countdown. Release the ON/OFF button as indicated. Factory defaults will now be set.

Note that, if the unit suffers a programme fault, it can be forced to power down by pressing the **SW OFF** (switch-off) pushbutton inside the unit.

Also note that, when power is applied to the unit, it always defaults to ON. The reason for this is that if, for example, external power is lost in the plant where a *WiVib-8x8pro* is installed, as soon as power is restored, the unit will power up and make a connection with the host computer in order to re-synchronise its measurement cycles.

5.5 Permanent Powering

There is a jumper on the device, labelled **PWR ON**, which overrides all software and pushbutton power control and allows the unit to be permanently powered.

Inserting the jumper means that the *WiVib-8x8pro* is permanently enabled and so will power up and down as its power source is turned on and off. This is useful when the device is running continuously and there is no opportunity for user intervention.