SmartSensor

Wireless accelerometer dedicated to shock measurement with integrated data logger

BeanDevice® AX-3D S main presentation video

Smart Shock Detection

MADE IN FRANCE

Main features

- Wireless accelerometer dedicated to shock measurement with integrated data logger
- Scalable measurement range : *±6g/±12g/±24g or ±2g/±4g/±8g*
- Excellent radio link thanks to the antenna diversity developed by Beanair®
- SSD (Smart Shock Detection) Technology by Beanair
- Non contact actuation for quick mounting
- Streaming mode: 1000 samples per second on each channel (maximum)
- Maximum radio range : 500 m (L.O.S)
- Ultra-Low Power Radio Technology IEEE 802.15.4
- Current consumption during deep sleeping mode : < 28 uA
- *Embedded Data Logger* : up to 1 000 000 data acquisition records (with events dating)
- OPC server allowing real time access from your IT system to the BeanScape® (available on BeanScape® Premium+)
- Entirely autonomous system with an integrated Lithium-Ion battery charger
- *Watertight aluminium enclosure IP66* (dimensions LxWxH : 80x55x21mm)—weight 145g (rechargeable battery included) -suitable for Harsh Industrial Environment
- *Free Scilab scripts for FFT & PPV filtering*

Applications

- Health and usage monitoring systems (HUMS)
- Shock measurement on vehicles & trains
- Transportation Monitoring
- Drop testing
- Crash and impact testing
- Ride Quality Measurement

BeanAir
Rethinking Sensing Technology

Smart Shock Detection technology

The ***BeanDevice® AX-3DS*** integrates a smart shock detection technology which permits to detect & recognize a shock event during the sleeping or deep sleeping mode of the ***BeanDevice® AX-3DS***.When the ***BeanDevice® AX-3DS*** is in sleeping mode, the accelerometer continues to track a shock event with a power consumption of 68 uA in sleeping mode and 28uA in deep sleeping mode.

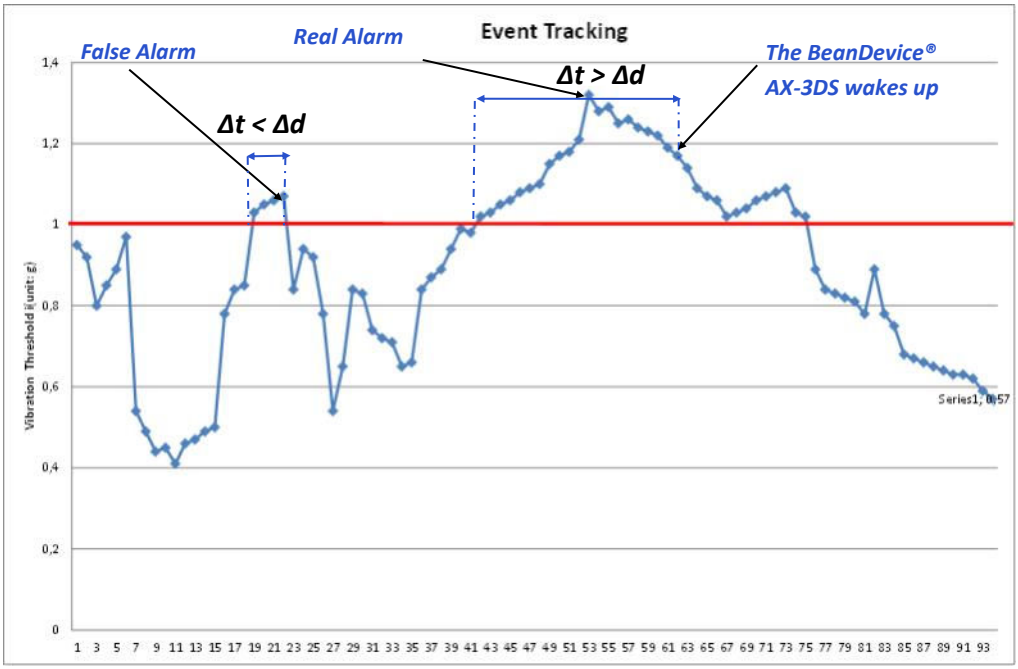
A hystereris on the shock event, fully configurable through the BeanScape®, allows to avoid false alarm.

Example: This curve shows two shock events, one considered as significant (real alarm) and another considered as not significant (false alarm) .

Δd: shock detection hysteresis.

Δt: Observed duration

If Δt =Δd, the shock event is detected and recognized, the BeanDevice® wakes up and start data sampling in "streaming mode".



The following tables show the accelerometer sampling rate and the hysteresis time value in deep sleeping mode and sleeping mode of the ***BeanDevice® AX-3DS***.

Accelerometer sampling rate during deep sleeping mode (in HZ)	*Δd max value (s)*	*Resolution*
0,5	128s	2s
1	64s	1s
2	32s	500 ms
5	12.8s	200 ms
10	6.4s	100 ms

Accelerometer sampling rate during sleeping mode (in HZ)	*Δd max value (s)*	*Resolution*
50	1,28s	20ms
100	640ms	10ms
400	160ms	2.5ms
1000	64ms	1ms

Shock measurement on pantograph

Shock tracking on high-value items

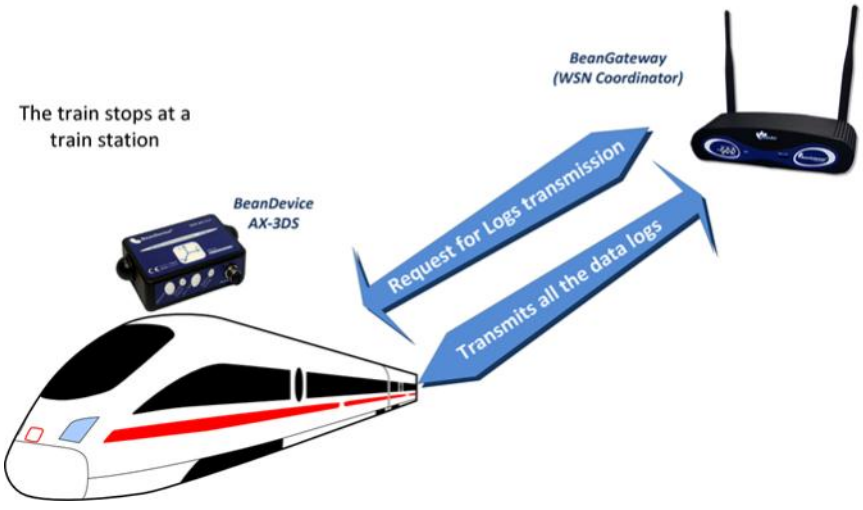
Embedded data logger up to 1 000 000 data acquisition records

The ***BeanDevice® AX-3DS*** integrates an embedded DataLogger, which can be used to log data when a Wireless Sensor network can not be easily deployed on your site. All the data acquisition are stored on the embedded flash and then transmitted to the BeanGateway® when a Wireless Sensor Network is established. The dataLogger function is compatible with all the data acquisition mode available on your ***BeanDevice® AX-3DS***:

- ***LowDutyCycle Data Acquisition***
- ***Alarm & Survey***
- ***Shock detection***
- ***Streaming & Streaming packet***

<u>Example</u>: Shock detection on a train

- The ***BeanDevice® AX-3DS*** is configured with the Datalogger feature. A standalone installation of the ***BeanDevice® AX-3DS*** will be done on the train, without the necessity to be connected to the BeanGateway®.
- When the train is running, all the data acquisition are logged on the embedded flash.
- When the train stops at a train station, a request for a log transmission is sent by the BeanGateway® to the BeanDevice®. The ***BeanDevice® AX-3DS*** starts sending all its logs . If all the logs are transmitted to the BeanGateway® sucessfully, the flash memory is erased and new logs will be started.



For further informations about the data logger, please read the following technical note – <u>TN_RF_007 – "BeanDevice® DataLogger User Guide "</u>

Remote configuration and monitoring

*Over-the-Air Configuration

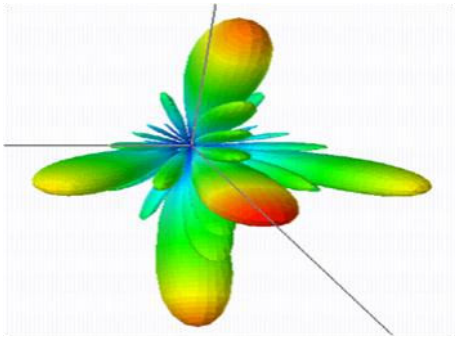
The BeanScape® application allows the user to view all the data transmitted by the BeanDevice® AX-3DS
With the OTAC (Over-the-Air configuration) feature, the user can remotely configure the BeanDevice® AX-3DS
Several data acquisition modes are available on the BeanDevice® AX-3DS :

- **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.
- **Alarm Mode** : the measured value is transmitted by radio whenever an alarm threshold (fixed by the user) is detected (4 alarm threshold levels High/Low).
- **Survey Mode** : operates like the Alarm mode but 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 1000Hz maximum
- **Streaming Mode**: all measured values are transmitted in real-time within a continuous flow at 100 samples per second maximum

The *BeanScape® 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.

For further informations about all the data acquisition modes available on this BeanDevice®, please read the following technical note: 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® AX-3DS 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%.

Product reference	
BND-AX3DS -*MR*G-*PS*-*WP*	
MR **–** ***Measurement Range***: ***24*** *: ±6/12/24g measurement range* ***8*** *: ±2/4/8g measurement range*	***PS*** **-** ***Power supply*** *:* ***RB*** *: Rechargeable battery* ***XT*** *: External Primary cell*
	WP– Wireless Technology : ***IEEE*** *: IEEE 802.15.4 (2006)*
Example*: BND-AX3DS-24G-RB-IEEE—Wireless Accelerometer with ±6/12/24g measurement range , rechargeable battery, IEEE 802.15.4 Wireless Technology*	

	Sensor specifications
Accelerometer Technology	MEMS Technology
Scalable measurement range	BND-AX3DS –24G-RB-IEEE Version : ±6g / ±12g/ ±24g BND-AX3DS –8G-RB-IEEE Version ±2g / ±4g/ ±8g The measurement range is remotely programmable (BeanScape®)
Measurement resolution	BND-AX3DS –24G-IEEE Version : 3 mg/digit @±6g , 6 mg/digit @±12g , 12 mg/digit @±24g BND-AX3DS –8G-IEEE Version : 1mg/digit @±2g , 2 mg/digit @±4g , 3.9 mg/digit @±8g
Typical non-linearity	±0,15%
Sensitivity change Vs temperature	±0,01% /°C
Zero-g level change vs temperature (max delta from 25°C)	BND-AX3DS –24G-IEEE Version: ±0,4 mg/°C BND-AX3DS –8G-IEEE Version : ±0,1 mg/°C
Typical zero-g level offset accuracy	BND-AX3DS –24G-IEEE Version: ±70 mg BND-AX3DS –8G-IEEE Version: ±20 mg
Analog to Digital converter	12-bits with temperature compensation
Noise spectral density @ BW 10Hz	BND-AX3DS –24G-IEEE Version : 650 µg/ √Hz BND-AX3DS –8G-IEEE Version : 218 µg/ √Hz
Anti-aliasing filter	Butterworth 2th order filter

	Over-the-air configuration (OTAC) 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 Packet Mode: 3 kSPS maximum Streaming Mode: 100 SPS maximum Shock detection: 1 kSPS maximum
Shock detection function	· Shock threshold in mg · Data acquisition sample rate in sleeping mode · Data acquisition sample rate after the shock detection · Shock detection hysteresis
Sampling Rate (in streaming packet mode)	Minimum: 1 SPS Maximum: 3 kSPS maximum (one axis activated), 1,5 kSPS (2-axis activated), 1 kSPS (3-axis activated)
Alarm Threshold	2 high levels alarms & 2 low levels alarms
Power Mode	Sleeping, Sleeping with Network Listening & Active
TX Power	-7 dBm / -1 dBm / 5 dBm / 11 dBm / 15 dBm / 18 dBm

	RF Specifications
Wireless Protocol Stack	IEEE 802.15.4 (2006 version)
WSN Topology	Point-to-Point / Star
Encryption	AES 128 bits (AES integrated coprocessor)
Data rate	250 Kbits/s
RF Characteristics	ISM 2.4GHz – 16 Channels. Antenna diversity architecture designed by Beanair®
TX Power	+0 dBm to +18 dBm
Receiver Sensitivity	-95.5 dBm to -104 dBm
Maximum Radio Range	500m (L.O.S)
Antenna	Antenna diversity : 2 omnidirectional antenna with a gain of 2,2 dBi

	Embedded Data logger
Storage capacity	up to 1 000 000 data acquisition
Write/read cycle	400000
Wireless data downloading	3 minutes to download the full memory (average time)

For further informations about aggregation capacity of wireless sensor networks:

TN_RF_003 Aggregation capacity of wireless sensor networks

	Real Time clock and crystal
Real Time Clock	Extremely Accurate Real Time Clock for measurement time stamping in Low duty cycle mode (±10ppm)
Crystal	Extremely accurate crystal for measurement time stamping in streaming & streaming packet mode
	Tolerance ±10ppm, stability ±10ppm

	Environmental and Mechanical
Enclosure	Aluminium & Watertight (IP66) enclosure Dimensions in mm (LxWxH): 80x55x21 mm, Weight (battery included) : 145g
Shock resistance	100g during 50 ms
Operating Temperature	-20 °C to +65 °C
Norms	CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 ROHS - Directive 2002/95/EC

	Power supply
Integrated battery charger	Integrated Lithium-ion battery charger with high precision battery monitoring : · Overvoltage Protection, Overcurrent/Short-Circuit Protection, Undervoltage Protection · Battery Temperature monitoring · Current accumulation measurement
Current consumption @3,3V	· During data acquisition : 20 to 30 mA · During Radio transmission : 40 mA @ 5dBm , 70 mA @ 18 dBm · During sleeping mode: 68uA · During deep sleeping mode : 28 uA
External power supply	External power supply : +8v to +28v
Rechargeable battery	High density Lithium-Ion rechargeable battery with a capacity of 1.3 Ah (referenced as BAT1.3DMG)

	Option(s)
Power-supply bloc	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67)

For further informations about the BeanDevice® battery life :

TN_RF_002 Current consumption in active & sleeping mode

TN_RF_012 Beandevice autonomy in Streaming and Streaming Packet Mode

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

MADE IN FRANCE

BeanAir
Rethinking Sensing Technology