

Wireless IIOT inclinometer sensor | tilt, inclination, slope monitoring | low-cost version

FEATURED VIDEO



USER GUIDE



QUICK START



MECHANICAL DRAWING



STEP FILE



SmartSensor



MADE IN GERMANY



207-132085



## MAIN FEATURES



• Wireless inclinometer (measurement range  $\pm 15^\circ$ ,  $\pm 30^\circ$ )



• Time-synchronized wireless sensor networks ( $\pm 2.5$ ms of accuracy)



• Embedded data logger : up to 1 million data points (with events dating)



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



• Waterproof IP67 casing (Nema 6)



• Integrated Lithium-Ion battery charger

**APPLICATIONS**

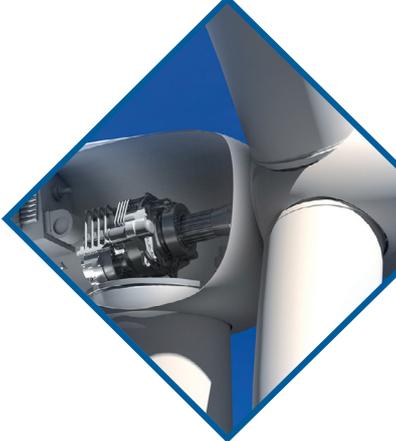


Structural Health Monitoring

Test and Measurement



Condition Monitoring



Land Surveying



For further information about bridge monitoring, please read the following applications note :  
AN\_RF\_002 – “Bridge monitoring with BeanAir® products”

**TIME-SYNCHRONIZED WIRELESS IIOT SENSORS**

TimeSync function brings time-synchronization over the Wireless IIOT Sensors ( $\pm 2.5$ ms of accuracy between each wireless IIOT sensors) and contributes to enhance user experience about correlation of remote sensing data and modal analysis.



## REMOTE CONFIGURATION & MONITORING

### BeanScape® 2.4GHz Basic

The **BeanScape® 2.4GHz** application allows the user to view all the data transmitted by the **BeanDevice® 2.4GHz INC**. Thanks to the OTAC (Over-the-Air configuration) feature, the user can remotely configure the **BeanDevice® 2.4GHz INC**.

SEVERAL DATA ACQUISITION MODES ARE AVAILABLE ON THE BEANDEVICE® INC :

- **Low Duty Cycle Data Acquisition mode (LDCDA)** : the data acquisition is immediately transmitted by radio. The transmission frequency can be configured from 1s to 24h.
- **Survey Mode**: the measured value is transmitted by radio whenever an alarm threshold (fixed by the user) is detected (4 alarms threshold levels High/Low). Meanwhile, the device sends frequently a beacon frame informing its current status.
- **Streaming Packet Mode** : all measured values are transmitted by packet within a continuous flow at 3 kbps maximum



### BeanScape® 2.4GHz Premium+ Add-on

The **BeanScape® 2.4GHz Premium+** integrates an OPC DA server (Data Access). OPC DA is particularly well suited for real time measurement and data sharing. Each data/measurement can be associated to a tag or its attributes and shared with one or many OPC clients.

**i** For further information about the different data acquisition modes:  
TN-RF-008 – “Data acquisition modes available on the BeanDevice®”

## ANTENNA DIVERSITY

While the vast majority of wireless sensors show their limits in harsh industrial environment, the **BeanDevice® 2.4GHz INC** integrates an innovative antenna diversity design, boosting the radio link quality in environments subject to random and diverse disturbances. Antenna Diversity improves both the quality and reliability of a wireless link by 30%.



EMBEDDED DATA LOGGER UP TO 1 MILLION DATA POINTS

The **BeanDevice® 2.4GHz INC** integrates an embedded datalogger, which can be used to log data when a Wireless IIOT Sensors can not be easily deployed on your site.

All the data acquisition are stored on the embedded flash and then transmitted to the **BeanGateway® 2.4GHz** when a Wireless IIOT Sensors is established.

The data logger function is compatible with all the data acquisition mode available on the **BeanDevice® 2.4GHz INC**:

- LowDutyCycle Data Acquisition
- Survey
- Streaming packet

EXAMPLE : TILT MONITORING ON A BRIDGE

- In standalone operation, the **BeanDevice® 2.4GHz INC** stores all the measurements on its onboard datalogger. Thus, a direct connection with the **BeanGateway® 2.4GHz** is not needed.
- During the measurement campaign, all the acquired measurements are stored on datalogger.
- Data logs can be transmitted to the **BeanGateway® 2.4GHz** on request. Once a successful transmission is done, the user can choose to erase automatically the logs from the datalogger memory, so new ones can be stored.



For further information about data logger, please read the following technical note :  
TN-RF-007 – “BeanDevice® DataLogger User Guide ”

## TECHNICAL SPECIFICATIONS

### PRODUCT REFERENCE

#### BND-2.4GHZ-INC-MR-PS

##### MR – Measurement Range

30B : bi-axial  $\pm 30^\circ$

90B : bi-axial  $\pm 90^\circ$

##### PS - Power Supply

RB : Internal rechargeable battery

XT : External Power supply

Example n°1: BND-2.4GHZ-INC-30B-RB, wireless bi-axial inclinometer with  $\pm 30^\circ$  measurement range, internal rechargeable battery

Example n°2: BND-2.4GHZ-INC-90B-XT, wireless bi-axial inclinometer with  $\pm 90^\circ$  measurement range, external primary cell

### SENSOR SPECIFICATIONS

Inclinometer Technology	Accurate and low power MEMS technology
Measurement resolution (Bandwidth 10 Hz)	0.0025°
Noise density	0.0008 °/√Hz
Measurement Repeatability (full scale, @ 25°C)	$\pm 0.04^\circ$
Measurement Accuracy (full scale, @ 25°C)	$\pm 0.05^\circ$
Offset temperature dependency	$\pm 0.008 \%/^\circ\text{C}$
Sensitivity temperature dependency	$\pm 0.008 \%/^\circ\text{C}$
Long term stability (@23°C)	$< 0.014^\circ$
Analog to Digital converter	16-bits, SAR architecture (Successive Approximation Register) with temperature compensation
Sensor frequency Response (-3 dB)	DC to 28 Hz
Noise spectral density DC to 100 Hz	0.0008 °/√Hz
Anti-aliasing Hardware filter	Butterworth 5th order filter – cut-off frequency : 1 Hz to 100 Hz remotely programmable (BeanScope®)

### CONFIGURABLE SETTINGS FROM THE BEANSCOPE® 2.4GHZ SOFTWARE

Data Acquisition mode (SPS = sample per second)	<p><b>Static Data Acquisition:</b> Low Duty Cycle Data Acquisition (LDCDA) and Survey (based on alarm thresholds) Mode. Measurement heartbeat 1s to 24 hour</p> <p><b>Dynamic data acquisition (not available on devices with ref. extension XT):</b> Streaming and S.E.T. (Streaming with Event Trigger) Mode</p>
Sampling Rate (in streaming packet mode)	<p>Minimum: 1 SPS</p> <p>Maximum: 100 SPS on each axis</p>
Alarm Threshold	2 High level and 2 Low level
Programmable cut-off frequency (Anti-aliasing filter)	1– 100 Hz
Power Mode	Battery saver mode & Active power mode (not available on XT version, External power supply)

**TECHNICAL SPECIFICATIONS**
**RF SPECIFICATIONS**

Wireless Protocol Stack	Ultra-Low-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E)
WSN Topology	Point-to-Point / Star
Data rate	250 Kbits/s
RF Characteristics	ISM 2.4GHz – 16 Channels. Antenna diversity designed by Beanair®
TX Power	+18 dBm
Receiver Sensitivity	-104dBm
Maximum Radio Range	500 m in Line-Of-Sight 30-100 m in Non-Line-of-Sight
Antenna	Omnidirectional radome antenna with antenna diversity Gain : 3 dBi Waterproof IP67

**EMBEDDED DATA LOGGER**

Storage capacity	up to 1 millions data points
Wireless data downloading	3 minutes to download the full memory (average time)

**TIMESYNC FUNCTION : CLOCK SYNCHRONIZATION OVER THE WIRELESS IOT SENSOR**

Clock synchronization accuracy	±2.5 ms (at 25°C)
Crystal specifications	Tolerance ±10ppm, stability ±10ppm

**ENVIRONMENTAL AND MECHANICAL**

Casing	Aluminum AL6061 & Waterproof casing Dimensions in mm (LxWxH): 100x55x21 mm Weight (battery included) : 155g
IP   NEMA Rating	IP67   Nema 6
Shock resistance	100g during 50 ms
Operating Temperature	<b>RB : Internal rechargeable battery</b> -40 °C to +60 °C <b>XT : External Power Supply</b> -40 °C to +75 °C during battery discharge
Norms & Radio Certifications	<ul style="list-style-type: none"> <li>• CE Labelling Directive R&amp;TTE (Radio) ETSI EN 300 328</li> <li>• FCC (North America)</li> <li>• ARIB STD-T66 Ver 3.6</li> <li>• ROHS - Directive 2002/95/EC</li> </ul>

## TECHNICAL SPECIFICATIONS

### POWER SUPPLY

Integrated battery charger	Integrated Lithium-ion battery charger with high precision battery monitoring : <ul style="list-style-type: none"> <li>• Overvoltage/Overcurrent/Short-Circuit/Undervoltage protection</li> <li>• Battery Temperature monitoring</li> </ul>
Current consumption @3,3V	<ul style="list-style-type: none"> <li>• During data acquisition : 30 to 40 mA</li> <li>• During Radio transmission : 80 mA @ 18 dBm</li> <li>• During Battery Saver Mode : &lt; 38 µA</li> </ul>
External power supply	8-28VDC with reverse polarity protection
Rechargeable Lithium-Polymer battery	High density Lithium-Ion rechargeable battery with a capacity of 950 mAh

### INCLUDED ACCESSORIES

- 1x Magnet to Power ON/Power OFF the device
- 1x M8 Cap for Power Supply

### OPTIONAL ACCESSORIES AND SERVICES

External Power Supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67/Nema 6) <a href="#">Ref: M8-PWR-12V</a>
Solar Panel Kit (compatible with External Power Supply version only)	High efficiency solar panel with with Solar charging controller and Lead-acid battery <a href="#">Ref: X-SOL-5W-M8-2M</a>
External Primary Cell in a Waterproof IP67 Casing	External Primary cell mounted in a IP67 aluminum Alloy casing: IP67 Battery Holder Lithium-thionyl chloride primary cell (Li-SOCl <sub>2</sub> ) 6,5 Ah <a href="#">Ref: PRIM-XTENDER</a>
M8 extension cable for external power supply	Molded cable with M8-3pins male plug <b>Material:</b> PVC with shield protection <b>IP Rating :</b> IP67   Nema 6 Cable length: 2 meters , <a href="#">Ref: CBL-M8-2M</a> Cable length : 5 meters, <a href="#">Ref: CBL-M8-5M</a> Cable length: 10 meters, <a href="#">Ref: CBL-M8-10M</a>
Calibration certificate	Calibration certificate provided by Beanair GmbH A static calibration method is used on a granite surface plate DIN876 <a href="#">Ref: CERT-CAL-SMART</a>

**GETTING STARTED WITH A WIRELESS IIOT SENSORS**



The **BeanDevice® 2.4GHz INC** operates only on our **Wireless IIOT Sensors**, you will need the **BeanGateway® 2.4GHz** and the **BeanScope® 2.4GHz** for starting a wireless IIOT sensors.

- i** For further information about **BeanDevice®** battery life :  
 TN-RF-002 Current consumption in active & sleeping mode  
 TN-RF-012 Beandevic autonomy in Streaming and Streaming Packet Mode

**BEANDEVICE® 2.4GHz INC FRONT VIEW**

Waterproof Antenna

Battery charge led

Network Reset  
non-contact push button



Network led

ON/OFF  
non-contact button

M8 Socket for power  
supply ( 8-28 VDC )



Product specifications are subject to change without notice.  
Contact Beanair for latest specifications.

**OPTIONS AND ACCESSORIES**

**External Primary cell**

Ref: PRIM\_XTEND

PRIM XTENDER - Extend your Beandevice battery autonomy  
External Primary cell mounted in a IP67 Alloy casing:

- . IP67 Battery Holder
- . Alloy Casing
- . Lithium-thionyl chloride primary cell (Li-SOCI2) 6,5 Ah



**AC/DC Power supply with M8 Plug**

Ref: M8-PWR-12V

- Wall plug-in power supply, Output: 12VDC, M8-3Pins plug
- AC Power plug: Europe/UK/Northamerica/China Australia
- Waterproof - IP67



**Molded Cable with M8 plug**

Ref: CBL-M8-2M

[cable length : 2 meters]

- CBL-M8-5M

[cable length : 5 meters]

- CBL-M8-10M

[cable length : 10 meters]



High efficiency Solar Panel with Solar Charging Controller and Lead-acid battery

**X-SOLAR**

[SOLAR Charging Controller]

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