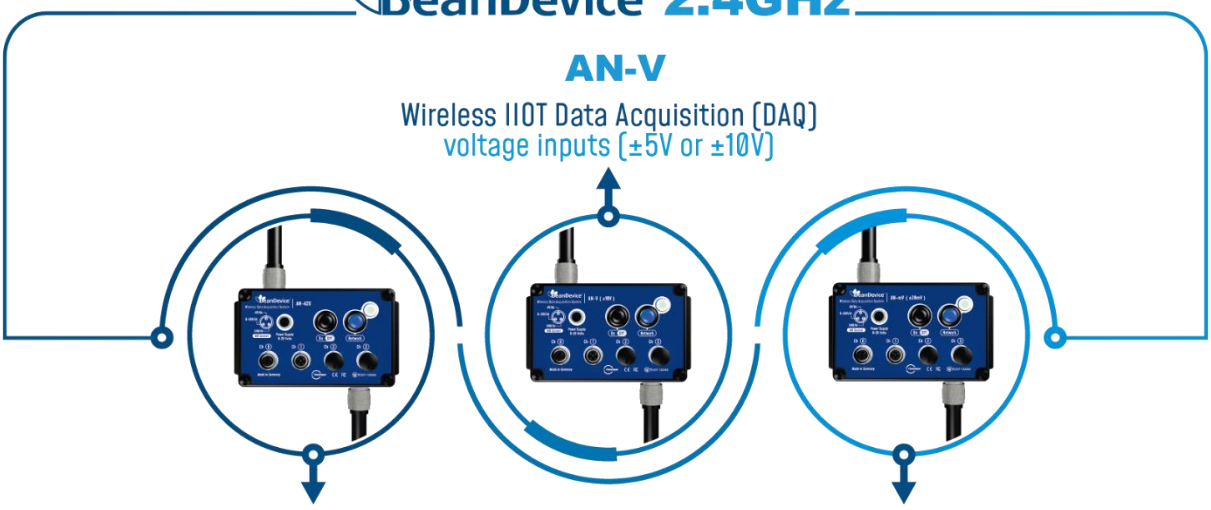
BeanAir
WIRELESS IIOT SENSORS

USER MANUAL

BeanDevice® 2.4 GHz

ProcessSensor

BeanDevice® 2.4GHz



DOCUMENT			
Document ID	UM_RF_05	**Version**	V2.7
External reference	UM_RF_05_ENG_BeanGateway	**Date**	24/06/2019
Author	Youssef SHAHINE, Technical Support Engineer		
		Project Code	
Document's name	BeanDevice® ProcessSensor 2.4GH User Guide		

VALIDATION			
Function	**Destination**	**For validation**	**For info**
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Validation	Shimon Abadi, Technical Support Engineer		✓

DIFFUSION			
Function	**Destination**	**For action**	**For info**
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Reader n°2	Mohamed-Yosri Jaouadi., Embedded software engineer	✓	

UPDATES			
Version	**Date**	**Author**	**Evolution & Status**
1.9	20/07/2012	Christophe Dontegreuil	• BeanDevice® AN-XX Xtender added
2.0	25/06/2015	Maxime Obraztsov	• TimeSync function added
2.1	21/03/2016	Rasha Friji	• Standalone option • Battery level display
2.2	21/04/2016	Rasha Friji	• Antenna specifications updated • Further description about sensor wiring code
2.3	22/12/2016	Salah Riahi	• Exporting a log file to Excel video added
2.4	14/02/2018	Youssef SHAHINE	• Ref to Xtender deleted • 2.4GHz Logo added
2.5	01/08/2018	Aymen Jegham	• Screenshots updated • Vocabulary updated

UPDATES			
2.6	29/04/2019	Youssef shahine	• M8 Molded cabe for external power supply added
2.6.1	29/04/2019	Mohamed Bechir Besbes	• Weblinks update
2.7	24/06/2019	Mohamed Bechir Besbes	• Examples of integration with analog sensors • Calibrate the BeanDevice ProcessSensor • Firewall Exception for BeanScape

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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*
	***Caution or Warning** – 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.*
	***Danger** – This information MUST be followed if not you may damage the equipment permanently or bodily injury may occur.*
	***Tip or Information** – Provides advice and suggestions that may be useful when installing Beanair Wireless Sensor Networks.*

3. ACRONYMS AND ABBREVIATIONS

AES	Advanced Encryption Standard
CCA	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
MAC	Media Access Control
PAN	Personal Area Network
PER	Packet error rate
RF	Radio Frequency
SD	Secure Digital
WSN	Wireless sensor Network

4. DOCUMENT ORGANISATION

This manual is organized in 7 chapters, as follows:

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

5. BEANDEVICE® PRODUCT OVERVIEW

It is highly recommended to read all the user manual related to Beanair software & equipment (BeanScape ®, BeanGateway®, BeanDevice ®) before getting start your BeanDevice®.

5.1 INTRODUCTION TO PROCESSSENSOR PRODUCT LINES

ProcessSensor product line comes with Wireless analog DAQ compatible with a large scale of analog sensors:

- Analog voltage ±5V and ±10V
- Analog low voltage ±20mV compatible with strain gauge sensor
- Analog current loop 4-20 mA

It comes with advanced features:

- ✓ High measurement precision (less than ±0.08% on the full scale)
- ✓ Providing power supply to external analog sensors (user configurable: 4.5V up to 20V)
- ✓ Back Up data acquisition on an internal flash memory (embedded data logger)
- ✓ Transmitting data by wireless
- ✓ Compatible with sleep or active power mode

BeanDevice® AN-420	Wireless system acquisition for analog 4-20 mA current loop measurement.
BeanDevice® AN-V	Wireless system acquisition for analog differential measurement ±5 volts or ±10 volts.
BeanDevice® AN-mV	Wireless system acquisition for analog differential measurement ±20 mV This product is dedicated to sensors integrating a Wheatstone bridge (strain gauge sensors, load cell sensors, pressure…).

Industrial sensors commonly use a 4-20 mA DC signal. With this method, the sensor signal is conveyed as a current. Raw output of the sensor will either be 4 mA at the lowest or 20 mA at the highest. By examining the current between 4 and 20 mA an actual reading can be determined. For example, assume an air temperature sensor has a range of 0°C to 100°C. If the output from the temperature sensor is 4 mA, then the temperature is 0°C. If the output from the sensor is 20 mA, then the temperature is 100°C. Readings between 4 and 20 mA are linear and simple to determine.
One of the major advantages of using 4-20 mA sensors is the limited signal loss of these devices. By outputting a sensor signal in the form of current, electrically noisy areas do not have an effect on the sensor's readings. Furthermore, accuracy is not affected by changes in line and connection resistance, or by the addition of other loads in the circuit.

5.2 BEANDEVICE® TECHNICAL SPECIFICATIONS

5.2.1 Common technical specifications

5.2.1.1 RF specifications

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
TX Power	+18 dBm
Receiver Sensitivity	-104 dBm
Maximum Radio Range	650m (Line of Sight) , 30-100m (Non Line of Sight)
Antenna diversity	· 2 omnidirectional N-Type antenna · Gain 5 dBi · Waterproof IP67

Table 1: RF specifications Table

5.2.1.2 Embedded Data logger

Embedded Data logger	
Storage capacity	up to 1 million data points
Wireless data downloading	3 minutes to download the full memory (average time)

Table 2: Embedded Data Logger Table

5.2.1.3 TimeSync: Time Synchronization over the Wireless Sensor Networks (WSN)

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

Table 3: TimeSync function Table

5.2.1.4 Environmental and Mechanical

Environmental and Mechanical	
Casing	Aluminum, Watertight IP65 – Fire Protection : ULV94/Getex
	casing dimensions (w/o antenna) L x l x h : 146.05mm x 65.5mm x 33.5mm
	Weight : 550g
Shocks resistance	50g 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)
	ROHS - Directive 2002/95/EC

Table 4: Environmental and Mechanical Table

5.2.1.5 Power Supply

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 : 70mA to 130 mA (depends on external sensor power supply)
	· During Radio transmission : 70 mA
	· During sleeping: < 35 µA
External power supply	External power supply : +8v to +28v
Rechargeable battery	Lithium-Ion high density rechargeable battery capacity of 950 mAh

Table 5: Power Supply specifications table

5.2.1.6 Options

Option(s)	
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**
M12 Plastic ABS plug for sensors	M12-4 Pins Male plug for sensor interface Coding : A , Locking type: Fix screw, Material: Plastic ABS IP Rating: IP67 in locked condition **Ref: M12-PL-SENSOR**
M12 Aluminum plug for sensors	M12-4 Pins Male plug for sensor interface Coding : A , Locking type: Fix screw, Material: Aluminum IP Rating: IP67 in locked condition **Ref: M12-AL-SENSOR**
Antenna cable	N-Type cable (Male/Male), Cable type: RF-5/H155 Cable length: 1 meter, **Ref: CBL-ANT-1M** Cable length: 2 meters, **Ref: CBL-ANT-2M** Cable length: 3 meters, **Ref: CBL-ANT-3M** Cable length: 5 meters, **Ref: CBL-ANT-5M** Cable length: 10 meters, **Ref: CBL-ANT-10M**
High Gain antenna option	High Gain Omnidirectional antenna Frequency range 2400-2500MHz VSWR < 1.4, Impedance 50 Ohm, Polarization Vertical Vertical plane 24° (7dBi Gain version), 16°(7dBi Gain version), 6°(12dBi Gain version), Horizontal plane 360° Connector N female, Wind load (170km/h) 7.3N Included: N-Type cable (Male/Male), length: 1 meter Gain: 7dBi, Dimensions 360mm x 23mm, Weight 0.44 kg, **Ref: HG-OMNI-OUT-7DBI** Gain: 9dBi , Dimensions 540x23 mm, Weight 0.61 kg , **Ref: HG-OMNI-OUT-9DBI** Gain: 12dBi , Dimensions: 1125mm x 19 mm, Weight 1.06 kg , **Ref: HG-OMNI-OUT-12DBI**
Calibration certificate	Calibration certificate linked to German Accreditation Body (DAkkS)

Table 6: BeanDevice® options table specifications

5.2.2 BeanDevice® AN-420

5.2.2.1 Product reference

Product reference
BND-AN420-4CH

5.2.2.2 Analog data acquisition block specifications

Analog data acquisition specifications	
Signal Conditionning	Analog current loop measurement
Number of channels	4 Channels
A/D Converter	16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation
Measurement range	4-20 mA Current Loop measurement
Non-linearity error	± 0.5 LSB
Measurement accuracy(@25°C)	< 0,1% when plugged on external power supply
	< 0,08% when operating on battery power
Sensor Connector	M12-4Pins coming with an IP rating IP67

Table 7: BeanDevice® AN-420 - Analog data acquisition table

5.2.3 BeanDevice AN-mV

5.2.3.1 Product reference

Product reference
BND-AN-MV–4CH

5.2.3.2 Analog data acquisition block specifications

	Analog data acquisition specifications
Signal Conditionning	Analog low voltage mV
Number of analog inputs	4 Channels
A/D Converter	16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation
Measurement range	±20 mV (bipolar) or 0-40 mV (unipolar)
Non-linearity error	± 0.5 LSB
Measurement accuracy @25°C	< 0,2% when the BeanDevice® is connected to an external power supply
	< 0,4% when the BeanDevice® operates on battery
Sensor Connector	M12-4Pins coming with an IP rating IP67

Table 8: BeanDevice® AN-mV - Analog data acquisition table

5.2.4 BeanDevice® AN-V

5.2.4.1 Product reference

Product reference
BND-ANV–4CH –*MR*
MR** -Measurement Range* ***5 : ±5V measurement range , ***10:*** ±10V measurement range
Example: BND-ANV-4CH-***5*** , ***BeanDevice® AN-V with four channels , measurement range: ±5V***

5.2.4.2 Analog data acquisition block specifications

	Analog data acquisition specifications
Signal Conditionning	Analog voltage measurement
Number of channels	4 Channels
A/D Converter	16 bits - SAR Architecture (Successive Approximation Register) with temperature compensation
Measurement range (analog polarity is configurable from the BeanScape®)	BND-ANV-4CH –***5*** : ±5V (bipolar) or 0-10 V (unipolar)
	BND-ANV-4CH –***10*** : ±10V (bipolar) or 0-20 V (unipolar)
Non-linearity error	± 0.5 LSB
Measurement accuracy *@25°C*	< 0,1% when plugged on external power supply
	< 0,08% when operating on battery power
Sensor Connector	M12-4Pins coming with an IP rating IP67

Table 9: BeanDevice® AN-V - Analog data acquisition table

5.3 PRODUCT FOCUS

Figure 1: Focus on BeanDevice® AN-V/AN-mV/AN-420

Number	Function	Description
1	***M8-3 Contacts Socket for external power supply*** 	***DC 8-28 volts*** power supply The socket sealing is assured with a screw cap ***To keep the BeanDevice® weatherproof, don't forget to protect the M8-3contacts socket with the screw cap provided with yor BeanDevice®.***

2	***Radio antenna***	2x N-Type Radio antenna, waterproof IP67 ***Do not try to change or modify the antenna, you will damage your BeanDevice®.***
3	***ON/OFF push button***	Allows to power up/power off the BeanDevice® **ON: button pushed** **OFF: button not pushed** ***Wait for a minimum of 5 seconds before your power-up the BeanDevice®. The BeanDevice® integrates an energy tank allowing a backup of the WSN context before powering OFF.***
4	***BeanDevice® Activity /Failure led***	Bi-color **GREEN** / **RED Led** Cf. Table for led description
5	***M12-5 Pins female socket for sensor interface***	This socket is compatible with a M12-5 Pins A-Coding male plug.
6	***BeanDevice® product version label***	Three label version are available: ***AN-420***: 4-20 mA current loop measurement ***AN-V***: +/-5 volts or +/-10 volts analog measurement ***AN-mV***: +/- 20 mV or +/-40 mV analog low voltage measurement
7	***Network context push button***	To restore default/factory parameters, you must perform a *Network context deletion*. Push on the push-button ("Network") for more than 2 seconds.
8	***Eyelet for wall mounting***	The BeanDevice® is provided with a wall mounting kit.
9	***M12 sensor cap***	M12 sensor cap ***Don't forget to protect the M12 contacts socket with a screw cap. You will lose the tightness of your device if you do not close properly.***
10	***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.***

5.4 LEDS DESCRIPTION

Operating status	Led Activity Failure
The BeanDevice® is power off & external power supply is connected.	LED OFF
The BeanDevice® is power down with no external power supply connected	LED OFF
The BeanDevice® is power on with wireless TX/RX activity	Green Led: Wireless Network Activity Red Led: Wireless transmission failure
The BeanDevice® is power on	Green led toggling
The BeanDevice® is power off (was power on before)	RED LED ON during 2s

5.5 RF ANTENNA

5.5.1 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.

Figure 2: Antenna Diversity present on the BeanDevice® AN-420/AN-V/AN-mV

5.5.2 Antenna specifications

Specifications	
Antenna Gain	5 dBi
Frequency	2400-2485 MHz
Bandwidth	83,5 MHz
Connector	N-Type (male)
VSWR	<2.5:1
Polarization	Vertical
Nominal impedance	50 Ohm
Weight	50g
Dimensions	length 193 mm
Material	TPE
Operating temperature	-40°C to 85°C

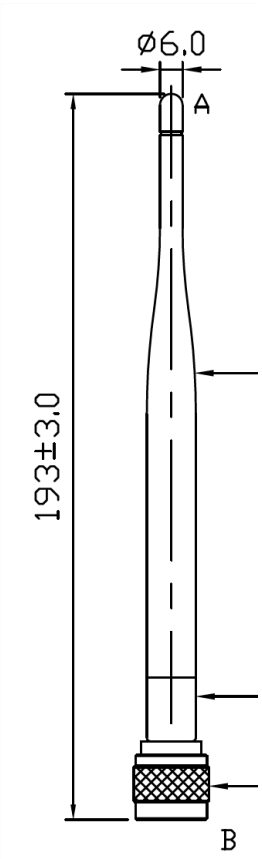


Table 10 : Antenna specifications

5.6 SENSOR INTERFACE

5.6.1 How to connect a sensor on your BeanDevice®?

Several types of sensor can be plugged on your BeanDevice®:

- ✓ Current loop 4-20 mA
- ✓ Analog low voltage measurement ±20 mV
- ✓ Analog differential measurement ±10 V

Connecting a sensor is very easy but it requests to follow up several steps:

Step 1: Access the configuration tab for the selected sensor channel.	•Mount the M12 Plug on your sensor . Follow the wiring code available on this document; • Don't plug your sensor on your BeanDevice® AN-XX; •From your BeanScape® software, click on the sensor profile associated to your BeanDevice®
Step 2: Configure the sensor power supply	• Enter the value of your sensor power supply; • A message appears on the screen, left click on "OK" to confirm.
Step 3: *Connect your sensor on the BeanDevice*	•Plug your sensor on your BeanDevice® AN-XX, an otch on the M12 connector allows a single way connection; •Rotate the dial clockwise until fully tightened (do not overdo the rotating ring) •You can start the calibration of your sensor from the BeanScape®;

Sensors are not provided with the BeanDevice® AN-XX series

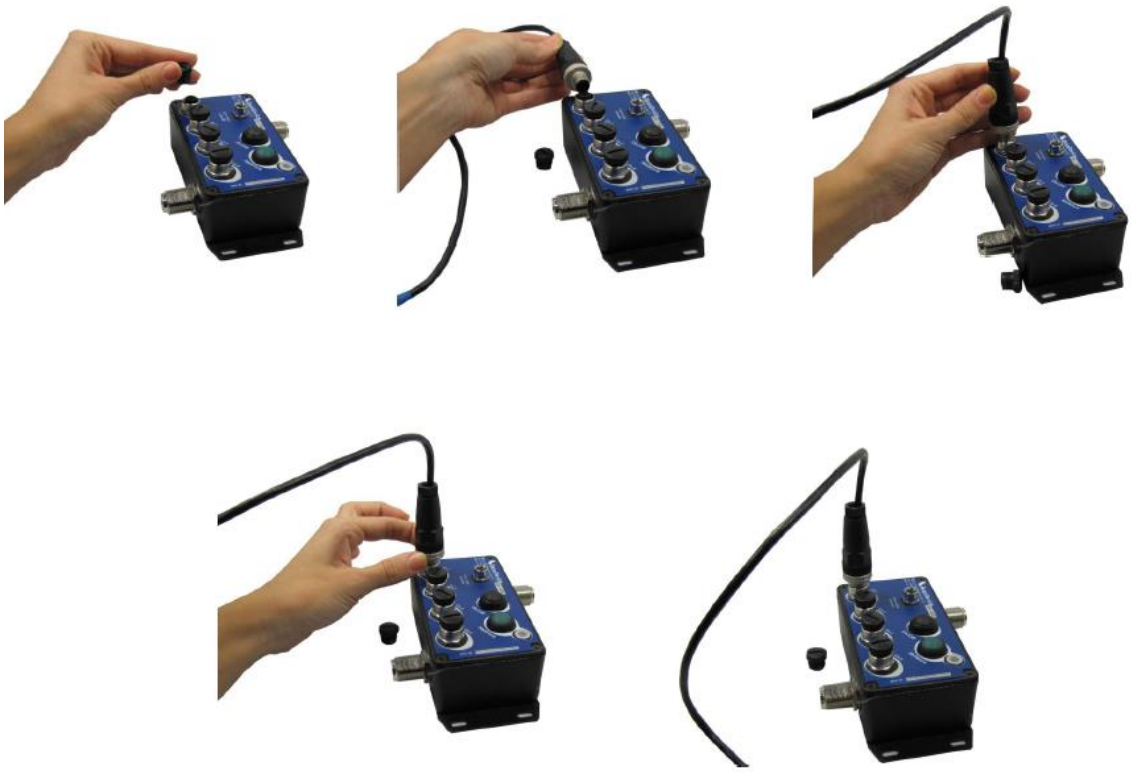


Figure 3: Sensor connection on the BeanDevice®

5.6.2 Sensor power supply

The BeanDevice® AN-XX series can supply power to your external sensor. You can easily configure your sensor voltage from the BeanScape®.

The following table presents technical specifications:

Technical specifications		
Voltage range		4.5-20Volts DC (configurable from the BeanScape®)
Voltage accuracy		0.2%
Maximum current delivered		100 mA
Maximum power delivered to the sensors		1.5W
Pre-process (time required to stabilize the measurement signal)	***Max & Min during***	***Configurable from the BeanScape® software:*** **10 ms minimum** **10000 ms maximum**
	Resolution	20 ms

Table 11: External sensor power supply specifications

In order to optimize the low consumption on the BeanDevice®, the power supply provided to the sensor operates in switching mode:

- ✓ Before performing a measurement, the sensor is powered by the BeanDevice®. The sensor warm-up time is settled by the end-user, it will reflect the time needed to stabilize the measurement signal after the sensor power-up;
- ✓ When all the measurements are done, the sensor is immediately power down;
- ✓ This cycle is repeated each time a data acquisition or a stream of data acquisition must be made;

Example: Sensor power supply is settled at 10 volts with 400 ms warm-up time

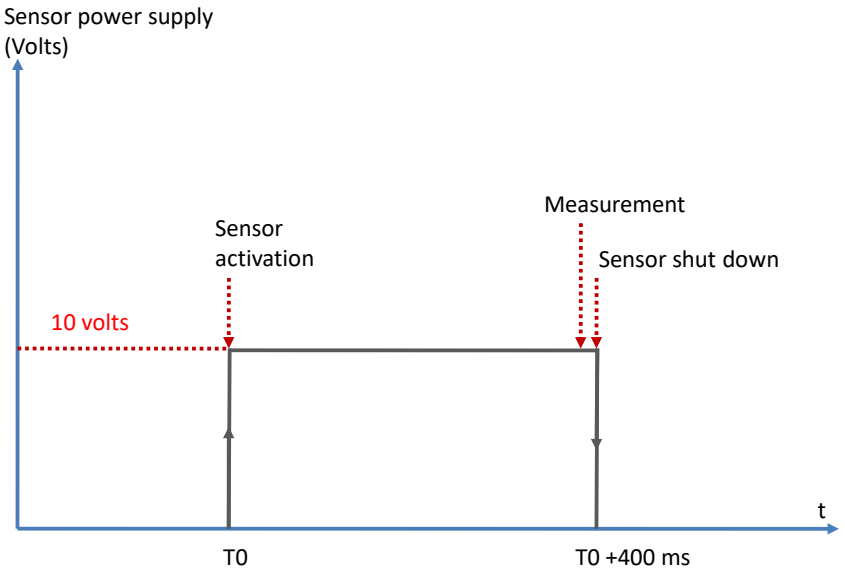


Figure 4: Sensor warm-up time

- ✓ ***Choose a sensor that requires a power supply having a pre-process duration as low as possible, otherwise you will decrease the BeanDevice® battery autonomy.***
- ✓ ***Some sensors require a very long pre-process duration (1-2 minutes) and some other sensors will work with a lot of current consumption. In this case we advise you to power up the sensor with an external power source.***
- ✓ ***If your pre-process period is higher than your data acquisition cycle, it will be automatically adjusted by the BeanDevice®.***

Don't forget to pre-configure the supply voltage and the pre-process duration of your sensor before connecting it. By configuring wrongly, you risk to damage your sensor.

5.6.3 Sensor wiring code (General overview)

Figure 5: M12 socket location the BeanDevice®

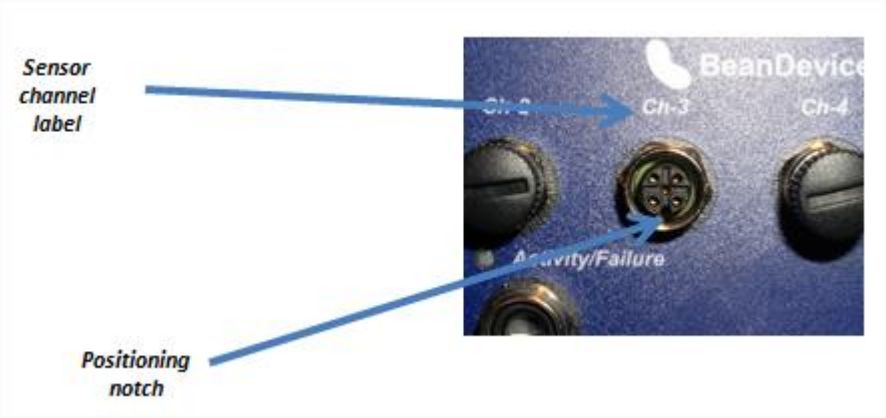


Figure 6: M12 Socket - positioning notch

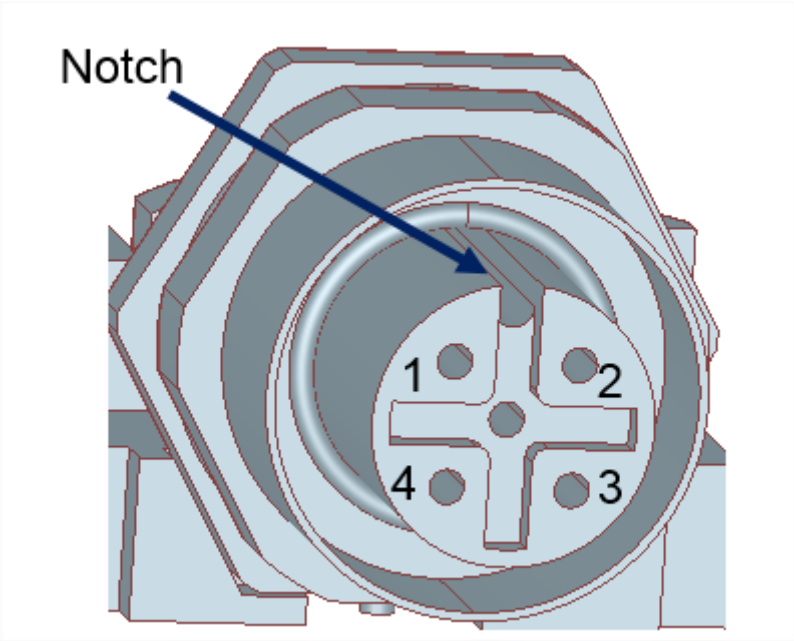
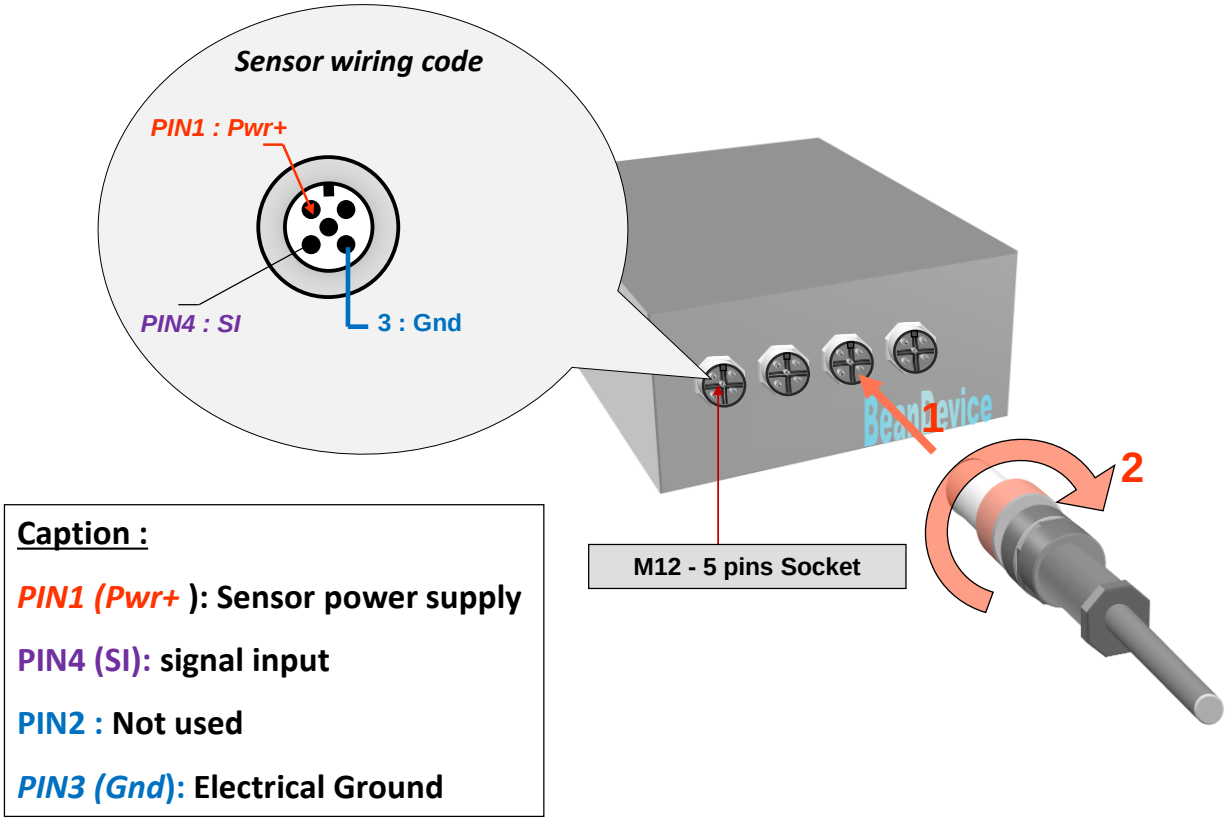


Figure 7: M12 socket Pin assignation

M12-4Pins A-coding should be used

5.6.4 Sensor wiring code (BeanDevice® AN-420)

M12 Socket Wiring code (BeanDevice® AN-420 side)



Caption :

PIN1 (Pwr+ **): Sensor power supply**

PIN4 (SI): signal input

PIN2 : Not used

PIN3 (Gnd)**: Electrical Ground**

Figure 8 : M12 socket Wiring Code (BeanDevice® side)

Caption :

PIN1 (Pwr+): Sensor power supply

PIN4 (SI): signal input

PIN2 : Not used, must be connected to Gnd

PIN3 (Gnd): Electrical Ground

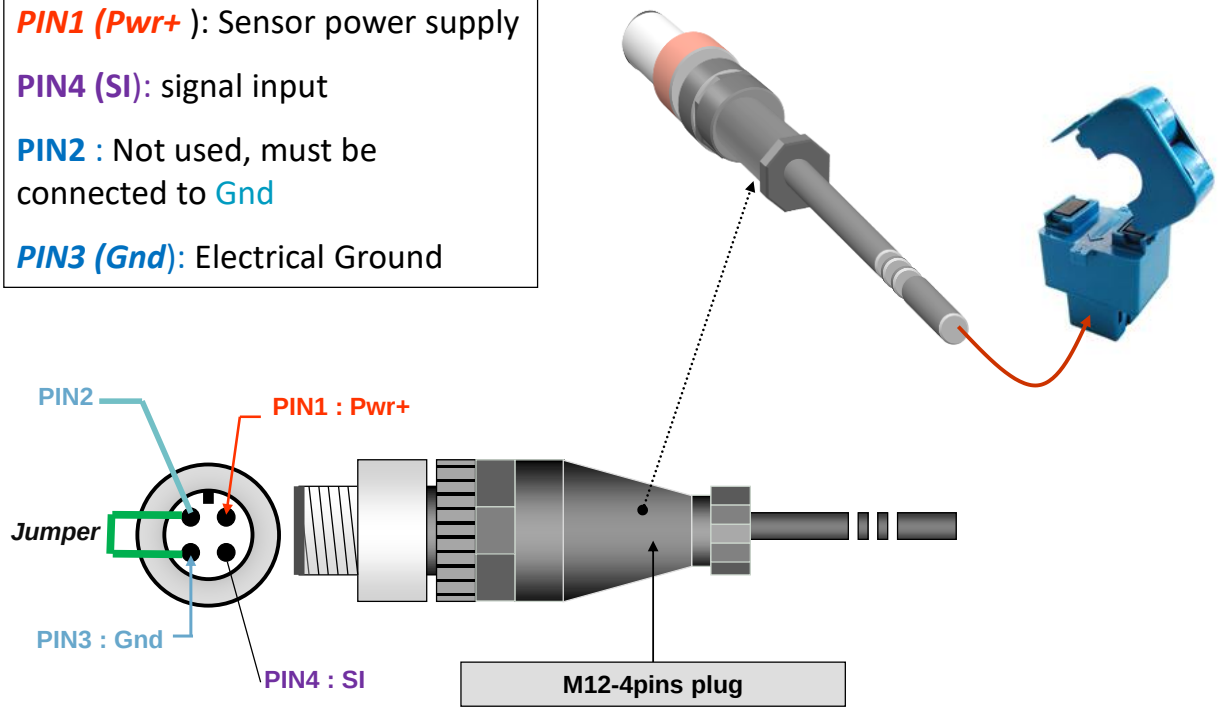


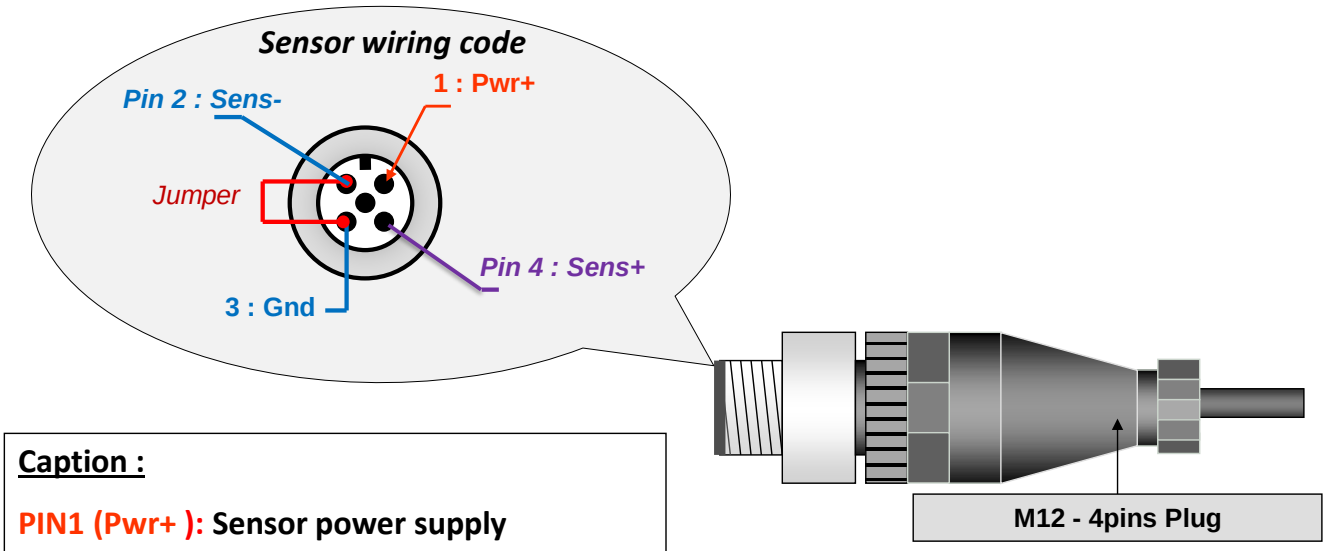
Figure 9: M12-4pins Plug Wiring code (sensor side)

Instructions for connecting a 2-wire sensor:

- ✓ Connect the sensor wire "**Loop Supply**" to ***PIN1 (Pwr+)***
- ✓ Connect the sensor wire "**Current output**" 4-20mA to ***PIN4(SI)***
- ✓ Use a jumper cable to connect **PIN3(Gnd) to PIN2**

5.6.5 Sensor wiring code (BeanDevice® AN-V & AN-mV)

Wiring code (sensor side)
Sensor with analog unipolar output



Caption :

PIN1 (Pwr+): Sensor power supply

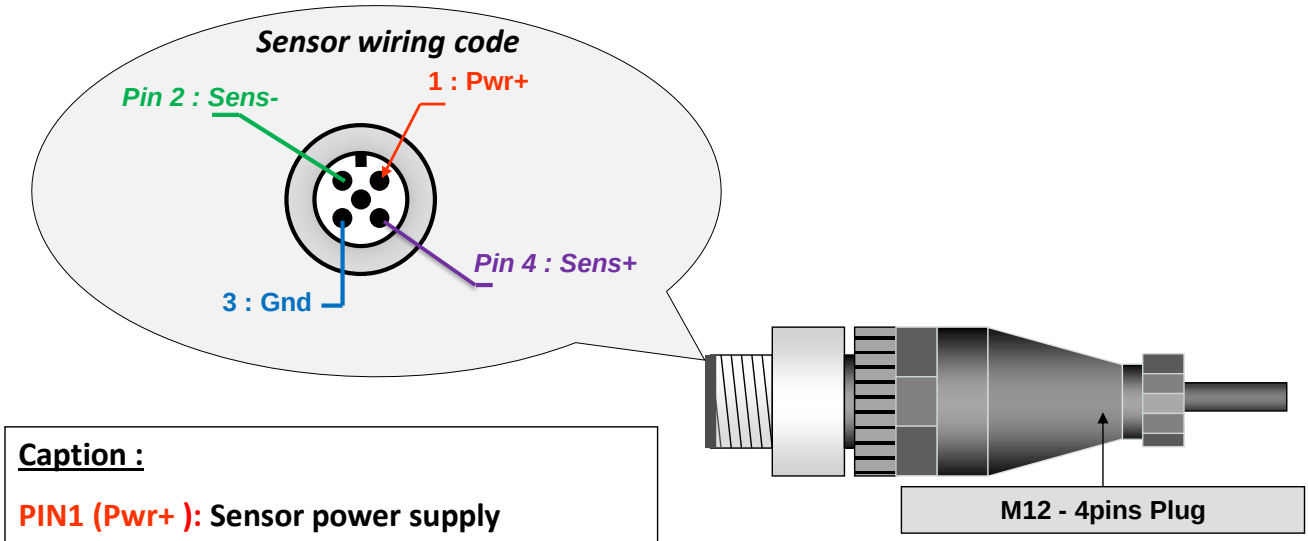
PIN4 (Sens+): Sensor signal + input

PIN2 (Sens-): Connected to Electrical Ground

PIN3 (Gnd): Electrical Ground

Figure 10: Wiring code (sensor side) – Analog unipolar

Wiring code (sensor side)
Sensor with analog bipolar output



Caption :

PIN1 (Pwr+): Sensor power supply

PIN4 (Sens+): Sensor signal + input

PIN2 (Sens-): Sensor signal - input

PIN3 (Gnd): Electrical Ground

Figure 11: Wiring code (sensor side) – Analog bipolar

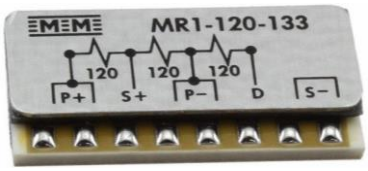
✓ *If you use a unipolar analog sensor, Sens- pin must be connected to the electrical ground*

You can damage your sensor and/or your BeanDevice® if you don't respect the wiring code.

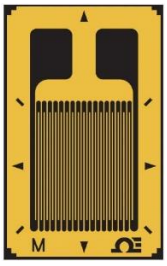
5.6.6 Examples of integration with analog sensors

1. Strain Gage sensors

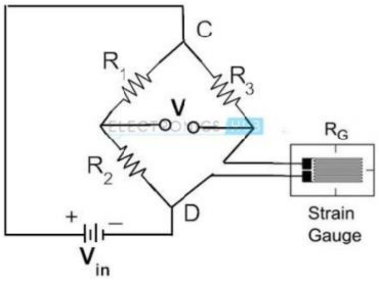
BeanDevice AN-mV/AN-V



Bridge Completion Module



Strain Gauge

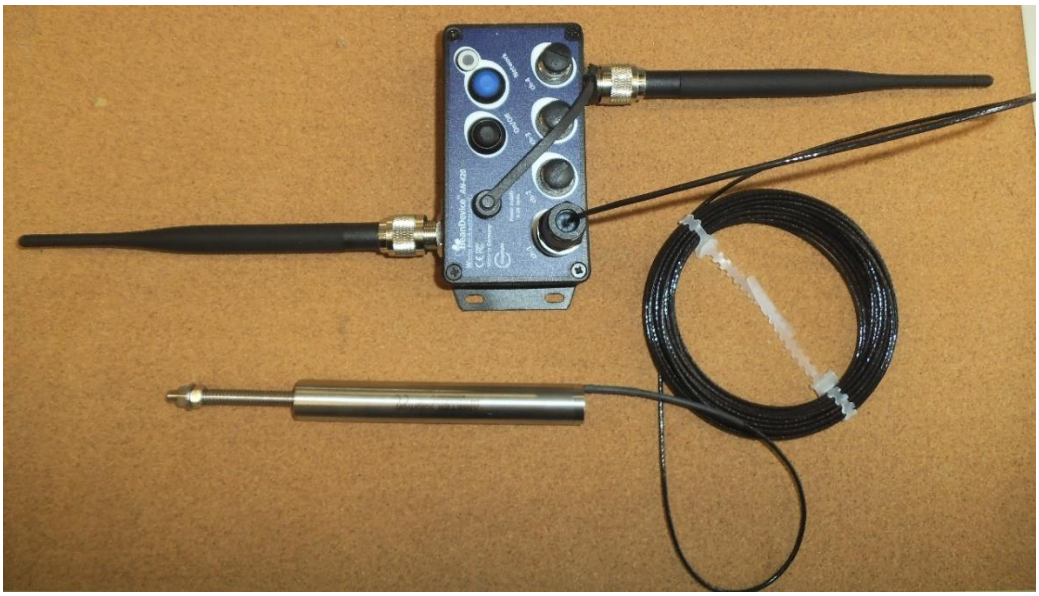


R1, **R2** and **R3** are included in the Bridge Completion Module.
Vin is the excitation voltage provided by the BeanDevice: 4.5 to 20V
V is the measured voltage by the BeanDevice channel.

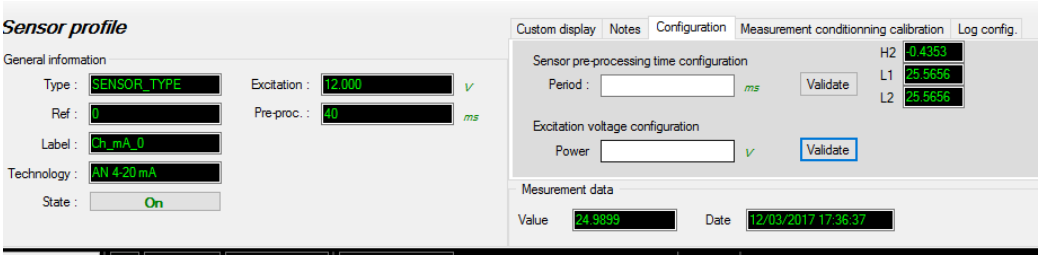
2. Potentiometer sensors

3. LVDT sensors

LVDT sensor integrated with M12-4Pins Plug



LVDT sensor mounted on the BeanDevice® AN-420



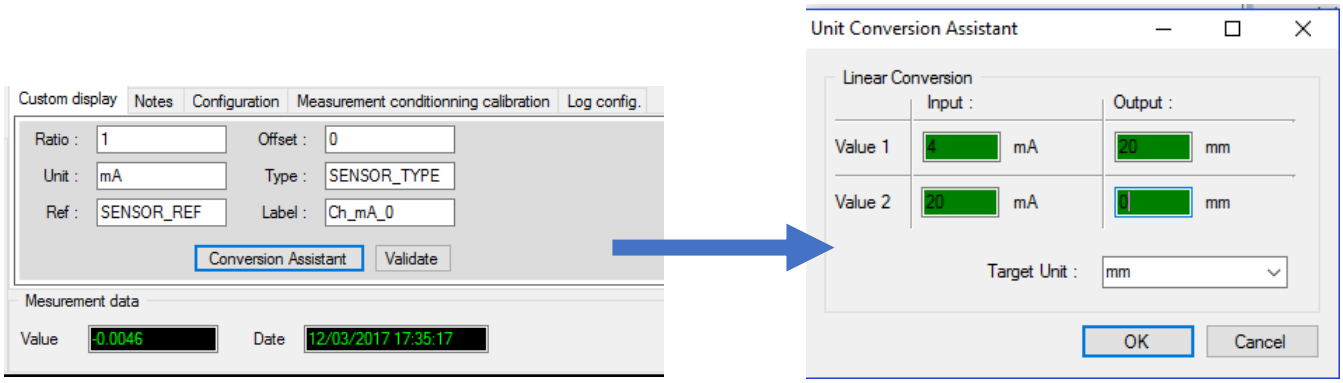
Recommended Voltage: 12V

Sensor warm-up time: 40ms

<u>Use the conversion Assistant:</u>

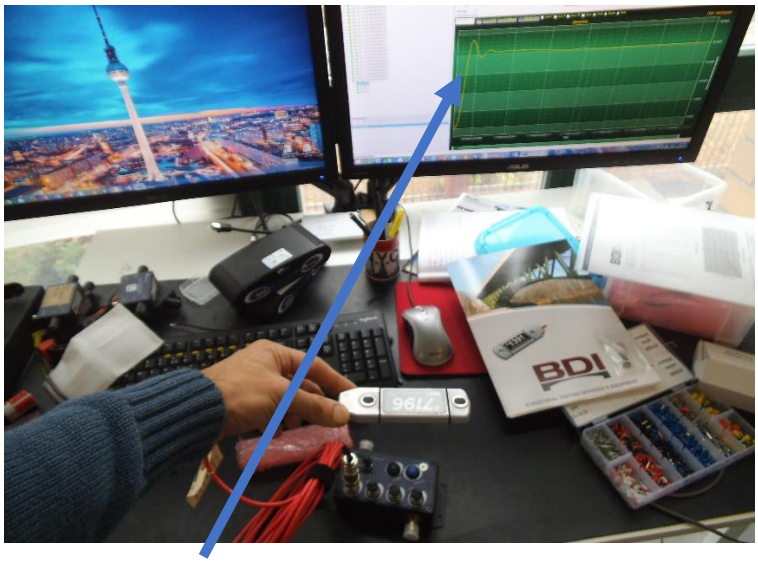
4 mA => 20 mm (sensor probe fully out)

20 mA => 0 mm (sensor probe fully in)



4. BDI sensors

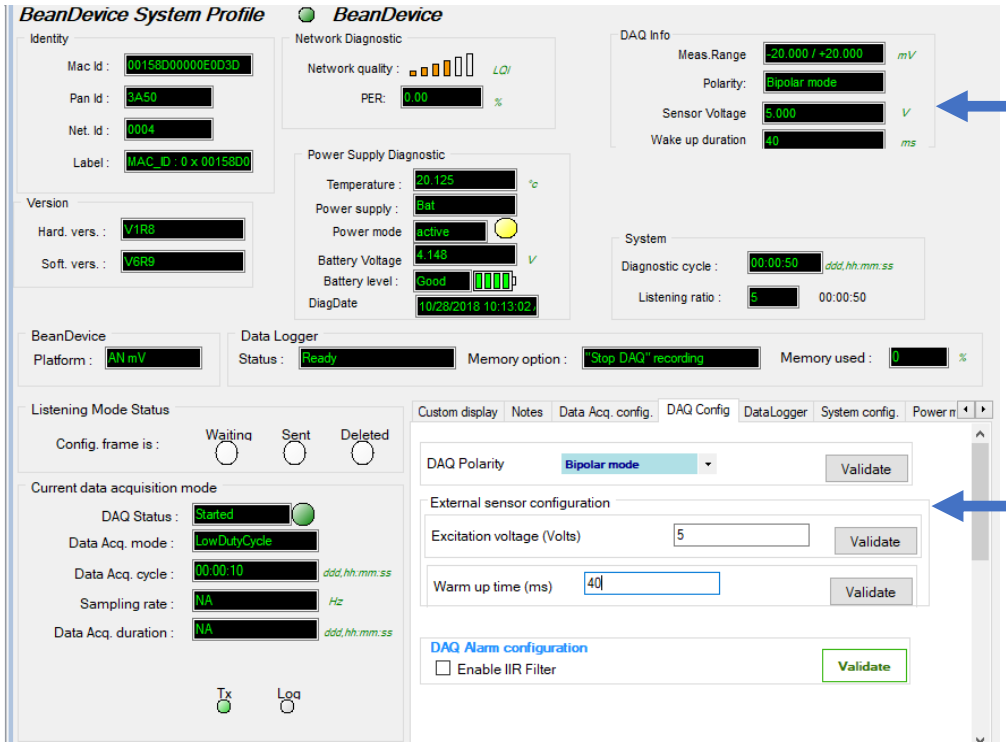
Load strain transducer combines with the Beandevice AN-mV



Load strain sensor reacting to a traction effort

- ***Sensor configuration***

Bipolar Polarity, Excitation Voltage: 5V, Sensor warm-up time: 40ms



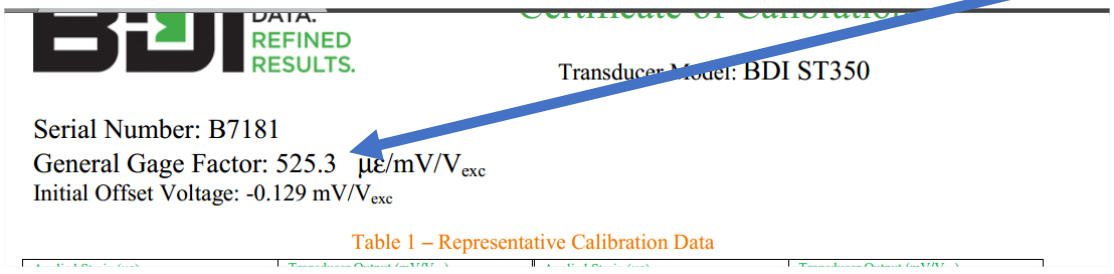
DAQ Info Area

Configuration Area

- **Applying calibration settings**

Do not change DAQ Calibration Settings

Use GFF Value displayed on BDI calibration file

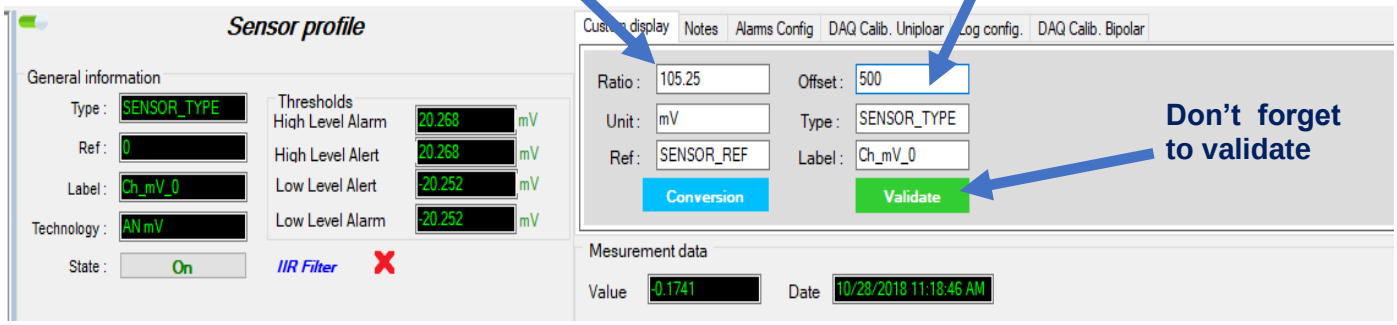


This example is using a ST350 with a supplied GGF = 525.3.32 με/mVout/Vexc. The BeanDevice AN-mV supplies a +5VDC excitation voltage. The current reading on the data acquisition system is 3.2312 mV

If the Excitation Voltage is 5VDC, GGF (με/mV) = 525.3/5VDC = 105.6 με /mV
Reading(με) = GFF*Vout(mV)/5 = 105.6 x 3.2312 = 341.21 με

Enter here GGF (με/mV) = 105.6 με /mV

Drop your sensor on a flat surface and avoid applying a load on it. Enter Initial Offset in με here



Don't forget to validate

5.7 MECHANICAL DRAWING

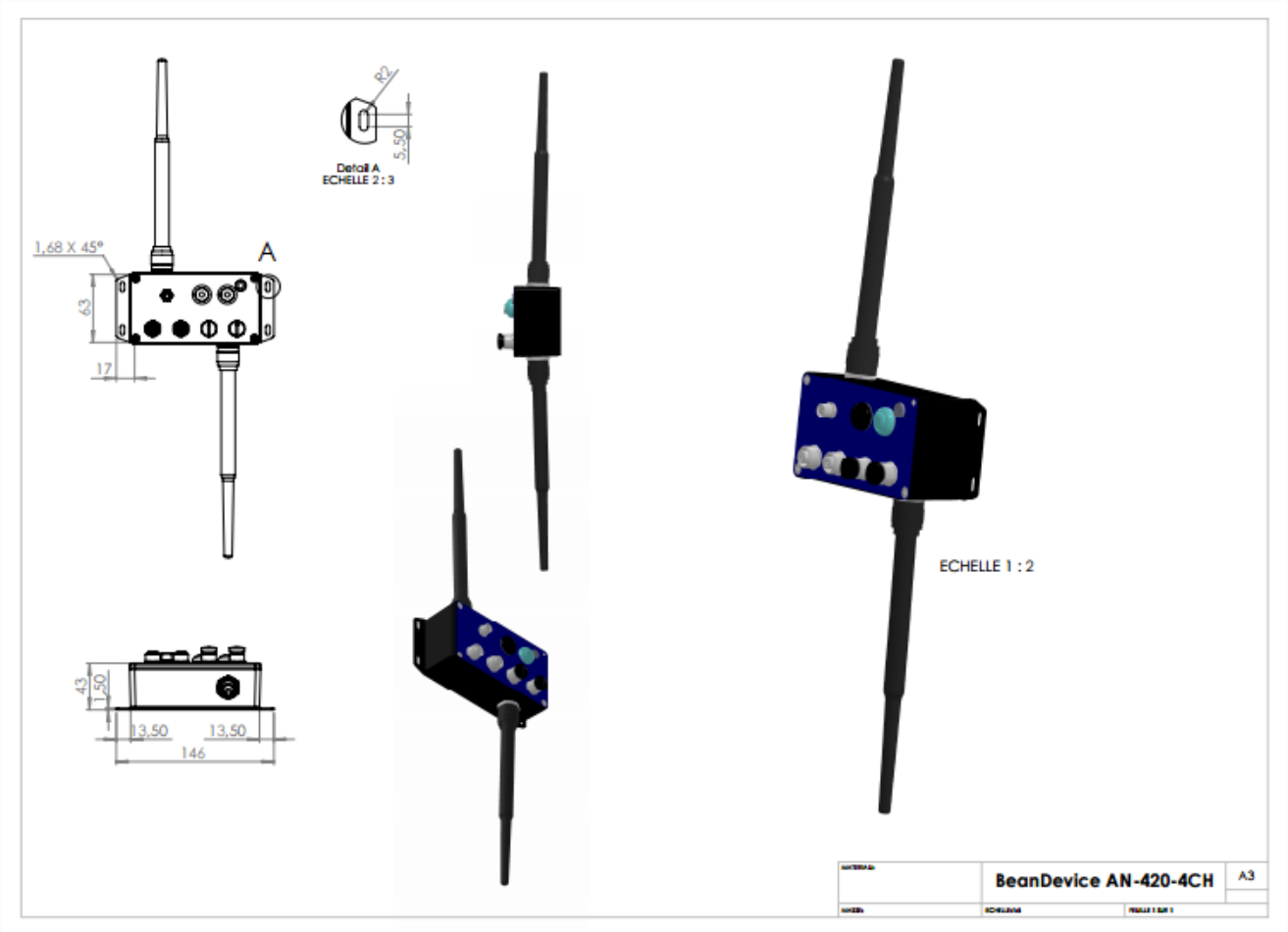


Figure 12: Mechanical Drawing

5.8 LITHIUM-ION RECHARGEABLE BATTERY

The BeanDevice® integrates a Lithium-Polymer rechargeable battery:

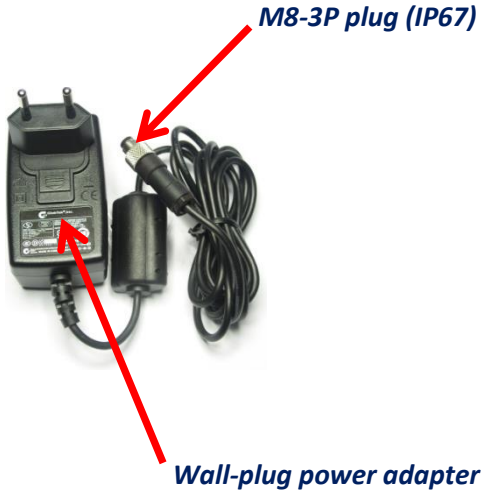
Battery Capacity	*Nominal Voltage*	*Charge/Discharge cycle*
950 mAh	4,2V	300 cycles

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

Do not try to change the battery. You will void the guarantee of the product.

5.9 AC-TO-DC POWER ADAPTER

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.

5.10 EXTERNAL POWER SUPPLY WIRING CODE

Caption:

PIN3 (Pwr+) : power supply 8-28 V DC

PIN1 (Gnd) : electrical ground

External power supply wiring code (M8-3Pins Socket)

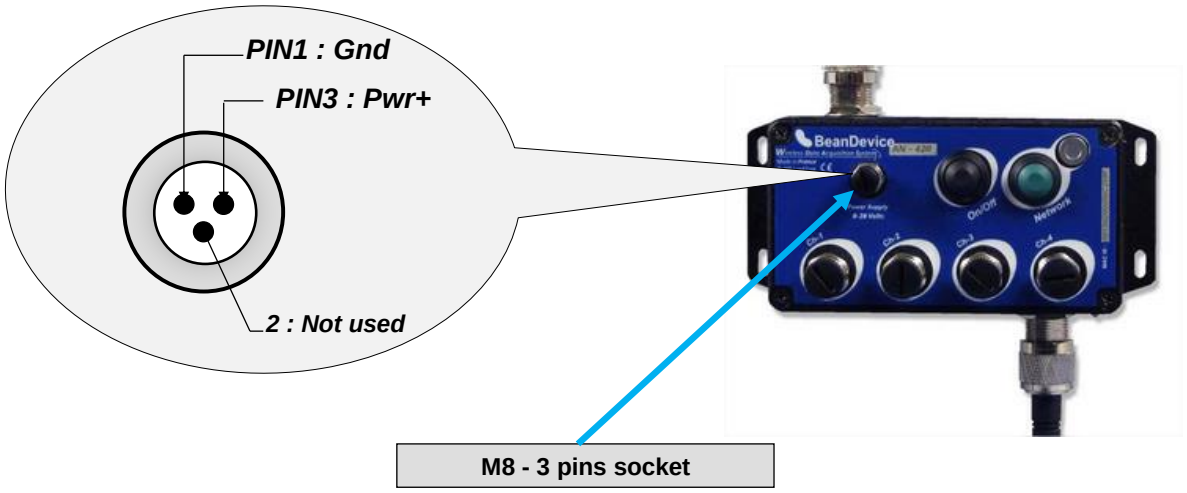
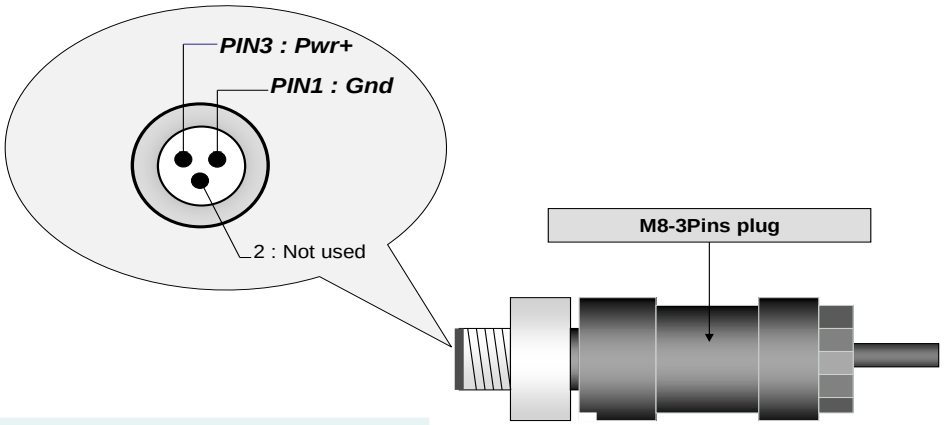


Figure 13 : External power supply M8-3Pin Socket - BeanDevice® side

External power supply wiring code



Caption:

Pwr+ : Power supply 8-28V DC

Gnd : Ground

Figure 14 : External power supply wiring code (M8-3Pin Plug side)

If you are using a molded M8 cable (Ref: CBL-M8-2M, CBL-M8-5M, CBL-M8-10M) the wiring code and color will be as follow:

Pin Number	*Description*	*Color code*
PIN3	**Pwr+ : Power supply 8-28VDC**	**Blue**
PIN1	**Ground**	**Brown**

Table 12: Wiring code table for molded M8 cable

Reversing the power supply polarity may damage your BeanDevice®/BeanGateway® product

6. DATA ACQUISITION MODE DESCRIPTION

Please read the technical note TN_RF_008 – "Data acquisition modes available on the BeanDevice®"

7. BEANDEVICE® PROCESSSENSOR INSTALLATION GUIDELINES

7.1 POWER MODE MANAGEMENT

Please read the technical note TN_RF_010 – « BeanDevice® Power Management »

7.2 BEANDEVICE® NETWORK ASSOCIATION

Please read the technical note TN_RF_006 – "WSN Association process"

7.3 DATALOGGER FUNCTION

Please read the technical note TN_RF_007 – "BeanDevice® Datalogger User Guide "

7.4 OTAC (OVER-THE-AIR-CONFIGURATION) PROCESS

Please read the technical note TN_RF_010 – « BeanDevice® Power Management »

7.5 FACTORY SETTINGS

If desired, the user can restore factory settings on the BeanDevice® with the following default parameters:

Parameter	*BeanDevice® 2.4GHz version*		
	AN-420	*AN-V*	*AN-mV*
Power Mode	*Active*		
Data Acquisition duty cycle	*10s*		
Data Acquisition mode	*LowDutyCycle*		
Alarms Threshold	*H1 :20* *H2 :20* *S2 :4* *S1 :4*	*H1 :10* *H2 :10* *S2 :0* *S1 :0*	*H1 :20* *H2 :20* *S2 :0* *S1 :0*
Pre-process duration time	*30 ms*		
Sensor polarity	*N.A.*	*Unipolar*	*Unipolar*

Table 13: Factory settings

To restore these defaults parameters, you must perform a *Network context deletion*. Push on the push-button ("Network") for more than 2 seconds.

If you fix the TX power at its minimum value (-7dBm), and the wireless range is more than 5m, you will lose the radio signal. To find a configuration with a maximum RF: by pressing the Network Context button, you can reset to factory settings (default RF power is fixed at its maximum: 18 dBm)

8. BEANDEVICE® SUPERVISION FROM THE BEANSCAPE

Don't hesitate to read the BeanScape® user manual for further information about the BeanScape®

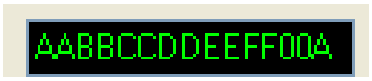
8.1 STARTING THE BEANSCAPE®

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

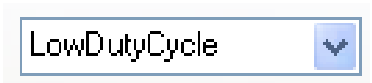
1. *Start the BeanScape® by double-clicking on the BeanScape® icon*
2. *Click on the button « start »*
3. *All the BeanDevice® connected to the WSN will appear on your left window*
4. *Select the BeanDevice® you want to configure. You can configure your BeanDevice® and its attached sensors.*

The User interface is organized as follow:

- Green on black background are displaying information

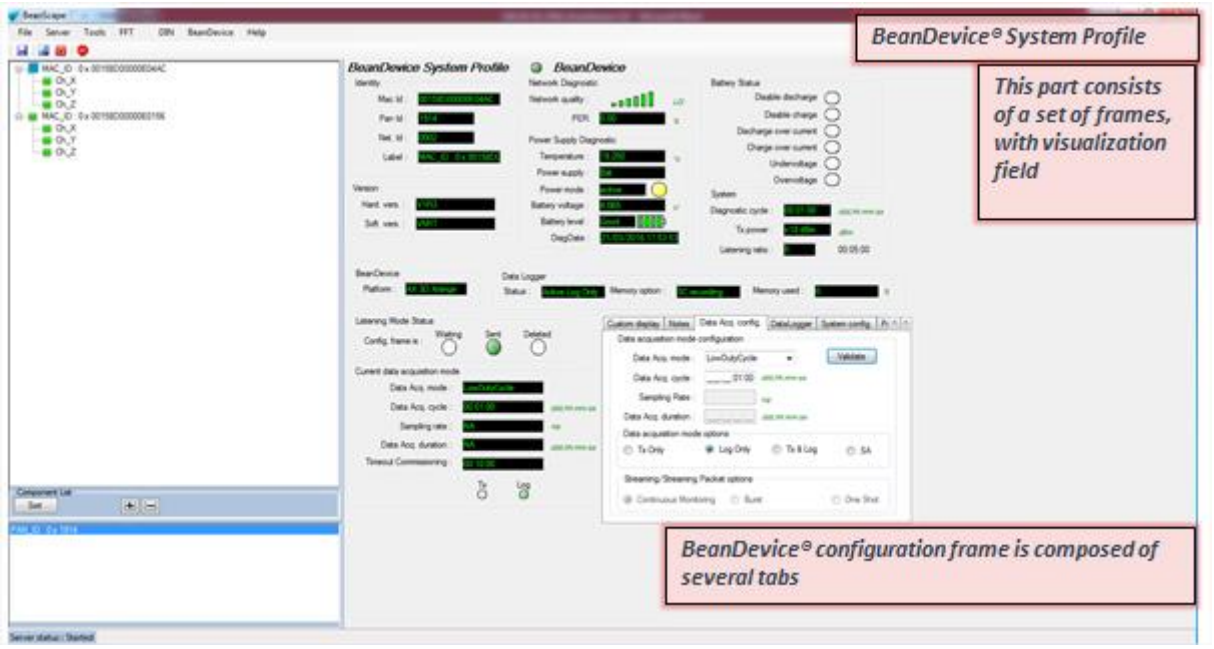


- Black on white background are customizable field;



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

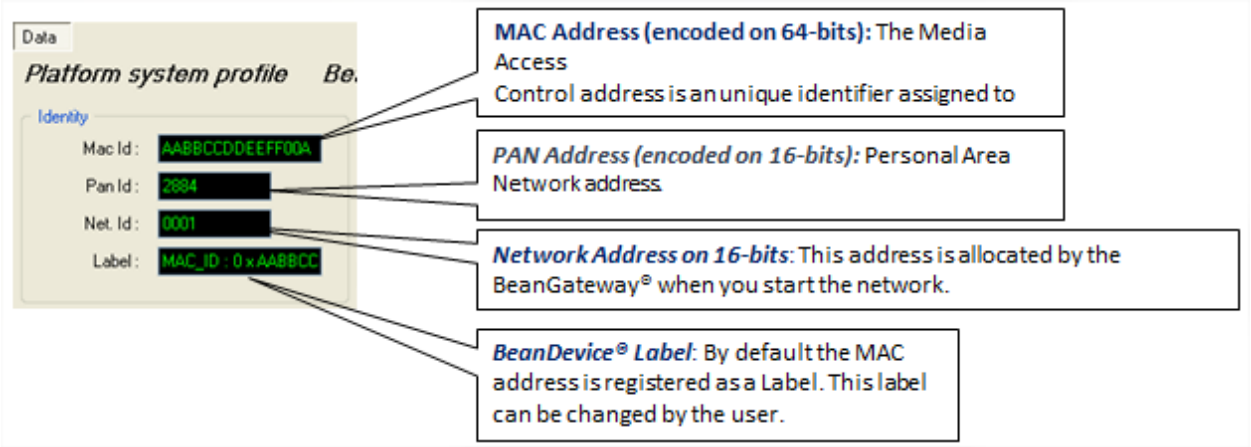
- ✓ BeanDevice® information display;
- ✓ BeanDevice® configuration;



8.2 DISPLAYING THE BEANDEVICE® INFORMATIONS

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

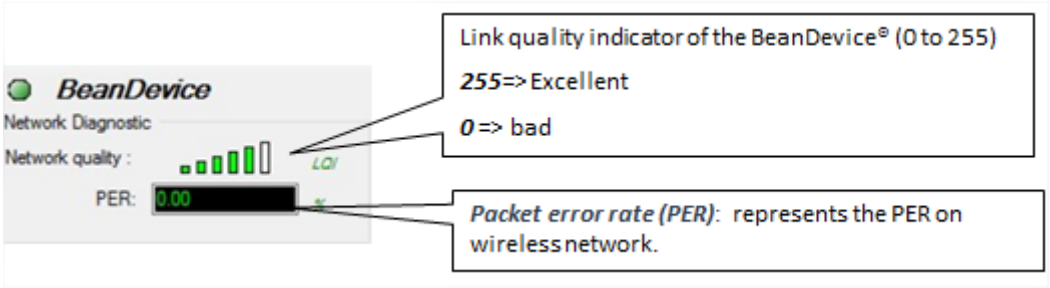
8.2.1 Frame: Identity



How 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®.

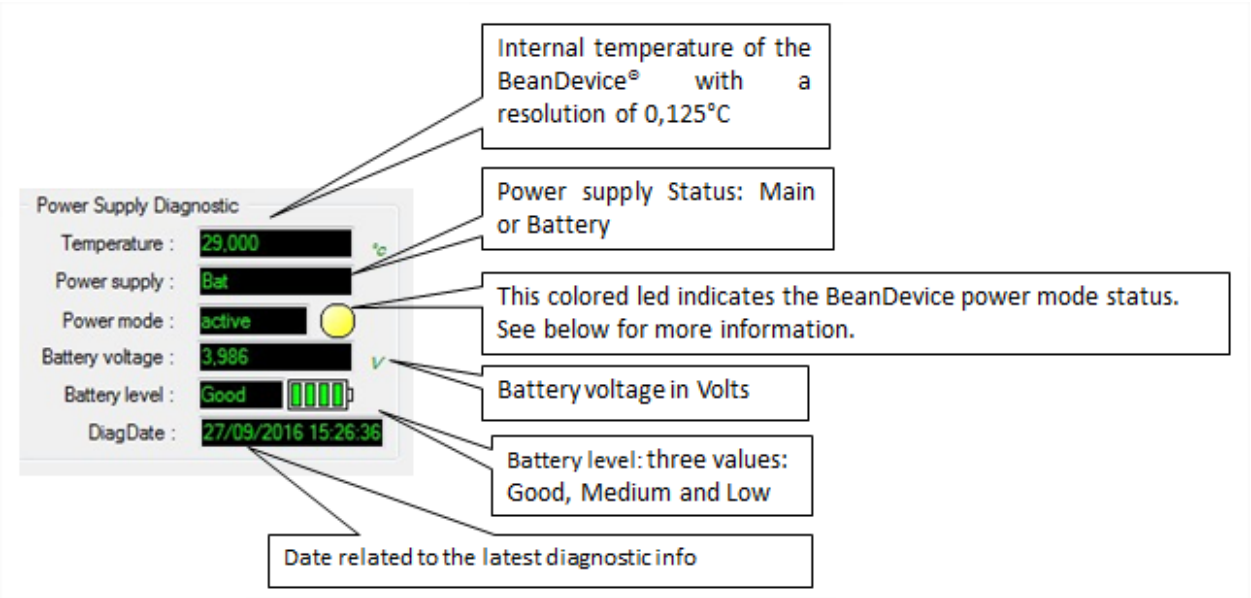
8.2.2 Frame: Wireless Network Diagnostic



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	*Orange*	*medium*
1 to 2 bars	*Red*	*bad*

8.2.3 Frame: Power supply diagnostic



The BeanDevice® incorporates an internal temperature sensor dedicated to the following tasks:

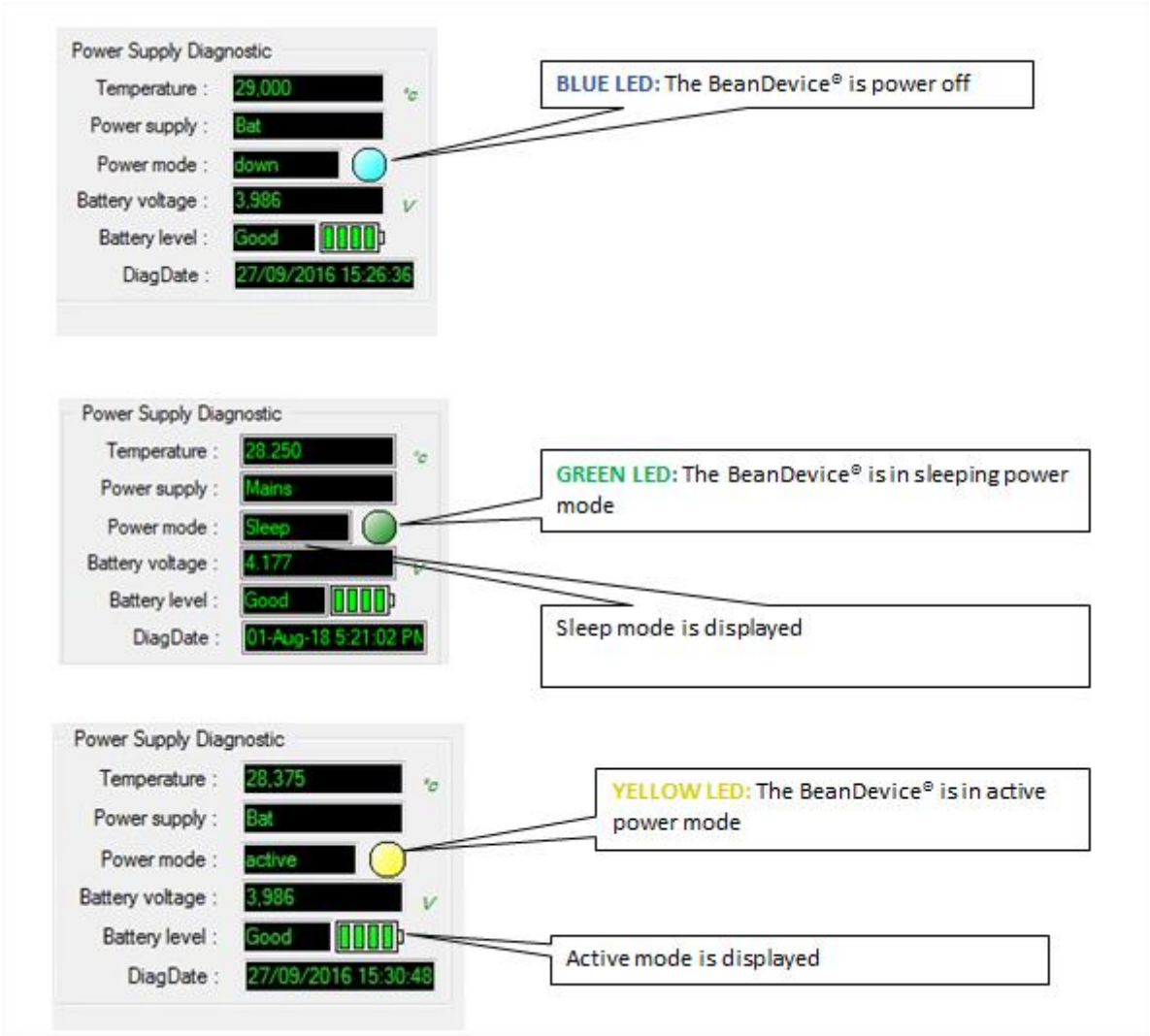
- ***Battery temperature monitoring during charging;***
- ***Temperature compensation of the analog conditioning chain;***
- ***An alarm notification is sent to the BeanGateway® if the internal temperature is abnormally high;***

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

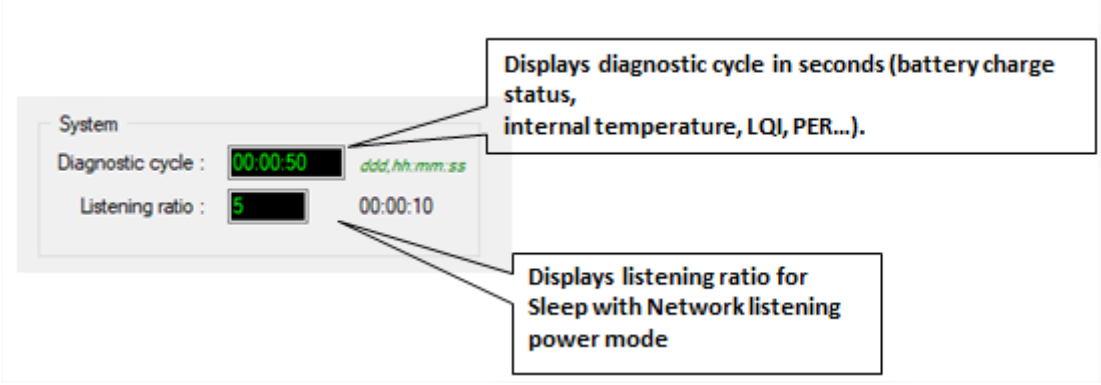
If your primary cell charge level is under 5%, it is highly recommended to recharge your battery. Your BeanDevice® from SmartSensor product lines integrates a battery charger.

8.2.3.1 BeanDevice® Power Mode status

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



8.2.4 Frame: System



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:

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

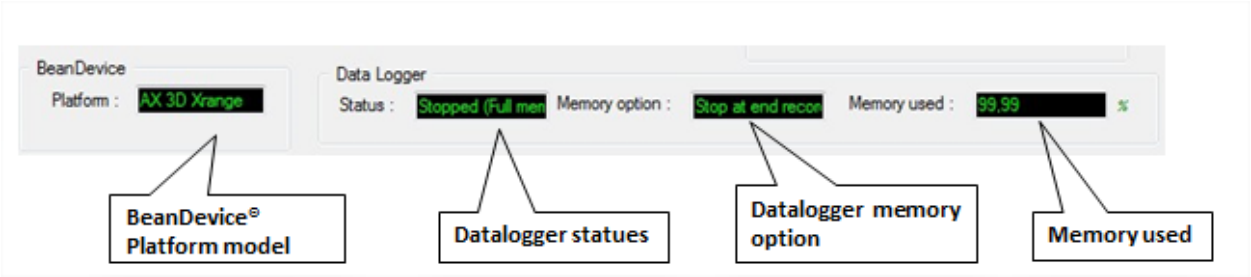
And

$$P = 10^{(x/10)}/1000 \text{ Or, } P = 10^{(x-30)/10}$$

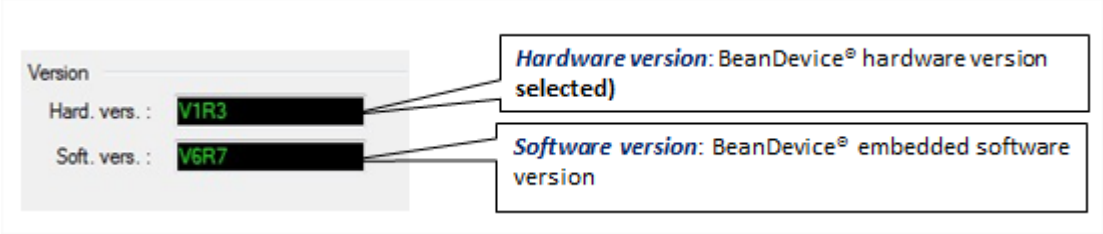
Where P is the power in W and x is the power ratio in dBm.

8.2.5 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:



8.2.6 Frame: Product Version



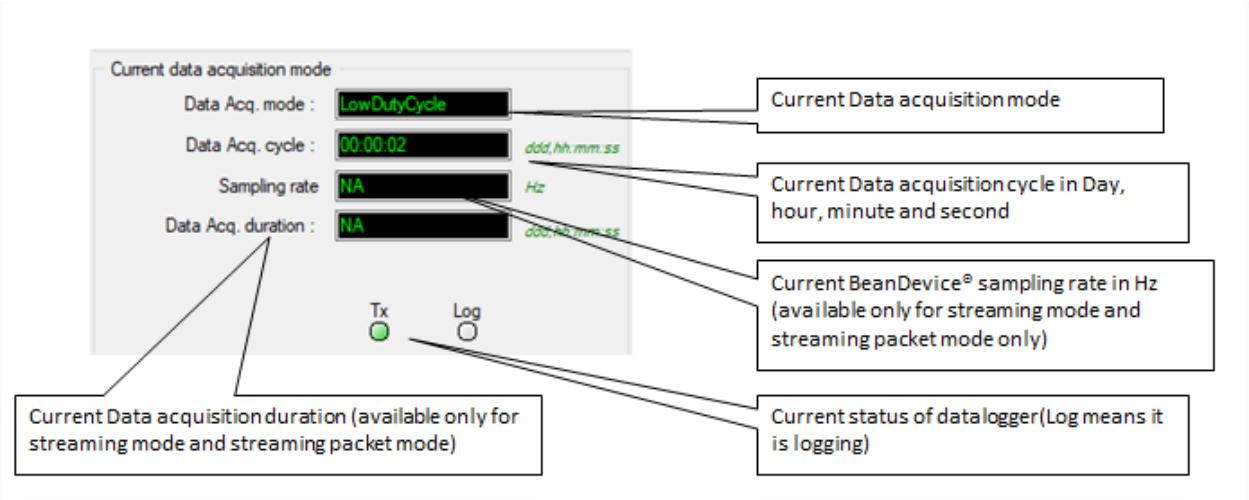
V (version) related to a major modification of the embedded software.

R (Release) related to a minor modification of the embedded software

These ID versions should be transmitted to our technical support center when you encountered a material or software dysfunction.

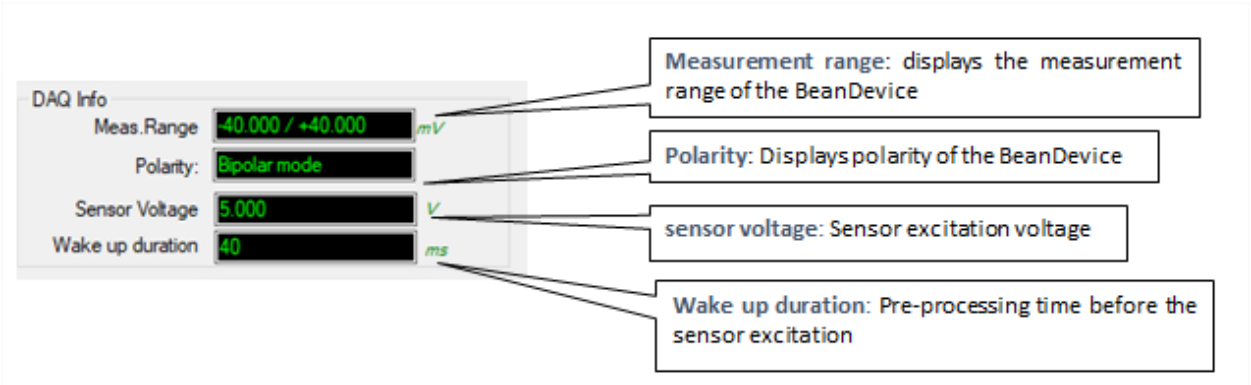
8.2.7 Frame: Actual Data Acquisition mode

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

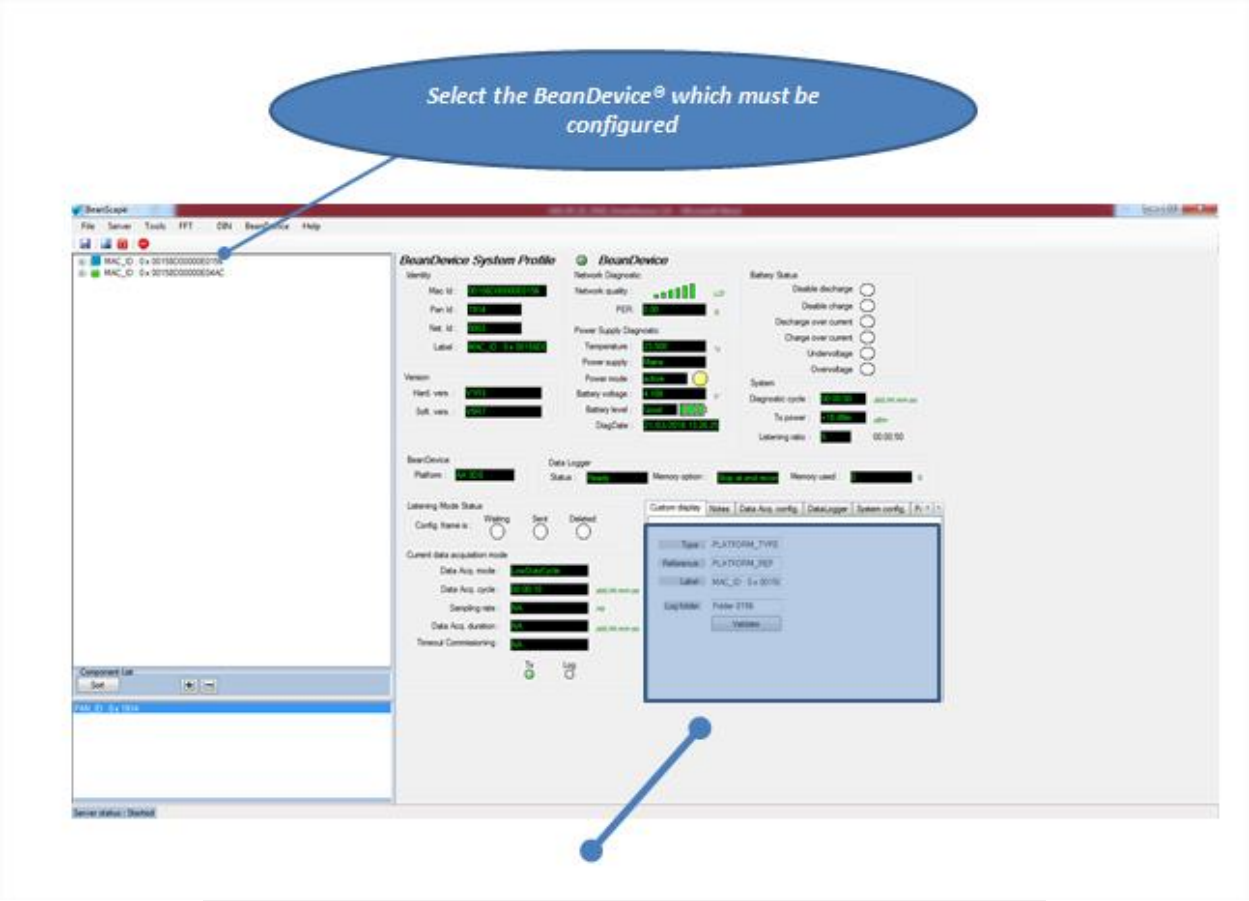


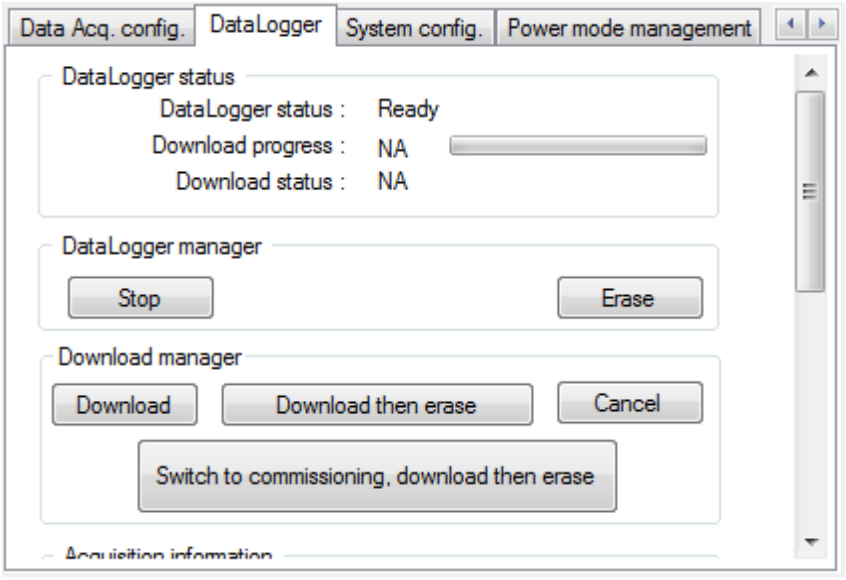
8.2.8 Frame: DAQ Info

This frame displays all the information on the ProcessSensor.



8.3 BEANDEVICE® CONFIGURATION

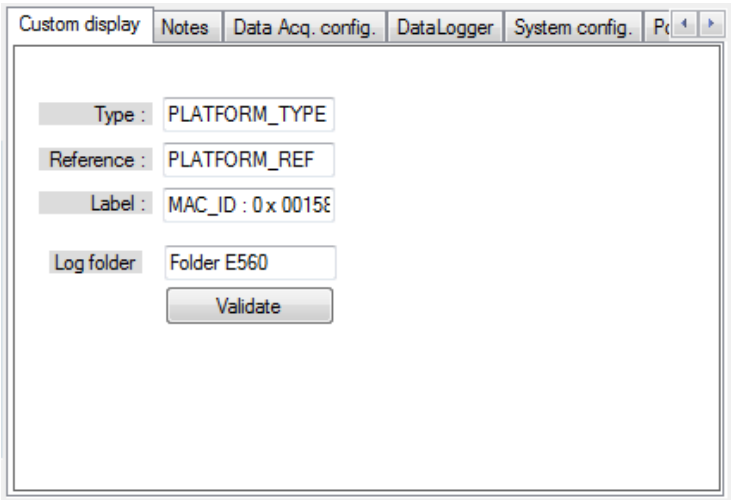




This frame is composed of several Tabs and includes BeanDevice® OTAC (Over the Air Configuration) Parameters:

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)

8.3.1 Tab: Custom Display

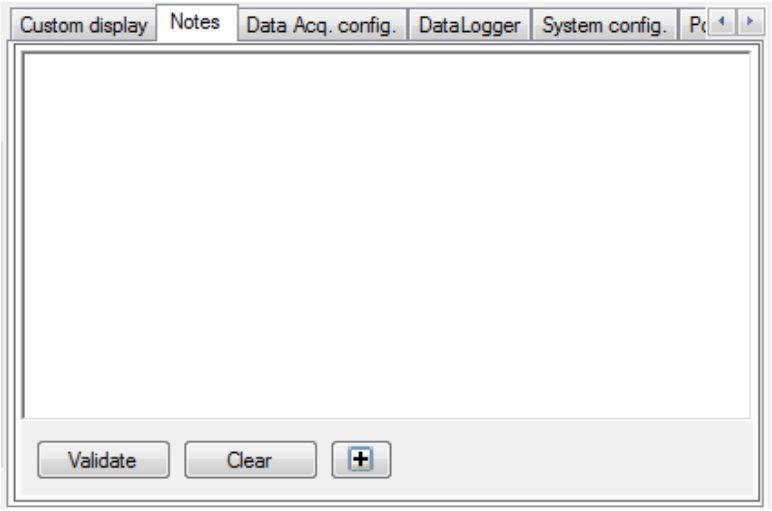


Parameter	Description
Type	You can enter here the type of BeanDevice® you want to use
Reference	You can assign an internal reference to the BeanDevice® you have purchased.

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.

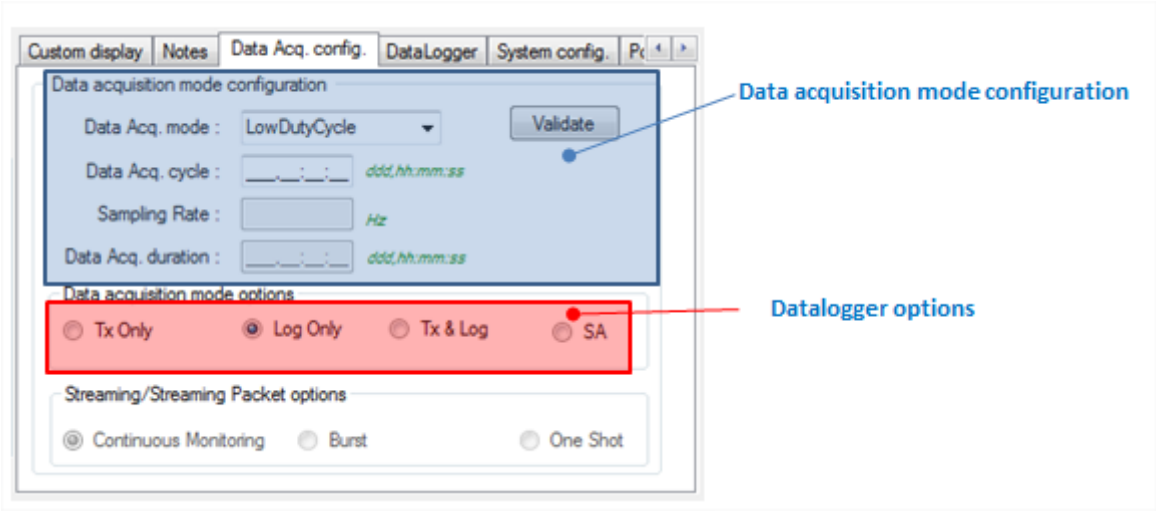
8.3.2 Tab: Notes



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.

8.3.3 Tab: Data Acquisition configuration

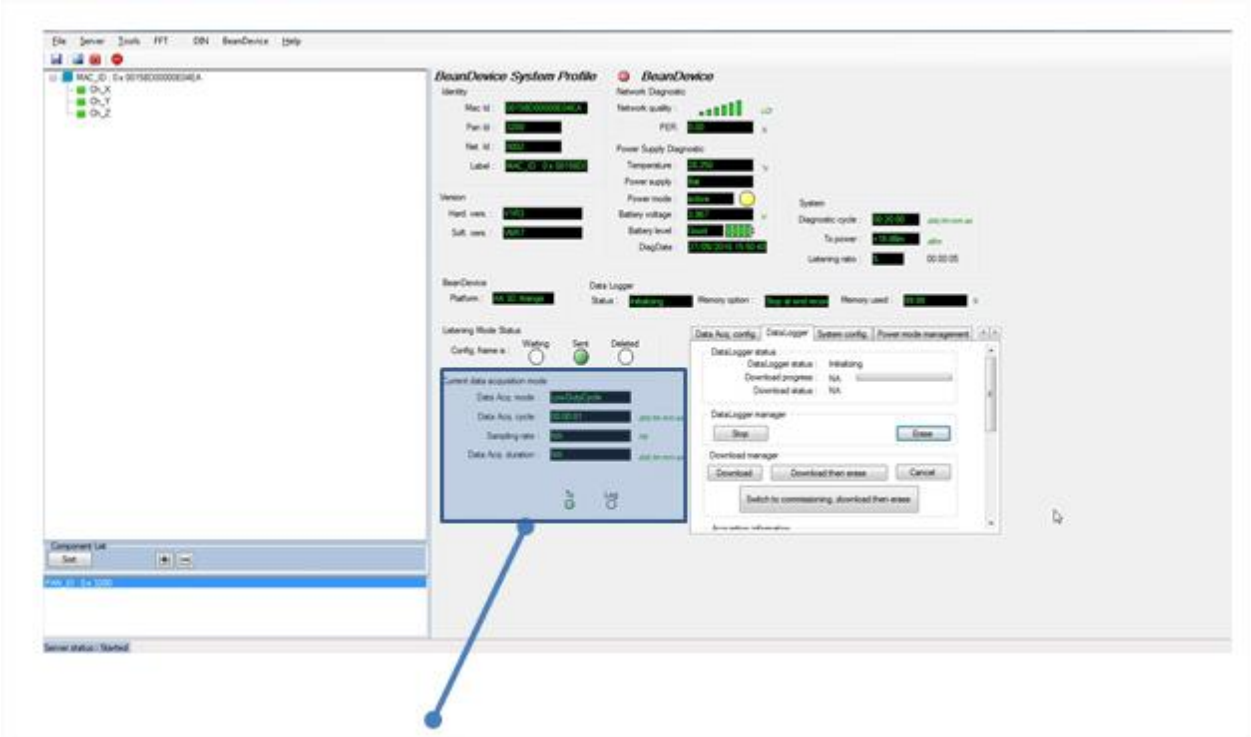


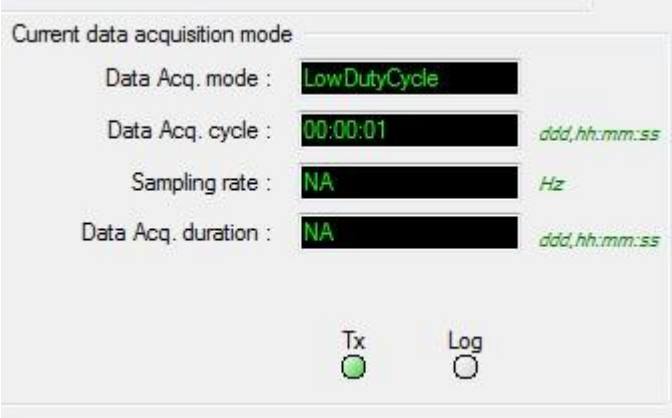
Parameter	Different values	Description
Data Acquisition mode	***Low duty cycle Data Acquisition (LDCDA)***	Low duty cycle data acquisition is adapted for static measurement (tilt, pressure, temperature) requiring a low power consumption on your BeanDevice®. The duty cycle can be configured between 1 data acquisition & transmission per second to 1 data acquisition & transmission per day.
	Survey	Survey mode is a mix between the LDCDA mode and Alarm mode. A data acquisition is transmitted ▪ Whenever an alarm threshold (fixed by the user) is reached (4 alarm threshold levels High/Low). ▪ 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 5 KHz). In order to achieve these performances, data sampling is transmitted by packet;
Data acquisition Cycle	Select the Data acquisition cycle between 1s and 24hours. The format is: Day: Hour : Minute :Second	

Sampling rate	Select the sampling 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 selected, the maximum sampling rate is 2000 samples per second. This field is available in streaming, and math mode Choose carefully the Sampling rate value: ✓ The PER (Packet Error Rate) can increase if the Sampling rate is high on your BeanDevice®. For further information, read the technical note ***TN_RF_003- "Wireless Network capacity"*** ✓ Power consumption increases with the sampling rate of your BeanDevice®
Data acquisition duration	Data acquisition duration in streaming, and math mode. The format is Day: Hour: Minute: Second The Data acquisition 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; ***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 TN_RF_007 – "BeanDevice® Datalogger User Guide "

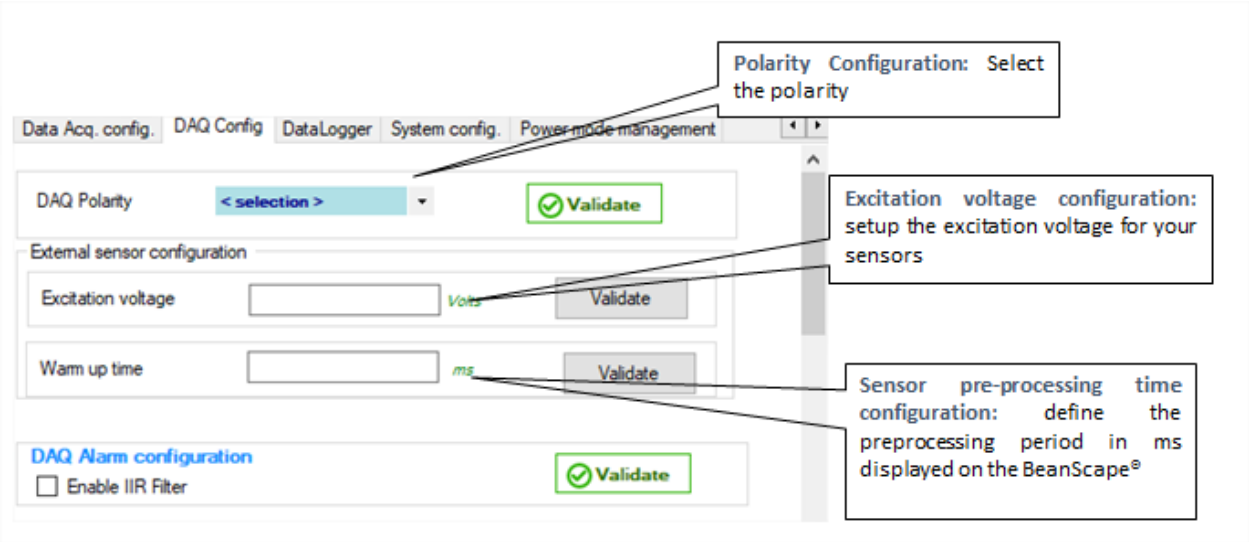
All your modifications are displayed on "***Current data acquisition mode***" frame:





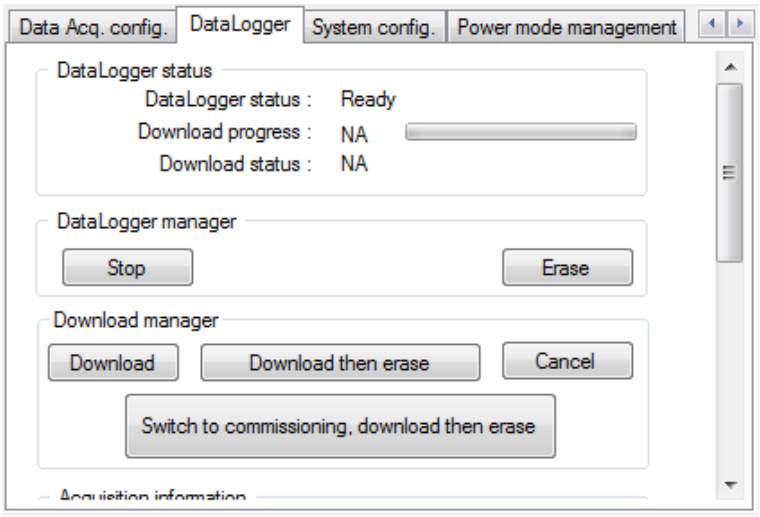
For further information, please read to the technical note [TN_RF_008 – "Data acquisition modes available on the BeanDevice®"]

8.3.4 Tab: DAQ Config



8.3.5 Tab: Datalogger

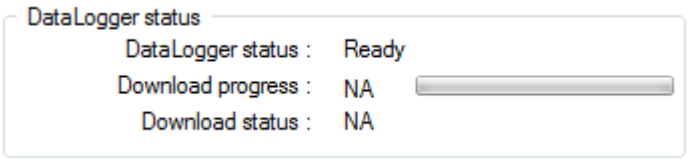
For further information about Datalogger, please read the technical note [TN_RF_007: "BeanDevice® Datalogger User Guide".]



The Logger tag is composed of five different fields:

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

8.3.5.1 Datalogger status

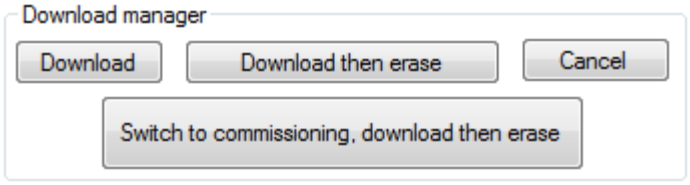


- ***Datalogger status***: Displays logger's status, four statuses are available:
  - ***Ready***: the Datalogger is ready to register data
  - ***NotInit***: the Datalogger is not initialized;
  - ***Active logs only***: Data acquisition is logged only;
  - ***Active Tx and Log***: Data acquisition is logged & transmitted by Radio;
  - ***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;

8.3.5.2 Logger manager

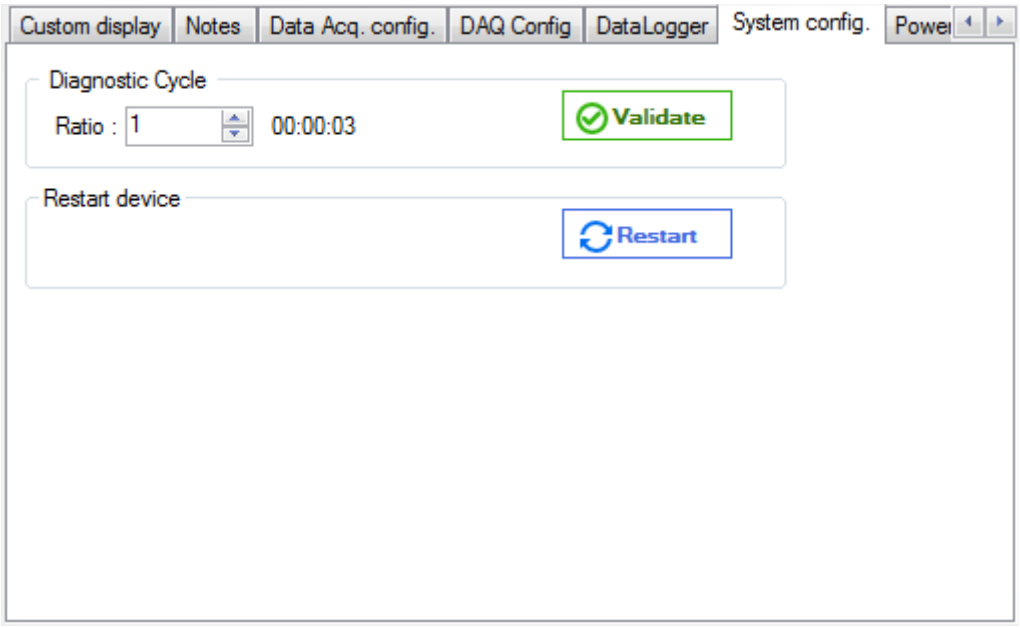
- ***Stop***: Stops Data Logging process
- ***Erase***: Stops & Erases all the logs on flash memory

8.3.5.3 Download manager



- ***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
- ***Switch to commissioning, download then erase***.

8.3.6 Tab: System Config.



Parameter	*Description*
Diagnostic cycle	You can set the BeanDevice® diagnostic cycle (Battery status, LQI, PER ...). The Diagnostic cycle is modulo the data acquisition cycle. ***Ex***: If you try to set the diagnostic cycle at 10s while the data acquisition cycle is set at 20s, the diagnostic cycle will be adjusted to 10s ;
Restart device	You can restart the BeanDevice® from BeanScape

8.3.7 Tab: Power mode management

For further information about Power mode management, please read the technical note TN_RF_010: "BeanDevice® Power management"

This Tab is composed of three frames:

- ✓ ***Power mode configuration:*** Configure the Power mode on your BeanDevice®
- ✓ ***Listening Mode Status:*** Describes the status of an OTAC (Over-the-air-Configuration)
- ✓ ***Sleep mode with listening Config. :*** Configuration settings for Sleep mode with network listening

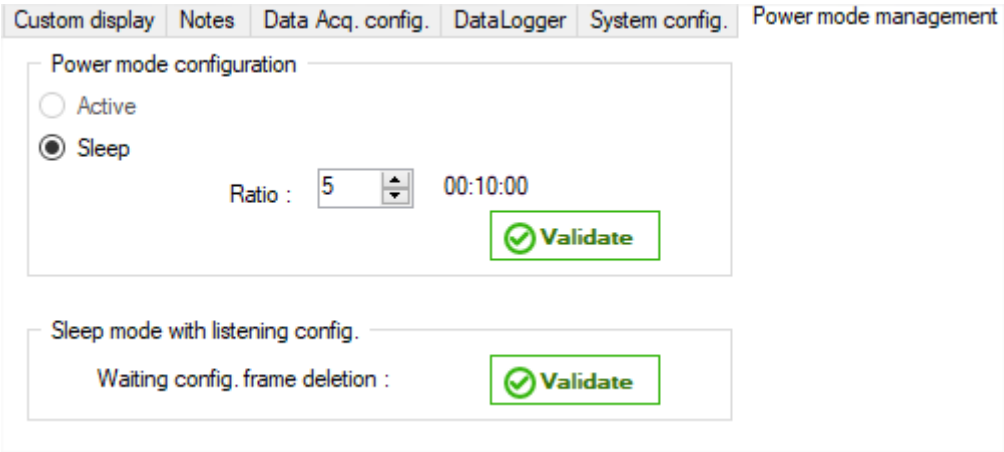


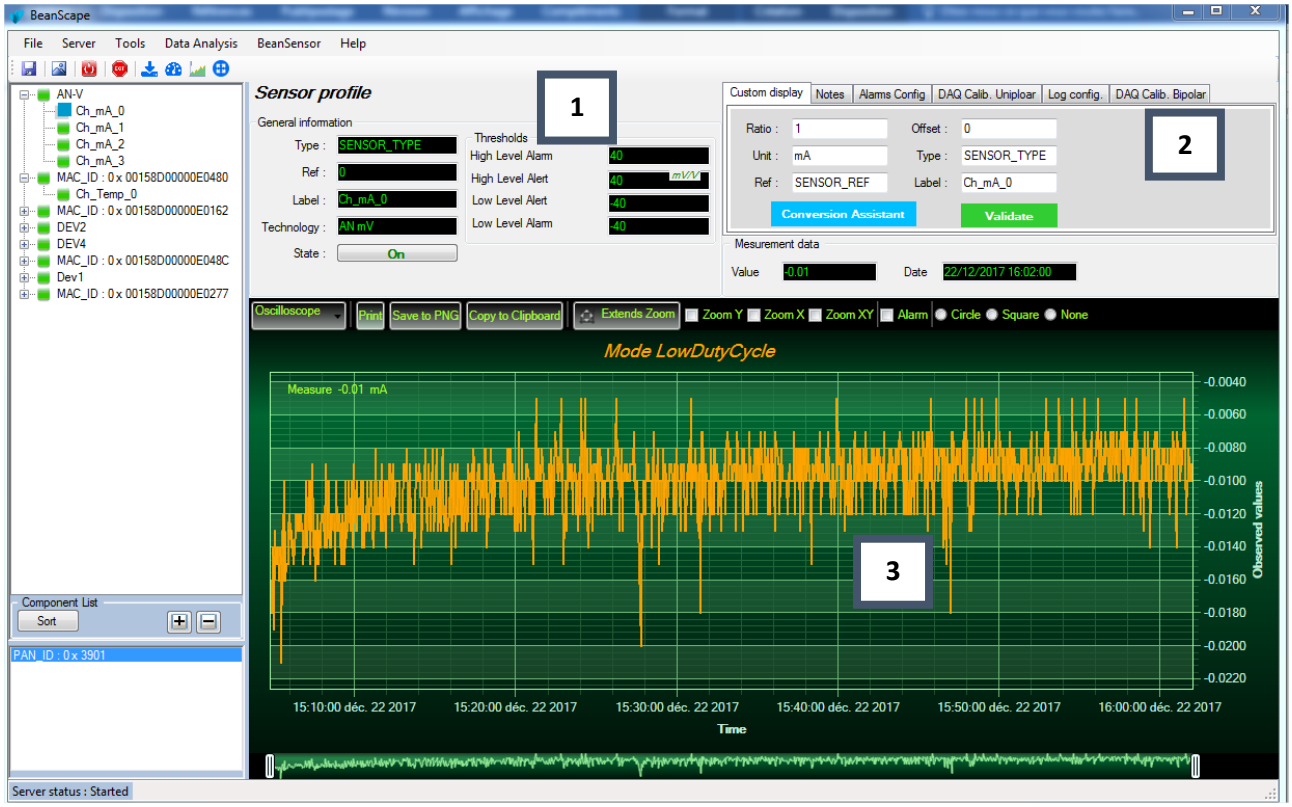
Figure 15 : Power mode management

Parameter	Description
Power mode configuration	***Active:*** Sleeping mode is disabled. The BeanDevice® operates in Active power mode. ***Sleep:*** Sleep power mode is enabled. ***Ratio***: Fix the Ratio of the listening cycle depending on the data acquisition low duty cycle. *Example*: If the data acquisition is 30 seconds and the ratio is set to 5, the Listening cycle will be 150 seconds (5*30).
Sleep mode with listening Config	By clicking on "validate", the pending OTAC frame is deleted

8.4 SENSORS CONFIGURATION

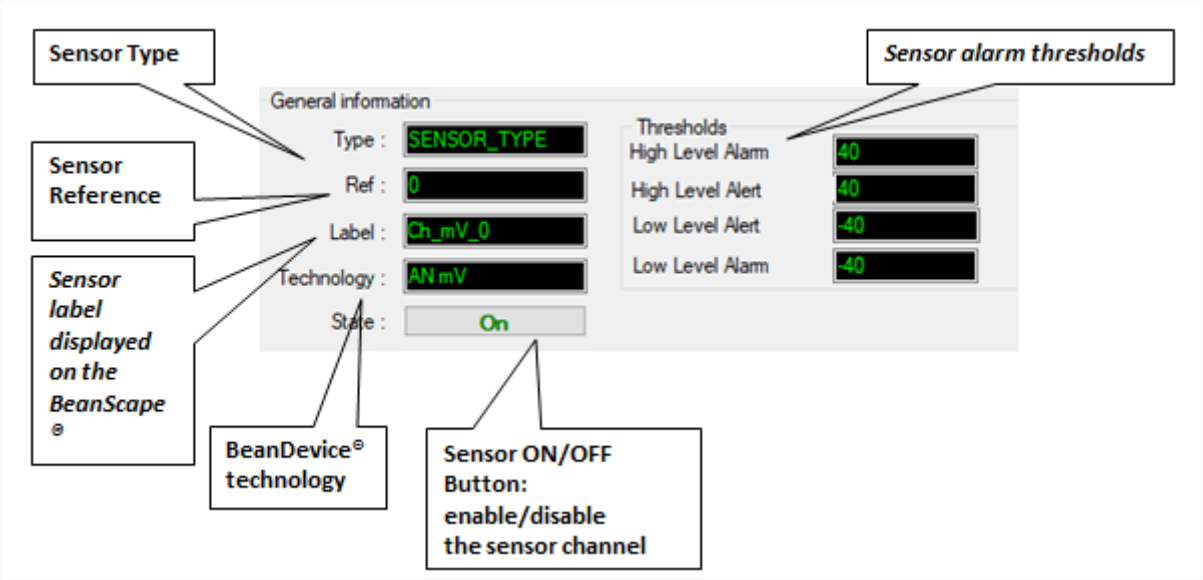
The screen « ***Sensor profile*** » consists of three parts:

1. ***General information on the measurement channel;***
2. ***Measurement channel configuration;***
3. ***A graph, which displays in real-time sensor signals during data acquisition;***

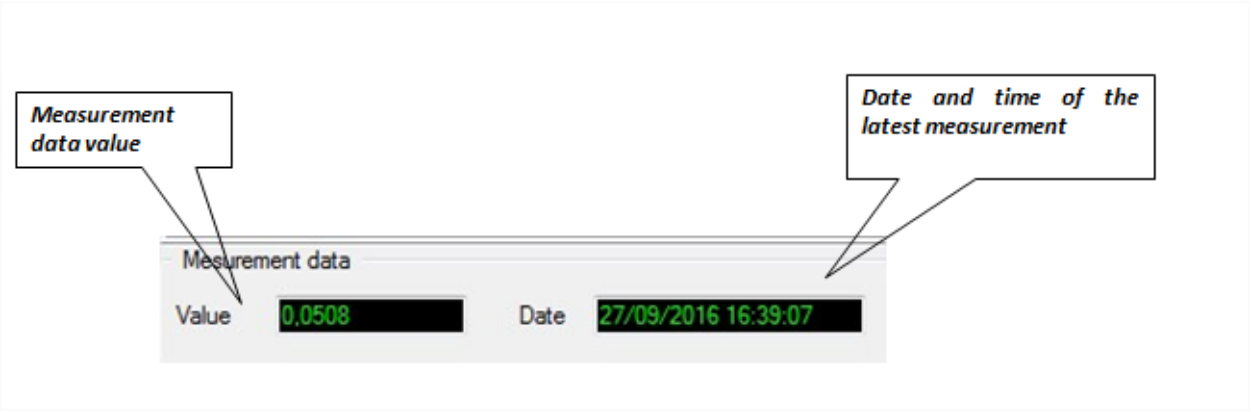

BeanScape
File
Server
Tools
Data Analysis
BeanSensor
Help
AN-V
Ch_mA_0
Ch_mA_1
Ch_mA_2
Ch_mA_3
MAC_ID : 0 x 00158D00000E0480
Ch_Temp_0
MAC_ID : 0 x 00158D00000E0162
DEV2
DEV4
MAC_ID : 0 x 00158D00000E048C
Dev1
MAC_ID : 0 x 00158D00000E0277
Component List
Sort
PAN_ID : 0 x 3901
Sensor profile
1
General information
Type : SENSOR_TYPE
Ref : 0
Label : Ch_mA_0
Technology : AN mV
State : On
Thresholds
High Level Alarm 40
High Level Alert 40 mV/V
Low Level Alert 40
Low Level Alarm 40
Custom display
Notes
Alarms Config
DAQ Calib. Uniploar
Log config.
DAQ Calib. Bipolar
Ratio : 1
Offset : 0
Unit : mA
Type : SENSOR_TYPE
Ref : SENSOR_REF
Label : Ch_mA_0
2
Conversion Assistant
Validate
Mesurement data
Value -0.01
Date 22/12/2017 16:02:00
Oscilloscope
Print
Save to PNG
Copy to Clipboard
Extends Zoom
Zoom Y
Zoom X
Zoom XY
Alarm
Circle
Square
None
Mode LowDutyCycle
Measure -0.01 mA
3
-0.0040
-0.0060
-0.0080
-0.0100
-0.0120
-0.0140
-0.0160
-0.0180
-0.0200
-0.0220
Observed values
15:10:00 déc. 22 2017
15:20:00 déc. 22 2017
15:30:00 déc. 22 2017
15:40:00 déc. 22 2017
15:50:00 déc. 22 2017
16:00:00 déc. 22 2017
Time
Server status : Started

8.4.1 Sensor profile

8.4.1.1 Frame: General information



8.4.1.2 Frame: Measurement data



By default, sensor unit format is

- ✓ BeanDevice® AN-V : V
- ✓ BeanDevice® AN-mV : mV
- ✓ BeanDevice® AN-420 : mA

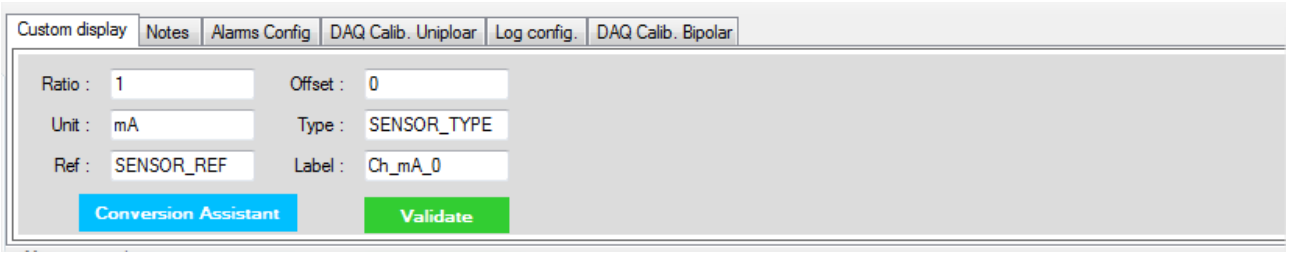
8.4.2 Sensor configuration & calibration

This frame contains a set of five 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
DAQ Calib. Unipolar	• Sensor or measurement channel calibration
Log configuration	• Logs configuration on the BeanScape®
DAQ Calib. Bipolar	• Sensor or measurement channel calibration

8.4.2.1 Tab: Custom display

These parameters allow the user to customize his sensor:



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

Measurement conversion formula:

$$Converted\ Measurement = Measurement \times RAT + OFF$$

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

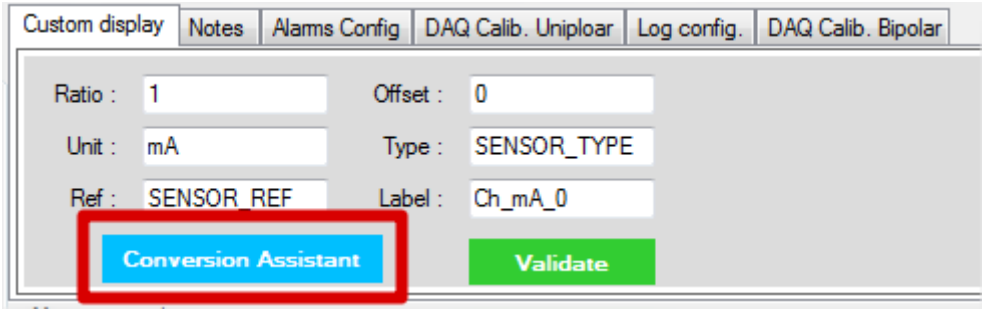
Converted Measurement [°F] = Measurement [°C] x RAT + OFF

With **RAT** = 1.8 and **OFF** = 32

Conversion assistant

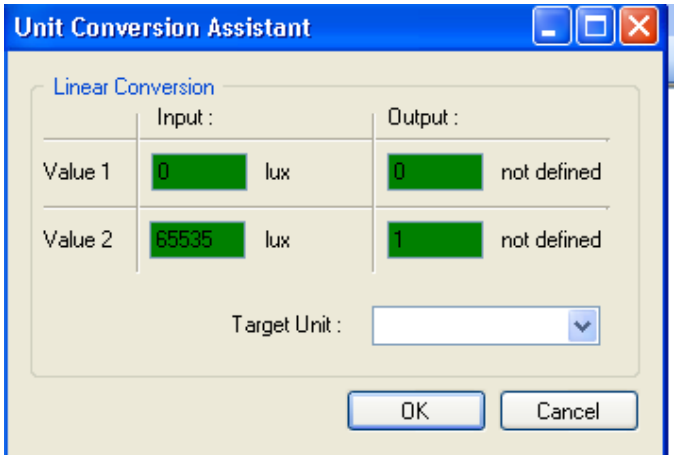
To avoid conversion error, a conversion assistant is available to help you to setup quickly your measurement channel of your BeanDevice®.

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

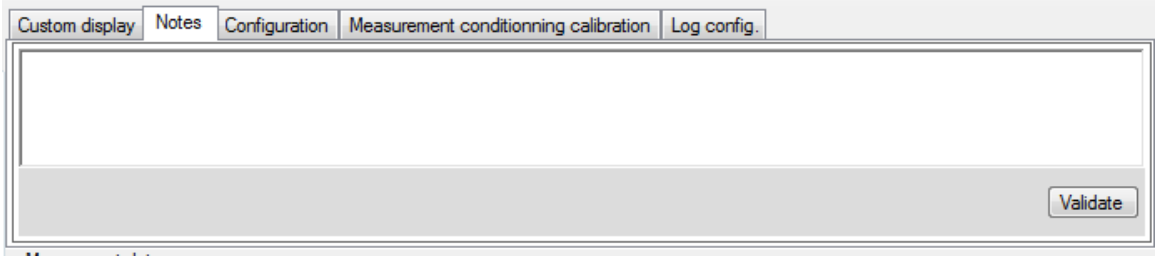


On the left column, the user can enter the non-converted measurement data. On the right column, the user can enter the converted measurement values with the desired unit.

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

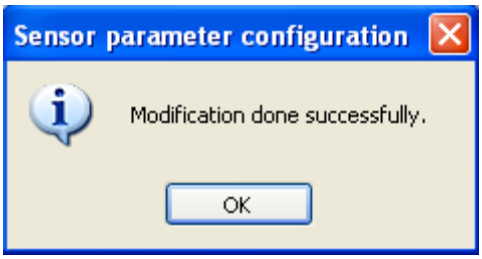


8.4.2.2 Tab: Notes



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”.

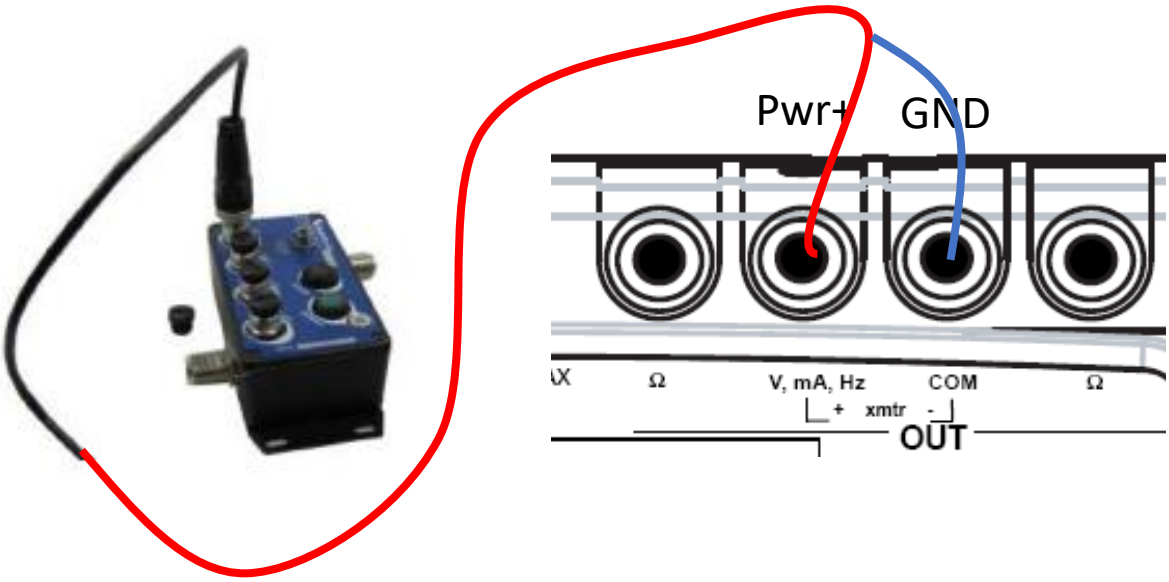


To back up your text click on the icon “Backup your Database”

8.4.3 Calibrate the BeanDevice ProcessSensor

The CALYS 50 is a multifunction calibrator. It is specially designed for calibration and maintenance and can measure and simulate physical and electrical quantities, either on site or in the laboratory.

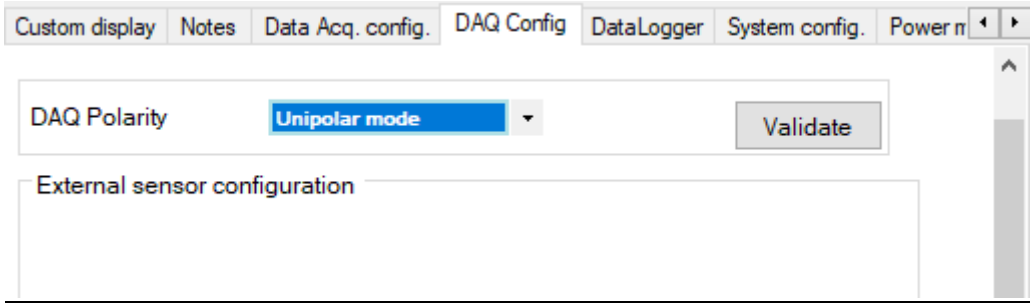
Measurement and transmission can take place simultaneously, with a double display.

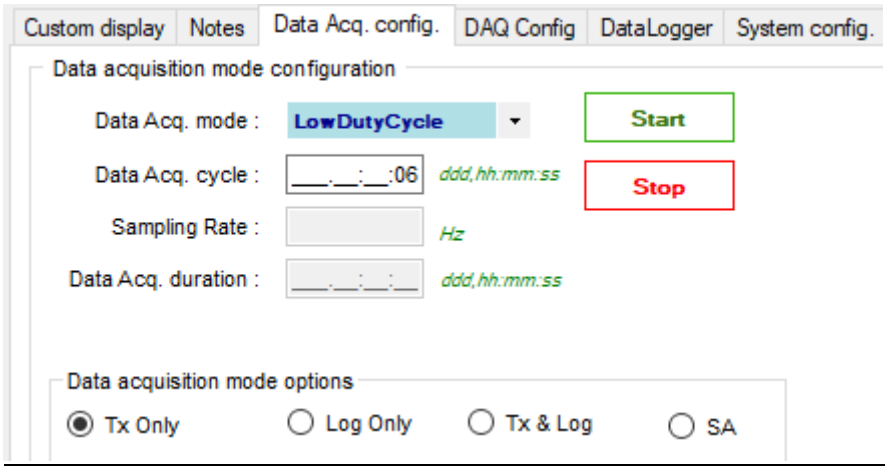


Connect the channel of the BeanDevice to the calibrator's Output: Sens+ to the V and Sens- to COM

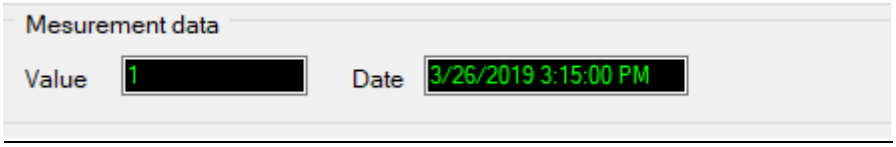
Then enter 1V from the calibrator and press ENTER to validate.

From the Beanscape software choose Unipolar mode as DAQ Polarity and configure the BeanDevice on LowDutyCycle with 6s.





Then select the sensor profile used for calibration and copy the displayed value from the Measurement data frame.



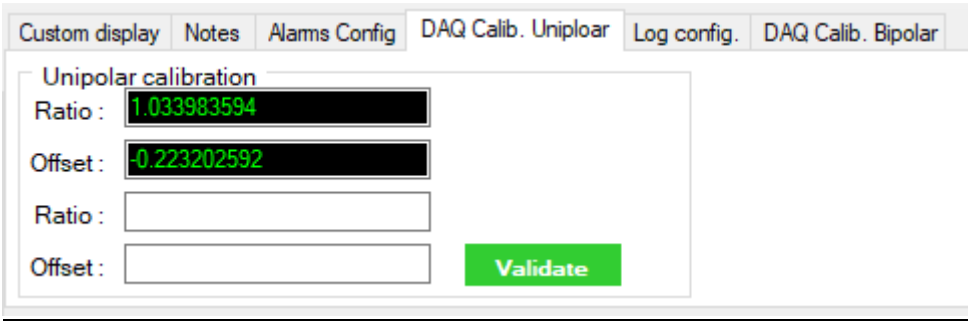
Paste the value in the excel sheet in front of the corresponding injected value

CH0		Bipolar	Unipolar	Injected value (Volts)
sample1				1
sample2				4
Ratio				
offset				

The ratio will be automatically displayed.
Do the same steps with the second injected value, then copy the ratio and the offset values.

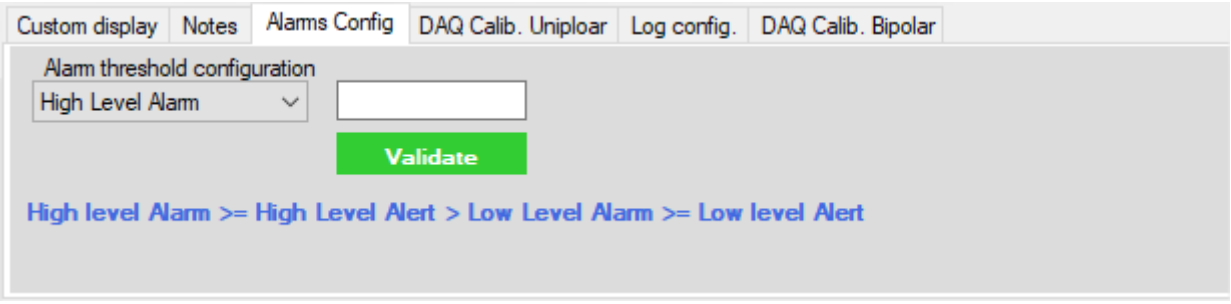
CH0		Bipolar	Unipolar	Injected value (Volts)
sample1			1.1893	1
sample2			4.0914	4
Ratio			1.033734192	
offset			-0.229420075	

Now from the BeanScape software select DAQ Calib. Unipolar and past the ratio and offset values then validate.



For Bipolar calibration you repeat the same steps.

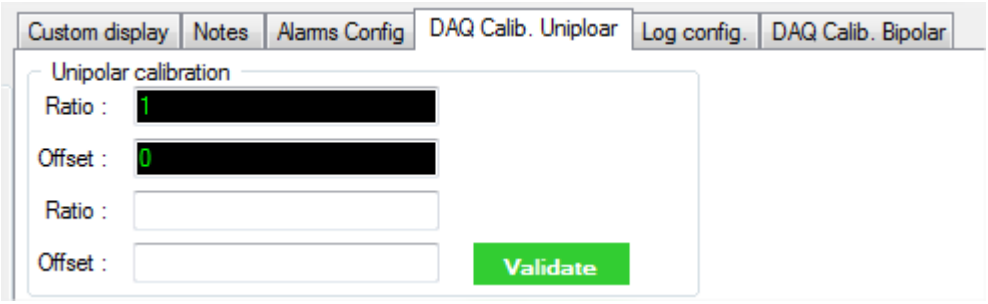
8.4.3.1 Tab: Configuration



Parameter	*Description*
Alarm threshold configuration	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

8.4.3.2 Tab: DAQ calibration Unipolar

These coefficients are used to calibrate the external sensors & Light sensor



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*

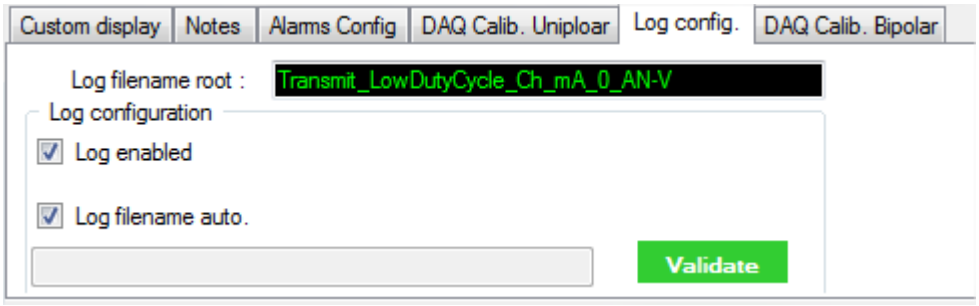
Enter the calibration coefficients and then click on Validate.

The calibrations coefficients are saved on the BeanDevice® flash memory and are conserved during the lifetime of your product.

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

8.4.3.3 Tab: Log configuration

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



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

< Sensor Channel Number > <MAC_ID>

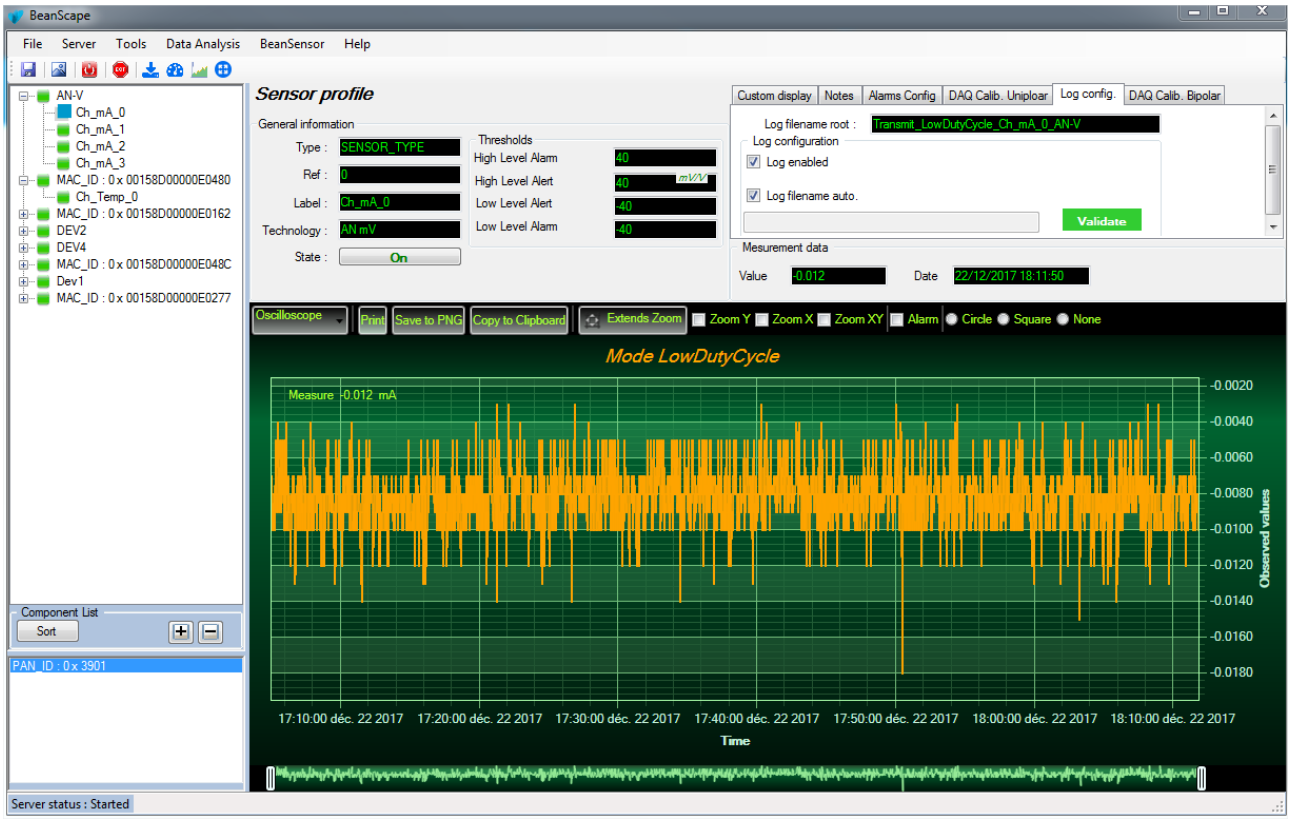
- ✓ ***Log enabled***: If checked, Log is enabled on the BeanScape®
- ✓ ***Log filename auto***.: If checked, Log file name is named automatically

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>***
Solution 2	***The log file name can be fully customized:*** ***Uncheck the case « Log filename auto" and add your own label***

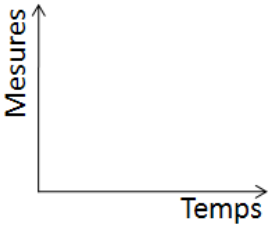
8.4.4 Graphical display



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;

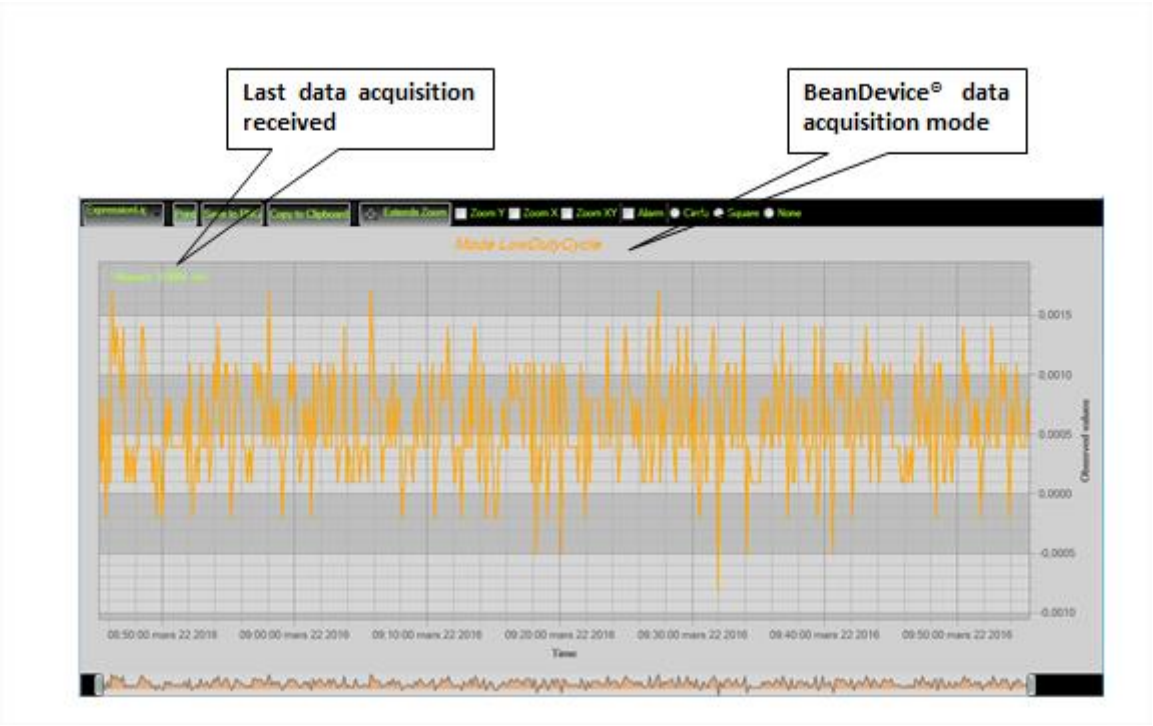
The graph has two axes:



Axe-X: Timeline

Axes-Y: received sensor acquisitions

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



8.4.4.1 Frame: Display

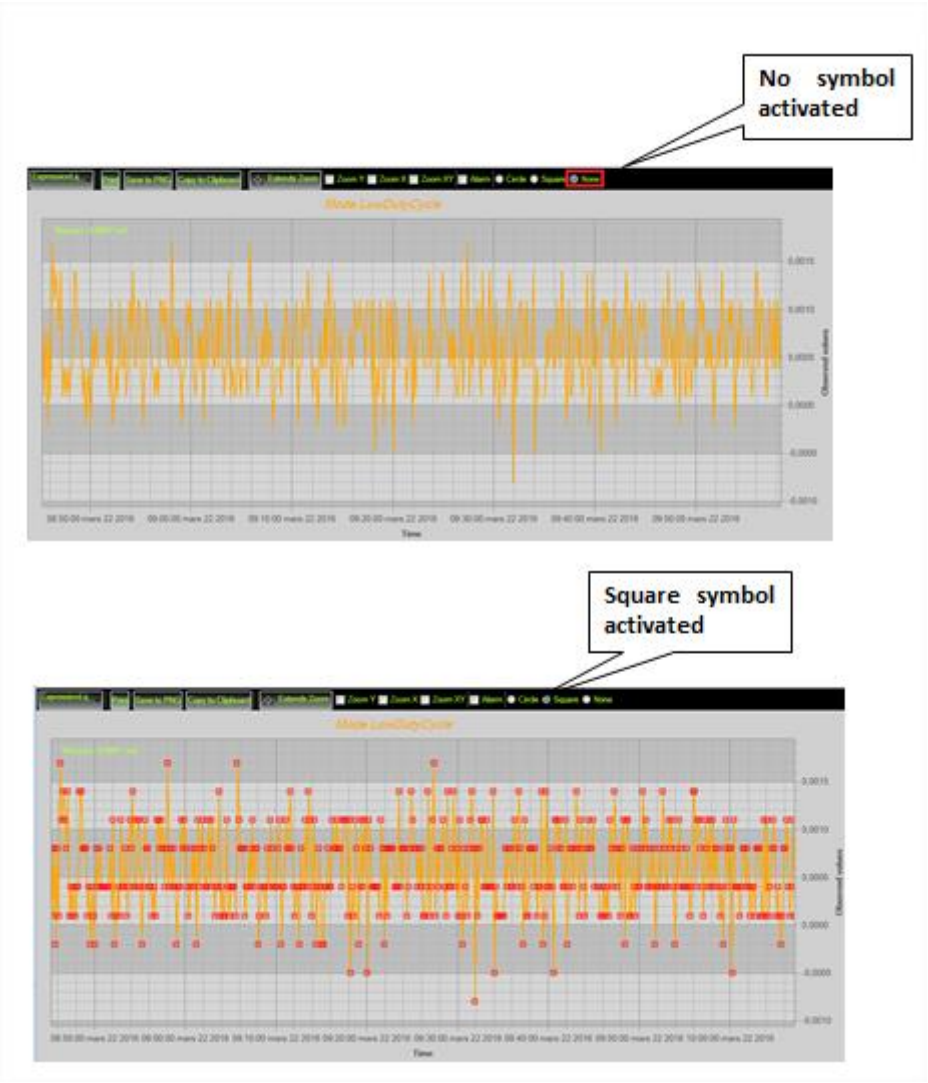
8.4.4.2 Frame: Symbols

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

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


No symbol activated
Square symbol activated
Circle symbol activated

8.4.4.3 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:

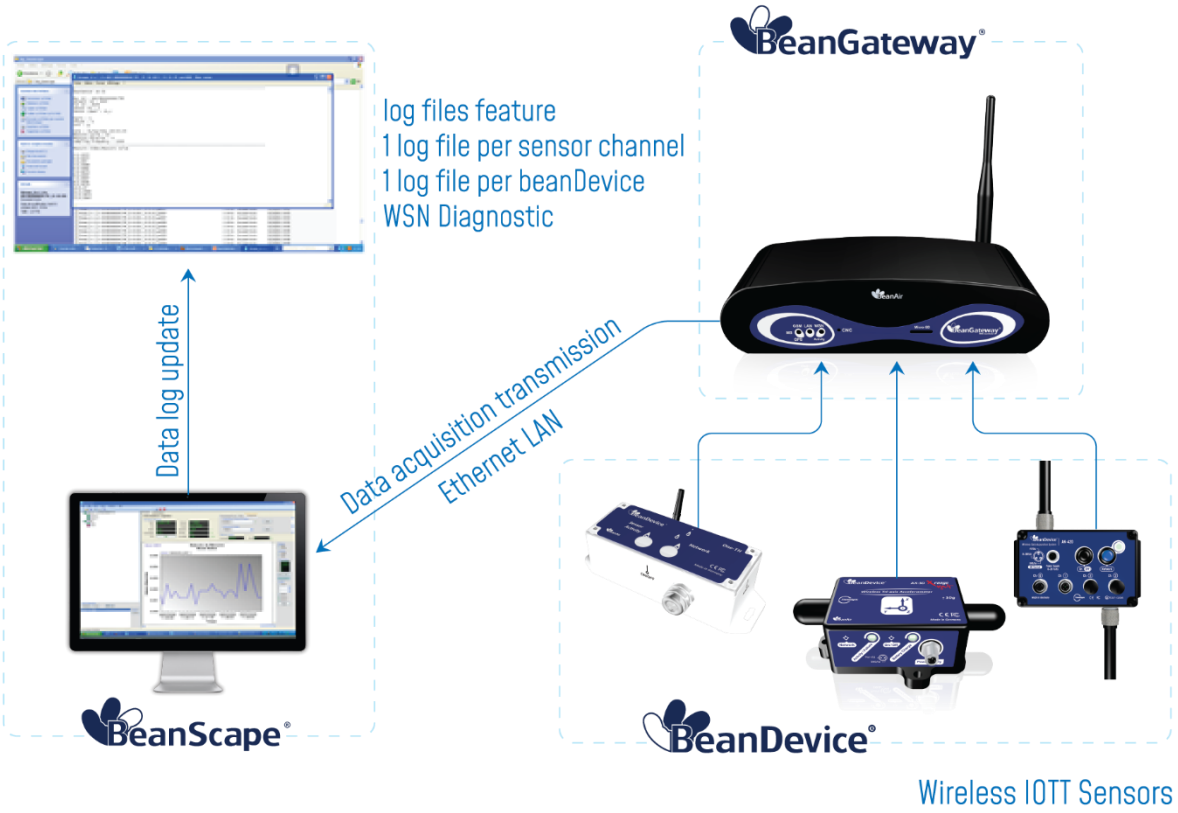
- ***Case 1***: Case "Zoom X" ticked. The graph zoom will only affect the X axis.
- ***Case 2***: Case "Zoom Y" ticked. The graph zoom will only affect the Y axis.
- ***Case 3***: Case "Zoom XY" ticked." Zoom will affect both X and Y axes
- ***Case 4***: Case "Zoom X ", "Zoom XY" and "Zoom Y" not ticked.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

8.5 DATALOGGER CONFIGURATION

Please read the technical note TN_RF_007 – "BeanDevice® Datalogger User Guide "

8.6 LOG FILE ORGANIZATION

8.6.1 Log File System Overview

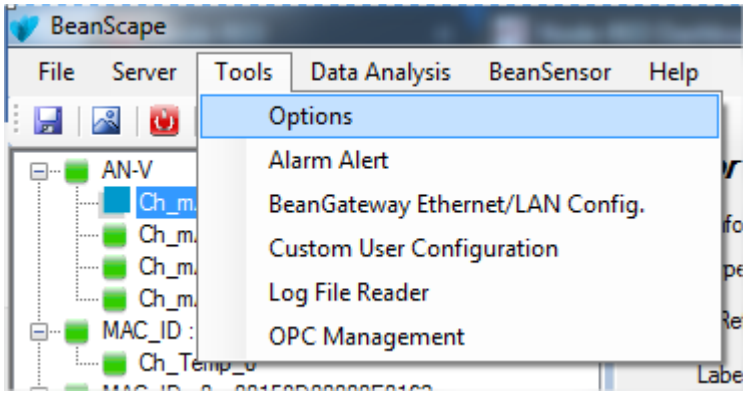


8.6.2 Log file directory

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

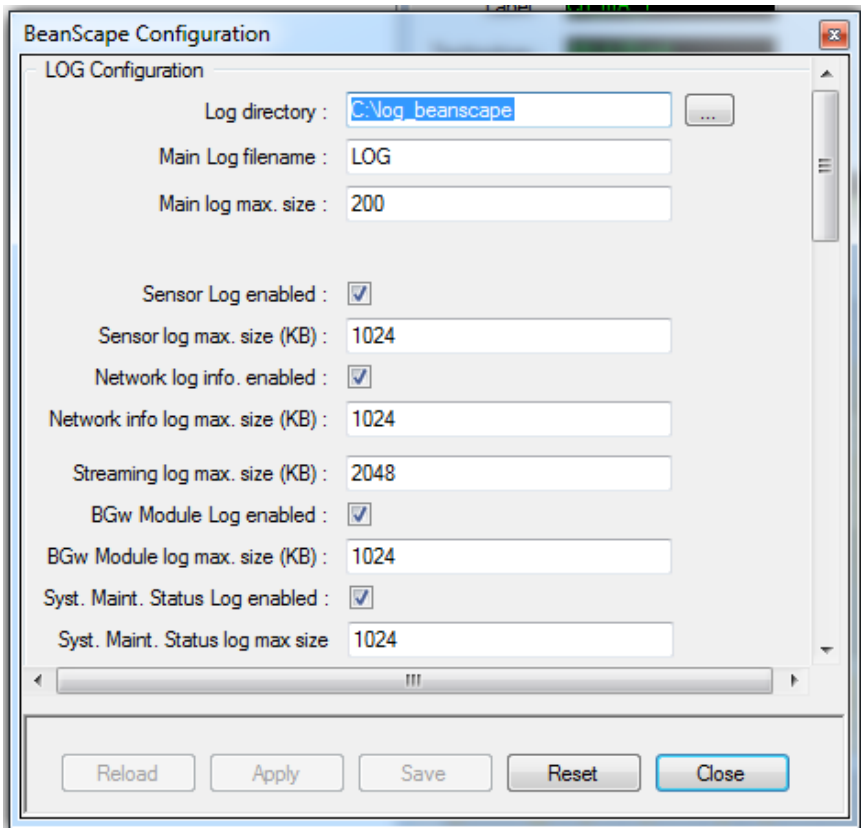
The following procedure applies only for advanced users

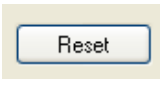
Click on the tab Tools then Options to configure advanced settings in BeanScape®:



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

- You will see the following window :



- Clicking the button 

reverts back to its original configuration.

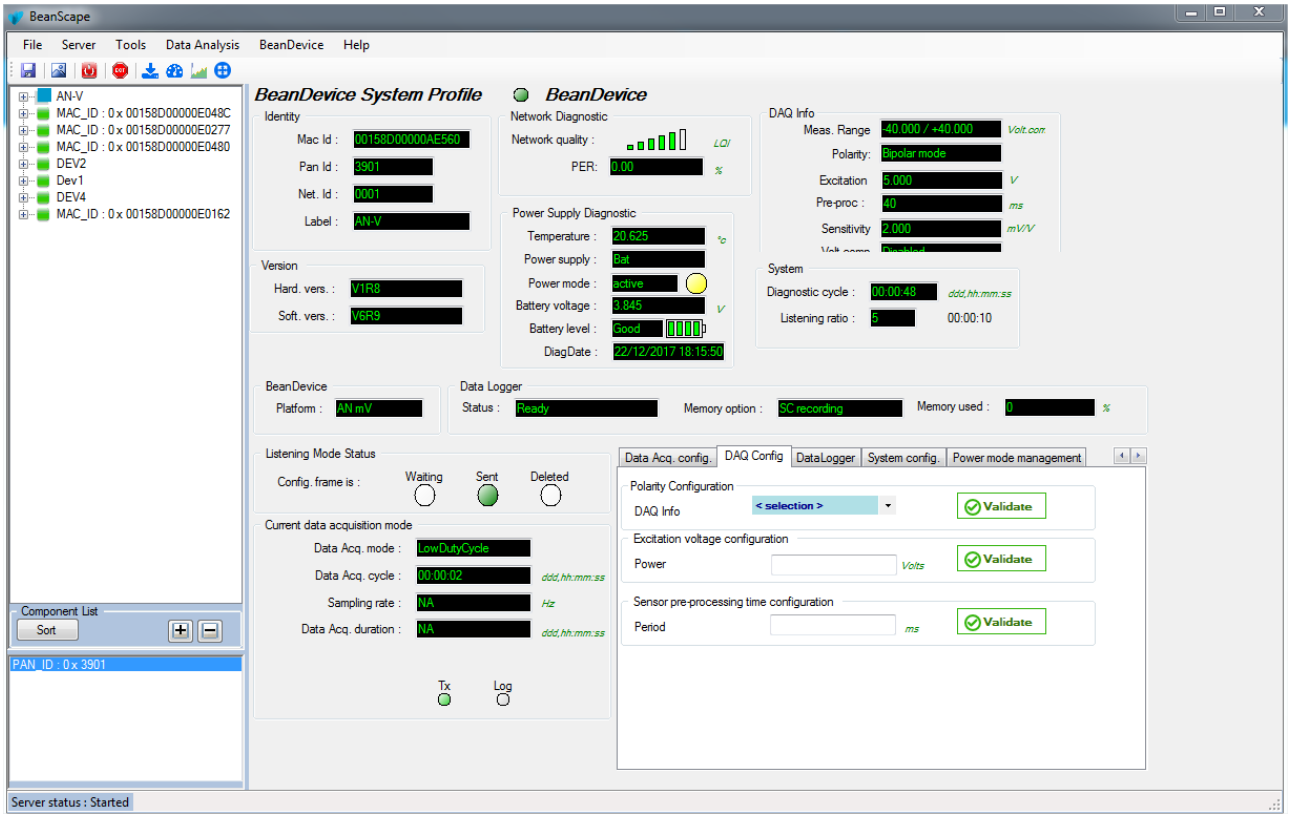
8.6.3 Log Folder

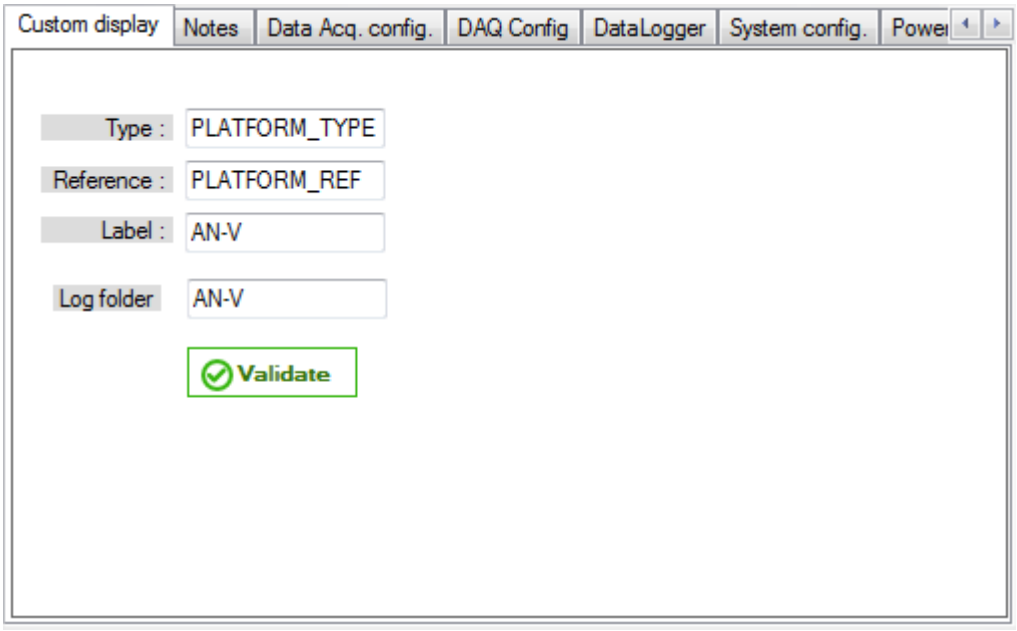
By Default log files linked to the ***BeanDevice®*** are stored in the log folder (located in C:/log_beanscape directory):

"***Folder MAC_ID***"

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

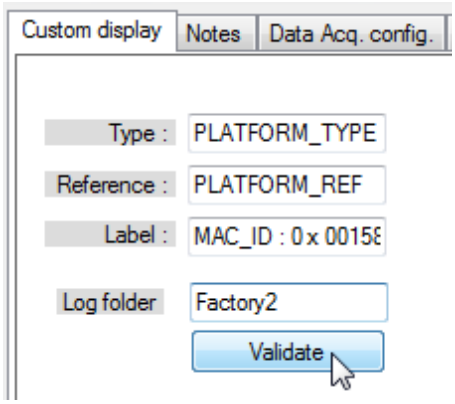
User can change log folder name by clicking on "Custom display" tab located on the **BeanDevice®** profile:



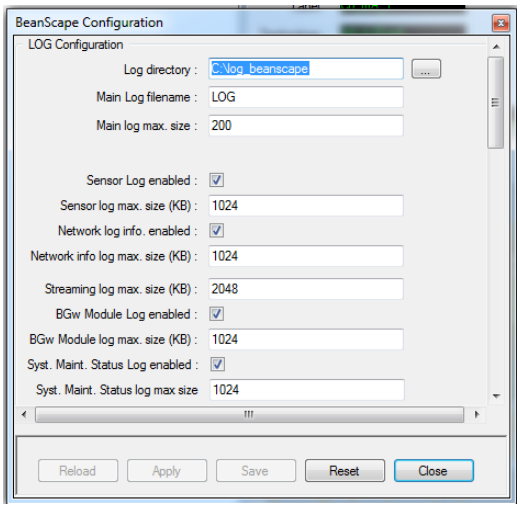


Enter your own log folder name, then click on validate.

The following example shows the log folder changed to “Factory2”:



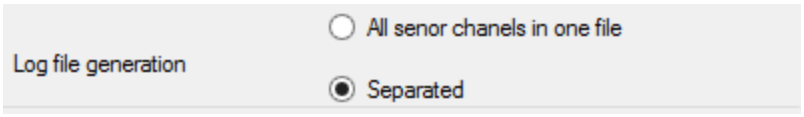
8.6.4 Log file size configuration



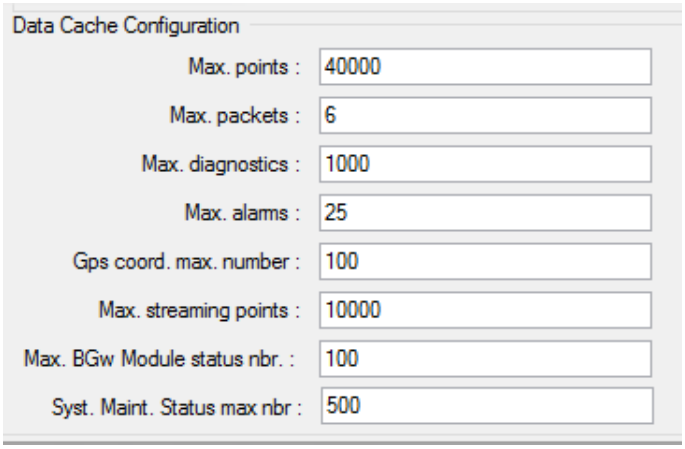
- ✓ ***LOG directory***: Enter here the path/folder where you would want to save the LOG files.
- ✓ ***Main log filename***: Here you may enter the desired name in order to save the LOG file.
- ✓ ***Main log max. size (KB):*** Maximum file size in Kilobytes (KB) for your principal LOG file
- ✓ ***Sensor 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 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 data acquisition mode)

8.6.5 Log file generation

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®.



8.6.6 Cache Data Configuration (for Graph)



- ✓ ***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 number of GPS coordinates***: Set here the maximum number of GPS information;
- ✓ ***Maximum streaming points***: Set here the maximum number of points displayed in Streaming on the BeanScape® graph

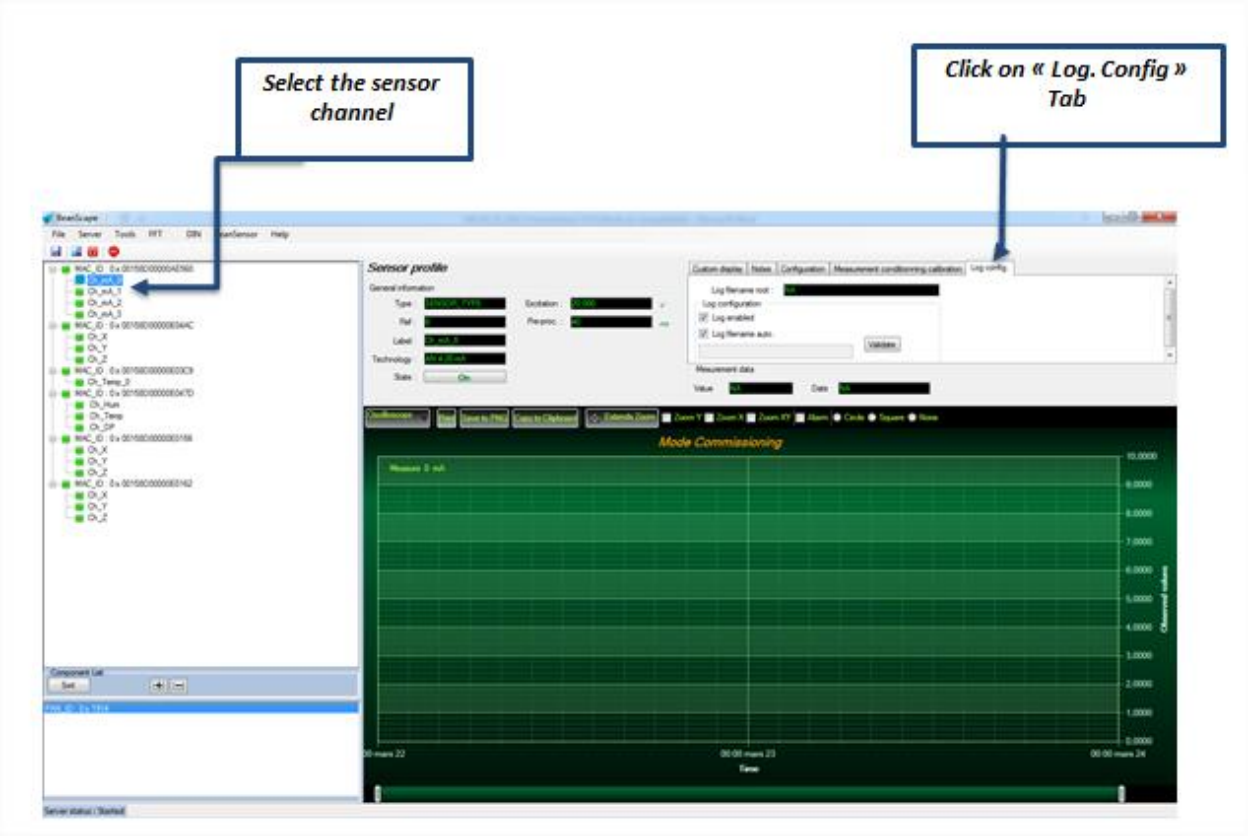
Please note that the values backed up by the BeanScape® may affect the memory capacity of your computer depending upon the size of every file.

8.6.7 Log file related to data acquisition

8.6.7.1 Log filename root

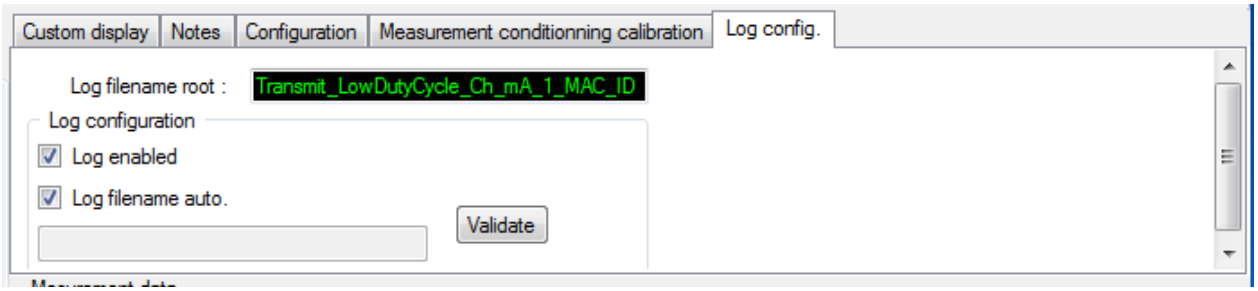
For each sensor channel a log file is automatically created by the BeanScape®.

The user can easily change the log file root:



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

For further information, please refer to the section Log configuration.



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>***
Solution 2	***The log file name can be fully customized:*** ***Uncheck the case "Log filename auto" and add your own label***

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

In Streaming mode, log filename is built as follow:

Stream_Sensor_channel_MAC_ID_DATE_partXXX

- ✓ ***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***

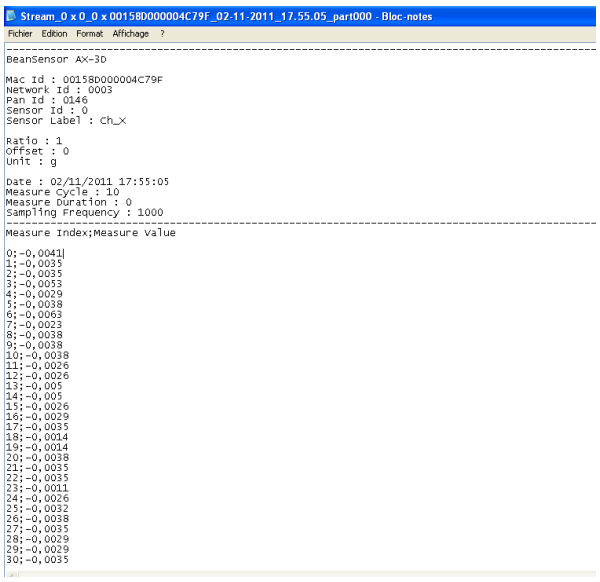
Example:

Stream_0 x 0_0 x 00158D000004C79F_02-11-2011_17.55.05_part000

Stream_0 x 2_0 x 00158D000004C79F_02-11-2011_17.55.05_part001

Stream_0 x 1_0 x 00158D000004C79F_02-11-2011_17.55.05_part001

8.6.7.3 Log file analysis



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.

Example: Data acquisition starts at 17h55min05s

A data acquisition with a measurement index of 30 (value -0,0035) corresponds to a time 17h55min05s30ms.

8.6.8 Log file organization in" Streaming" mode

8.6.8.1 Log file naming format

In Streaming mode, log file is built with a different format:

Stream_Sensor_channel_MAC_ID_DATE_partXXX

- ✓ ***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:

Stream_0 x 0_0 x 00158D000004C79F_02-11-2011_17.55.05_part000

Stream_0 x 2_0 x 00158D000004C79F_02-11-2011_17.55.05_part001

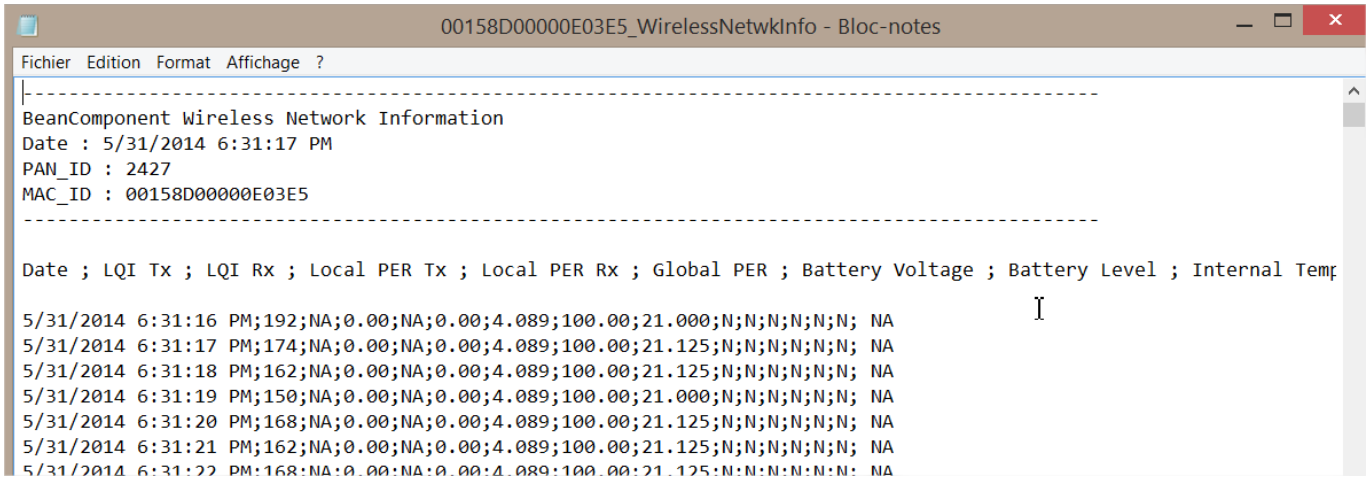
Stream_0 x 1_0 x 00158D000004C79F_02-11-2011_17.55.05_part001

8.6.8.2 Log file analysis

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

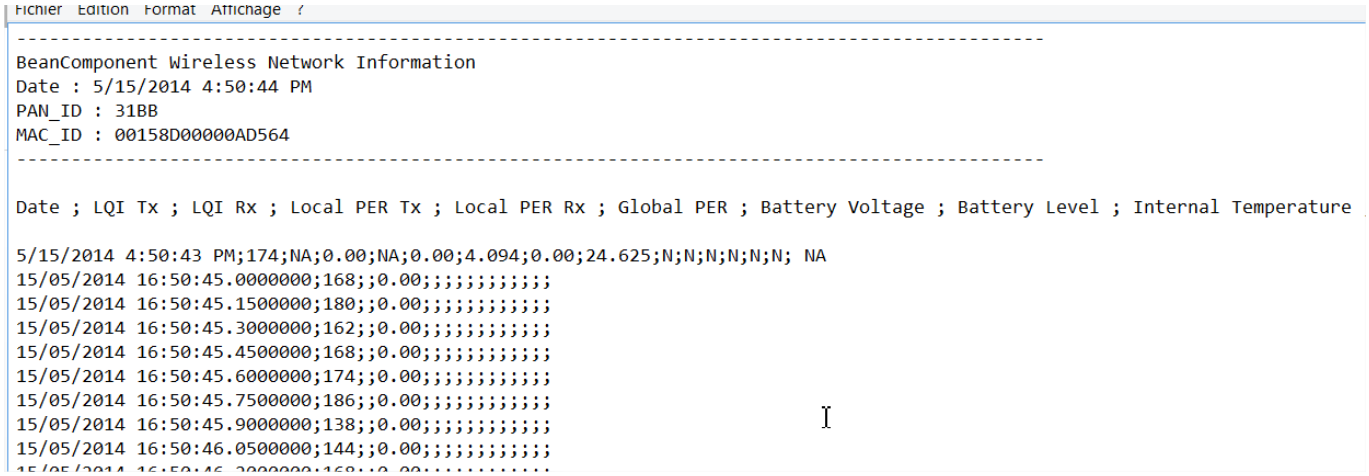
- ***Date*** : diagnostic date
- ***LQI TX***: Link quality indicator on the BeanDevice® side
- ***LQI RX***: Link quality indicator on the BeanGateway® side
- ***Local PER Tx***: Local Packet Error Rate on the BeanDevice® side
- ***Local PER Rx***: Local Packet Error Rate on the BeanGateway® side
-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

- ***Battery level***: battery level of charge
- ***Internal temperature***: Local temperature of the BeanDevice®



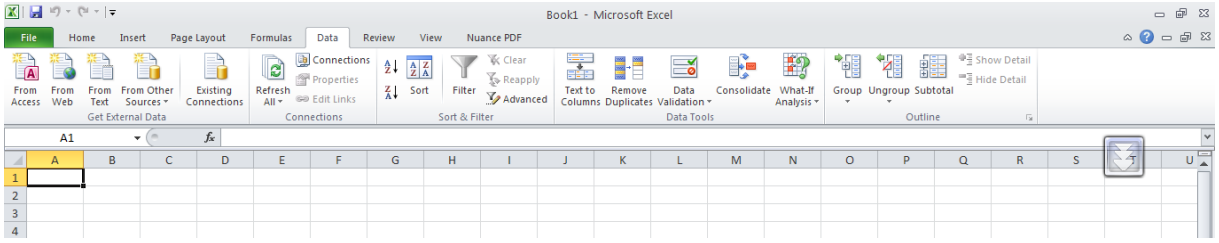
If the BeanDevice® is configured with the streaming data acquisition mode, the following diagnostic information are not refreshed:

- ***Battery voltage***
- ***Battery level***
- ***Internal temperature***

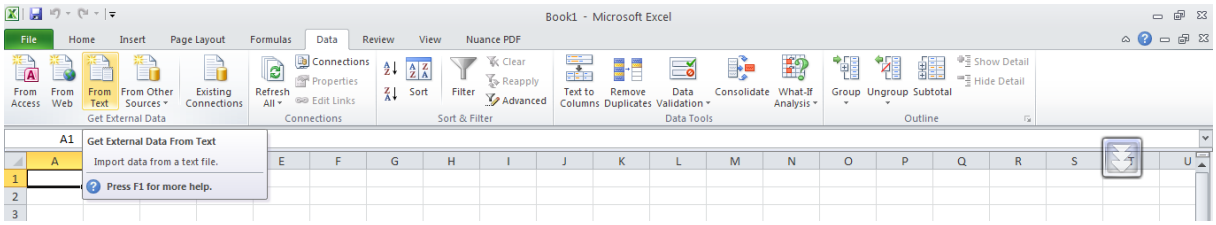


8.6.8.3 How to open a measurement file with excel

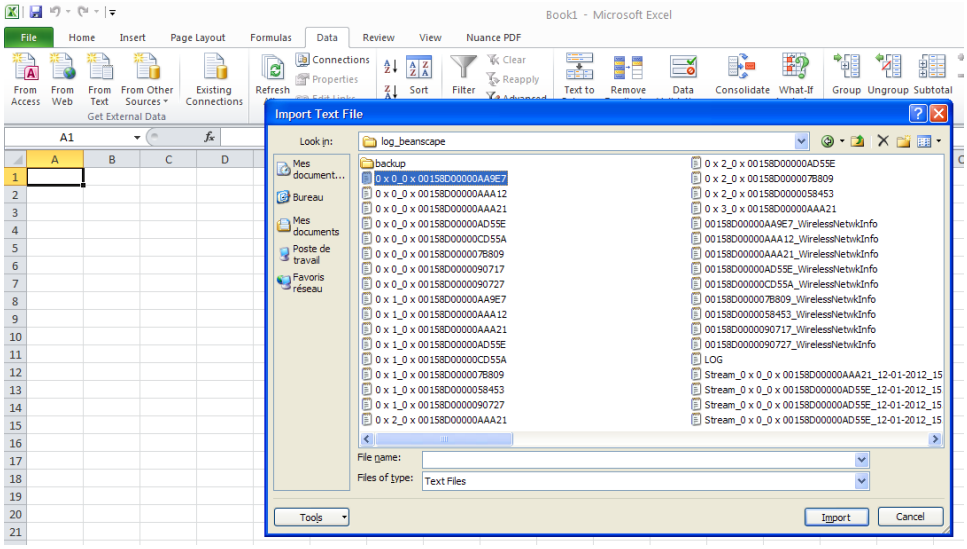
Step 1 : Open Excel



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

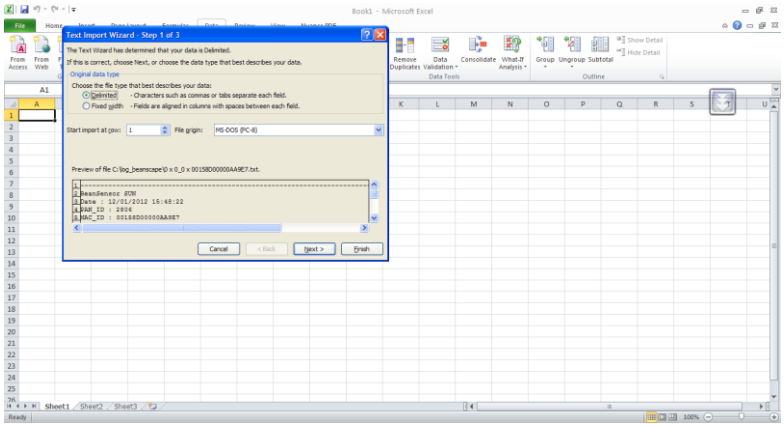


Step 3 : Choose your log file

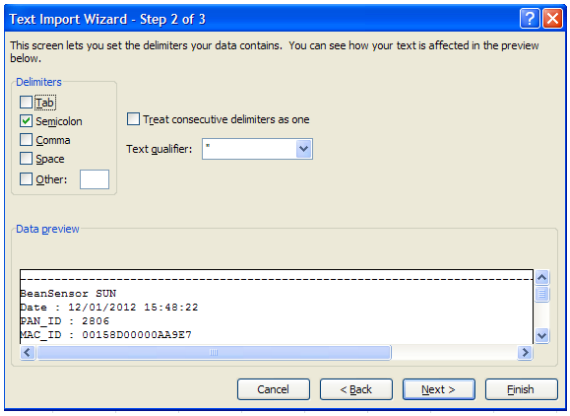


Step 4: Text import wizard will open, select « Delimited » for Characters such as commas or tabs separate each field.

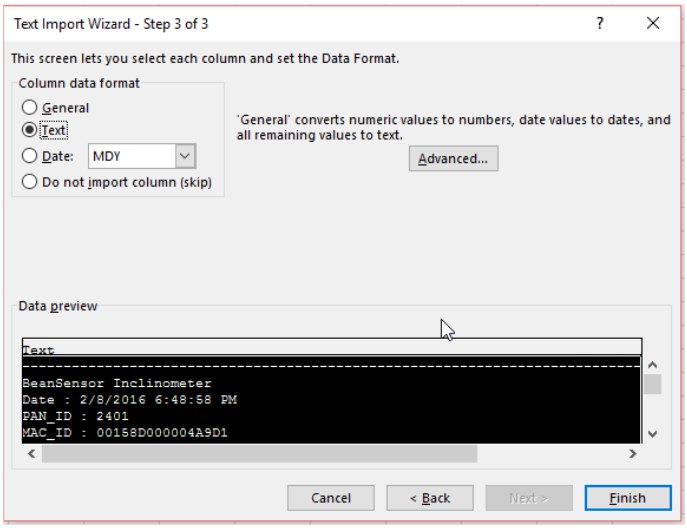
On "***Start import at row***" field: Select the number of lines that you want to suppress from the header:



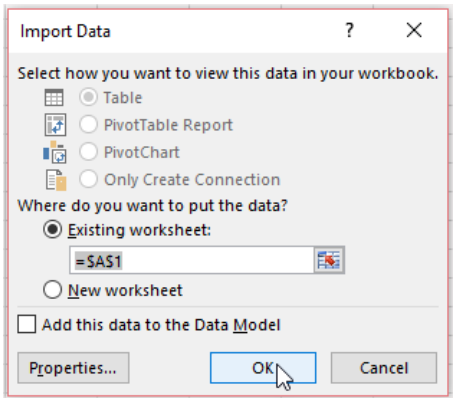
Select semicolon


Text Import Wizard - Step 2 of 3
This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.
Delimiters
Tab
Semicolon
Comma
Space
Other:
Treat consecutive delimiters as one
Text qualifier:
Data preview
BeanSensor SUN
Date : 12/01/2012 15:48:22
PAN_ID : 2806
MAC_ID : 00158D00000AA9E7
Cancel
< Back
Next >
Finish

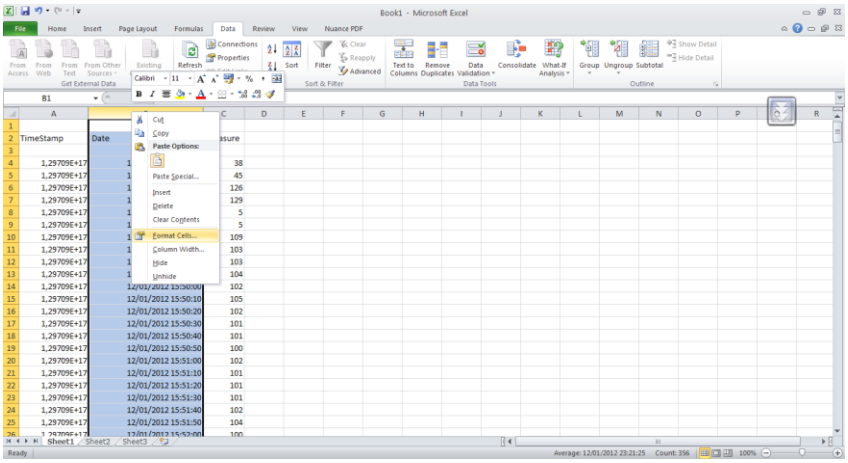
Select Text



Click on OK



Click on format cells:



[See “Exporting a log file to Excel” YouTube video]

9. BEANDEVICE® MAINTENANCE & SUPERVISION (FOR EXPERIENCED USER)

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

9.1 HOW TO OPTIMIZE THE BATTERY AUTONOMY ON YOUR BEANDEVICE®

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 mode:

BeanDevice® version	*Current consumption during radio TX at 25°C, powered by a battery of 3,6V*	*Current consumption in sleep mode at 25°C, powered by a battery of 3,6V*
BeanDevice® AN-mV	60-61 mA (external sensor power supply not included)	< 40 uA
BeanDevice® AN-420	60-61 mA (external sensor power supply not included)	< 40 uA
BeanDevice® AN-V	60-61 mA (external sensor power supply not included)	< 40 uA

For further information, please read the technical note TN_RF_002 - Current consumption in active & sleeping mode

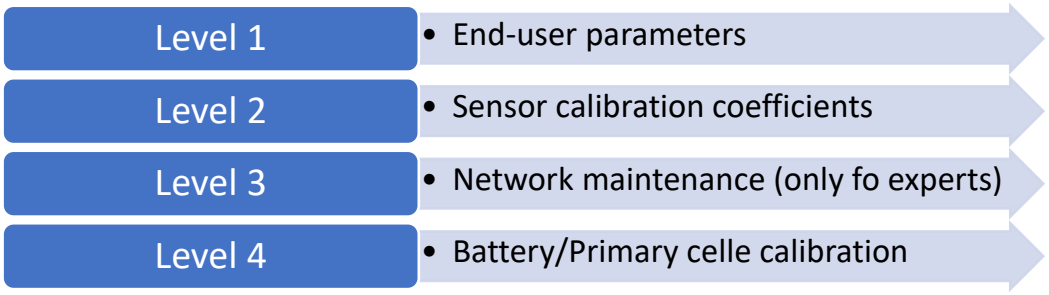
The following table gives you a list of recommendations in order to extend the battery autonomy of your BeanDevice®:

Influence factors on battery autonomy	Observations	Recommendations
Sleep power mode on the BeanDevice®	The BeanDevice® can be configured with sleep mode from the BeanScape® interface	By activating sleep power mode on your BeanDevice®, you will dramatically decrease battery autonomy of your BeanDevice®. By activating sleep mode, the BeanDevice® current consumption can decrease from 30 mA to 10-45 micro-amperes. ***For further information, please read the technical note TN_RF_010 – « BeanDevice® Power Management »***
Sampling rate in streaming mode	The higher your sample rate, the higher the RF transmissions are more consistent and your consumption will grow.	Choose the right sampling rate on your BeanScape® interface.
TX Power	More your TX power is important more the current consumption of the BeanDevice® is important	If your wireless range is low, try to use a lower TX Power.
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).

9.2 OVER-THE-AIR CONFIGURATION (OTAC) PARAMETERS BACKED UP ON FLASH

The BeanDevice® integrates an internal flash memory used to backup OTAC (Over-the-air configuration) configuring parameter backups and restoration.

This memory is organized into several levels:



9.2.1 Level 1: End-user OTAC parameters

The following table presents all the defaults configuration parameters:

To restore these defaults parameters, you must perform a *Network context deletion*. The "Network" push button is outside the product.

Parameter	*BeanDevice® version*		
	AN-420	*AN-V*	*AN-mV*
Power Mode	*Active*	*Active*	*Active*
Data Acquisition duty cycle	*10s*	*10s*	*10s*
Acquisition duration time	*OK*	*OK*	*OK*
Sampling rate	*OK*	*OK*	*OK*
Data Acquisition mode	*LowDutyCycle*	*LowDutyCycle*	*LowDutyCycle*
TX Power	*+18dBm*	*+18dBm*	*+18dBm*
Alarms Threshold	*H1 :20* *H2 :20* *S2 :4* *S1 :4*	*H1 :10* *H2 :10* *S2 :0* *S1 :0*	*H1 :20* *H2 :20* *S2 :0* *S1 :0*
Pre-process duration time	*30 ms*	*30 ms*	*30 ms*
Sensor polarity	*N.A.*	*Unipolar*	*Unipolar*

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

9.2.2 Level 2: Sensor calibration parameters

The table below shows the sensor calibration parameters depending on BeanDevice® version:

Parameter	*BeanDevice® Version*		
	AN-420	AN-V	AN-mV
Sensor gain	*OK*	*OK* *2 gains value (unipolar & bipolar)*	*OK* *2 gains value (unipolar & bipolar)*
Sensor offset	*OK*	*OK* *2 offset value (unipolar & bipolar)*	*OK* *2 offset value (unipolar & bipolar)*

9.2.3 Level 3: Network maintenance (only for expert in wireless sensor networks)

The table below shows the sensor calibration parameters depending on ***BeanDevice®*** version:

Parameter	**BeanDevice® Model**		
	AN-420	AN-V	AN-mV
Software reset counter	*OK*	*OK*	*OK*
Physical reset counter	*OK*	*OK*	*OK*
Threshold value on software reset	*OK*	*OK*	*OK*

9.2.4 Level 4: Primary cell/Rechargeable battery calibration

The table below shows Primary cell/Rechargeable battery calibration depending on ***BeanDevice®*** version:

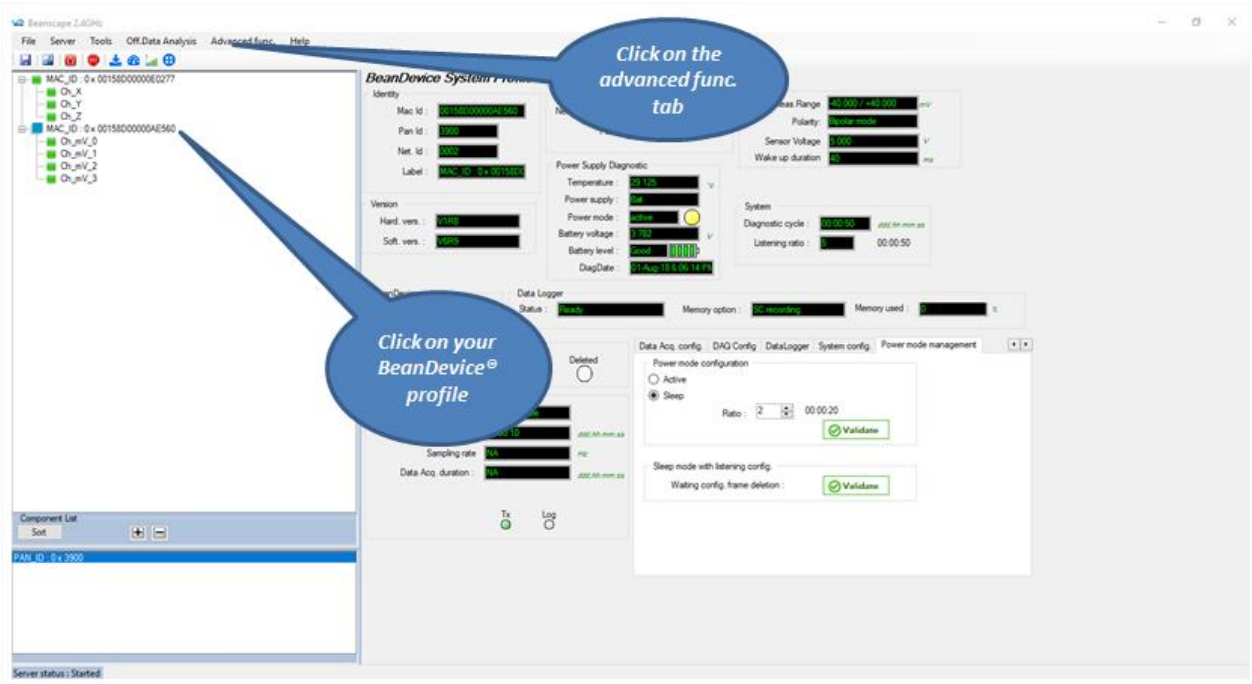
Parameter	BeanDevice® Model		
	AN-420	AN-V	AN-mV
Battery, primary cell ID	OK	OK	OK
Calibration battery/pile	OK	OK	OK

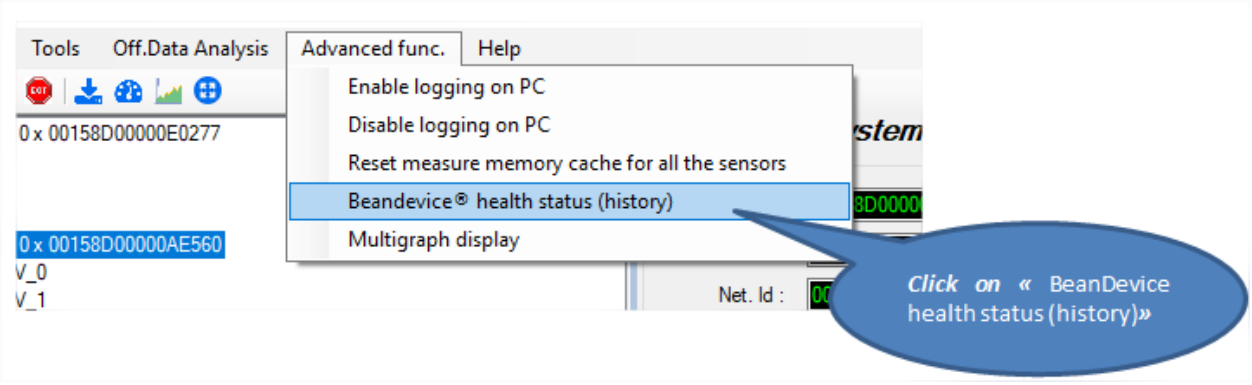
9.3 NETWORK DIAGNOSTIC FROM YOUR BEANSCAPE® SOFTWARE

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

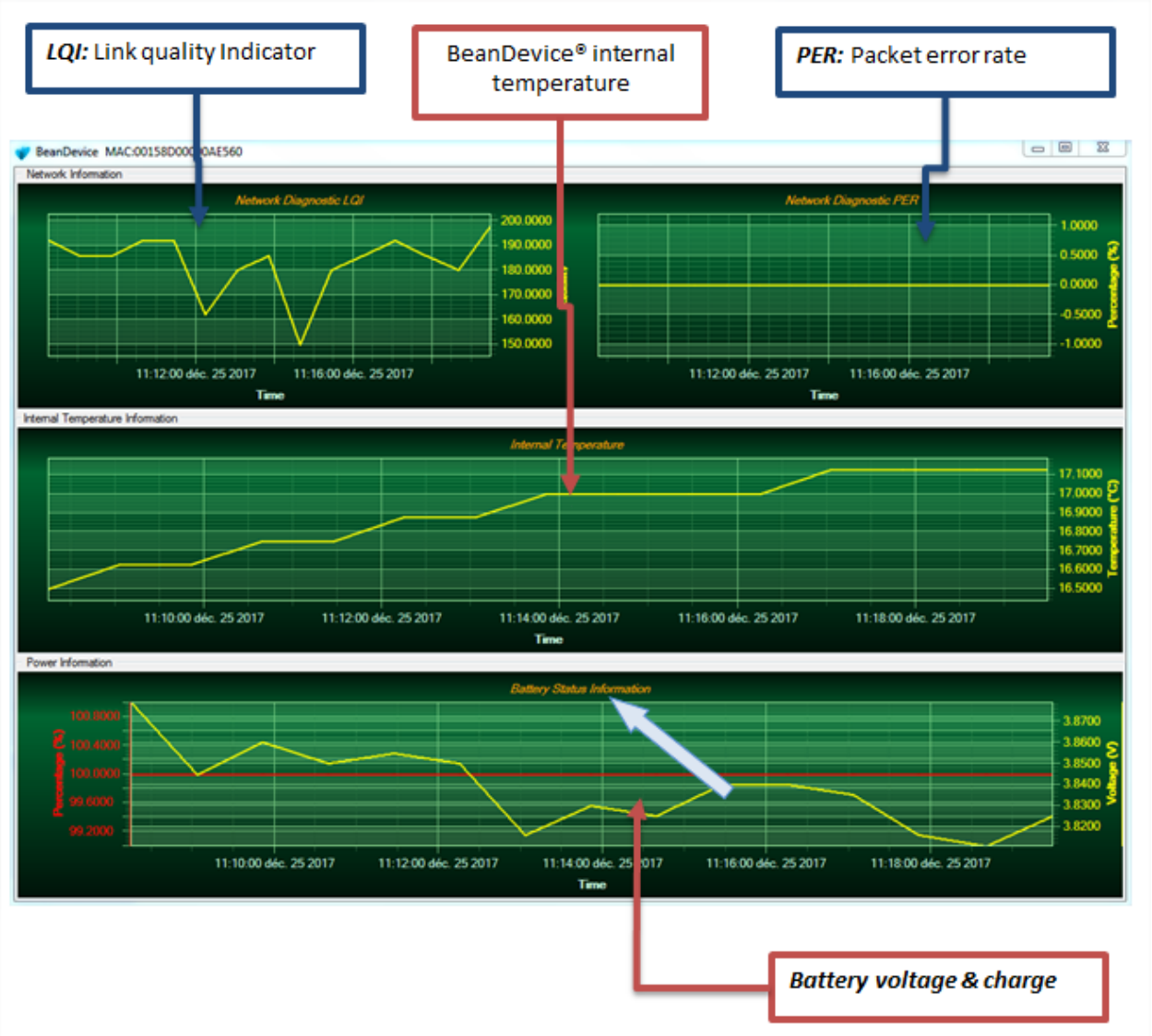
9.3.1 Displaying Network information

1. Launch your BeanScape® application
2. 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)”.


Click on the advanced func. tab
Click on your BeanDevice® profile


Tools
Off.Data Analysis
Advanced func.
Help
Enable logging on PC
Disable logging on PC
Reset measure memory cache for all the sensors
Beandevice® health status (history)
Multigraph display
0 x 00158D00000E0277
0 x 00158D00000AE560
V_0
V_1
Net. Id :
Click on « BeanDevice health status (history)»

A new window pop up:



9.3.1.1 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®.

9.3.1.2 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.

For further information, read the application note on "How to extend your wireless range?"

9.3.1.3 Internal temperature monitoring

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

9.3.1.4 Battery charge monitoring

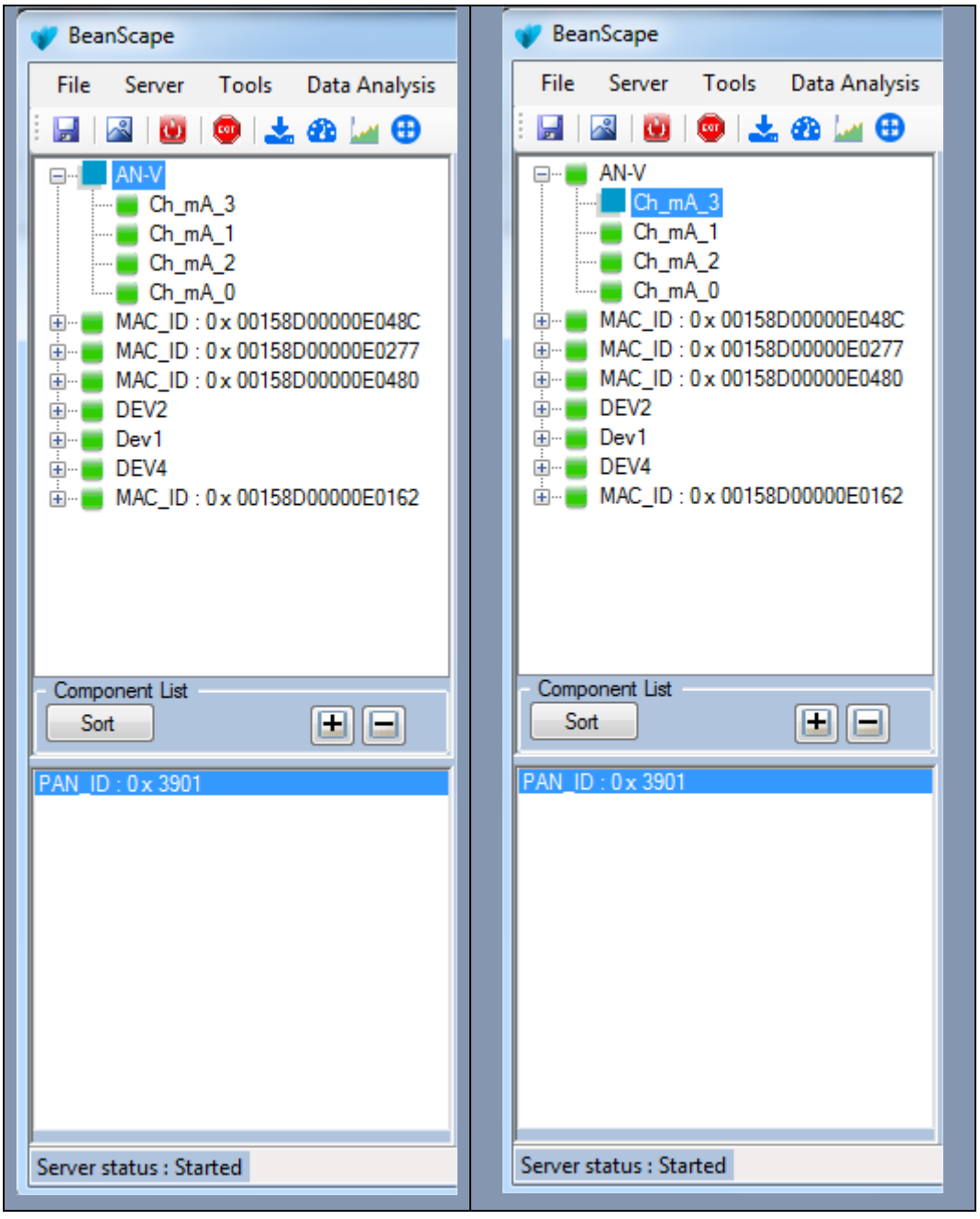
Battery charge is based on current accumulation. The BeanDevice® integrates a current accumulator circuit which facilitates remaining capacity estimation by tracking the net current flow into and out of the battery. Current flow into the battery increments the current accumulator while current flow out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

Voltage measurement corresponds to battery voltage.

9.3.2 Scrolling menu « BeanSensor »

The BeanSensor® 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 BeanSensor® scrolling menu appearing.

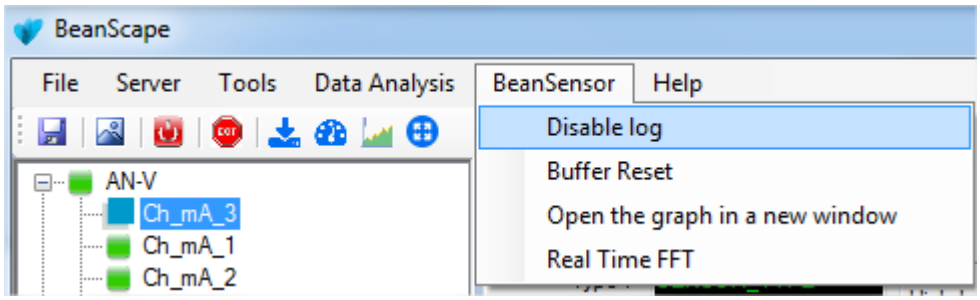


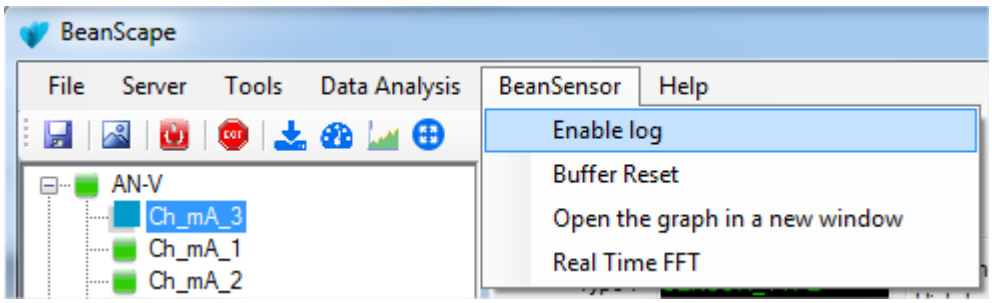
By clicking on the scrolling menu « BeanSensor », you can access to the following features:

9.3.2.1 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.





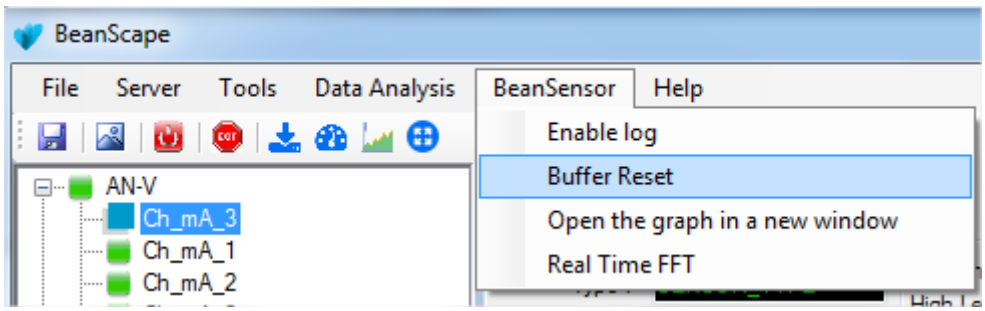
For further information about CSV log file, please read the BeanScape® user manual.

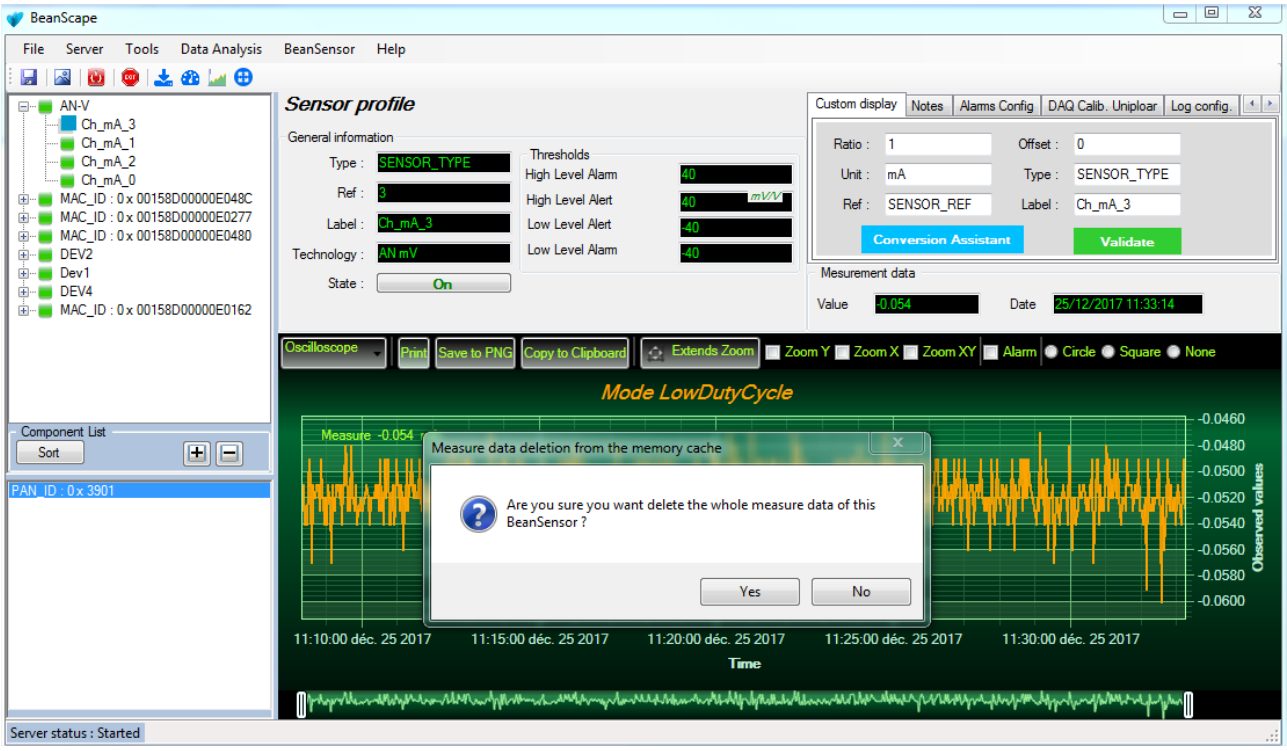
9.3.2.2 Buffer reset

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:

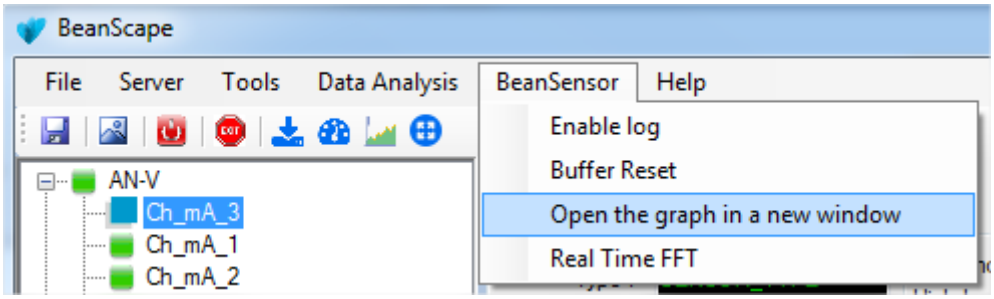
- Yes, you accept to delete the whole measure data of this BeanSensor;
- No, don't delete the whole measure data of this BeanSensor;



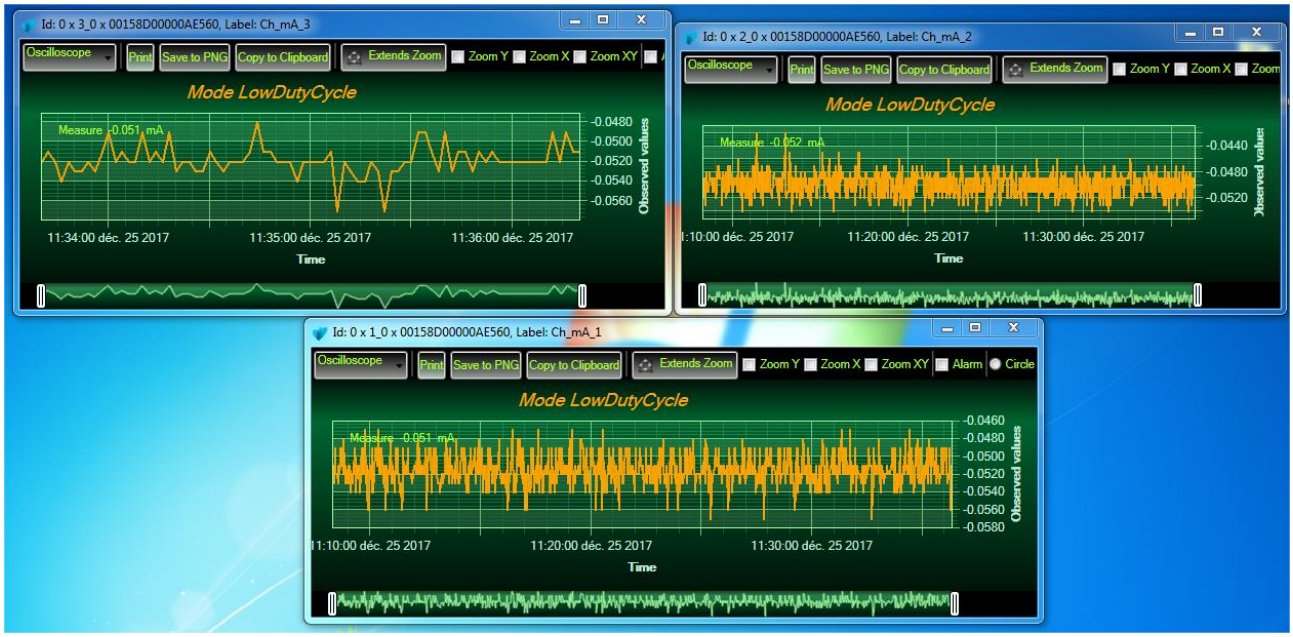


9.3.2.3 Open the graph in a new window

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



You can easily open several graphs in a window.



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

10. TROUBLESHOOTING

- ***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 the radio channel is perturbed?***

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 in sleep mode, the RF Hardware is also in sleep mode. 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-HD: don't forget to configure the cutoff frequency of your anti-aliasing filter

  ✓ If you use a BeanDevice® AN-mV: use a shielded cable.

11. INSTALLATION PROCEDURES

11.1 SEALING

The product BeanDevice® comes with an *IP66* rating. So, do not install the BeanDevice® in a marine environment with high turbulence.
If you use the BeanDevice® AN-XX/TSI/TH, do not install the BeanDevice® up front to prevent the accumulation and infiltration of water from the front of the case.

11.2 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: TN_RF_011 – "Coexistence of Beanair WSN at 2.4GHz"

11.3 TEMPERATURE & HUMIDITY

The table below shows temperature operating of the different BeanDevice®:

Product Version	Temperature range
BeanDevice® AN-XX	*-20 ° C to +75 ° 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), ...

11.4 REFLECTIONS, OBSTRUCTIONS AND MULTIPATH

For further information, read the application note: AN_RF_007 :" Beanair_WSN_Deployment"

11.5 SHOCK & VIBRATION RESISTANCE

Shock resistance on BeanDevice® products are:

BeanDevice® Type	*Shock resistance*
BeanDevice® AN-XX	10g during 50 ms

Avoid dropping the BeanDevice®. BeanDevice® mechanical mounting on a wall, pole or on a DIN rail must be well performed.
Do not force connections.

11.6 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: AN_RF_007 :" Beanair_WSN_Deployment"

12. APPENDIX

12.1 FIREWALL EXCEPTION FOR BEANSCAPE®

By default, firewall blocks all unknown network traffic coming into 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"

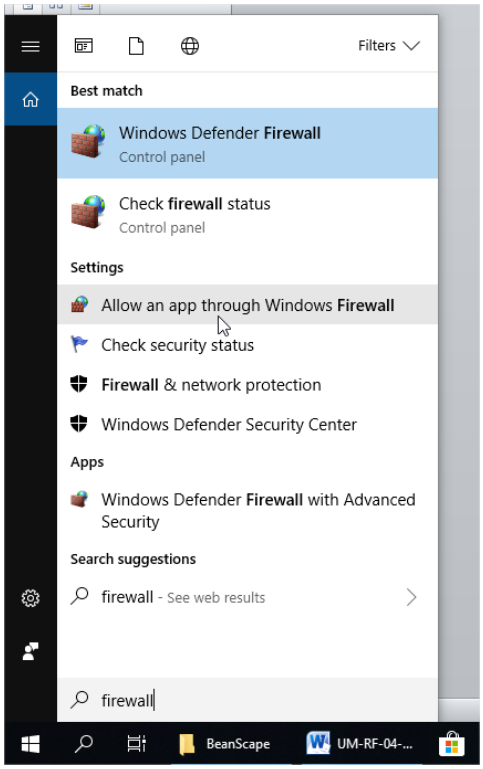


Figure 16 :Windows search for firewall screenshot

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.

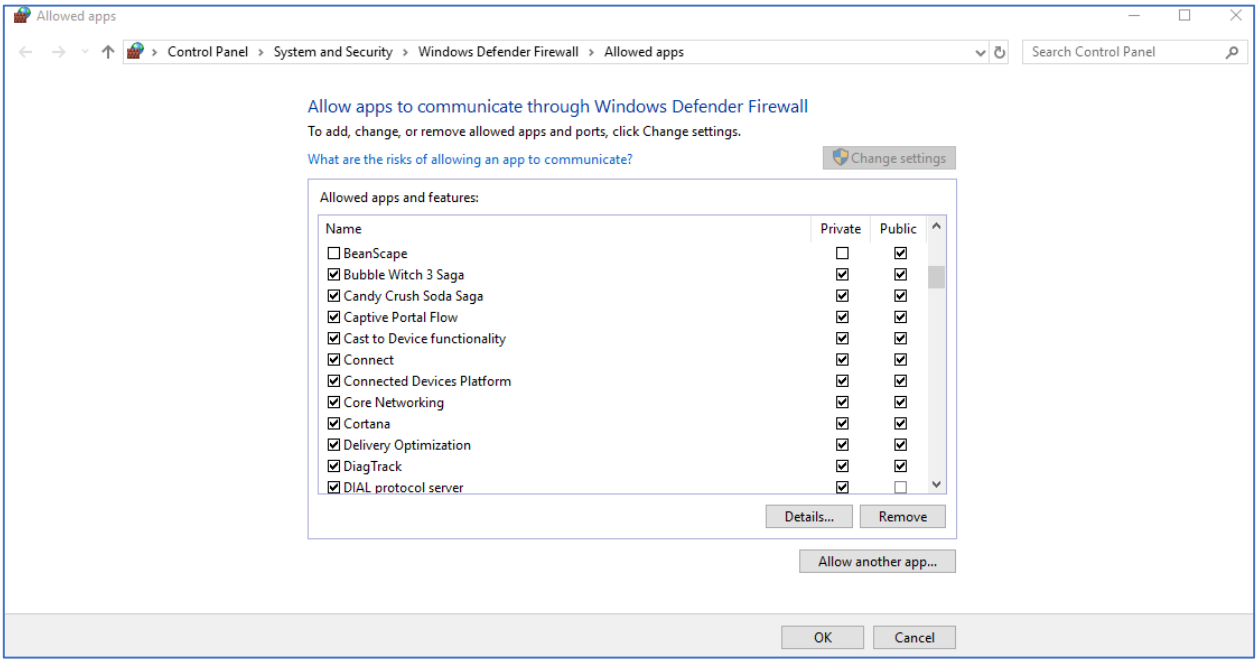


Figure 17: allowed apps window

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.

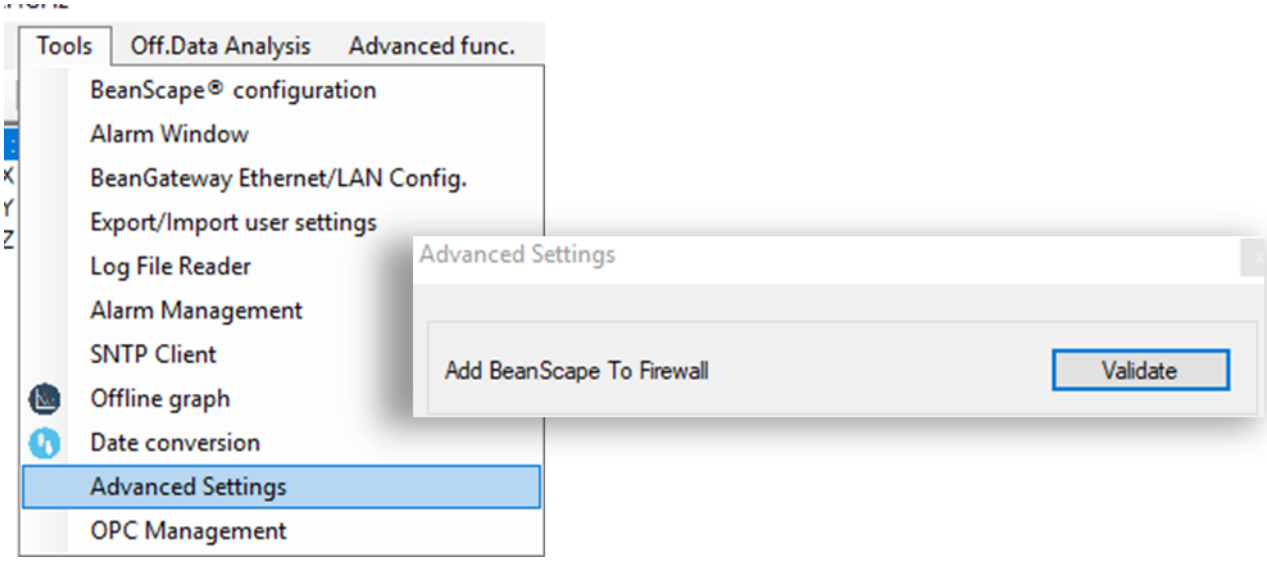


Figure 18: Firewall auto exception