



ULP (Ultra-Low-Power) WIFI combo sensors

(accelerometer, inclinometer and shock) with built-in data logger



willow DATASHEET



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Product Video



User Guide



Quick Start



Mechanical Drawing



STEP File



MQTT Toolkit for IOT Sensors



OVERVIEW



- ULP (Ultra Low Power) Wifi technology



- Embedded data logger: up to 5 million data points (with events dating)



- High accuracy accelerometer (measurement range $\pm 2g$ or $\pm 10g$) with FFT and DIN4150-3 (Ground Vibration) modules

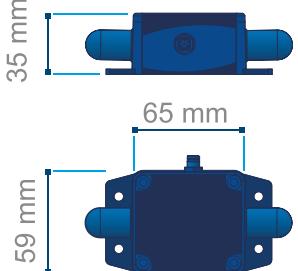


- High accuracy bi-axis inclinometer $\pm 15^\circ$ or $\pm 30^\circ$



- Scalable shock sensor $\pm 2/4/8/16g$ with SSD (Smart Shock Detection) mode enabling trigger data acquisition on a shock detection

MADE
IN
GERMANY



- Rugged aluminum enclosure, Waterproof IP67 |NEMA 6



- USB 2.0 link for device configuration (including firmware upgrade)



- Store & Forward+ : lossless data transmission with hard real-time



- Excellent radio link relying on the radio antenna diversity developed by Beanair®



- IOT Ready : Integrated MQTT data exchange, lightweight and open-source Internet of Things (IOT) protocol



- Smart and flexible power supply:
 - Internal lithium-polymer rechargeable battery (780 mAh)
 - External power supply: USB 5VDC or 5-17VDC compatible with solar energy harvesting



BeanAir Rethinking Sensing Technology

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APPLICATIONS



• Structural Health Monitoring



AN OPEN-STANDARD & INDUSTRIAL WIFI TECHNOLOGY

- ULP (Ultra Low power) Wifi – IEEE 802.11 b/g/n
- Lower total cost of ownership-works with existing access points
- Large installed base and consequent broad-based familiarity with configuration, use and troubleshooting at the physical and link layers
- Easy provisioning & IT friendly: our ULP wifi sensors use IP-over-Ethernet networking environment

A RELIABLE WIFI TECHNOLOGY THANKS TO OUR " STORE AND FORWARD+ " FUNCTION



The store and forward technique works by storing the message transmitted by **the BeanDevice® Willow** (wireless DAQ/sensor) to a Wifi access point/ Wifi receiver. If the message is not received due to a network disruption, it will be retransmitted on the next transmission cycle. This technique allows to bring a lossless data transmission.

User can also enable the Hard real-time option; i.e. the message must be received by the Wifi Access Point/Wifi Receiver within the confines of a stringent deadline. It is automatically deleted if it failed to reach its destination within the allotted time span



TECHNICAL SPECIFICATIONS

Product Reference

BND-WILOW-X-INC-ACCMR-INCMR-MO

ACCMR – Measurement Range:	INCMR – Measurement Range:	MO - Mounting option
2: ±2g measurement range	15B : bi-axis ±15°	BR - 90° Mounting bracket
10: ±10g measurement range	30B : bi-axis ±30°	M - Magnetic Mounting

Example 1: BND-WILOW-2G-15B-BR - ULP Wifi Combo sensors accelerometer (measurement range 2g) and Inclinometer (measurement range 15° Bi-axis) with 90° bracket mounting

Example 2: BND-WILOW-10G-30B-M - ULP Wifi Combo sensors accelerometer (measurement range 10g) and Inclinometer (measurement range 30° Bi-axis) with magnet mounting

Example 3: BND-WILOW-2G-15B - ULP Wifi Combo sensors accelerometer (measurement range 2g) and Inclinometer (measurement range 15° Bi-axis)

Accelerometer Specifications

Accelerometer technology	High precision accelerometer based on MEMS technology
Accelerometer measurement range	Two versions: ±2g and ±10g
Sensitivity	±2g Version : 660 mV/g ±10g version: 200 mV/g
Typical non-linearity	±0,1% FS
Analog to Digital converter	24-bit delta-sigma with temperature compensation Syncronous measurement channel
Sensor frequency response (-3 dB)	DC to 800 Hz
Noise spectral density	±2g Version : 45 µg/√Hz ±10g version: 100 µg/√Hz
Zero-g Offset Variation from RT over Temp	±2g Version : ±0.2 mg/°C ±10g version: ±0.1 mg/°C
Sensitivity Variation from RT over Temp	±2g Version : ±0.01 %/°C (XY) , ±0.02 %/°C (Z) ±10g version: ±0.01 %/°C
Offset Ratiometric Error	±2g Version : 4mg ±10g version: ±0.2% (XY) , ±0.1% (Z)



TECHNICAL SPECIFICATIONS

Accelerometer Specifications

Sensitivity	Sensitivity Ratiometric Error
	±2g Version : ±1.25 % (X-Y) , ±0.2 % (Z) ±10g Version : ±1.6% (X-Y) , ±0.2 % (Z)
Cross Axis Sensitivity	2%
Maximum sampling rate	3 kSPS per axis
Onboard temperature sensor	Range -40°C to +65°C , accuracy ±1°C

Shock sensor specifications

Shock Sensor technology	MEMS technology
Shock sensor range	±2g/±4g/±6g/±8g/±16g dynamically selectable from the BeanScape software
Sensitivity	±2g range: 0.06 mg/digit ±4g range: 0.12 mg/digit ±6g range: 0.06 mg/digit ±8g range: 0.12 mg/digit ±16g range: 0.12 mg/digit
Typical non-linearity	±0.15% on the FS
Analog to Digital converter	12-bits with temperature compensation
Sensor frequency response (-3 dB)	DC to 800 Hz
Noise spectral density	150 µg/√Hz
Zero-g level change vs temperature (max delta from 25°C)	±0.5 mg/°C
Sensitivity change Vs temperature	±0.01 %/°C
Anti-aliasing filter	Butterworth 2th order filter
Maximum sampling rate	1.6 kSPS per axis
Typical zero-g level offset accuracy	±40 mg



Remote configuration parameters

Data Acquisition mode (SPS = sample per second)	Low Duty Cycle Data Acquisition (LDCDA) Mode: 1s to 24 hour Alarm & Survey mode: 1s to 24 hour Streaming mode : 100 SPS by default Alarm Streaming Mode : 100 SPS by default
Sampling Rate (in streaming packet mode)	Minimum: 1 SPS Maximum: 3 kSPS per axis
Alarm Threshold	2 high levels alarms & 2 low levels alarms
Power Mode	Sleep with Network Listening & Active

Inclinometer sensor specifications

Inclinometer Technology	Inclinometer based on MEMS Technology
Measurement resolution (Bandwidth 10 Hz)	0.001°
Noise density	0.0004 °/√Hz
Accuracy (Full scale)	±0.05° (±0.02° on customer request)
Offset temperature dependency (temperature range -25°C to +85°C)	±0.002 °/°C
Sensitivity temperature dependency (temperature range -25°C to +85°C)	±0.005 %/°C with temperature compensation ±0.013 %/°C without temperature compensation
Long term stability (@23°C)	< 0.004 °
Analog to Digital converter	24-bit delta-sigma analog-to-digital with temperature compensation Synchronous measurement channel
Sensor frequency Response (-3dB)	DC to 28 Hz
	0.0004 °/ √Hz

Embedded Data logger

Storage Capacity	up to 5 million data points
Wireless data downloading	3 minutes to download the full memory (average time)



TECHNICAL SPECIFICATIONS

RF Specifications

Wireless Protocol Stack	IEEE 802.11 b/g/n
WSN Topology	Point-to-Point / Star / Cluster-Tree
Data rate	250 Kbits/s
RF Characteristics	ISM 2.4GHz – 16 Channels. Antenna diversity architecture designed by BeanAir®
Receiver Sensitivity	-95.7 dBm @1 DSSS -74.0 dBm @54 OFDM
Maximum Radio Range	200 m (L.O.S), radio range can be extended by adding wifi repeater
Antenna	Omnidirectional radome antenna with antenna diversity Gain : 3 dBi Waterproof IP67

Environmental and Mechanical

Casing	Aluminum casing Dimensions in mm (LxWxH):35x59x65 mm without antenna & eyelet, Weight (with internal battery, w/o mounting option) : 220g
Shocks resistance	100g during 50 ms
Operating Temperature	-40 °C to +65 °C
Norms & Radio Certifications	. CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 (Europe) . FCC (North America) . ARIB STD-T66 Ver. 3.6 (Japan) . ROHS - Directive 2002/95/EC
IP NEMA Rating	IP67 Nema 6



TECHNICAL SPECIFICATIONS

Included accessories	
M8 plastic cap	1pcs, Ref: WL-PC
M8 to USB cable	1pcs M8-5pins to USB Cable, 2 meters length. Ref:WL-CBL-M8-USB-2M
Magnet for power on/power off	1pcs Magnet. Ref: WL-MGN
Wall mounting kit	4 pcs M5 screws+ Locknut. Ref:WL-SCMKIT
Options (not included)	
Power-supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with USB plug
M8 Cable	M8-5Pins Cable , cable length : - 2 meters. Ref: WL-CBL-M8-2M - 5 meters. Ref: WL-CBL-M8-5M
WIFI AP/Repeater (wifi link extension)	Wireless AP/Repeater with an integrated N-Type RF connector + High Gain Antenna Casing : Polycarbonate Waterproof casing Dimensions: 190 x 46 mm Weight: 196 g Antenna Connector: N-Type Connector (male) Power Supply: 24V, 0.5A PoE Adapter (included) Power Method: Passive Power over Ethernet Max. Power Consumption: 6 Watts Operating Temperature: -40 to 80° C Shock and Vibration: ETSI300-019-1.4 Ref: WL-AP-UBIQ-TIT-7DBI for 7dBi Antenna Ref: WL-AP-UBIQ-TIT-9DBI for 9dBi Antenna
Solar Panel	Polycrystalline Solar Panel for BeanDevice® Willow® power supply Maximum Power : 3W Optimum operating Voltage: 12 VDC Dimension: 235 mm x 135 mm x 17mm Protection Frame: Aluminum Frame , Waterproof IP67 Length : 2 meters (Ref: WL-SLP-3W-2M) or 5 meters (Ref: WL-SLP-3W-5M) with M8 plug for a direct connection to the BeanDevice® Willow® Country of origin: solar panel from China, assembled and tested in Germany
Calibration certificate	Calibration certificate linked to national and international standards (DRAKKS) (Ref: WL-CERT-CAL)



Power supply

Rechargeable battery	High density Lithium-Ion rechargeable battery with a capacity of 780 mAh
Integrated battery charger	Integrated Lithium-ion battery charger with high precision battery monitoring
Current consumption @ 3,3V	<p>During data acquisition : 20 to 30 mA</p> <p>During Radio transmission :</p> <ul style="list-style-type: none"> - 1 DSSS - 278 mA - 54 OFDM - 229 mA <p>During sleep power mode : < 100 µA</p>
External power supply	<p>Two power supplies available:</p> <ul style="list-style-type: none"> - USB Power supply 5V - 5VDC to 17VDC compatible with solar energy harvesting

Beandevice® Willow® Front View



- Radome Antenna
- M8-5 pins connector for USB & Power supply
- Activity / Failure LED
- Battery LED



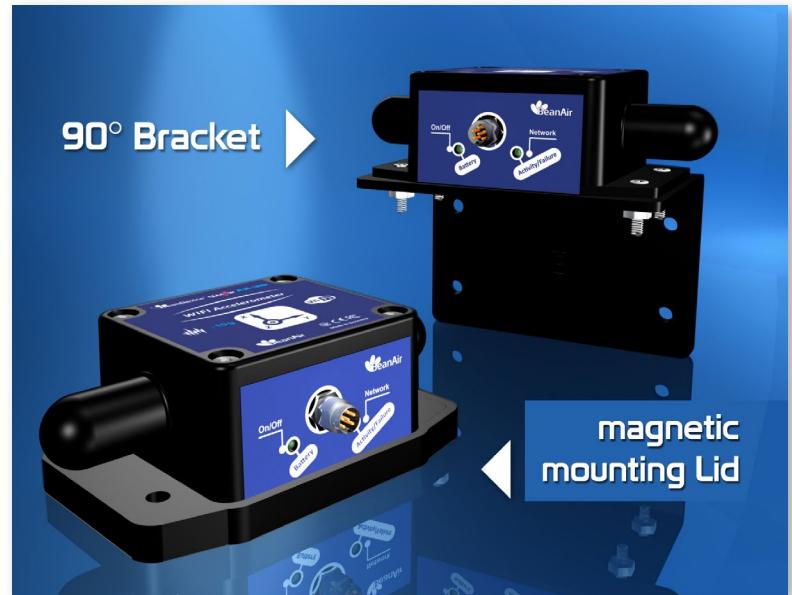
Mechanical Mounting Options

By default, the **BeanDevice® Willow®** comes with a screw mounting lid.

Two other mounting options are available:

- Magnetic mounting , add the extension –M on your product reference
- 90° bracket, add the extension –BR on your product reference

Mechanical Mounting Options Video



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