Waspmote Plug & Sense!

The new Waspmote Plug & Sense! line allows you to easily deploy wireless sensor networks in a easy and scalable way ensuring minimum maintenance costs. The new platform consists of a robust waterproof enclosure with specific external sockets to connect the sensors, the solar panel, the antenna and even the USB cable in order to reprogram the node. It has been specially designed to be scalable, easy to deploy and maintain.

Note: *For a complete reference guide download the "Waspmote Plug & Sense! Technical Guide" in the* ***Development section*** *of the* ***Libelium website****.*

Features

- Robust waterproof IP65 enclosure
- Add or change a sensor probe in seconds
- Solar powered with internal and external panel options
- Radios available: Zigbee, 802.15.4, Wifi, 868MHz, 900MHz and 3G/GPRS
- Over the air programming (OTAP) of multiple nodes at once
- Special holders and brackets ready for installation in street lights and building fronts
- Graphical and intuitive programming interface

Sensor Probes

Sensor probes can be easily attached by just screwing them into the bottom sockets. This allows you to add new sensing capabilities to existing networks just in minutes. In the same way, sensor probes may be easily replaced in order to ensure the lowest maintenance cost of the sensor network.

Figure 1: Connecting a sensor probe to Waspmote Plug & Sense!

Solar Powered

Battery can be recharged using the internal or external solar panel options.
The external solar panel is mounted on a 45º holder which ensures the maximum performance of each outdoor installation.

Figure 2: Waspmote Plug & Sense! powered by an external solar panel

For the internal option, the solar panel is embedded on the front of the enclosure, perfect for use where space is a major challenge.

Figure 3: Internal solar panel

Figure 4: Waspmote Plug & Sense! powered by an internal solar panel

Programming the Nodes

Waspmote Plug & Sense! can be reprogrammed in two ways:

The basic programming is done from the USB port. Just connect the USB to the specific external socket and then to the computer to upload the new firmware.

Figure 5: Programming a node

Over the Air Programming is also possible once the node has been installed. With this technique you can reprogram wirelessly one or more Waspmote sensor nodes at the same time by using a laptop and the Waspmote Gateway.

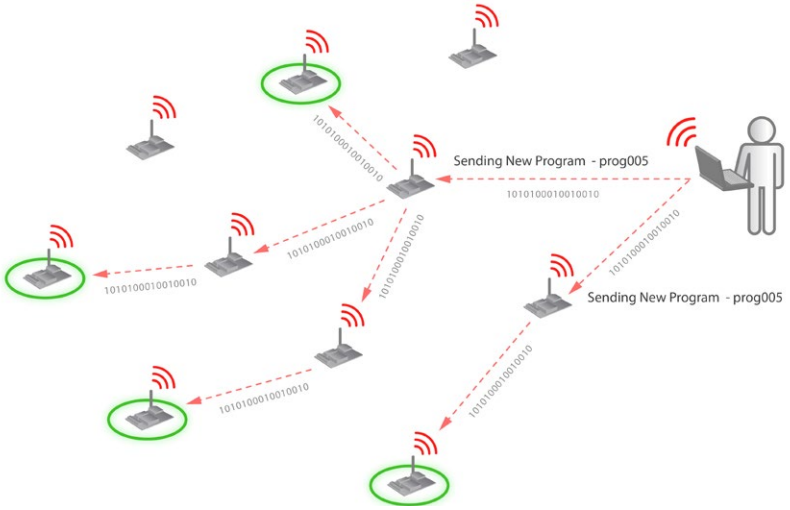


Figure 6: Typical OTA process

Radio Interfaces

Model	Protocol	Frequency	txPower	Sensitivity	Range *
XBee-802.15.4-Pro	802.15.4	2.4GHz	100mW	-100dBm	7000m
XBee-ZB-Pro	ZigBee-Pro	2.4GHz	50mW	-102dBm	7000m
XBee-868	RF	868MHz	315mW	-112dBm	12km
XBee-900	RF	900MHz	50mW	-100dBm	10Km
Wifi	802.11b/g	2.4GHz	0dBm - 12dBm	-83dBm	50m-500m
GPRS	-	850MHz/900MHz/ 1800MHz/1900MHz	2W(Class4) 850MHz/900MHz, 1W(Class1) 1800MHz/1900MHz	-109dBm	
3G/GPRS	-	Tri-Band UMTS 2100/1900/900MHz Quad-Band GSM/EDGE, 850/900/1800/1900 MHz	UMTS 900/1900/2100 0,25W GSM 850MHz/900MHz 2W DCS1800MHz/PCS1900MHz 1W	-106dBm	

** Line of sight and Fresnel zone clearance with 5dBi dipole antenna*

Program in minutes

In order to program the nodes an intuitive graphic interface has been developed. Developers just need to fill a web form in order to obtain the complete source code for the sensor nodes. This means the complete program for an specific application can be generated just in minutes. Check the Code Generator to see how easy it is at:

http://www.libelium.com/development/plug_&_sense/sdk_and_applications/code_generator

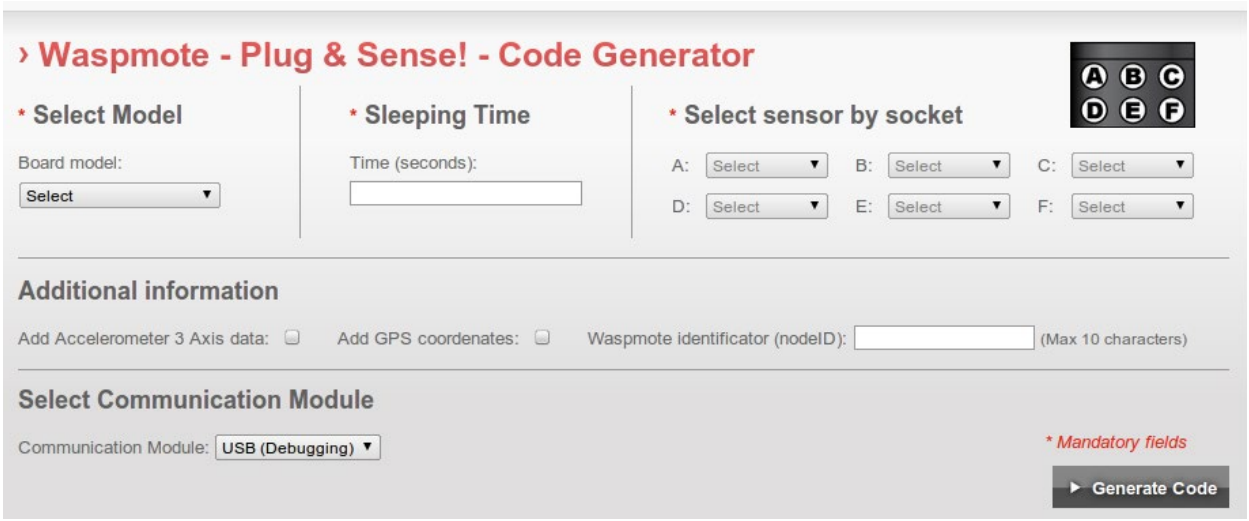


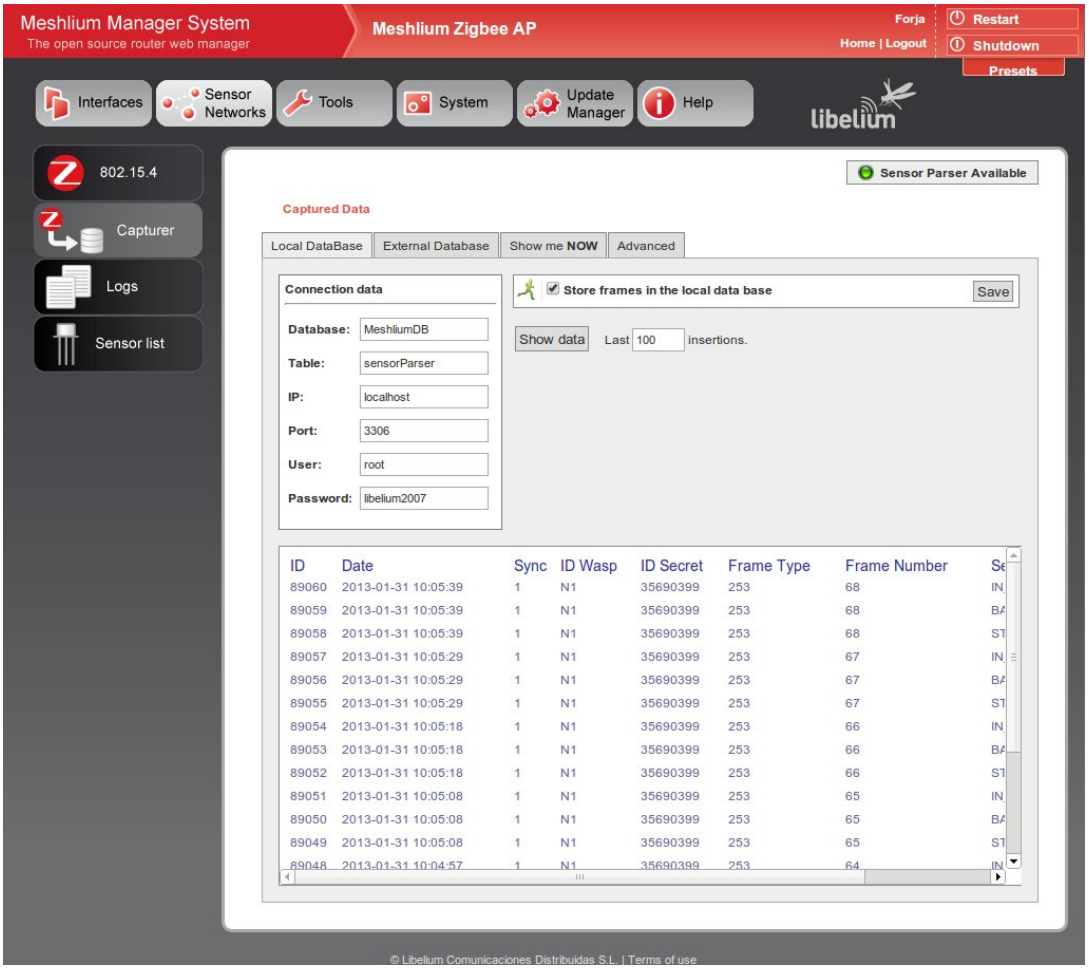
Figure 7: Code Generator

Data to the Cloud

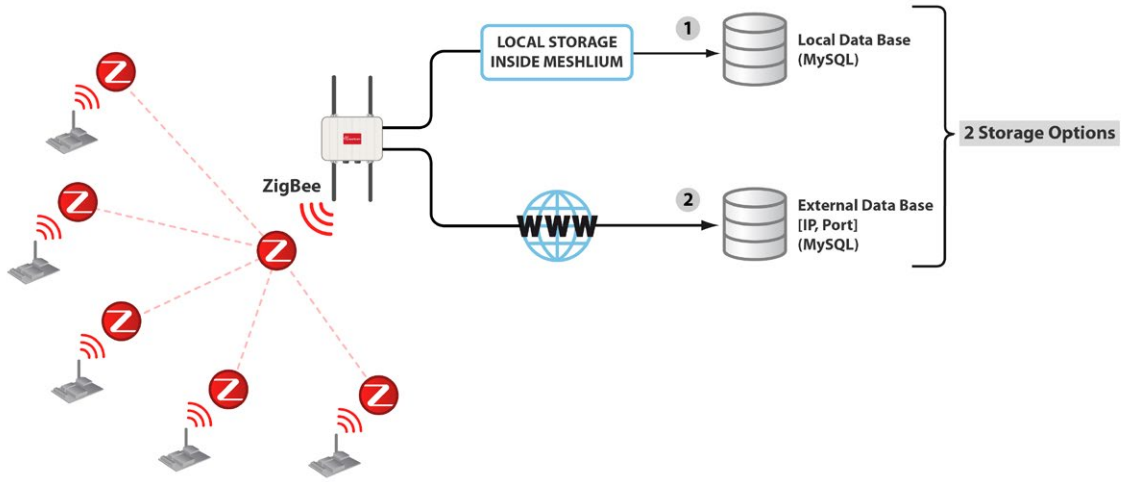
The Sensor data gathered by the Waspmote Plug & Sense! nodes is sent to the Cloud by **Meshlium**, the Gateway router specially designed to connect Waspmote sensor networks to the Internet via Ethernet, Wifi and 3G interfaces.

Figure 8: Meshlium

Now it is much easier to receive frames Waspmote to Meshlium in an automatic way. Inside the "Sensor Network" section, the user can use the new feature Sensor Parser.

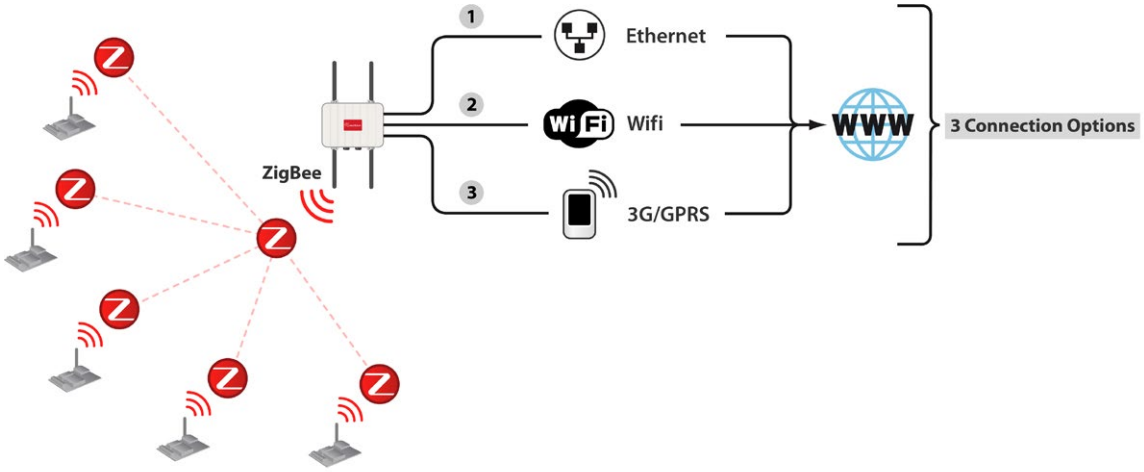


Meshlium Storage Options:



- Local Data Base
- External Data Base

Meshlium Connection Options:



- ZigBee → Ethernet
- ZigBee → Wifi
- ZigBee → 3G/GPRS

Models

There are some defined configurations of Waspmote Plug & Sense! depending on which sensors are going to be used. Waspmote Plug & Sense! configurations allows connecting up to six sensor probes at the same time.

Each model takes a different conditioning circuit to enable the sensor integration. For this reason each model allows to connect just its specific sensors.

This section describes each model configuration in detail, showing the sensors which can be used in each case and how to connect them to Waspmote. In many cases, the sensor sockets accept the connection of more than one sensor probe. See the compatibility table for each model configuration to choose the best probe combination for the application.

It is very important to remark that each socket is designed only for one specific sensor, so **they are not interchangeable**. Always be sure you connected probes in the right socket, otherwise they can be damaged.

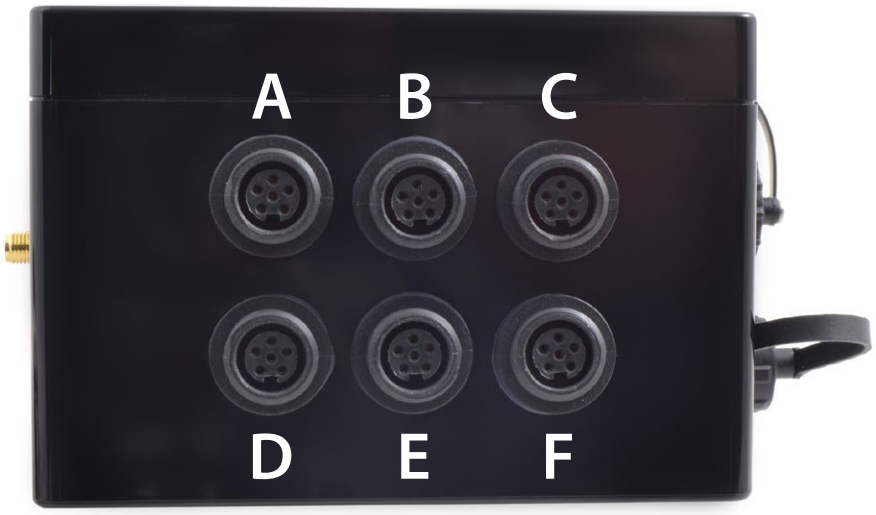


Figure 9: Identification of sensor sockets

Smart Enviroment

Smart Environment model is designed to monitor environmental parameters such as temperature, humidity, atmospheric pressure and some types of gases. The main applications for this Waspmote Plug & Sense! configuration are city pollution measurement, emissions from farms and hatcheries, control of chemical and industrial processes, forest fires, etc. Go to the application section in the **Libelium website** for a complete list of services.

Figure 10: Smart Environment Waspmote Plug & Sense! model

Sensor sockets are configured as shown in the figure below.

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Temperature	9203
	Carbon monoxide - CO	9229
	Methane - CH_4	9232
	Ammonia – NH_3	9233
	Liquid Petroleum Gases: H_2, CH_4, ethanol, isobutene.	9234
	Air pollutants 1: C_4H_{10}, CH_3CH_2OH, H_2, CO, CH_4	9235
	Air pollutants 2: $C_6H_5CH_3$, H_2S, CH_3CH_2OH, NH_3, H_2	9236
	Alcohol derivates: CH_3CH_2OH, H_2, C_4H_{10}, CO, CH_4	9237
B	Humidity	9204
	Atmospheric pressure	9250
C	Carbon dioxide - CO_2	9230
D	Nitrogen dioxide - NO_2	9238
E	Ozone - O_3	9258
	Hydrocarbons - VOC	9201
	Oxygen - O_2	9231
F	Carbon monoxide - CO	9229
	Methane - CH_4	9232
	Ammonia – NH_3	9233
	Liquid Petroleum Gases: H_2, CH_4, ethanol, isobutene.	9234
	Air pollutants 1: C_4H_{10}, CH_3CH_2OH, H_2, CO, CH_4	9235
	Air pollutants 2: $C_6H_5CH_3$, H_2S, CH_3CH_2OH, NH_3, H_2	9236
	Alcohol derivates: CH_3CH_2OH, H_2, C_4H_{10}, CO, CH_4	9237

Figure 11: Sensor sockets configuration for Smart Environment model

Note: *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

Smart Security

The main applications for this Waspmote Plug & Sense! configuration are perimeter access control, liquid presence detection and doors and windows openings.

Figure 12: Smart Security Waspmote Plug & Sense! model

Note: *The probes attached in this photo could not match the final location. See next table for the correct configuration.*

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Temperature + Humidity (Sensirion)	9247
B	Liquid flow	9296, 9297, 9298
C	Presence - PIR	9212
D	Luminosity (LDR)	9205
	Liquid level	9239, 9240, 9242
	Liquid presence	9243
	Hall effect	9207
E	Luminosity (LDR)	9205
	Liquid level	9239, 9240, 9242
	Liquid presence	9243
	Hall effect	9207
F	Luminosity (LDR)	9205
	Liquid level	9239, 9240, 9242
	Liquid presence	9243
	Hall effect	9207

Figure 13: Sensor sockets configuration for Smart Security model

As we see in the figure below, thanks to the directional probe, the presence sensor probe (PIR) may be placed in different positions. The sensor can be focused directly to the point we want.

Figure 14: Configurations of the Presence sensor probe (PIR)

Note: *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

Smart Metering

The main applications for this Waspmote Plug & Sense! model are energy measurement, water consumption, pipe leakage detection, liquid storage management, tanks and silos level control, supplies control in manufacturing, industrial automation, agricultural irrigation, etc. Go to the application section in the **Libelium website** for a complete list of services.

Figure 15: Smart Metering Waspmote Plug & Sense! model

Sensor sockets are configured as shown in the figure below.

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Temperature	9203
	Soil temperature	86949*
B	Humidity	9204
C	Ultrasound (distance measurement)	9246
	Liquid flow	9296, 9297, 9298
D	Current sensor	9266
E	Ultrasound (distance measurement)	9246
	Liquid flow	9296, 9297, 9298
F	Luminosity (LDR)	9205

Figure 16: Sensor sockets configuration for Smart Metering model

* Ask Libelium **Sales Department** for more information.

As we see in the figure below, thanks to the directional probe, the ultrasound sensor probe may be placed in different positions. The sensor can be focused directly to the point we want to measure.

Figure 17: Configurations of the ultrasound sensor probe

Note: *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

Smart Cities

The main applications for this Waspmote Plug & Sense! model are noise maps (monitor in real time the acoustic levels in the streets of a city), air quality, waste management, structural health, smart lighting, etc. Refer to **Libelium website** for more information.

Figure 18: Smart Cities Waspmote Plug & Sense! model

Sensor sockets are configured as shown in the figure below.

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Temperature	9203
	Soil temperature	86949*
	Ultrasound (distance measurement)	9246
B	Humidity	9204
	Ultrasound (distance measurement)	9246
C	Luminosity (LDR)	9205
D	Noise sensor	9259
E	Dust sensor	9320
F	Linear displacement	9319

Figure 19: Sensor sockets configuration for Smart Cities model

* Ask Libelium **Sales Department** for more information.

As we see in the figure below, thanks to the directional probe, the ultrasound sensor probe may be placed in different positions. The sensor can be focused directly to the point we want to measure.

Figure 20: Configurations of the ultrasound sensor probe

***Note:** For more technical information about each sensor probe go to the **Development section** in Libelium website.*

Smart Parking

Smart Parking allows to detect available parking spots by placing the node under the pavement. It works with a magnetic sensor which detects when a vehicle is present or not. Waspmote Plug & Sense! can act as a repeater for a Smart Parking node.

Figure 21: Smart Parking enclosure

Sensor sockets are no used for this model.

There are specific documents for parking applications at Libelium website. Refer to Smart Parking Technical guide to see typical applications for this model and how to make a good installation.

Smart Agriculture

The Smart Agriculture models allow to monitor multiple environmental parameters involving a wide range of applications. It has been provided with sensors for air and soil temperature and humidity (Sensirion), solar visible radiation, wind speed and direction, rainfall, atmospheric pressure , etc.

The main applications for this Waspmote Plug & Sense! model are precision agriculture, irrigation systems, greenhouses, weather stations, etc. Refer to **Libelium website** for more information.

Two variants are possible for this model, normal and PRO. Next section describes each configuration in detail.

Figure 22: Smart Agriculture Waspmote Plug & Sense! model

Normal

Sensor sockets are configured as shown in the figure below.

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Humidity + Temperature (Sensirion)	9247
B	Atmospheric pressure	9250
C	Soil temperature	86949*
	Soil moisture	9248
D	Weathermeters + pluviometer	9256
E	Soil moisture	9248
F	Leaf wetness	9249
	Soil moisture	9248

Figure 23: Sensor sockets configuration for Smart Agriculture model

* Ask Libelium **Sales Department** for more information.

Note: *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

PRO

Sensor sockets are configured as shown in the figure below.

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Humidity + Temperature (Sensirion)	9247
B	Soil temperature	9255
C	Solar radiation	9251, 9257
D	Soil temperature	86949*
	Soil moisture	9248
E	Dendrometers	9252, 9253, 9254
	Soil moisture	9248
F	Lear wetness	9249
	Soil moisture	9248

Figure 24: Sensor sockets configuration for Smart Agriculture PRO model

* Ask Libelium **Sales Department** for more information.

Note: *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

Ambient Control

This model is designed to monitor main environment parameters in an easy way. Only three sensor probes are allowed for this model, as shown in next table.

Figure 25: Ambient Control Waspmote Plug & Sense! model

Sensor sockets are configured as it is shown in figure below.

Sensor Socket	Sensor probes allowed for each sensor socket	
	Parameter	**Reference**
A	Humidity + Temperature (Sensirion)	9247
B	Luminosity (LDR)	9205
C	Luminosity (Luxes accuracy)	9325
D	Not used	
E	Not used	
F	Not used	

Figure 26: Sensor sockets configuration for Ambient Control model

As we see in the figure below, thanks to the directional probe, the Luminosity (Luxes accuracy) sensor probe may be placed in different positions. The sensor can be focused directly to the light source we want to measure.

Figure 27: Configurations of the Luminosity sensor probe (luxes accuracy)

Note: *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

Radiation Control

The main application for this Waspmote Plug & Sense! configuration is to measure radiation levels using a Geiger sensor. For this model, the Geiger tube is already included inside Waspmote, so the user does not have to connect any sensor probe to the enclosure. The rest of the other sensor sockets are not used.

Figure 28: Radiation Control Waspmote Plug & Sense! model

Sensor sockets are not used for this model.

> ***Note:*** *For more technical information about each sensor probe go to the* ***Development section*** *in Libelium website.*

Documentation changelog

Added references to 3G/GPRS Board in section: Radio Interfaces

Certifications

- CE (Europe)
- FCC (USA)
- IC (Canada)

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