

Installation Manual ParQSense Outdoor Sensors ITS-420

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1 INTRODUCTION

1.1 Scope and purpose

The scope of this document is to provide specifications for the installation and deployment of Q-Free ITS-420 Standard Outdoor Sensors.

1.2 Purpose

The purpose of this document is to describe the installation procedure for the ITS-420 Standard Outdoor Sensors at a given site, including preparation, hardware installation and activation.

1.3 Document overview

This document contains the following section:

1. Section 1, this section, introducing the document.
2. Section 2 describes the preparation before the installation on site
3. Section 3 describes the installation, deployment and activation of equipment on site
4. Section 4 lists frequently asked questions

1.4 Abbreviations

Term	Definition
4G	Fourth generation of mobile telecommunications technology
iTest	Installation Test, validating that units are functional after installation on site
NB IoT	Narrow Band Internet of Things
ITS-420	Standard Outdoor Sensor
ITS-950	Base Station for Standard Outdoor Sensor Communication
OPGS	Outdoor Parking Guidance System
PGS	Parking Guidance System
GSM	Global Systems Mobile
LPWAN	Low Power Wide Area Network
SU	Sensor Unit
SE	Sensor
RE	Repeater
BS	Base Station
API	Application Programming Interface
SIM	Subscriber Identity/Identification Module
IC	Identification Card

1.5 References

- [1.] QFR-2018-820-003-ITS420 Outdoor Sensor Product Specifications
- [2.] QFR-2018-820-001-ITS950 ParQSense Base Station Product Specifications
- [3.] QFR-2018-820-001-ITS950I ParQSense Base Station Installation Manual

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2 PREPARATION OF THE INSTALLATION

Q-Free recommends the procedure described in this section for preparation of the installation.

There are some tasks that should, and some tasks that must, be prepared and ready before the onsite installation work can be initiated. This is important to economize time when equipment is to be installed on a “live” road. All drilling and sealant equipment must be procured and available on-site prior to arrival. All local laws and regulations must be followed including traffic and road closure regulations.

2.1 Sensor installation

The installation's infrastructure consists of the following parts:

- drilling a hole for the sensor
- placing the sensor in the hole
- sealing the hole

2.2 Sensor deployment

The deployment's infrastructure consists of the following parts:

- Matching a geographical address to the unique sensor ID
- Setting the sensor up in the backend software

2.3 System communication

The ITS-420 Standard ParQSense Outdoor Sensors will communicate to ITS-950 ParQSense Base Station/s via radiolink.

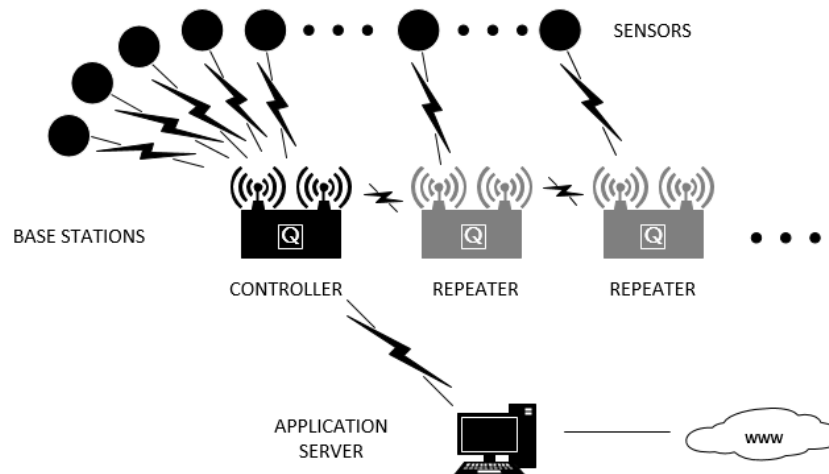


Figure 1 Communication overview ITS-420 ParQSense Standard Outdoor Sensors

2.4 Detection setup

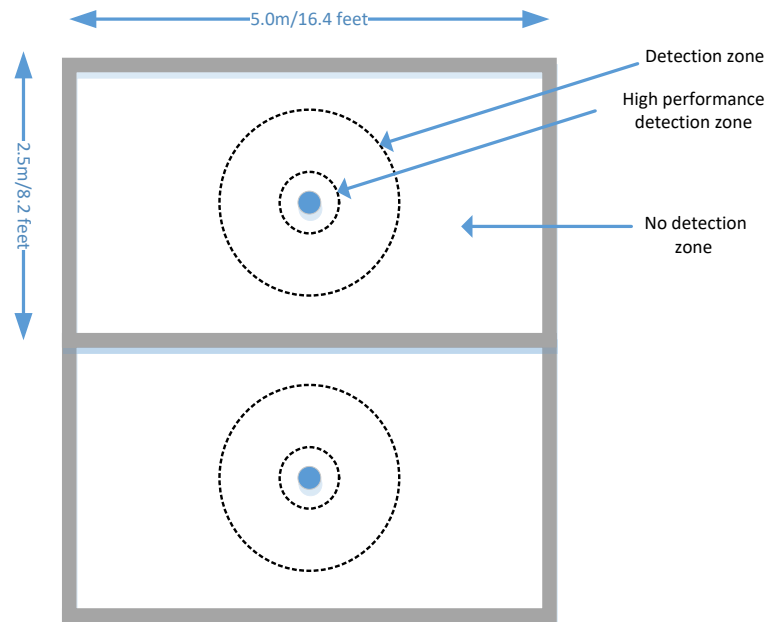


Figure 2 Detection area

By default, the sensor is set up to work in a standard parking space with the size of 2.5x5.0 meters/8.2x16.4 feet. The sensor is working on 2 performance zones:

- A parked object within the sensor's 0.5m/20 inch high performance detection zone diameter will be detected with highest accuracy (>99%)
- A parked object within the sensor's 1.0m/40 inch detection zone diameter will normally be detected but with lower accuracy (<99%)
- Objects parked outside these zones will not be detected

It is possible to extend the size of the detection zone if the parking spot is of different size by adjusting the sensitivity of the detectors. This can be accomplished in the Q-Free ParQSense software.

2.5 Safety guidelines

Always wear proper eye protection when grinding or drilling. Gloves, hearing protection, and sturdy boots are also highly recommended. Always read and follow all specific instructions and safety precautions provided by manufacturers of all equipment. Verify safe drilling procedures with local authorities. Always be aware and follow safe installation procedures on "live" roads. Check local licensing, permitting, and documentation requirements prior to any installation. Follow all applicable local laws and regulations.

3 SPECIFICATIONS

3.1 Mechanical specifications

The maximum physical dimensions of the Q-Free ITS-420 ParQSense Outdoor Sensors are:

- Ø 110 mm/ 4 1/3 inches
- Height: 75 mm/3 inches
- Weight: 550 g/ 1 lbs.

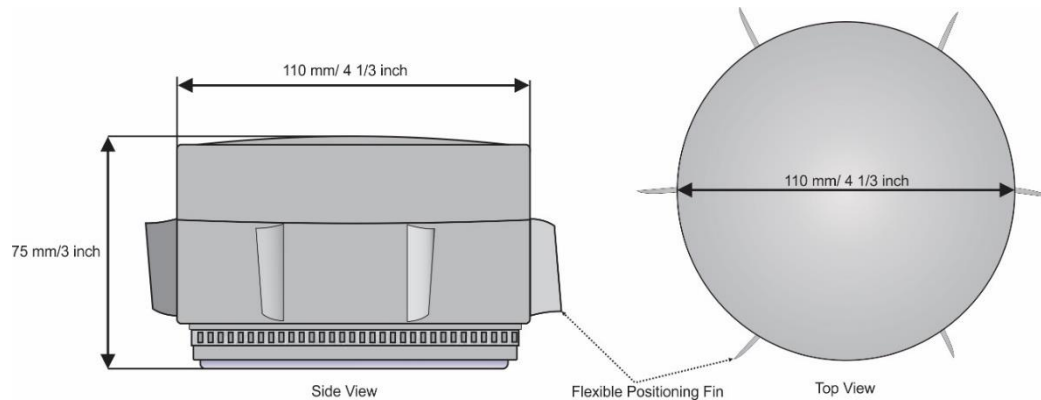


Figure 3 Sensor Dimensions

The color of the ITS-420 ParQSense Outdoor Sensors is grey. This is equal to RAL 7036 Platinum grey.

3.2 Electrical specifications

Parameter:	Specification:
Power supply	2 x Lithium Manganese Dioxide A size -cell battery, 10+ year lifetime
Electromagnetic emission	30 – 1000 MHz ref EN 301489-1, -3
Electromagnetic immunity	80 – 2000 MHz, 3V/m Ref EN 301489-1, -3
Electrostatic discharge (ESD)	Air discharge ± 8KV
	Contact discharge ± 4KV
	Ref EN 301489-1, -3

3.3 Environmental specifications

The Q-Free ITS-420 ParQSense Outdoor Sensors conform to IEC 60721-3-4 Class 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5. This corresponds to Class 4.1 (Non-weather protected locations) as defined in ETSI EN 300 019 [2].

Parameter:	Specification:
Operating temperature:	-40°C to +85°C / -40°F to +185°F
Storage temperature:	-40°C to +85°C / -40°F to +185°F

4 FCC DECLARATIONS

4.1 Modification Statement (§15.21)

Changes or modifications to the equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

4.2 Compliance Statement (§15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

4.3 RF exposure statement, for outdoor Mobile device (§2.1091)

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed on outdoor permanent structures to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

4.4 FCC Testing Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

5 ISED DECLARATIONS

5.1 Interference Statement (RSS-GEN, Section 8.4):

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage ; (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

6 SENSOR MODES

6.1 ITS-420 ParQSense Outdoor Sensor Modes

The ITS-420 ParQSense Outdoor Sensors have two basic modes:

- **Transportation/Sleep Mode:** The ITS-420 ParQSense Outdoor Sensors will be put in a low power mode after manufacturing during packaging by turning it upside down. The ITS-420 ParQSense Outdoor Sensors will be activated (leaving this state) during installation.



Picture 1 Sensor in Deep Sleep/Transportation Mode

- **Active Mode:** Turning the ITS-420 ParQSense Outdoor Sensors over, puts them into the Active Mode. The sensors will now monitor parking space occupancy using radar and magnetic field sensing technology.



Picture 2 Sensor in Active Mode

7 SENSOR INSTALLATION

The following section describes the installation steps for installing the ITS-420 ParQSense Outdoor Sensors.

7.1 Position of ITS-420 ParQSense Outdoor Sensors in parking space

For optimum detection, the ITS-420 ParQSense Outdoor Sensors must be installed in the middle of the parking space approximately 2.5 m/8.2 feet from the end of the parking space as shown in below figure.

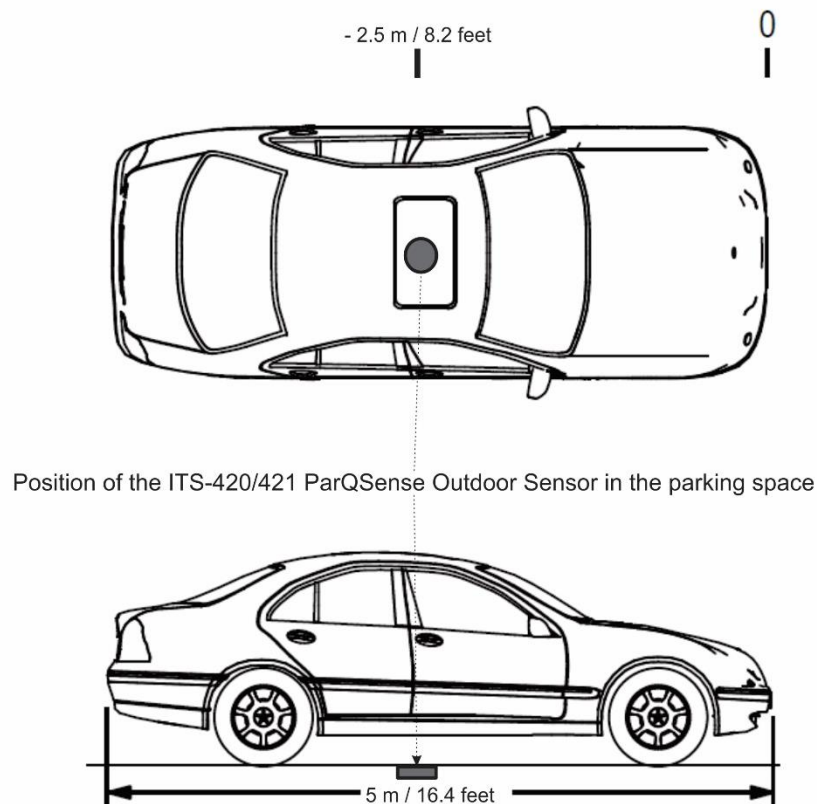


Figure 4 Sensor location in parking space

7.2 Equipment required

- Ø 125 mm/5-inch coring equipment: Many varieties exist; choose whichever best suits the conditions of the installation site.
- Sealant: Recommended is a flexible, weather-proof liquid asphalt/concrete repair compound such as epoxy, resin enforced concrete, or equivalent. For large installations Q-Free will propose a concrete/cement type to use. Any other type of sealant may be used upon approval by Q-Free. Always check local regulations for permitted sealant types.

7.3 Installation & deployment

The installation objective is to encapsulate the sensor in sealant, leaving the top of the sensor exposed, activate it, and set it up in the system.

1. For the ParQSense ITS-420 ParQSense Standard Outdoor Sensors, the ITS-950 ParQSense Base Station/s must be installed, connected, and activated before installation.

2. Using coring equipment, drill a \varnothing 125 mm/5 inch and 75 mm/3-inch depth hole. Use a chisel to break off the plug of material. Remove any loose material remaining in the bottom of the hole.



Picture 3 Coring the sensor hole

3. Verify all surfaces inside and near the hole are clean (free of debris), warm (consult sealer manufacturer data for temperature threshold data), and thoroughly dry.

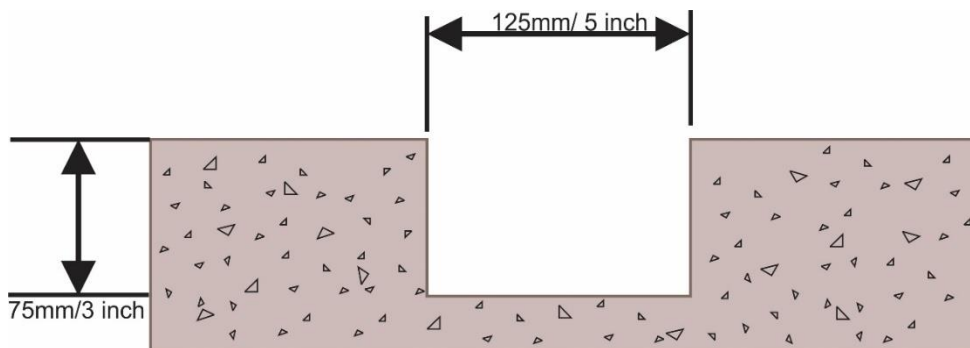


Figure 5 Sensor hole

4. Registration process (alternatively the sensors may come pre-registered. Check with your Q-Free project manager prior to installation):
 - a. Take the sensor out of the transportation package and turn it over to the Active Mode position. Put in on the ground to perform system registration.



Picture 4 Sensor in Active Mode

- b. After 60 seconds, turn the sensor upside down. A red LED visible through the transparent bottom of the sensor will blink for 10 seconds to indicate successful sensor registration.



Picture 5 Sensor with red LED indicating successful sensor registration

- c. Turn the sensor back over to Active Mode again. It is now successfully registered in the back-office system.
- d. If the red LED does not blink after 60 seconds, mark this sensor and set it aside for RMA processing.
5. Repeat steps 1 through 5 for all locations.
6. One hole at a time, pour enough sealer into the hole to fill the hole about 1/3 of the way.

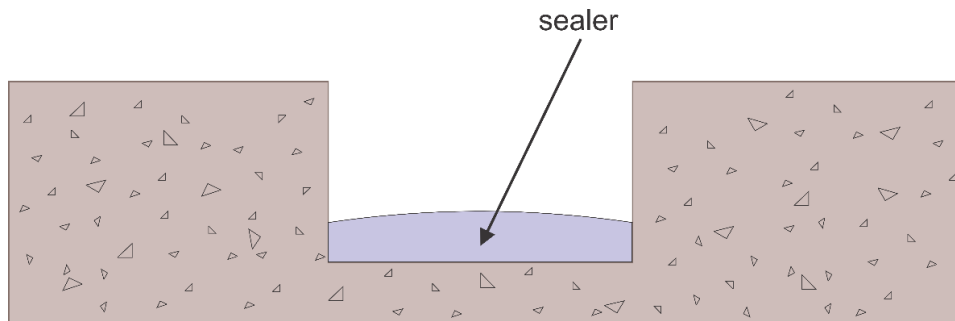


Figure 6 Sensor hole with sealant

8. Maintain a list of the serial numbers of each sensor location. The Sensor ID is written on the bottom of the sensor. The serial number will be used to assign the sensor to geographical location.
9. Place the ITS-420 ParQSense Outdoor Sensor into the hole and press down until the sealer material flows up and around the sensor.

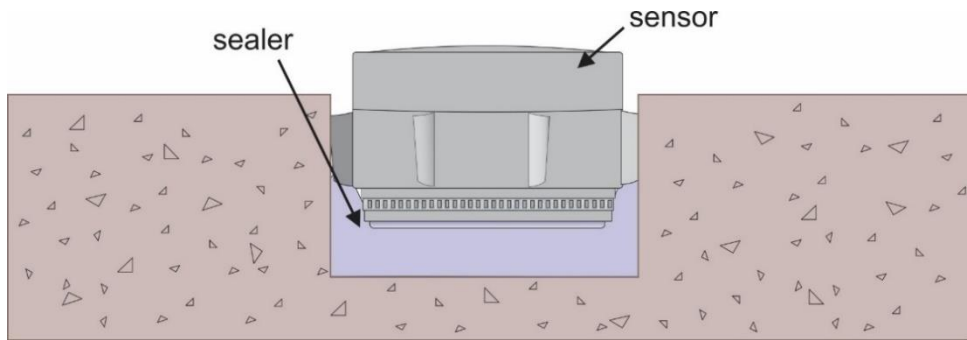


Figure 7 Placing sensor in hole with sealant

10. The top the ITS-420 ParQSense Outdoor Sensor should be flush with the surface and exposed.

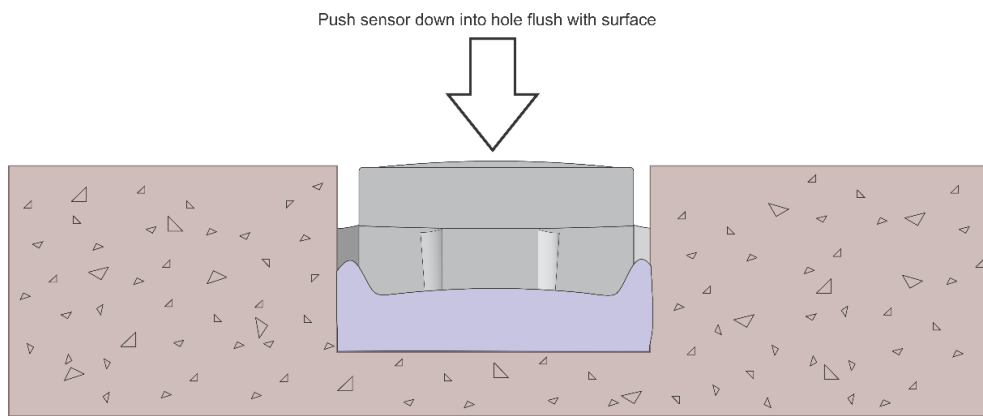


Figure 8 Sensor in hole with sealant

11. Add additional sealer if needed to ensure that the sides of the hole are filled with sealer to avoid leaving a recess that will collect water and dirt. Clean off any access sealer around the sensor. The top of the sensor must be clean and exposed.

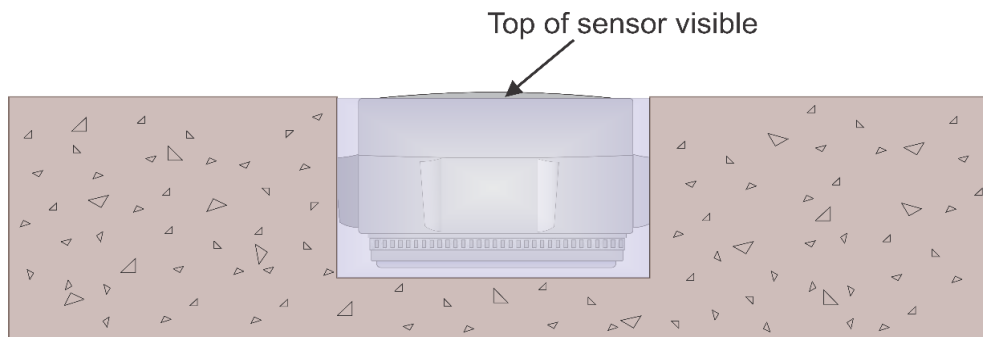


Figure 9 Installed sensor

12. The sensor is self-calibrating. Leave the parking spot and clear it from debris and other objects. Calibration will occur within 4 minutes.
13. After 4 minutes the ITS-420 ParQSense Outdoor Sensors will be operating in regular vehicle detection mode.

14. Repeat steps 7 to 11 for all locations.



Picture 6 Installed Sensor

7.4 ITS-420 ParQSense Outdoor Sensor Connection

After activation, each ITS-420 ParQSense standard outdoor sensor will automatically attempt connection to the respective ITS-950 base station. Once the sensor is activated, installed, and connected to a ITS-950 base station, it can be remotely set up in the system through the Q-Free ParQSense software.

7.5 Setting the sensors up in the software backend

All sensors will have an unassigned ID's implemented in the system, prior to configuration and deployment. The Sensor ID is written at the bottom of the sensor. Q-free will handle the configuration of the sensors after receiving the geographical location (coordinates) for each sensor. This can be done prior or after the installation. After the sensor ID has been assigned with a geographical location, Q-free will provide a login portal for sensor view on a map.

Sensor ID	Sensor Location	Zone	Space Number

Table 1 Sample sensor ID & location table

8 FAQ

- Q: Is it easy to drill and remove/replace the sensor?

A: Yes, the same drill bit can be used. The sensor cannot be reused, and must be replaced.

- Q: Regarding the 4-minute calibration time after flipping over the sensor, can calibration be checked, and if calibration went wrong, (e.g. not quick enough)?

A: This can be done remotely in the Q-Free ParQSense Software system.

- Q: What happens when the sensor is turned over by accident too early?

A: Turn it over again to restart the process.

- Q: How will the sensors be installed in hilly environments?

A: They should be installed parallel to the car for optimum detection same as for standard installations.