Document Name

IoT Park Enhanced Instruction Manual

Version

V5.8

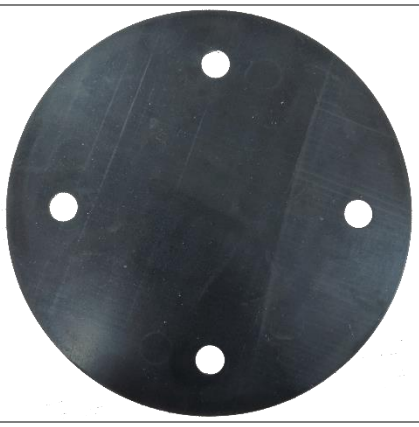
Contents

Document Revision

Revision	Date	Author	Description
5.0	31/01/2020	L.GALEA	Initial Draft by IoTSolutions Ltd.
5.1	30/04/2020	R.CAMILLERI	1. Updated Installation Sequence 2. Updated Payload Structure based on Firmware 2.6
5.2	15/05/20	L.GALEA	1. Added IoT Solutions Application Instructions 2. Updated Installation Sequence
5.3	26/05/2020	L.GALEA	1. Added Vehicle Tag Detection Message to 'IoT Park Payload Structure' Chapter. 2. Added Instructions for iBeacon Scanning in the 'IoT Solutions Application' Chapter.
5.4	04/06/2020	L.GALEA	1. Updated the SIGFOX Call back Configuration URL 2. Added installation procedure to include importance of pad sealing 3. Adjusted Mobile Application Steps
5.5	17/06/2020	R.CAMILLERI	1. Updated document Name
5.6	18/06/2020	R.CAMILLERI	1. Added SIGFOX Certification Number for Zone 1 and 4
5.7	18/08/2020	L.GALEA	1. Added Message Type 11 in Sensor Data Messages
5.8	29/09/2020	L.GALEA	1. Added Message Type 29 in Application Data Messages 2. Added Message Type 30 in Application Data Messages 3. Updated IoT Solutions Mobile Application with new Features

Installation

Package Contents

Description	Quantity	Image
IoTPark Enhanced - Assembled Parking Sensor	1	
M6 RowBolts	4	
M6 Security Caps	4	
Base Rubber Seal	1	

Base Foam Seal	1	

Email: contact**@snoc.fr**
Contact Number: +33 2 52 35 04 90

Required Equipment for Installation

Description	Image
All IoTPark Enhanced Package Contents (Supplied)	
Measuring tape to find the center of the parking space	
Spray to mark sensor installation Location (Not Supplied)	
Cordless Hand Drill (Not Supplied)	

7mm HSS Drill (Not Supplied) **11mm HSS Drill (Not Supplied)**	
Masking Tape (Not Supplied) **- To help to mark drill**	
10mm Socket to attach to Drill **(Not Supplied)**	
Corded Hand Drill with Hammer Action **(Not Supplied)**	
Extension and Small Generator for Corded Hand Drill **(Not Supplied)**	

Hammer (Not Supplied)	
Plier (Not Supplied) **- To help if Rowbolt is not inserted correcly**	
Trolleys to move around equipment and sensors on the field	

Installation and Initialization Procedure

Step	Description	
1	Open the IoTPark Enhanced package and check that the package includes all the contents	
2	Mark the location were you want to install the sensor in the middle of the parking spot on the road by spray or otherwise using the measuring tape or otherwise	
3	Place the sensor on top of the marked position in the parking place and with the Cordless Hand drill and 7mm HSS Drill mark the position of the holes	
4	Use the corded hand drill with 7mm HSS Drill to drill the hole deep enough for the 7mm drill to completely go in. Make sure you use up and downward action to clean the hole	

5	Mark the 11mm HSS Drill with masking tape at 42mm from the tip of the drill. Use the Cordless hand drill with marked 11mm HSS Drill to drill a hole 42mm deep whilst applying up and down action to always keep the hole clean	
6	Place the anchor part of the row bolt into the hole and hammer them softly if required such that they are flush with the surface. The row bolts should fit slightly tight in the hole	
7	Place the rubber seal at the bottom, the foam seal on top of it and the parking sensor on top of both seals. Make sure to align the holes in order for the bolt to pass	
8	Place the washers and the bolts	
9	Use the 10mm Socket and Cordless Hand Drill to Secure the sensor in place by the four supplied washers and bolts and screwing the bolts up to the point they touch the sensor without tighetining	

10	Use the 10mm Socket and Cordless Hand Drill to tighten the bolts in a cross manner. For the installation to be good the sensor will go down into the sponge seal when tightening the bolts	
11	Attention must be taken that when the sensor is bolted to the ground the foam layer is squeezed around the whole circumference of the parking spot sensor and that the four bolts are tight. This step must be carried out correctly to ensure that the device will perform according to product datasheet	
12	Finally, apply the four security caps.	
13	Refer to the relevant sections in the **IoT Solutions Application** Chapter to enable the device.	

IoT Solutions Mobile Application

Download the Mobile Application

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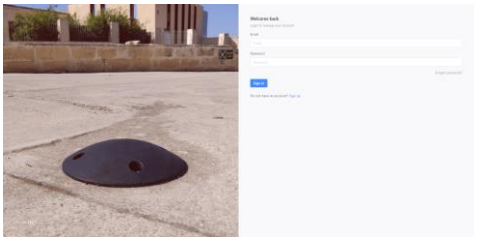
1 Create an Account and Log In to our Online Dashboard



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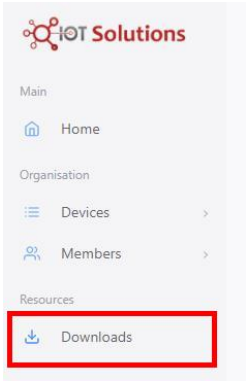
2 Navigate to the **Downloads** Section



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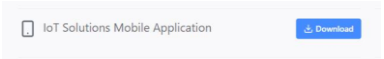
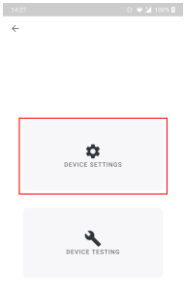
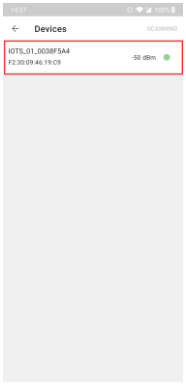
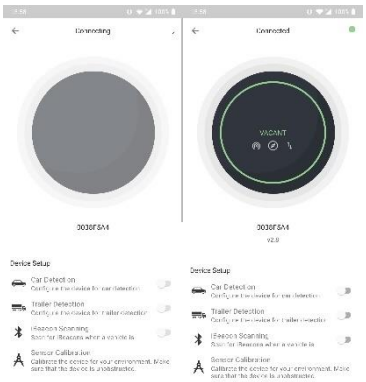
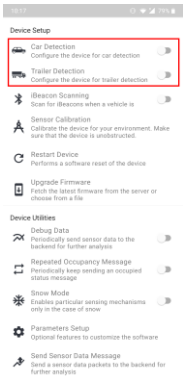
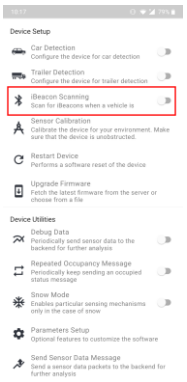
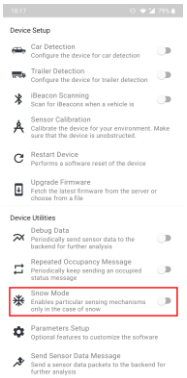
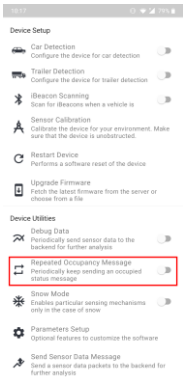
3 Click on **Download** for the Mobile Application and then **Install** the APK on your phone

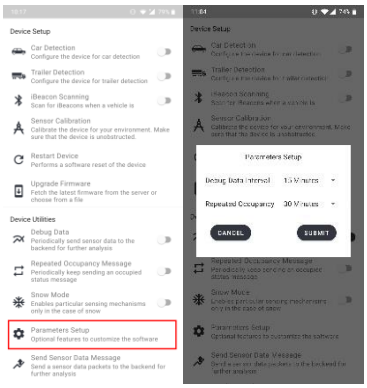
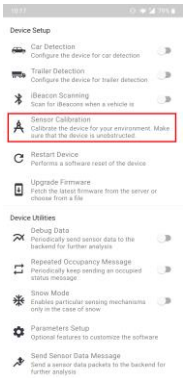
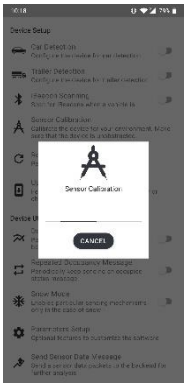


Initialize/Configure IoT Park Enhanced Device

1	Enter the **IoT Solutions** Application and press on **IoT Park**	
2	From the **IoT Park** menu, press on **Device Settings**	
3	In the **Device Settings**, the application will scan for nearby IoT Park Devices. Once the desired device shows, press on it. The **ID** should match the ID on the label of the device. The list is also sorted by **RSSI**, hence the device having the least RSSI is the closest device to you.	

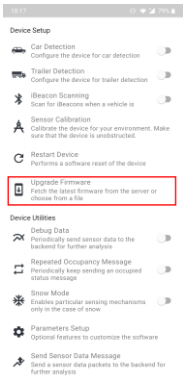
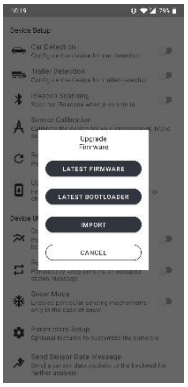
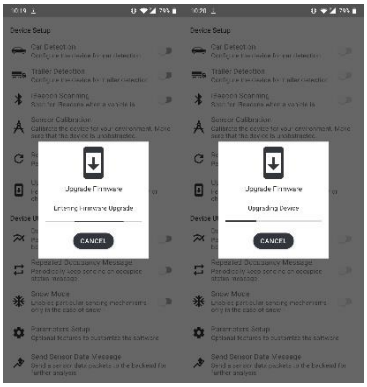
4	Once you click on the Device, the following **Connecting** screen will show and soon after the device should show as **Connected**.	
5	Enable Vehicle Detection: Press on the switch for **Car Detection** or **Trailer Detection** to enable the required mode.	
6	When the Car or Trailer Detection is enabled a pop up will show up stating "**Car Detection Enabled**" or "**Trailer Detection Enabled**". When either mode is switched off, a pop up shows "**Vehicle Detection Disabled**".	

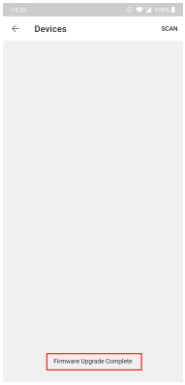
7	To enable the **iBeacon** feature which scans and returns to the online platform nearby beacons provided by IoT Solutions, ensure Vehicle Detection Mode already Enabled (Car or Trailer) and press on the switch for iBeacon Scanning.	
8	**Snow Mode** may optionally be enabled in certain cases when a large amount of snow is expected to fall on the parking sensor.	
9	**Repated Parking Ocuppancy** can also be enabled. In this mode, the sensor repeats the parking occupancy message after a time interval only when it becomes occupied.	

10	The interval for the repeated parking occupancy message can be setup by pressing on the **Parameters Setup**. The interval can then be configured from the opened menu. Finally press **Send** to apply the configuration.	
11	To carry out manual sensor calibration, ensure the following: • The IoT Park Device is secured and installed in the parking space • The IoT Park Device is clear and unobstructed • No Cars are in nearby parking spots (parallel or adjacent to) Press on the **Sensor Calibration** Button	
12	The following pop up will open, showing that the device is carrying out the calibration process	

13	Once the process is carried out successfully, a popup stating **"Sensor Calibration Successful"** will show	
14	To disconnect from the device, simply press the **back button** at the top left of the screen	

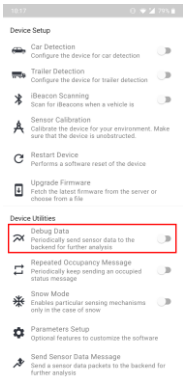
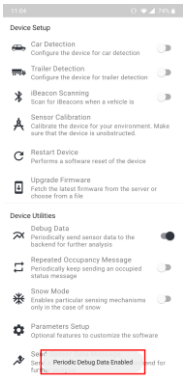
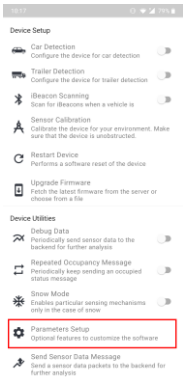
Upgrading the Firmware

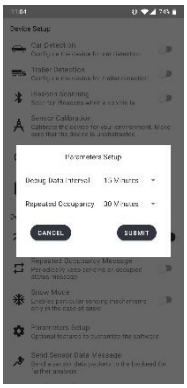
1	With the device already **Connected**, press on the **Upgrade Firmware** Button.	
2	From the menu, choose **Latest Firmware** or **Latest Bootloader**. The update will be automatically downloaded to your phone and the firmware upgrade process will start soon after.	
3	The following **Upgrade Firmware** popup will open and show Upgrading Device together with a progress bar.	

4	Once the process completes successfully the following popup stating "**Firmware Upgrade Complete**" should show.	

Debug Data Mode

In addition to the vehicle detection, the **Debug Data** mode offers the option that the sensor sends magnetometer and radar data to our server every 15 minutes. **Note** that this mode is not recommended for normal operation but only to investigate further the behaviour of the device.

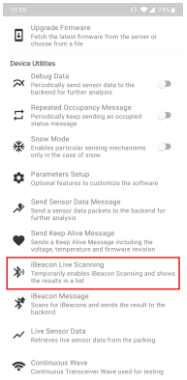
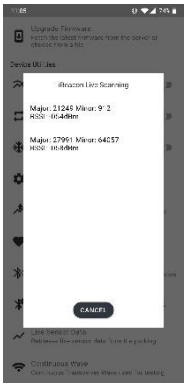
1	With the device already **Connected**, press on the switch for **Debug Data**.	
2	When **enabling** or **disabling** this mode, a popup will show stating "**Periodic Debug Data Enabled**" or "**Periodic Debug Data Disabled**".	
3	The periodic time interval for the Debug Data can be configured by pressing on the **Parameters Setup** Button	

4	The debug data interval can be configured from this menu. Finally press **Submit** to send the configuration to the device.	

iBeacon Scanning

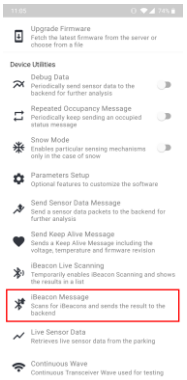
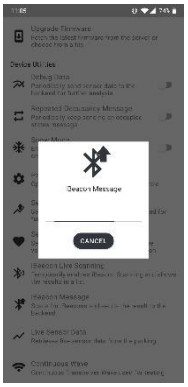
Live Scanning Mode

In this mode the device **temporarily scans** for nearby iBeacons and returns the results to the application. The **RSSI** is updated in real-time

1	With the device already **Connected** click on the **iBeacon Live Scanning** Button.	
2	The device will start scanning for nearby iBeacons and return a list of scanned beacons including the **Major**, **Minor** and **RSSI**.	
3	This mode is enabled temporarily while the dialog is open. The device will stop scanning for iBeacons when the **Cancel** button is pressed.	

Send Network iBeacon Message

This mode simulates what happens when **iBeacon Scanning** is **Enabled** and a new a vehicle is detected. In this mode, the device will scan for the same pre-defined time period and send the results through a message.

1	With the device already **Connected** click on the **iBeacon Message** Button.	
2	The device will start scanning for nearby iBeacons and finally send a message as described in the **IoT Park Data Payload Structure** Chapter.	

Email: contact**@snoc.fr**
Contact Number: +33 2 52 35 04 90

SIGFOX Device Product Certification

- Zone 1: P_00DC_34FC_02
- Zone 2: TBD
- Zone 3: TBD
- Zone 4: P_00DC_F78E_01

IoT Park Enhanced Data Payload Structure

The first byte of the payload (in HEX) always indicates the message type and the following message types exist:

- 1 to 5 – Diagnostic Messages
- 6 to 10 – Keep Alive Messages
- 11 to 25 – Sensor Data Messages
- 26 to 50 – Application Data Messages

Diagnostic Messages

Device Reset Reason

This message is four characters long where the first two characters are ‘01’which indicate Message 1.

The next two characters define the reason for reset. The representation is in HEX and unsigned. The possible reset reasons are the following:

- 1 – Brown Out or Power On Reset
- 2 – PIN Reset
- 3 – Watchdog Timer Reset
- 4 – Soft Reset (Usually from software after a device firmware upgrade)
- 5 – CPU Lock-Up Detected
- 6 – Wakeup from System Off when wakeup is triggered from Detect signal from GPIO
- 7 – Wakeup from System Off when wakeup is triggered from ANADETECT signal from LPCOMP
- 8 – Wakeup from System Off when wakeup is triggered from entering into debug interface
- 9 – Wakeup from System Off when wakeup is triggered from NRF field detect
- 10 – Wakeup from System Off when VBUS rises into valid range

Hardware Initializiation Report

This message is six characters long where the first two characters are ‘02’ which indicate Message 2. The last character of this message is ignored. A character ‘0’ implies that the hardware was initialized, a character ‘1’ implies that the hardware was not initialized correctly.

- The third character represents whether the magnetometer was succesfully initialized
- The fourth character represents whether the radar was succesfully initialized
- The fifth character represents whether the bluetooth was succesfully initialized

Sensor Runtime Report

This message is six characters long where the first two characters are ‘03’ which indicate Message 3. The representaions are explained below:

- ‘030000’ – Parking Sensor switched to default sensing
- ‘031000’ – Parking Sensor switched to radar sensing
- ‘030100’ – Parking Sensor switched to magnetometer sensing
- ‘031100’ – Parking Sensor sensing error

Keep Alive Messages

This message is ten characters long where the first two characters are ‘06’ which indicate Message 6.

The representation is in HEX and unsigned.

- The second two characters indicate the temperature to the nearest Degree Celsius.
- The third two characters indicate the idle voltage of the transmitter chip.
- The fourth two characters indicate the major revision of the firmware.
- The fifth two characters indicate the minor revision of the firmware.

Application Data Messages

Vehicle Detection

This message is six characters long where the first two characters are ‘1a’ which indicate Message 26.

The representation is in HEX and unsigned.

- The second two characters represent the peak distance detected
    - 12cm to 60cm inidicate a car
    - 90cm and above indicate a trailer
    - 0 means that the vehicle detection was carried out using the magnetometer
- The third two characters indicate whether a vehicle was detected or not
    - 00 if the parking space is vacant
    - 01 if the parking space is full

Bluetooth Connection

This message is four characters long where the first two characters are ‘1b’ which indicate Message 27.

The next two characters can be as follows:

- 01 indicates that a command has been entered outside a session which is not authenticated
- 02 indicates that a connection was made with the device but failed to authenticate the session

iBeacon Detection

This message may consist of two SIGFOX messages depending on the amount of beacons scanned.

1. The first two characters of the first message are '1c' which indicates Message 28.
    a. The next four characters are the Major of the first beacon
    b. The next four characters are the Minor of the first beacon
    c. The next two characters are the RSSI of the first beacon
    d. The next four characters are the Major of the second beacon
    e. The next four characters are the Minor of the second beacon
    f. The next two characters are the RSSI of the second beacon
2. The first two characters of the second message are '1d' which indicates Message 29.
3. If the message is only '1c' this means that the device has the iBeacon Scanning functionality enabled but did not detect any nearby iBeacons
4. The representation of the Major and Minor values of the beacons is in HEX.
    a. HEX to Decimal Converter
        i. Decimal Number
5. The representation of the RSSI of the device is in HEX and Signed.
    a. HEX to Signed Decimal Converter
        i. Decimal from signed 2's complement

Mobile Application Features

This message is six characters long where the first two characters are '1e' which indicate Message 29.

1. The next two characters indicate the type of feature enabled
    a. The representation is HEX and unsigned
        i. 1 – Car Detection
        ii. 2 – Trailer Detection
        iii. 3 – iBeacon Scanning
        iv. 4 – Debug Data
        v. 5 – Repeated Occupancy
        vi. 6 – Snow Mode
2. The next two characters indicate whether the feature was enabled or disabled
    a. 00 if disabled
    b. 01 if enabled

Repeated Vehicle Detection

This message is six characters long where the first two characters are ‘1f’ which indicate Message 31.

This message has the same structure as the Vehicle Detection Message i.e. Message 26 starting with ‘1a’. It is enabled optionally in areas of poor coverage where a secondary occupancy message may be sent just in case the first message is not received by the base station.

Sensor Data Messages

Magnetometer Data

Note: This message is not used during normal operation of the parking sensor.

This message is 14 characters long.

1. The first two characters are '0b' which indicate Message 11.
2. The next four characters are the magnetometer X data in HEX format.
3. The next four characters are the magnetometer Y data in HEX format.
4. The next four characters are the magnetometer Z data in HEX format.

The magnetometer data should be converted to a decimal and considered as signed 2s complement. Use the following data representation converter.

Radar Data

Note: This message is not used during normal operation of the parking sensor.

The actual message is constructed of three different SIGFOX messages, each twenty-four characters long. The data representation for all these messages is in HEX and unsigned.

Confirm the amplitude scaling (set to 20 by default).

1. The first two characters of the first message are '0c' which indicate Message 12.
    a. The next two characters represent the starting measurement distance in centimeters.
    b. The next two characters represent the distance range in centimeters.
    c. The next two characters represent the amplitude for the starting distance.
        i. Each of the next two characters represent the amplitudes for the following distances.
        ii. This first message then contains nine amplitudes.
2. The first two characters of the second message are '0d' which indicate Message 13.
    a. The next two characters continue to represent the amplitudes for the distances, following the previous message.
3. The first two characters of the third message are '0e' which indicate Message 14.
    a. The next two characters continue to represent the amplitudes for the distances, following the previous message.

Distance Calculation

Knowing the starting distance, range distance, and that in total there are thirty-one distance measurements (nine in the first message, and eleven in each of the second and third messages), the distances that each amplitude reading represents can be worked out.

$$\text{Distance}[i] = \text{Start} + \frac{\text{Range} \times i}{30}$$

where $i = 0$ is the starting distance and i = 30 is the last distance

Auto-Calibration

This message is four characters long where the first two characters are ‘0f’ which indicate Message 15.

The next two characters can then either be ‘01’ or ‘10’. These are explained below:

- ‘10’ – Radar Auto Calibration carried out
- ‘01’ – Magnetometer Auto Calibration carried out

Manual Calibration

This message is four characters long where the first two characters are ‘10’ which indicate Message 16.

The next two characters represent the following:

- If the third character is ‘1’ this means that the Radar was calibrated
- If the fourth character is ‘1’ this means that the Magnetometer was calibrated

This message is sent when manual calibration is carried out through the smartphone application. In the case of a succesful calibration, the following message is expected ‘1011’.

Cumulative Total Data

Note: This message is not used during normal operation of the parking sensor.

This message is 10 characters long.

1. The first two characters are ‘11’ which indicate Message 17.
2. The next six characters are the cumulative (and filtered) total of the reading
    a. Representation is Unsigned and HEX