

Parking Lot Sensor | PLS

User manual 2.0



User manual

Table of contents

1	Gene	eral description and intended use	3
2	Asse	embly and commissioning	3
	2.1	Mandatory pre requirements	3
	2.2	Installation requirements	3
	2.3	Installation of the sensor base	4
	Req	quired material for installing the parking lot sensor	4
	Prep	paration of the parking space	5
	Insta	tallation of the sensor base	7
	2.4	Installing the sensor core	8
	2.5	Replacing/removing the sensor	11
	2.6	Setup and operation of the parking lot sensor in the backend	12
3	Tech	nnical specifications	13
4	Lega	al information	14
	4.1	Disposal note	14
	4.2	Manufacturer Information	14
	4.3	European Union: EU Declaration of Conformity	14
	4.4	Japan: Japanese Radio Law (電波法) Notice	14
	4.5	India: Equipment Type Approval	14
	4.6	Singapore: Equipment Registration	15
	4.7	Australia: Declaration of Conformity	15
	4.8	Hongkong: Declaration of Conformity	15
	4.9	Republic of South Africa: Equipment Type Approval	15
	4.10	0 Federal Communications Commission (FCC) Notice	16
	4.11	1 ISED Canada (IC) Notice	16
	4.12	2 Note for transport	16
	4.13	3 OSS note	17

1 General description and intended use

The Parking Lot Sensor (PLS) with TPS110 sensor core ("the Product", or "PLS") is designed for detecting parked light vehicles in parking lots. This user manual is valid for the PLS with TPS110 sensor core by Robert Bosch France SAS.

The Parking Lot Sensor with TPS110 sensor core is not designed for use in life-sustaining applications, safety-critical applications or applications for which a malfunction could lead to bodily harm, death or severe property damage. The Parking Lot Sensor with TPS110 sensor core is not designed for detection of heavy vehicle.

2 Assembly and commissioning

2.1 Mandatory pre requirements

Network infrastructure is not included in the scope of delivery. Before installing the sensors, please ensure that an adequate and sufficiently robust network infrastructure is available and working properly, namely: the LoRaWAN backend and the associated management software are functional, the gateways are switched on and there is a stable Internet connection established between the gateways and the backend.

2.2 Installation requirements

A Warning



Read carefully and keep the user manual for future reference. The Product, as referenced in this manual, comprises the complete hardware components for the Parking Lot Sensor, including the Cap, Screw, Core and Base.

Follow these instructions and all information.

⇒ The Customer must comply with all applicable laws and regulations for the installation and operation of the Product, and if necessary, obtain necessary approvals. The Customer must take appropriate measures to avoid injury of third parties, for example, by them tripping over the Product. Therefore, the Product should only be installed in a clearly designated parking space and should not, for instance, be installed on the sidewalk.

Prior to starting the installation work, please ensure that all Product components (see Fig. 1 Parking Lot Sensor with TPS110 sensor core), as well as required tools and material, are readily available.



Figure 1 Parking Lot Sensor with TPS110 sensor core

2.3 Installation of the sensor base

A Precaution



To ensure safe installation:

- ⇒ Do not install the sensor core (black part) into the sensor base (grey part) before the final installation of the sensor base on the ground.
- \Rightarrow Do not screw the sensor base on the ground!
- \Rightarrow Do not drill holes in the base!
- \Rightarrow Do not bring a magnet near the PLS (this would power-on the device).
- ⇒ Avoid uninstalling and reinstalling the sensor core after the initial installation into the sensor base.
- \Rightarrow Do not open the sensor core!



The sensor base must be fixed to the ground (substrate such as concrete, asphalt) with a two-component adhesive from a leading supplier (e.g., DELO®, 3M®, ...).

Customers have reported good experience with the following adhesive: DELO®-PUR 9692 (universal 2-component polyurethane adhesive available in 50 ml and 200 ml cartridges).

Required material for installing the parking lot sensor



Figure 2 Material for attachment

- 1 Disposable gloves (protection against contact with adhesive)
- 2 Two-component adhesive
- 3 Adhesive press (these differ, depending on the cartridge size)
- 4 Mixing tube
- **5** Tape rule
- 6 Sensor base
- **7** Sensor core (sensor)
- 8 T20 screw
- **9** Sensor cap (sensor sealing cap)
- **10** Appropriate tool to clean ground surface (e.g., broom, air blower)



INFORMATION:

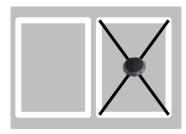
For the bonding procedure, please follow the instructions of the adhesive manufacturer (e.g., temperature, safety information and work instructions).

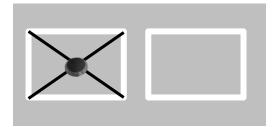
A prior cleaning of the relevant place of installation (**parking slot**) should be clarified in advance with the operator of the premises so that the treatment does not result in removal of existing coatings.

Preparation of the parking space

The parking space must be free of dirt, dust, oil, water and other contaminants.

It is recommended to clean the surface to remove contamination using a high-pressure cleaner and a burner. The PLS must be installed in the center of the parking space (intersection of the two diagonals, see Fig. 3) in order to ensure optimum sensor accuracy.





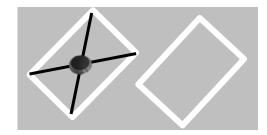


Figure 3 Determination of the center of the parking space



Figure 4 Available parking space for sensor installation

To provide the adhesive with a closed substrate, the ground surface must be free of any gaps or misalignment (see Figure 4 Available parking space for sensor installation). This is not only crucial for the contact surface and the adhesive effect of the product, but also to avoid structural issues when a car runs over it.

Figure 5 Substrate example (continuous)

Figure 6 Substrate example (gap)





A Precaution



Do not install the product on an unstable or uneven ground surface, like interlocking paving stone or directly on the bare ground. These installations can harm the product!







Figure 7 Example of a not compliant installation

Installation of the sensor base

A Precaution

The bottom of the base has been processed with a plasma treatment to improve the adhesion of the glue on the ground:

- ⇒ Take out the base of its protective wrap only just before putting down the adhesive there.
- \Rightarrow Do not touch the bottom side of the base with your hands or anything else.
- \Rightarrow Do not put the base on the ground before gluing, to avoid dust on the sensor base.
- ⇒ Ensure that all parts of the PLS will be protected and will be kept clean until the installation has been completed, so that these parts will be used only within the described intended use.
- ⇒ Check that the adhesive is compatible with the ground and the base of the sensor.
- \Rightarrow Ensure that sufficient adhesive is uniformly spread over the bottom side of the sensor base.

Prepare the adhesive following the manufacturer instruction.

Please note that, as soon as the two components are mixed, the adhesive cures within a few minutes.

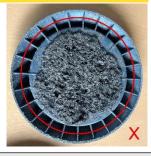
A Precaution



Do not try to save adhesive by adding less adhesive per sensor base!

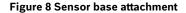
First, insufficient quantity of adhesive may subsequently lead the PLS to detach from the ground and the PLS may get lost.

Second, if the adhesive is not uniformly spread-over the base, it could lead to localized stresses and therefor to structural damages when a car runs over the product.



Once all precautions have been taken, you can proceed with the fixing of the sensor base to the ground (by applying light pressure on it. See Fig. 8 Sensor base attachment). Make sure that the sensor base is thoroughly and uniformly fixed flat against the ground, that the base is centered in the parking space and that the Bosch logo on the sensor base points towards the access road (see Figure 9 Sensor base installed). Subsequent twisting of the sensor base is not possible.





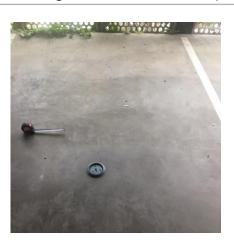


Figure 9 Sensor base installed

Please follow the adhesive manufacturer's recommendation regarding the cure time of the two-component adhesive. To prevent **damages to the sensor base**, keep the parking space unused (no car or engine running over the PLS) until the sensor installation is finalized.

We recommend installing several sensor bases first and only then inserting the sensor cores.

2.4 Installing the sensor core

A Precaution



An improper installation could impact the seals and cause water to get into the sensor which will lead to damages. A smooth and continuous operation of the parking lot sensor is at risk if the PLS is not properly installed.

- ⇒ Do not install the PLS when it is raining or snowing.
- ⇒ Ensure that the inner side of the sensor base is completely dry and without impurity (i.e., dust, mud)
- \Rightarrow before installing the sensor core.
- ⇒ Make sure that the sealing rings on the cap and sensor are seated correctly.
- ⇒ Do not use damaged components and only use original replacement parts.
- \Rightarrow Do not open the sensor housing!

A Precaution



Risk of explosion: extreme heat can damage the battery and the sensor.

- \Rightarrow Do not expose the sensor to temperatures above 85 °C!
- ⇒ Do not expose the sensor to open flames!

When using a gas burner (for example, when removing weeds), keep a distance of at least 1.50 m between the flame and the sensor!

The sensor can be screwed into the base after the adhesive has cured. Before the insertion, use an air-blower to clean the base of any residual dust. To simplify insertion, the arrow on the bottom of the sensor points towards the Bosch logo (see Figure 10 Installing/screwing in the sensor). The sensor should be completely screwed in to ensure optimum teaching of the sensor. To tighten it, use the T20 screw and a T20 screwdriver and tightening torque of 1,8 to 2,2 Nm. Close the opening with the sensor sealing cap afterward.

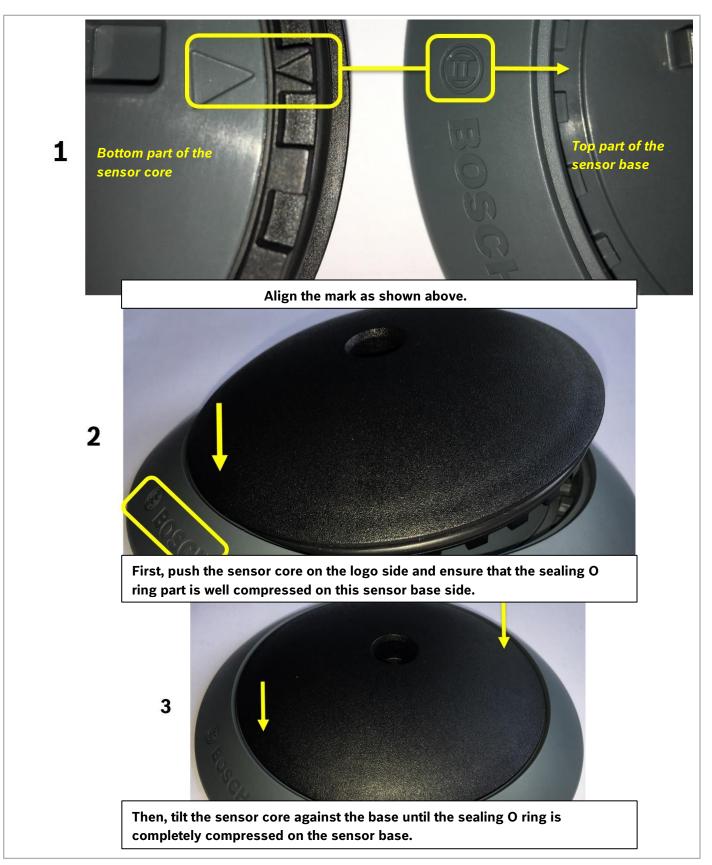


Figure 10 Installing the sensor - method



Figure 11 Installing the sensor - example

A Precaution



Respecting the insertion process described above is necessary for an easy and smooth installation, and to ensure that the core is correctly placed into the base for a good watertightness.

Respecting the tightening torque is important to avoid damaging the screw pitch of the base.

- \Rightarrow Insert completely the sensor core into the base before screwing!
- ⇒ Do not install the core with your feet!
- ⇒ Do not use a blunt object (like a hammer) to insert the core into the base!







INFORMATION:

After the installation of the sensor, it will take approx. 2 minutes before the first measurements are carried out. During operation, a continuous automatic calibration of the parking lot sensor takes place through parking changes (i.e., "parking" and "exiting parking space" events), which happens in its vicinity.

The sensor is fully operational only after at least 10 parking events have been fulfilled with passenger cars or light commercial vehicles.

2.5 Replacing/removing the sensor

In case the sensor core has to be replaced at a later moment in time (for example in case of end-of-life of the battery), you have to remove the T core cap and loose the T20 screw; then remove the sensor core from the sensor base. Should the replacement be done due to physical damages to the PLS, please carefully inspect the sensor base for visible damages prior to installing the replacement sensor core. Replace the whole PLS where required.



Precaution



The screwing path will show signs of wear after multiple screwings of the core into the base. Consequently, we strongly recommend to change the whole PLS after three replacement/removing actions.



INFORMATION:

The battery is not eligible to a stand-alone replacement. At battery end-of-life, the whole sensor core must be replaced.

To completely remove the PLS from the parking space, while not damaging the ground surface, it is necessary to use a hammer and chisel to destroy the adhesive effect by chiseling the sensor base parallel to the parking space surface.



Precaution



If the sensor is not working as expected and investigation is needed to understand the issue, please contact the BOSCH customer support by email with these elements:

- ⇒ Device EUI
- ⇒ log file containing RSSI, SNR, Join requests, debug messages, spreading factor
 If physical analysis of the sensor is required, the support team will send you the return procedure.

Do not attempt to open the sensor by yourself, as this device contains a LiSOCl2 battery. Also, this behavior makes the task harder for our expert team to analyse the problem and, therefore, make the warranty completely void for the opened sensor core. This implies that there would be no warranty replacement for the opened sensor under any circumstance.

2.6 Setup and operation of the parking lot sensor in the backend

In order to set up the sensor in the LoRaWAN backend, the following information is required, which will be provided to you:

- ▶ DevEUI (for example, FCD6BD0000190001)
- ► AppKey (for example, 00112233445566778899AABBCCDDEEFF)

AppEUI/JoinEUI:

Sensor variant	AppEUI
TPS110 EU	FCD6BD0000190000
TPS110 US	FCD6BD0000190001
TPS110 JP	FCD6BD0000190002
TPS110 IN	FCD6BD0000190003

Table 1 AppEUI per sensor variant



A Precaution



Network Quality of Service is extremely dependent on product environment and usage. Customer or customer's network operator is the best stakeholders to configure the LoRaWAN network. The customer must verify that the network performances are good enough to operate the Parking Lot Sensors. After installation, the customer must monitor network performances in order to proceed to potential improvements.

At least, the following values should be monitored:

- ⇒ RSSI which should be higher than -120dBm.
- ⇒ SNR which should be higher than -7dB.
- ⇒ Number of SW resets from the device, that should be exceptions (method to get this value from the sensor is described in the PLS Communication Interface that could be communicated on request).

The number of gateways should be higher than two (to manage unexpected unavailability of one gateway). This number should also be proportionate to the number of installed sensors and to the maximum of expected simultaneous parking events. We recommend to install at least a minimum of two gateways for smaller projects to get the appropriate network coverage redundancy. For bigger projects with higher number of installed sensors, add the appropriate number of gateways.

3 Technical specifications

Table 2 Device specifications - Parking Lot Sensor PLS with TPS110 sensor core

Properties	Values
Temperature range	-20 °C to 65 °C
Humidity	up to 95%
Protection index	IP67/IPx9K
Assembled weight	215 g (of which core 148 g)
Dimensions	Ø: 14,5 cm H: 3,0 cm
Battery life	Up to 5 years *
LoRa frequencies and LoRa Channel Plans (RP002-1.0.0)	TPS110 EU: 863-865/868-868.6/869.4-869.65 MHz (EU868) Transmitting power max. 14 dBm ERP Supported channel frequencies: 864.1 MHz, 864.3 MHz, 864.5 MHz, 868.1 MHz, 868.3 MHz, 868.5 MHz, 869.525 MHz
	Note: For TPS110 EU core used in Rep. of South Africa the K-Band 863-865MHz is deactivated.
	TPS110 IN: 865-867 MHz (IN865) Transmitting power max. 14 dBm ERP
	TPS110 JP: 920-923.4 MHz (AS923) Transmitting power max. 14 dBm ERP
	TPS110 US: 902-928 MHz (US902-928) Transmitting power max. 14 dBm ERP
Radar frequency	2.4-2.4835 GHz Transmission power max28 dBm EIRP

^{*} The network quality impacts the battery lifetime significantly. Duration is not guaranteed under poor network conditions. 5 years estimated with the following conditions: Sensor operating under SF7, 200 messages per week including heartbeat, max 200 resets over lifetime, typical operating temperature 15° to 25°C, ACK on.

Additional information can be found in the datasheet available on request.





Risk of interference to other radio services and malfunction.

Operation of the TPS110 variant out of the Target Markets specified in Chapter 4 can cause disturbance of other services and can be subject of legal prosecution. Regulatory notices for other countries are included in Chapter 4 of the English part of this user manual.

- ⇒ Ensure that TPS110 variants are operated only in the target markets with a valid approval statement.
- ⇒ Ensure that it is connected to LoRa gateways that are certified for operation in the target markets and support the regional channel plans published by the LoRa Alliance.

4 Legal information

4.1 Disposal note



Bosch is committed to environmental protection. Recycling save resources and creates jobs. We encourage you to responsibly recycle your Bosch product when it reaches the end of its service life. The sensor, as well as all the individual parts, must not be disposed of with household waste or industrial waste. You are obliged to dispose of the device in accordance with the requirements of the WEEE Directive 2012/19/EU (in the European Union) or other applicable country regulations in order to protect the environment and to reduce waste through recycling. Please find a local certified recycling facility near you to properly dispose of this product.

For additional information and how to carry out proper disposal, please contact your local certified disposal service providers.

The sensors contain a Li battery, which must be disposed of separately.

4.2 Manufacturer Information

Robert Bosch France SAS 32 avenue Michelet 93400 Saint Ouen France

4.3 European Union: EU Declaration of Conformity

Product type: Parking lot sensor Designation: TPS110 EU



Robert Bosch France SAS hereby declares that the "Parking Lot Sensor TPS110 EU" radio equipment is in conformity with Directive 2014/53/EU (Radio Equipment Directive) and Directive 2011/65/EU (RoHS Directive).

The full text of the EU Declaration of Conformity is available on request.

The following countries are covered by mutual recognition agreements: Turkey, Norway, Iceland, Liechtenstein, Switzerland.

4.4 Japan: Japanese Radio Law (電波法) Notice

Product type: Parking Lot Sensor

Product name: TPS110 JP



This device is granted pursuant to the Japanese Radio Law (電波法) and registered as radio equipment R: 202-SMH007. This device should not be modified, otherwise the granted designation number will become invalid.

4.5 India: Equipment Type Approval Product type: Parking lot sensor / APLM Sensor

Product name: TPS110 IN

The TPS110 IN has been granted an Equipment Type Approval by the Government of India Ministry of Communications WPC Wing Licensing Office. The following certificates have been granted WPC-ETA-SD-20200100986 (TPS110 IN) and WPC-ETA-SD-20200100984 (APLM Sensor)

4.6 Singapore: Equipment Registration

Product type: Parking lot sensor

Complies with IMDA Standards DB101762 Product name: TPS110 EU

The TPS110 EU has been granted an Equipment Registration by the Info-communications Media

Development Authority of Singapore (IMDA) under registration Number N0234-20.

Product name: TPS110 JP

The TPS110 JP has been granted an Equipment Registration by the Info-communications Media Development

Authority of Singapore (IMDA) under registration Number N0235-20.

4.7 Australia: Declaration of Conformity

Product type: Wireless Parking Space Occupation Sensor

Product name: TPS110 JP

Robert Bosch France SAS declares that the TPS110 JP is in conformity with the requirements of the

Australian Communications and Media Authority (acma)

4.8 Hongkong: Declaration of Conformity

Product type: Parking Sensor Product name: TPS110 JP

Hongkong Telecommunication Ordonance C106, C106Z

The TPS110 JP meets the requirements in Telecommunication Ordonance C106, C106Z and related national standards HKCA 1035, HKCA 1078, HKTA 2001.

The TPS110 JP is exempted from licensing by HK Communication Authority by means of its technical performances proven in this report according to the standards specified by the Communication Authority of Hongkong. It may be sold and operated in connection with a public LoRa network service according section 5(a) and as a standalone device according section 5(b) of ordonance C106Z.

4.9 Republic of South Africa: Equipment Type Approval

Product type: Parking lot sensor

Product name: TPS110 EU (with band 863-865MHz deactivated)



The TPS110 EU has been granted an Equipment Type Approval by the Independent Communications Authority of South Africa (ICASA). Within South Africa the TPS110 EU is not suitable for integration in systems that operate in the band 863-865MHz.

4.10 Federal Communications Commission (FCC) Notice

Product type: Parking lot sensor Product name: TPS110 US

This device complies with Part 15 of the FCC rules and has been certified. 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. The manufacturer is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications may void the FCC authorization to operate this equipment. NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- · Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

4.11 ISED Canada (IC) Notice

Product type: Parking lot sensor Product name: TPS110 US

This device complies with Industry Canada license-exempt RSS standard(s) and has been certified. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference, including interference that may cause undesired operation. This Class B digital apparatus complies with Canadian ICES-003.

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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

4.12 Note for transport

The TPS110 contains a lithium metal battery and is classified as UN 3091 (lithium metal batteries packed in equipment, including lithium alloy batteries).

The lithium metal battery for the TPS110 complies with the requirements of the UN Manual of Tests and Criteria, Part III, Subsection 38.3. The battery contains less than 2 g of lithium. Packages with up to 2 TPS110 and a maximum of 2 packages per shipment should not be affected by special transport regulations. For your safety, however, check with your transport service provider. Packages with more than 2 TPS110 (for example, also for returns to Robert Bosch France SAS) must carry a lithium battery handling label specified in the appendix.

- * UN 3091
- ** Telephone number

The telephone number on the lithium battery handling label should be that of a person knowledgeable about the shipment but is not intended to be for the purposes of obtaining immediate emergency response guidance, and is therefore not required to be monitored at all times while the package is in transit. It is acceptable for the number to be monitored during the company's normal business hours in order to provide product-specific information relative to the shipment. However, it also is acceptable to use an emergency response, 24-hour phone number on the lithium battery mark. Source: guidelines for Li battery in transport included in p. 7 'IATA 2021 Guidance Document – Battery Powered Cargo Tracking Devices / Data Loggers'



The following requirements must be met:

- The lithium metal batteries are included in the TPS110.
- The TPS110 and the included batteries are not damaged.
- The TPS110 contains the original supplied lithium metal batteries. Replacement of used batteries is not permitted.
- The TPS110 is protected by sturdy packaging.
- No additional separate batteries may be added to the packaging.
- Shipping documents must include a note stating that the shipment contains "Lithium metal batteries in compliance with Section II of Packing Instruction PI 970" for air freight, or "Exempted lithium batteries under Special Provision 188" for road transport.
- Packaging with the TPS110, in accordance with the above-mentioned regulations, may be consolidated in outer packaging that is marked with the lithium battery label and is designated as "outer packaging."

Note that this document cannot contain complete and up-to-date information on all the requirements to be observed. The consignor is responsible for fulfilling all the requirements for the transport of lithium batteries themselves. The International Air Transportation Association (IATA) has issued further regulations on the transport of lithium batteries IATA (International Air Transport Association) Lithium Battery Guidance Document, which must be observed for air transport. The IATA regulations for transport by air freight are the most restrictive and thus also provide assistance for road and sea transport. However, the customer or consignor should inquire about national requirements as well as any requirements from their transport service provider.

4.13 OSS note

The parking lot sensor firmware includes free open source software ("FOSS") components subject to certain FOSS license terms.

The customer must observe the resulting obligations. The detailed FOSS license terms are available on request.



Robert Bosch France SAS

Connected Objects for Smart Territories 32 avenue Michelet 93400 Saint Ouen France

Sales and distribution: contact.cost@fr.bosch.com
Technical support: support@bosch-connectivity.com