

Beanair GmbH

SmartSensor User Manual

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Contents

1.	TECHNICAL SUPPORT	15
2.	VISUAL SYMBOLS DEFINITION	16
3.	ACRONYMS AND ABREVIATIONS	17
4.	RELATED DOCUMENTS & VIDEOS	18
	4.1 White paper webpage	18
	4.2 Featured videos	19
	4.3 Technical videos	20
5.	ACRONYMS AND ABBREVIATIONS	21
6.	PRODUCT DESCRIPTION	22
	6.1 About Smartsensor product line	22
	6.2 BeanDevice [®] 2.4GHz AX-3D	23
	6.2.1 Featured video	23
	6.2.2 Main features	
	6.2.3 Applications	23
	6.3 BeanDevice [®] 2.4GHz HI-INC - 2.4GHZ series (Wireless Inclinometer)	24
	6.3.1 Main features	24
	6.3.2 Applications	25
	6.4 BeanDevice [®] 2.4GHz AX-3DS - 2.4GHz series (Wireless shock sensor)	25
	6.4.1 Main features	
	6.4.2 Applications	25
	6.5 BeanDevice [®] 2.4GHz AX-3D XRange – 2.4GHz series (High Performance Wireless Accelerometer)	
	6.5.1 Main features	26
	6.5.2 Applications	
	6.6 BeanDevice [®] HI-INC Xrange (High performance wireless inclinometer)	27
	6.6.1 Main features	27
	6.7 Technical specifications	28
	6.7.1 BeanDevice [®] 2.4GHz AX-3D	28
	6.7.2 Beandevice [®] AX-3DS	31
	6.7.3 BeanDevice [®] INC	34
	6.7.4 Beandevice [®] HI-INC	36

		6.7.5	BeanDevice [®] AX-3D XRange	40
		6.7.6	BeanDevice [®] HI-INC Xrange	44
	6.8	Prod	uct focus	49
		6.8.1	Casing description	49
		6.8.2	Leds description	51
		6.8.3	Mechanical drawing for standard version	51
		6.8.4	Mechanical drawing for Xrange version	52
		6.8.5	Antenna diversity	52
		6.8.6	Radome antenna	53
	6.9	Mou	nting instructions	55
		6.9.1	Adhesive mounting instructions (BeanDevice [®] INC, HI-INC, AX-3D, AX-3DS)	55
		6.9.2	Screw Mounting (BeanDevice® AX-3D Xrange & BeanDevice® HI-INC Xrange)	60
		6.9.3	Wireless inclinometer special instructions (BeanDevice® HI-INC, INC & HI-INC Xrange)	61
	6.1	0 Bean	Device [®] 2.4GHz Power Supply	61
		6.10.1	Integrated Lithium-ion Rechargeable battery (Xtend version excluded)	61
		6.10.2	External Primary cell (Xtend version only)	62
		6.10.3	How to change the Primary cell on the BeanDevice® (Xtend version only)	63
		6.10.4	AC-To-DC power adapter (option)	69
		6.10.5	Power supply wiring code	69
	6.1	1 Resto	oring Factory settings	71
7.	BE	ANDEV	ICE® SUPERVISION FROM THE BEANSCAPE®	72
	7.1	Start	ing the BeanScape [®]	72
	7.2	Displ	aying the BeanDevice [®] Information	74
		7.2.1	Frame: Identity	74
		7.2.2	Frame : Wireless Network Diagnostic	75
		7.2.3	Frame: Power supply diagnostic	76
		7.2.4	Frame : System	78
		7.2.5	Frame : BeanDevice [®]	78
		7.2.6	Frame : Product Version	79
		7.2.7	Frame : Current Data Acquisition mode	79
	7.3	Bean	Device [®] configuration	80
		7.3.1	Tab: Custom Display	81
		7.3.2	Tab: Notes	82
		7.3.3	Tab : Data Acquisition configuration	83
		7.3.4	Tab: Sensor Config	87
		7.3.5	Tab: Online Data Analysis	90
		7.3.6	Tab: Datalogger	110
		7.3.7	Tab : System config	112
		7.3.8	Tab : Power mode management	112
		7.3.9	Right Click functionalities	113

	7.4 Senso	or channel profile	114
	7.4.1	Sensor channel status	115
	7.4.2	Sensor channel configuration	116
	7.4.3	Graphical display	128
	7.5 Datal	ogger configuration	133
	7.6 Optio	ns for Log file generation & folder organization	134
	7.6.1	Log file system overview	134
	7.6.2	Log file directory	134
	7.6.3	Log folder	136
	7.6.4	Log file size configuration	137
	7.6.5	All sensor channels in one log file	137
	7.6.6	Cache Data configuration (for Graph)	139
	7.6.7	Data acquisition Log file	
	7.6.8	Log file related to Wireless Network diagnostic	143
8.		ANAGEMENT	
		Alarm	
	•	m Alarm	
	8.4 DIN 4	150-30 Configuration	
9.	OFFLINE G	RAPH	154
		RAPH	
10.	DATE CON		156
10.	DATE CON	VERSION	156
10.	DATE CON ONLINE AN 11.1 Offlin	VERSION ID OFFLINE DATA ANALYSIS TOOL	156 160 160
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1	VERSION ID OFFLINE DATA ANALYSIS TOOL e data analysis tool	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2	VERSION ND OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin	VERSION. ID OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin 11.2.1	VERSION ND OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin 11.2.1 11.2.2	VERSION. ID OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool Online FFT	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin 11.2.1 11.2.2 11.2.3	VERSION ND OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool Online FFT Online Velocity	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.2 11.2 Onlin 11.2.1 11.2.2 11.2.3 11.2.4	VERSION ND OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity Particle Velocity online FFT Online FFT IIR Sofltware Filter	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin 11.2.1 11.2.2 11.2.3 11.2.4 11.2.5	VERSION ND OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool Online FFT Online FFT IIR Sofltware Filter Number of Points (Streaming)	156 160 160 160 168 176 176 176 184 195 195 196
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.2 11.2 Onlin 11.2.1 11.2.2 11.2.3 11.2.4 11.2.5 11.2.6	VERSION ID OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool Online FFT Online FFT IIR Sofltware Filter Number of Points (Streaming) Online Waveform Configuration	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.2 11.2 Onlin 11.2.1 11.2.2 11.2.3 11.2.4 11.2.5 11.2.6 11.2.7	VERSION ND OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool Online FFT Online FFT Online Velocity IIR Sofltware Filter Number of Points (Streaming) Online Waveform Configuration Unit of acceleration	156 160 160 160 168 176 176 176 184 195 195 195 196 196 196
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin 11.2.1 11.2.3 11.2.4 11.2.5 11.2.6 11.2.7 APPENDIC	VERSION ID OFFLINE DATA ANALYSIS TOOL e data analysis tool FFT (Fast Fourier Transform) waveform analysis module Particle Velocity e data analysis tool Online FFT Online FFT Online Velocity IIR Sofitware Filter Number of Points (Streaming) Online Waveform Configuration Unit of acceleration S.E.T threshold	
10.	DATE CON ONLINE AN 11.1 Offlin 11.1.1 11.1.2 11.2 Onlin 11.2.1 11.2.3 11.2.4 11.2.5 11.2.6 11.2.7 APPENDIC 12.1 Appe	VERSION ND OFFLINE DATA ANALYSIS TOOL	156 160 160 160 168 176 176 176 184 195 195 195 196 196 196 196 197

12.1.2 Coexistence With other Frequencies at 2.4 GHz	197
12.1.3 Temperature & Humidity	197
12.1.4 Reflections, Obstructions and Multipath	198
12.1.5 shock & Vibration resistance	198
12.1.6 Antenna	198
12.2 Appendice 2: Sensor Characteristics	199
12.2.1 BeanDevice [®] AX-3D & AX-3D Xrange	199
12.2.2 BeanDevice [®] HI-INC & HI-INC Xrange	204
12.2.3 Inclinometer Block Diagram (BeanDevice [®] version)	205
12.2.4 MEMS Inclinometer & differential output	205
12.2.5 5 th order Anti-aliasing filter	206
12.2.6 Analog to digital converter	206
12.2.7 Accuracy considerations	206
12.2.8 Offset & temperature dependencies	206
12.2.9 BeanDevice [®] AX-3DS	208
12.2.10 Sensor position inside the casing	209
12.3 Appendice 3: maintenance & supervision (for experienced user)	210
12.3.1 Extending battery life	210
12.3.2 Over-the-air Configuration (OTAC) parameters backed up on Flash	212
12.3.3 Scrolling menu « BeanDevice »	218
12.4 Appendice 4: Troubeshooting	221
12.5 Appendix 5: Sensor calibration	223
12.5.1 Factory Calibration procedure	223
12.5.2 Re-calibration	223
12.6 Firewall exception for BeanScape [®]	223

List of Tables

52
70
70
209
213

List of Figures

Figure 1 : White Paper webpage	18
Figure 2: Casing description	49
Figure 3: Mechanical drawing - BeanDevice® AX-3D/HI-INC/INC	52
Figure 4 : Radome antenna performances	53
Figure 5: Antenna position on the BeanDevice AX-3D	54
Figure 6: BeanDevice [®] mounting reference angle	
Figure 7: Xrange base plate overview	
Figure 8: External Primary cell	
Figure 9: Changing the External Primary cell	
Figure 10: Changing the External Primary cell	65
Figure 11: Changing the External Primary cell (wrong practice)	
Figure 12: Changing the External Primary cell (connecting the BeanDevice [®])	
Figure 13: Power supply diagnostic frame on BeanScape [®])	
Figure 14: M8-3P Wall Plug-in power supply	
Figure 15: M8 socket Power supply Wiring code	
Figure 16: M8 Plug Power supply Wiring code	
Figure 17: Network Reed non-contact button	
Figure 18: BeanDevice [®] display on BeanScape [®]	
Figure 19: Overview: BeanDevice [®] System Profile on BeanScape [®]	
Figure 20: BeanDevice [®] Identity	
Figure 21: BeanDevice® network-link status	
Figure 22: BeanDevice [®] Power Supply information	
Figure 23:BeanDevice [®] Power modes	
Figure 24: BeanDevice [®] Diagnostic cycle information	
Figure 25: Frame BeanDevice [®] on BeanScape [®]	
Figure 26: BeanDevice [®] Product version frame	
Figure 27: Frame: Current data acquisition mode	
Figure 28: BeanDevice [®] configuration frame	
Figure 29: BeanDevice [®] custom display tab	
Figure 30: Tab : Notes	
Figure 30: Tab : Notes	
Figure 32: Current data acquisition mode display	
Figure 33:BeanDevice [®] AX 3D and AX 3D X-range Sensor Config tab	
5 5 5 F	
Figure 34: BeanDevice [®] Hi-Inc and Hi-Inc X-range Sensor Config tab	
Figure 35: : BeanDevice [®] Hi-Inc and AX-3DS Sensor Config tab	
Figure 36: Signal processing tab	
Figure 37: FFT Spectrum	
Figure 38: Online FFT Configuration frame	
Figure 39: FFT log files folder	
Figure 40:Enabling Automatic FFT Report	
Figure 41: Report Folder	
Figure 42: FFT Report (S.E.T mode)	
Figure 43: FFT Shift Spectrum	
Figure 44: Online Velocity configuration tab	
Figure 45: Velocity Graph	
Figure 46: Velocity and FFT Graph, PPV and PVS	

Figure 47: DIN 4150 Real Time Graph, PPV & PVS	100
Figure 48: DIN 4150-3 Report email	101
Figure 49: Velocity Log Folder/Files	103
Figure 50: PPV Log Folder/Files	
Figure 51: Velocity Advanced Configuration	104
Figure 52: Datalogger Tab	
Figure 53: System Configuration Tab	112
Figure 54: Power Mode Management Tab	113
Figure 55: Right Click on BeanDevice [®] Profile	114
Figure 56: Overview: Sensor channel profile	114
Figure 57: Sensor Channel General information frame	115
Figure 58: Measurement data frame	115
Figure 59: Sensor channel custom display tab	
Figure 60: Unit Conversion Assistant	118
Figure 61: Sensor channel notes tab	
Figure 62: Alarm configuration tab (BeanDevice [®] AX-3D)	119
Figure 63: Alarm configuration tab (BeanDevice [®] HI-Inc)	120
Figure 64: Alarm configuration tab (BeanDevice® AX-3DS)	
Figure 65: Shock detection configuration window	
Figure 66: Sensor calibration tab.	126
Figure 67: Log configuration tab	
Figure 68: Right Click on the Sensor's Channel	
Figure 69: Overview: Channel acquisition graph visualization	
Figure 70: Sensor profile ON/OFF display button	
Figure 71: Wide view of the graph	
Figure 72: Example: Graph visualization	
Figure 73: Graph measure mode: Frame Display	
Figure 74: Graph measure mode: Frame Marks	
Figure 75: BeanScape [®] configuration menu	
Figure 76: BeanScape [®] configuration window	
Figure 77: BeanDevice [®] Custom Display tab	
Figure 78: Log file generation options	
Figure 79: Example of Log file	
Figure 80: Data cache configuration options	
Figure 81: Overview: Log Config tab on BeanScape [®]	
Figure 82: Log config tab	
Figure 83: Log file example (Streaming mode)	
Figure 84: Wireless Network Info log file	
Figure 85: Alarm management menu	
Figure 86: Alarm management window	
Figure 87: Frame: Email alarm for S.E.T mode	
Figure 88: Frame: Soud config	
Figure 89: Email alarm for Survey mode and Alert for Shock detection	
Figure 90: Alarm Mailing SMTP Test	
Figure 91: System Alarm Settings	
Figure 92: Enable/Disable Notif/mail for Diagnostic and Datalogger	
Figure 93: Alarm Note settings	
Figure 95: Alarm Note settings	
Figure 94. DIN 4150-5 Configuration Figure 95: Building type & Pipeline Material on the DIN Report	
Figure 96: Building type & Pipeline Material on the Velocity Log file	153

Figure 97: Offline graph menu on BeanScape [®]	
Figure 98: Offline graph window	
Figure 99: Grid display of graphs	
Figure 100: Overlaid (frequency)display of FFT graphs	
Figure 101: Data conversion example	
Figure 102: Data Conversion menu on BeanScape [®]	
Figure 103:Data Conversion window	
Figure 104: Data Conversion main options	
Figure 105: Importing files into Data Conversion tool	
Figure 106: Overview of the selected files on Data Conversion window	
Figure 107: Overview: Converted File Folder	
Figure 108: FFT offline data analysis on BeanScape® top menu	
Figure 109: FFT tool window	
Figure 110:FFT tool options	
Figure 111: Browsing TX files on FFT tool	
Figure 112: Overview: FFT window	
Figure 113: FFT generation	
Figure 114: FFT generated View	
Figure 115: Generated FFT Log files	
Figure 116: Graph display (Offline Data Analysis)	
Figure 117: Selecting a graph to display	
Figure 118: Selected graph display	
Figure 119: FFT invalid files	
Figure 120: FFT Shift activation	
Figure 121: Gird of FFTShift spectra	
Figure 122: DIN on BeanScape® top menu	
Figure 123: Particle Velocity window	
Figure 124: Browsing TX files into Particle Velocity tool	
Figure 125: Particle Velocity result generation	
Figure 126: Particle Velocity Display Window	
Figure 127: VPPV & DIN buttons	
Figure 128: VPPV Report	
Figure 129: DIN Report	
Figure 130: Online FFT Configuration frame	
Figure 131: FFT Spectrum	
Figure 132: Online FFT Configuration frame	
Figure 133: FFT log files folder	
Figure 134:Enabling Automatic FFT Report	
Figure 135: Report Folder	
Figure 136: FFT Report (S.E.T mode)	
Figure 137: FFT Shift Spectrum	
Figure 138: Online Velocity configuration tab	
Figure 139: Velocity Graph	
Figure 140: Velocity and FFT Graph, PPV and PVS	
Figure 141: DIN 4150 Real Time Graph, PPV & PVS	
Figure 142: DIN 4150-3 Report email	
Figure 143: Velocity Log Folder/Files	
Figure 144: PPV Log Folder/Files	
Figure 145: Velocity Advanced Configuration	
Figure 146: Sensor design	
וופטוב דאסי סבווסטו תבטוצוויייייייייייייייייייייייייייייייייי	

Figure 147: Inclinometer Block Diagram (BeanDevice® HI-INC ±30° and ±15° versions)	204
Figure 148: Inclinometer Block Diagram (BeanDevice® version)	205
Figure 149: BeanDevice® AX-3DS mems Sensor architecture	208
Figure 150: Overview: MEMS Accelerometer in BeanDevice® AX-3D	210
Figure 151: Network reed non-contact button	214
Figure 152: BeanDevice [®] health status option	215
Figure 153: BeanDevice [®] health status window	216
Figure 154: BeanDevice [®] Scolling menu	218
Figure 155: BeanSensor: Enable/Disable Log	219
Figure 156: BeanSensor: Buffer Reset option	
Figure 157: Buffer Reset	220
Figure 158: BeanSensor: Open the graph in a new window	220
Figure 159: Graphs opened in separated windows	221
Figure 160 :Windows search for firewall screenshot	224
Figure 161: allowed apps window	225
Figure 162: Firewall auto exception	225

1. TECHNICAL SUPPORT

For general contact, technical support, to report documentation errors and to order manuals, contact *Beanair Technical Support Center* (BTSC) at:

tech-support@Beanair.com

For detailed information about where you can buy the Beanair equipment/software or for recommendations on accessories and components visit:

www.Beanair.com

To register for product news and announcements or for product questions contact Beanair's Technical Support Center (BTSC).

Our aim is to make this user manual as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Beanair appreciates feedback from the users of our information.

2. VISUAL SYMBOLS DEFINITION

Symbols	Definition
	<u>Caution or Warning</u> – Alerts the user with important information about Beanair wireless sensor networks (WSN), if this information is not followed, the equipment /software may fail or malfunction.
	<u>Danger</u> – This information MUST be followed if not you may damage the equipment permanently or bodily injury may occur.
1	<u>Tip or Information</u> – Provides advice and suggestions that may be useful when installing Beanair Wireless Sensor Networks.

3. ACRONYMS AND ABREVIATIONS

AES	Advanced Encryption Standard
ССА	Clear Channel Assessment
CSMA/CA	Carrier Sense Multiple Access/Collision Avoidance
GTS	Guaranteed Time-Slot
kSps	Kilo samples per second
LLC	Logical Link Control
LQI	Link quality indicator
LDCDA	Low duty cycle data acquisition
МАС	Media Access Control
PAN	Personal Area Network
PER	Packet error rate
RF	Radio Frequency
SD	Secure Digital
WSN	Wireless sensor Network

4. RELATED DOCUMENTS & VIDEOS

4.1 WHITE PAPER WEBPAGE

Application notes, technical notes and user guides are available on our White Paper webpage:

Click here

Home P	roducts Applications Succ	ess Stories Support News & Ever	nts Videos About Contact
Reference Number	Document Name	Related product	Description
AN_RF_002	Structural Health Monitoring on bridges	All BeanAir products	The aim of this document is to overview BeanAir® products suited for bridge monitoring, their deployment, as well as their capacity and limits by overviewing various data acquisition modes available on each BeanDevice®
AN_RF_003	IEEE 802.15.4 2.4 GHz Vs 868 MHz	All BeanAir products	Comparison between 868 MHz frequency band and a 2.4 GHz frequency band
AN_RF_005	BeanGateway & Data Terminal Equipment Interface	BeanGateway®	DTE interface Architecture on the BeanGateway®
AN_RF_006	How to extend your wireless range	All BeanAir products	A guideline very useful for extending your wireless range
AN_RF_007	BeanAir WSN Deployment	All BeanAir products	Wireless sensor networks deployment guidelines

		Technical Notes	
Reference Number	Document Name	Related product	Description
TN-RF-001	Wireless range benchmarking	BeanDevice® 2.4GHz Sensor series	Wireless range tests results of BeanDevice® 2.4GHz inside (N.L.O.S.) and outside a Building (L.O.S.)
TN-RF-002	Current consumption in active & sleeping mode	BeanDevice® 2.4GHz Sensor series	Current consumption estimation in active and sleeping mode.
TN-RF-003	Aggregation capacity of Wireless Network	BeanDevice® 2.4GHz Sensor series	Overview of aggregation capacity of wireless sensor networks in streaming mode
TN-RF-004	MQTT Communication Protocol	BeanDevice® Wilow® sensor series	MQTT Communication Protocol for a seamless integration into a third-party IOT software

Figure 1 : White Paper webpage

4.2 FEATURED VIDEOS



All the videos are available on our YouTube channel

Beanair video link (YouTube)	Related products
First step into Beanair Wireless Sensor Networks	All
Wireless Sensor Networks	All
Wireless Sensor Networks dedicated to Structural Health Monitoring	All
BeanGateway [®] - Ethernet Outdoor version introduction	BeanGateway [®] - Ethernet Outdoor version introduction
BeanGateway [®] – Ethernet Indoor version presentation	BeanGateway® Ethernet Indoor version
BeanDevice [®] AN-XX wireless range demonstration	BeanDevice® AN-V/AN-420/AN-mV Standard and Extender
BeanDevice [®] AN-XX presentation	
Self-powered data logger	BeanDevice® AN-V/AN-420/AN-mV Xtender
BeanDevice [®] AX-3D presentation	BeanDevice® AX-3D
BeanDevice [®] HI-INC presentation	BeanDevice® HI-INC
Wireless inclinometer with integrated datalogger	
BeanDevice® AX-3DS presentation	BeanDevice® AX-3DS
Wireless Accelerometer dedicated to shock detection	
High performance wireless accelerometer	BeanDevice® AX-3D Xrange
Wireless temperature and humidity sensor with integrated data logger	BeanDevice® ONE-TH
High performance wireless inclinometer	BeanDevice® HI-INC Xrange
High Grade and affordable wireless sensor networks for environmental monitoring	Ecosensor products

4.3 TECHNICAL VIDEOS



All the videos are available on our Youtube channel

Beanair video link (Youtube)	Related products
How to launch the BeanScape® software	BeanScape [®]
BeanGateway [®] Ethernet/LAN Configuration, directly connected to the Laptop/PC	BeanGateway [®]
How to remove a BeanDevice [®] from your Network	BeanDevice®
Energy Scan	BeanGateway®
Synchronous Multicasting process	BeanGateway®
Manual channel selection	BeanGateway®
Automatic Channel selection	BeanGateway®
Authorized Channels	BeanGateway®
Fast Fourier Transform waveform analysis module	BeanScape®

5. ACRONYMS AND ABBREVIATIONS

BeanDevice [®] product overview	• Details the BeanDevice [®] product presentation
Data acquisition mode description	 Details the data acquisition mode available on the BeanDevice[®] <i>Related Technical Note:</i> TN_RF_008 - "Data acquisition mode available on the BeanDevice[®]"
BeanDevice [®] installation guidelines	 Details the installation guidelines of the BeanDevice[®] <i>Related Technical Note:</i> TN_RF_010 - "Beandevice[®] Power Management " <i>Related Technical Note:</i> TN_RF_007- "Beandevice[®] DataLogger user Guide" <i>Related Technical Note:</i> TN_RF_006- "Beandevice[®] wireless network association"
BeanDevice [®] supervision from the Beanscape [®]	• Details the BeanDevice [®] supervision from the BeanScape [®]
BeanDevice [®] maintenance & supervision (for experienced user)	• Details the BeanDevice [®] maintenance (for experienced user)
Troubleshooting	•Frequently asked questions
Installation procedures	• Details the installation procedures

6. PRODUCT DESCRIPTION



- It is highly recommended to read all the user manual related to Beanair software & equipment (BeanScape® 2.4GHz, BeanGateway® 2.4GHz, BeanDevice® 2.4GHz) before getting start your BeanDevice® 2.4GHz.
- ✓ Use only accessories supplied by Beanair (batteries, power supply unit, and antenna). Use of other materials may damage the BeanDevice[®] 2.4GHz;
- ✓ Only Beanair is qualified to make changes on the BeanDevice[®] 2.4GHz;
- ✓ Don't try to remove the adhesive label on the product; it contains important information such as the MAC address or sensor measurement range

6.1 ABOUT SMARTSENSOR PRODUCT LINE

SmartSensor product line was initially designed for Structural Health monitoring (SHM), Condition Maintenance Monitoring (CMS) and Testbed applications.

It comes with different types of sensor for dynamic measurements:

- Wireless accelerometer for vibration measurement
- Wireless inclinometer for tilt/slope measurement
- Wireless shock sensor for shock monitoring

6.2 BEANDEVICE® 2.4GHZ AX-3D

6.2.1 Featured video



6.2.2 Main features

Main Features

- Wireless Tri-axis accelerometer based on MEMS Technology
- Measurement range: ±2g, ±10g
- Very Low noise Density:
- 45 μg/VHz (±2g version), 100 μg/VHz (±10g version),
- Excellent radio link thanks to the radio antenna diversity developed by Beanair®
- Maximum sampling rate: 3.5 KSPS
- TimeSync function : Time Synchronization through wireless sensor network
- Maximum Radio Range: 650 m (L.O.S)
- Ultra-Power Radio Technology IEEE 802.15.4
- Current consumption in idle mode: < 30 uA
- Embedded logger: up to **1 million** data points (with events dating)
- Entirely autonomous system with an integrated Lithium-Ion battery charger
- Anti-aliasing Butterworth filter (5th order) with a cut-off frequency of 1
 Hz to 2 KHz (remotely programmable from the BeanScape[®])
- Watertight aluminum enclosure IP66 (dimensions Lxlxh : 80x55x21 mm - weight 145g rechargeable battery included) - suitable for Harsh Industrial Environment

6.2.3 Applications

This BeanDevice® AX-3D is suitable for the following applications:

- Ground vibration Monitoring on construction site
- Dynamic measurement on rolling stock
- Condition monitoring
- Structural Health Monitoring (SHM)
- Vibration analysis

6.3 BEANDEVICE® 2.4GHZ HI-INC - 2.4GHZ SERIES (WIRELESS INCLINOMETER)

6.3.1 Main features

	Main Features	
ſ	Wireless Inclinometer based on MEMS Technology	
	Measurement range:	
	 mono-axis or bi-axis ±15° 	
	 mono-axial or bi-axis ±30° 	
	o bi-axis +/-90°	
	Excellent resolution:	
	 0,001° for ±15° & ±30° version 	
	 0,0025° for ±90° version 	StanDevice' Hi-Inc & range
	• TimeSync function : Time Synchronization through wireless	Wireless # asis inclinometer + 15-
	sensor network	
	• Excellent radio link thanks to the antenna diversity developed	
	by Beanair®	
	 Streaming mode: 200 SPS on each channel 	
	 Maximum Radio Range : 650 m (L.O.S) 	
	 Ultra-Power Radio Technology IEEE 802.15.4 	
	 Current consumption in idle mode : < 30 uA 	
	 Embedded logger : up to 1 000 000 data acquisition records (with events dating) 	
	 Entirely autonomous system with an integrated Lithium-Ion battery charger 	
	 Anti-aliasing Butterworth filter (5th order) with a cut-off 	
	frequency of 1 Hz to 2 KHz (remotely programmable from the	
	BeanScape [®])	
	Watertight Aluminum enclosure IP66	
	 Dimensions LxWxH : 80x55x21 mm—weight 145g 	
	(rechargeable battery included) -suitable for Harsh Industrial	
	Environment	

6.3.2 Applications

- ✓ Platform Leveling and stabilization
- ✓ Laser level rotation
- ✓ Slope measurement (Building, infrastructure & construction)
- ✓ Oïl drilling
- ✓ Axial rotor measurement

6.4 BEANDEVICE® 2.4GHZ AX-3DS - 2.4GHZ SERIES (WIRELESS SHOCK SENSOR)

6.4.1 Main features

Main Features	
Wireless tri-axis accelerometer	
 Scalable measurement range (two versions) : 	
±6g/±12g/±24g or ±2g/±4g/±8g	
• Excellent radio link thanks to the antenna diversity develop	ped
by Beanair®	
 Advanced and smart shock detection 	
 Non-contact actuation for faster installation 	
 Maximum sampling rate: 3.5 KSPS (maximum) 	
 Maximum radio range : 650 m (L.O.S) 	
Ultra-Low Power Radio Technology IEEE 802.15.4	
• Current consumption during deep sleeping mode : < 28 uA	۹.
• Embedded Data Logger : up to 1 million data points	
Entirely autonomous system with an integrated Lithium-Io	n
battery charger	
• Watertight aluminum enclosure IP66 (dimensions LxWxH	:
80x55x21mm)—weight 135g (rechargeable battery	
included) -suitable for Harsh Industrial Environment	

6.4.2 Applications

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

6.5 BEANDEVICE[®] 2.4GHZ AX-3D XRANGE – 2.4GHZ SERIES (HIGH PERFORMANCE WIRELESS ACCELEROMETER)

6.5.1 Main features

Main Features	
 Wireless Tri-axis accelerometer based on MEMS Technology Measurement range (2 versions): ±2g & ±10g Very Low noise Density: 45 µg/VHz (± 2g version) 100 µg/VHz (± 10g version) TimeSync function : Time Synchronization through wireless sensor network Watertight IP67 aluminum enclosure coming with a rugged base plate and three-point-mounting Excellent radio link relying on the radio antenna diversity developed by Beanair[®] Non-contact actuation for quick mounting Maximum sampling rate: 3.5 KSPS Maximum Radio Range : 650 m (L.O.S) Ultra-Power radio technology IEEE 802.15.4 Current consumption in sleeping mode : < 30 μA Embedded data logger : up to <i>8 millions</i> data points 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 Anti-aliasing Butterworth filter (5th order) with a cut-off frequency of 1 Hz to 2 KHz (remotely programmable from the BeanScape[®]) Fully calibrated sensor 	

6.5.2 Applications

This BeanDevice® AX-3D Xrange is suitable for the following applications:

- Ground vibration Monitoring on construction site
- Dynamic measurement on rolling stock
- Condition monitoring
- Structural Health Monitoring (SHM)
- Vibration analysis

6.6 BEANDEVICE® HI-INC XRANGE (HIGH PERFORMANCE WIRELESS INCLINOMETER)

6.6.1 Main features

Main Features

- Wireless Inclinometer based on MEMS Technology
- Measurement range: ±15° & ±30° (mono-axis & bi-axis)
- Excellent resolution (0.001°) & accuracy (±0.05°)
- Temperature compensated sensor
- Excellent radio link thanks to the antenna diversity developed by Beanair[®]
- Non-contact actuation for quick mounting
- Maximum sampling rate: 200 SPS
- Maximum radio range : 650 m (L.O.S)
- Ultra-Power Radio Technology IEEE 802.15.4
- Current consumption in sleeping mode : < 30 μA
- Embedded data Logger : up to 8 million data points
- OPC server allowing real time access from your IT system to the BeanScape[®] (available on <u>BeanScape[®] Premium+</u>)
- Entirely autonomous system with an integrated Lithium-Ion battery charger
- Watertight IP67 aluminum enclosure coming with a rugged base plate and three-point-mounting
- Anti-aliasing Butterworth filter (5th order) with a cut-off frequency of 1 Hz to 100Hz (remotely programmable from the BeanScape[®])
- Fully calibrated sensor



6.7 TECHNICAL SPECIFICATIONS

6.7.1 BeanDevice® 2.4GHz AX-3D

Product reference BND-AX3D -*MR* G-RB

MR – Measurement Range (1g = 9806.65 mm/s^2)

2 :±2g measurement range

10 :±10gmeasurement range

Example : BND-AX3D-10G-RB, Wireless Accelerometer with 10g measurement range

	Accelerometer Specifications	
Accelerometer technology	Accurate and low power MEMS technology	
Soncitivity	±2g Version : 660 mV/g	
Sensitivity	±10g version: 200 mV/g	
Typical non-linearity	±0.1% FS	
Analog to Digital converter	16-bit, SAR architecture (Successive Approximation Register) with temperature	
	compensation	
Sensor frequency response (-3 dB)	DC to 800 Hz	
Noise spectral density	±2g Version : 45 μg/VHz	
Noise spectral density	±10g version: 100 μg/VHz	
Zero-g Offset Variation from RT over	±2g Version : ±0.2 mg/°C	
Тетр	±10g version: ±0.1 mg/°C	
Sensitivity Variation from RT over	±2g Version : ±0.01 %/°C (XY) , ±0.02 %/°C (Z)	
Тетр	±10g version: ±0.01 %/°C	
Offset Ratiometric Error	±2g Version : 4mg	
	±10g version: ±0.2% (XY) , ±0.1% (Z)	
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%	
Anti-aliasing filter	Butterworth 5 th order filter – cut-off frequency : 1 Hz to 2000 Hz remotely	
	programmable (BeanScape [®])	
	Over-the-air configuration (OTAC) parameters	
Data Acquisition mode	Low Duty Cycle Data Acquisition (LDCDA) Mode: 1s to 24 hour	
(SPS = sample per second)	Streaming Mode	
	Minimum: 1 SPS	
Compling Date (in streaming mode)	Maximum: 3 kSPS per axis (one axis enabled)	
Sampling Rate (in streaming mode)	1.5 kSPS per axis (2-axis enabled)	
	1 kSPS per axis (3-axis enabled)	
Programmable Cut-off frequency	1– 2000 Hz	
(Anti-aliasing filter)	1 2000 112	
Power Mode	Sleep & Active	

	RF Specifications	
Wireless Technology	Ultra-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	650m (Line of Sight) , 30-100m (Non Line of Sight)	
Antenna	Omnidirectional radome antenna with antenna diversity Gain : 3 dBi Waterproof IP67	
	Embedded Data logger	
Storage capacity	up to 1 million data points	
Wireless data downloading	3 minutes to download the full memory (average time)	

TimeSync function : Clock synchronization over the Wireless Sensor Networks (WSN)		
Clock synchronization accuracy	±2.5 ms (at 25°C)	
Crystal specifications	Tolerance ±10ppm, stability ±10ppm	
	Environmental and Mechanical	
	Aluminum & Waterpoof casing	
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	-20 °C to +65 °C during battery discharge	
	0 to 45°C during battery charge	
	· CE Labelling Directive R&TTE (Radio) ETSI EN 300 328	
	· FCC (North America)	
Norms & Radio certifications	· ARIB STD-T66 Ver 3.6	
	ROHS - Directive 2002/95/EC	

	Power supply	
	Integrated Lithium-ion battery charger with high precision battery monitoring :	
Integrated battery charger	· Overvoltage/Overcurrent/Short-Circuit/Undervoltage protection	
	· Battery Temperature monitoring	
	· During data acquisition : 20 to 30 mA	
Current consumption @ 3,3V	· During Radio transmission : 70 mA @ 18 dBm	
	· During sleeping : < 30 μA	
External power supply	8-28VDC	
Rechargeable Lithium-Polymer battery	Capacity 1.25 Ah	
	Options	
	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug	
External Power Supply	(IP67/Nema 6) Ref: M8-PWR-12V	
External Power Supply M8 extension cable for external power supply	(IP67/Nema 6)	

6.7.2 Beandevice[®] AX-3DS

Product reference	
BND-AX3DS -MR -RB-SCM	_
IR – Measurement Range (1g = 9806.65 mm/s^2)	
IG: ±6/12/24g measurement range	
G: ±2/4/8g measurement range	
S - Power supply :	
B: Rechargeable battery	
IO - Mounting Option	
CM - Screw Mounting Lid	
IM - Magnet Mounting Lid	
eave it empty if there is no mounting option	
<i>cample 1</i> : BND-AX3DS-24G-RB—Wireless Accelerometer with ±6/12/24g measurement range , rechargeable	
attery	
cample 2: BND-AX3DS-8G-RB-SCM—Wireless Accelerometer with ±2/4/8g measurement range, rechargeable	۵

Example 2: BND-AX3DS-8G-RB-SCM—Wireless Accelerometer with ±2/4/8g measurement range , rechargeable battery, screw mounting option

	Sensor specifications	
Accelerometer Technology	Low power MEMS technology	
Scalable measurement range	24G Version :±6g / ±12g/ ±24g	
Scalable measurement range	8G Version: ±2g / ±4g/ ±8g	
	24G Version: 3 mg/digit @±6g , 6 mg/digit @±12g , 12 mg/digit @±24g	
Measurement resolution	8G Version: 1mg/digit @±2g, 2 mg/digit @±4g, 3.9 mg/digit @±8g	
Typical non-linearity	±0,15%	
Sensitivity change Vs	±0,01% /°C	
temperature	±0,01% / C	
Zero-g level change vs	24G Version :±0,4 mg/°C	
temperature (max delta from 25°C)	8G Version: ±0,1 mg/°C	
Turical save a lovel offect economy	24G Version: ±70 mg	
Typical zero-g level offset accuracy	<i>8G Version:</i> ±20 mg	
Analog to Digital converter	12-bit with temperature compensation	
Noise spectral density @ PW/ 10Hz	24G Version: 650 μg/√Hz	
Noise spectral density @ BW 10Hz	8G Version: 218 μg/ VHz	
Anti-aliasing filter	Butterworth 2th order filter	

	Over-the-air configuration (OTAC) parameters
Data Acquisition mode (SPS = sample per second)	Data Acquisition mode Streaming Mode Shock detection
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 mode)	Minimum: 1 SPS Maximum: 3 kSPS per axis (one axis enabled) 1.5 kSPS per axis (2-axis enabled) 1 kSPS per axis (3-axis enabled)
Power Mode	Sleep & Active

	RF Specifications	
Wireless Technology	Ultra-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	650m (Line of Sight) , 30-100m (Non Line of Sight)	
Antenna	Omnidirectional radome antenna with antenna diversity Gain : 3 dBi Waterproof IP67	
	Embedded Data logger	
Storage capacity	up to 1 million data points	
Wireless data downloading	3 minutes to download the full memory (average time)	

	Environmental and Mechanical
Casing	Aluminum & Waterpoof 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	-20 °C to +65 °C during battery discharge 0 to 45°C during battery charge
Norms	 CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 FCC (North America) ARIB STD-T66 Ver 3.6
	ROHS - Directive 2002/95/EC

	Power Supply	
Integrated battery charger	Integrated Lithium-ion battery charger with high precision battery Overvoltage/Overcurrent/Short-Circuit/Undervoltage protection Battery Temperature monitoring 	
Current consumption @3,3V	 During data acquisition : 20 to 30 mA During Radio transmission : 60 mA @ 18 dBm During sleeping mode: 68uA During deep sleeping mode : 28 uA 	
External power supply	8-28VDC	
Rechargeable battery	Capacity 1.25 Ah	
	Options	
External Power Supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67/Nema 6) Ref: M8-PWR-12V	
M8 extension cable for external power supply	Molded cable with M8-3pins male plug Material: PVC with shield protection IP Rating : IP67 Nema 6 Cable length: 2 meters , Ref: CBL-M8-2M Cable length : 5 meters, Ref: CBL-M8-5M Cable length: 10 meters, Ref: CBL-M8-10M	
Calibration certificate	Calibration certificate provided by Beanair GmbH A static calibration method is used on a granite surface plate DIN876	

6.7.3 BeanDevice® INC

	Product reference	
	BND-INC – <i>MR –PS</i>	
MR- Measurement Range:		
30B : bi-axial ±30°		
90B : bi-axial ±90°		
PS - Power supply :		
RB : Internal rechargeable battery		
XT : External Power Supply		

Example 1: BND-INC-30B-RB-wireless bi-axial inclinometer with ±30° measurement range, internal rechargeable battery **Example 2**: BND-INC-90B-XT-wireless bi-axial inclinometer with ±90° 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 °/vHz		
Accuracy (full scale, @ 25°C)	±0,1°		
Offset temperature dependency	±0.008 °/°C		
Sensitivity temperature dependency	±0.008 %/°C		
Long term stability (@23°C)	< 0.014 °		
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 filter	Butterworth 5 th order filter – cut-off frequency : 1 Hz to 100 Hz remotely programmable (BeanScape®)		
	Over-the-air configuration (OTAC) parameters		
Data Acquisition mode (SPS = sample per second)	Low Duty Cycle Data Acquisition (LDCDA) Mode: 1s to 24 hour Streaming Mode (not available on XT version, External power supply) Survey Mode: 1s to 24h		
Sampling Rate (in streaming mode)	Minimum: 1 SPS		
	Maximum: 60 SPS on each axis		
Alarm Threshold	2 High level and 2 Low level		
Programmable cut-off frequency (Anti-aliasing filter)	1– 100 Hz		
Power Mode	Sleep Active (not available on XT version, External power supply)		

	RF Specifications
Wireless Protocol Stack	Ultra-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	650m (Line of Sight) , 30-100m (Non Line of Sight)
	Omnidirectional radome antenna with antenna diversity
Antenna	Gain : 3 dBi
	Waterproof IP67
	Embedded Data logger
Storage capacity	up to 1 million data points
Wireless data downloading	3 minutes to download the full memory (average time)
TimeSync function	: Clock synchronization over the Wireless Sensor Networks (WSN)
Clock synchronization accuracy	±2.5 ms (at 25°C)
Crystal specifications	Tolerance ±10ppm, stability ±10ppm
	Environmental and Mechanical
	Aluminum & Waterpoof casing
Casing	Dimensions in mm (LxWxH): 100x55x21 mm
	Weight (battery included) : 155g
IP NEMA Rating	IP67 Nema 6
Shock resistance	100g during 50 ms
	RB : Internal rechargeable battery
	-20 °C to +65 °C during battery discharge
Operating Temperature	0 to 45°C during battery charge
	XT : External Power Supply
	-40 °C to +75 °C during battery discharge
	· CE Labelling Directive R&TTE (Radio) ETSI EN 300 328
	• FCC (North America)
Norms & Radio certifications	· ARIB STD-T66 Ver 3.6
	ROHS - Directive 2002/95/EC
	Dewergunghu
	Power supply
	Integrated Lithium-ion battery charger with high precision battery monitoring :
Integrated battery charger	· Overvoltage/Overcurrent/Short-Circuit/Undervoltage protection
	Battery Temperature monitoring
	· During data acquisition : 30 to 40 mA
Current consumption @3,3V	· During Radio transmission : 80 mA @ 18 dBm
	· During sleeping : < 38 μA
External power supply	8-28VDC
Rechargeable battery	High density Lithium-Ion rechargeable battery with a capacity of 950 mAh

	Options
External Power Supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67/Nema 6) Ref: M8-PWR-12V
Solar Panel Kit (compatible with External Power Supply version only)	High effeciency solar panel with with Solar charging controller and Lead-acid battery Ref: X-SOL-5W-M8-2M
External Primary Cell in a Waterproof IP67 Casing	Exernal Primary cell mounted in a IP67 aluminum Alloy casing: IP67 Battery Holder Lithium-thionyl chloride primary cell (Li-SOCI2) 6,5 Ah Ref: PRIM-XTENDER
M8 extension cable for external power supply	Molded cable with M8-3pins male plug Material: PVC with shield protection IP Rating : IP67 Nema 6 Cable length: 2 meters , Ref: CBL-M8-2M Cable length : 5 meters, Ref: CBL-M8-5M Cable length: 10 meters, Ref: CBL-M8-10M
Calibration certificate	Calibration certificate provided by Beanair GmbH A static calibration method is used on a granite surface plate DIN876

6.7.4 Beandevice[®] HI-INC

Product reference		
	BND-HI-INC- <i>MR - PS</i>	
MR – Measurement Range :	PS - Power supply :	
15B : bi-axis ±15°	RB : Internal rechargeable battery	
30B : bi-axis ±30°	XT : External power supply	

Example 1: BND-HI-INC-15B-RB-wireless bi-axial inclinometer with ±15° measurement range, internal rechargeable battery

Example 2: BND-HI-INC-30B-XT-wireless mono-axial inclinometer with ±30° measurement range, external primary cell

	Sensor specifications
Inclinometer Technology	Accurate and low power MEMS technology
Measurement resolution (Bandwidth 10 Hz)	0.001°
Noise density	0.0004 °/VHz
Accuracy (full scale, @ 25°C)	±0.05° (±0.02° on customer request)
Offset temperature dependency	±0.002 °/°C
Sensitivity temperature dependency	±0.005 %/°C
Long term stability (@23°C)	< 0.004 °
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	0.0004 °/ vHz
Anti-aliasing filter	Butterworth 5 th order filter – cut-off frequency : 1 Hz to 100 Hz remotely programmable (BeanScape®)

	Over-the-air configuration (OTAC) parameters
Data Acquisition mode (SPS = sample per second)	Low Duty Cycle Data Acquisition (LDCDA) Mode: 1s to 24 hour Streaming Mode (not available on XT version, External power supply) Survey Mode: 1s to 24h
Sampling Rate (in streaming mode)	Minimum: 1 SPS Maximum: 60 SPS on each axis
Alarm Threshold	2 High level and 2 Low level
Programmable cut-off frequency (Anti-aliasing filter)	1– 100 Hz
Power Mode	Sleep Active (not available on XT version, External power supply)
	RF Specifications
Wireless Protocol Stack	RF Specifications Ultra-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E)
Wireless Protocol Stack WSN Topology	
	Ultra-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E)
WSN Topology	Ultra-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E) Point-to-Point / Star
WSN Topology Data rate	Ultra-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E) Point-to-Point / Star 250 Kbits/s
WSN Topology Data rate RF Characteristics	Ultra-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E) Point-to-Point / Star 250 Kbits/s ISM 2.4GHz – 16 Channels. Antenna diversity designed by Beanair®
WSN Topology Data rate RF Characteristics TX Power	Ultra-Power and license-free 2.4Ghz radio technology (IEEE 802.15.4E) Point-to-Point / Star 250 Kbits/s ISM 2.4GHz – 16 Channels. Antenna diversity designed by Beanair® +18 dBm

SmartSensor User Manual

2.4GHz wireless sensors

	Embedded Data logger
Storage capacity	up to 1 million data points
Wireless data downloading	3 minutes to download the full memory (average time)
TimeSync function :	Clock synchronization over the Wireless Sensor Networks (WSN)
Clock synchronization accuracy	±2.5 ms (at 25°C)
Crystal specifications	Tolerance ±10ppm, stability ±10ppm
	Environmental and Mechanical
Casing	Aluminum & Waterpoof 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	RB : Internal rechargeable battery -20 °C to +65 °C during battery discharge0 to 45°C during battery charge XT : External Power Supply -40 °C to +75 °C during battery discharge
Norms & Radio certifications	 CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 FCC (North America) ARIB STD-T66 Ver 3.6 ROHS - Directive 2002/95/EC

	Power supply
	Integrated Lithium-ion battery charger with high precision battery monitoring :
Integrated battery charger	 Overvoltage/Overcurrent/Short-Circuit/Undervoltage protection
	Battery Temperature monitoring
	· During data acquisition : 30 to 40 mA
Current consumption @3,3V	· During Radio transmission : 80 mA @ 18 dBm
	· During sleeping : < 38 μA
External power supply	8-28VDC
Rechargeable battery	High density Lithium-Ion rechargeable battery with a capacity of 950 mAh
	Onting
	Options
External Power Supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67/Nema 6) Ref: M8-PWR-12V
Solar Panel Kit (compatible with External Power Supply version only)	High effeciency solar panel with with Solar charging controller and Lead-acid battery Ref: X-SOL-5W-M8-2M
External Primary Cell in a Waterproof IP67 Casing	Exernal Primary cell mounted in a IP67 aluminum Alloy casing: IP67 Battery Holder Lithium-thionyl chloride primary cell (Li-SOCI2) 6,5 Ah Ref: PRIM-XTENDER
M8 extension cable for external power supply	Molded cable with M8-3pins male plug Material: PVC with shield protection IP Rating : IP67 Nema 6 Cable length: 2 meters , Ref: CBL-M8-2M Cable length : 5 meters, Ref: CBL-M8-5M Cable length: 10 meters, Ref: CBL-M8-10M
Calibration certificate	Calibration certificate provided by Beanair GmbH A static calibration method is used on a granite surface plate DIN876

6.7.5 BeanDevice[®] AX-3D XRange

Product reference

BND-AX3D-MR-XR-PS-MO

MR – Measurement Range (1g = 9806.65 mm/s^2)

2 :±2g measurement range

10 :±10gmeasurement range

PS - Power Supply

RB : Built-in rechargeable Lithium-Polymer battery 2Ah

MO - Mounting Option

SCM - Screw Mounting Lid

MM - Magnetic Mounting Lid

Example n °1 : *BND-AX3D-10G-XR-RB-SCM*, High performance wireless accelerometer with 10g measurement range, built-in rechargeable battery, screw mounting

Example n°2: BND-AX3D-2G-XR-RB-MM, High performance wireless accelerometer with 2g measurement range, built-in rechargeable battery, Magnet Mounting

	Accelerometer Specifications
Accelerometer technology	Accurate and low power MEMS technology
Sensitivity	±2g Version : 660 mV/g ±10g version: 200 mV/g
Typical non-linearity	±0.1% FS
Analog to Digital converter	16-bit, SAR architecture (Successive Approximation Register) with temperature compensation
Sensor frequency response (-3 dB)	DC to 800 Hz
Noise spectral density	±2g Version : 45 μg/VHz ±10g version: 100 μg/VHz
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)
Sensitivity Ratiometric Error	±2g Version : ±1.25 % (X-Y) , ±0.2 % (Z) ±10g Version : ±1.6% (X-Y) , ±0.2 % (Z)
Cross Axis Sensitivity	0.02
Anti-aliasing filter	Butterworth 5th order filter – cut-off frequency : 1 Hz to 2000 Hz remotely programmable (BeanScape®)

	Over-the-air configuration (OTAC) parameters
Data Acquisition mode	Low Duty Cycle Data Acquisition (LDCDA) Mode: 1s to 24 hour
(SPS = sample per second)	Streaming Mode
	Minimum: 1 SPS
Compliant Data (in strangening mode)	Maximum: 3 kSPS per axis (one axis enabled)
Sampling Rate (in streaming mode)	1,5 kSPS per axis (2-axis enabled)
	1 kSPS per axis (3-axis enabled)
Sampling Rate	Minimum: 1 SPS
	Maximum: 4 kSPS maximum per axis (one or two axis enabled)
logger only)	3,5 kSPS per axis (3-axis enabled)
Programmable Cut-off frequency	1– 2000 Hz
(Anti-aliasing filter)	
Power Mode	Sleep & Active

	RF Specifications
Wireless Protocol Stack	Ultra-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	650m (Line of Sight) , 30-100m (Non Line of Sight)
Antenna	Omnidirectional radome antenna with antenna diversity Gain : 3 dBi Waterproof IP67

	Embedded data logger
Storage capacity	up to 8 millions data points
Wireless data downloading	20 minutes to download the full memory (average time)
TimeSync function	: Clock synchronization over the Wireless Sensor Networks (WSN)
TimeSync function Clock synchronization accuracy	Clock synchronization over the Wireless Sensor Networks (WSN) ±2.5 ms (at 25°C)

	Environmental and Mechanical
Casing	Aluminum & Waterpoof casing • Dimensions in mm (LxWxH): 100 x 60 x 31 (without antennas and mounting eyelet) • Weight (with internal battery) : 217g (screw mounting) and 245g (magnetic mounting)
IP NEMA Rating	IP67 Nema 6
Base plate	 Aluminum black anodized AL 7075 with rugged three-point-mounting Screw Mounting Option: the device should be mounted on a flat and smooth surface with 3 screws, dimension M5. Mounting torque 5 ±1Nm Magnetic Mounting Option: the device should be mounted on a steel surface.
Shock resistance	150g during 50 ms
Operating Temperature	-20 °C to +65 °C during battery discharge 0 to 45°C during battery charge
Norms & Radio certifications	 CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 FCC (North America) ARIB STD-T66 Ver 3.6
	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 consumption @ 3,3V	 During data acquisition : 20 to 30 mA During Radio transmission : 40 mA @ 0dBm , 80 mA @ 18 dBm During sleeping : < 30 μA A 20 μPC
External power supply Rechargeable Lithium-Polymer battery	8-28VDC Capacity 2Ah
	Options
External Power Supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67/Nema 6) Ref: M8-PWR-12V
Bracket Mounting	90° Bracket for BeanDevice (Xrange smartsensor) with 4 x M5 screws + Locknut Ref: SMART-BRACK-MNT
M8 extension cable for external power supply	Molded cable with M8-3pins male plug Material: PVC with shield protection IP Rating : IP67 Nema 6 Cable length: 2 meters , Ref: CBL-M8-2M Cable length : 5 meters, Ref: CBL-M8-5M Cable length: 10 meters, Ref: CBL-M8-10M
Calibration certificate	Calibration certificate provided by Beanair GmbH A static calibration method is used on a granite surface plate DIN876

6.7.6 BeanDevice[®] HI-INC Xrange

Product reference

BND-HI-INC-MR -XR-PS-MO

MR- Measurement Range:

15B : bi-axis ±15°

30B : bi-axis ±30°

PS - Power supply :

RB : Internal rechargeable battery

XT : External power supply

MO - Mounting Option

SCM - Screw Mounting Lid

MM - Magnetic Mounting Lid

Example 1: BND-HI-INC-15B-XR-RB-SCM, High performance wireless bi-axis inclinometer with ±15° measurement range, internal rechargeable battery, Screw mounting

Example 2: BND-HI-INC-30M-XR-XT-MM, High performance wireless mono-axis inclinometer with ±30° measurement range, external power supply, Magnet Mounting

	Sensor specifications
Inclinometer Technology	Accurate and low power MEMS technology
Measurement resolution (Bandwidth 10 Hz)	0,001°
Noise density	0.0004 °/vHz
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
Long term stability (@23°C)	< 0.004 °
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	0.0004 °/ √Hz
Anti-aliasing filter	Butterworth 5 th order filter – cut-off frequency : 1 Hz to 100 Hz remotely programmable (BeanScape®)

	Over-the-air configuration (OTAC) parameters
Data Acquisition mode (SPS = sample per second)	Low Duty Cycle Data Acquisition (LDCDA) Mode: 1s to 24 hour
	Streaming Mode (not available on XT version, External power supply)
	Survey Mode: 1s to 24h
Sampling Rate (in streaming mode)	Minimum: 1 SPS
Sampling Kate (in streaming mode)	Maximum: 60 SPS on each axis
Alarm Threshold	2 High level and 2 Low level
Programmable cut-off frequency (Anti-aliasing filter)	1– 100 Hz
Device Manda	Sleep
Power Mode	Active (not available on XT version, External power supply)

	RF Specifications	
Wireless Protocol Stack	Ultra-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	650m (Line of Sight) , 30-100m (Non Line of Sight)	
Antenna	Omnidirectional radome antenna with antenna diversity Gain : 3 dBi Waterproof IP67	
	Embedded data logger	
Storage capacity	up to 8 millions data points	

TimeSync function : Clock synchronization over the Wireless Sensor Networks (WSN)	
Clock synchronization accuracy	±2.5 ms (at 25°C)
Crystal specifications	Tolerance ±10ppm, stability ±10ppm

20 minutes to download the full memory (average time)

Wireless data downloading

	Environmental and Mechanical	
	Aluminum & Waterpoof casing	
Casing	 Dimensions in mm (LxWxH): 100 x 60 x 31 (without antennas and mounting eyelet) Weight (with internal battery) : 217g (screw mounting) and 245g (magnetic mounting) 	
IP NEMA Rating	IP67 Nema 6	
Base plate	 Aluminum black anodized AL 7075 with rugged three-point-mounting Screw Mounting Option: the device should be mounted on a flat and smooth surface with 3 screws, dimension M5. Mounting torque 5 ±1Nm Magnetic Mounting Option: the device should be mounted on a steel surface. 	
Shock resistance	150g during 50 ms	
Operating Temperature RB : Internal rechargeable battery -20 °C to +65 °C during battery discharge 0 to 45°C during battery charge XT : External Power Supply -40 °C to +75 °C during battery discharge		
Norms & Radio certifications	 CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 FCC (North America) ARIB STD-T66 Ver 3.6 	
	ROHS - Directive 2002/95/EC	

	Power supply
	Integrated Lithium-ion battery charger with high precision battery monitoring :
Integrated battery charger	· Overvoltage/Overcurrent/Short-Circuit/Undervoltage protection
	Battery Temperature monitoring
	· During data acquisition : 30 to 40 mA
Current consumption @3,3V	· During Radio transmission : 80 mA @ 18 dBm
	· During sleeping : < 30 μA
External power supply8-28VDCRechargeable batteryHigh density Lithium-Ion rechargeable battery with a capacity of 1.25 Ah	

	Options	
External Power Supply	Wall plug-in, Switchmode power Supply 12V @ 1,25A with sealed M8 Plug (IP67/Nema 6) Ref: M8-PWR-12V	
Solar Panel Kit (compatible with External Power Supply version only)	High effeciency solar panel with with Solar charging controller and Lead-acid battery Ref: X-SOL-5W-M8-2M	
Bracket Mounting	90° Bracket for BeanDevice (Xrange smartsensor) with 4 x M5 screws + Locknut Ref: SMART-BRACK-MNT	
External Primary Cell in a Waterproof IP67 Casing	Exernal Primary cell mounted in a IP67 aluminum Alloy casing: IP67 Battery Holder Lithium-thionyl chloride primary cell (Li-SOCl2) 6,5 Ah Ref: PRIM-XTENDER	
M8 extension cable for external power supply	Molded cable with M8-3pins male plug Material: PVC with shield protection IP Rating : IP67 Nema 6 Cable length: 2 meters , Ref: CBL-M8-2M Cable length : 5 meters, Ref: CBL-M8-5M Cable length: 10 meters, Ref: CBL-M8-10M	
Calibration certificate	Calibration certificate provided by Beanair GmbH A static calibration method is used on a granite surface plate DIN876	

	Environmental and Mechanical	
	· Aluminum & Watertight (IP66) enclosure	
Enclosure	 Dimensions in mm (LxWxH): 100 x 71 x 30 (135 x 71 x 30 with antennas), Weight (battery included) : 165g 	
Base plate	 Aluminum black anodized AL 7075 with rugged three-point-mounting The sensor module is to be mounted on a flat and smooth surface with 3 screws, dimension M5. Mounting torque 5 ±1Nm 	
Shock resistance	200g 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	

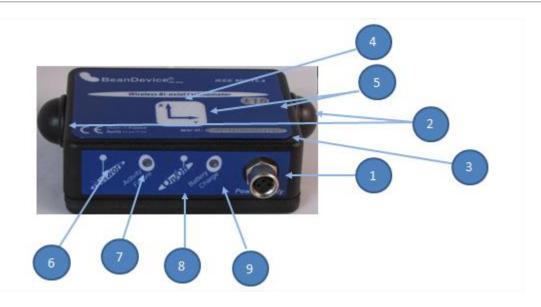
	Power supply
	Integrated Lithium-ion battery charger with high precision battery monitoring :
Integrated battery charger	Overvoltage Protection
	Battery Temperature monitoring
	Current accumulation measurement
	· During data acquisition : 20 to 30 mA
Current consumption @3,3V	· During Radio transmission : 40 mA @ 0dBm , 80 mA @ 18 dBm
	\cdot During sleeping : < 30 μ A
External power supply External power supply : +8v to +28v	
Rechargeable battery	High density Lithium-Ion rechargeable battery with a capacity of 1.35 Ah (referenced as BAT1.35DMG)

	Option(s)	
Power-supply bloc	Wall plug-in, Switch mode power Supply 12V @ 1,25A with sealed M8 Plug (IP67)	
Calibration certificate	Calibration certificate provided by Beanair A static calibration method is used on a granite surface plate DIN876	

2.4GHz wireless sensors

6.8 PRODUCT FOCUS

6.8.1 Casing description



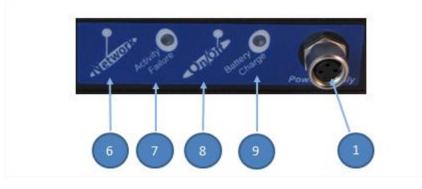




Figure 2: Casing description

Number	Function	Description	
1	M8-3 Contacts Socket for power supply input	 DC 8-28 volts power supply. The socket sealing is assured with a screw cap. If you don't use the external power supply, don't forget 	
		to protect the M8-3 pins socket with a M8 protection cap.	
2	Radome antenna	Waterproof IP67 Radome antenna	
3	MAC ID Label	Unique identifier assigned to the BeanDevice [®] (64-bytes) Every wireless network product which is based on the IEEE 802.15.4 standard must have a 64-bit MAC address that allows unique identification of the device within a global network.	
4	BeanDevice [®] product version label	 Three label version are available : ✓ BeanDevice® AX-3D: measurement range and the three axis are indicated on the Label ✓ BeanDevice® HI-INC: measurement range and the three axis are indicated on the Label ✓ BeanDevice® AX-3DS: measurement range and the three axis are indicated on the Label ✓ BeanDevice® AX-3DS: measurement range and the three axis are indicated on the Label 	
5	Acceleration/inclination axis	n Indicates acceleration/inclination on X/Y/Z axis	
6	" <i>Network</i> " non-contact button	 "Network context" non-contact button restores the factor settings on the BeanDevice[®]. Point the pole of the Neodymium magnet that was provided wir your BeanDevice[®] towards the "Network" label circle. Hold the magnet for approximately 2s Please read the following section for more information "clinehere" 	
7	"Network LED"	This bi-color GREEN / RED Led represents the BeanDevice [®] : Cf. table below for led description	
8	ON/OFF Non- contact button	Allows to power up/power off the BeanDevice [®] . Point the pole of the Neodymium magnet that was provided with your BeanDevice towards the "ON/OFF" label circle (refer fig. 3) (V1R2 only).Hold the magnet for approximately 2s	

9

		This bi-color GREEN / RED Led indicates battery charge status: Cf. table below for led description
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6.8.2 Leds description

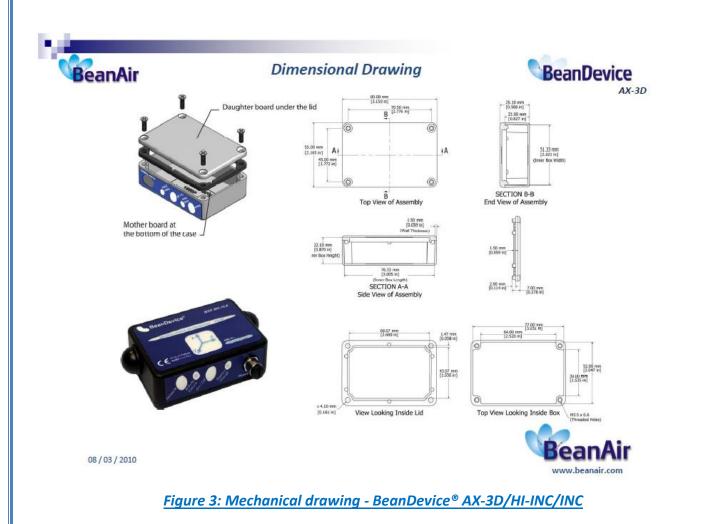
Operating status	Network LED	Battery Charge LED
The BeanDevice [®] is power off	LED OFF	<u>No external power supply</u> is connected:
The BeanDevice [®] is power on with wireless TX/RX activity	Green LED: Wireless Network Activity Red LED: Wireless transmission failure	LED OFF <u>External power supply</u> is connected:
The BeanDevice [®] is power on	Green led blinks twice	Green LED ON: Battery charged Red LED ON: Battery not charged
The BeanDevice [®] is power off (was power on before)	Red LED ON during 2s	
The BeanDevice [®] is power on & a network Reset is performed	Red LED ON during 2s then Green LED ON during 2s then Green LED blinks Repeated until connecting to BeanGetway®	
The BeanDevice [®] is power on & waits for a network activity	Green LED blinks	

6.8.3 Mechanical drawing for standard version

The BeanDevice® AX-3DS/AX-3D/HI-INC/INC products use the same sensor housing.

Enclosure Features

Material	Aluminum	
Protection	IP66	
Dimensions	(L/l/h : 80x55x21 mm)	
Weight	135g battery included	



6.8.4 Mechanical drawing for Xrange version

The BeanDevice® AX-3D/HI-INC Xrange products use the same sensor housing.

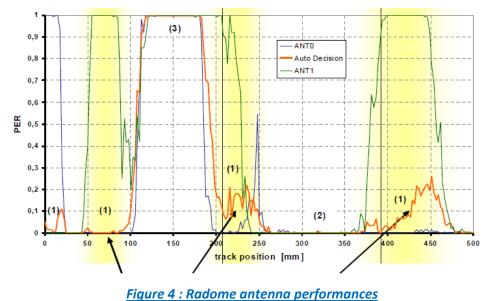
Enclosure Features

Material	Aluminum	
Protection	IP67	
Dimensions	(L/l/h : 100x71x30 mm)	
Weight	165g battery included	
Table 1 : BeanDouice AX 2D/HI INC/INC enclosure feature		

<u> Table 1 : BeanDevice AX-3D/HI-INC/INC enclosure feature</u>

6.8.5 Antenna diversity

Antenna diversity is a technique that maximizes the performance of an antenna system. It allows the radio to switch between two antennas that have very low correlation between their received signals. Typically, this is achieved by spacing two antennas around 0.25 wavelengths apart or by using two orthogonal polarizations. So, if a packet is transmitted and no acknowledgement is received, the radio system can switch to the other antenna for the retry, with a different probability of success.



The diagram below provides information on the radome antenna performance:

The radome antenna radio used on BeanDevice® product is a tamper resistant and unobtrusive.

6.8.6 Radome antenna

Electrical specification	ns	
Picture		
Center Frequency	2,45 GHz	
Gain	2,5 dBi	
Wavelength	¼-wave	
VSWR	<1.9 typ. at center	
Impedance	50 Ω	
Size	Diameter: 27mm	
	Height: 11 mm	



2.4GHz wireless sensors

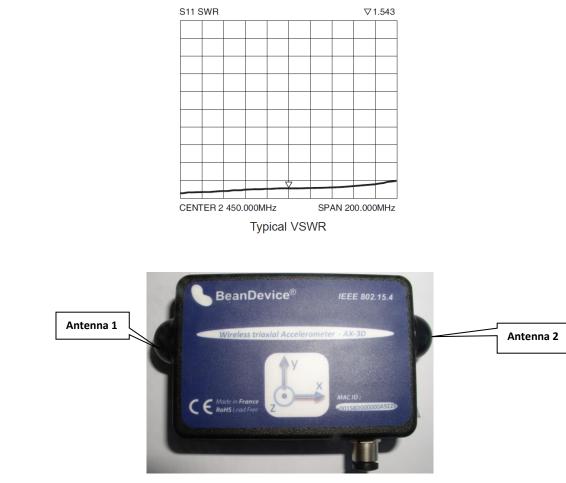


Figure 5: Antenna position on the BeanDevice AX-3D

Never try to change the antenna integrated on the BeanDevice[®]. This action may void the product warranty.

6.9 MOUNTING INSTRUCTIONS

6.9.1 Adhesive mounting instructions (BeanDevice[®] INC, HI-INC, AX-3D, AX-3DS)

Characteristics	SmartSensor
Mounting techniques	Adhesive mounting
Flatness	0,1 mm
Surface Roughness	0,1 mm
Surface treatment	Satin black textured polyester powder paint
Material	AL 6061

6.9.1.1 <u>Components needed for a non-permanent mounting</u>

Aluminum Foil Tape	Use an aluminum foil offering a good breaking load & water resistant for outdoor use. Example : Advance Tapes – Ref: 196074 - Thickness 0,09mm - Breaking load: 35 N/cm - Adhesion: 4 N/cm - Water resistant	
High strength Epoxy Glue	High Strength Epoxy Adhesive – Resin <i>Example</i> : Radio spares 159-3957	

6.9.1.2 <u>Reference edge</u>

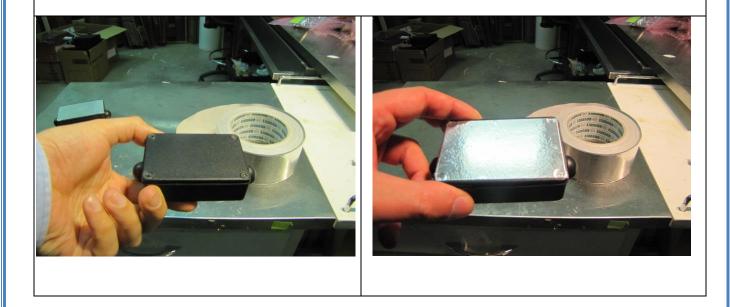
The BeanDevice[®] has a mounting reference angle (red line) for an optimal mounting of the product, which is parallel to the Y-axis. This reference edge must be placed exactly parallel to the object to be measured to prevent or minimize any mechanical offset/cross sensitivity.



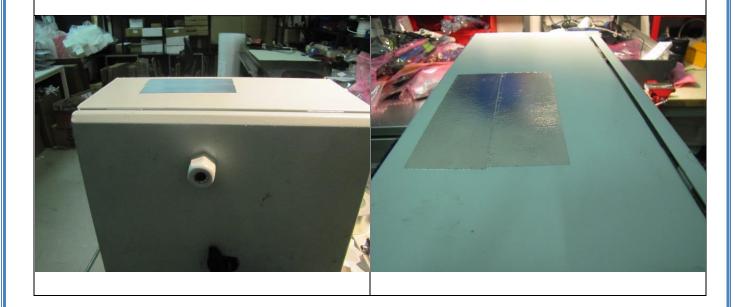
6.9.1.3 <u>Mounting instructions for non-permanent mounting</u>

For a non-permanent mounting we recommend to use the following process:

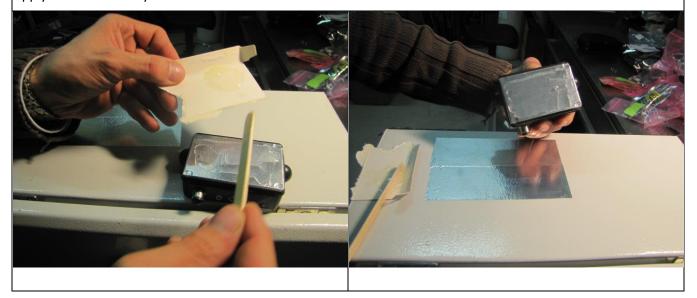
Step 1: Fix the aluminum foil tape on the back side of your BeanDevice[®] casing. Surface should be clean, dry and free from Grease.



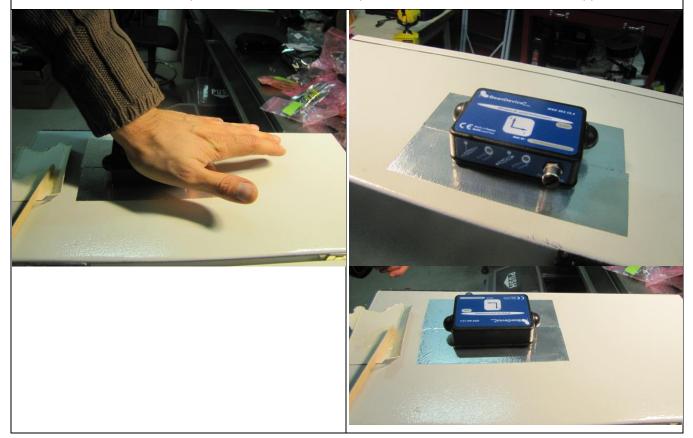
Step 2: Mount the aluminum foil tape on the equipment where you wanted to mount the BeanDevice[®]. Surface should be clean, dry and free from Grease.



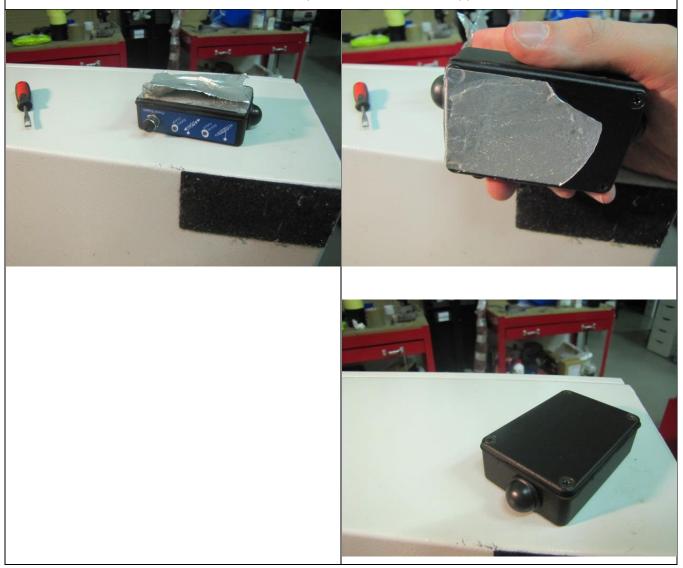
Step 3: Mix equal amount s of resin and hardener for 1 minute. Mixture should be used within 15-20 minutes. Apply the mixture on your BeanDevice[®]



Step 4: Clamp the two surface together until adhesive has cured (depending of the type of epoxy glue that you use, it can take 1 hour to 1 day). Your BeanDevice[®] is ready to be used for indoor and outdoor application.



Step 5: You can unmount the BeanDevice[®] very easily. Use a knife or a sharp object to unmount the BeanDevice[®]. Your BeanDevice[®] is clean and ready to be used on another application.



6.9.2 Screw Mounting (BeanDevice® AX-3D Xrange & BeanDevice® HI-INC Xrange)

Characteristics	SmartSensor Xrange
Mounting techniques	Screw mounting Three M5 drilled flanges
Flatness	38,1 μm
Surface Roughness	RA 1.6 (μm)
Surface treatment	Black anodized (Corrosion-proof)
Material	AL 7075 (twice harder than AL6061)

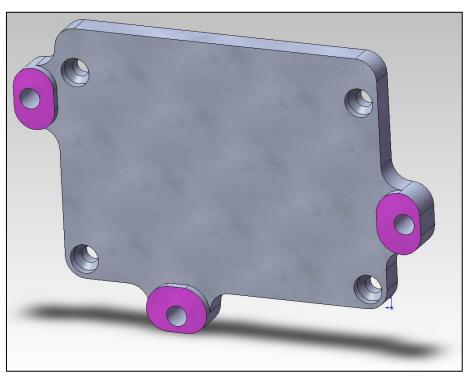


Figure 7: Xrange base plate overview

- ✓ For vibration measurement, the mass of the wireless accelerometer must be <1/10 of the mass of the object under study.</p>
- ✓ Mounting surfaces need to be clean, free of any residue from epoxies, waxes, paint or other foreign materials.
- ✓ Mounting surface should be flat.

- ✓ The mounting hole must be checked to ensure it is longer than the mounting screw so as to prevent "bottoming out".
- ✓ Use a torque wrench for tightening screws to the manufacturer's specifications. Do not use electric tools as their frequencies may damage the accelerometer.
- ✓ Spread mating surface with a light coating of silicone grease, heavy machine oil or bees wax to ensure contact is secure thereby maximizing the usable frequency range.
- ✓ Secure the cable using clamps, O-rings, tape or other materials most suited to the application. Ensure that you have sufficient slack to allow for free movement of the sensor.
- ✓ Inspect mounting holes and remove any debris, burrs or other foreign materials.

6.9.3 Wireless inclinometer special instructions (BeanDevice® HI-INC, INC & HI-INC Xrange)

The BeanDevice[®] HI-INC is designed for a horizontal mounting, i.e. the base plate of the inclinometer needs to be placed on the horizontal plane of the object to be measured.

Avoid shock and vibration during measurement, as these could corrupt the measurement results. Inclination sensors that base on a fluidic measurement principle are optimal for static measurements and suitable to only a limited extent of dynamic measurement.

6.10 BEANDEVICE® 2.4GHZ POWER SUPPLY

6.10.1 Integrated Lithium-ion Rechargeable battery (Xtend version excluded)

The BeanDevice[®] 2.4GHz from SmartSensor product lines integrates a Lithium-Ion rechargeable battery (except XTend version):

BeanDevice® version	Battery Capacity @25°C	Nominal Voltage @25°C	Charge/Discharge cycle @25°C
BeanDevice [®] 2.4GHz AX-3D			
BeanDevice [®] 2.4GHz AX-3DS	1250 mAh	4,2∨	370
BeanDevice [®] 2.4GHz HI-INC	950 mAh		

The rechargeable battery can be used as an UPS (uninterruptible power supply) battery on your BeanDevice[®]. It provides an emergency power when the external power source, typically the utility mains, fails.

Do not try to change the integrated battery. This action may void the product warranty.

6.10.2 External Primary cell (Xtend version only)

The battery life can be increased by using an external primary cell with a capacity of 6500 mAh. The primary cell is integrated in a watertight (IP65) enclosure.



Figure 8: External Primary cell



6.10.2.1 Primary cell specifications

The Primary lithium-thionyl chloride cell (*Li-SoCl2*) provides the following features:

Primary Cell Capacity	Size	Nominal Voltage	Operating temperature range	Maximum recommended continuous current	Pulse Capability
6000 mAh	C-size spiral cell	3,6 V	- 55°C/+ 80°C	1.5A	2.5 A during 0.1s

A Primary Cell is not a rechargeable battery; do not try to recharge it. You will damage your primary cell and your BeanDevice®

We recommend you the following primary cell provider:

Provider	Model
SAFT	LSH14
Europa Batteries	
EVE	ER26500M
Able Battery	

6.10.2.2 Main advantages of primary cell

These are the main advantages of using a primary cell:

- ✓ The operating temperature of your BeanDevice[®] is extended: -55°C to +80°C instead of -20°C to +75°C;
- ✓ The self-discharge of a primary cell is **2%/year** instead of 12%/year for a rechargeable battery;
- ✓ The capacity of a primary cell is 6000 mAh instead of 1250 mAh,



Please read the following section for more information about the primary cell replacement and calibration: "<u>click here</u>"

6.10.3 How to change the Primary cell on the BeanDevice® (Xtend version only)

This section concerns the BeanDevice[®] provided with an external primary cell power supply.

All the BeanDevice[®] HI-INC/AX-3D/AX-3DS provided with an internal rechargeable battery are not concerned by this section.



- •Open the screw cap on the battery holder
- •The primary cell (C Size) is inside the battery holder

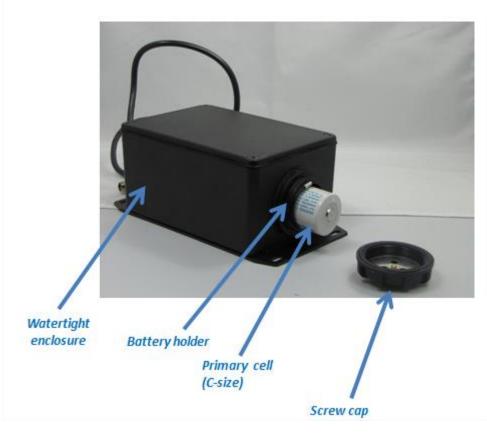


Figure 9: Changing the External Primary cell

Step 2 : Change the primary Cell Change the primary cell

•Check the battery polarity: pole + is on the screw cap side;



Figure 10: Changing the External Primary cell

Step 3 : Close the screw cap

- •Close properly the screw cap
- Don't forget the Gasket, it's very important to maintain a watertight seal on your device



Do not invert the battery polarity; your BeanDevice® will not work.



The primary cell is inverted

Figure 11: Changing the External Primary cell (wrong practice)

Step 4: Connect your primary cell enclosure to your BeanDevice® •Screw the M8 Plug on the M8 socket of your BeanDevice®

• Make sure that your M8 plug is correctly connected to your M8 socket, otherwise the sealing between the enclosures is not maintained;



Figure 12: Changing the External Primary cell (connecting the BeanDevice®)

Check the Power mode of you BeanDevice®

<u>Example:</u> If your BeanDevice[®] is operating in "Sleeping" power mode. You should Power off then power on your BeanDevice[®], the new configuration parameter is loaded during the cold start of your BeanDevice[®].

For further information about Power mode management, please read the technical note <u>TN_RF_010 -</u> <u>« BeanDevice® Power Management »</u>



Step 5: Check your battery charge level • Check the battery charge level which is dsplayed in the "*Power* Supply Diagnostic frame", battery charge level should be Good SmartSensor User Manual

le Server Tools Off.Data Analysis Advanced func.	Help
MAC_ID: 0::0015800000000000000000000000000000000	BeanDevice System Profile I BeanDevice Mac Id: 10150000000000000000000000000000000000
Sort 🛨 🖃	TX Log

Figure 13: Power supply diagnostic frame on BeanScape®)

The nominal voltage of a primary cell is 3,6 Volts instead of 4,2 volts for a rechargeable battery. This value is correct.

Make sure that the power mode configured on your BeanDevice[®] is in "sleep power mode". If the power mode is configured in active, the battery autonomy of your BeanDevice[®] will be dramatically reduced.

6.10.4 AC-To-DC power adapter (option)

The BeanDevice[®] can also be powered by an AC-to-DC adapter 8-28Volts. The power adapter can be used for recharging Lithium-Ion battery or to power supply continuously the BeanDevice[®].

A M8-3Pins standard plug is used for connecting the power adapter to the BeanDevice[®].

If battery charge is very low, connect the power adapter in order to recharge your internal battery.



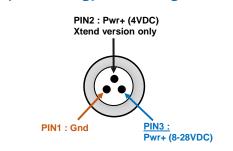
Only the M8 plug is fully sealed, the power adapter is not sealed.

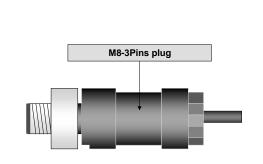
6.10.5 Power supply wiring code



Figure 15: M8 socket Power supply Wiring code

M8 Plug (A –Coding) - Pin Assignation





Interface Name	M8 Pin assignation	Wire Color (A-coding)
Power Supply 8-28VDC	PIN3	Blue
Power Supply 4VDC (available on Xtend version only)	PIN2	Black
Ground	PIN1	Brown

Figure 16: M8 Plug Power supply Wiring code

If a M8 plug with a molded cable is used, the wiring code comes as follow:

Pin Number	Description	Color code	
PIN3	Pwr+ : Power supply 8-28VDC	Blue	
PIN1	Ground	Brown	
Table 2 : M8-3P Plug Wiring code			

If a M8 plug with a molded cable is used, the wiring code comes as follow:

Pin Number	Description	Color code
PIN3	Pwr+ : Power supply 8-28VDC	Blue
PIN2	PM_Primary cell power supply (4V Maximum)	Black
PIN1	Ground	Brown

Table 3 : M8-3P Plug Wiring code (Xtend version)

6.11 RESTORING FACTORY SETTINGS

If desired, the user can perform a Network context deletion. It allows restoring default parameters on the BeanDevice[®]:

Parameter	BeanDevice® version		
	AX-3D – standard and Xrange version	AX-3DS	HI-INC – Standard and Xrange version
Power Mode	Active		
Data Acquisition duty cycle	10 5		
Acquisition duration time	ΟΚ		
Sampling rate	ОК		
Data Acquisition mode	LowDutyCycle		
Anti-aliasing Filter cut-off frequency	100 Hz	/	100 Hz

To restore these defaults parameters, you must perform a *Network context deletion*. The "Network" noncontact button is outside the product. Hold the magnet on the button network ("Network") for more than 2 seconds.



Figure 17: Network Reed non-contact button

7. BEANDEVICE® SUPERVISION FROM THE BEANSCAPE®

For more information about the BeanScape®, please read the BeanScape® User Manual.



It is recommended to install MatLab MCR to ensure running the Online/Offline Data analysis

MaltLab MCR 64 bits download link

http://ssd.mathworks.com/supportfiles/downloads/R2015a/deployment_files/R2015a/installers/win64 /MCR_R2015a_win64_installer.exe

MaltLab MCR 32 bits download link

http://ssd.mathworks.com/supportfiles/downloads/R2015a/deployment_files/R2015a/installers/win32 /MCR_R2015a_win32_installer.exe

7.1 STARTING THE BEANSCAPE®

The BeanScape® is a supervision software monitor fully dedicated to Beanair WSN (Wireless Sensor Networks):

- 1. Start the BeanScape® by double-clicking on the BeanScape® icon
- 2. Click on the button « start » 🛄
- 3. All the BeanDevice® connected to the WSN will appear on your left window
- 4. Select the BeanDevice[®] you want to configure. You can configure your BeanDevice[®] and its attached sensors.

SmartSensor User Manual

2.4GHz wir	less sensors
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Beanscape 2.4GHz File Server Tools Off.Data Analysis Advanced func. Help			
Image: Constraint of the state of		te Sensor channel profi Memory option : Custom display Notes Data Type : PLATFORM. Reference : PLATFORM.	Step DAQ"recording Memory used : # Acq. config. Sensor Config Online Data Analysis DataLogger TYPE
Component List Sort PAN_ID : 0 x 37C7	<u>ل</u> ة الم		

Figure 18: BeanDevice® display on BeanScape®

The user interface is organized as follow:

Green on black background are displaying information

00158D00000E06A8

Black on white background and Dark blue on light blue are customizable field;



You can configure your BeanDevice[®] from the page "*BeanDevice[®] System Profile*". This page is composed of two parts:

- ✓ BeanDevice[®] information display
- ✓ BeanDevice[®] configuration

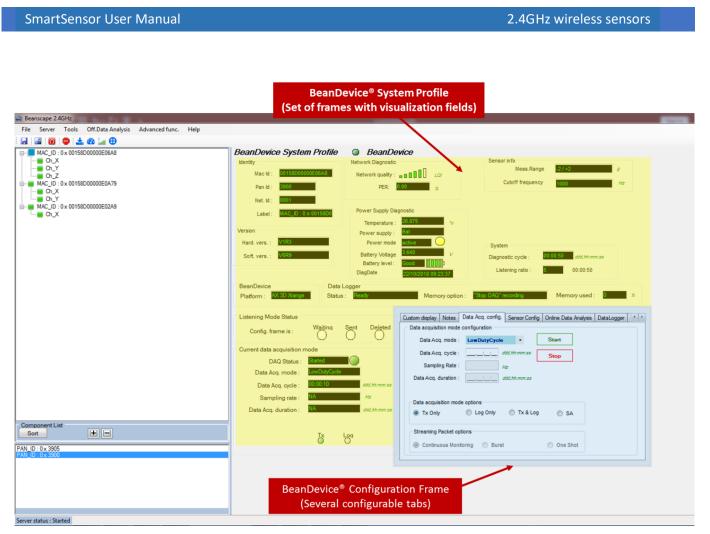
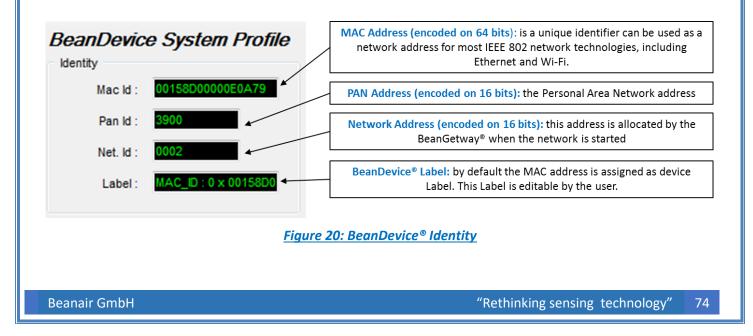


Figure 19: Overview: BeanDevice® System Profile on BeanScape®

7.2 DISPLAYING THE BEANDEVICE® INFORMATION

You will find below a description of the data information fields making up for each frame.

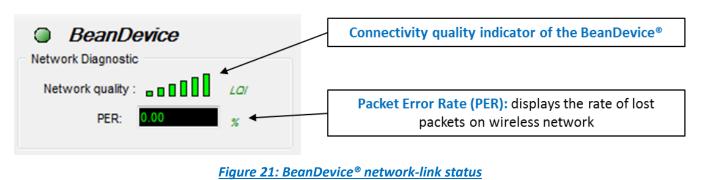
7.2.1 Frame: Identity



How the PAN ID is assigned ?

The BeanGateway[®] starts the WSN, assigning a PAN ID (Personal Area Network identifier) to the network. The PAN ID is pre-determined and cannot be modified. If you use several WSN, before deploying your BeanDevice[®] check to which WSN is assigned your BeanDevice[®].

7.2.2 Frame : Wireless Network Diagnostic



PER = Number of lost packet/Total of packet transmitted

Number of bars	Color	Link quality indicator
5 to 6 bars	Green	Very good
4 bars	Green	Good
3 bars	Red	medium
to 2 bars	Red	bad

7.2.3 Frame: Power supply diagnostic

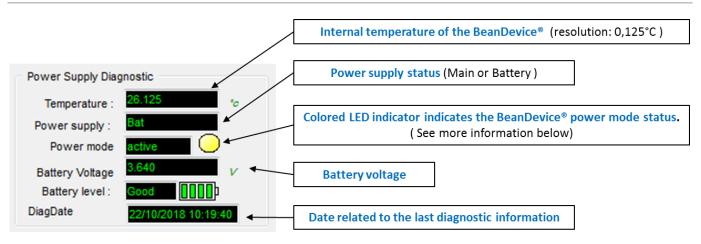


Figure 22: BeanDevice® Power Supply information

The BeanDevice® incorporates an internal temperature sensor:

- Battery temperature monitoring during charging ;
- Temperature compensation of the analog conditioning chain ;
- ✓ An alarm notification is send to the BeanGaeway[®] if the internal temperature is anormally high ;

When you plug the BeanDevice[®] on an external power supply, the power supply status is automatically detected.

If your primary cell charge level is low, it is highly recommended to recharge your battery. Your BeanDevice® from SmartSensor product lines integrates a battery charger.

For further information about Power mode management, please read the technical note <u>TN_RF_010 –</u> <u>« BeanDevice® Power Management »</u>



When using the Streaming mode or the S.E.T mode, BeanScape[®] stops to display the full Battery health status information on the Power Supply Diagnostic frame until stopping the acquisition.

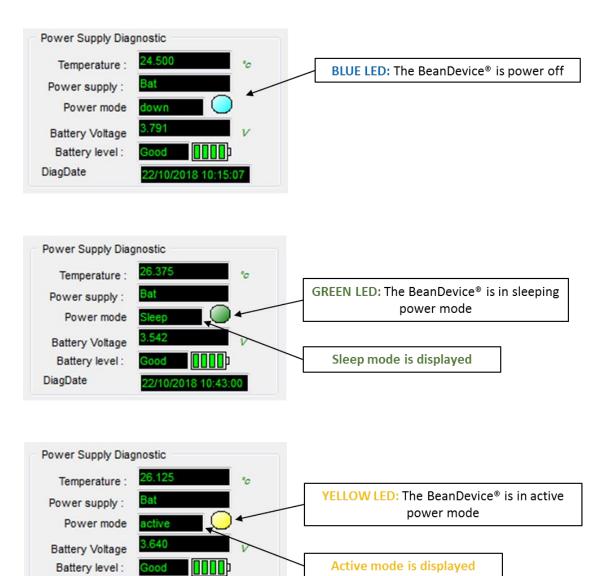


Figure 23:BeanDevice[®] Power modes

22/10/2018 10:19:40

DiagDate

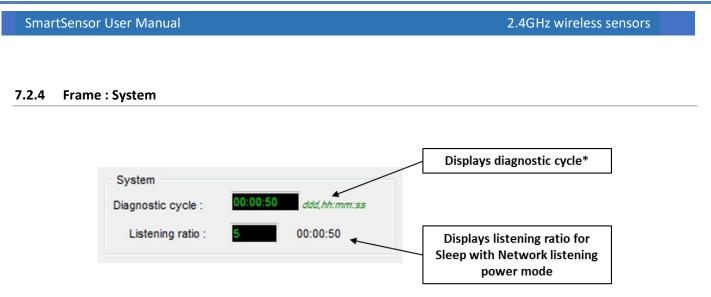


Figure 24: BeanDevice® Diagnostic cycle information

* The diagnostic cycle is a regular period during which the system collects information about the BeanDevice[®] (battery charge status, internal temperature, LQI, PER ..).

How to convert dBm to mW

Zero dBm equals one milliwatt. A 3dB increase represents roughly doubling the power, which means that 3 dBm equals roughly 2 mW. For a 3 dB decrease, the power is reduced by about one half, making –3 dBm equal to about 0.5 milliwatt. To express an arbitrary power P as x dBm, or go in the other direction, the following equations may be used:

$$x = 10 \log_{10}(1000P)_{Or}, x = 10 \log_{10} P + 30$$

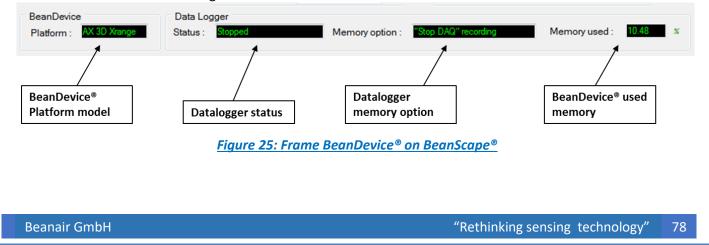
And

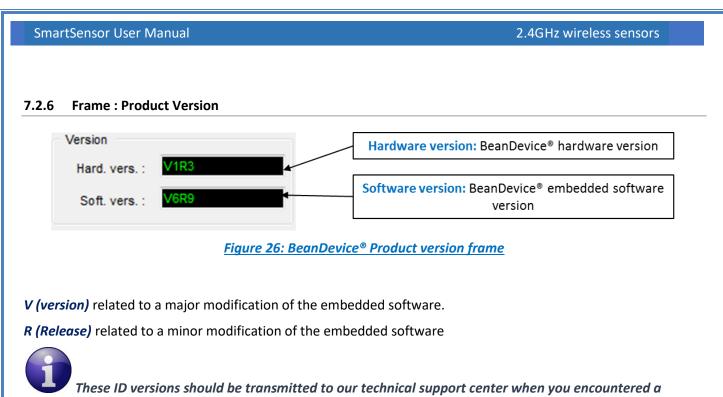
$$P = 10^{(x/10)}/1000_{or}$$
, $P = 10^{(x-30)/10}$

Where P is the power in W and x is the power ratio in dBm.

7.2.5 Frame : BeanDevice®

According to the BeanDevice[®] version, the information displayed in the frame will not be the same. For example, for the BeanDevice[®] AX-3D Xrange:





material or software dysfunction.

7.2.7 Frame : Current Data Acquisition mode

This frame displays all the informations returned by the BeanDevice® on its actual data acquisition mode:

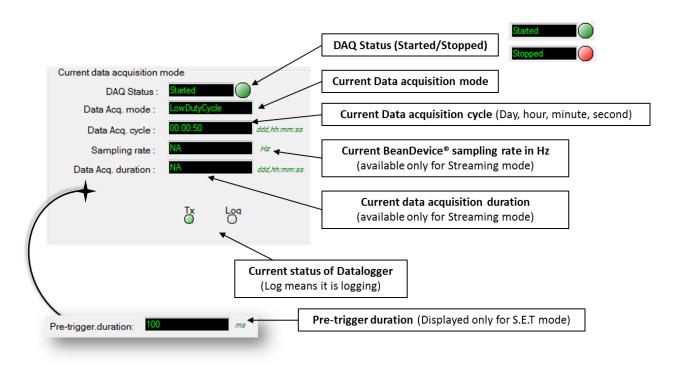


Figure 27: Frame: Current data acquisition mode

SmartSensor User Manual

7.3 BEANDEVICE® CONFIGURATION

Beanscape 2.4GHz File Server Tools Off.Data Analysis Advanced func. Help → MAC_D: 0 x 00158000000E06A8 → MAC_D: 0 x 0015800000E04A7 → MAC_D: 0 x 001580000E04A7 → MAC_D: 0 x 001580000E04A7 → MAC_D: 0 x 00158000E04A7 → MAC_D	BeanDevice System Profile BeanDevice idently Mac Id : ID15500000000000000000000000000000000000	Sensor info Meas Range 2/-22 g Cutoff frequency 1000 Hz
£ MAC_ID:0x001\$0000000058	Label: MAC_D: 0 x 0015000 Version Hard. vers.: VIR3 Soft. vers.: VER9 Battery tovage & 6009 Battery tevel: Cood ())	*c V Diagnostic cycle : 00.00.01 _ddc/.ht.mm:xa Listening ratio : 5 00:00:05
□ - □ MAC_ID : 0 x 00158D00000E06A - □ Ch_Y - □ Ch_Z - □ Ch_X	8 Config. frame is : Waiting Sent Delated Current data acquisition mode DAQ Status : Rooped Data Acq. mode : UA Data Acq. mode : UA Data Acq. sycle : UA Sampling rate : UA //2	voption : "Stop DAQI recording Memory used : * iotes : Data Acq. config.: Sensor Config : Online Data Analysis : DataLogger : * * PLATFORM_TYPE PLATFORM_REF MAC_ID : 0x 00158D00000E06A8 Folder 06A8 Validate
Component List Sort At. (D. 0x 3900 At. (D. 0x 3905	Data Acq. duration : LA def. Ah.mm.zs	

Figure 28: BeanDevice® configuration frame

This frame is composed of several Tabs and includes BeanDevice® OTAC (Over the Air Configuration) Parameters:

Tab	Description
Custom Display	Customize the BeanDevice [®] label
Notes	This area contains the notes related to the BeanDevice [®] .
Data Acquisition configuration	Configure the Data acquisition mode on your BeanDevice [®] , set the acquisition cycle or the sampling rate, enable/disable the datalogger function.
Datalogger	Manage the Datalogger function on the BeanDevice®
System configuration	Configure the diagnostic cycle and the TX Power
Power Mode Management	Configure the Power mode on your BeanDevice [®] (Active mode, Sleep power mode)

7.3.1 Tab: Custom Display

Custom display	Notes	Data Acq. config.	Sensor Config	Online Data Analysis	DataLogger 4
Type :	PLATE	ORM_TYPE			
Reference :	PLATE	ORM_REF			
Label :	MAC_I	D : 0 x 00158D0000	0E06A8		
Log folder	Folder	06A8			
	Val	idate			

Figure 29: BeanDevice[®] custom display tab

Parameter	Description
Туре	You can enter here the type of BeanDevice [®] you want to use
Reference	You can assign an internal reference to the BeanDevice [®] you have purchased.
Label	You can assign any sort of Label to your BeanDevice [®] . Therefore, the user can easily associate the BeanDevice [®] with its equipment (example: Room_N521_Second_Floor)

Click on "Validate" if you want to validate your configuration.

7.3.2 Tab: Notes

Custom display	Notes	Data Acq. config.	Sensor Config	Online Data Analysis	DataLogger
		Clear 💽			Validate

Figure 30: Tab : Notes

This field contains your notes concerning the BeanDevice[®]. To change this field, enter your text and click on « *Validate* » button. To back up your text, press the icon

Example: Machine failure n°XX, requested intervention.

SmartSensor User Manual

7.3.3 Tab : Data Acquisition configuration

				Data a	cquisiti	on mode	configu	iration
Custom display	Notes Da	ata Acq. config.	Sensor Config	Online Data	Analysis	DataLogger	•••	
 Data acquisitio 	on mode co	nfiguration						
Data Acq.	mode :	LowDutyCycle	-	Start				
Data Acq.	cycle :	d	dd,hh:mm:ss	Stop				
Samplin	ng rate :		 اz					
Data Acq. du	uration :	a	ldd,hh:mm:ss					
Tx Only		Log Only	Tx & Log	© SA		1		
-	ous Monitori			One Sh	ot			
				Datalo	ogger of	ptions		
		Figure 31: T	ab: Data acq	uisition cor	nfigurati	<u>on</u>		
Paramete	er _				Des	cription		

ode	Low duty cycle Data Acquisition (LDCDA)	Low duty cycle data acquisition is adapted for static measurement (tilt, pressure, temperature) requiring a low power consumption on your BeanDevice [®] . The duty cycle can be configured between 1 data acquisition & transmission per second to 1 data acquisition & transmission per day.
ion m	Survey	Survey mode is a mix between the LDCDA mode and Alarm mode. A data acquisition is transmitted
cquisit		 Whenever an alarm threshold (fixed by the user) is reached (4 alarm threshold levels High/Low).
Data Acquisition mode		 A transmission cycle is reached, the transmission cycle is configurable through the BeanScape[®] 1s to 24h
	Streaming	Streaming is more suitable for users requiring a high data sampling rate (maximum 1 KHz).

	Shock Detection When the Shock detection ode is activated (only available for the BeanDevice AX-3DS) the BeanDevice will wake up if a shock is detected. During the sleeping mode of the BeanDevice [®] , the sensor will continue to track a shock event.					
	S.E.T	The streaming with event trigger mode allows user to receive notification via email when the measurement reaches the preconfigured thresholds, the measurement is in streaming mode with high sampling rates (up to 1Ksps)				
Б	Select the Data acc	uisition cycle between 1s and 24hours.				
e isiti	The format is: Day	: Hour : Minute :Second				
acquis Cycle						
Data acquisition Cycle						
Da						
		rate of your BeanDevice [®] between 1 sample per second and 5000				
	Samples per second	maximum. The resolution is 1 sample per second.				
	If Datalogger is sele	cted, the maximum sampling rate is 2000 samples per second.				
rate	This field is availabl	e in streaming :				
Sampling rate	Choose carefully the Sampling rate value:					
am	✓ The PER (Packet Error Rate) can increase if the Sampling rate is high on your					
		In the second				
		<u>etwork capacity"</u>				
	 Power consumption increases with the sampling rate of your BeanDevice[®] 					
<u>ح</u>						
Data acquisition duration	Data acquisition du	ration in streaming mode.				
a acquisi duration	The format is Day: I	Hour : Minute :Second				
a ac dura						
Dat	The Data acquisitio	n duration value can be higher than Data acquisition cycle.				

Options

TX only: The BeanDevice[®] transmits the data acquisition without Datalogging *Log only*: The BeanDevice[®] logs the data acquisition without wireless transmission

Tx & Log: The BeanDevice[®] transmits and logs the data acquisition;

For further information about the Datalogger feature, read the technical note TN_RF_007 – "BeanDevice® Datalogger User Guide"

SA: Standalone: The BeanDevice[®] logs the data acquisition without wireless transmission. The BeanDevice stores all the measurements on its embedded datalogger. Thus, a direct connection with the BeanGateway[®] is not needed.

For further information about the Datalogger, please read the technical note <u>TN_RF_007 –</u> <u>"BeanDevice® Datalogger User Guide"</u> All the modifications are displayed on "*Current data acquisition mode*" frame:

Beanscape 2.4GHz		and the second s		
File Server Tools Off.Data Analysis Advanced func. Help				
i 🖬 📓 🞯 📥 🏤 🚂 🤁				
	BeanDevice System Profile	BeanDevice		
	Identity	Network Diagnostic	Sensor info Meas.Range	21.02
	Mac Id : 00158D00000E06A8	Network quality : 👦 🛛 🖉 🖉 🖉 🖉		
	Pan Id : 3900	PER: 0.00 %	Cutoff frequency	1000 Hz
mac_ID : 0 x 00158D00000E02A9	Net. Id : 0001			
MAC_ID : 0 x 00158D0000E0D58	Label : MAC_D : 0 x 00158D0	Power Supply Diagnostic		
		Temperature : 36.625 *c		
	Version	Power supply : Mains		
	Hard. vers. : VIR3	Power mode active	System	
	Soft. vers. : V6R9	Battery Voltage 4.162 V Battery level : Good	Diagnostic cycle : 00:01	ddd, hh:mm:ss
		DiagDate 22/10/2018 13:47:52	Listening ratio : 5	00:05:00
	BeanDevice Data Lo			
	Platform : AX 3D Xrange Status :	Stopped Memory option :	"Stop DAQ" recording	Memory used : 0 %
	Listening Mode Status	Custom display Notes Data	a Acq. config. Sensor Config Onlin	e Data Analysis DataLogger
	Config. frame is : Waiting S	ent Deleted Data acquisition mode cont	figuration	
	0 (Data Acq. mode :	owDutyCycle • Sta	rt
	Current data acquisition mode	Data Acq. cycle -		
	DAQ Status : Stated	Sampling rate :	Hz	
	Data Acq. mode : LowDotyCycle	Data Aco, duration :	ddd.hh:mm:ss	
	Data Acq. cycle : 00.01:00	Current data acquisit	tion mode	
	Sampling rate : NA			
	Data Acq. duration : NA	DAQ Stat	us : Started	
Component List				
Sort E	Ja La	Data Acq. mod	le: LowDutyCycle	e
PAN ID : 0x 3900				
PAN_ID : 0 x 3905	·	 Data Acq. cyc 	le: 00:01:00	ddd,hh:mm:ss
		Sampling rat	te: NA	Hz
			NIA	
		Data Acq. duratio	on: NA	ddd,hh:mm:ss
Server status : Started				
JEIVEI SLOLUS , SLOLLEU				
				100.00
			TX .	
			U	0

Figure 32: Current data acquisition mode display

For further information, please read the technical note <u>TN_RF_008 – "Data acquisition modes available</u> on the BeanDevice[®]"

7.3.4 Tab: Sensor Config

Sensor Config tab offers different functionalities according the nature of the BeanDevice[®].

7.3.4.1 BeanDevice® AX-3D and AX-3D X-range Sensor config Tab

AAF- Cutoff frequency(Hz)
AAF- Cutoff frequency(Hz) Validate
Y

Figure 33:BeanDevice® AX 3D and AX 3D X-range Sensor Config tab

When using the BeanDevice[®] Ax-3D or AX-3D Xrange, the Sensor Config Tab will be used to set the Sensor AAF-Cut frequency.

7.3.4.2 BeanDevice[®] Hi-Inc Sensor and Hi-Inc X-range Config Tab

Custom display	Notes	Data Acq. config.	Sensor Config	DataLogger	System config.	Power
	-					
Software Fil		r		[Validate	
AAF- Cutoff fr	equenc	y(Hz)			Validate	
Tare Inclinor	neter				Validate	

Figure 34: BeanDevice® Hi-Inc and Hi-Inc X-range Sensor Config tab

When using the BeanDevice® Hi-Inc or Hi-Inc X-range, user can have access to these functionalities:

- IIR Filter: Enable/Disable IIR Filter
- AAF-Cutoff Frequency: Used to set the Cutoff frequency
- **Tare Inclinometer:** Used to calibrate the Zero Degree during the calibration process.

Custom display Notes Da	ta Acq. config.	Sensor Config	DataLogger	System config.	Power 1
Software Filters			[Validate	
Meas.Range(g)		-2/+2	•	Validate	
Sensor measurement U	nit g	-		Validate	
Sensor measurement U	lnit g	·		Validate	

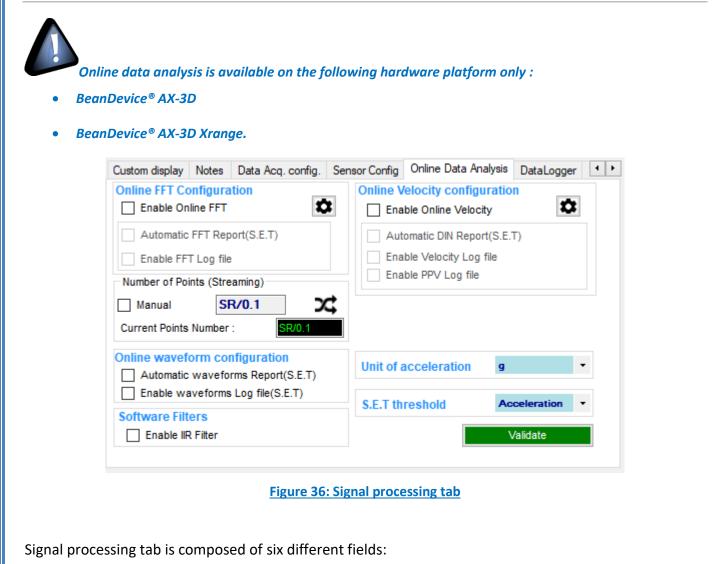
Figure 35: : BeanDevice[®] Hi-Inc and AX-3DS Sensor Config tab

When using the BeanDevice® AX-3DS, user can have access to these functionalities:

- IIR Filter: Enable/Disable IIR Filter
- Meas. Range: Used to set Measurement Range according to the Sensor measurement unit.
- Sensor measurement Unit: Used can select between g or mm/s²

2.4GHz wireless sensors

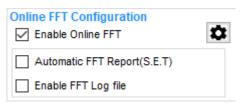
7.3.5 Tab: Online Data Analysis



Online FFT Configuration

- Online Velocity configuration
- Online waveform config
- **Software filters**
- Unit of acceleration
- S.E.T threshold

7.3.5.1 Online FFT Configuration



1: Check Enable Online FFT to view the display of FFT graph in the sensor profile



Figure 37: FFT Spectrum

2: Check Enable FFT Log file to generate log files in the log beanscape directory.

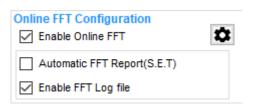


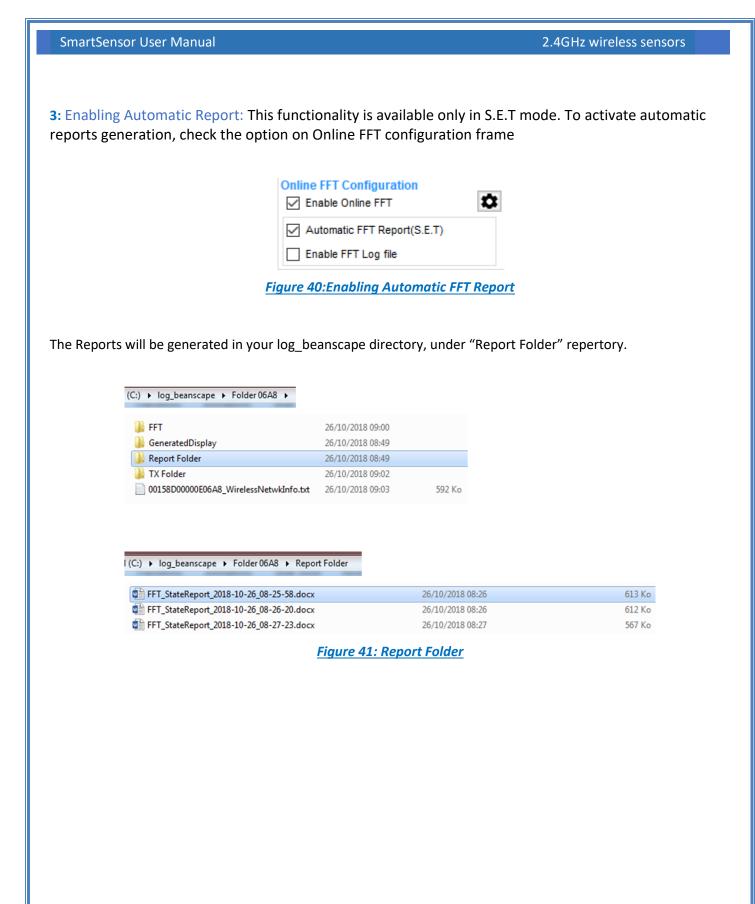
Figure 38: Online FFT Configuration frame

The log files will be generated in a folder called "FFT" under the BeanDevice® repertory.

(C:)
Iog_beanscape
Folder 06A8

🕌 FFT	26/10/2018 08:51		
🎉 GeneratedDisplay	26/10/2018 08:49		
keport Folder	26/10/2018 08:49		
🕌 TX Folder	26/10/2018 08:51		
00158D00000E06A8_WirelessNetwkInfo.txt	26/10/2018 08:53	435 Ko	
(C:) I log_beanscape Folder 06A8 FFT			
FFT_RealTime_MAC_ID0_x_00158D00000El	06A8_2018-10-26_08-51-44.txt	26/10/2018 08:5 26/10/2018 08:2	
FFT_RealTime_MAC_ID0_x_00158D00000E	06A8_2018-10-26_08-51-44.txt 0-26_08-25-58.txt		10 K
FFT_RealTime_MAC_JD0_x_00158D00000E FFT_SET_MACID_00158D00000E06A8_2018-10	06A8_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-26-20.txt	26/10/2018 08:2	26 10 K 26 10 K
FFT_RealTime_MAC_ID0_x_00158D00000E FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/	0648_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-26-20.txt 0-26_08-26-20.txt	26/10/2018 08:2 26/10/2018 08:2	16 10 K 16 10 K 17 11 K
FFT_RealTime_MAC_JD0_x_00158D00000E FFT_SET_MACID_00158D0000E06A8_2018-1/ FFT_SET_MACID_00158D0000E06A8_2018-1/ FFT_SET_MACID_00158D0000E06A8_2018-1/	06A8_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-26-20.txt 0-26_08-26-20.txt 0-26_08-27-23.txt 0-26_08-28-24.txt	26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2	16 10 K 16 10 K 17 11 K 18 11 K
FFT_RealTime_MAC_JD0_x_00158D00000E FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/	06A8_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-26-20.txt 0-26_08-26-20.txt 0-26_08-27-23.txt 0-26_08-28-24.txt 0-26_08-29-25.txt	26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2	16 10 K 16 10 K 17 11 K 18 11 K 19 11 K
FFT_RealTime_MAC_JD0_x_00158D00000E FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/	0648_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-26-20.txt 0-26_08-27-23.txt 0-26_08-27-23.txt 0-26_08-28-24.txt 0-26_08-29-25.txt	26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2	6 10 K 6 10 K 7 11 K 8 11 K 9 11 K
FFT_RealTime_MAC_JD0_x_00158D0000E FFT_SET_MACID_00158D0000E06A8_2018-11 FFT_SET_MACID_00158D0000E06A8_2018-11 FFT_SET_MACID_00158D0000E06A8_2018-11 FFT_SET_MACID_00158D0000E06A8_2018-11 FFT_SET_MACID_00158D0000E06A8_2018-11 FFT_SET_MACID_00158D0000E06A8_2018-11 FFT_SET_MACID_00158D0000E06A8_2018-11	0648_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-25-20.txt 0-26_08-227-23.txt 0-26_08-28-24.txt 0-26_08-28-24.txt 0-26_08-30-26.txt 0-26_08-30-26.txt	26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:3	16 10 K 16 10 K 17 11 K 18 11 K 19 11 K 10 11 K
FFT_RealTime_MAC_JD0_x_00158D0000E FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i FFT_SET_MACID_00158D0000E06A8_2018-1i	0648_2018-10-26_08-51-44.txt 0-26_08-25-58.txt 0-26_08-27-23.txt 0-26_08-27-23.txt 0-26_08-28-24.txt 0-26_08-29-25.txt 0-26_08-29-25.txt 0-26_08-30-26.txt 0-26_08-31-27.txt	26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:2 26/10/2018 08:3 26/10/2018 08:3	16 10 K 16 10 K 17 11 K 18 11 K 19 11 K 10 11 K 11 11 K 12 11 K

Figure 39: FFT log files folder



For further information about the configuration of Online FFT please refer to section <u>7.3.4</u> of this user manual

After enabling Real time FFT and setting SMTP configuration (<u>more information on section 8</u>), this is an example of an FFT report emailed to concerned recipients.



Figure 42: FFT Report (S.E.T mode)

1	Logo of your company, you can upload it from the alarm management configuration window. Tools→Alarm management
2	General information about the Measurement, Date, duration sampling rate ,pre-trigger duration, IIR filter status and triggered axis
3	Information related to monitoring site: user, location and monitoring sites (can be configured from the Alarm tool window. This field can be configured be from the alarm management configuration window Tools-Alarm management
4	BeanDevice [®] Information: Type, MAC ID and label, measurement range, and Alarm Type : Acceleration or Velocity
5	Alarm thresholds value on each Axis, the three levels of alarms are displayed Action-Alert-Alarm
6	FFT Report with Max Frequency for each Axis, VPPV (Vector Peak Particle Velocity) value and Max amplitude
7	Graph Area – 3 Axis are displayed on the same graph

For further information about managing your notification and reports email please refer to section <u>8:</u> Alarm management.

FFT Advanced Configuration

The FFT configuration allows the user to activate the FFT Shift and to go for manual settings related to FFT.

FFT Configuration		×
Auto	FFT Shift	
		Current FFT Configuration
Window Type :	Rectangular 🚖	Mode : By FFT_Auto
Algorithm :	Estimate 🜲	FFT Shift : Disabled
Zero Padding :		Window type : Rectangular
Nucleard		Algorithm : Estimate
Number of (Streaming mode)	SR/0.1	Zero padding : Enabled
	Validate	

- Auto/Manual

Manual	FFT Shift
Window Type :	Rectangular 🔶
Algorithm :	Estimate 🚔
Zero Padding :	

- Window type:

Destangular
Rectangular
Hamming
Hann
Blackman
Blackman Harris
Gaussian
Kaiser
Taylor
Triangular
Flattop
Bartlett
Bartlett-Hann

When the number of periods in the acquisition is not an integer, the endpoints are discontinuous. These artificial discontinuities show up in the FFT as high-frequency components as not present in the original signal. These frequencies can be much higher than the Nyquist frequency and are aliased between 0 and half of your sampling rate. This phenomenon is known as spectral leakage.

You can minimize these effects by using a technique called windowing.

Windowing reduces the amplitude of the discontinuities at the boundaries of each finite sequence acquired by the digitizer. Windowing consists of multiplying the time record by a finite-length window with an amplitude that varies smoothly and gradually toward zero at the edges. This makes the endpoints of the waveform meet and, therefore, results in a continuous waveform without sharp transitions. This technique is also referred to as applying a window.

There are several different types of window functions that you can apply depending on the signal. To understand how a given window affects the frequency spectrum, you need to understand more about the frequency characteristics of windows.

Selecting a window function is not a simple task. Each window function has its own characteristics and suitability for different applications. To choose a window function, you must estimate the frequency content of the signal.

- If the signal contains strong interfering frequency components distant from the frequency of interest, choose a smoothing window with a high side lobe roll-off rate.
- If the signal contains strong interfering signals near the frequency of interest, choose a window function with a low maximum side lobe level.

• If the frequency of interest contains two or more signals very near to each other, spectral resolution is important. In this case, it is best to choose a smoothing window with a very narrow main lobe.

• If the amplitude accuracy of a single frequency component is more important than the exact location of the component in a given frequency bin, choose a window with a wide main lobe.

• If the signal spectrum is rather flat or broadband in frequency content, use the uniform window, or no window.

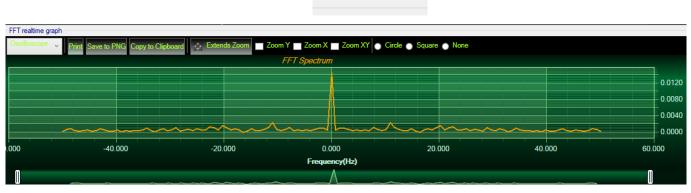
In general, the Hanning (Hann) window is satisfactory in 95 percent of cases. It has good frequency resolution and reduced spectral leakage. If you do not know the nature of the signal but you want to apply a smoothing window, start with the Hann window.

- Algorithm

Estimate	Determine a best-guess transform algorithm based on the size of problem.
Measure	Find a better algorithm by computing multiple transforms and measuring the run times.
Patient	Run a wider range of testing compared to 'measure', resulting in a better transform algorithm, but at the expense of higher computational cost to determine the parameters.
Hybrid	Use a combination of 'measure' for transforms with dimension length (number of points) 8192 or smaller and 'estimate' for transforms with dimension length (number of points) larger than 8192.

- Zero Padding: The use of zero padding enables you to estimate the amplitudes of frequencies correctly.
- FFT Shift: Check to enable real time FFT Shift processing for BeanDevice AX-3D on streaming mode and the FFT spectrum will appear shifted below the Streaming graph in the sensor profile.

FFT Shift





7.3.5.2 Online Velocity configuration

Real time observation of velocity available for BeanDevice AX-3D only with Streaming and S.E.T acquisition modes and is enabled from the signal processing tab in the Configuration panel.

Custom display Notes Data Acq. config. S	ensor Config	Online Data Ana	alysis DataLogge	er 🚺 🕨
Online FFT Configuration Enable Online FFT Automatic FFT Report(S.E.T) Enable	Ena	elocity configu ble Online Velocit omatic DIN Repor	ty t(S.E.T)	X
Number of Enable Online Velocity configuration Manual Automatic DIN Report(S.E.T Current Poi Enable Velocity Log file Online way Enable PPV Log file	\$	PPV Log file	9	•
Automatic waveforms Report(S.E.T) Enable waveforms Log file(S.E.T) Software Filters Enable IIR Filter	S.E.T th	reshold	Acceleration Validate	•

Figure 44: Online Velocity configuration tab

Enable online Velocity: check to enable real time Velocity processing, PPV and PVS, the velocity graph will be displayed.

On the Graph side a real time DIN 4150 graph will be displayed on the right side of the screen.

Under the DIN 4150 Graph, the PPV and the PVS values will be displayed in real time.

On the PPV frame, BeanScape will display PPV in mm/s, ZC Frequency in Hz, Peak Acceleration in g and Peak Displacement in mm.



It is important to notice that the PVS calculation required 3 active channels to be generated.

PPV: is a measurement of maximum ground particle movement speed, it is in millimeters per second (mm/sec), PPV is a "vector" quantity (i.e. it has both a value and an associated direction).

Peak Vector Sum (PVS): is simply the square root of the sum of the squares of the individual PPV values. PVS is a "scalar" quantity, i.e. one with only a value, which is always larger than the individual PPV vector values.

Scientific studies have shown that the PPV correlates best with damage potential of all the tested characterizations of ground movement (e.g. acceleration, displacement, or strain). Most, though not all, ground vibration standards are quoted in PPV values, although the "acceptable" values of PPV differ with the standard applied and with the frequency of the vibration components.

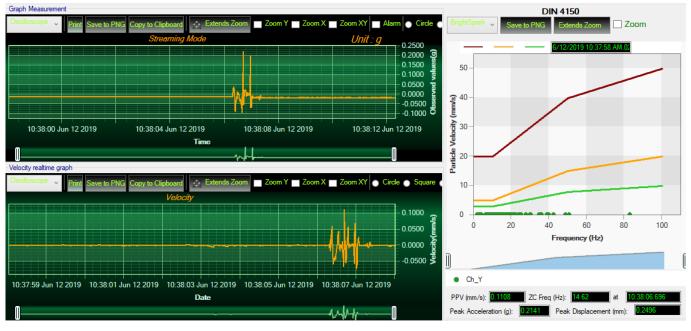
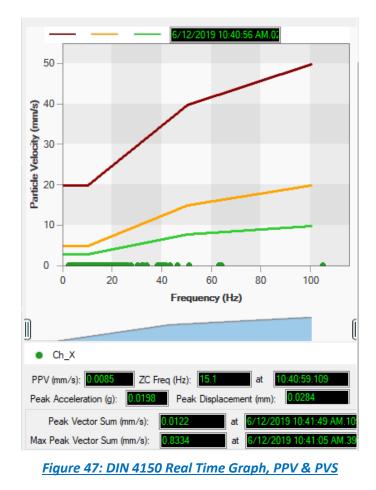


Figure 45: Velocity Graph



Figure 46: Velocity and FFT Graph, PPV and PVS



Automatic DIN Report (S.E.T): check to enable DIN4150-3 report automatic generation when threshold is reached, or an acquisition cycle is reached on the S.E.T acquisition mode.

An automatic Report will be sent to the email addresses configured on Alarm Management Option.

BeanAir

BeanDevice MAC_ID : F4B85E00A14B0000

06-Feb-19 12:07:37

Sensor Label : Ch_Z

DIN 4150-3 REPORT

Building Type	Commercial
Pipeline Material	Steel
Velocity Average(mm/s)	0.0177327272727272
Sampling Rate(hz)	100
Analyze Duration(hh:mm:ss)	00:00:01.1000000
LTVEE	ок
LTEBP	ок
Velocity Frequency(hz)	0
PCPV(mm/s)	2.4892
STEBP	ок
STVEE	NOK

KeyWord	Meaning
LTVEE	Long Term Vibration Evaluation Effect
LTEBP	Long Term Effect on Buired Pipework
STEBP	Short Term Effect on Buired Pipework
STVEE	Short Term Effect Evaluation
PCPV	Peak Component Particle Velocity

Figure 48: DIN 4150-3 Report email

INFORMATION	DETAILS
Building type	User configurable
Pipeline Material	User Configurable
Velocity Average	Get the average of the signal after transforming the acceleration signal into velocity signal
Sampling Rate	In Hz
Analyse duration	BeanScape property
Long term vibration evaluation	1-Find the maximum velocity values over the Time
effect	2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.
	3-Display if the result is OK or not (guideline respected or not)
Long term Effect on buried pipework	1-Find the maximum velocity values over the Time2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.3-Display if the result is OK or not (guideline respected or not)
Velocity Frequency	Get the signal frequency (FFT + windowing)
Maximum velocity (mm/s)	BeanScape Property
Short term Effect on buried	1-Find the maximum velocity values over the Time
pipework	2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.
	3-Display if the result is OK or not (guideline respected or not)
Short term vibration effect evaluation	 1-find the maximum velocity value over the time. 2-Determine the significant frequency (use the FFT + windowing). 3-compare the maximum velocity to the guideline value described on the Norm DIN 4150 5-Display if the result is OK or not (guideline respected or not)

Enable Velocity Log file: check to enable Velocity data to be stored in the log folder.

poond	Organize	140.00		open
→ Thi	s PC > Local Disk (C:) > log_beanscape > Fo	lder 5C313E06A9A7000	00	
	Name	Date modified	Туре	Size
	FFT	13-Feb-19 14:43	File folder	
*	📕 TX Folder	13-Feb-19 14:58	File folder	
*		13-Feb-19 14:58	File folder	
INIS 🖈	5C313E06A9A70000 WirelessNetwkInfo	13-Feb-19 14:58	Text Document	
Velo	city_RealTime_Ch_X_MAC_ID0_x	_F4B85E00A14B	0000_6_12_2019	_10_48_

Velocity_RealTime_Ch_Y_MAC_ID___0_x_F4B85E00A14B0000_6_12_2019_10_48_00_AM

Velocity_RealTime_Ch_Z_MAC_ID___0_x_F4B85E00A14B0000_6_12_2019_10_48_00_AM

Figure 49: Velocity Log Folder/Files

Enable PPV Log file

poourd	orge	11120	140.44	OP OP	C11
> This	PC → Local Disk (C:) → log_bean	scape > Folder	5C313E06A9A70000		
	Name	C	Date modified	Туре	Size
*	FFT	1	3-Feb-19 14:43	File folder	
	TX Folder	1	3-Feb-19 14:58	File folder	
Ŕ		1	3-Feb-19 14:58	File folder	
INIS 🖈	5C313E06A9A70000 WirelessN	etwkinfo 1	3-Feb-19 14:58	Text Document	
PPV_	RealTime_Ch_X_MAC_ID_	_0_x_F4B85	E00A14B0000_6	_12_2019_10_48	_00_AN
PPV_	RealTime_Ch_Y_MAC_ID_	_0_x_F4B85	E00A14B0000_6	_12_2019_10_48	_00_AN
PPV_	RealTime_Ch_Z_MAC_ID_	_0_x_F4B85	E00A14B0000_6	_12_2019_10_48	_00_AN

Figure 50: PPV Log Folder/Files

martSensor User	Manual		2.4GHz wireless sensors
📕 🔛 : Veloc	city Advanced Configurat	ion	
	Velocity Configuration O By FFT FFT) By Filter	
	Auto	Streaming Mode SET Mode	ers Profile : < Empty> 🗸 🔮 🕅 🏑 🕁 🏠
	Window Type : Rectangular 💠 Algorithm : Estimate 💠	Import Auto Hite Response Type Highpass	Frequency Specification — Magnitude Specification —
	Zero Padding : Current Velocity Configuration	Bandpass Design Method	Units : Az Units : da Fis : 2000 Astop 1 : 60
	Points Used Number of points(Streaming) (Streaming mode)	IIR Chebyshev_type_I FIR Equiripple	Fatop1: 0.1 Fpass1: 2.5 Apass: 0.1
	Mode : Zero Crossing	Filter Order	Fpass2 : 800 Astop2 : 60 Fstop2 : 999
		Specify Order	Filter Name :
		⊢ Filter Specification ∱Mag. (dB)	
			1.
			Apass T
		0 F _{stop1} F	Fpass1 Fpass2 Fstop2 Fs/2 f (Hz)
			Close Validate
	Figure 51: N	/elocity Advanced Config	<u>juration</u>
city Configuration			
By FFT		O By Filter	By Zero Crossing
Γ			
- Byff	I: By selecting this option,	the user will setup the ve	elocity basing on customized FFT setting
	• Auto: If Auto is sele	ected, The Velocity calcul	ation will activate FFT Auto mode Setti
	By FFT		
	FFT		
	Auto		
	Window Type :	Rectangular 🔶	import
	Algorithm :	Estimate +	
	Zero Padding :		
	Zero Fadulity .		

 Manual: Once switched to Manual, the user must configure the FFT settings manually (Window Type, Algorithm & Zero Padding).

By clicking on Import the Configuration will import the FFT current settings, already configured on the FFT frame.

By FFT FFT Manual				
Window Type : Algorithm :	Rectangular Estimate	* *	Ŷ	Import
Zero Padding :				
• • • • • • •				

<u>To save all settings Press Validate. The new settings should be displayed on the Left side of the Window.</u>

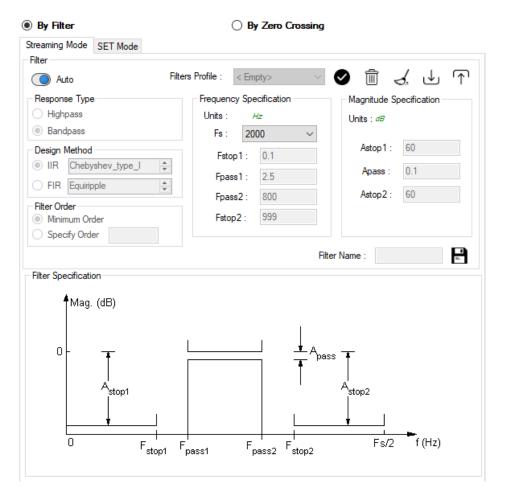
By FFT	O By Filter	O By Zero Crossing
) Manual	Streaming Mode SET Mode	
	Fiter Fiter Manual Response Type Highpass Bandpass Design Method IIR Chebyshev_type_1 Fiter Order Fiter Order Fiter Order Fiter Specificat Ma	Fpass : 2.5
		Apass Apass Fs/2 F (Hz)

- **By Filter:** By selecting this option, the user will setup the Velocity basing on the Software Filter.

The Software filter is avai	ilable for Streaming and S.E.T Mode.
	By Filter

Streaming Mode	SET Mode	
Filter		

 \circ $\;$ Auto: If Auto is selected, Velocity Automatic filter will be configured



- Manual: Once switched to Manual, the user must configure manually the Filter settings.
 - Response Type: User should specify if the Response is Highpass or Bandpass

Response Type	
Highpass	
O Bandpass	

 Design Method: User should Select the nature of the Filter between IIR or FIR From the List of every filter, user have to specify the method of the Filter: IIR: Chebyshev_type_I, Chebyshev_type_II or Butterworth FIR: Equiripple, Generalized_Equiripple or Kaiser_Window

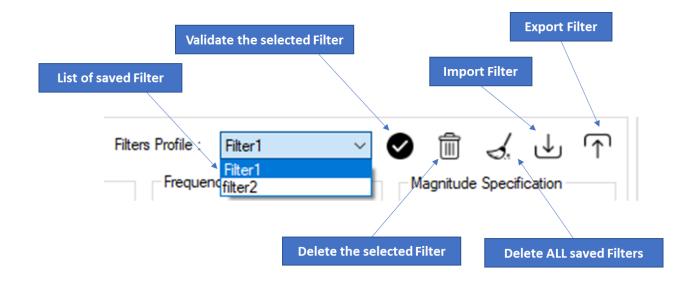
The Frequency Specification and The Magnitude Specification will be modified according the selected Design Method

Filter Order: If the user is using IIR Design Method, Minimum Order will be selected automatically.
 If the FIR Design Method is selected, user must Specify Order.

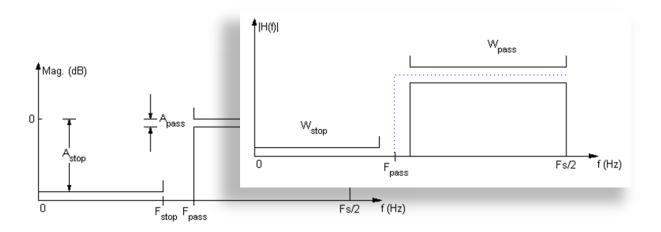
 Frequency Specification: Is a customizable frame according to the Design Method.

- Magnitude Specification: Is a customizable frame according to the Design Method.
- Filter Profile: User can save a specific Configuration and re-use it later.





 Filter Specification: Is a Graphical Display of the Filter Specification depends on the user settings.



<u>To save all settings Press Validate. The new settings should be displayed on the Left side of the</u> <u>Window.</u>

By FFT	By Filter By Zero Crossing
) Manual	Streaming Mode SET Mode
Window Type : Rectangular Import Algorithm : Estimate Import Zero Padding : Import Import rent Velocity Configuration foints Used Import Import Number of points(Streaming) (Streaming mode) SR/0.1 Import Streaming mode) Streaming S.E.T Mode : V Filter_Manual Mode : V Filter_Auto Sampling Rate : 100 Hz Sampling Rate : 200 Hz Response Type : Horighpass Response Type : Horighpass Response Type : Horighpass Design Method : Theb_type_I Design Method : Theb_type_I Filter Order : Hz Frass : 25 Hz Fibass : 40 Hz Frass : 25 Hz Frass : 25 Hz Fibass : 40 Hz Frass : 25 Hz Frass : 25 Hz Fibass : 40 Hz Frass : 25 Hz Frass : 25 Hz Fibass : 40 Hz Frass : 25	Fiter Manual Fiters Profile : Fitter 1 Image: Constraint of the system of the s

7.3.5.3 Online waveform configuration

```
Online waveform configuration
Automatic waveforms Report(S.E.T)
Enable waveforms Log file(S.E.T)
```

- Automatic Wave Report(S.E.T): Check to enable waveform reports, this is only available for S.E.T mode
- **Enable Wave Log file:**check to enable logging wave form for real-time data(only S.E.T mode)

7.3.5.4 Software filters

Enable IIR Filter: Check to enable IIR filter

7.3.5.5 Unit of acceleration

Select which unit to be used for acceleration measurement.

Unit of acceleration	g 🝷
	g
0 F T 45	mm/s ²

7.3.5.6 S.E.T threshold

In so many cases the threshold is needed to be set in mm/s and not in g or mm/s², you need to configure your S.E.T threshold parameters before starting.

To configure the threshold to be set in mm/s, you need to go to Online Data Analysis and change S.E.T threshold from acceleration to Velocity.

S.E.T threshold	Acceleration	•
	Acceleration Velocity	

7.3.6 Tab: Datalogger

Custom display	Notes	Data Acq. co	nfig.	Sensor Config	Online Data Anal	_{/sis} DataLogg
DataLogg						
			eady			
		rogress: N				
D	ownioad	d status : N	A			
DataLogg	er mana	ager				1
					Erase	
	Stop				Erase	
Download	manag	er				1
Downl	oad	Downle	oad tł	nen erase	Cancel	
	5	Stop DAQ, do	vnloa	ad then erase		
		•				
Acquisition	n inform	ation				1
		quisition N	Δ			

Data logger tab is composed of five different fields:

- **Datalogger Status**
- Datalogger manager
- Download manager
- Acquisition information
- Datalogger memory configuration

7.3.6.1 Datalogger status

DataLogger status	
DataLogger status :	Ready
Download progress :	NA
Download status :	NA

Datalogger status: Displays logger status, four status are available:

- o *Ready*: the Datalogger is ready to register data
- *NotInit*: the Datalogger is not initialized;
- o Active logs only: Data acquisition is logged only;

0	Active TX	and Log: Data ace	quisition is logged	& transmitted by	Radio:
0	ALLIVE IA	und Log. Data act	quisition is logged		y Naulo,

• *Stopped*: Datalogger is stopped;

- Download process: Displays the download process 0 to 100%. If 100%, all the data logs are successfully downloaded on your PC.
- **Download status**: Displays the download status, two types of status are available:
 - Processing: Data logs download is under process;
 - *Completed:* Data Logs are completely downloaded on your PC;

7.3.6.2 Datalogger manager

DataL	ogger manager	
	Stop	Erase

- **Stop**: Stops Data Logging process
- **Erase**: Stops & Erases all the logs on flash memory

7.3.6.3 Download manager

Download m	nanager		
Downloa	ad	Download then erase	Cancel
		p DAQ, download then erase	
-			

- **Download**: Starts to download all the logs on the flash memory
- **Download then erase**: downloads all the logs and the erase them.
- Cancel: Stops the download process
- Stop DAQ, download then erase.

7.3.7 Tab : System config.

Data Acq. config.	Sensor Config	Online Data Analysis	DataLogger	System config.	Power mc 1
Diagnostic Cy	cle	r		1	
Ratio : 1	00:00:0	1	Validate		
Restart device					
			Restart		

Figure 53: System Configuration Tab

Parameter	Description
Diagnostic cycle	You can set the BeanDevice [®] diagnostic cycle (Battery status, LQI, PER). The Diagnostic cycle is a ratio of the data acquisition cycle. <i>Ex</i> : If you try to set the diagnostic cycle ratio at 2 while the data acquisition cycle is set at 5s, the diagnostic cycle will be settled to 10s ;
Restart Device	You can restart your BeanDevice [®] from BeanScape [®] .

7.3.8 Tab : Power mode management

For further information about Power mode management, please read the technical note <u>TN_RF_010 -</u> <u>« BeanDevice® Power Management »</u>

This Tab is composed of three frames:

- ✓ *Power mode configuration:* Configure the Power mode on your BeanDevice[®]
- ✓ *Sleep with listening config.* : Configuration settings for Sleep power mode

SmartSenso	r User Manual	2.4GHz wireless sensors
	Sensor Config Online Data Analysis DataLogger System config. Pow	er mode management
	Power mode configuration Active Sleep Ratio : 5 00:00:05 Validate	
	Sleep mode with listening config. Waiting config. frame deletion : Validate	

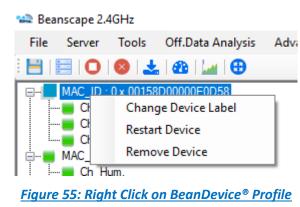


Parameter	Description
Power mode configuration	 Active: Sleeping power mode is disabled. The BeanDevice® operates in Active power mode. Sleep: Sleep power mode is enabled. Ratio: Fix the Ratio of the listening cycle. This ratio depends on the data acquisition low duty cycle.
Sleep mode with listening config	By clicking on "validate", the pending OTAC frame is deleted

7.3.9 Right Click functionalities

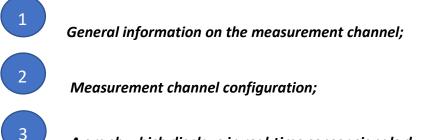
BeanScape® offers access to quick functionalities in relation with BeanDevices®. By using the mouse, Right Click on the BeanDevice® profile then you can quickly

- **Change the Device Label**
- **Restart the Device**
- Remove the Device



7.4 SENSOR CHANNEL PROFILE

The screen « Sensor channel profile » consists of three parts:



A graph which displays in real-time sensor signals during data acquisition;



Figure 56: Overview: Sensor channel profile

7.4.1 Sensor channel status

7.4.1.1 Frame: General information

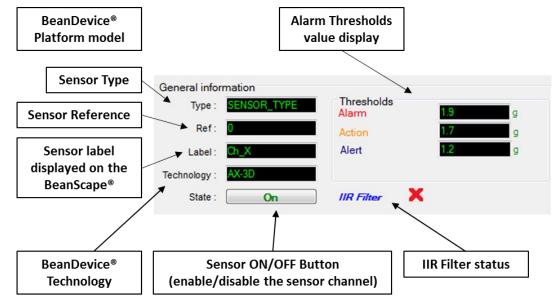


Figure 57: Sensor Channel General information frame

7.4.1.2 Frame: Measurement data



Figure 58: Measurement data frame

By default, sensor unit format is

- G or mm/s² for the BeanDevice AX-3D & AX-3DS
- o ° for the BeanDevice HI-INC

7.4.2 Sensor channel configuration

This frame contains a set of 5 tabs:

Custom Display	Allows the end user to customzie the sensor
Notes	 Contains notes relating to the BeanDevice[®] sensor
Alarm Config	 Sensor configuration interface. The user can configure the alarm thresholds related to the sensor Depending on the BeanDevice[®] version which is used, other configuration parameters are available
Sensor calibration	Sensor channel calibration
Log config	 Logs configuration on the BeanScape[®]

7.4.2.1 Tab: Custom display

These parameters allow the user to customize his sensor:

Custom display	Notes Alarms Conf	fig Sensor calibration	Log config.
Ratio: 1 Unit: 9		Offset: 0 Type: SENSOR_T	YPE Apply
	ENSOR_REF [Label : Ch_X Validat	e e e e e e e e e e e e e e e e e e e

Figure 59: Sensor channel custom display tab

- ✓ Type: Describe the sensor type (ex: load cell, pressure, Strain gage +/- 2 Mv/v, LVDT,....)
- ✓ Unit: customer sensor unit (bar, °C, I/h....)
- *Ratio*: Sensor Ratio coefficient (*RAT*);
- ✓ Offset: Sensor Offset coefficient (OFF);
- ✓ Label: Give a name to your sensor. (<u>ex</u>: Sensor on Stator Machine 1, sensor in Room 2 Floor 3)

Measurement conversion formula:

Converted Measurement = Measurement x RAT + OFF

Example with a temperature sensor: By default, the temperature unit is in degree Celsius. The user wants to convert the unit in degree Fahrenheit.

Converted Measurement [°F] = Measurement[°C] x RAT + OFF

With RAT = 1.8 and OFF = 32

<u>Zeroing</u>



In order to secure accurate and precise Velocity and FFT measurements on axis that's mounted toward the earth gravity you should Apply zeroing to cancel earth gravity.

Ze	eroing sensor chann	el
	Apply	

Conversion assistant

To avoid conversion error, a conversion assistant is available to help you to setup quickly your measurement channel of your BeanDevice[®].

Click on conversion assistant from the tab "*Custom display*", a window will open allowing you to do a linear conversion.

Custom display Notes Alarms	Config Sensor calibration Log config.	
Ratio: 1 Unit: 9 Ref: SENSOR_REF	Offset : 0 Type : SENSOR_TYPE Label : Ch_X Zeroing sensor channel Apply	
Conversion	Validate	

On the left column, the user can enter the non-converted measurement data. On the right column, the user can enter the converted measurement values with the desired unit.

The ratio and offset values are calculated automatically by the conversion assistant.

Linear Co	nversion Input :	Out	put :
/alue 1	10 g		°
/alue 2	10 9		D •
	Targe	t Unit : °C	5
	laige		K Cano

Figure 60: Unit Conversion Assistant

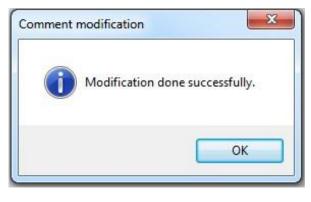
7.4.2.2 <u>Tab : Notes</u>

Custom display	Notes	Alarms Config	Sensor calibration	Log config.
				Validate

Figure 61: Sensor channel notes tab

This field contains notes relating to the BeanDevice[®] sensor. To change this field, enter a value or free text and click the "Validate" button.

A new window opens; accept your modifications by clicking on "OK".



To backup your text click on the icon "Backup your Database"

7.4.2.3 <u>Tab: Alarms Config - BeanDevice® AX-3D</u>

Custom display	Notes	Alarms Config	Sensor ca	libration	Log config.
Alarm thres	holds co	nfiguration for	S.E.T mo	de	
Alarm	~		g	Valid	ate
				Res	et
					0.000

Figure 62: Alarm configuration tab (BeanDevice® AX-3D)

Parameter	Description
Alarm threshold configuration for S.E.T mode	For BeanDevice AX-3D and in the S.E.T mode (Streaming with event triggering) the threshold is based on AAA(Alert/Action/Alarm) with :
inouc	Alert values < Action value < Alarm value.
	Measurement exceeding each threshold will results in notification sent with the appropriate reports and info via email and audio notification on the computer will take place.

7.4.2.4 Tab: Alarms Config - BeanDevice® HI-INC

Custom display	Notes	Alarms Config	Sensor calibration	Log config.	
Alarm three	shold co	onfiguration			
High Level A	arm	~			
		Val	idate		
High level A	arm >=	High Level Al	ert > Low Level /	Nert >= Low	level Alarm

Figure 63: Alarm configuration tab (BeanDevice® HI-Inc)

Parameter	Description
Alarm threshold	You can configure threshold high values (High level alarm, High level alert) and low values (Low level alarm, Low level alert). In alarm mode, when a higher low threshold value is reached, an alarm notification is transmitted to the BeanGateway ;
	 If the sensor value is higher than High level alarm/High level alert, notification is send to the BeanGateway/BeanScape;
	 If the sensor value is lower than Low level alarm/Low level alert, notification is send to the BeanGateway/BeanScape.
	Threshold values must be organized in this manner:
	High level alarm >=High level alert > Low level alarm >= Low level alert
Cutoff Frequency	<u>Cutoff frequency</u> Configure the anti-aliasing filter cutoff frequency
	The range of cutoff frequency which can be configured is:
	✓ 0 Hz to 2 KHz if the product is a BeanDevice AX-3D
	✓ 0 Hz to 2 KHz if the product is a BeanDevice AX-HD
	✓ 0 Hz to 60 Hz if the product is a BeanDevice HI-INC

A

For further information about the alarms threshold configuration, please read the technical note ponse<u>TN RF 008 – "Data acquisition modes available on the BeanDevice®"</u>

7.4.2.5 <u>Tab: Alarms Config Configuration - BeanDevice® AX-3DS</u>

For further information about the SSD (Smart Shock Detection) measurement mode, read the technical note TN RF 008 – "Data acquisition modes available on the BeanDevice®"

Custom display Notes Alarms Config Sensor calibration	on Log config.
Alarm threshold configuration	Shock detection configuration
High Level Alam Validate	Modify
High level Alarm >= High Level Alert > Low Leve	el Alarm >= Low level Alert

Figure 64: Alarm configuration tab (BeanDevice® AX-3DS)

Parameter	Description
Alarm threshold	You can configure threshold high values (High level alarm, High level alert) and low values (Low level alarm, Low level alert). In alarm mode, when a higher low threshold value is reached, an alarm notification is transmitted to the BeanGateway ;
	If the sensor value is higher than High level alarm/High level alert, notification is send to the BeanGateway/BeanScape;
	If the sensor value is lower than Low level alarm/Low level alert, notification is send to the BeanGateway/BeanScape.
	Threshold values must be organized in this manner:
	High level alarm >=High level alert > Low level alarm >= Low level alert
	Alarm thresholds are not available for SSD (Smart shock detection mode)
Accelerometer range configuration	 ✓ The user can change the measurement range of the accelerometer: BeanDevice® AX-3DS 24G: ±6g or ±12g or ±24g BeanDevice® AX-3DS 8G : ±2g or ±4g or ±8g
Shock detection configuration	Click on modify, a new window will open.

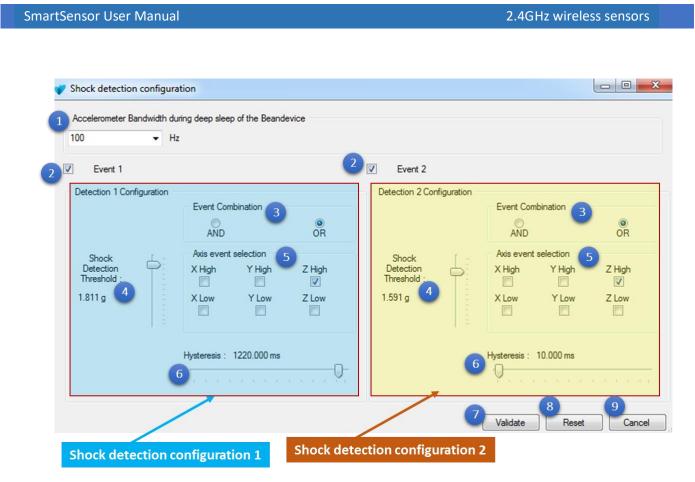
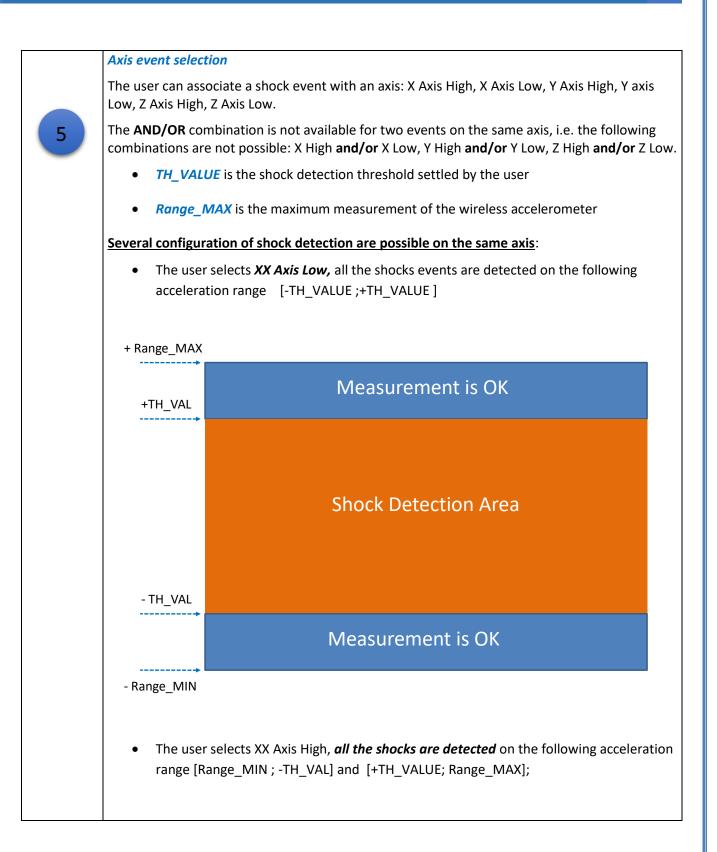


Figure 65: Shock detection configuration window

1	Changes the accelerometer bandwidth du	ring the sleep period of the BeanDevice®:	
	BeanDevice [®] current consumption can val Accelerometer sampling rate during	e accelerometer during the sleep period, t ry: BeanDevice [®] Current consumption	the
	sleep period		
	0,5 Hz	21 μΑ	
	1 Hz	31 μΑ	
	2 Hz	50 μΑ	
	5 Hz	78 μA	
	10 Hz	130 μΑ	
	50 Hz	302 μΑ	
	100 Hz	308 μA	
	400 Hz	343µA	
	1000 Hz	413 μΑ	
2	The user can select two events profile Even Event combination The user can use two logical combinations selection.	ent 1 and Event 2.	ıt
4	positive. If the Low axis is selected, the threshold v	igh axis is selected, the threshold value will k alue will be negative. 2g, if X High Axis <u>OR</u> X Low Axis is selected. Axis, a shock event is detected	ce



	+ Range_MAX				
	+TH_VAL				
	Measurement is OK				
	- TH_VAL Shock Detection Area				
	 The user selects a high event on the axis (+TH_VALUE), a shock is detected if the threshold value +TH_VALUE is reached: 				
	Hysteresis				
6	The user can fix an hysteresis on threshold value				
	Choose closely the value of the hysteresis.				
	The resolution depends on the accelerometer bandwidth during sleep or deep sleep.				
7	VALIDATE Click here to validate your new configuration				
	RESET				
8	Click to restore a default configuration				
	CANCEL				
9	Click here to cancel your configuration				

Depending on your sensor resolution, the displayed threshold value can differ from the reference value.

7.4.2.6 Tab : Sensor calibration

WARNING: These calibration coefficients should be accessible to an advanced user. A wrong calibration will result in false measurements.

These coefficients are used to calibrate the *internal accelerometer/inclinometer* sensors:

Custom displa	ay Notes	Alarms Config	Sensor calibration	Log config.
Calibratio Ratio :	n			
Offset:				
Ratio :				
Offset :			Validate	

Figure 66: Sensor calibration tab

The BeanScape® provides a calibration interface for each measurement channel:

- **Ratio** : multiplier coefficient
- **Offset**: adder/subtracted coefficient. its unit is the sensor unit

Calibrated value = (Ratio x Non_Calibrated_Value) + Offset

Enter the calibration coefficients and then click on validate.

The calibrations coefficients are backed up on the BeanDevice® flash memory, and cannot be lost if the BeanDevice® is switched off

7.4.2.7 <u>Tab: Log configuration</u>

This tab should not be confused with the Datalogger feature available on the BeanDevice®:

Custom display	Notes	Alarms Config	Sensor calibration	Log config.	
Loa filenam Log configu Log enat	ration	Transmit_Low	rDutyCycle_Ch_X_M	AC_ID : 0 x 00158D00(
Log filen	ame au	to.			
				Validate	

Figure 67: Log configuration tab

By default, Log file name is built with the measurement channel & BeanDevice® MAC Address:

< Sensor Channel Number > < MAC_ID >

- ✓ Log enabled: If checked, Log is enabled on the BeanScape[®]
- ✓ Log filename auto.: If checked, Log file name is named automatically

Click on *validate* in order to validate all your modifications.

For users who want to rename the log file, two solutions are provided:

Add automatically the channel "Label" in your log file name:
<label><sensor channel="" number=""> <mac_id></mac_id></sensor></label>
The log file name can be fully customized:
Uncheck the case « Log filename auto" and add your own label

7.4.2.8 Right Click functionalities

Graphic BeanScape[®] offers access to quick functionalities in relation to Sensor channels. By using the mouse, Right Click on the channel under the BeanDevice[®] profile then you can quickly:

- Change State to: off
- Change Sensor Label
- Disable Log

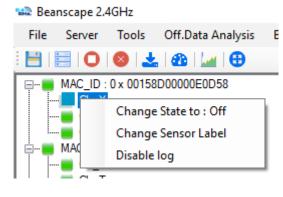


Figure 68: Right Click on the Sensor's Channel

7.4.3 Graphical display

By selecting the suitable sensor's channel, user will get this view on his BeanScape[®] software.

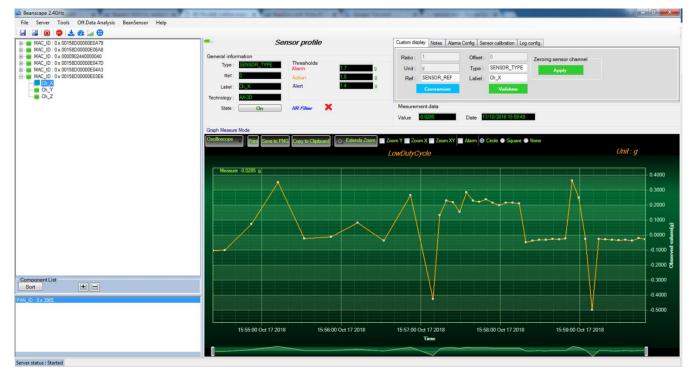


Figure 69: Overview: Channel acquisition graph visualization

To have a wide display view of the graph, it is recommended to click on the Green button on the top of the sensor's channel configuration area to hide it.

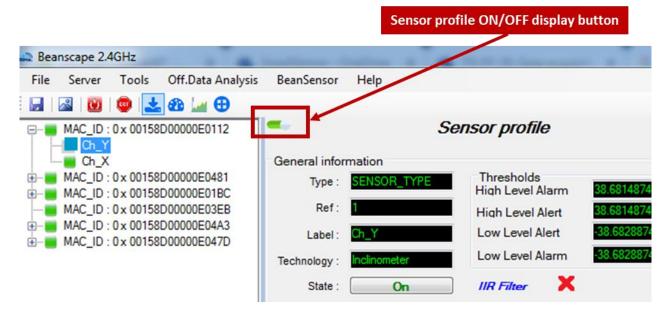


Figure 70: Sensor profile ON/OFF display button

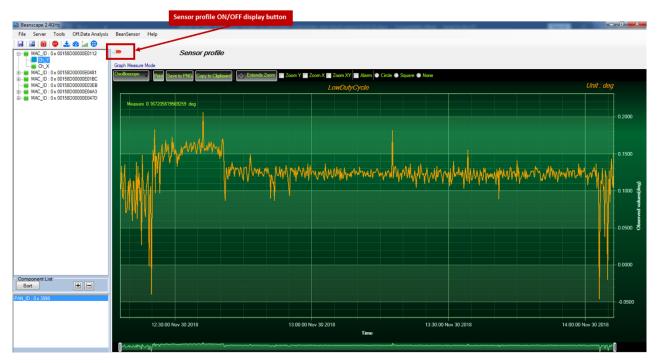


Figure 71: Wide view of the graph

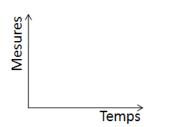
The chart is composed of two parts:

- **Part 1**: This is a preview window, allowing you to observe sensors acquisitions.
- **Part 2**: A strip on the side composed of different frames allows customizing the graph.

The graph has two axes:

Axe-X: Timeline

Axes-Y: received sensor acquisitions



SmartSensor User Manual

The BeanDevice[®] data acquisition mode and the last data acquisition can be visualized directly from the graph.



Figure 72: Example: Graph visualization

7.4.3.1 Frame: Display



Figure 73: Graph measure mode: Frame Display

7.4.3.2 Frame: Marks

From this frame you can select the display mode of action of the chart. Three types of symbols are available:

🔍 Circle 🔘 Square 🔘 None

Circle: Brings up a point on each bar graph

Square: brings up a square on each measure of the graph

None: No logs is displayed on the graph







Figure 74: Graph measure mode: Frame Marks

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7.4.3.3 Frame : Scale

From this frame, the scaling of the graphics can be customized to suit your needs.



Checkbox "Zoom X and Y Zoom"

These boxes are useful for performing a graph zoom from the mouse wheel, there are four cases:

- **Case 1**: Case "Zoom X" ticked. The graph zoom will only affect the X axis.
- **Case 2**: Case "Zoom Y" ticked. The graph zoom will only affect the Y axis.
- **Case 3**: Case "Zoom XY" ticked." Zoom will affect both X and Y axes
- **Case** 4: Case "Zoom X ", "Zoom XY "and "Zoom Y " not ticked. The zoom function from the mouse wheel is disabled.

7.5 DATALOGGER CONFIGURATION

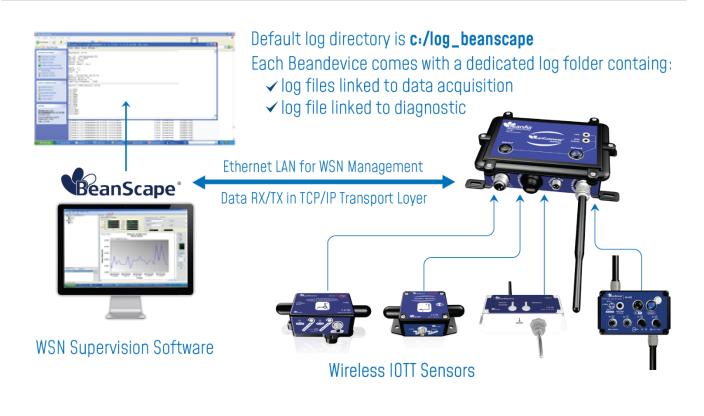
Please read the technical note <u>TN_RF_007 – "BeanDevice® datalogger User Guide "</u>

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SmartSensor User Manual

7.6 OPTIONS FOR LOG FILE GENERATION & FOLDER ORGANIZATION

7.6.1 Log file system overview



7.6.2 Log file directory

By default, the Log file directory is: C:\log_beanscape

Click on the tab Tools then Options to configure advanced settings in *BeanScape®*:

🚵 Bean	scape 2.4	GHz	5 mar 1 m		
File	Server	Tools	Off.Data Analysis	Advanced func.	Help
	8 🕛	Be	anScape® configura	tion	
	MAC_ID : Ch_X Ch_Y Ch_Z Ch_Z MAC_ID : Ch_X Ch_Y MAC_ID : Ch_Z MAC_ID : Ch_X Ch_Y MAC_ID : Ch_X	Be Ex Lo Al SN () Of O	arm Window canGateway Ethernet, port/Import user sett og File Reader arm Management ITP Client ffline graph ate conversion PC Management	-	
	_				

Figure 75: BeanScape® configuration menu

This window lets you configure the logs, and the data cache.

✓ A second window is displayed:

BeanScape Configuration			×
LOG Configuration			*
Log directory :	C:Vog_beanscape		
Stop loggin when disc space is	2048 🚔 ME	3	Ξ
Main Log filename :	LOG		
Main log max. size :	200		
Sensor Log enabled :			
Sensor log max. size (KB) :	1024		
Network log info. enabled :			
Network info log max. size (KB) :	1024		
Streaming log max. size (KB) :	2048		
BGw Module Log enabled :	2040		
BGw Module log max. size (KB) :	1024		
Syst. Maint. Status Log enabled :	₩		
Syst. Maint. Status Ebg enabled .			Ŧ
Direct Antonio	Dent.	Class	
Reload Apply	Save Reset	Close	
1			

Figure 76: BeanScape® configuration window

✓ Clicking the button

reverts back to its original configuration.

7.6.3 Log folder

By Default log files linked to the *BeanDevice*[®] are stored in the log folder (located in C:/log_beanscape directory):

"Folder MAC_ID"

Only the last 4 Char of BeanDevice[®] MAC ID are displayed.

User can change log folder name by clicking on "Custom display" tab located on the **BeanDevice**[®] profile:

Custom display	Notes	Data Acq. config.	Sensor Config	Online Data Analysis	DataLogger	4
Type :	PLATE	ORM_TYPE				
Reference :	PLATE	ORM_REF				
Label :	MAC_I	D : 0 x 00158D0000	0E06A8			
Log folder	Folder	06A8				
	Val	idate				

Figure 77: BeanDevice® Custom Display tab

Enter your own log folder name, then click on validate.

The following example shows the log folder changed to "Factory2":

Type :	PLATFORM_TYPE
Reference :	PLATFORM_REF
Label :	MAC_ID : 0 x 00158D00000E06A8
Log folder	Factory2
	Validate

7.6.4 Log file size configuration

BeanScape Configuration		×
- LOG Configuration		
Log directory :	C:Nog_beanscape	
Stop loggin when disc space is	2048	мв ≡
Main Log filename :	LOG	
Main log max. size :	200	
Sensor Log enabled :		
Sensor log max. size (KB) :	1024	
Network log info. enabled :		
Network info log max. size (KB) :	1024	
Streaming log max. size (KB) :	2048	
BGw Module Log enabled :		
BGw Module log max. size (KB) :	1024	
Syst. Maint. Status Log enabled :		-
•		
		_
Reload Apply	Save Reset	Close

- ✓ *LOG directory*: Enter here the path/folder where you would want to save the LOG files.
- ✓ *Main log filename*: Here you may enter the desired name in order to save the LOG file.
- ✓ Main log max. size (KB): Maximum file size in Kilobytes (KB) for your principal LOG file
- Sensor Log Enabled: Check this box if you want to enable the sensor(s) data acquisition in your LOG file
- ✓ Sensor log max. size (KB): Maximum size in Kilobytes (KB) of sensor log files (except for streaming & streaming data acquisition mode)
- ✓ *Network log info. enabled* : Check this box if you want to enable network information in your LOG file
- ✓ Network info log max. size (KB) : Maximum size in Kilobytes for your network information LOG file
- ✓ Streaming log max. size : Maximum size in Kilobytes (KB) of sensor log files (only for streaming & streaming data acquisition mode)

7.6.5 All sensor channels in one log file

By default, 1 log file is linked to 1 sensor channel. The user can select a log file linked to all the sensor channels present on the BeanDevice[®].

anScape Configuration		
Network info log max. size (KB) :	1024	J
Streaming log max. size (KB) :	2048	
BGw Module Log enabled :		
BGw Module log max. size (KB) :	1024	
Syst. Maint. Status Log enabled :		
Syst. Maint. Status log max size	1024	
AutoStart BeanScape:		
Log file generation	All sensor channels in one file	
	Separated	
BeanGateway configuration via U	dp	
Udp port :	53130	
Tcp port to listen :	5313]
KeepAliveApp		
KeepAliveApp enabled :		
		•
Reload Apply	Save Reset	Close
5 :	g file generation op	

• You should have all channels data recorded in one single file located in your C:\log_beanscape directory

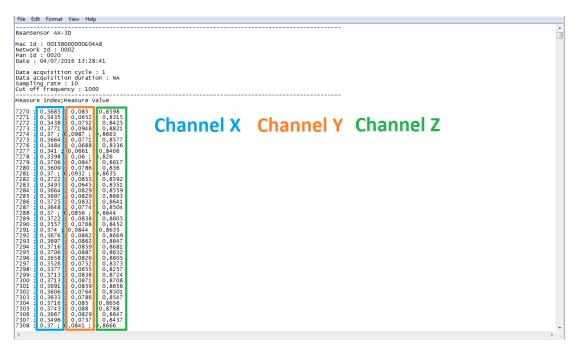


Figure 79: Example of Log file

7.6.6 Cache Data configuration (for Graph)

Data Cache Configuration	
Max. points :	40000
Max. packets :	6
Max. diagnostics :	1000
Max. alarms :	25
Max. streaming points :	5000
Max. BGw Module status nbr. :	100
Syst. Maint. Status max nbr :	500

Figure 80: Data cache configuration options

- ✓ Maximum number of points: Set here the maximum number of points displayed on the BeanScape[®] graph
- ✓ Maximum number of packets: Set here the maximum number of packets displayed on the BeanScape[®] graph
- ✓ Max number of diagnostics: Set here the maximum number of diagnostics displayed on the BeanScape[®] graph
- Max number of alarms: Set here the maximum number of alarms displayed on the BeanScape[®] graph
- ✓ Maximum streaming points: Set here the maximum number of points displayed in Streaming/Streaming on the BeanScape[®] graph



Please note that the values backed up by the BeanScape[®] may affect the memory capacity of your computer depending upon the size of every file.

7.6.7 Data acquisition Log file

7.6.7.1 Log filename root

For each sensor channel a log file is automatically created by the BeanScape[®].

The user can easily change the log file root:



Figure 81: Overview: Log Config tab on BeanScape®

This tab should not be confused with the Datalogger feature available on the BeanDevice®.

Custom display	Notes	Alarms Config	Sensor calibration	Log config.		
Log filename root : Transmit_LowDutyCycle_Ch_X_MAC_ID : 0 x 00158D000 Log configuration						
Log filen	ame aut	to.				
Validate						
Figure 82: Log config tab						

By default, Log file name is built with the measurement channel & *BeanDevice*[®] MAC Address:

< Sensor Channel Number > <MAC_ID>

- ✓ Log enabled: If checked, Log is enabled on the BeanScape®
- ✓ Log filename auto.: If checked, Log file name is named automatically

Click on *validate* in order to validate all your modifications.

For users who want to rename the log file, two solutions are provided:

Solution 1	Add automatically the channel "Label" in your log file name: <label><sensor channel="" number=""> <mac_id></mac_id></sensor></label>
Solution 2	The log file name can be fully customized: Uncheck the case « Log filename auto" and add your own label

7.6.7.2 Specific case: log filename creation in "Streaming" mode

In streaming mode, log filename is built as follow (separated channels):

Transmit_Streaming_Sensor_channel_MAC_ID_DATE

- ✓ Sensor channel = Sensor channel
- ✓ MAC_ID: BeanDevice[®] MAC ID
- ✓ DATE: date when the streaming mode starts

Example:

Transmit_Streaming_Ch_X_MAC_ID0_x_00158D00000E06A8_2018-10-24_11-42-31.txt	24/10/2018 11:45	1 Ko
Transmit_Streaming_Ch_Y_MAC_ID0_x_00158D00000E06A8_2018-10-24_11-42-31.txt	24/10/2018 11:45	1 Ko
Transmit_Streaming_Ch_Z_MAC_ID0_x_00158D00000E06A8_2018-10-24_11-42-31.txt	24/10/2018 11:45	1 Ko
Transmit_Streaming_Ch_X_MAC_ID0_x_00158D00000E06A8_2018-10-24_11-45-14.txt	24/10/2018 11:47	192 Ko
Transmit_Streaming_Ch_Y_MAC_ID0_x_00158D00000E06A8_2018-10-24_11-45-14.txt	24/10/2018 11:47	185 Ko
Transmit_Streaming_Ch_Z_MAC_ID0_x_00158D00000E06A8_2018-10-24_11-45-14.txt	24/10/2018 11:47	181 Ko

In streaming mode, log filename is built as follow (all channels in one file):

Transmit_Streaming_Sensor_channel_MAC_ID_DATE_PART

- ✓ Sensor channel = Sensor channel
- ✓ MAC_ID: BeanDevice[®] MAC ID
- ✓ DATE: date when the streaming mode starts
- ✓ partXXX : Log file sequence number, part000 corresponds to the first log file

Example:

Transmit_Streaming_MacId_00158D00000E06A8_24_10_2018_11_42_31_part1.txt	24/10/2018 11:44	2,064 Ko
Transmit_Streaming_MacId_00158D00000E06A8_24_10_2018_11_42_31_part2.txt	24/10/2018 11:44	174 Ko

7.6.7.3 Log file analysis

Transmit_Streaming_	Ch_X_MAC_ID_	_0_x_00158D00000E06A8_2018-10-24_11-45-14.txt -
Fichier Edition Form	at Affichage	?
BeanSensor AX-3D		
Mac Id : 00158D0 Network Id : 000 Pan Id : 3999 Sensor Id : 0 Sensor Label : C	2	
Ratio : 1 Offset : 0 Unit : g		
Date : 24/10/201	8 11:45:14	
Data acquisition Data acquisition Sampling rate : Cut off frequenc	duration 100	: NA
Measure Index;Me	asure Valu	e
0; -0.0296 1; -0.02839 2; -0.02908 3; -0.02951 4; -0.02605 5; -0.03047 6; -0.02691 7; -0.02544 8; -0.02735 9; -0.02587 10; -0.02735 11; -0.02795 12; -0.02613		
Figu	re 82. Log file	evample (Streaming mode)

Figure 83: Log file example (Streaming mode)

The date which is displayed in the log file corresponds to the date when the streaming mode starts.

Measure index allows the user to use a timestamp, the time value between the Index N and N+1 corresponds to the period rate.

7.6.8 Log file related to Wireless Network diagnostic

7.6.8.1 Log filename organization

Wireless Diagnostic log filename is built as follow:

MAC_ID_WirelessNetwkInfo

- ✓ MAC_ID: BeanDevice[®] MAC ID
- ✓ DATE: date when the streaming mode starts

7.6.8.2 Log file analysis

Log file related to wireless network diagnostic provides the following information:

- Date : diagnostic date
- LQI TX: Link quality indicator on the BeanDevice[®] side
- LQI RX: Link quality indicator on the BeanGateway[®] side
- Local PER TX: Local Packet Error Rate on the BeanDevice[®] side
- Local PER Rx: Local Packet Error Rate on the BeanGateway® side
- Global PER: N.A.
- *Battery voltage*: internal battery voltage
- Battery level: battery level of charge
- Internal temperature: Local temperature of the BeanDevice[®]

	00158D00000E03	E5_WirelessNetwkl	nfo - Bloc-notes		_ □ ×
Fichier Edition Format Afficha	je ?				
 BeanComponent Wireless Date : 5/31/2014 6:31:1 PAN_ID : 2427 MAC_ID : 00158D0000E03	7 PM				^
5/31/2014 6:31:16 PM;19 5/31/2014 6:31:17 PM;17 5/31/2014 6:31:18 PM;16 5/31/2014 6:31:19 PM;15 5/31/2014 6:31:20 PM;16 5/31/2014 6:31:21 PM;16	; Local PER Tx ; Local PER R 2;NA;0.00;NA;0.00;4.089;100. 4;NA;0.00;NA;0.00;4.089;100. 2;NA;0.00;NA;0.00;4.089;100. 0;NA;0.00;NA;0.00;4.089;100. 8;NA;0.00;NA;0.00;4.089;100. 2;NA;0.00;NA;0.00;4.089;100. 8:NA:0.00;NA;0.00;4.089;100.	00;21.000;N;N;N; 00;21.125;N;N;N; 00;21.125;N;N;N; 00;21.000;N;N;N; 00;21.000;N;N;N; 00;21.125;N;N;N;	y, N;N; NA N;N;N; NA N;N;N; NA N;N;N; NA N;N;N; NA N;N;N; NA N;N;N; NA	Battery Level ; Int I	ternal Temŗ
	Figure 84: Wi	reless Network	Info log file		

If the BeanDevice[®] is configured with the streaming data acquisition mode, the following diagnostic information are not refreshed:

- Battery voltage
- Battery level
- Internal temperature

Fichler Edition Format Affichage ?

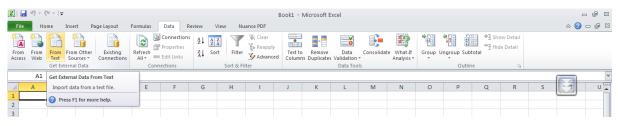
```
_____
BeanComponent Wireless Network Information
Date : 5/15/2014 4:50:44 PM
PAN_ID : 31BB
MAC_ID : 00158D00000AD564
Date ; LQI Tx ; LQI Rx ; Local PER Tx ; Local PER Rx ; Global PER ; Battery Voltage ; Battery Level ; Internal Temperature
5/15/2014 4:50:43 PM;174;NA;0.00;NA;0.00;4.094;0.00;24.625;N;N;N;N;N;N;N; NA
15/05/2014 16:50:45.0000000;168;;0.00;;;;;;;;;;;;;
15/05/2014 16:50:45.1500000;180;;0.00;;;;;;;;;;;
15/05/2014 16:50:45.3000000;162;;0.00;;;;;;;;;;;;
15/05/2014 16:50:45.4500000;168;;0.00;;;;;;;;;;;;;
15/05/2014 16:50:45.7500000;186;;0.00;;;;;;;;;;;;
                                                         Ï
15/05/2014 16:50:45.9000000;138;;0.00;;;;;;;;;;;;
1E/0E/2014 16.E0.46 2000000.160..0 00..
```

7.6.8.3 How to open a measurement file with excel

Step 1 : Open Excel

🗶 i 🛃	a ") - (" - - Book1 - Microsoft Excel													- # 23								
File	Ho	me In:	sert Pag	e Layout	Formulas	Data R	eview	View Nu	ance PDF												۵ 🕜	- 8 %
From	From Web	From From From From From From From From		Existing	Refresh	Connections Properties Edit Links	Z + Z	The Filter	😵 Clear 📡 Reapply 🌠 Advanced	Text to	Remove	Data Validation	Consolidat	e What-If Analysis •	Group	Jngroup S	3 22	♥클 Show ■클 Hide I	Detail Detail			
		Get Exterr			Conr	nections		Sort & Fi	lter			Data Too				Out	tline		G ₂			
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	А	В	С	D	E	F	G	н	I.	J	К	L	М	Ν	0	Р		Q	R	S	- 3	U
1																						
2																						
4																						

Step 2: Go on « Data » Tab, then select "From Text"

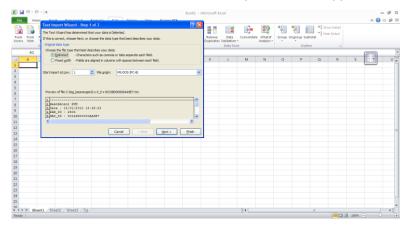


Step 3 : Choose your log file

🔣 🛃 19 × (°1 × v	Book1 - Microsoft	Excel
File Home Insert Page Layout Fo	rmulas Data Review View Nuance PDF	
From From Other Existing R Access Web Text Sources* Connections Get External Data	Connections	
A1 - <i>f</i> x	Look in: Constant	@ • 🖄 X 📸 III •
A B C D 1 -	Mess Mess Bureau Mess Peste de Peste de Peste Peste	O × 2_0 × 0015800000A055E O × 2_0 × 0015800000A055E O × 2_0 × 0015800000A055E O × 2_0 × 0015800000AA21 O 0158000000AA21 O 0158000000AA21 O 0158000000AA21 VieleastletwikInfo O 0158000000AA21 VieleastletwikInfo O 01580000005545 VieleastletwikInfo O 0158000000545 VieleastletwikInfo O 01580000000545 Stream_0 × 0_0 × 00158000000A55 Stream_0 × 0_0 × 00158000000055 Stream_0 × 0_0 × 001580000000055 Stream_0 × 0_0 × 00158000000005 Stream_0 × 0_0 × 00158000000000 Stream_0 × 0_0 × 001580000000000 Stream_0 × 0_
20		Import Cancel
1		

<u>Step 4</u>: Text import wizard will open, select « Delimited » for Characters such as commas or tabs separate each field.

On "*Start import at row*" field: Select the number of lines that you want to suppress from the header:



Select semicolon

ext Import Wiza	rd - Step 2 of 3				?
nis screen lets you s elow.	et the delimiters your	data contains. You	i can see how your	text is affected in	the preview
Delimiters					
Tab					
Semicolon	Treat consecut	ive delimiters as on	e		
Comma	Text gualifier:				
Space	rext guainer.				
Other:					
Nata and inclusion					
Data <u>p</u> review					
					🔺
BeanSensor SU					
Date : 12/01/2 PAN ID : 2806	2012 15:48:22				
	3D00000AA9E7				*
<					>

Select Text

Column data format ○ General ○ Text ○ Date: MDY ○ Do not import column (skip) Data greview Cext Cex	This screen lets you select each colu	mn and set the Data Format.			
Text BeanSensor Inclinometer Date : 2/8/2016 6:48:58 PM PAN_ID : 2401 MAC_ID : 00158D000004A9D1	General Text Date: MDY		t	_	ues to dat
	_		2		

Click on OK

Import Data	?	×
Select how you want to view this data in	your wo	orkbook.
 PivotTable Report PivotChart 		
Only Create Connection Where do you want to put the data?		
Existing worksheet: SAS1	K	
 <u>New worksheet</u> Add this data to the Data <u>M</u>odel 		
Properties OK	Ca	ncel

Click on format cells:

SmartSensor User Manual

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From From From From Other Exis Access Web Text Sources * Get External Data	ting Refresh Connections 2 L 2 Z Refresh Sort	V Nuance PDF V Clear Filter V Advanced Sort & Filter Data Tr	Consolidate What-If Group Ungroup Su n * Analysis * * *	
1 Date 2 TimeStamp Date 3	Cut C D E Copy asure asure	F G H I - - - - - - - - - - - - - - - - - - -	J K L M	N O P R
25 1,29709E+17 12/01	/2012 15:51:50 104 /2012 15:52:00 100			□□ → 0



See "Exporting a log file to Excel" Youtube video

8. ALARM MANAGEMENT

8.1 DAQ ALARM

User can receive alarms notification by email. This function is only available with "Survey" data acquisition mode, "S.E.T" mode or "SSD".

From your BeanScape® software click on "Tools" tab then "Alarm Management"

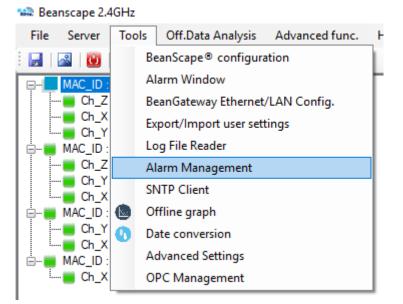


Figure 85: Alarm management menu

A new window will pop up with **DAQ alarm SMTP configuration** and reports management, also other system related to alarm notification (Internal temperature, Battery level, Packet Error Rate, Link Quality Indicator) are configured from this window

Check on Enable Notification by email:

Enable Notification by email

and fill out the parameters described below:

Field	Description
From	Enter the email address sending the alarm notification
То	Enter the receiver(s) address(es) for alarm notification (max. 3)
SMTP server	Enter your Outgoing SMTP server
Port	Enter your port Number for your outgoing SMTP server
User name	Enter your full email address
Password	Enter the password (case sensitive) of your email account
Max Email per minute	Maximum number of emails allowed to be sent in one minute

DAQ Alarm System Alarm Note DIN 4150-3 Configuration DAQ Alarm configuration C Enable Notification by email From : host@host.com To: host@host.com To: host@host.com To: host@host.com Smtp Server SMTPServer Port 25 User Name USERName	Sound Config O Beep signal Import your own mp3 sound Import your own mp3
✓ Enable Notification by email S From : host@host.com To: host@host.com To: host@host.com To: host@host.com To: host@host.com Smtp Server SMTPServer	Beep signal Import your own mp3 sound
Image: Server Form : host@host.com To: host@host.com To: host@host.com To: host@host.com To: host@host.com Smtp Server SMTPServer	Beep signal Import your own mp3 sound
To: host@host.com To: host@host.com To: host@host.com Smtp Server SMTPServer Port 25	Import your own mp3 sound
To: host@host.com To: host@host.com Smtp Server SMTPServer Port 25	
To: host@host.com Smtp Server SMTPServer Port 25	
Smtp Server SMTPServer Port 25	Validate
	Validate
User Name USERName	
Password	
SMTP Test	
Email alarm for S.E.T. mode	Email alarm for Survey mode
Report Format PDF -	Enable email
	Enable Notif/Sound
	Alert for SSD
	✓ Enable email
Send FFT Report	Enable Notif/Sound
Send DIN Report	Alert for S.E.T Enable Notif/Sound
Send FFT Log file	
Send velocity Log file	Validate

Figure 86: Alarm management window

On the **Email alarm for S.E.T mode** panel, you can select Report format (word, PDF, png) and the specific Report/File related to the S.E.T mode to be sent via email.

Email alarm for S.E.T. mode		
Report Format	PDF	•
 Send Waveform Log file Send Waveform Report Send FFT Report Send DIN Report Send FFT Log file Send velocity Log file 		

Figure 87: Frame: Email alarm for S.E.T mode



<u>More details about FFT Report/ Log files can be found on the</u> Data acquisition modes available on the BeanDevice <u>Technical note</u>





See « Alarm by email » Youtube video



See «S.E.T mode for 2.4GHz» Youtube video

If a threshold is reached, it is possible to have audio alarm on your PC, it is also possible to import your own MP3 sound.

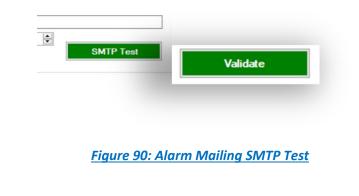


To enable email notification for survey mode and Smart Shock Detection, check Enable email, for Audio notification on PC check Enable Notif/Sound

Email alarm for S	
Alert for SSD Enable email Enable Notif/So	und
Alert for S.E.T	Enable Notif/Sound

Figure 89: Email alarm for Survey mode and Alert for Shock detection

To Test your Configuration, you can send a test email by clicking on SMTP Test, if everything is ok and you received your email then Validate and close the window.



8.2 SYSTEM ALARM

Same as the DAQ Alarm tab, the **System Alarm tab** contains SMTP configuration in order to receive notification on system status:

- Internal temperature: email notification if the internal temperature reached the pre-defined levels.
- **Battery level**: email notification if the battery level reached the pre-defined minimum and maximum voltages.
- Packer error rate: email notification if the PER reaches the pre-defined levels
- Link quality indicator: email notification when the LQI reaches the pre-defined levels

Alarm con	figuration for i	internal Tempera	iture		
Min	20	°C	Max	60	°C
Alarm con	figuration for	Battery Level			
Min	3	VDC	Max	4	VDC
Alarm conf	figuration for f	PER (Packet Em	or Rate)		
Min	0	%	Max	10	%
Alarm con	figuration for	LQI (Link Quality	Indicat	ar)	
Min	125	pts	Max	255	pts
IMILLI	.20		Max		

Figure 91: System Alarm Settings

From System Alarm, user can receive Alert for Datalogger by enabling Notification or Emails, also receiving Alert for Diagnostic.

Enable email	
Enable Notif/Sound	
Alert for Diagnostic	
Enable email	
Enable Notif/Sound	

SmartSensor User Manual	2.4GHz wireless sensors
8.3 NOTE	
In this area user can upload	a logo and other textual information related to monitoring site:
User Name	
Monitoring Site	
Location	
	Alarm Management
	DAQ Alarm System Alarm Note DIN 4150-3 Configuration
	Related note to monitoring site
	Logo Browse
	User Name
	Monitoring Site
	Location
	Validate
	Figure 93: Alarm Note settings
8.4 DIN 4150-30 CO	ONFIGURATION
Din Configuration tab is use	ed to select the Building type and the pipe material that should be displayed on the
Report and the Velocity Log	
/ou can select 3 Building typ	pes from the list: Commercial, Dwellings and Non_Classified.
For the Pipe material, the lis	st contains: Steel, Clay Concrete and Masonry Plastic.
🖳 Alarm Management	building type: Commercial
DAQ Alarm System Alarm	Commercial
DIN_Config	Non_Classified
	ding type: Commercial ~
The second s	e material: Steel
	pipe material: Steel
	Clay, Concrete
Apply Sav	Reset Save Reset

Figure 94: DIN 4150-3 Configuration

SmartSensor User Manual

Ch_Z – Max Frequency: 0 hz , VPPV = 119.329442495219 mm/s , Max Amplitude = 0.688049814453125 g								
Ch_X Ch_Y								
Building Type	Commercial	Commercial	Commercial					
Pipeline Material	Steel	Steel	Steel					
Velocity Average(mm/s)	0.0031145223880597	0.00540280099502487	-0.00366334328358209					

Figure 95: Building type & Pipeline Material on the DIN Report

====> NO acceleration event occurred - monit
DIN Report
Building type = Dwellings Pipeline Material = Masonry,Plastic
Velocity Average (mm/s) = -0.0007515524999999

Figure 96: Building type & Pipeline Material on the Velocity Log file

9. OFFLINE GRAPH

Offline Graph gives the ability to read previous measurements files, proceeding by browsing the files and then clicking on view.

Under the Tool menu on the BeanScape[®] software, select Offline Graph option, a new window will pop up, and will be ready to be used to display graphs from the saved measurements.

🔐 вeanscape 2.4	IGHZ			
File Server	Tools	Off.Data Analysis	Advanced func.	Help
🛃 🔜 🔟	B	eanScape® configura	tion	
MAC ID :	A	larm Window		
Ch_X	B	eanGateway Ethernet/	LAN Config.	
Ch_Y	E	port/Import user setti	ings	
	L	og File Reader		
	A	larm Management		
∎ Ch_Y ∎ MAC_ID :	SI	NTP Client		
Ch_X	🙆 O	ffline graph		
	0 D	ate conversion		
: 🧧 Ch_Z	0	PC Management		

Figure 97: Offline graph menu on BeanScape®

Offline graph							
Gelect Log Files							
	Graph	Show selected graph	N°	Parts	Unit	File Name	
Browse View	 Grid Overlaid (Time) 	View All Charts					
	 Overlaid (Time) Overlaid (Frequency) 	Number graph :					
			•				
		Extends Zoom X Zoom X Zoom XY					
							10.000
							9.0000
							9.0000
							9.0000 8.0000 7.0000
							9.0000

Figure 98: Offline graph window

- Chose Grid if you want to see the graphs displayed on a grid
- Chose overlaid if you want to see the graphs displayed overlaid (pick Time for temporal x axis or frequency for frequential x axis)

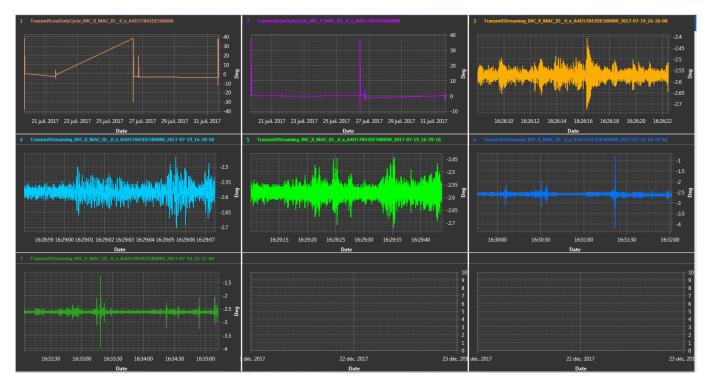


Figure 99: Grid display of graphs

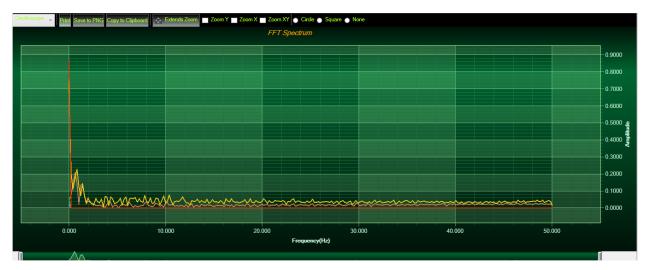


Figure 100: Overlaid (frequency)display of FFT graphs

10. DATE CONVERSION

Data downloaded from the data logger are organized in a system well optimized to minimize non-important data and leave maximum storage space for measurement values, hence using indexation to refer to measurement timing.

To make these files more readable we use the Data Conversion tool.

Transmit_Streaming_Ch_Z_MAC_ID0_x_00158D00000CE454_20	DataConversion_MAC_ID_0_x_00158D00000CE454_CH_22
File Edit Format View Help	File Edit Format View Help
 BeanSensor AX-3D	BeanSensor AX-3D
Mac Id : 00158D00000CE454 Network Id : 0003 Pan Id : 3905 Sensor Id : 2 Sensor Label : Ch_Z	Mac Id : 00158D00000CE454 Network Id : 0003 Pan Id : 3905 Sensor Id : 2 Sensor Label : Ch Z
Ratio : 1 Offset : 0 Unit : g	Ratio : 1 offset : 0 Unit : g Date : 10/07/2017 10:32:47 Data acquisition cycle : 10
Date : 10/07/2017 10:32:47	Data acquisition duration : NA Sampling rate : 100
Data acquisition cycle : 10 Data acquisition duration : NA Sampling rate : 100 Cut off frequency : 1000	Cut off frequency : 1000 Date: Measure 10/07/2017 10:32:47.000 ; -0.03017
Measure Index Measure Value	10/07/2017 10:32:47.010 ; -0.02981 10/07/2017 10:32:47.020 ; -0.02855
0; -0.03017 1; -0.02981 2; -0.02855 3; -0.03047 4; -0.03084	10/07/2017 10:32:47.030 ; -0.03047 10/07/2017 10:32:47.040 ; -0.03084 Converte 10/07/2017 10:32:47.050 ; -0.02892 10/07/2017 10:32:47.060 ; -0.0301 file 10/07/2017 10:32:47.070 ; -0.02936 10/07/2017 10:32:47.080 ; -0.03003
5; 0.02892 Original file 6; 0.0301 Original file 7; 0.02936 8; 0.03003 9; -0.02944 10; -0.02892	10/07/2017 10:32:47.090 ; -0.02944 10/07/2017 10:32:47.100 ; -0.02892 10/07/2017 10:32:47.110 ; -0.02885 10/07/2017 10:32:47.120 ; -0.02892 10/07/2017 10:32:47.130 ; -0.02944 10/07/2017 10:32:47.140 ; -0.0301
11; -0.02885 12; -0.02892 13; -0.02944 14; -0.0301 15; -0.02907 16; -0.03032	10/07/2017 10:32:47.150 ; -0.02907 10/07/2017 10:32:47.160 ; -0.03032 10/07/2017 10:32:47.170 ; -0.02981 10/07/2017 10:32:47.180 ; -0.02988 10/07/2017 10:32:47.190 ; -0.0304
10; -0. 02981 18; -0. 02988 19; -0. 0304 20; -0. 02973 21; -0. 02855	10/07/2017 10:32:47.200 ; -0.02973 10/07/2017 10:32:47.210 ; -0.02855 10/07/2017 10:32:47.220 ; -0.03054 10/07/2017 10:32:47.230 ; -0.0287 10/07/2017 10:32:47.240 ; -0.02899 10/07/2017 10:32:47.250 : -0.02833

Figure 101: Data conversion example

Under the Tool menu on the BeanScape[®] software, select Data Conversion, a new window will pop up, where downloaded data can be converted.

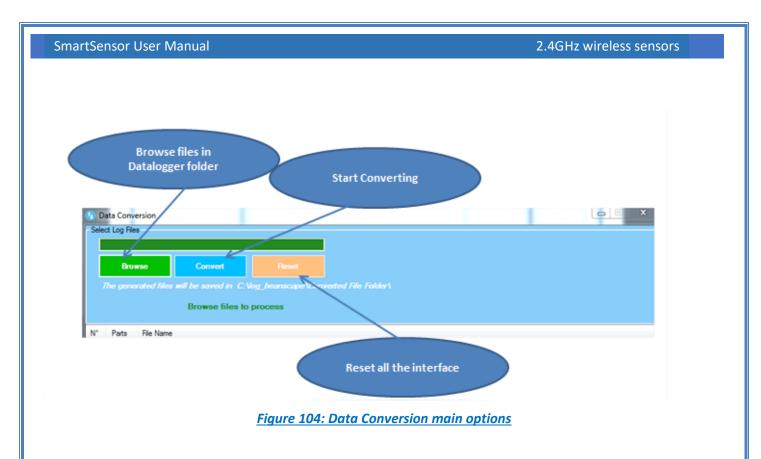
📸 Bear	nscape 2.4	GHz		and the second	100
File	Server	Tools	Off.Data Analysis	Advanced func.	Help
	a 🔃	E	eanScape® configura	tion	
	MAC_ID :	4	larm Window		
	🔲 Ch_X	E	BeanGateway Ethernet/	'LAN Config.	I
	· Ch_Y · Ch Z	E	xport/Import user sett	ings	
	MAC_ID :	L	.og File Reader		
	Ch_X	4	Alarm Management		
	MAC_ID :	s	NTP Client		I
	Ch_X	(Offline graph		
	Ch_Y	0	ate conversion		
i	E Ch_Z	C	OPC Management		1
					*
1					

Figure 102: Data Conversion menu on BeanScape®

A new window will open:

Da Da	ate conve at Log File	ersion	A.I.A.petin	1	Transmitting and	1000	
	Bro	wse	Convert ill be saved in C:\ Browse files to	Reset log_beanscape \Con process			
N°	Parts	File Name					

Figure 103:Data Conversion window



• Click on browse and import streaming file containing the logged measurement.

0 00 200000000000000000000000000000000	Data Convert Select Log Files Data Data Convert Select Log Files Data			Aum. Min Hum <mark>D</mark> % Jax Hum <mark>100 %</mark>	Ch_DP. RH Min Temp RH May Temp	40	
	Open	Brane Rivels press				×	
		OS (C:) I log_beanscape Folder E454	 TX Folder 	• + j	Search TX Folder	<u>م</u>	
	Organize 🔻 New folder				800	- 1 0	
	222	* Name		Date modified	Туре	Size	
	Lustomers	Transmit_LowDutyCycle_Ch_X_M	AC_ID0_x_00158D00000CE454(g)	07/07/2017 17:03	Text Document	133 KB	
	log_beanscape	Transmit_LowDutyCycle_Ch_Y_M		07/07/2017 17:03	Text Document	134 KB	
	🚵 Google Drive	Transmit_LowDutyCycle_Ch_Z_M		07/07/2017 17:03	Text Document	135 KB	
	E Desktop		D_0_x_00158D00000CE454_2017-07-10_10-31-52	10/07/2017 10:32	Text Document	74 KB	
			D_0_x_00158D00000CE454_2017-07-10_10-31-52	10/07/2017 10:32	Text Document	74 KB	
	Cibraries		D_0_x_00158D00000CE454_2017-07-10_10-32-47	10/07/2017 10:34	Text Document	109 KB	
	Documents		D_0_x_00158D00000CE454_2017-07-10_10-31-52	10/07/2017 10:32	Text Document	74 KB	
	J Music		D0_x_00158D00000CE454_2017-07-10_10-32-47	10/07/2017 10:34	Text Document	109 KB	
	Pictures		MAC_ID0_x_00158D00000CE454_2017-07-07_11-01	07/07/2017 11:55	Text Document	137 KB	
	Videos 🗄			07/07/2017 11:55	Text Document	133 KB	
			MAC_ID0_x_00158D00000CE454_2017-07-07_11-01		Text Document	141 KB	
	🖳 Computer						
	🚢 OS (C:)						
H	HP_RECOVERY (D:)						
		▼				•	
J	File name:	Transmit_Streaming_Ch_X_MAC_ID0_x_0	0158D00000CE454_2017-07-10_10-31-52	•	Log files (*.txt)	-	
					Open 🔻	Cancel	
					open It	- cancer	
	<u> </u>						

Figure 105: Importing files into Data Conversion tool

• Overview of the selected files

BeanScape		- 0 X
File Server Tools Data Analysis BeanDevice Help		
📓 📓 🕲 🕲 📥 🏤 🕍		
	BeanDevice System Profile BeanDevice Verwork Dagnodic Metwork Dagnodic On-Ham Min Ham Down Server Very Min Ham Down S	
	N* Pats File Name 1 - CNog beancape\Converted File Folder/MAC_ID_00158000000CE454/DataConversion_MAC_ID_0_x_00158000000CE454, CH_02017-07-10 15-22-56.bd	
	2 - C:\log_beanscape\Converted File Folder\MAC_ID_00158D00000CE454\DataConversion_MAC_ID_0_x_00158D00000CE454_CH_12017-07-10 15-22-58.bt	
	3 - C\log_beanscape\Converted File Folder/MAC_ID00158D00000CE454 DataConversion_MAC_ID0_x_00158D00000CE454 CH_120174710 15-23 00 bt 4 - C\log_beanscape\Converted File Folder/MAC_ID00158D00000CE454 DataConversion_MAC_ID0_x_00158D00000CE454 CH_120174710 15-23 02 bt	
Component List		
Server status : Started		

Figure 106: Overview of the selected files on Data Conversion window

• Select the converted file to view or go to your log directory and you will find all the converted files in a new generated folder named **Converted File Folder**

rganize 🔻 🛛 Include in libra	ry ▼ Share with ▼ Burn New folder			
Favorites	Name	Date modified	Туре	Size
🐌 Downloads	MAC_ID_00158D00000CE454	10/07/2017 15:23	File folder	
🝊 OneDrive	MAC_ID_00158D00000E04A8	06/07/2017 15:45	File folder	
📃 Recent Places				
📗 customers				
膭 log_beanscape				
🚹 Google Drive				
🌉 Desktop				

Figure 107: Overview: Converted File Folder

11. ONLINE AND OFFLINE DATA ANALYSIS TOOL

Online and offline analysis tool is only available on BeanDevice® AX-3D and BeanDevice® AX-3D Xrange

11.1 OFFLINE DATA ANALYSIS TOOL

11.1.1 FFT (Fast Fourier Transform) waveform analysis module

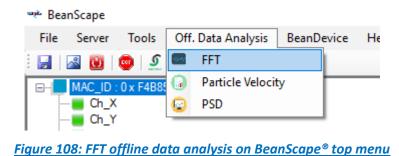
The Fast Fourier Transform (FFT) resolves a time waveform into its sinusoidal components. The FFT takes a block of time-domain data and returns the frequency spectrum of the data. The FFT is a digital implementation of the Fourier transform. Thus, the FFT does not yield a continuous spectrum. Instead, the FFT returns a discrete spectrum, in which the frequency content of the waveform is resolved into a finite number of frequency lines, or bins.



FFT (Fast Fourier transform) module is only compatible with "Streaming" and "S.E.T" measurement modes.

11.1.1.1 FFT generation

The BeanScape[®] Software includes an FFT module used for spectrum analysis. Under the menu Off.Data Analysis displayed on the BeanScape[®] top menu, select FFT to have access to FFT spectrum analysis module.



A new pop up window will appear, where the user is invited to browse Tx files to be treated and graphically displayed.

SmartSensor User Manual

2.4GHz wireless sensors

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Sta Enc	√ A nt 2019	VI time 3-06-26 11:29:52 🔹	Browse View Reset	Show selected g		Window Type : Algorithm : Zero Padding :	FFT Shift Rectangular ‡ Estimate ‡	Current FFT Configuration Mode : [FFT Auto FFT Shift : [Deabled Window type : Restangular Agonthm : Estimate
Br	owse fil	es to process			Use	onts e All Measurement data ust number of FFT points (Streaming mode)	SR/0.1 Valida	Zero padding : Enabled
N°	Parts	File Name		Start	End			
			<u>Figu</u>	ire 109: FF	<u>T tool win</u>	<u>dow</u>		
		k all time to disable ime range and work with All Data	st	lick on View to art FFT process nd to generate the Graphs Reset al	II the interface	Enable/Dis Auto/Manu]
	Ŀ							– 🗆 🗙
		All time 2019-06-26 11:29:52 1019-06-26 11:29:52	Browse View Reset	Show selected g		to ¥ Window Type : Algorithm : Zero Padding :	FFT Shift Rectangular Estimate	Current FFT Configuration Mode : FFT Auto FFT Shift : Deabled Window type : Fectangular
	End 2	2019-06-26 11:29:52		Number graph : Pagination	araph () Au Au An Panel FFT Poi () Use	to ¥ Window Type : Algorithm : Zero Padding :	Rectangular ≑	Current FFT Configuration Mode : FFT Auto FFT Shit : Deabled Window type : Rectangular Algorithm : stimate Zero padding : Enabled Recta used :
	End 2	2019-06-26 11:29:52 🔄	Generate Log files	Number graph : Pagination	araph () Au Au An Panel FFT Poi () Use	to Vindow Type : Algorithm : Zero Padding : ints All Measurement data ist number of FFT points	Rectangular ¢ Estimate ¢	Current FFT Configuration Mode : FFT Auto FFT Shit : Deabled Window type : Rectangular Algorithm : stimate Zero padding : Enabled Recta used :
	End 2	101906-26 11:29 52 101906-26 11:29 52 files to process	Generate Log files	Number graph : Pagination	Autor	to Vindow Type : Algorithm : Zero Padding : ints All Measurement data ist number of FFT points	Rectangular ¢ Estimate ¢	Current FFT Configuration Mode : FFT Ado FFT Shift : Induled Window type : Inclamation Algorithm : Entende Zero padding : Frabled Points used : Mindesurence Manual Mode Settings:
	End 2	101906-26 11:29 52 101906-26 11:29 52 files to process	Generate Log files	Number groph: Pagination ph Start	Autor	to Window Type : Algorithm : Zero Padding : rits All Measurement data at number of FFT points (Streaming mode)	Rectangular ¢ Estimate ¢	Current FFT Configuration Mode : FFT Auto FFT Shift : Besbled Window type : Rectangular Algorithm : Estimate Zero padding : FraBled Points used : Minegacurene

Figure 110:FFT tool options

To import the files containing the logged measurement, the user should click on Browse, then import the files from log_beanscape folder, where Tx files are saved.

The FFT tool will generate as a result:

• Power spectral density and a new window displays

1: Click on Browse to choose files

Start	All time 2019-06-26 11:29:52		Show se	FFT Configuration	FFT Shift		Current FFT Configuration
End	2019-06-26 11:29:52		View Reset Number g	raph: Window Type :	Rectangular	\$	Mode : FFT A
	2019-06-26 11:29:52			Algorithm :	Estimate	\$	FFT Shift : Disab
		Generate Log	files	Zero Padding :			Window type : Recta
Bros	wse files to process	/		FFT Points Use All Measurement data	0		Algorithm : Estima
0.01	inco to process			Adjust number of FFT points	SR/0.1		Zero padding : Enabl Points used : Al me
			Dpen		010 0.1		× ×
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		Click on Browse	Organize 👻 New fold	er		III •	
		o browse Tx files	🕹 Downloads 🖈 ^	Name	Date modified	Туре	Size
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			📙 log_beanscar 🖈	Transmit_Streaming_MacId_00158D00000	6/25/2019 5:19 PM	Text Document	11 K
			II All	Transmit_Streaming_MacId_00158D00000		Text Document	21 K
			BeanDevice Wilc	Transmit_Streaming_MacId_00158D00000		Text Document	215 K
			SmartSensor	Transmit_Streaming_MacId_00158D00000		Text Document	117 K
			User Guide	Transmit_Streaming_MacId_00158D00000			1,186 K
			OneDrive	Transmit_Streaming_MacId_00158D00000			8 K
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			This PC	Transmit_Streaming_MacId_00158D00000			2,052 K 1,800 K
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			Documents				
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	C-last	de fler en leller en or				Open	Cancel
	Select	the files and click on Op	ben		2		.al

Figure 111: Browsing TX files on FFT tool

2: Overview of the selected files

			Click or	n View to show r	esult			
FF	т							- 0 >
Start End Bro	• 20 20	All time > 5 Files Selected 01906:25 17:13:46 • 01906:26 09:27:37 • Browse Verw © Generate Log files	Result	Show selected g Number graph : o generate Log fil	jraph (T Configuration Auto Window Type : Agonthm : Zero Padding : FFT Points Use All Measurement data Adjust number of FFT points (Streaming mode)	FFT Shit Rectangular ¢ Estimate ¢ SR/0.1	Current FFT Configuration Mode : FFT Auto FFT Shift : Databled Window type : Restangular Agonthm : Estangular Zero padding : Enabled Points used : A measureme
N° I	Parts	File Name		Start	End			
1	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_13_46_PM		6/25/2019 5:13:46	6/25/2019 5:13	.52		
2	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_14_06_PM		6/25/2019 5:14:06	6/25/2019 5:14	1:12		
3	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_14_26_PM		6/25/2019 5:14:26	6/25/2019 5:15	i:34		
4	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_15_57_PM		6/25/2019 5:15:57	6/25/2019 5:11			
5	•	Transmit_Streaming_MacId_00158D00000E0C4D_6_26_2019_9_24_54_AM		6/26/2019 9:24:54	6/26/2019 9:2	7.37		

Figure 112: Overview: FFT window

S	imai	rtSensor User Manual	2.4GHz wireless sensors
3: L	oad	ling	
sterie	FFT		- 0
St Er	art 2	All time →> 5 Files Selected 019-06-25 17:13:46 ♦ 019-06-26 09:27:37 ♦ Image: Constraint of the selected of the selecte	Show selected graph FFT Configuration Current FFT Configuration Number graph:
Ρ	rocess	ing 4/5	FFT Points Algorithm : Center
N°	Parts	File Name	Start End
1	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_13_46_PM	6/25/2019 5:13:46 6/25/2019 5:13:52
2	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_14_06_PM	6/25/2019 5:14:06 6/25/2019 5:14:12
3	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_14_26_PM	6/25/2019 5:14:26 6/25/2019 5:15:34
4	1	Transmit_Streaming_MacId_00158D00000E0C4D_6_25_2019_5_15_57_PM	6/25/2019 5:15:57 6/25/2019 5:18:23
		Fig	re 113: FFT generation

- **4:** FFT report generated with the following results:
 - a. Frequency
 - b. Amplitude

Image: State	FI	FT									_	L X
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Successful operation Part 1/1, 1101 Samp Velocity log files are located at C:\log_beanscape\FFT FOLDER Image: Comparison of the compari				Generate Log files		-		1480000 6 26 201	9 3 00 48 PM			- 0
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					U	known	water marked and	monor and the salar	and the second and the second	mandownation	and the and the Andrews	U

Figure 114: FFT generated View

5: FFT LOG files generated

FFT LOG files will be generated in a folder located in log_beanscape repertory called FFT FOLDER. In this folder, BeanScape[®] will create separate folders for each BeanDevice[®].

2		
MAC_ID_00158D00000E02A9	25/10/2018 12:36	Dossier de fichier
MAC_ID_ 00158D00000E06A8	25/10/2018 12:36	Dossier de fichier
	25/10/2018 12:36	Dossier de fichier
MAC_ID_00158D00000E0277	23/10/2010 12:30	
I (C:) → log_beanscape → FFT FOLDER → MAC_ID_0015	and the second	
	and the second	

6: The graphs will be displayed automatically when VPPV Report is generated via a pop-up window, that can be formatted to select the number of graphs to display simultaneously in this window. An easy navigation bar on the top of the window, allow to the user to navigate between the graphs and select the page size.

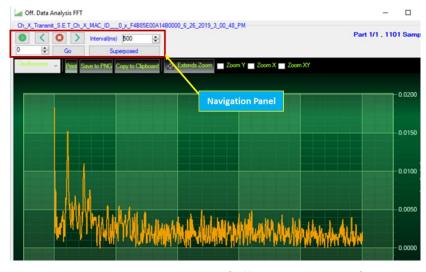


Figure 116: Graph display (Offline Data Analysis)

7: Users can manually select and launch graph by double click or selecting file and click on "Show selected graph" button.

-> 6 Files Selected Show selected graph ber graph: 6 Generate Log files Selected item ISTR N° Parts End File Name Start Transmit_Streaming_Ch_X_MAC_ID_ _0_x_F4B85E00A14B0000_6_26_2019_11_21_10_AM 6/26/2019 11:21:1... 6/26/2019 11:47:3.. 2 4 6/26/2019 11:21:1. 6/26/2019 11:47:2 Transmit_Streaming_Ch_Z_MAC_ID___0_x_F4B85E00A14B0000_6_26_2019_3_08_42_PM 6/26/2019 3:08:42 6/26/2019 3:36:38 6 Transmit_Streaming_Ch_Z_MAC_ID__0_x_F4B85E00A14B0000_6_26_2019_11_21_10_AM 5 6/26/2019 11:21:1... 6/26/2019 11:47:2.

Figure 117: Selecting a graph to display

8: The selected graph is displayed

SmartSensor User Manual

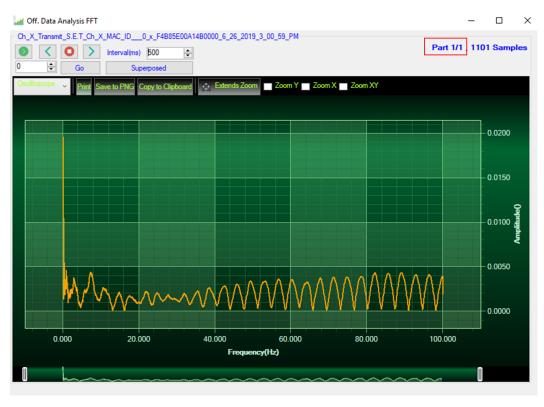
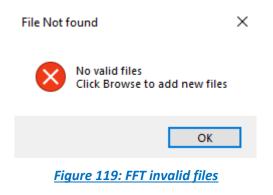


Figure 118: Selected graph display

2.4GHz wireless sensors

10: Make sure that the time range is within your measurements, otherwise the files will be considered as invalid.



11.1.1.2 FFT shift

FFT shift allows sorting the FFT output by moving the zero-frequency component to the center of the array. It is useful for visualizing a Fourier transform with the zero-frequency component in the middle of the spectrum.

FFT shift option is activated when the checkbox "FFT shift" is checked.

Click on browse and import file containing the logged measurement, the result will be:

• Power spectral density and a new window displays (with zero-frequency at the center)

1: To use FFTShift: check FFTShift, Select files and click the "View" button:

T Configuration Auto	🗹 FFT Shift	
Window Type :	Rectangular	
Algorithm :	Estimate	-
Zero Padding :		
FT Points Use All Measurement data	0	
Adjust such as of FFT as inte-		

Figure 120: FFT Shift activation

2: FFT Spectrum with FFT Shift option enabled

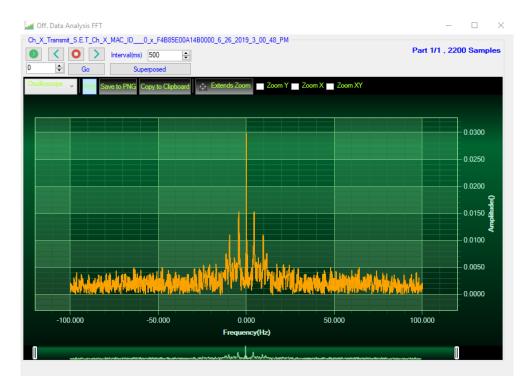


Figure 121: Gird of FFTShift spectra



11.1.2 Particle Velocity

According to the DIN4150-3, the BeanScape[®] software Particle Velocity option acts as follow:

1-Display Particle velocity which is calculated from the acceleration.

2-Implement an analysis report.

The first step: Under Off.Data Analysis menu on the Beanscape® top menu, select Particle Velocity

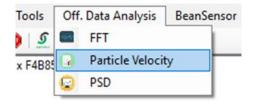


Figure 122: DIN on BeanScape® top menu

Browse files from Tx Folder Reset all the interface	Particle Velocity Settings
Particle Velocity Click on View to show result	Particle velocity settings – \Box ×
Select Log Files Show selected graph	By FFT By Filter By Zero Crossing FFT Current Velocity Configuration
Browso Max Reset VPPV View Generate Log files DIN 4159-3 Report Browse files to process	• Ato Window Type : Rectangular • O Agent Mindow Type : Rectangular • O Agent Mindow Type : Constance Accord and the Mindow Mindow Mode : Rectangular • O Agent Mindow Mode • O Agent Mindow Mode • O Agent Mindow Mode • O Agent (Streaming mode) SR/0.1
N° Parts Fie Name Check to generate Log files	Filter Filters Profile : Empty> Response Type Frequency Specification Highpass Bandpass Design Method Filters Filter Filters Filter Filters IIR Chebyshev_type_ Filter Filters Filter Filters <
Invalid files will be listed here The following file are Invalid	Mag. (dB) A pass Fatro p Fatr
	Validate

Figure 123: Particle Velocity window

The second step is to browse and import the file containing the logged measurement. The result will be:

- Velocity display window
- DIN report generated
- o Velocity files created

3: Velocity Advanced Configuration.

Auto Window Type : Rectangular Algorithm : Estimate Zero Padding :	FFT Points © Use All Measurement da Adjust number of FFT points (Streaming mode)	· · · · · · · · · · · · · · · · · · ·	Current Velocity Configuration Mode : Zero Crossing
ter Auto Auto Auto Auto Auto Auto Auto Auto	Filters Profile : <empty> Frequency Specification Units : Hz Fs : 5 Fatop : 0.1 Fpass : 2.5</empty>	Magnitude Specification Units : dB Astop : 60 Apass : 0.1	
Specify Order	Apass f Apass f Stop Fpass	er Name :	

By default, the Velocity is configured "By Zero Crossing", to edit the Velocity settings user must select "By FFT" or "By Filter".

 Auto: If Auto is selected, The Velocity calculation will activate FFT Auto mode By FFT By Filter By Zero Crope FFT Auto Window Type : Rectangular Algorithm : Estimate Adjust number of FFT points 	 Auto: If Auto is selected, The Velocity calculation will activate FFT Auto mode Set By FFT By Filter By Zero Crossin FFT Auto Window Type : Rectangular Algorithm : Estimate Adjust number of FFT points Content of the sector of the sector
 By FFT By Filter By Zero Cross FFT Auto Window Type : Rectangular Algorithm : Estimate Adjust number of FFT points 	 By FFT By Filter By Zero Crossing FFT Auto Window Type : Rectangular Algorithm : Estimate Adjust number of FFT points Adjust number of FFT points Adjust number of FFT points
FFT Image: Auto Window Type : Rectangular Algorithm : Estimate FFT Points Image: Organized and the structure of the structure o	FFT Auto Window Type : Rectangular Algorithm : Estimate Algorithm : Estimate O Adjust number of FFT points (Characteristic model)
Auto Window Type : Rectangular Algorithm : Estimate FFT Points O Use All Measurement data O Adjust number of FFT points	Auto Window Type : Rectangular Algorithm : Estimate FFT Points O Adjust number of FFT points
Zero Padding : (Streaming mode) SR/0.1	Zero Padding : V (Streaming mode) SR/0.1

 Manual: Once switched to Manual, the user must configure the FFT settings manually (Window Type, Algorithm & Zero Padding).

By FFT		O By Filter	O By Zero Crossing
FFT Manual Window Type : Algorithm : Zero Padding :	Rectangular -	FFT Points Use All Measurement data Adjust number of FFT points (Streaming mode)	128 文
• FFT Poin	nts:		
	FT Points) Use All Measureme) Adjust number of Ff (Streaming mo	T points	

By default, the Number of Points is configured to be set automatically as Sampling Rate / 0.1 (SR/0.1). By moving to the Manual settings, user must choose a value between 128 and 32768.

FFT Points		
Use All Measurement data		0
O Adjust number of FFT points		
(Streaming mode)	128	÷ 74

It is important to notice that larger Number of Points provide higher spectral resolution but take longer to compute.

The frequency resolution of each spectral line is equal to the Sampling Rate divided by the Number of Points. For instance, for example, if the Number of Points is 4096 and the Sampling Rate is 2000, the resolution of each spectral line will be:

2000/4096 = 0.48828125



The Number of Points should be equal or higher than the Samplig Rate (Acquisition time at least = 1 second)

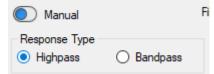
It is important to notice that larger Number of Points provide higher spectral resolution but take longer to compute.

By Filter: By selecting this option, the user will setup the Velocity basing on the Software Filter.

Filter		
O Auto	Filters Profile : < Empty> ~	✓ 1 🚽 🗠
Response Type	Frequency Specification	Magnitude Specification
Highpass	Units : Hz	Units : dB
	Fs : 5 ~	
Design Method	Fstop: 0.1	Astop: 60
IIR Chebyshev_type_I	Fpass : 2.5	Apass: 0.1
○ FIR Equiripple		
Filter Order Minimum Order		
O Specify Order	Fi	ter Name :
Filter Specification Mag. (dB) 0 Astop 0	Apass	Fs/2 f (Hz)

• Auto: If Auto is selected, Velocity Automatic filter will be configured

- Manual: Once switched to Manual, the user must configure manually the Filter settings.
 - Response Type: User should specify if the Response is Highpass or Bandpass



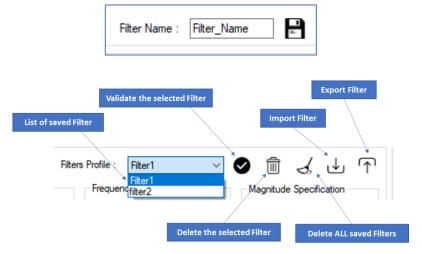
 Design Method: User should Select the nature of the Filter between IIR or FIR From the List of every filter, user have to specify the method of the Filter: IIR: Chebyshev_type_I, Chebyshev_type_II or Butterworth FIR: Equiripple, Generalized_Equiripple or Kaiser_Window

The Frequency Specification and The Magnitude Specification will be modified according the selected Design Method

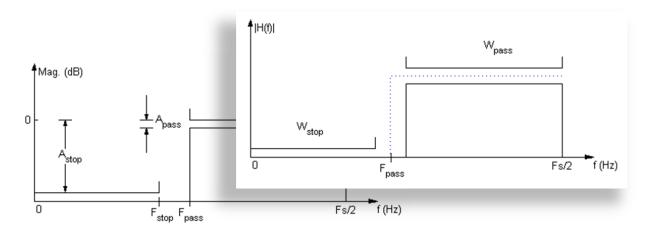
 Filter Order: If the user is using IIR Design Method, Minimum Order will be selected automatically.

If the FIR Design Method is selected, user must Specify Order.

- Frequency Specification: Is a customizable frame according to the Design Method.
- Magnitude Specification: Is a customizable frame according to the Design Method.
 - ◆ <u>Filter Profile:</u> User can save a specific Configuration and re-use it later.



 Filter Specification: Is a Graphical Display of the Filter Specification depends on the user settings.



4: Click on browse button to choose TX Files.

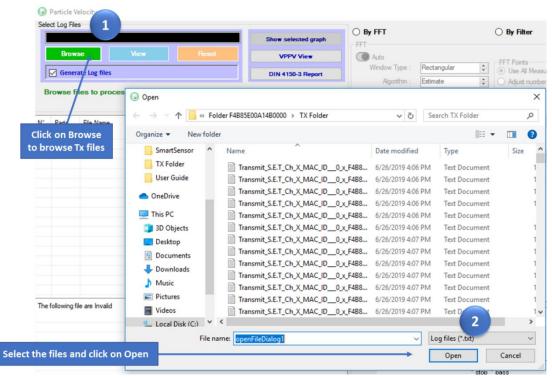


Figure 124: Browsing TX files into Particle Velocity tool

5: Loading.

	ect Log File	Files Selected	Show selected graph	O By FFT
		Reset	VPPV View	Auto
Π	Gene	rate Log files	DIN 4150-3 Report	Window Typ
1			Dire 4150-5 Neport	Algorith
Р	rocessi	ng 16/31		Zero Paddi
				Filter
_	_			
N°	Parts	File Name		Auto
1	1	Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000	_6_26_2019_3_00_48_PM	Response Type
2	1	Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000	_6_26_2019_3_00_53_PM	Highpass
3	1	Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000	_6_26_2019_3_00_59_PM	
4	1	Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000	_6_26_2019_3_01_04_PM	Design Method
5	1		_6_26_2019_3_01_13_PM	
6	1		_6_26_2019_3_01_18_PM	IIR Cheby
7	1		_6_26_2019_3_01_23_PM	O FIR Equirin
	1		_6_26_2019_3_01_29_PM	
9	1		_6_26_2019_3_01_34_PM	Filter Order
10	1		_6_26_2019_3_01_40_PM	Minimum Or
11	1		_6_26_2019_3_01_45_PM	Specify Ord
12	1		_6_26_2019_3_01_51_PM	
13	1		_6_26_2019_3_01_56_PM	Filter Specificatio
14	1		_6_26_2019_3_02_02_PM	≜ Ma
	1	Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000 Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000	_6_26_2019_3_02_07_PM	
15 16	1			

Figure 125: Particle Velocity result generation

6: The Particle Velocity Window will be displayed and will display:

- Velocity Graph
- Particle Velocity Graph
- PPV Values

- Zero Crossing frequency values
- Peak Acceleration and Displacement values

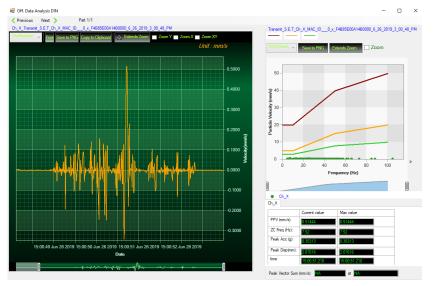


Figure 126: Particle Velocity Display Window

6: The VPPV and DIN Report:

VPPV & DIN Report will be generated by clicking on the VPPV View and DIN-4150-3 Report buttons

Reset	VPPV View
	DIN 4150-3 Report
	Reset

n ber					– 🗆 🗙
🖣 🖣 1 🛛 of 1 🕨 🗏 🛊 🛞 🕼 🖨 🗐 🔎 🚚 🛛 100%	•	Find Next			
BeanAir	VPP	V REPORT			6/27/2019 11:11:1
File Name	VPPV (mm/s)	Time PPV	ZC Freq(hz)	Peak Acc	Peak Disp(mm
Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000_6_26_2019_3 00_48_PM	0.5144	6/26/2019 3:00:51 PM	7.52	0.3531	2.0762
Transmit_S.E.T_Ch_X_MAC_ID0_x_F4B85E00A14B0000_6_26_2019_3 00_53_PM	0.0041	6/26/2019 3:00:53 PM	5.01	0.0024	0.0227

Figure 128: VPPV Report

ansmit_S.E.T_Ch_X_MAC_ID_0_X_F4885E00A1480000_6_26 Commercial Steel 0.00270607272727273 200 00:00:05.5000000 OK OK 7.52 0.5144 OK OK 019_3_00_48_PM ansmit_S.E.T_Ch_X_MAC_ID_0_X_F4885E00A1480000_6_26 Commercial Steel -6.643636363636E05 200 00:00:05.5000000 OK OK 5.01 0.0027 OK OK 019_3_00_53_PM Keyword Meaning UTVEE Long Term Vibration Effect UTVEP Long Term Vibration Effect 0 Burled Pipe work	4 1 of 1 ▶ ⋈ ⇐ ⊗ 𝔅 ♣ 🗐 💷 씨, + 100	1% -	Find	Next							_	
ansmit_S.E.T_Ch_X_MAC_ID0_X_F4885E00A1480000_6_26 Commercial Steel 0.00270607272727273 200 00:00:05.5000000 OK OK 7.52 0.5144 OK OK 019_3_00_48_PM ansmit_S.E.T_Ch_X_MAC_ID0_X_F4885E00A1480000_6_26 Commercial Steel -6.643636363636E-05 200 00:00:05.5000000 OK OK 5.01 0.0027 OK OK 019_3_00_53_PM Keyword Meaning UTVEE Long Term Vibration Effect UTVEP Long Term Vibration Effect on Buried Pipe work	×		DI	N 4150-3 R	EPORT					6/27/2019 1	1:11:56 A	M
19.3.0.0.46 PM	File Name	Building type	Pipe Material	Velocity Average(mm/s	Sampling Rate(hz)	Analyze duration	LTVEE	LTEBP	Real Frequency(hz)	PCPV(mm/s)	STEBP	STVE
Keyword Meaning. LTVEE Long Term Vibration Exploration Effect LTVEP Long Term Effect on Buried Pipe work		Commercial	Steel	0.00270607272727273	200	00:00:05.5000000	ок	ОК	7.52	0.51444	ОК	ОК
LTVEE Long Term Vibration Evaluation Effect Later Ltreep Long Term Effect on Buried Pipe work		Commercial	Steel	-6.6436363636363636E-05	200	00:00:05.5000000	ок	ОК	5.01	0.0027	ОК	ОК
STEBP Short Term Effect on Buried Pipe work	2019_3_00_53_PM	Commercial	K D D	eyword Mei IVEE Long Term Vibratio IEBP Long Term Effect of	aning n Evaluation Effect n Buried Pipe work	00:00:05.5000000	ок	OK	5.01	0.0027	OK	C
PCPV Peak Component Particle Velocity				TVEE Short Term Effect E								

Figure 129: DIN Report

INFORMATION	DETAILS
Building type	User configurable
Pipeline Material	User Configurable
Velocity Average	Get the average of the signal after transforming the acceleration signal into velocity signal
Sampling Rate	In Hz
Analyse duration	BeanScape property
Long term vibration evaluation	1-Find the maximum velocity values over the Time
effect	2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.
	3-Display if the result is OK or not (guideline respected or not)
Long term Effect on buried pipework	 1-Find the maximum velocity values over the Time 2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150. 3-Display if the result is OK or not (guideline respected or not)
Real Frequency	Get the signal frequency (FFT + windowing)
Maximum velocity (mm/s)	BeanScape Property
Short term Effect on buried	1-Find the maximum velocity values over the Time
pipework	2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.
	3-Display if the result is OK or not (guideline respected or not)
Short term vibration effect evaluation	 1-find the maximum velocity value over the time. 2-Determine the significant frequency (use the FFT + windowing). 3-compare the maximum velocity to the guideline value described on the Norm DIN 4150 5-Display if the result is OK or not (guideline respected or not)

Signal windowing is used in this analysis. Windowing is a technique used to cut out a section of your data to measure, in order to minimize distortions that cause spectral leakage of the FFT.

DIN 4150-3 Interpretation video

11.2 ONLINE DATA ANALYSIS TOOL

11.2.1 Online FFT

The FFT (Fast Fourier transform) operates by decomposing an N point time domain signal into N time domain signals each composed of a single point.

The second step is to calculate the N frequency spectra corresponding to these N time domain signals.

Lastly, the N spectra are synthesized into a single frequency spectrum.

When using FFT in SET mode, for best performance FFT points are automatically calculated on the number of data acquisition (sampling rate xdata acquisition duration).



Real time observation of FFT available for BeanDevice AX-3D only with Streaming and S.E.T acquisition modes and is enabled from the Online Data Analysus tab in the Configuration panel.

Custom display Notes Data Acq. config.	Sensor Config Online Data Analysis DataLogger
Online FFT Configuration ✓ Enable Online FFT	Conline Velocity configuration
Automatic FFT Report(S.E.T)	Automatic DIN Report(S.E.T)
Enable FFT Log file	Online FFT Configuration
Number of Points (Streaming)	Enable Online FFT
Current Points Number : SR/0.1	Automatic FFT Report(S.E.T)
Online waveform configuration Automatic waveforms Report(S.E.T)	Enable FFT Log file
Enable waveforms Log file(S.E.T)	S.E.T threshold Acceleration -
Software Filters	Validate

Figure 130: Online FFT Configuration frame

1: Check Enable Online FFT to view the display of FFT graph in the sensor profile



Figure 131: FFT Spectrum

2: Check Enable FFT Log file to generate log files in the log_beanscape directory.

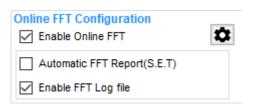


Figure 132: Online FFT Configuration frame

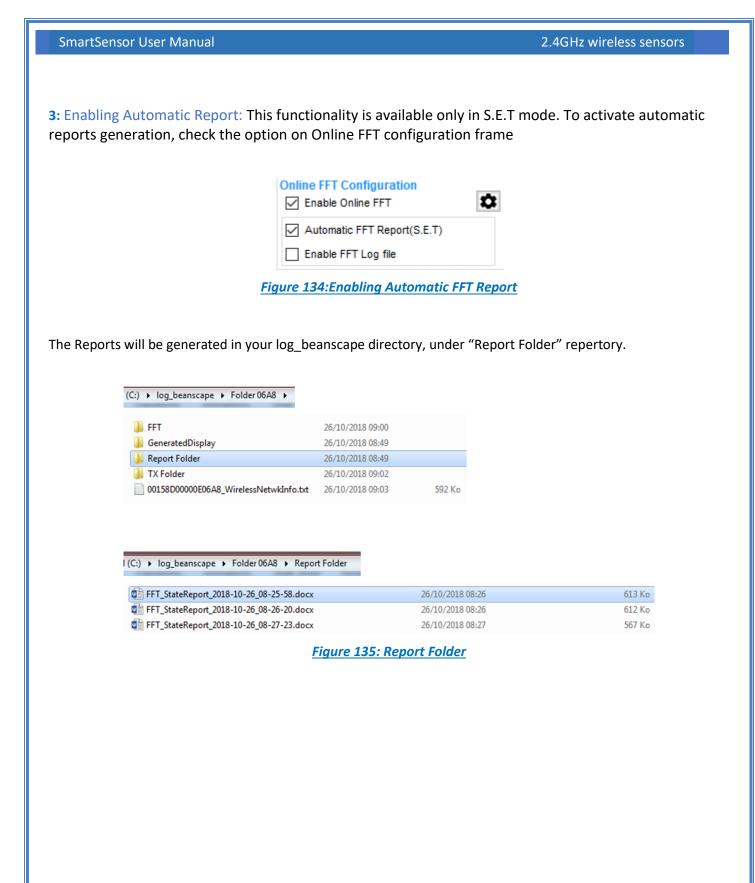
The log files will be generated in a folder called "FFT" under the BeanDevice® repertory.

FFT	26/10/2018 08:51		
GeneratedDisplay	26/10/2018 08:49		
Report Folder	26/10/2018 08:49		
TX Folder	26/10/2018 08:51		
00158D00000E06A8_WirelessNetwkInfo.txt	26/10/2018 08:53	435 Ko	
C:) ▶ log_beanscape ▶ Folder 06A8 ▶ FFT			
C:) → log_beanscape → Folder 06A8 → FFT FFT_RealTime_MAC_JD_0_x00158D00000E		.txt 26/1	10/2018 08:54
and the second s	06A8_2018-10-26_08-51-44		
FFT_RealTime_MAC_ID0_x_00158D00000E	06A8_2018-10-26_08-51-44 0-26_08-25-58.txt	26/3	10/2018 08:20
FFT_RealTime_MAC_ID0_x_00158D00000E FFT_SET_MACID_00158D00000E06A8_2018-10	06A8_2018-10-26_08-51-44 0-26_08-25-58.txt 0-26_08-26-20.txt	26/1 26/1	10/2018 08:54 10/2018 08:24 10/2018 08:24 10/2018 08:23
FFT_RealTime_MAC_ID0_x_00158D00000E FFT_SET_MACID_00158D0000E06A8_2018-1/ FFT_SET_MACID_00158D00000E06A8_2018-1/	06A8_2018-10-26_08-51-44 0-26_08-25-58.txt 0-26_08-26-20.txt 0-26_08-26-20.txt	26/3 26/3 26/3	10/2018 08:20 10/2018 08:20
FFT_SET_MACID_00158D00000E06A8_2018-10 FFT_SET_MACID_00158D00000E06A8_2018-10 FFT_SET_MACID_00158D00000E06A8_2018-10	06A8_2018-10-26_08-51-44 0-26_08-25-58.txt 0-26_08-26-20.txt 0-26_08-27-23.txt 0-26_08-27-23.txt	26/3 26/3 26/3 26/3	10/2018 08:2 10/2018 08:2 10/2018 08:2

11 Ko 11 Ko 11 Ko FFT SET MACID 00158D00000E 48 2018-10-26 08-30-26.txt 26/10/2018 08:30 FFT_SET_MACID_00158D00000E06A8_2018-10-26_08-31-27.txt 26/10/2018 08:31 11 Ko FFT_SET_MACID_00158D00000E06A8_2018-10-26_08-32-29.bt 26/10/2018 08:32 11 Ko FFT_SET_MACID_00158D00000E06A8_2018-10-26_08-33-30.bt 26/10/2018 08:33 11 Ko FFT SET MACID 00158D00000E06A8 2018-10-26 08-34-31.bt 26/10/2018 08:34 11 Ko

Figure 133: FFT log files folder

619 Ko 10 Ko 10 Ko 11 Ko



For further information about the configuration of Online FFT please refer to section <u>7.3.4</u> of this user manual

After enabling Real time FFT and setting SMTP configuration (<u>more information on section 8</u>), this is an example of an FFT report emailed to concerned recipients.



Figure 136: FFT Report (S.E.T mode)

1	Logo of your company, you can upload it from the alarm management configuration window. Tools→Alarm management
2	General information about the Measurement, Date, duration sampling rate ,pre-trigger duration, IIR filter status and triggered axis
3	 Information related to monitoring site: user, location and monitoring sites (can be configured from the Alarm tool window. This field can be configured be from the alarm management configuration window Tools→Alarm management
4	BeanDevice [®] Information: Type, MAC ID and label, measurement range, and Alarm Type : Acceleration or Velocity
5	Alarm thresholds value on each Axis, the three levels of alarms are displayed Action-Alert-Alarm
6	FFT Report with Max Frequency for each Axis, VPPV (Vector Peak Particle Velocity) value and Max amplitude
7	Graph Area – 3 Axis are displayed on the same graph

For further information about managing your notification and reports email please refer to section <u>8:</u> <u>Alarm management.</u>

FFT Advanced Configuration

The FFT configuration allows the user to activate the FFT Shift and to go for manual settings related to FFT.

FFT Configuration		×
Auto	FFT Shift	
		Current FFT Configuration
Window Type :	Rectangular 🛓	Mode : By FFT_Auto
Algorithm :	Estimate 🜲	FFT Shift : Disabled
Zero Padding :		Window type : Rectangular
Nucleard		Algorithm : Estimate
Number of (Streaming mode)	SR/0.1	Zero padding : Enabled
	Validate	

- Auto/Manual

Manual	FFT Shift
Window Type :	Rectangular 🔶
Algorithm :	Estimate 🚔
Zero Padding :	\checkmark

- Window type:

Destangular
Rectangular
Hamming
Hann
Blackman
Blackman Harris
Gaussian
Kaiser
Taylor
Triangular
Flattop
Bartlett
Bartlett-Hann

When the number of periods in the acquisition is not an integer, the endpoints are discontinuous. These artificial discontinuities show up in the FFT as high-frequency components as not present in the original signal. These frequencies can be much higher than the Nyquist frequency and are aliased between 0 and half of your sampling rate. This phenomenon is known as spectral leakage.

You can minimize these effects by using a technique called windowing.

Windowing reduces the amplitude of the discontinuities at the boundaries of each finite sequence acquired by the digitizer. Windowing consists of multiplying the time record by a finite-length window with an amplitude that varies smoothly and gradually toward zero at the edges. This makes the endpoints of the waveform meet and, therefore, results in a continuous waveform without sharp transitions. This technique is also referred to as applying a window.

There are several different types of window functions that you can apply depending on the signal. To understand how a given window affects the frequency spectrum, you need to understand more about the frequency characteristics of windows.

Selecting a window function is not a simple task. Each window function has its own characteristics and suitability for different applications. To choose a window function, you must estimate the frequency content of the signal.

- If the signal contains strong interfering frequency components distant from the frequency of interest, choose a smoothing window with a high side lobe roll-off rate.
- If the signal contains strong interfering signals near the frequency of interest, choose a window function with a low maximum side lobe level.

• If the frequency of interest contains two or more signals very near to each other, spectral resolution is important. In this case, it is best to choose a smoothing window with a very narrow main lobe.

• If the amplitude accuracy of a single frequency component is more important than the exact location of the component in a given frequency bin, choose a window with a wide main lobe.

• If the signal spectrum is rather flat or broadband in frequency content, use the uniform window, or no window.

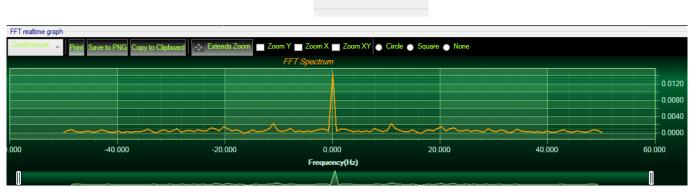
In general, the Hanning (Hann) window is satisfactory in 95 percent of cases. It has good frequency resolution and reduced spectral leakage. If you do not know the nature of the signal but you want to apply a smoothing window, start with the Hann window.

- Algorithm

Estimate	Determine a best-guess transform algorithm based on the size of problem.
Measure	Find a better algorithm by computing multiple transforms and measuring the run times.
Patient	Run a wider range of testing compared to 'measure', resulting in a better transform algorithm, but at the expense of higher computational cost to determine the parameters.
Hybrid	Use a combination of 'measure' for transforms with dimension length (number of points) 8192 or smaller and 'estimate' for transforms with dimension length (number of points) larger than 8192.

- Zero Padding: The use of zero padding enables you to estimate the amplitudes of frequencies correctly.
- FFT Shift: Check to enable real time FFT Shift processing for BeanDevice AX-3D on streaming mode and the FFT spectrum will appear shifted below the Streaming graph in the sensor profile.

FFT Shift





11.2.2 Online Velocity

Real time observation of velocity available for BeanDevice AX-3D only with Streaming and S.E.T acquisition modes and is enabled from the signal processing tab in the Configuration panel.

Custom display Notes Data Acq. config. Sen	sor Config Online Data Analysis DataLogger
Online FFT Configuration Enable Online FFT	Online Velocity configuration ✓ Enable Online Velocity
Automatic FFT Report(S.E.T) Enable Online Velocity configuration Number of Manual Current Po Dnline Velocity Log file Enable PPV Log file	Automatic DIN Report(S.E.T) Feable Velocity Log file PPV Log file
Automatic waveforms Report(S.E.T) Enable waveforms Log file(S.E.T)	eleration g 🔹
Software Filters Enable IIR Filter	S.E.T threshold Acceleration Validate

Figure 138: Online Velocity configuration tab

Enable online Velocity: check to enable real time Velocity processing, PPV and PVS, the velocity graph will be displayed.

On the Graph side a real time DIN 4150 graph will be displayed on the right side of the screen.

Under the DIN 4150 Graph, the PPV and the PVS values will be displayed in real time.

On the PPV frame, BeanScape will display PPV in mm/s, ZC Frequency in Hz, Peak Acceleration in g and Peak Displacement in mm.



It is important to notice that the PVS calculation required 3 active channels to be generated.

<u>PPV:</u> is a measurement of maximum ground particle movement speed, it is in millimeters per second (mm/sec), PPV is a "vector" quantity (i.e. it has both a value and an associated direction).

Peak Vector Sum (PVS): is simply the square root of the sum of the squares of the individual PPV values. PVS is a "scalar" quantity, i.e. one with only a value, which is always larger than the individual PPV vector values.

Scientific studies have shown that the PPV correlates best with damage potential of all the tested characterizations of ground movement (e.g. acceleration, displacement, or strain). Most, though not all, ground vibration standards are quoted in PPV values, although the "acceptable" values of PPV differ with the standard applied and with the frequency of the vibration components.

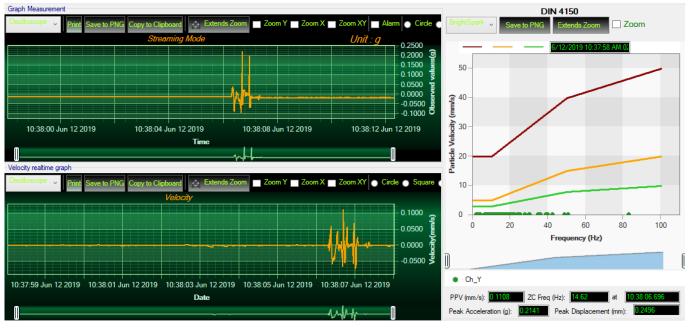


Figure 139: Velocity Graph

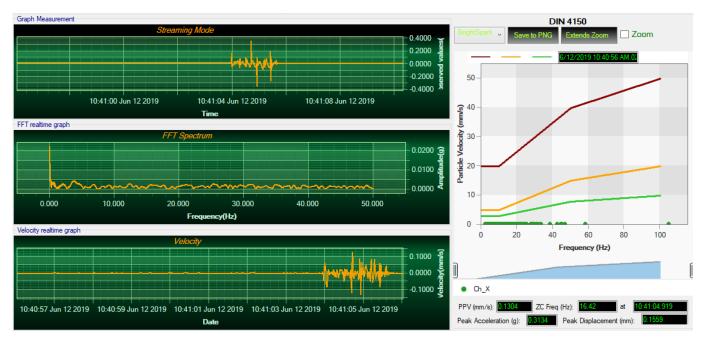
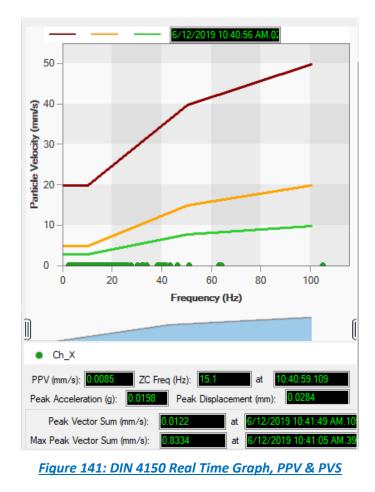


Figure 140: Velocity and FFT Graph, PPV and PVS



Automatic DIN Report (S.E.T): check to enable DIN4150-3 report automatic generation when threshold is reached, or an acquisition cycle is reached on the S.E.T acquisition mode.

An automatic Report will be sent to the email addresses configured on Alarm Management Option.

BeanAir

BeanDevice MAC_ID : F4B85E00A14B0000

06-Feb-19 12:07:37

Sensor Label : Ch_Z

DIN 4150-3 REPORT

Building Type	Commercial
Pipeline Material	Steel
Velocity Average(mm/s)	0.0177327272727272
Sampling Rate(hz)	100
Analyze Duration(hh:mm:ss)	00:00:01.1000000
LTVEE	ОК
LTEBP	ок
Velocity Frequency(hz)	0
PCPV(mm/s)	2.4892
STEBP	ОК
STVEE	NOK

KeyWord	Meaning		
LTVEE	Long Term Vibration Evaluation Effect		
LTEBP	Long Term Effect on Buired Pipework		
STEBP	Short Term Effect on Buired Pipework		
STVEE	Short Term Effect Evaluation		
PCPV	Peak Component Particle Velocity		

Figure 142: DIN 4150-3 Report email

INFORMATION	DETAILS		
Building type	User configurable		
Pipeline Material	User Configurable		
Velocity Average	Get the average of the signal after transforming the acceleration signal into velocity signal		
Sampling Rate	In Hz		
Analyse duration	BeanScape property		
Long term vibration evaluation	1-Find the maximum velocity values over the Time		
effect	2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.		
	3-Display if the result is OK or not (guideline respected or not)		
Long term Effect on buried pipework	1-Find the maximum velocity values over the Time2- Compare the maximum velocity to the guideline value described on the Norm DIN 4150.3-Display if the result is OK or not (guideline respected or not)		
Velocity Frequency	Get the signal frequency (FFT + windowing)		
Maximum velocity (mm/s)	BeanScape Property		
Short term Effect on buried	1-Find the maximum velocity values over the Time		
pipework	2- Compare the maximum velocity to the guideline value described or the Norm DIN 4150.		
	3-Display if the result is OK or not (guideline respected or not)		
Short term vibration effect evaluation	 1-find the maximum velocity value over the time. 2-Determine the significant frequency (use the FFT + windowing). 3-compare the maximum velocity to the guideline value described on the Norm DIN 4150 5-Display if the result is OK or not (guideline respected or not) 		

Enable Velocity Log file: check to enable Velocity data to be stored in the log folder.

	Name	Date modified	Туре	Size
	FFT	13-Feb-19 14:43	File folder	
*	📕 TX Folder	13-Feb-19 14:58	File folder	
*		13-Feb-19 14:58	File folder	
	5C313E06A9A70000 WirelessNetwkInfo	13-Feb-19 14:58	Text Document	

Uelocity_RealTime_Ch_Y_MAC_ID___0_x_F4B85E00A14B0000_6_12_2019_10_48_00_AM

Velocity_RealTime_Ch_Z_MAC_ID___0_x_F4B85E00A14B0000_6_12_2019_10_48_00_AM

Figure 143: Velocity Log Folder/Files

Enable PPV Log file

poourd	orgunize	140.44		/01		
> This	> This PC > Local Disk (C:) > log_beanscape > Folder 5C313E06A9A70000					
	Name	Date modified	Туре	Size		
*	FFT	13-Feb-19 14:43	File folder			
	TX Folder	13-Feb-19 14:58	File folder			
Ŕ	Velocity	13-Feb-19 14:58	File folder			
INIS 🖈	5C313E06A9A70000 WirelessNetwkInfo	13-Feb-19 14:58	Text Document			
PPV_F	RealTime_Ch_X_MAC_ID0_x_F	F4B85E00A14B0000_	6_12_2019_10_48	00_AI		
PPV_F	RealTime_Ch_Y_MAC_ID0_x_F	F4B85E00A14B0000_	6_12_2019_10_48	_00_AI		
PPV_F	RealTime_Ch_Z_MAC_ID0_x_F	F4B85E00A14B0000_	6_12_2019_10_48	_00_AI		

Figure 144: PPV Log Folder/Files

nartSensor User	Manual		2.4GHz wireless sensors
D	tity Advanced Configurat	:	
Veloc		ion	×
	O By FFT	O By Filter	By Zero Crossing
	Auto	Streaming Mode SET Mode Filter Auto Filters Pr	rofile : 🛛 < Empty> 🗸 🔮 🏛 🏑 🕁 🏹
	Window Type : Rectangular \$ Algorithm : Estimate \$		Frequency Specification Magnitude Specification
	Zero Padding : Current Velocity Configuration	Bandpass Design Method	Fs : 2000 V
	Points Used Number of points(Streaming) (Streaming mode)	SR/0.1 IIR Chebyshev_type_l FIR Equiripple	Fstop1: 0.1 Fpass1: 2.5 Apass: 0.1
	Mode : Zero Crossing	Filter Order	Fpass2: 800 Astop2: 60 Fstop2: 999
		Specify Order	Filter Name :
		Filter Specification	
			pass
		A _{stop1}	^stop2
		0 F _{stop1} F _{pas}	s1 F _{pass2} F _{stop2} F _{S/2} F(Hz)
			Close Validate
	<u>Figure 145:</u>	Velocity Advanced Configu	<u>iration</u>
city Configuration			
By FFT		O By Filter	By Zero Crossing
- By FF	T: By selecting this option,	the user will setup the Velo	ocity basing on customized FFT settin
	 Auto: If Auto is sel 	ected, The Velocity calculat	tion will activate FFT Auto mode Setti
	By FFT		
	FFT		
	Auto		
	Window Type :	Rectangular 🜲	import
	Algorithm :	Estimate	
	Zero Padding :		
	Zero Faduring :	\checkmark	

 Manual: Once switched to Manual, the user must configure the FFT settings manually (Window Type, Algorithm & Zero Padding).

By clicking on Import the Configuration will import the FFT current settings, already configured on the FFT frame.

By FFT FFT Manual				
Window Type : Algorithm :	Rectangular Estimate	▲ ▼ ▼	Ŷ	Import
Zero Padding :				
• •••• • • •				

<u>To save all settings Press Validate. The new settings should be displayed on the Left side of the Window.</u>

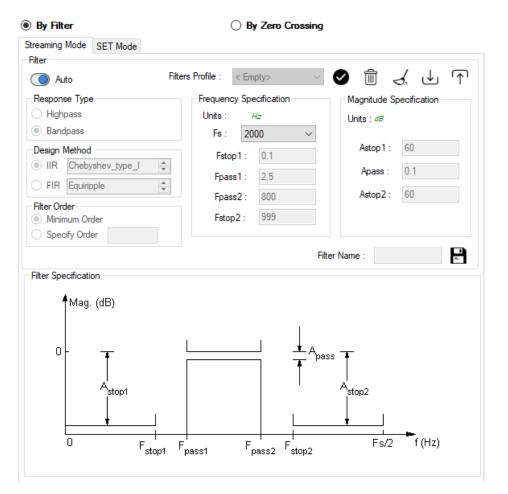
) By FFT FT	O By Filter	O By Zero Crossing
Manual	Streaming Mode SET Mode	
	Response Type Response Type Highpass Bandpass Design Method IIR Chebyshev_type_1 FIR Equippele Filter Order Velocity Configu Minimum O Specify Ord	Fpass : 2.5
		F _{stop} F _{pass} F _{s/2} f (Hz)

- **By Filter:** By selecting this option, the user will setup the Velocity basing on the Software Filter.

The Software filter	r is available for Streaming and S.E.T Mode.
	By Filter

_ ,		
Streaming Mode	SET Mode	
Filter		

 \circ $\;$ Auto: If Auto is selected, Velocity Automatic filter will be configured



- Manual: Once switched to Manual, the user must configure manually the Filter settings.
 - Response Type: User should specify if the Response is Highpass or Bandpass

Response Type	
Highpass	
O Bandpass	

 Design Method: User should Select the nature of the Filter between IIR or FIR From the List of every filter, user have to specify the method of the Filter: IIR: Chebyshev_type_I, Chebyshev_type_II or Butterworth FIR: Equiripple, Generalized_Equiripple or Kaiser_Window

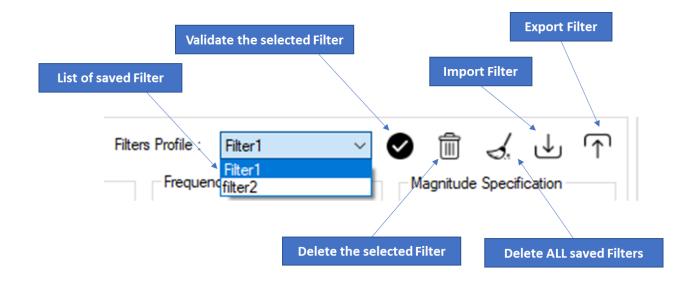
The Frequency Specification and The Magnitude Specification will be modified according the selected Design Method

Filter Order: If the user is using IIR Design Method, Minimum Order will be selected automatically.
 If the FIR Design Method is selected, user must Specify Order.

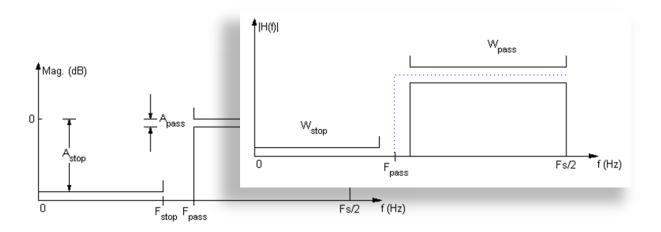
 Frequency Specification: Is a customizable frame according to the Design Method.

- Magnitude Specification: Is a customizable frame according to the Design Method.
- Filter Profile: User can save a specific Configuration and re-use it later.





 Filter Specification: Is a Graphical Display of the Filter Specification depends on the user settings.

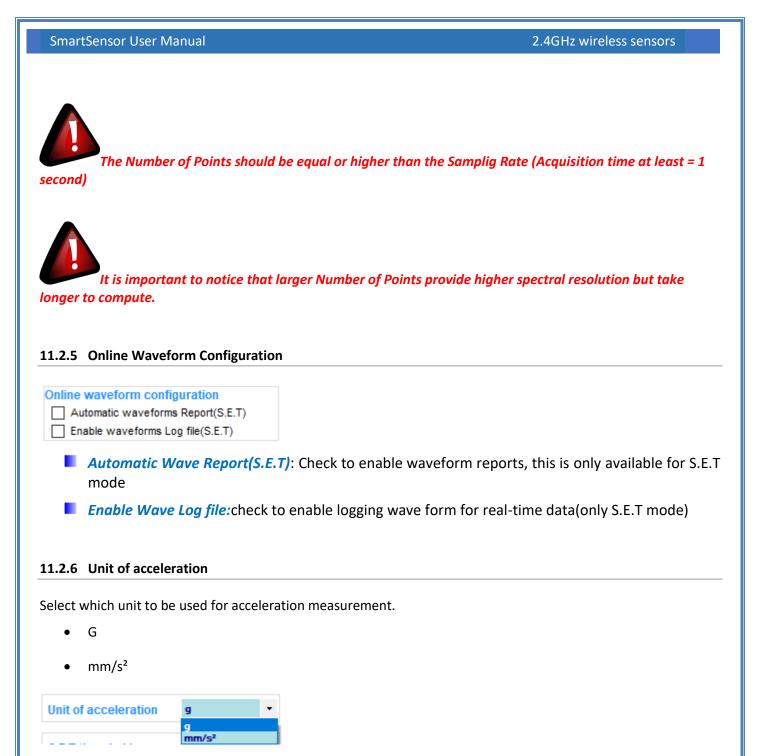


To save all settings Press Validate. The new settings should be displayed on the Left side of the Window.

By FFT	By Filter O By Zero Crossing
Manual	Streaming Mode SET Mode
Manual Window Type : Rectangular	

SmartSensor User Manual	2.4GHz wireless sensors
11.2.3 IIR Sofitware Filter	
Enable IIR Filter : Check to enable I	IR filter
	e Filters
✓ Enal	ble IIR Filter
11.2.4 Number of Points (Streaming)	
- Number	of points(Streaming)
Manu	al SR/0.1 X
The num	ber of the current point SR/0.1
By default, the Number of Points is confi	gured to be set automatically as Sampling Rate / 0.1 (SR/0.1).
By moving to the Manual settings, user must of	
Number of	f points(Streaming)
Manua Tanana I	
	er of the current point SR/0.1
	Number of Points provide higher spectral resolution but take
longer to compute.	
	nulation tool which will estimate the FFT Spectral Resolution
regarding the Sampling Rate and the Number	
FFT Spectral Resolution	Converter. ×
Sampling Rate Hz	Number of points(Streaming) ectral Resolution Hz
2000 🔹 /	4096 = 0.48828125
The frequency resolution of each spectral line	is equal to the Sampling Rate divided by the Number of Points. For
	is 4096 and the Sampling Rate is 2000, the resolution of each spectral

2000/4096 = 0.48828125



11.2.7 S.E.T threshold

In many cases the threshold is needed to be set in mm/s and not in g or mm/s², you need to configure your S.E.T threshold parameters before starting. To configure the threshold to be set in mm/s, you need to go to Online Data Analysis and change S.E.T threshold from acceleration to Velocity.

S.E.T threshold	Acceleration	•
	 Acceleration	
	Velocity	

12. APPENDICES

12.1 APPENDICE 1: INSTALLATION PROCEDURES

12.1.1 Sealing

The product BeanDevice[®] comes with an *IP67* rating. So, do not install the BeanDevice[®] in a marine environment with high turbulence.

Do not install the BeanDevice[®] up front to prevent the accumulation and infiltration of water from the front of the case.

If the BeanDevice[®] is used in a cold environment, it will be better to integrate it inside a plastic casing.

12.1.2 Coexistence With other Frequencies at 2.4 GHz

The BeanDevice[®] is sensitive to noise 2.4GHz (Wi-Fi as a source for example), but many protections are already in place, particularly in the IEEE 802.15.4[®].

It should however be careful when installing the product, check all the possibilities of radio channels on the frequency range 2.4-2.5GHz. The operation of the product will be improved.

For further information, read the application note: <u>AN_RF_004 – "Coexistence of Beanair WSN at</u> <u>2.4GHz"</u>

12.1.3 Temperature & Humidity

The BeanDevice[®] SmartSensor series comes with an operating temperature of -20°C to +65°C.

BeanDevice[®] products can operate in an area with 90% humidity.

However, the wireless range can be reduced in the presence of water. Avoid mounting the BeanDevice[®] in an enclosure surrounded by water, or near bushy plants (plants are composed of 90% water), ...

12.1.4 Reflections, Obstructions and Multipath

For further information, read the application note: <u>AN_RF_007 :" Beanair_WSN_Deployment"</u>

12.1.5 shock & Vibration resistance

Shock resistance on BeanDevice® products are:

Shock resistance

Do not force connections.

12.1.6 Antenna

Check the LQI (Link Quality Indicator) of your BeanDevice® for being sure that your antenna is right oriented.

For further information, read the application note: <u>AN_RF_007 :" Beanair_WSN_Deployment"</u>

SmartSensor User Manual

12.2 APPENDICE 2: SENSOR CHARACTERISTICS

12.2.1 BeanDevice® AX-3D & AX-3D Xrange

12.2.1.1 Sensor architecture

BEANDEVICE® AX-3D

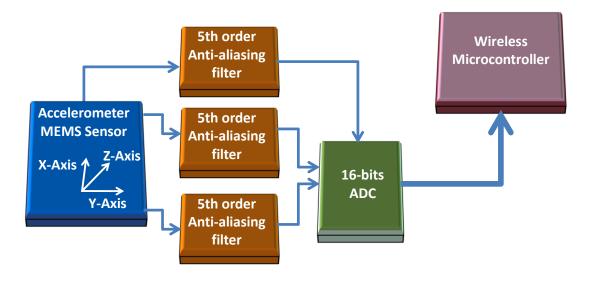


Figure 146: Sensor design

12.2.1.2 MEMS Accelerometer

The BeanDevice[®] AX-3D integrates a tri-axis, silicon micromachined accelerometer with a full-scale output range of ±2g, ±10g.

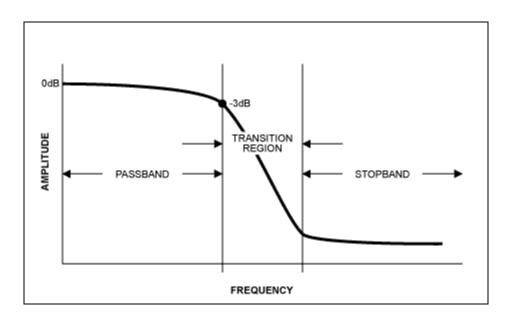
Acceleration sensing is based on the principle of a differential capacitance arising from acceleration-induced motion of the sense element, which further utilizes common mode cancellation to decrease errors from process variation, temperature, and environmental stress. The sense element is hermetically sealed at the wafer level by bonding a second silicon lid wafer to the device using a glass frit.

12.2.1.3 5th order Anti-aliasing filter

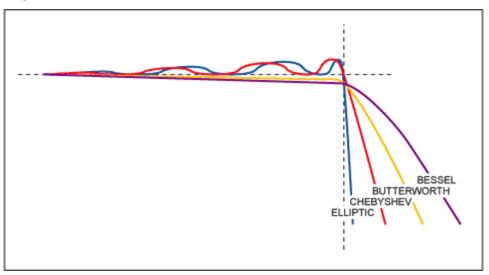
BeanDevice[®] AX-3D & HI-INC products integrates a high-performance 5th order Butterworth filter.

12.2.1.4 Why using an anti-aliasing filter?

When selecting an analog filter, the goal is to provide a cutoff frequency that removes unwanted signals from the ADC input or at least attenuates them to the point that they will not adversely affect the circuit. An anti-aliasing filter is a low-pass filter that accomplishes this. How does one select the right filter? The key parameters that need observation are the amount of attenuation (or ripple) in the passband, the desired filter rolloff in the stopband, the steepness in the transition region and the phase relationship of the different frequencies as they pass through the filter.



Once the signal frequencies of interest are known, use a simple filter program to determine the filter topology needed to meet the passband, stopband, and transition region requirements. Of the four basic filter types, each has its own advantages

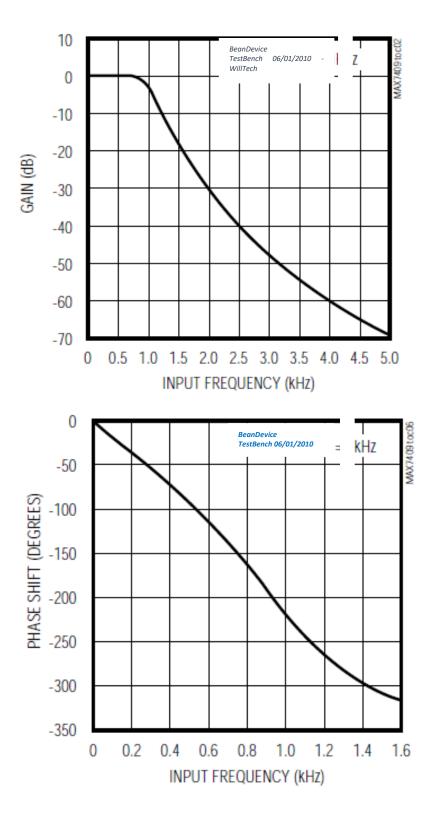


The Butterworth filter used on the BeanDevice[®] SmartSensor product lines, has the flattest passband region, meaning it has the least attenuation over the desired frequency range. The Bessel filter has a more gradual roll-off but its key advantage is that it has a linear phase response, meaning each frequency component is delayed by an equal amount of time as it passes through the filter. A linear phase response is often specified as a constant group delay, since group delay is defined as the derivative of the phase response with respect to frequency. The Chebyshev filter has a steeper rolloff but more ripple in the passband. The Elliptic filter has the steepest rolloff. For a simple anti-aliasing filter, often times a simple single-pole passive RC filter is acceptable. In other cases an active filter works well. One advantage of an active filter is that for multi-order filters, the operation of the filter is less sensitive to the values of the external components, in particular, the 'Q' value of the filter.

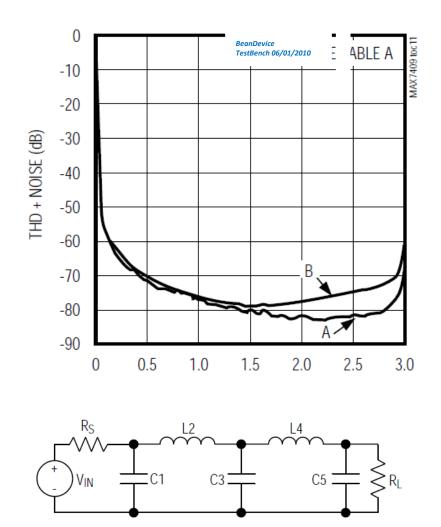
12.2.1.5 Anti-aliasing filter features

specifications	Typical
Type of Lowpass filter	5-th Butterworth response
Total harmonic distortion plus Noise (THD + N)	-81 dB
Typical Harmonic Distortion	-86,4 dB
Cutoff frequency (or corner frequency)	Configurable from the BeanScape® :
	AX-3D : 0 à 2 KHz
	AX-HD : 0 à 2 KHz
	HI-INC : 0 à 60 Hz

Table 4: Frequency & Phase response curve cutoff frequency 1 KHz



Total Harmonic Distortion plus Noise vs Input signal amplitude



5th-order Ladder Filter network

12.2.1.6 Analog Digital Converter

The Analog-to-Digital (16-bits) converter is based on a true SAR (Successive Approximation Register) architecture with no missing codes.

The ADC integrates an internal temperature sensor, which is useful for performing a system calibration. The internal reference is temperature-compensated to within 10 mV. The reference is trimmed to provide a typical drift of ±10 ppm/°C.

12.2.2 BeanDevice[®] HI-INC & HI-INC Xrange

12.2.2.1 Sensor architecture

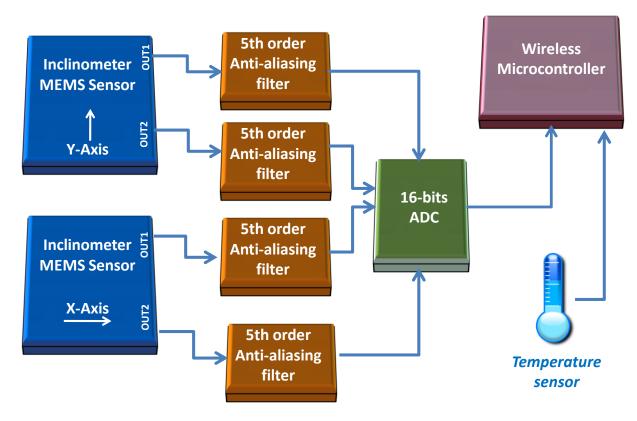
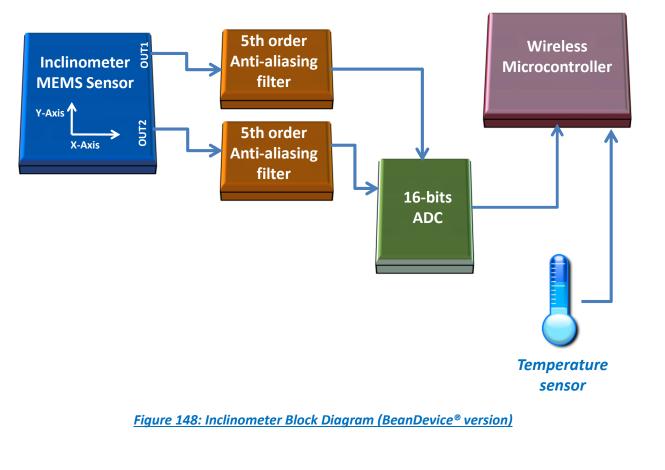


Figure 147: Inclinometer Block Diagram (BeanDevice® HI-INC ±30° and ±15° versions)



12.2.3 Inclinometer Block Diagram (BeanDevice® version)



12.2.4 MEMS Inclinometer & differential output

The BeanDevice[®] HI-INC integrates a 3D-MEMS-based single axis inclinometer that uses the differential measurement principle. The high calibration accuracy combines extremely low temperature dependency, high resolution and low noise together with a robust sensing element design, to make the BeanDevice[®] HI-INC an ideal choice for high accuracy leveling instruments.

The inclinometer used on the BeanDevice[®] HI-INC $\pm 15^{\circ}$ and $\pm 30^{\circ}$ provides a differential output: the measuring axes of the sensing elements are mutually opposite in direction, thus providing two inclination signals which can be differentiated externally by our wireless processor.

The differential measurement principle removes all common mode measurement errors. Most of the error sources have similar effects on both sensing elements. These errors are removed from measurement result during signal differentiation. The differential measurement principle gives very efficient noise reduction, improved long term stability and extremely low temperature dependency.

12.2.5 5th order Anti-aliasing filter

Same specifications as BeanDevice® AX-3D

12.2.6 Analog to digital converter

Same specifications as BeanDevice® AX-3D

12.2.7 Accuracy considerations

Main error components are:

Zero Point Error

In most cases the most significant error component is the zero point error. In the range -25 ... +85°C it is ±0.057° (6 δ limit) and the temperature dependence is typically ±0.002°/°C. The room temperature variation can be reduced by calibration at the instrument level and the effects of the temperature dependence dealt with by using temperature compensation.

Error Caused by the SIN Function:

When used as an inclinometer, the output of the accelerometer is proportional to 1g * SIN (Phi + Phi0), where Phi is the inclination angle and Phi0 the internal mounting error. The internal mounting error is a maximum of ±2.9°, corresponding to ±50mg. This error is of importance when using large inclination angle amplitudes and is seen as an addendum to the non-linearity (Typically ±5mg in ±0.5g and ±10mg in ±1g).

Cross-axis Sensitivity

The cross-axis sensitivity (4%) shows how much perpendicular acceleration or inclination is coupled to the signal.

Rectification of Vibration

The effect of high frequency vibration is strongly suppressed by the over-damped sensing element (upper cutoff freq. $f_{-3dB} = 0 \dots 10Hz$). In an extreme case, high amplitude vibrations (>5g) may cause a measurable zero point shift.

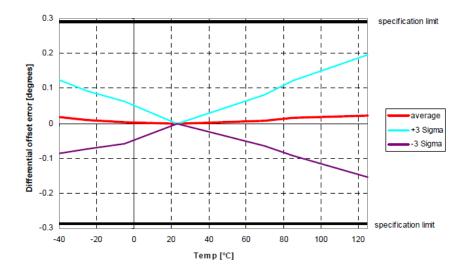
12.2.8 Offset & temperature dependencies

To achieve the best possible accuracy, an internal temperature sensor is used for sensitivity temperature dependency compensation. By using an additional 3rd order polynome compensation curve based on average sensitivity temperature dependency curve and temperature measurement information, it is possible to reduce sensitivity temperature dependency from:

- ✓ 0.013%/°C down to 0.005%/°C for the BeanDevice[®] HI-INC ±15° and ±30° versions
- ✓ 0.014%/°C down to 0.008%/°C for the BeanDevice[®] HI-INC ±90°

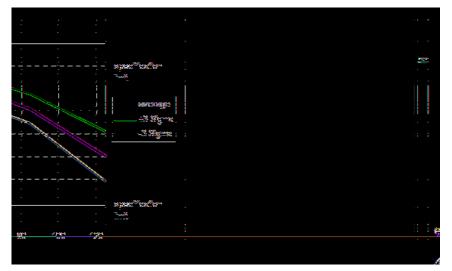
Typical offset and sensitivity temperature dependencies of the inclinometer sensor are presented in following diagrams. These results represent the typical performance of inclinometer sensor components. The mean value

and 3 sigma limit (mean ± 3× standard deviation) and specification limits are presented in following diagrams. The 3 sigma limits represents 99.73% of the inclinometer sensor population.



Temperature dependency of the inclinometer sensor offset (differential output)





12.2.9 BeanDevice® AX-3DS

12.2.9.1 Mems Sensor architecture



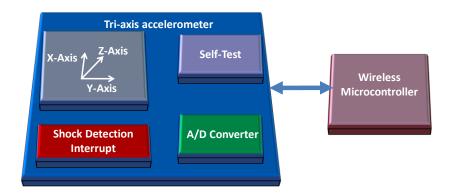


Figure 149: BeanDevice® AX-3DS mems Sensor architecture

12.2.9.2 Shock detection trigger

The shock detection trigger allows the BeanDevice[®] AX-3DS to wake up when a threshold is reached. The threshold value can be modified from the BeanScape[®].

This feature is used for "Smart shock detection" data acquisition mode.

12.2.9.3 <u>BeanDevice[®] current consumption in sleeping mode with SSD activated (Smart shock detection)</u>

When SSD is activated, the BeanDevice will wake up if a shock is detected. During the sleeping mode of the BeanDevice[®], the sensor will continue to track a shock event.

Depending on the sampling rate of the accelerometer during sleeping, the BeanDevice[®] current consumption can change:

Accelerometer sampling rate during sleeping	BeanDevice [®] AX3DS Current consumption
0,5 Hz	21 μΑ
1 Hz	31 μΑ
2 Hz	50 μΑ

SmartSensor User Manual

2.4GHz wireless sensors

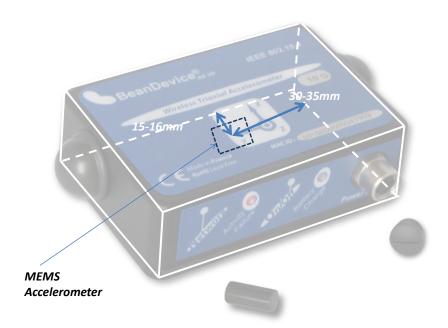
5 Hz	78 μA
10 Hz	130 μΑ
50 Hz	302 μΑ
100 Hz	308 μA
400 Hz	343µA
1000 Hz	413 μΑ

Table 5 : BeanDevice® AX-3DS power consumption for a given sampling rate

For further information about the SSD (Smart Shock Detection) measurement mode, read the technical note TN RF 008 – "Data acquisition modes available on the BeanDevice®"

12.2.10 Sensor position inside the casing

12.2.10.1 BeanDevice® AX-3D



Position of the MEMS Accelerometer



Figure 150: Overview: MEMS Accelerometer in BeanDevice® AX-3D

12.3 APPENDICE 3: MAINTENANCE & SUPERVISION (FOR EXPERIENCED USER)

This section allows to an experienced user to configure correctly the Wireless Sensor Networks.

12.3.1 Extending battery life

The battery autonomy depends on several parameters:

- ✓ The environment where the BeanDevice[®] is deployed
- ✓ Data acquisition mode which is configured

The table below presents the BeanDevice® current consumption during radio TX or during sleep phase:

BeanDevice [®] version		Current consumption in sleep phase at 25°C, powered by a battery of 3.6V
BeanDevice® AX-3D & BeanDevice® AX-3D XRange	60-61 mA	< 30 uA

BeanDevice [®] HI-INC	70-73 mA	<30uA
BeanDevice [®] HI-INC XRange		
BeanDevice [®] INC		
BeanDevice® AX-3DS	50-55 mA	<30uA
BeanDevice® AX-3DS XRange		

For further information, please read the technical note <u>"TN_RF_002 V1.0 - Current consumption in</u> active & sleeping mode"

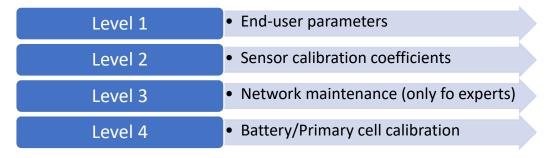
The following table gives you a list of recommendations in order to extend the battery autonomy of your BeanDevice[®]:

Influence factors on battery lifetime	Observations	Recommendations
Sleeping power mode on your BeanDevice®	Sleeping power mode can be configured on the BeanDevice® from the BeanScape®	By activating this power mode on your BeanDevice [®] , you will increase the battery autonomy of your BeanDevice [®] . By activating sleeping power mode, the BeanDevice [®] current consumption can decrease from 30 mA to 10-45 micro-amperes. For further information, please read the technical note <u>TN_RF_010 –</u> <u>« BeanDevice[®] Power Management »</u>
Sampling rate in streaming mode	Power consumption will grow with the sampling rate.	Choose the right sampling rate on your BeanScape [®] interface.
Packet Error Rate (PER)	A high packet error rate can cause a higher retransmission data and this increase the current consumption.	Try to replace your BeanDevice [®] in an area where the radio link is much better (see Link Quality Indicator value).

12.3.2 Over-the-air Configuration (OTAC) parameters backed up on Flash

The BeanDevice[®] integrates an internal flash memory used for backing up OTAC (Over-the-air configuration) parameters.

This memory is organized into several levels:



12.3.2.1 Level 1: End-user OTAC parameters

The following table presents all the defaults configuration parameters:

	BeanDevice® version						
Parameter	AX3D & AX-3D Xrange	HI-INC & HI-INC XRange	AX-3DS & AX-3DS XRange				
Power Mode	Active	Active	Active				
Data Acquisition duty cycle	10s	10s	10s				
Acquisition duration time	ОК	ОК	ОК				
Sampling rate	ОК	ОК	ОК				
Data Acquisition mode	LowDutyCycle	LowDutyCycle	LowDutyCycle				
Alarms Threshold	H1 :2 ou10 H2 :2 ou 10 S2 :-2 ou -10 S1 :-2 ou -10	H1 :20 H2 :20 S2 :0 S1 :0	H1 :20 H2 :20 S2 :0 S1 :0				
Anti-aliasing Filter cut-off frequency	100 Hz	10 Hz	10 Hz				

Table 6: End-user OTAC parameters

To restore these defaults parameters, you must perform a *Network context deletion*.

The "Network" non-contact button is outside the product. Hold the magnet on the button network ("Network") for more than 2 seconds.



Figure 151: Network reed non-contact button

Level 2, 3 & 4 of Configuration parameters are not affected by network context deletion (by hardware or software)

12.3.2.2 Level 2: Sensor calibration parameters

The table below presents the sensor calibration parameters depending on BeanDevice[®] version:

	BeanDevice [®] Version					
Parameter	AX3D & AX-3D Xrange	HI-INC & HI-INC XRange	AX-3DS & AX-3DS XRange			
Sensor gain	ОК	ОК	ОК			
Sensor offset	ОК	ОК	ОК			

Network diagnostic from your BeanScape[®] software

The BeanScape[®] provides network diagnostic information which is described in this chapter.

12.3.2.3 Displaying Network information

- 1. Launch your BeanScape[®] application
- Select your BeanDevice[®] profile, a new tab "Advanced func." will appear in your BeanScape[®] toolbar;
- 3. Click on this tab, and then click on "BeanDevice[®] health status (history)".

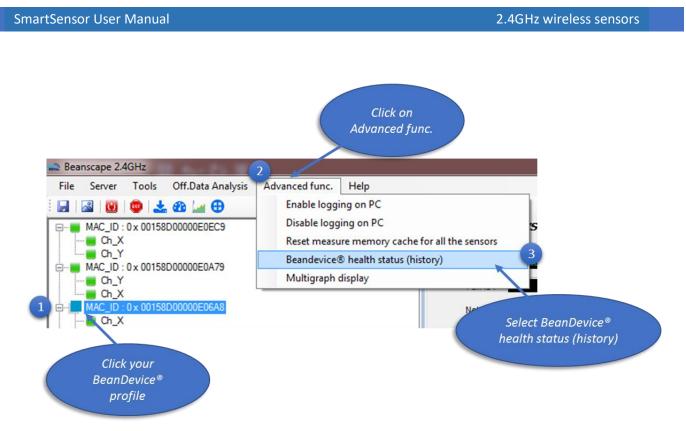
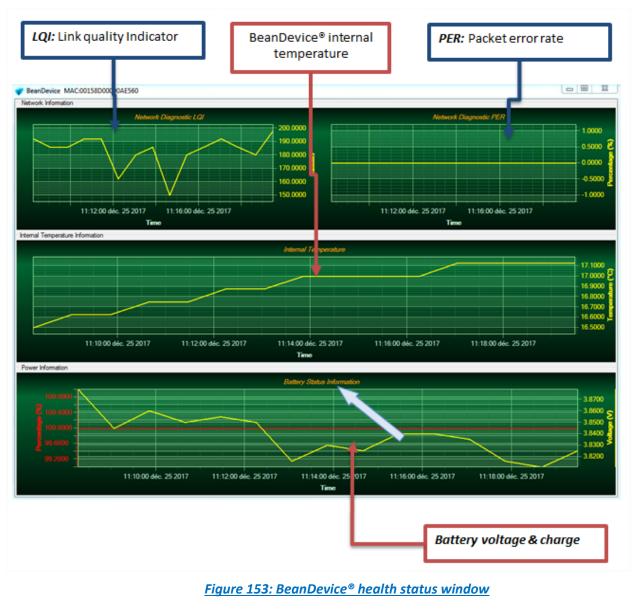


Figure 152: BeanDevice® health status option

A new window occurs:



12.3.2.4 Packet Error Rate

Packet error rate (PER) is the number packet errors divided by the total number of transferred packets during a studied time interval. PER is a unit less performance measure, often expressed as a percentage number.

PER is only available with IEEE 802.15.4 Network; it represents the ratio of "lost data/data send" between the BeanDevice[®] and the BeanGateway[®].

12.3.2.5 LQI (Link Quality Indicator)

LQI (Link Quality Indicator) represents the radio signal quality in your Environment. It is possible that LQI is low due to EMC interference or metal presence in the environment.

If you encounter such problems, several solutions are proposed to increase your LQI:

- ✓ Try to configure your receiver antenna and your transmitter antenna on the same antenna pattern (cf. the Beam with of your antenna)
- ✓ Use a high gain antenna (in outdoor use only) for a better RF Link Budget
- ✓ Fix your BeanDevice & BeanGateway on a top of a mast or a building.



12.3.2.6 Internal temperature monitoring

An internal temperature sensor is used for onboard & battery temperature monitoring

12.3.2.7 Battery charge monitoring

Battery charge is based on current accumulation. The BeanDevice[®] integrates a current accumulator circuit which facilitates remaining capacity estimation by tracking the net current flow into and out of the battery. Current flow into the battery increments the current accumulator while current flow out of the battery decrements it.

Voltage measurement corresponds to battery voltage.

12.3.3 Scrolling menu « BeanDevice »

The BeanDevice[®] scrolling menu provides access to additional features: like the multi-graph mode (display of multiple windows on a graph measuring the same screen), deleting graphs displayed and the activation / deactivation of logging measurements.

To access to this scrolling menu, click on the sensor attached to your BeanDevice[®]. You will then see the BeanDevice[®] scrolling menu appearing.

File Server Tools Off.Data Analysis Advanced func. Help Image: Mac_iD: 0 x 00158D00000E0EC9 Image: Mac_iD: 0 x 00158D00000E06A3 Image: Mac_iD: 0 x 00158D00000E02A9 File Server Tools Off.Data Analysis BeanSensor Help Image:	🕰 Bea	nscape 2.	4GHz	l'anne i				
Image: Mac_ID : 0 x 00158D00000E0EC9 Image: Mac_ID : 0 x 00158D00000E06A8 Image: Mac_ID : 0 x 00158D00000E06A8 Image: Mac_ID : 0 x 00158D00000E02A9 File Server Tools Off.Data Analysis BeanSensor Help Image:	File	Server	Tools	Off.Data A	nalysis	Advanced func.	Help	
MAC_ID: 0 x 00158D00000E0A79 MAC_ID: 0 x 00158D00000E0GA8 MAC_ID: 0 x 00158D00000E02A9 File Server Tools Off.Data Analysis BeanSensor Help MAC_ID: 0 x 00158D00000E02A9 File Server Tools Off.Data Analysis BeanSensor Help MAC_ID: 0 x 00158D00000E0EC9 MAC_ID: 0 x 00158D00000E0A79 MAC_ID: 0 x 00158D00000E0A79 MAC_ID: 0 x 00158D00000E0A8 MAC_ID: 0 x 00158D00000E0A8		a 🙋	۵ 🕹	🚳 🕍 🖯	•			
MAC_ID : 0 x 00158D00000E0EC9 MAC_ID : 0 x 00158D00000E0A79 MAC_ID : 0 x 00158D00000E06A8 MAC_ID : 0 x 00158D00000E06A8 Ch_X Ch_X Ch_Y	÷	MAC_ID : MAC_ID :	0 x 001580 0 x 001580	000000E0A7	9 8			
MAC_ID : 0 x 00158D00000E0EC9 MAC_ID : 0 x 00158D00000E0A79 MAC_ID : 0 x 00158D00000E06A8 MAC_ID : 0 x 00158D00000E06A8 Ch_X Ch_Z Ch_Y			File	Server	Tools	Off.Data Analysis	BeanSensor	Help
MAC_ID : 0 x 00158D00000E0A79 MAC_ID : 0 x 00158D00000E06A8 MAC_ID : 0 x 00158D00000E06A8 Gh_X Gh_Z Gh_Y				🛛 🖉	0 🛃	a 🙆 🕍 🤁		
				MAC_ID : MAC_ID : 	0 x 00158 0 x 00158	3D00000E0A79		
			÷	MAC_ID :	0 x 00158	BD00000E02A9		

Figure 154: BeanDevice® Scolling menu

By clicking on the scrolling menu « BeanSensor », you can access to the following features :

12.3.3.1 Disable/Enable log

All the data received on the BeanScape® are stored in a log file in CSV format.

This feature allows you to Enable / Disable data logging on your log file.

File Server Tools Off.Data Analysis	BeanSensor	Help
🛃 📓 🔮 📥 🏤 🕀	Disable	log
● MAC_ID: 0 x 00158D00000E0EC9 ● MAC_ID: 0 x 00158D00000E0A79 ● MAC_ID: 0 x 00158D00000E06A8 ● Ch_X ● Ch_Z ● Ch_Y ● MAC_ID: 0 x 00158D00000E02A9	Buffer R Open th	eset le graph in a new window
Beanscape 2.4GHz File Server Tools Off.Data Analysis	BeanSensor	Help
File Server Tools Off.Data Analysis	BeanSensor Enable le	Help
	Enable le Buffer R	og



12.3.3.2 Buffer reset

This function clears the graphical display concerning recorded measurements of your sensor. The data stored in a log are not affected by this function.

By clicking on « Buffer reset », a second window appears asking you to confirm your choice:

- Yes, you accept to delete the whole measure data of this BeanSensor;
- No, don't delete the whole measure data of this BeanSensor;

Beanscape 2.4GHz	
File Server Tools Off.Data Analysis	BeanSensor Help
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	Open the graph in a new window
MAC_ID : 0 x 00158D00000E06A8	General
	Ту
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Figure 156: BeanSensor: Buffer Reset option

Beanscape 2.4GHz			
File Server Tools Off.Data Analysis	BeanSensor	Help	
📕 📓 🕘 🔹 🏤 🕍 🕀	Enable	og	
	Buffer R	eset	
MAC_ID: 0 x 00158D00000E0A79	Open th	e graph in a new window	
MAC_ID : 0 x 00158D00000E06A8			General
Gh_Z Ch_Z ⊕ Ch_Y ⊕ MAC_ID : 0 x 00158D00000E02A9		Are you sure you want d BeanSensor ?	elete the whole measure data of this
			Oui Non

Figure 157: Buffer Reset

12.3.3.3 Open the graph in a new window

By clicking on "Open the graph in a new window", you can open a graph corresponding to your sensor.

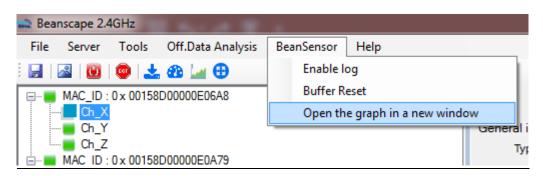


Figure 158: BeanSensor: Open the graph in a new window

You can easily open several graphs in a window.

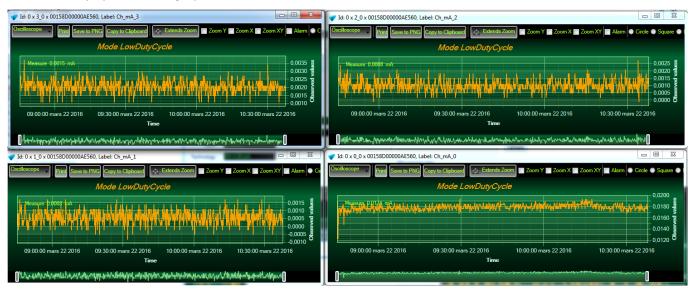


Figure 159: Graphs opened in separated windows

The multi-graph mode requires a lot of resources on your computer, it is recommended to install the BeanScape® software on a powerful computer.

12.4 APPENDICE 4: TROUBESHOOTING

✓ Why the Red LED is flashing?

Each time a packet is lost by the BeanDevice[®], Nwk/Activity led will blink in red. Try to decrease the wireless range between the BeanGateway[®] and the BeanDevice[®].

✓ Why the BeanDevice[®] LEDS are not activated?

If there is no wireless network activity, the led will be inactive. Make sure you have powered your BeanDevice[®] with a charged battery.

✓ What should I do if interference is present on the radio channel?

Please turn off your BeanDevice [®], and then choose an appropriate channel. The channel selection is done from the BeanGateway [®].

For further information, please Read BeanGateway User's Manual BeanGateway [®].

Why the BeanDevice[®] does not provide the right measurement value?

- Check if your sensor channel is activated on your BeanScape[®] interface (ON Position)?;
- Check if your BeanDevice[®] is powered up;
- Check your LQI quality, if your LQI is under 50-60. You must change your antenna position, or your product position;

- Check your data acquisition mode, maybe you have specified a data acquisition which is too long;
- ➢ If you use a BeanDevice[®] AN-XX :
 - Check your sensor power supply, maybe you need to increase/decrease your power supply;
 - Check your sensor preprocess time. Maybe your sensor preprocess time is too short?
 - Check the wiring code of your sensor plug;
- Why the BeanDevice[®] doesn't respond when I try to configure it (Over-the-air-configuration)?
 - ✓ If your BeanDevice[®] operates with sleep phase, the RF Hardware operates also with a sleep phase. Therefore an Over-the-air-configuration will not be possible.
 - Check the LQI (Link Quality Indicator) value, if this value is under 80, the over-the-air configuration will not be easy. Try to decrease the wireless range between the BeanDevice[®] and the BeanGateway[®].
 - ✓ If your BeanDevice[®] works in streaming mode, in order to keep a full synchronization of the data acquisition, any over-the-air-configuration is authorized.
- Why do I have too much noise on my sensor signal?
 - ✓ If you use a BeanDevice[®] AX3D/HI-INC/AX-3DS: don't forget to configure the cutoff frequency of your anti-aliasing filter
 - ✓ If you use a BeanDevice[®] AN-mV: use a shielded cable.
- Why I see 1g on the axis pointing to the ground?
 - Accelerometers are devices that measure acceleration, which is the rate of change of the velocity of an object. They measure in meters per second squared (m/s2) or in G-forces (g). A single G-force for us here on planet Earth is equivalent to 9.8 m/s2 = 1g.
 - ✓ The gravitational force has three vector components, in X, Y & Z directions, the accelerometer should read 1g on the Z axis (Z axis is pointed to the ground), it's usual to view 1g on this axis as it's the gravity. Our sensors are MEMS based and are working between DC to 800Hz. It's a normal behavior.

12.5 APPENDIX 5: SENSOR CALIBRATION

12.5.1 Factory Calibration procedure

12.5.1.1 Beandevice[®] HI-INC/INC & HI-INC Xrange (Wireless Inclinometer)

The calibration procedure is based on a side-by-side comparison with a reference tiltmeter (Level development, Ref: SOLAR-2-05-1-RS232, accuracy $\pm 0.01^{\circ}$ on the FS). For a better measurement stability, the two tiltemeters are mounted on a sinus table (Mecamag, ref: 1005/02/175100S, accuracy ± 5 seconds, planity $\pm 0.005/100$ mm).

12.5.1.2 BeanDevice[®] AX-3D/AX-3DS & AX-3D Xrange (Wireless Accelerometer)

A static calibration method is used to calibrate the sensor.

12.5.2 Re-calibration

Depending on the operating environmental conditions, the following table summarize how often user should recalibrate its sensor:

BeanDevice® version	Operating temperature < 40°C	Operating temperature > 40°C
BeanDevice [®] AX-3D & BeanDevice [®] AX-3D Xrange	6 years	3 years
BeanDevice [®] AX-3DS	3 years	2 years
BeanDevice HI-INC, BeanDevice [®] HI-INC Xrange and BeanDevice [®] INC	-	3 years

Click here for more information about calibration settings

12.6 FIREWALL EXCEPTION FOR BEANSCAPE®

By default, firewall blocks all unknown network traffic coming in to the network. To permit traffic through the firewall we create exceptions (or rules) that allow certain traffic on the network. In our case the rules are defined by the software which is BeanScape.

Usually when launching BeanScape for the first time your Windows OS will ask you to add an exception and to allow the software to use your network resources, however in case this doesn't occur or rejected, manually adding BeanScape to exceptions list is possible through these following steps:

1. Use your Search bar at the windows launcher and look for "Allow an app through Windows Firewall"

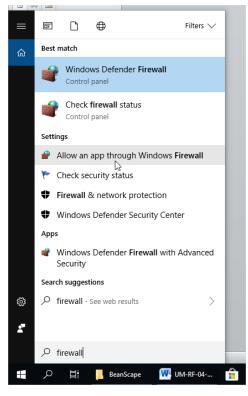


Figure 160 : Windows search for firewall screenshot

2. Look for BeanScape in the list and check its box, check Private if you are only willing to use BeanScape in your LAN or Public for allowing remote access from outside the LAN.Validate and your BeanScape will be allowed in your network.

tSensor User Ma	anuai			2.40 П	z wireless ser	1501
Allowed apps						
				-		
- → × ↑ 👉 > Control F	Panel > System and Security > Windows Defender Firewall > Allowed apps			√ Ū	Search Control Panel	
	Allow apps to communicate through Windows Defen					
	To add, change, or remove allowed apps and ports, click Change setti	-		_		
	What are the risks of allowing an app to communicate?	Ch 😌	ange settir	ngs		
	Allowed apps and features:					
				_		
	Name	Private	Public	^		
	BeanScape		V			
	Bubble Witch 3 Saga	\checkmark	V			
	Candy Crush Soda Saga	\checkmark				
	Captive Portal Flow	\checkmark				
	Cast to Device functionality	\checkmark	V			
	Connect	\checkmark				
	Connected Devices Platform					
	Core Networking	\checkmark				
	✓ Cortana	\checkmark	✓			
	Delivery Optimization					
	☑ DiagTrack	\checkmark				
	DIAL protocol server	✓		~		
		Details	Remove			
		Allow an	other app.			
		OK	Cance			
		UK	Cance	1		

Figure 161: allowed apps window

If you are not familiar to configure a firewall exception, you can directly from BeanScape[®] add this rule automatically.

On the BeanScape® menu select Tools, then Advanced Settings then click on validate to add BeanScape® to the Firewall.

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		BeanScape® configuration					
×		Alarm Window					
		BeanGateway Ethernet/LAN Cor	nfig.				
7		Export/Import user settings					
-		Log File Reader	Advanced S	ettings			
		Alarm Management					
		SNTP Client	Add Beans	cape To Firewall Validate	Validate		
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	0	Date conversion					
		Advanced Settings					
		OPC Management					
			Figure 10	52: Firewall auto exception			
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