SENSIT SYSTEM

install guide

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1 INTRODUCTION

The SENSIT vehicle detection system facilitates accurate measurement on occupancy of individual parking spaces in car parks, and on-street parking spaces. This information can be used to guide traffic to free parking spaces but can also be used for on-street parking enforcement and overstay detection. For on-street enforcement the number of occupied parking spaces can be compared with the number of payments realized by the pay station. For overstay detection the system alerts instantly a parking officer to the presence of nearby overstaying vehicles. Based on this information you can exactly determine which space to enforce.

All the SENSIT vehicle detection sensors are featured with detection and communicate wireless, creating their own network. The SENSIT sensors do not require power wiring, in contrast to conventional systems that require wiring throughout the car park and mounting onto the ceiling.

Easy installation of the sensors is guaranteed. Once installed no maintenance is required for years. The actual status (occupancy) of the sensor is transmitted to the Relay Node, which is part of the wireless mesh network.

Different types of ruggedly designed sensors are available to accommodate installation in indoor car parks, on-street spaces and road surfaces.

2 SENSIT SYSTEM

2.1 ARCHITECTURE

The actual status (occupancy) of the SENSIT sensors is finally collected by one or more SENSIT Gateway. The SENSIT sensors transmit their status via one or more Relay Nodes to the SENSIT Gateway. The SENSIT Gateway (formally known as Data Collector) is the interface between the wireless sensors network and the SENSIT Interface Software running on the server. The SENSIT Gateway transmits status information about the sensors to the server using TCP/IP via Ethernet or GPRS communication.

Figure 1: System Architecture

For a parking site you need at least one SENSIT Gateway, a Relay Node and a SENSIT per parking bay.

2.2 THE SENSIT SENSORS

Three types of ruggedly designed sensors are available to accommodate installation in indoor car parks, on-street spaces and road surfaces. The standard, most used, SENSIT Sensor is the SENSIT IR. For regions with lots of snow the SENSIT Flush Mount is designed to withstand frequent snow ploughing. The SENSIT Surface Mount is designed for indoor car parks or roof tops where drilling is not allowed.

2.2.1 SENSIT IR

Vehicle detection sensor featured with dual detection technology (infrared and earth-magnetic field detection. The SENSIT IR is mounted into the floor of each parking space allowing for vandal resistant installation, making the unit suitable for on-street application.

SENSIT IR		
Operating frequency	SENSIT IR EU: 868.2 MHz SENSIT IR CN: 868.2 MHz SENSIT IR US: 902-928 MHz (FHSS) SENSIT IR AU: 915-928 MHz (FHSS) SENSIT IR NZ : 920-925MHz (FHSS) SENSIT IR SG : 920-925MHz (FHSS) SENSIT IR ID: 923-925MHz (FHSS) SENSIT IR MY : 919-923MHz (FHSS)	
Detection	Magnetic and IR	Accuracy: 98%
Load resistance	Heavy traffic	
Mounting	Into the floor	
Weight	365 gram	(12.87 oz)
Dimensions	Ø 78 mm In the floor 55 mm Above the floor 20 mm	(3.07 inch) (2.16 inch) (0.79 inch)
Color	Black or Yellow (optional)	
Detection height	0...90 cm	(0 ... 35.5 inch)
Protection	IP67, completely sealed housing PE	
Operating temperature	-40 ... +85°C	(-40°F ... +185°F)
Power supply	Built in Lithium batteries expected lifetime of 5-10 years *	
Antenna	Included	

* Under normal circumstances and dependent on settings.

2.2.2 SENSIT FLUSH MOUNT

Vehicle detection sensor for flush mount installation in the road surface. The sensor is resistant to snow ploughs and offers vandal resistant installation. The SENSIT Flush Mount is featured with earth-magnetic field detection.

SENSIT Flush Mount		
Operating frequency	SENSIT FLUSH MOUNT EU: 868.2 MHz SENSIT FLUSH MOUNT CN: 868.2 MHz SENSIT FLUSH MOUNT US: 902-928 MHz (FHSS) SENSIT FLUSH MOUNT AU: 915-928 MHz (FHSS) SENSIT FLUSH MOUNT NZ : 920-925MHz (FHSS) SENSIT FLUSH MOUNT SG : 920-925MHz (FHSS) SENSIT FLUSH MOUNT ID: 923-925MHz (FHSS) SENSIT FLUSH MOUNT MY : 919-923MHz (FHSS)	
Detection	Magnetic	Accuracy: 95%
Load resistance	Heavy traffic	
Mounting	Into the floor	
Weight	350 gram	(12.35 oz)
Dimensions	Ø 78 mm In the floor 72 mm	(3.07 inch) (2.09 inch)
Color	Black	
Detection height	0...90 cm	(0 ... 35.5 inch)
Protection	IP67, completely sealed housing PE	
Operating temperature	-40 ... +85°C	(-40°F ... +185°F)
Power supply	Built in Lithium batteries expected lifetime of 5-10 years*	
Antenna	Included	

* Under normal circumstances and dependent on settings.

2.2.3 SENSIT SURFACE MOUNT

Vehicle detection sensor designed for car parks where drilling is not allowed or non-permanent mounting is required. The unit is suitable for indoor car parks and rooftop parking's. The sensor can easily be glued onto the surface. Replacement can be achieved by removing the sensor installed in the mounting ring. The SENSIT Surface Mount is featured with dual detection technology (infrared and earth-magnetic field).

SENSIT Surface Mount			
Operating frequency	SENSIT SURFACE MOUNT EU: 868.2 MHz SENSIT SURFACE MOUNT CN: 868.2 MHz SENSIT SURFACE MOUNT US: 902-928 MHz (FHSS) SENSIT SURFACE MOUNT AU: 915-928 MHz (FHSS) SENSIT SURFACE MOUNT NZ : 920-925MHz (FHSS) SENSIT SURFACE MOUNT SG : 920-925MHz (FHSS) SENSIT SURFACE MOUNT ID : 923-925MHz (FHSS) SENSIT SURFACE MOUNT MY : 919-923MHz (FHSS)		
Detection	Magnetic and IR		Accuracy: 98%
Load resistance	Regular traffic		
Mounting	On the floor surface		
Weight	455 gram		(16.05 oz)
Dimensions	Mounting ring: Sensor: Height:	Ø 240 Ø 167 cm 35mm	(9.45 inch) (6.57 inch) (1.38 inch)
Color	Sensor black and yellow (optional black) ring		
Detection height	0...90 cm		(0 ... 35.5 inch)
Protection	IP67, completely sealed housing PE		
Operating temperature	-40 ... +85°C		(-40°F ... +185°F)
Power supply	Built in Lithium batteries expected lifetime of 5-9 years *		
Antenna	Included		

* Under normal circumstances and dependent on settings.

2.3 RELAY NODES

A Relay Node allows for communication increase and ensures a robust and reliable communication network. It ensures fast transmission of event messages from the vehicle detection sensors to the SENSIT Gateway.

2.3.1 SENSIT RELAY NODE 2G

The Relay Node 2G is has an improved communication range and a battery lifetime. It ensures a robust and reliable communication network. The Relay Node 2G ensures fast transmission of event messages from the SENSIT sensors to the SENSIT Gateway. Relay Node 2G should be mounted preferable at about 3 – 6 meters [10- 20 ft] from the floor (e.g. onto a lamppost) to allow for visible view of the sensors.

Relay Node 2G			
Operating frequency	SENSIT RELAY NODE 2G EU: 868.2 MHz SENSIT RELAY NODE 2G CN: 868.2 MHz SENSIT RELAY NODE 2G US: 902-928 MHz (FHSS) SENSIT RELAY NODE 2G AU: 915-928 MHz (FHSS) SENSIT RELAY NODE 2G NZ : 920-925MHz (FHSS) SENSIT RELAY NODE 2G SG : 920-925MHz (FHSS) SENSIT RELAY NODE 2G ID : 923-925MHz (FHSS) SENSIT RELAY NODE 2G MY : 919-923MHz (FHSS)		
Weight	540 gram	(12.87 oz)	
Dimensions	200 x 170 x 204 mm	(7.87 x 6.69 x 8.03 inch)	
Mounting	Onto a pole, lamppost or wall, mounting bracket included.		
Mounting height	3 – 6 meters	(10 – 20 ft.)	
Pole dimensions	Min. Ø 40 mm Max. Ø 150 mm	(1.57 inch) (6 inch)	
Protection	IP65		
Operating temperature	-40 … +85°C	(-40°F … +185°F)	
Communication range *	DC – RN 2G omnidirectional DC – RN 2G directional max. DC GPRS – RN 2G max. RN 2G – RN 2G max. SENSIT – RN 2G omnidirectional SENSIT – RN 2G directional	35 m 50 m 10 m 100m 35 m 50 m	(135 ft) (164 ft) (33 ft) (328 ft) (135 ft) (164 ft)
Power supply **	Replaceable Lithium batteries expected lifetime of 5 years		
Antenna connection	Antenna included		

* Dependent on the environment.
** Under normal circumstances and dependent on settings.

2.4 SENSIT GATEWAY

The actual status (occupancy) of the SENSIT sensors is collected by one or more Gateway. The Gateway is the interface between the wireless sensors network and the SENSIT Interface Software running at the server. The Gateway transmits status information about the sensors to the server using TCP/IP via Ethernet or 3G mobile communication.

For a parking site you need at least one Gateway, a Relay Node and a SENSIT per parking bay. One Gateway is required per 250 parking bays. All Gateway must be separated as far as possible from each other, preferably at the remote corners of the site.

2.4.1 THE GATEWAY

The Gateway can be installed virtually anywhere due to its IP65 weatherproof housing and embedded 3G wireless modem. The only requirements in case it is uses the mobile internet are; an AC mains power supply and that it should be installed within reach of the SENSIT wireless network.

SENSIT Gateway		
Operating frequency	SENSIT GATEWAY EU: 868.2 MHz SENSIT GATEWAY CN: 868.2 MHz SENSIT GATEWAY US: 902-928 MHz (FHSS) SENSIT GATEWAY AU: 915-928 MHz (FHSS) SENSIT GATEWAY NZ : 920-925MHz (FHSS) SENSIT GATEWAY SG : 920-925MHz (FHSS) SENSIT GATEWAY ID : 923-925MHz (FHSS) SENSIT GATEWAY MY : 919-923MHz (FHSS)	
Dimensions	252 x 251 x 89 mm	(10 x 10 x 3.5 inch)
Weight	1850 gram	(65 oz)
Protection	IP65	
Color	Aluminum & dark blue side covers RAL5011	
Operating temperature	-40°C ... +65°C	(-40°F ... +149°F)
Communication range*	From SENSIT to Gateway in principle unendless as the nodes communicate to each other. It is recommended to locate the nearest Relay Node within 25 meters (82 ft) of the Gateway.	
Communication	3G mobile or RJ45 TCP/IP	
Power input	110-240 VAC 50/60Hz or 12VDC (solar panel set)	
Antenna connection	Antenna included	

* Dependent on the environment.

2.4.2 SENSIT BACKUP BATTERY

The Gateway can be completed with a backup battery to make sure the Gateway stays alive when the mains power fails. This backup battery can also been used when the Gateway is powered by the public lighting pole. This cyclic use will have an influence on the lifetime of the internal lead-acid battery.

SENSIT Battery pack		
Dimensions	252 x 251 x 89 mm	(10 x 10 x 3.5 inch)
Weight	3800 gram	(134 oz)
Protection	IP65	
Color	Aluminum & dark blue side covers RAL5011	
Operating temperature	-15°C ... +50°C	(5°F ... +122°F)
Internal battery	12VDC | 7Ah (lead-acid)	
Lifetime*	>1000 discharge/charge cycles	
Autonomous time**	Up to 35 hours	

* Depends upon the average depth of discharge.
** Depends upon communication means 3G/Ethernet, temperature and battery age

2.5 ADDITIONAL EQUIPMENT

Additional equipment is available to expand the functionality of the SENSIT system.

2.5.1 ELECTRONIC PARKING LICENSE

The Electronic Parking License (EPL) physically is a device that is positioned inside the car. Whenever the car stops for a specific period of time it considers the car to be parked and it will look for a wireless SENSIT network. If a network is detected, it will make itself know to the network. Its unique EPL identifier is registered at the server with SENSIT Interface Software (SIS). The SIS is triggered when parking bays that require a license change status (become occupied or free). When such a parking bay is occupied the system will calculate the odds of the parking bay being occupied by an unauthorized vehicle.

Electronic Parking License		
Operating frequency	SENSIT EPL EU: 868.2 MHz SENSIT EPL US: 902-928 MHz (FHSS) SENSIT EPL AU: 915-928 MHz (FHSS)	
Mounting	Attaches with suction pads to the windscreen on the inside of the car	
Weight	120 gram	(4.2 oz)
Dimensions	116 x 72 x 27 mm	(4.6 x 2.8 x 1.1 inch)
Color	Grey, RAL7016	
Protection	IP32	
Operating temperature	-40 ... +85°C	(-40°F ... +185°F)
Power supply	User replaceable AAA 1.5V alkaline batteries	
Antenna	Included	

2.5.2 SENSIT DISPLAY

The SENSIT Display enables signage of available parking spaces for stand-alone parking guidance installations. The display is designed for outdoor use, indicating the number of available parking spaces per parking lot thus guiding motorists to the closest parking space.

Availability of parking spaces can be indicated per zone, for the specific zone the SENSIT Display is allocated to. Configuration of the display can be realized using the SENSIT Interface Software.

SENSIT Display		
Display	Graphical display for outdoor use, single sided	
Dimensions	330 x 221 x 171 mm	(13.0 x 8.7 x 6.7 inch)
Display dimensions	320 x 160 x 15 mm	(12.6 x 6.3 x 0.6 inch)
Weight	5900 gram	(208 oz)
Protection	IP65, UV protected	
Color	Stainless steel housing, Amber LEDs	
Character height	160 x 100 mm [h x w]	(6.3 x 3.9 in)
Number of digits	3	
Readability	5.000 cd/m2, readable in full sunlight.	
Luminance	Ambient light luminance regulation.	
Viewing angle	70º/35º	
Operating temperature	-20 ... +60°C	(32°F ... +122°F)
Power supply	110-230 VAC 50/60Hz or PoE+ (25W)	
Relay outputs	3 Low voltage relays	

2.5.3 SENSIT CONFIGURATION TOOL

The SENSIT Configuration Tool can be used during installation of the SENSIT system. This tool enables easy installation; segmentation, calibration and administration (CVS-file including GPS-coordinates) of the SENSIT equipment (SENSIT Gateways, Relay nodes and sensors). The SENSIT The Configuration Tool works with an App which must be installed on an Android smartphone. This App, called 'SENSIT Configurator' is available in the google play store. The communication between the App and Configuration Tool is over Bluetooth.

SENSIT Configuration Tool		
Dimensions	200 x 115 x 93 mm	(7.9 x 5.9 x 2.4 inch)
Weight	505 gram	(17.8 oz)
Protection	IP44	
Color	Yellow housing, black front	
Communication	Bluetooth	
Operating temperature	-10 … +50°C	(14°F … +122°F)
Battery powered	2x 1.5V AA alkaline batteries	
Lifetime	About 40 hours of continuous use on a set of AA alkaline batteries.	

2.6 SENSIT INTERFACE SOFTWARE

SENSIT Interface Software allowing easy system integration into enforcement, traffic guidance or parking guidance management application. The main features of the SENSIT Interface Software to help you and make easy system integration possible are:

- Installation
- Configuration
- Basic administration
- Integration

The SENSIT Interface Software enables easy installation of the wireless sensor network. Once the network and sensors are installed, the sensors will automatically appear in the software. Configuration of sensors to specific parking bays, parking zone and parking lot can easily be realized.

Additionally the software configures and monitors communication of the SENSIT node network. It monitors the data transfer between the sensors and the SENSIT Gateways. Moreover it also analyzes communication reliability of the sensor network in a graphical map, automatically alerting areas for maintenance.

Easy integration can be done via to SOAP or REST interface.

SOAP or Simple Object Access Protocol, is a protocol specification for exchanging structured information. It relies on Extensible Mark-up Language (XML) for its message format.

The SOAP interface can query data from the SIS using the http(s) interface, the found data is returned in a XML description format.

Representational state transfer (REST) is a simple stateless architecture that generally runs over HTTP(S). REST involves reading a designated Web page that contains an XML file. The XML file describes and includes the desired content.

3 INSTALLATION PROCEDURES

The installation of the SENSIT system is basically the same with or without a Configuration Tool and can be described in 4 major steps: The preparation, the installation of Gateways and Relay Nodes, the installation of SENSIT sensors and finally setting up the SENSIT Interface Software.

In the next 2 paragraphs both methods are describe; with- or without the Configuration Tool. The functionality and used of the Configuration tool is described in more detail in chapter 5.

3.1 4-STEPS WITHOUT THE CONFIGURATION TOOL

3.1.1 STEP 1 – PREPARATION

a. Arrange a scaled map of the site.
b. Make a site inspection to gather information:
    - Draw on the map where the parking bays are located.
    - Draw on the map where you can mount Relay Nodes
    - Draw on the map the possible locations for the Gateway.
c. Make an installation plan:
    - Number every parking bays with a unique number.
    - Use the Relay Node Tool to plan the final Relay Node and Gateway locations to form a covering network.

Note
Relay Node Tool is a planning-tool, to design the Relay Node and Gateway locations. See chapter below for an example.

3.1.2 STEP 2 – GATEWAY AND RELAY NODE INSTALLATION

a. Install and power-up the Gateway according the plan.
b. Activate and install the Relay Nodes according the plan.
c. Write the ID numbers of the Gateways and Relay Nodes at the right location in the plan.
d. Verify at the server that all Gateways and Relay Nodes are online.

3.1.3 STEP 3 – SENSIT INSTALLATION

a. Free the bays and close off the parking area.
b. Mark the right location at the road surface with a piece of chalk or paint.
c. Distribute the SENSIT sensors at the, to be installed locations and activate them with the magnet.
d. Make a list of the correct ID numbers and bay numbers.
e. Verify at the server if all SENSIT sensors come online.
f. Drill the holes and glue the SENSIT sensors.
g. Calibrate the SENSIT sensors without cars or metal tools in the neighborhood of the SENSIT's.

3.1.4 STEP 4 – SETTING UP THE SENSIT INTERFACE SOFTWARE

a. Make a (simple) Inkscape drawing of the site based on the map and gathered information during STEP 1 and STEP 2.
    - Draw the Relay Nodes and Gateways at the right locations
    - Draw the bays at the right locations
b. Upload the SVG-drawing to the server.
c. Make a correct CSV-file and upload it to the server.
d. Verify if all Gateways, Relay Nodes and SENSIT sensors show up correctly in the system.

Note
Inkscape is an open-source drawing program to create the SVG (Scalable Vector Graphic) drawing.

3.2 4-STEPS WITH THE CONFIGURATION TOOL

As mentioned the installation of a SENSIT system with a Configuration tool is similar as the configuration without a tool and can also be described in 4-steps: The first and last step is exactly the same, the configuration of SENSIT Gateways, Relay Nodes and SENSIT sensors is automated with the Configuration Tool to prevent writing errors, automatic calibration and to make segmentation possible.

3.2.1 STEP 1 – PREPARATION

a. Arrange a scaled map of the site.
b. Make a site inspection to gather information:
    - Draw on the map where the parking bays are located.
    - Draw on the map where you can mount Relay Nodes
    - Draw on the map the possible locations for the Gateway.
c. Make an installation plan:
    - Number every parking bays with a unique number.
    - Use the Relay Node Tool to plan the final Relay Node and Gateway locations to form a covering network.

Note
Relay Node Tool is a planning-tool, to design the Relay Node and Gateway locations. See chapter 4 for an example.

3.2.2 STEP 2 – GATEWAYS AND RELAY NODE INSTALLATION

a. Install and power-up the Gateway according the plan.
b. Use the Configuration Tool for activation, segmentation and registration of the Gateway.
c. Install the Relay Nodes according the plan.
d. Use the Configuration Tool for activation, segmentation and registration of the Relay Nodes.
e. Verify at the server that all Gateways and Relay Nodes are online.

Note
In chapter 5 a more detailed description about the configuration tool and how it works can be found.

3.2.3 STEP 3 – SENSIT INSTALLATION

a. Free the bays and close off the parking area.
b. Mark the right location at the road surface with a piece of chalk or paint.
c. Drill the holes and glue the SENSIT sensors.
d. Use the Configuration Tool for activation, segmentation, calibration and registration of the SENSIT sensor. Make sure there are no cars or metal tools in the neighborhood of the SENSIT sensors.

3.2.4 STEP 4 – SETTING UP THE SENSIT INTERFACE SOFTWARE

a. Make a (simple) Inkscape drawing of the site based on the map and gathered information during STEP 1 and STEP 2.
    - Draw the Relay Nodes and Gateways at the right locations
    - Draw the bays at the right locations
b. Upload the SVG-drawing to the server.
c. Use the data received from the configuration tool app and make a correct CSV-file after upload it to the server.
d. Verify if all Gateways, Relay Nodes and SENSIT sensors show up correctly in the system.

Note
Inkscape is an open-source drawing program to create the SVG (Scalable Vector Graphic) drawing.

4 RELAYNODETOOL

The RelayNodeTool software is developed to get a good estimation of the needed system components; Gateways and Relay Nodes. The estimation of needed components is based on drawings of the site. In this way you are able to get a good idea of the needed components.

In this example we are going to design the SENSIT system for two segments; the parking basement and the outside parking terrain at the Nedap Headquarter office.

Note
Please keep in mind that with help of this RelayNodeTool you can determine the needed components, but it will always be an estimation.

4.1 SCALED DRAWING

First get a drawing of the parking lot(s) and find out if it are open areas or closed (indoor) areas. Try to get information about mounting locations, like lampposts and poles for Relay Nodes and power and internet for the Gateway. Below you can find a map of the Nedap Headquarter office, with its parking areas.

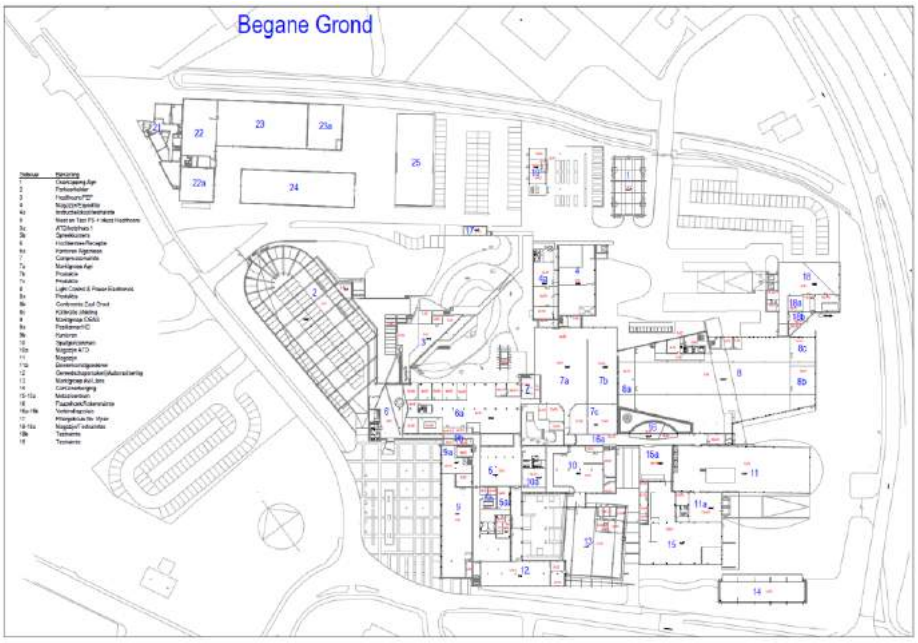


Figure 2: Example drawing of parking lots.

The drawing of a segment can be copied out of the larger map e.g. via the standard Snipping Tool of Windows.

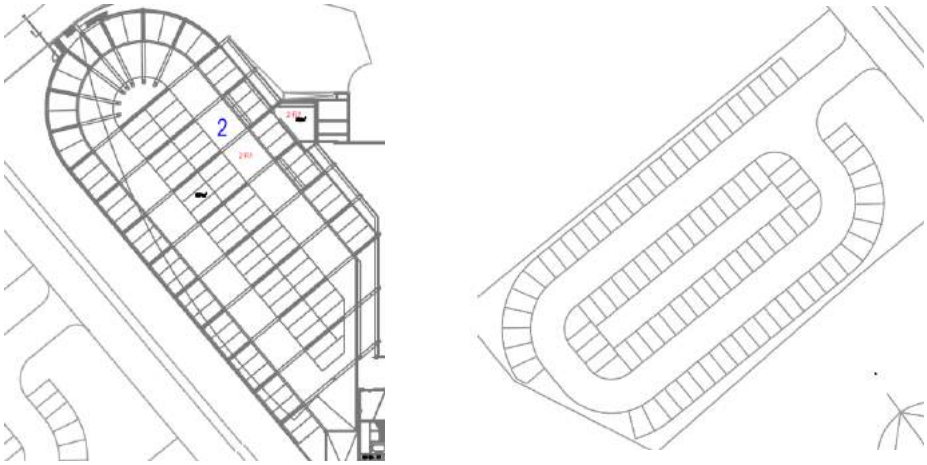


Figure 3: The Basement and the outside area.

4.2 START A NEW PROJECT

Fill-in the project details; the project title, your name and you company name. Please also indicate the country and region where the project is situated.

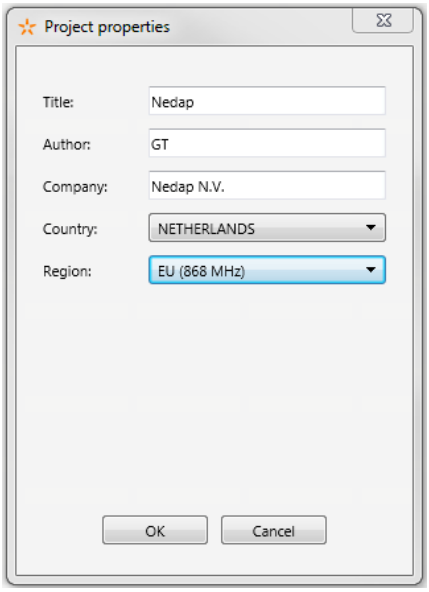


Figure 4: RelayNodeTool: Project details

4.3 THE FIRST SEGMENT

Via the option Segment -> Add new segment, or click on the tab <new> you can add a segment to the design. Fill-in the segment properties; the segment name and the number of parking bays.

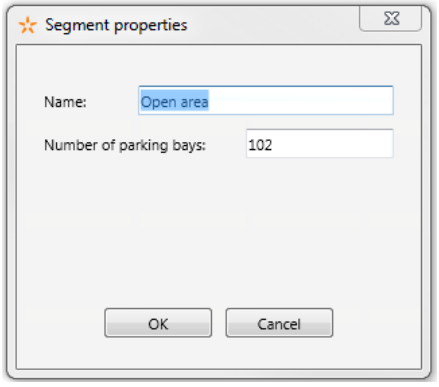


Figure 5: RelayNodeTool: Segment properties

Note
The Relay Node Tool will give you a warning if you have more than 500 bays in a segment. With more than 500 bays, segmentation is necessary. Please contact your Nedap account manager for more information.

4.3.1 IMPORT MAP

First import the drawing via the Paste from clipboard option or open the map image file.

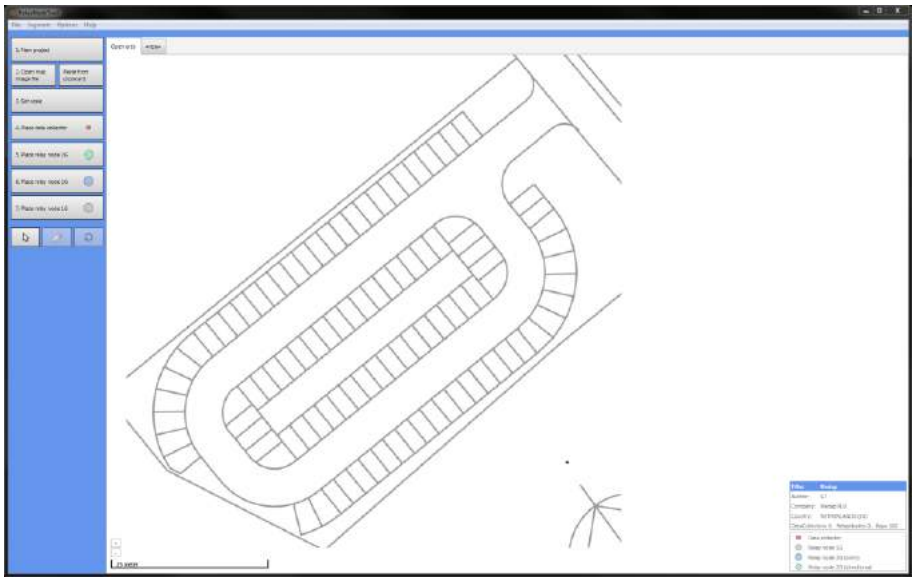


Figure 6: RelayNodeTool: Map import.

4.3.2 SET THE SCALE

Now set the scale, for an open area you set it at 25m if there isn't a clear indication about the size you can use the width of 10 parking bays:

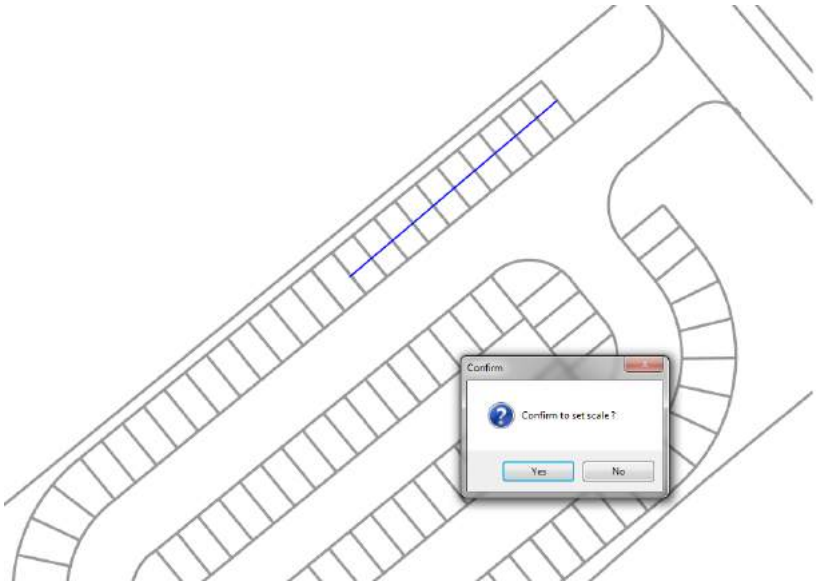


Figure 7: RelayNodeTool: Scaling of the map.

4.3.3 PLACE THE GATEWAY

Place at least one Gateway for every 250 bays. Use the information you already gathered or ask the client for the installation options for the Gateway(s). At least you need a power connection and an internet connection in case of Ethernet.

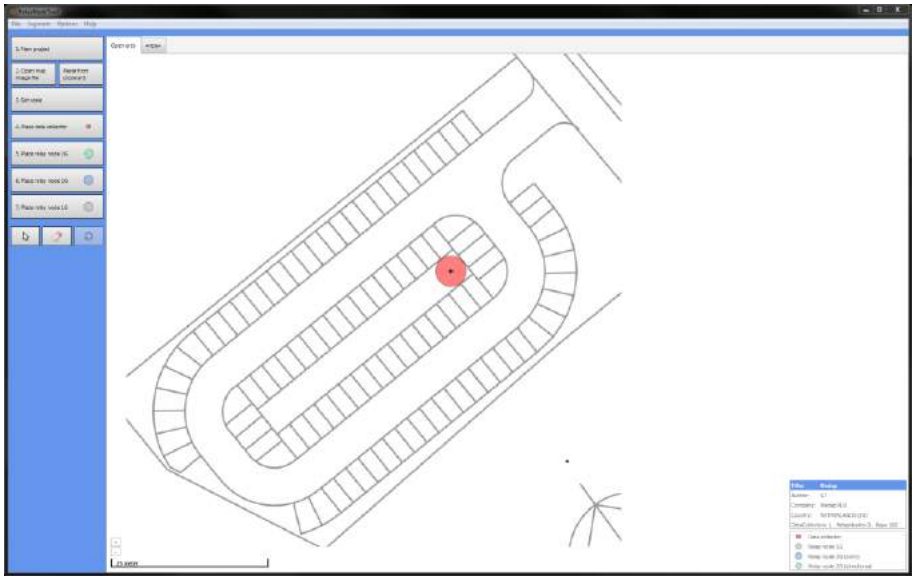


Figure 8: RelayNodeTool: SENSIT Gateway placement.

4.3.4 PLACE THE RELAY NODE

Place the Relay Nodes at locations were you can mount it e.g. at lampposts in a way that it covers all parking bays. With the tool you can choose between Relay Nodes 2G omni- or directional..

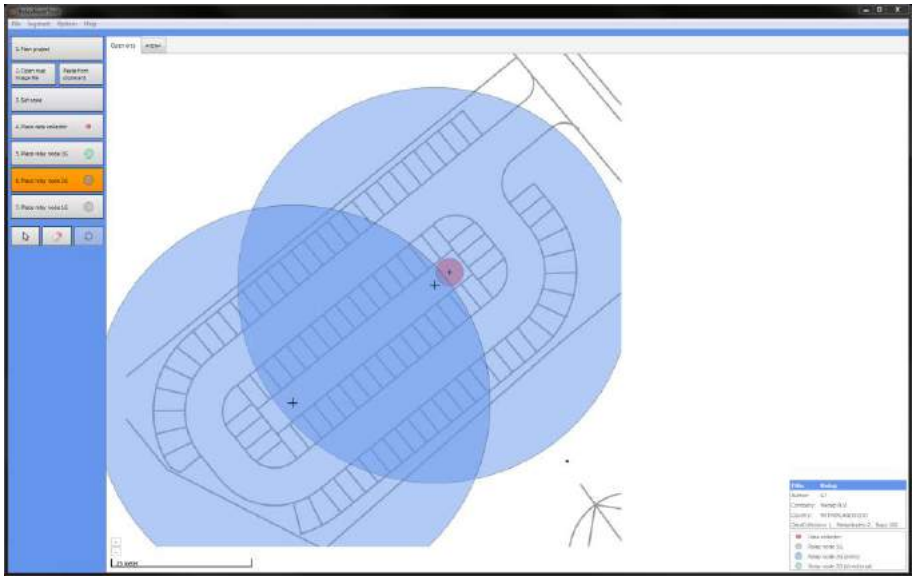


Figure 9: RelayNodeTool: RelayNode placement.

Note
The Relay Node Tool will give you a warning if you have more than 16 Relay Nodes in a segment. With more than 16 Relay Nodes, segmentation might be necessary. Please contact your Nedap account manager for more information.

4.4 THE SECOND SEGMENT

Via the option Segment -> Add new segment, or click on the tab <new> you can add a segment to the design. Fill-in the segment properties; the segment name and the number of parking bays.

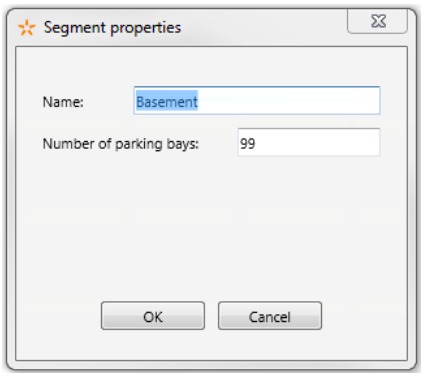


Figure 10: RelayNodeTool: Segment properties

4.4.1 IMPORT MAP

Also import the drawing for the second segment via the Paste from clipboard option or open the map image file.

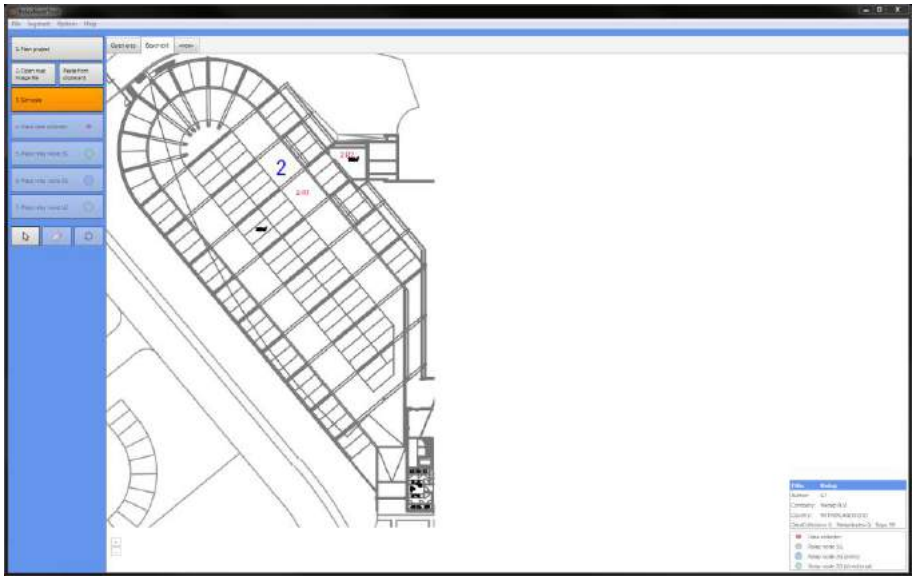


Figure 11: RelayNodeTool: Map import for the second segment.

4.4.2 SET THE SCALE

Also Set the scale, this location is a parking basement with a roof, large concrete columns and walls. This will influence the range of the Relay Nodes and therefore we advise to reduce the range with about 20%, so set the range to about 20m e.g. the width of 8 parking bays.

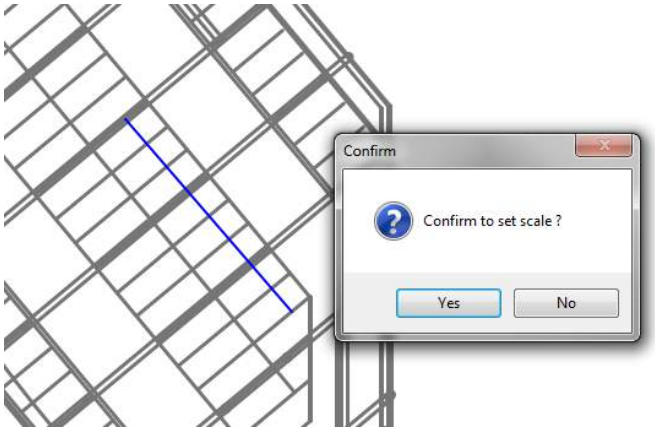


Figure 12: RelayNodeTool: Scaling of the map.

4.4.3 PLACE THE GATEWAY

Because this basement parking area is half open we can use the Gateway of the open area, so we don't need to add one for this segment.

4.4.4 PLACE THE RELAY NODE

Place the Relay Nodes at locations were you can mount it e.g. at lampposts in a way that it covers all parking bays. With the tool you can choose between Relay Nodes 2G omni- or directional.

There are 2 large concrete walls and after every 3 parking bays there is large concrete pillar, all is indicated with red. This will influence the range and radiation pattern of the Relay Nodes.

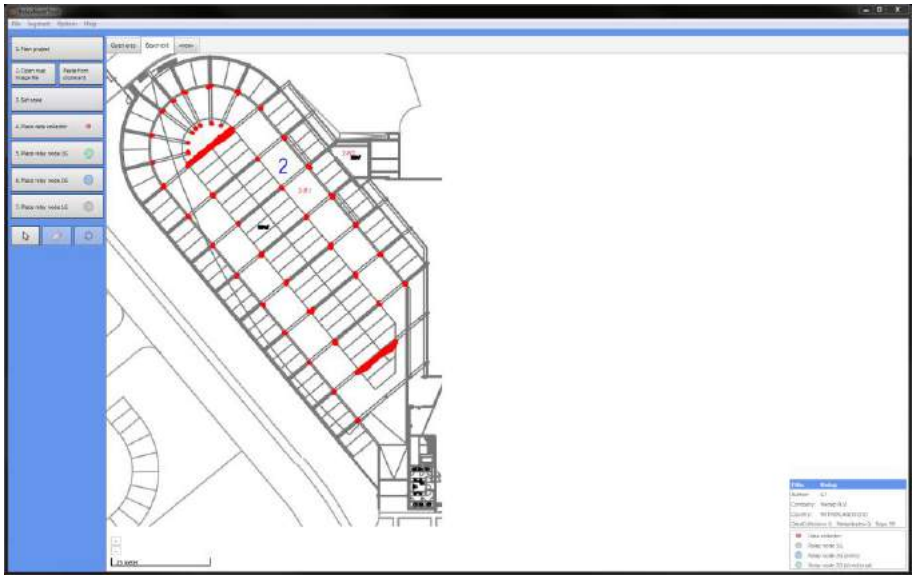


Figure 13: Imported map with concrete wall and pillar indication.

Probably with only 3 Relay Nodes 2G it is possible to get coverage of all bays, but because of these large influencing concrete objects we used 2 Relay Nodes 2G extra to make sure all SENSIT sensors are sufficient reachable.

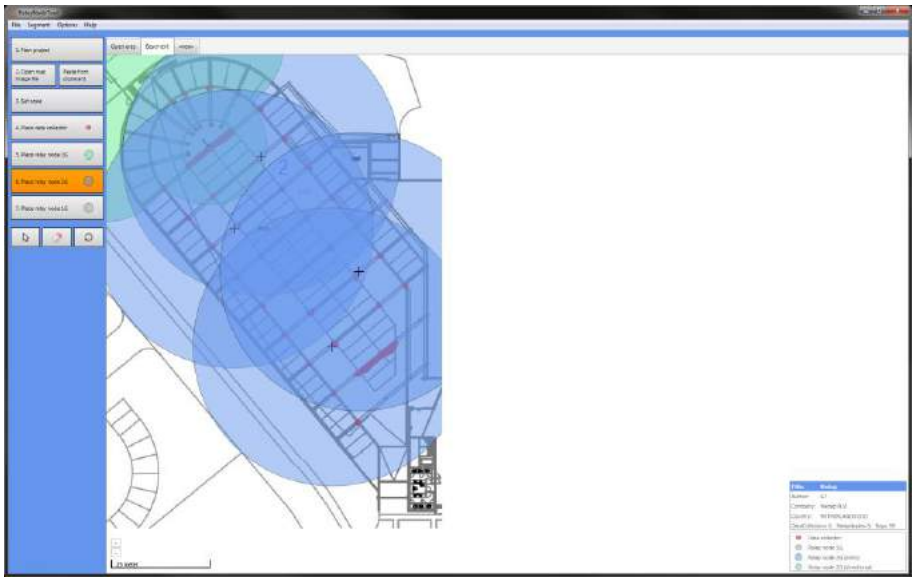


Figure 14: RelayNodeTool: RelayNode placement

4.5 SAVE THE PROJECT

Now you can save the project file:

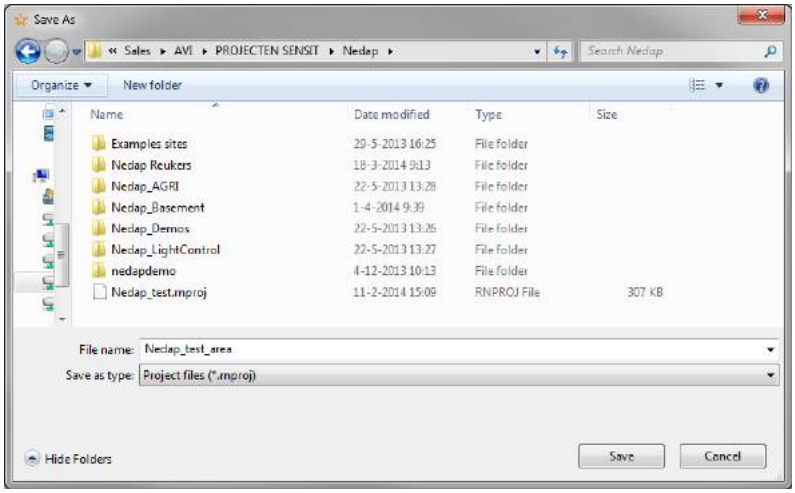


Figure 15: RelayNodeTool: Project save.

4.6 EXPORT PROJECT FILES

4.6.1 PROJECT FILE

You can send the project file (*.rnproj) to a colleague or Nedap so it can be reviewed.

4.6.2 SAVE AS IMAGE

You can save the segments you have designed to an image file, via the option File -> Save image (current segment and use it in your offer.

4.6.3 PRINT PROJECT

You can print the project file to a normal printer or to a PDF printer like the free PDF writer CutePDF (http://www.cutepdf.com/) and use this in your offer.

4.7 REQUEST PROJECT REVIEW

You can also request Nedap to review the project you have designed. Fill-in: your name, company, email address and phone number and write your comments on the design. With this information and the automatically added *.rnproj file Nedap can give you advise on the design.

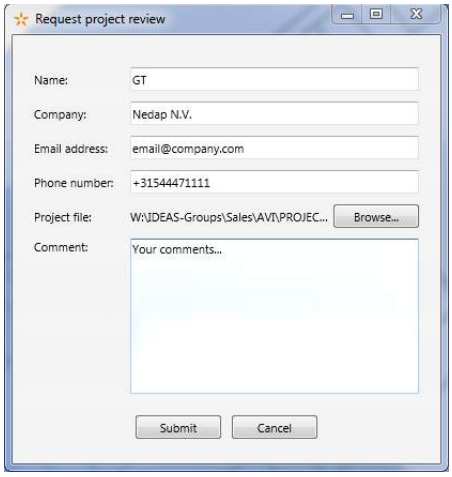


Figure 16: RelayNodeTool: Project review request

5 CONFIGURATION TOOL

The SENSIT Configuration Tool can be used during installation for the following functionalities: Creating a CSV file, Storing the GPS coordinates, starting or restarting the SENSIT Gateways, SENSIT sensors and Relay Nodes, Calibrating sensors and dividing larger parking areas into segments.

Please find below a figure of the Configuration Tool with a small description.

Figure 17: Configuration tool.

The Configuration Tool is equipped with two buttons and feedback LED's. The Tool is powered with the black button, the green LED will light-up. The reader is started with the yellow button, the red LED will flash will the reader is active.

Note
At the portal an E-learning course about the Tools can be found, in here also the Configuration Tool is explained.

5.1 DOWNLOADING THE APP

The SENSIT Configuration Tool works with an Android app. This app, called 'SENSIT Configurator' is available in the Google Play Store. The app and SENSIT Configuration Tool use Bluetooth to communicate. Make sure Bluetooth is enabled on your smartphone.

5.2 STARTING THE CONFIGURATION TOOL AND INITIALIZE THE APP

1) Start the Configurator app on the Android smartphone
2) Turn on the Configuration Tool by pressing the black ON/OFF button, the green LED will light up.
3) Following steps are done on the app: Navigate to Options > Pair Device. Scan for devices. Connect to the device with the Bluetooth name that can be found on the label of the SENSIT Configuration Tool.
4) Wait until the tool name appears on the display of the smartphone.
5) Make sure the memory in the app is cleared before making a start: navigate to List Configured Nodes > Clear.
6) Check the segment setting, before configuring the first node. Navigate to Settings > General Settings > Set Segment ID > Select Segment ID. Segment 0 is the default value.
7) The tool is now ready for use. It is important to use the following commissioning sequence: first configure the SENSIT Gateways, second the Relay Nodes and finally the SENSIT sensors.

5.3 CONFIGURE THE GATEWAY

1) To configure Gateway, navigate to Manual Input
2) Enter the node ID, which can be found on backside of the Gateway and select Program Node.
3) Restart the Gateway by switching off the power for a few seconds. The app will detect that the SENSIT Gateway is starting up and will start the configuration sequence. The selected segment and GPS position will be programmed and saved in the List Configured Nodes.
4) When the app shows OK, the SENSIT Gateway is ready for use.
5) Repeat this process for all Gateways. Make sure to check the segment number before configuring the Gateways.

5.4 CONFIGURE THE RELAY NODES

1) To configure the Relay Nodes, press the yellow button of the SENSIT Configuration Tool. During 20 seconds, the SENSIT Configuration Tool is active (red LED blinks).
2) Move the SENSIT Configuration Tool up and down over the front surface of the Relay Node. The Relay Node ID is detected and configuration is started automatically. During the configuration, the GPS position is stored in the app and the node segment is set.
3) After OK is indicated, the Relay node is ready for use.
4) Repeat this process for all Relay Nodes. Make sure to check the segment number before configuring the Relay Nodes

5.5 CONFIGURE SENSIT

1) To configure the SENSIT sensors, start with the sensor in the first parking bay on the map in the SIS.
2) Press the yellow button of the SENSIT Configuration Tool. During 20 seconds, the SENSIT Configuration Tool is active (red LED blinks).
3) Rotate the SENSIT Configuration Tool over the surface of the sensor.
4) The SENSIT is activated and the ID number will appear in the app. The ID number and GPS coordinate are stored in the app and the sensor calibration is started.
5) When the display indicates OK, the sensor is ready for use.
6) Repeat this process for all SENSIT sensors by following the bay numbers sequentially. Make sure to check the segment number before configuring the SENSIT sensors.

5.6 SIS SOFTWARE

After configuring the SENSIT components, the stored app data must be transmitted to the SIS Software. Therefore go to 'list configured nodes', check the list and select 'Export'. Select the media of your choice and send the data. The message contains a file in CSV format which can be loaded into the SIS software.

5.7 REPLACING THE BATTERIES

The lifetime of the 2x 1.5V AA alkaline batteries is about 40 hours of continuous use. The batteries can be replaced by a new set of batteries. For this the housing has to be opened, first remove the 4 screws at the front plate.

Figure 18: Configuration tool remove screws to open housing

Note
Be careful when you open the housing and make sure the RFID antenna is disconnected before you completely open the housing to replace the batteries.

Now the front plate including the electronics can be removed out of the housing. Disconnect the reader antenna before you can completely remove the front including the batteries and electronics.

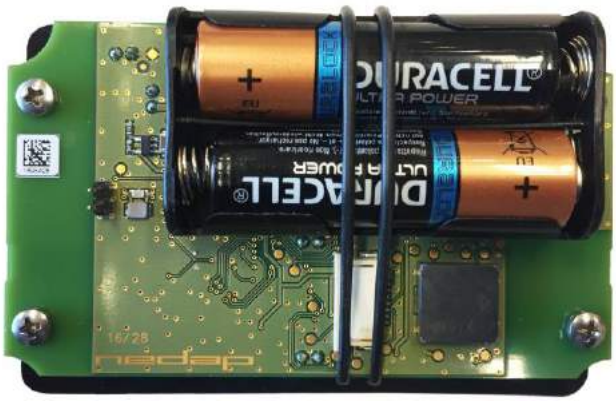


Figure 19: Configuration tool: Battery replacement

Before the batteries can be removed the rubber strap has to be loosened. Replace the empty batteries with 2 new 1.5V AA-type alkaline batteries, make sure the polarity is correct. Reinstall the rubber strap and reconnect the reader antenna before you close the housing again.

6 INSTALLATION SENSIT GATEWAY

The SENSIT Gateway is available in one versions equipped with as well Ethernet as a 3G modem. The installation of the SENSIT Gateway is described in chapter 6.3.

6.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair.

- The SENSIT Gateway may only be installed and serviced by qualified service personnel.
- Disconnect the power supply before removing or installing any parts.
- To be sure of safety, do not modify or add anything to the SENSIT Gateway other than mentioned in this manual or indicated by NEDAP N.V.

6.2 IC AND FCC ID

FCC ID: CGDSENSITGATEWAY and IC: 1444A-SENSITGATEWAY

6.3 GATEWAY INSTALLATION

6.3.1 INSTALLATION CONDITIONS

The installation recommendation is based on the following environmental conditions;

- Dry weather conditions.

6.3.2 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting of the SENSIT Gateway. In case of wall mounting.

- Special Equipment: Ladder, Bucket-truck or an aerial platform
- Power drill
- Set screw driver
- Wall plugs or anchors including screws

The needed materials for pole mounting are described at chapter 9.

6.3.3 MOUNTING

The SENSIT Gateway can be installed virtually anywhere due to its IP65 weatherproof housing and embedded 3G wireless modem. The only requirements are an AC mains power supply and that it should be installed within reach of the SENSIT wireless network.

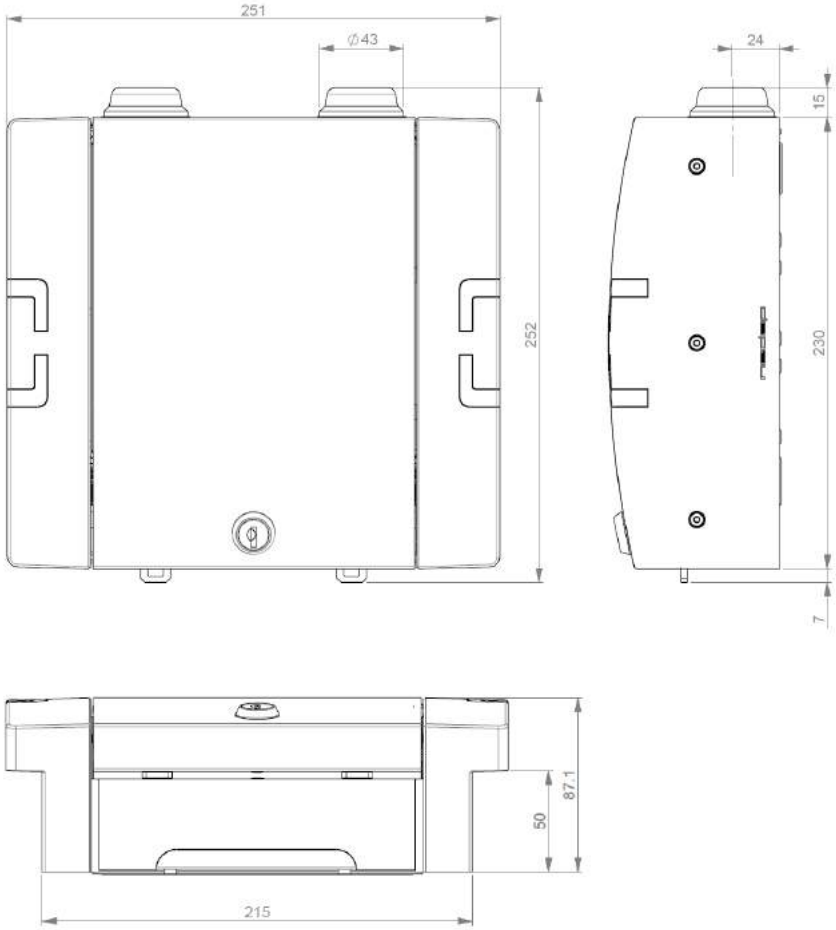


Figure 20: Gateway dimensions (mm)

6.3.4 AC POWER SUPPLY

Connect an AC mains power supply to the Gateway. An earth wire isn't needed due to the double isolated (Safety class II) design of the power supply.

- Input requirements: 100 – 240VAC 50/60Hz
- Safety class II, UL 1310 class II, NEC class 2 compliance.
- Power supply is UL 508 listed.
- Short circuit and overload protection.
- DC ok LED indicator.
- 6A slow blow circuit breaker is recommended

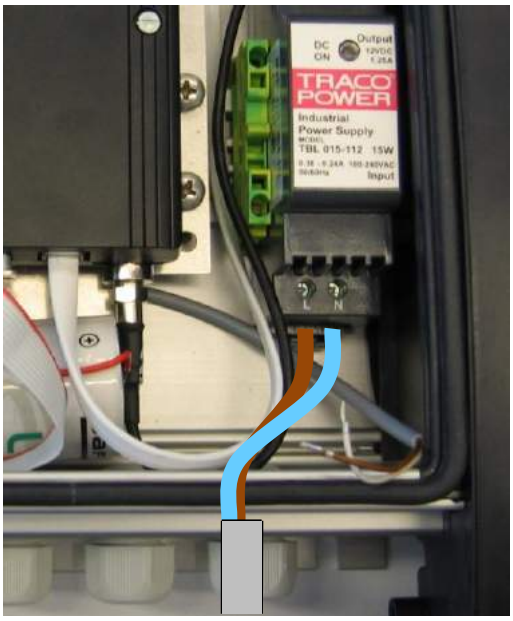


Figure 21: Power supply connection

6.3.5 EXTERNAL SOLAR SET

It is also possible to connect an external 12V solar set to the SENSIT Gateway. The external solar set should include beside the solar panel a (solar)battery charger and a 12V battery. The set should be capable to source 120mA at 12VDC (about 1.5W) continuously.

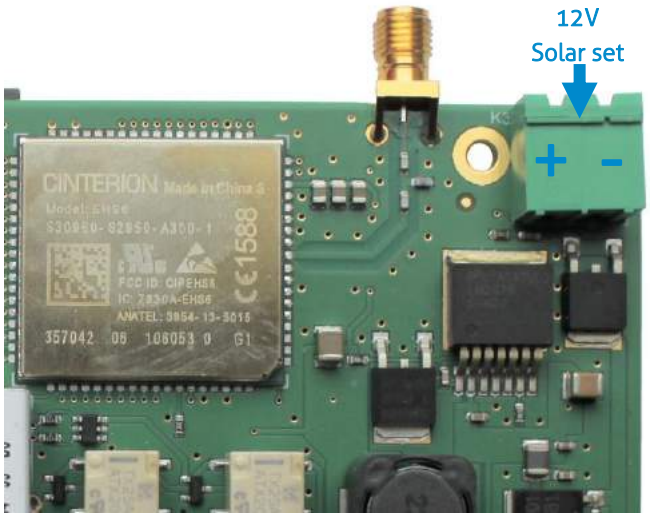


Figure 22: Solar panel set connection.

6.3.6 SIM CARD

Insert the SIM card at the top of the PCB as indicated.

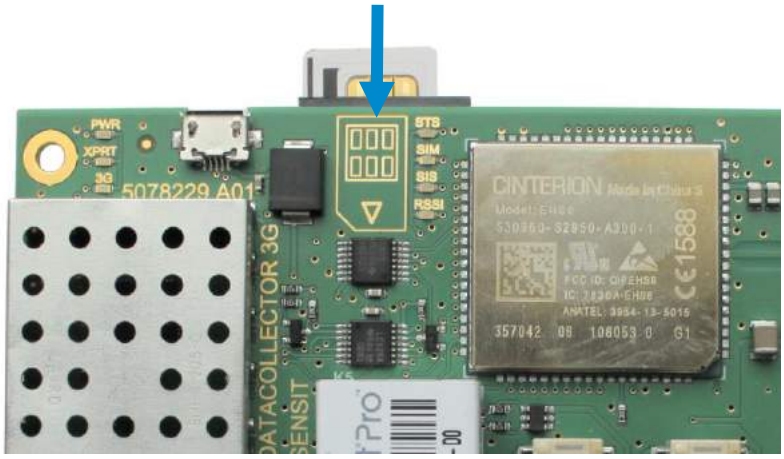


Figure 23: SIM Card installation

6.3.7 ANTENNA

The SENSIT Gateway is featured with two antennas. One for communication with the SENSIT nodes and the other is the mobile 3G antenna.

Note
Make sure your remove the pin code from your SIM-card e.g. by using your mobile phone.

Note
SIM card must be capable to receive and transmit SMS messages and to transfer Data.

Note
Data usages is normally less than 250MB per month.

Note
Some mobile providers disconnect an open TCP connection when no data transfer take place. The Gateway expect an uninterrupted TCP connection.

Note
By default every 2 minutes a small package is transmitted by the SIS to verify the open TCP connection.

7 GATEWAY CONFIGURATION

7.1 TCP/IP CONFIGURATION

The standard SENSIT Gateway has an on-board TCP/IP communication. The TCP/IP communication is used to send the messages from the SENSIT vehicle detections sensors to the SENSIT Interface Software running on the server.

7.1.1 GATEWAY TCP/IP SETTINGS

The default fixed IP-address for the SENSIT Gateway is 192.168.1.2. Configuration can be done using a web browser. By default there is no authentication needed, click OK when the authentication popup appears. Nedap strongly recommends to change the password. The fixed IP-address can be changed or set to DHCP, via at the left Network and Configuration:

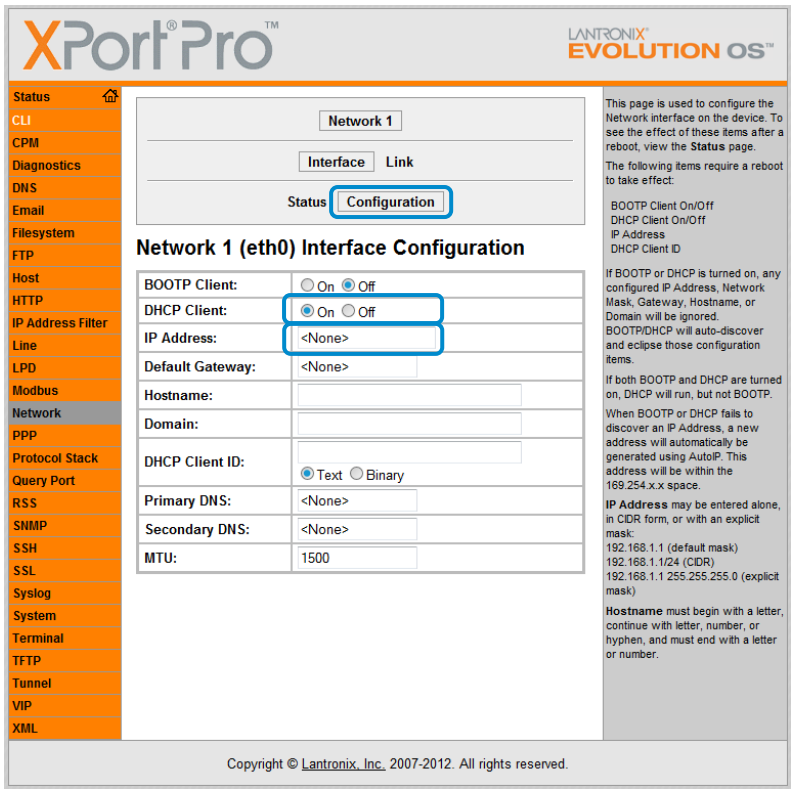


Figure 24: SENSIT Gateway TCP/IP Network configuration

Note
For safety reasons Nedap strongly recommends to set a password.

Next the SENSIT server settings should be configured. These settings are provided to you when the SENSIT Interface Software (SIS) is installed on the server. These setting you fill-in via at the left side Tunnel, Connect Mode and Host 1:

Figure 25: SENSIT Gateway TCP/IP Tunnel configuration

Note
The SENSIT Gateway automatically connect to the server via internet. Please make sure that the IP-address and assigned port is open in your firewall.

Fill in the (IP) Address: 217.114.111.246 is the default SIS server Address. In the provide PDF you find the correct Port number. To use both settings, click the Submit button.

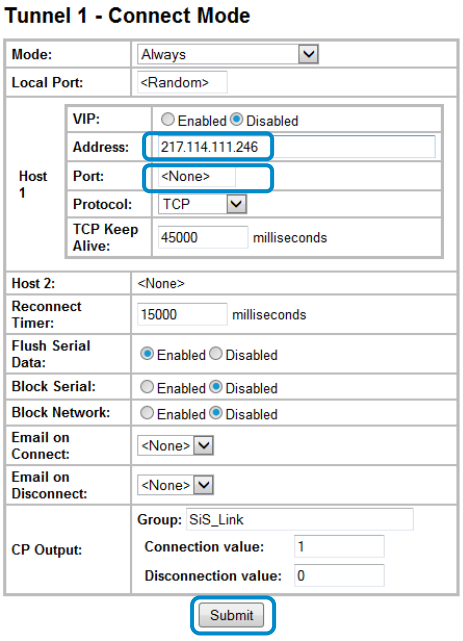


Figure 26: SENSIT Gateway Host IP-address and port setting

7.2 3G CONFIGURATION

The 3G modem inside the SENSIT Gateway needs to be configured before it can access the internet and connect to the SENSIT Interface Software at the server. This is done by sending 2 SMS text messages to the SENSIT Gateway. Any GSM cell phone can be used to send these configuration text messages.

First the APN settings should be configured. These settings depend upon the mobile network provider. The settings are sent in a SMS message using the following format:
PROFILE:APN=<apn>;APNLOGIN=<login>;APNPASSWORD=<pwd>;DNS=<dns>;

Where:	<apn>	APN (Access Point Name)
	<login>	User name
	<pwd>	Password
	<dns>	DNS (Domain Name Server)

Example:
PROFILE:APN=gprsinternet;APNLOGIN=gprs;APNPASSWORD=;DNS=;

Next the SENSIT server settings should be configured. These settings are provided to you when the SENSIT Interface Software (SIS) is installed on the server. The settings are sent in a SMS message using the following format:

PROFILE:HOSTNAME=<server>;PORT=<port>;SSL=<ssl>;

Where:	<server>	SENSIT server hostname or ip-address
	<port>	Port number
	<ssl>	true / false depending if SSL security is used.

Example:
PROFILE:HOSTNAME=217.114.111.246;PORT=10000;SSL=false;

Note
Make sure the SMS does not get longer than the default message size of 160 characters.

Note
The SENSIT Gateway will send a SMS back to the phone number you send the SMS with. All current settings are transmitted after sending a SMS message.

7.3 SENSIT GATEWAY LED BEHAVIOR

At the SENSIT Gateway there is a more detailed LED feedback implemented. At the left top corner, the power and general connection feedback and at the right of this the 3G modem feedback LEDs. The WSN LED indications can be found just above the tamper switch.

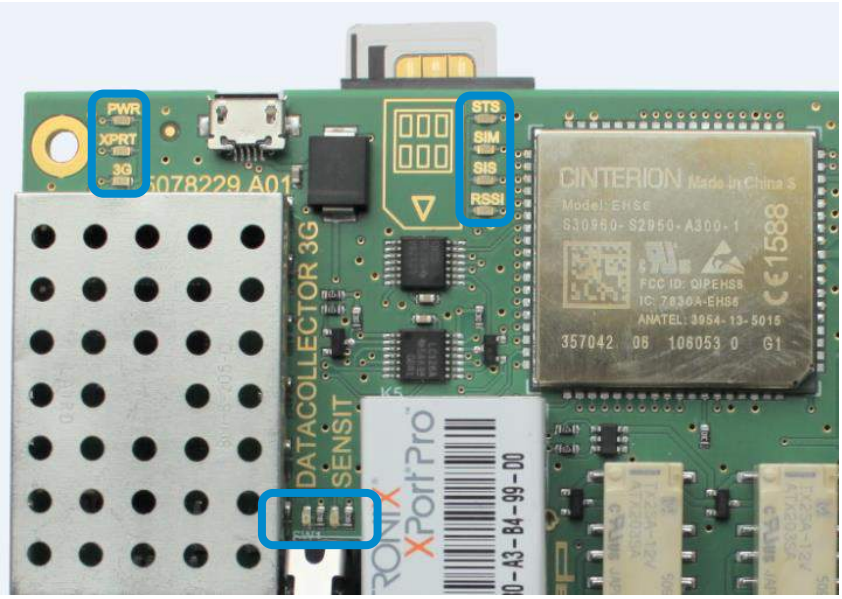


Figure 27: SENSIT Gateway LED feedback

7.3.1 PWR (POWER) LED

The first LED at the top left corner is the power (PWR) LED, this indicates if the SENSIT Gateway electronics is powered. The LED behavior is described below:

- Permanently off
  The electronics isn't powered.
- Permanently on
  The electronics is powered.

7.3.2 XPRT (XPORT) LED

The second LED at the top left corner is the XPORT (XPRT) or Ethernet LED, this indicates if the SENSIT Gateway is connected via Ethernet to the SIS. The LED behavior is described below:

- Permanently off
  Not connected with the SIS via Ethernet.
- Permanently on
  Connected with the SIS via Ethernet.

7.3.3 3G LED

The second LED at the top left corner is the 3G LED, this indicates if SENSIT Gateway is connected via the 3G mobile network to the SIS. The LED behavior is described below:

- Permanently off
  Not connected with the SIS via 3G.
- Permanently on
  Connected with the SIS via 3G.

7.3.4 STS (3G STATUS) LED

The first feedback LED of the 3G modem LEDs is the status (STS) LED of the 3G modem. This LED has the following behavior::

- Permanently off
  3G Modem is not running.
- 500 ms on / 500ms off
  3G Modem firmware is starting.
- Permanently on
  Firmware of the 3G modem is up and running.

7.3.5 SIM LED

The second feedback LED of the 3G modem LEDs is the SIM-card LED. This LED has the following behavior::

- Permanently off
  No SIM card inserted or detected.
- 500 ms on / 500ms off
  SIM card is inserted and busy to unlock or the SIM card is locked.
- Permanently on
  Sim card is unlocked.

7.3.6 SIS LED

The second feedback LED of the 3G modem LEDs is the SENSIT Interface Server (SIS) LED and shows the connection to the (SIS) Server. This LED has the following behavior::

- Permanently off
  An not unlocked SIM-card or searching for a (3G) network.
- 500 ms on / 500ms off
  Registered to a (3G) network.
- Permanently on
  Port is opened and connected to the (SIS) server.

7.3.7 RSSI LED

The forth feedback LED of the 3G modem LEDs is the RSSI (Receive Signal Strength Indication) LED and shows the signal strength of the 3G base station. This LED has the following behavior::

- Permanently off
  No (3G) network or RSSI level is below -100dBm.
- 500 ms on / 500ms off
  RSSI level is between -100 dBm and -70dBm.
- Permanently on
  RSSI level is above -70dBm.

7.3.8 WSN LED INDICATIONS

The SENSIT Gateway is featured with two LEDs indicating the WSN (Wireless SENSIT Network) operation. These LEDs can be found just above the tamper switch, see Figure 27: SENSIT Gateway LED feedback. The table below describes the function of the WSN LEDs.

SENSIT Gateway LED indication.	
Green (D1)	LED indicating the presence of active Relay Nodes in the wireless SENSIT network.
Red (D2)	LED indicating the activity of the SENSIT Gateway, the Gateway is stated and maintaining the wireless SENSIT network.

Table 1: LED indications

7.4 VERIFY COMMUNICATION

Via the SENSIT Interface Software (SIS) a more detailed description can be found in chapter 17.1. After choosing: Detection ➔ Gateway choice at the left side of the screen. The powered and to the internet connected SENSIT Gateways, should show up automatically in the Gateways connected list.

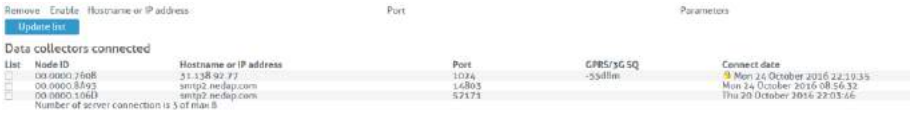


Figure 28: Verify connected SENSIT Gateways at the SIS

8 MOUNTING THE SENSIT BACKUP BATTERY

8.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair.

- The SENSIT backup battery may only be installed and serviced by qualified service personnel.
- Disconnect the power supply of the SENSIT Gateway before removing or installing the SENSIT backup battery.
- To be sure of safety, do not modify or add anything to the SENSIT backup battery other than mentioned in this manual or indicated by NEDAP N.V

8.2 INSTALLATION CONDITIONS

The installation recommendation is based on the following environmental conditions;

- Dry weather conditions.

8.3 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting of the SENSIT backup battery. In case of wall mounting.

- Special Equipment: Ladder, Bucket-truck or an aerial platform
- Power drill
- Set screw driver
- Wall plugs or anchors including screws

The needed materials for pole mounting are described at chapter 9.

8.4 MOUNTING

The SENSIT backup battery must be mounted in the close vicinity of Gateway. Often it is installed back-to-back on a pole. Similar as the Gateway it can be installed virtually anywhere due to its IP65 weatherproof housing.

8.4.1 DIMENSIONS

The SENSIT back up battery is installed inside a similar housing as the Gateway. Only without the antennas and with a few less cable glands. The dimensions can be found below.

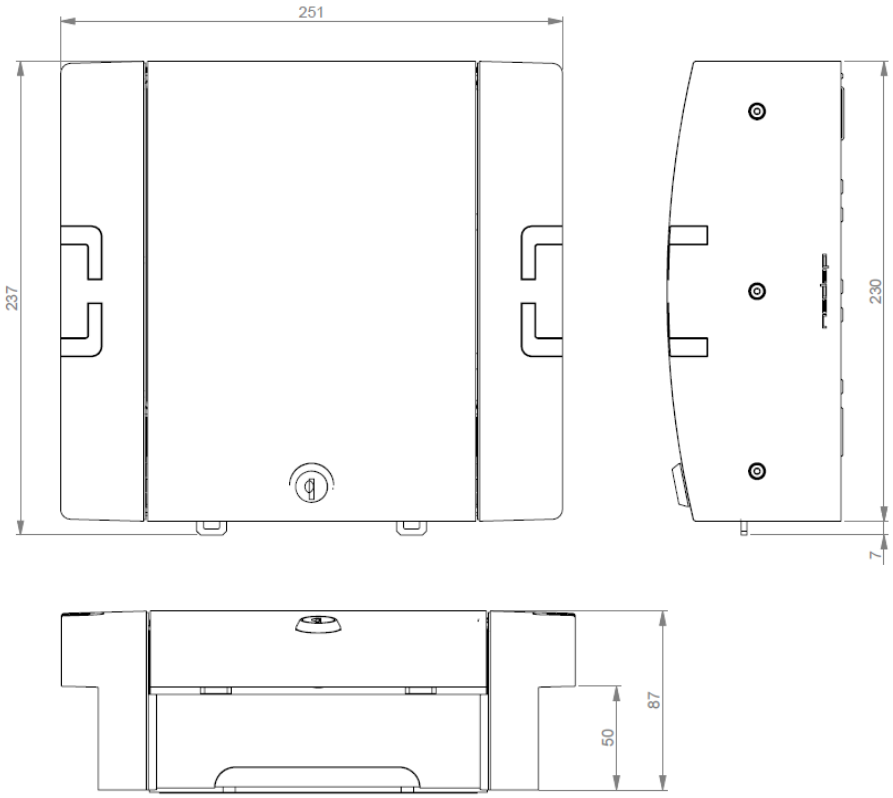


Figure 29: Back up battery dimensions (mm)

8.4.2 CONNECTION TO THE GATEWAY

The SENSIT backup battery contains a lead-acid battery, a fuse and a connection wire that can directly be connected to the SENSIT Gateway. The SENSIT Gateway contains the circuit to charge the lead-acid battery when connected to mains. The figure below indicates the right connection and polarity to connect the SENSIT backup battery.

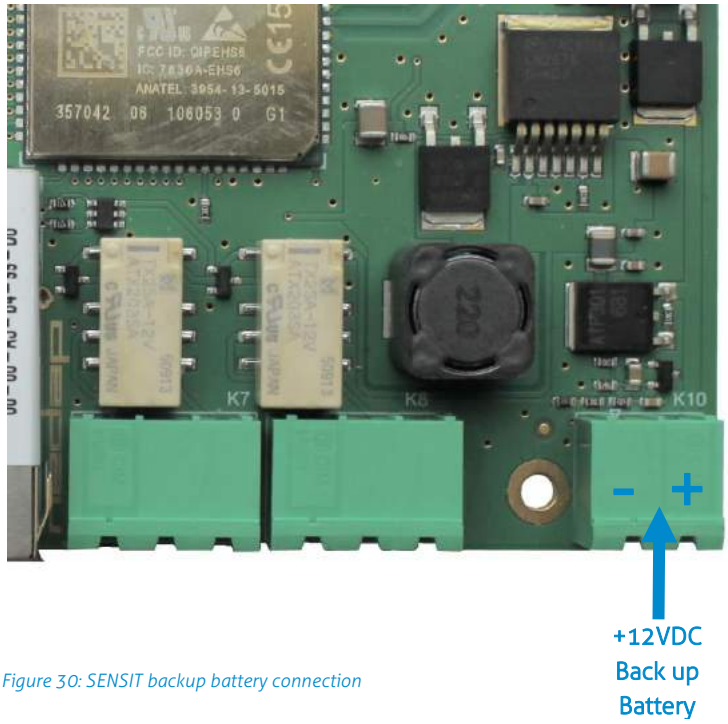


Figure 30: SENSIT backup battery connection

9 POLE MOUNTING SET

The Backup Battery and the SENSIT Gateway can be equipped with a pole mounting set. This set includes all mounting materials to mount a SENSIT Gateway or a Battery Pack housing to a round- (max. diameter is 300mm) or square pole (max. 250mm).

9.1 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting the Pole mount set to a SENSIT Gateway or a Battery Pack housing and finally to a pole.

- Special Equipment: Ladder, Bucket-truck or an aerial platform
- Wrench: size 10
- Cutter: for stainless steel strap
- Set screw driver

9.2 MOUNTING

The pole mount set includes all mounting materials to mount a SENSIT Gateway or a Battery Pack housing to a pole. The bracket can be bolted to the SENSIT Gateway or Battery Pack housing, see figure below for more details.

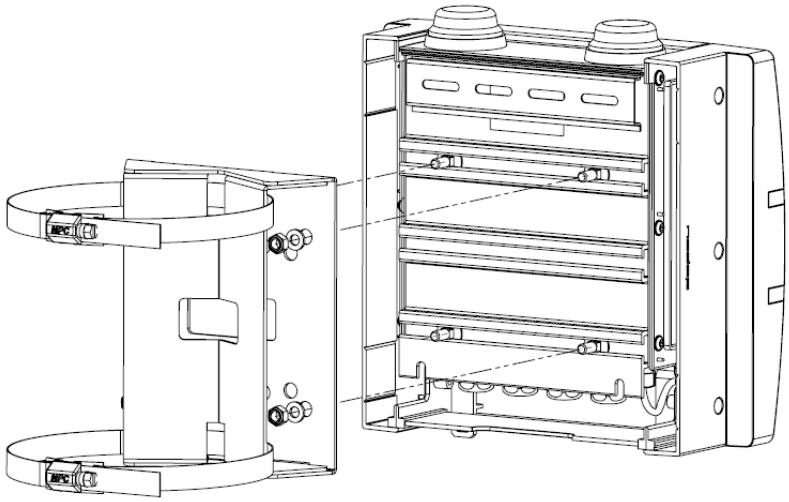


Figure 31: Pole Mount set installation

Furthermore the pole mount set includes, the needed bolts, washers and nuts (4x) and an adjustable clamp set, to strap the housing to the pole.

10 MOUNTING THE RELAY NODE 2G

10.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair:

- The Relay Node only be installed and serviced by qualified service personnel.
- To be sure of safety, do not modify or add anything to the SENSIT Relay Node 2G other than mentioned in this manual or indicated by Nedap N.V.

10.2 IC AND FCC ID

FCC ID: CGDRELAY and IC: 1444A-RELAY

10.3 DIMENSIONS

See Figure 32 for the dimensions (in mm) of the Relay Node 2G unit.

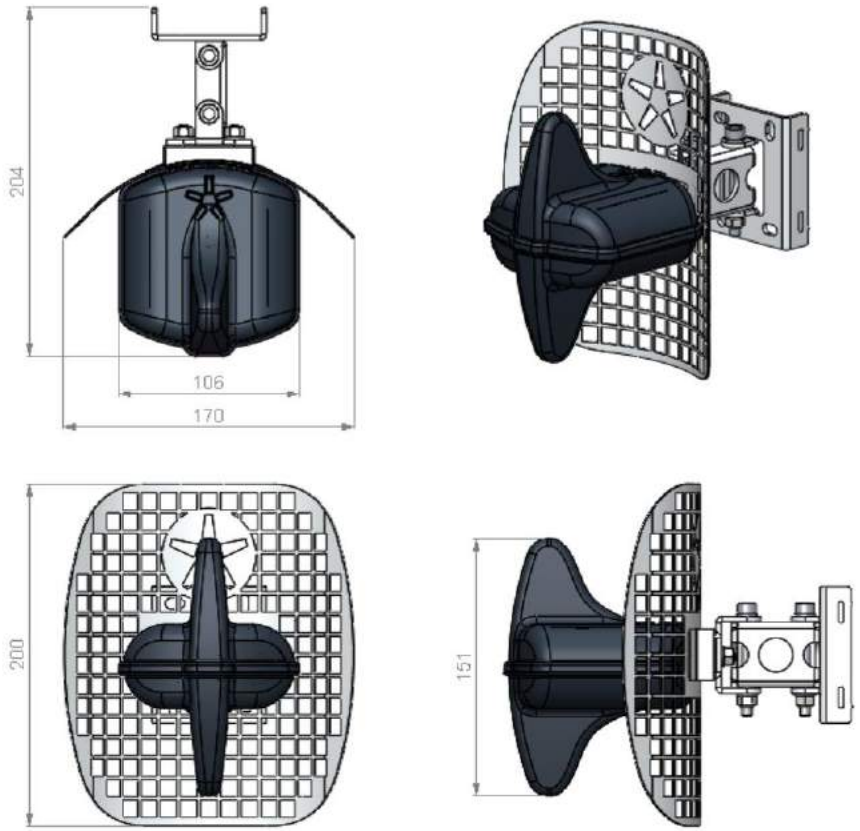


Figure 32: Dimensions Relay Node 2G (mm)

10.4 INSTALLATION CONDITIONS

The installation recommendation is based on the following environmental conditions;

- Dry weather conditions.

10.5 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting of the SENSIT Relay Node 2G.

- Special Equipment: Ladder, Bucket-truck or an aerial platform
- TORX screw driver: T20
- Allen key: no. 5
- Wrench: size 10

10.6 INSTALLATION PROCEDURE

Below the mounting procedure for the Relay Node 2G. The Relay Node 2G features visual status feedback using two LED indicators: a green and a red LED.

SENSIT Relay Node 2G mounting procedure		
Step 1: Mounting	Mount the reflector and top of the housing on the pole or wall. With the Nedap asterisk at the top. The Relay Node 2G can also be mounted without the reflector for an omni-directional radiation pattern.	
Step 2: Power the Relay Node	Remove the isolation tabs, to power up the Relay Node.	
Step 3: Verify start-up	Green LED starts blinking fast (duration: 15 sec.), indicating that battery power has been connected correctly.	
Step 4: WSN search	Red LED starts to blink slowly. This indicates that the Relay Node didn't found an active WSN (wireless SENSIT Network) yet. It is searching for a WSN.	
Step 5: WSN found	Green LED starts slow blinking and red LED is turned off. This indicates that a WSN has been found.	
Step 6: Final installation	Now the Relay Node electronics can be installed at the pole or wall with a TORX (T20) screw driver.	

Note
When segmentation is needed, please use the Configuration Tool and set the right segment.

Note
The Green and Red feedback LED's are located in the blue circle.

Note
After 15 minutes LED feedback is turned off, to save battery power.

Note
After 1 minute the LED feedback is turned off, to save battery power.

10.7 BATTERY REPLACEMENT

When the battery life of the Relay Node 2G fails after specified lifetime, the batteries can be changed make sure you use the right batteries:

D-cell Lithium Thionyl Chloride batteries (Li-$SOCl_2$) 3.6V, recommended types are:

- SAFT | LS 33600
- XENO | XL-205F

SENSIT Relay Node 2G battery replacement			
Step 1: Opening the housing	Open the Relay Node 2G housing by unscrewing the TORX, T20 screw.		
Step 2: Replace the batteries	Remove the old batteries and dispose them in the correct manner. Place the new 3.6V Lithium (Li-$SOCL_2$) batteries (see suggested types above) and make sure the polarity is correct, as indicated.		**Note** Previous segmentation is stored, when the same segment still applies you don't need to segment the Relay Node 2G again.
Step 3: Verify start-up	Green LED starts blinking fast (duration: 15 sec.), indicating that battery power has been connected correctly.		**Note** The Green and Red feedback LED's are located in the blue circle.
Step 4: WSN search	Red LED starts to blink slowly. This indicates that the Relay Node didn't found an active WSN (wireless SENSIT Network) yet. It is searching for a WSN.		**Note** After 15 minutes LED feedback is turned off, to save battery power.
Step 5: WSN found	Green LED starts slow blinking and red LED is turned off. This indicates that a WSN has been found.		**Note** After 1 minute the LED feedback is turned off, to save battery power.
Step 6: Final installation	Now the Relay Node electronics can be installed at the pole or wall with a TORX (T20) screw driver.		

11 MOUNTING THE SENSIT IR

11.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair:

- The SENSIT IR may only be installed and serviced by qualified service personnel.
- To be sure of safety, do not modify or add anything to the SENSIT IR other than mentioned in this manual or indicated by NEDAP N.V.

11.2 IC AND FCC ID

FCC ID: CGDSENSIT and IC: 1444A-SENSIT

11.3 DIMENSIONS

The SENSIT IR is designed for mounting into the floor of a parking space. See Figure 33 for the dimensions of the unit in mm.

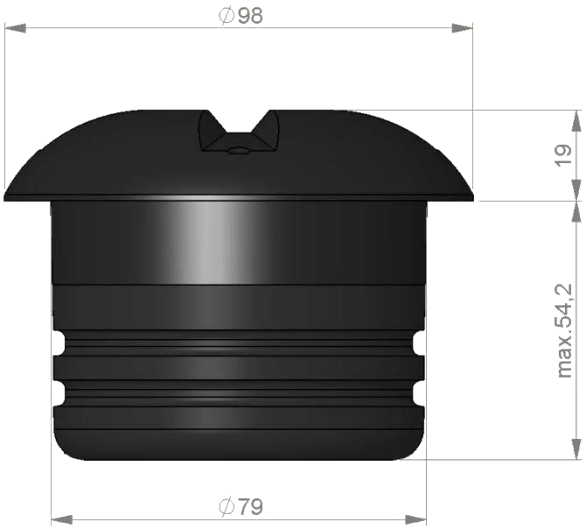


Figure 33: Dimensions SENSIT IR (mm).

11.4 INSTALLATION CONDITIONS

The installation recommendation is based on the following environmental conditions;

- Ambient temperature between 5 to 40 °C (41 to 104 °F0
- Dry weather conditions
- Surface based on concrete, asphalt or pavement

11.5 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting of the SENSIT IR.

- Equipment: Automatic core drill
- Drill size: Dimensions Ø 85 mm (3.35 in)
- Drill depth: 55 mm (2.16 in)
- Filler material: Liquid rapid mortar
- Required amount per sensor: Approx 100 ml

We have good results with the rapid mortar TM 5R. See appendix B for specifications. Ensure to follow the guidelines and instructions as outlined on the filler material.

11.6 INSTALLATION PROCEDURE

Below the mounting procedure for the SENSIT sensor with and without the Configuration Tool.

11.6.1 WITHOUT THE CONFIGURATION TOOL

SENSIT sensor mounting procedure		
Step 1: Preparation	Indicate on the closed parking lot where the SENSIT sensor should be mounted. Distribute the SENSIT sensors over the parking lot and write down the correct ID numbers on your installation plan.	
Step 2: Drilling	Drill a hole of Ø 85 mm [3.35 in] and at least 55 mm [2.16 in] deep into the center of the parking bay	
Step 3: Gluing	Apply the right amount of filler and pour into the hole.	
Step 4: Mounting	Double-check the node ID number and the parking bay on the installation plan and place the SENSIT sensor into the hole.	
Step 5: Cleaning-up	After mounting the SENSIT sensors in all parking bays or a selection of parking bays. Clean up the parking bays and remove all (metal) tools and objects.	
Step 6: Activating	All SENSIT sensors are set into transport/stock mode during shipment. After installation all mounted SENSIT sensors must be swept with the reset magnet.	
Step 7: Calibrating	After installation the SENSIT sensor must be calibrated. Ensure that the parking space is empty and that there is no car parked on top of the sensor or on neighboring parking bays. SENSIT sensors can be calibrated via the SENIST Interface Software (SIS). See chapter 17.7.6 for more information about calibration.	
Step 8: Glue curing	Leave the filler harden for 8 hours before vehicles are allowed in the parking space again.	

Note
Take attention that you fixate the SENSIT sensor during the curing time otherwise the sensor will start to float.

Note
Once out of the transport/stock mode the battery lifetime starts to count.

Note
When the SENSIT sensors are not calibrated they hardly send any messages. This is due to the fact that there are no events generated because the magnetic thresholds are not crossed.

11.6.2 WITH THE CONFIGURATION TOOL

SENSIT sensor mounting procedure		
Step 1: Preparation	Indicate on the closed parking lot where the SENSIT sensor should be mounted. Distribute the SENSIT sensors over the parking according the installation plan.	
Step 2: Drilling	Drill a hole of Ø 85 mm [3.35 in] and at least 55 mm [2.16 in] deep into the center of the parking bay	
Step 3: Gluing	Apply the right amount of filler and pour into the hole.	
Step 4: Mounting	Place the SENSIT sensor into the hole and make sure it doesn't start to float.	
Step 5: Cleaning-up	After mounting the SENSIT sensors in all parking bays or a selection of parking bays. Clean up the parking bays and remove all (metal) tools and objects.	
Step 6: Activating Segmentation Calibration	Use the Configuration Tool: Activate, perform the segmentation according the installation plan and calibrate the SENSIT sensor.	
Step 7: Glue curing	Leave the filler harden for 8 hours before vehicles are allowed in the parking space again.	

Note
Take attention that you fixate the SENSIT sensor during the curing time otherwise the sensor will start to float.

Note
Once out of the transport/stock mode the battery lifetime starts to count.

11.7 REPLACEMENT

When the battery life of the SENSIT IR fails after specified lifetime, we advise to replace the unit completely. The SENSIT IR is fully sealed and for outdoor use, therefore batteries cannot be replaced.
Drill out the old SENSIT IR and complete the mounting procedure as describe in the previous paragraph.

Ensure to note the node ID number of the SENSIT IR to the parking bay. Update the parking bay configuration list in the SIS software to ensure the new sensor is linked to the right parking bay.

12 MOUNTING THE SENSIT FLUSH MOUNT

12.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair.

- The SENSIT Surface Mount may only be installed and serviced by qualified service personnel.
- To be sure of safety, do not modify or add anything to the SENSIT Surface Mount other than mentioned in this manual or indicated by NEDAP N.V.

12.2 IC AND FCC ID

FCC ID: CGDSENSIT and IC: 1444A-SENSIT

12.3 DIMENSIONS

The SENSIT Flush Mount is designed for full mounting into the floor of a parking space. As the unit is fully flush with the road surface the unit is snow plough resistant. The SENSIT Flush Mount is only featured with magnetic detection. See Figure 34 for the dimensions of the unit in mm. The top of the SENSIT Flush Mount is laser engraved with the node ID number.

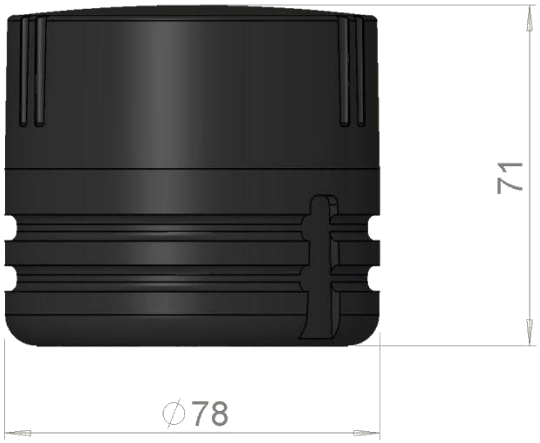


Figure 34: Dimensions SENSIT Flush mount (mm).

12.4 INSTALLATION CONDITIONS

The installation recommendation is based on the following environmental conditions;

- Ambient temperature between 5 to 40 °C [41 to 104 °F]
- Dry weather conditions
- Surface based on concrete, asphalt or pavement

12.5 INSTALLATION MATERIAL

The following would be required for mounting of the SENSIT FLUSH MOUNT.

- Equipment: Automatic core drill
- Drill size: Dimensions Ø 85 mm (3.35 in)
- Drill depth: 75 mm (2.95 in)
- Filler material: Liquid concrete mortar
- Required amount per sensor: Approx. 100 ml

We have good results with the rapid mortar TM 5R. See appendix B for specifications. Ensure to follow the guidelines and instructions as outlined on the filler material.

12.6 INSTALLATION PROCESS

Installation process as described in paragraph 11.6, however with above mentioned drilling depth. See figure below for more details about the mounting depth of the SENSIT Flush Mount, dimensions in mm.

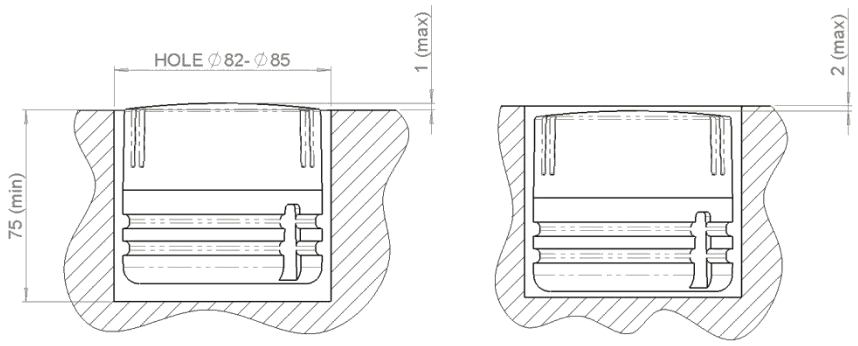


Figure 35: Mounting depth SENSIT Flush mount (mm).

12.7 REPLACEMENT

When the battery life of the SENSIT Flush Mount fails after specified life time, we advise to replace the unit completely. The SENSIT Flush Mount is fully sealed, therefore batteries cannot be replaced. Drill out the old SENSIT Flush Mount and complete the mounting procedure as described in paragraph 11.6.

Ensure to note the node ID number of the SENSIT IR to the parking bay. Update the parking bay configuration list in the SIS software to ensure the new sensor is linked to the right parking bay.

13 MOUNTING THE SENSIT SURFACE MOUNT

The SENSIT Surface Mount is designed for installations where the sensors cannot be drilled into the parking space e.g. multi storey car parks and rooftop car parks or existing car parks.

13.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair.

- The SENSIT Surface Mount may only be installed and serviced by qualified service personnel.
- To be sure of safety, do not modify or add anything to the SENSIT Surface Mount other than mentioned in this manual or indicated by NEDAP N.V.

13.2 IC AND FCC ID

FCC ID: CGDSENSITSM and IC: 1444A-SENSITSM

13.3 DIMENSIONS

The SENSIT Surface Mount can easily be glued onto the surface of a parking space. The unit consists of two components;

- Sensor core; the black core is the vehicle detection sensor. This unit can be replaced after end of battery life.
- Mounting ring; the mounting ring allows easy installation onto the surface of a parking space.

See Figure 36 for the dimensions of the unit, dimensions in mm. The top of the SENSIT Surface Mount is laser engraved with the node ID number.

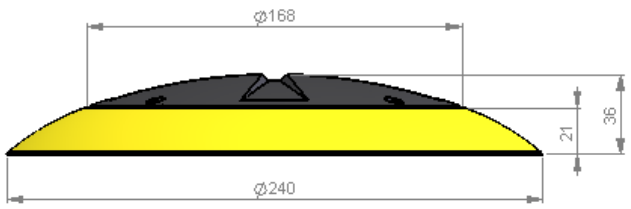


Figure 36: Dimensions SENSIT Surface Mount (mm).

13.4 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting of the SENSIT FLUSH MOUNT.

- Equipment: Pneumatic kit dispenser
- Filler material: MSP or PU glue
- Required amount per sensor: Approx. 150 ml

Note
See Appendix 20B and 20C for more information about the recommended MSP or PU glue.

13.5 INSTALLATION PROCESS

Follow the recommended installation procedure for the SENSIT Surface Mount as described below. In the chapters below you can find the installation procedure with and without the Configuration Tool.

13.5.1 WITHOUT THE CONFIGURATION TOOL

SENSIT Surface Mount mounting procedure		
Step 1: Preparation	Indicate on the closed parking lot where the SENSIT sensor should be mounted. Clean the location where the sensor should be mounted. Distribute the SENSIT sensors over the parking lot and write down the correct ID numbers on your installation plan.	
Step 2: Gluing	Pour the filler into the mounting ring of the SENSIT Surface Mount. A pneumatic kit dispenser makes it easy to apply the glue into the mounting ring. For good fixture with the surface please fill the entire mounting ring.	
Step 3: Mounting	Press firmly and double check the ID number.	
Step 4: Cleaning-up	After mounting the SENSIT sensors in all parking bays or a selection of parking bays. Clean up the parking bays and remove all (metal) tools and objects.	
Step 5: Activating	All SENSIT sensors are set into transport/stock mode during shipment. After installation all mounted SENSIT sensors must be swept with the reset magnet.	
Step 6: Calibrating	After installation the SENSIT sensor must be calibrated. Ensure that the parking space is empty and that there is no car parked on top of the sensor or on neighboring parking bays. SENSIT sensors can be calibrated via the SENIST Interface Software (SIS). See chapter 17.7.6 for more information about calibration.	
Step 7: Glue curing	Leave the glue dry for at least 4 hours before vehicles are allowed in the parking space again.	

Note
Ensure excessive glue is removed from the bottom black core part of the unit, as this will make it very difficult to replace the core part.
For non-permanent mounting only glue the ring with a few dots of glue.

Note
Once out of the transport/stock mode the battery lifetime starts to count.

Note
When the SENSIT sensors are not calibrated they hardly send any messages. This is due to the fact that there are no events generated because the magnetic thresholds are not crossed.

13.5.2 WITH THE CONFIGURATION TOOL

SENSIT Surface Mount mounting procedure		
Step 1: Preparation	Indicate on the closed parking lot where the SENSIT sensor should be mounted. Clean the location where the sensor should be mounted. Distribute the SENSIT sensors according your installation plan.	
Step 2: Gluing	Pour the filler into the mounting ring of the SENSIT Surface Mount. A pneumatic kit dispenser makes it easy to apply the glue into the mounting ring. For good fixture with the surface please fill the entire mounting ring.	
Step 3: Mounting	Press firmly.	
Step 4: Cleaning-up	After mounting the SENSIT sensors in all parking bays or a selection of parking bays. Clean up the parking bays and remove all (metal) tools and objects.	
Step 5: Activating Segmentation Calibrating	Use the Configuration Tool: Activate, perform the segmentation according the installation plan and calibrate the SENSIT sensor.	
Step 7: Glue curing	Leave the glue dry for at least 4 hours before vehicles are allowed in the parking space again.	

Note
Ensure excessive glue is removed from the bottom black core part of the unit, as this will make it very difficult to replace the core part.
For non-permanent mounting only glue the ring with a few dots of glue.

Note
Once out of the transport/stock mode the battery lifetime starts to count.

13.6 REPLACEMENT

When the battery life of the SENSIT Surface Mount fails after specified lifetime, we advise to replace the core. The core part of the SENSIT Surface Mount is fully sealed and for outdoor use, therefore batteries cannot be replaced.

SENSIT Surface Mount replacement procedure		
Step 1: Remove core	The mounting ring can remain positioned in the parking space. The core can be unscrewed using a TORX screwdriver. Unscrew the core by opening the 4 screws in the core part of the SENSIT Surface Mount using a T20 size bit screwdriver. Twist the core to lift up.	
Step 2: Replace core	Place a new core into the mounting ring by aligning the marks on the core part with the marks on mounting ring as indicated in figure 9. Strongly push down the core and secure with 4 screws. Write down the correct ID numbers of the replaced core on your installation plan.	
Step 3: Activating (Segmentation) Calibration	Activate the sensor, perform segmentation when needed and calibrate. Do this according the procedures for with or without the Configuration Tool as described in the previous chapter.	
Step 4: Update SIS	Ensure to note the node ID number of the SENSIT Surface Mount to the parking bay and update the parking bay configuration list in the SENSIT Interface Software (SIS), see chapter 17.7.2	

Note
Once out of the transport/stock mode the battery lifetime starts to count.

Note
Also ensure not metal parts (such as tools) aren't positioned in the surrounding of the sensors as this might affect calibration.

14 MOUNTING THE SENSIT EPL

The SENSIT EPL is designed for installations at the windscreen of a vehicle.

14.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair.

- The SENSIT EPL may only be installed and serviced by qualified service personnel.
- To be sure of safety, do not modify or add anything to the SENSIT EPL other than mentioned in this manual or indicated by NEDAP N.V.

14.2 IC AND FCC ID

FCC ID: CGDSENSITEPL and IC: 1444A-SENSITEPL

14.3 DIMENSIONS

The SENSIT EPL can easily be mounted on the inside of a vehicle. Clean the inside surface of the windshield and make sure it free of grease and dirt. Than attaches, the SENSIT EPL with the suction cups to the windscreen. See Figure 37 for the dimensions of the unit, dimensions in mm. The bottom of the SENSIT EPL is laser engraved with the node ID number.

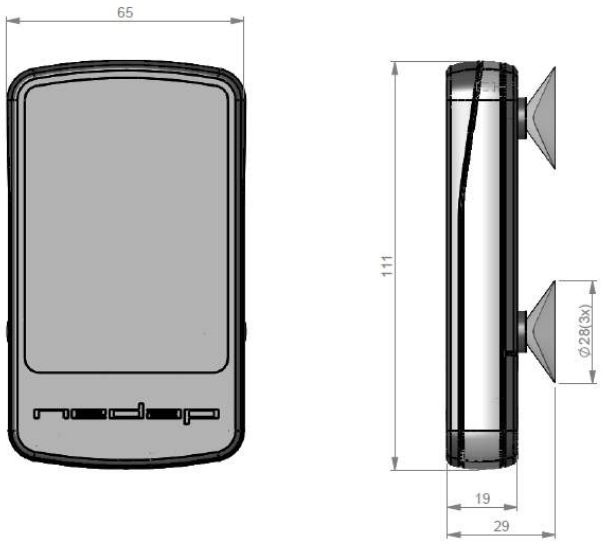


Figure 37: Dimensions SENSIT EPL (mm).

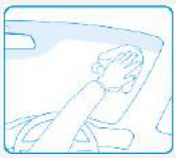
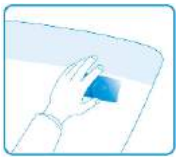
14.4 REQUIRED INSTALLATION MATERIALS

The following would be required for mounting of the SENSIT EPL.

- Equipment: Soft lint free cloth
- Cleaner material: Isopropyl alcohol

14.5 INSTALLATION PROCESS

Follow the recommended installation procedure for the SENSIT EPL as described below.

SENSIT Surface Mount mounting procedure		
Step 1: Preparation	Write down the unique ID-number of the SENSIT EPL and insert the AAA alkaline batteries.	
Step 2: Cleaning	Clean the windscreen at the location you like to install the SENSIT EPL.	
Step 3: Mounting	Attach the SENSIT EPL with the suction cups to the windscreen.	
Step4: Registration	Register the SENSIT EPL in the SIS by filling in the permit details and the by Step1 written unique ID-number, this explained in more details in chapter 17.5.1.	

14.6 SYSTEM SETUP FOR EPL

To get the best performance of detecting EPL's in a SENSIT installation with different segments the next steps have to be performed and checked.

1. The SIS needs accurate GPS coordinates of all system components; DC, RN and SENSIT Sensors. The GPS coordinates can be uploaded into the SIS via the Parking bay configuration menu see chapter 17.7.2.
2. All active system components (DC and RN) needs at least firmware version 2D.
3. The EPL needs at least firmware version 2D.
4. Segmentation announcement has to be enabled for all active system components (DC and RN). Segmentation announcement can be enabled via REST.

15 MOUNTING THE SENSIT DISPLAY

The SENSIT Display enables signage of available parking spaces for stand-alone parking guidance installations. The display is designed for outdoor use, indicating the number of available parking spaces per parking lot thus guiding motorists to the closest parking space.

The display has adequate mechanical protection to withstand demanding environmental conditions and automatic regulation of LED luminance to optimally adept to surrounding conditions.

15.1 SAFETY PRECAUTIONS

The following safety precautions should be observed during normal use, service and repair:

- The SENSIT Display may only be installed and serviced by qualified service personnel.
- Disconnect the power supply before removing or installing any parts.
- To be sure of safety, do not modify or add anything to the SENSIT Display other than mentioned in this manual or indicated by NEDAP N.V.

Note
Make sure the ambient light sensor isn't covered.

15.2 DIMENSIONS

In general the SENSIT Display is mounted inside a sign to be part of a (small) dynamic guidance system. The only requirements are an AC mains power supply and an Ethernet connection it is also possible to power the display over a PoE+ connection. The ambient light sensor for the automatic regulation of the LED luminance is located just above the LED's in the center of the sign. The mounting dimension can be found below.

Note
6x M5x15mm stainless steel bolts are included

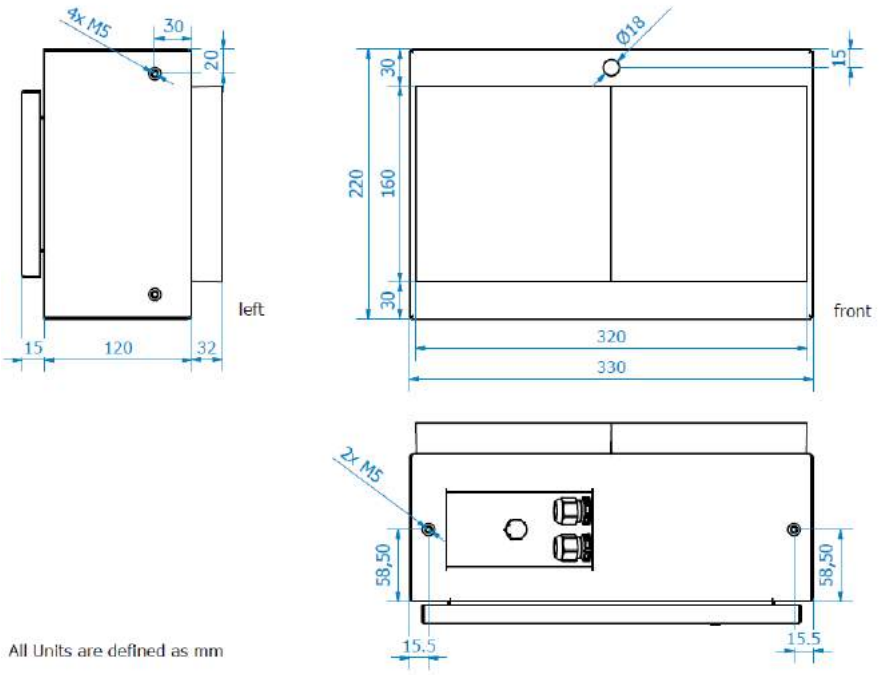


Figure 38: Dimensions SENSIT DISPLAY (mm).

16 PROJECT SUPPORT

Based on our thorough project analysis including configuration and installation advice we can offer the customer the best AVI solution.

16.1 SITE SURVEY & INSTALLATION ADVICE

This will consist of an engineer visiting the site to visually inspect and analyze the location. We will then carry out calculations and provide you with detailed configuration and installation advice for the equipment for a specific project.

16.2 ON-SITE CERTIFICATION

An engineer will visit the site to inspect the installation of the equipment on reliable and accurate detection. Nedap engineers are not involved in installation (wiring) of any equipment. The installation must be completed before the engineer arrives on-site. We will ensure that the operation confirms our commissioning requirements, only on condition of prior given installation advice.

17 SENSIT INTERFACE SOFTWARE

17.1 INTRODUCTION

The SENSIT Interface Software (SIS) enables easy system integration into an enforcement, traffic guidance or parking guidance management application.

The SENSIT Interface Software enables easy installation of the wireless sensor network. Once the network and sensors are installed and calibrated, the sensors will automatically appear in the software. Configuration of sensors to specific parking bays, parking zones and parking lot can easily be realized.

Additionally the software configures and monitors communication of the SENSIT node network. It monitors the data transfer between the sensors and the SENSIT Gateways. Moreover it also analyzes communication reliability of the sensor network in a graphical map, automatically alerting areas for maintenance.

The SENSIT Interface Software is installed on a hosted server, so no IT infrastructure is required at the client. The software application can be approached with any modern web browser that supports Java can connect to the software application.

Each sensor site has a site specific URL indicated in the following way;
https://sitename.nedapparking.com

17.2 USERS

Start the web browser and enter the SENSIT Server hostname. A login screen will appear.

Please view the document outlining the SENSIT Gateway configuration settings for the details on the URL, login and password for your site. This information is required to obtain access.

17.2.1 LOGIN

The login screen provides access to the software. Enter username and password.

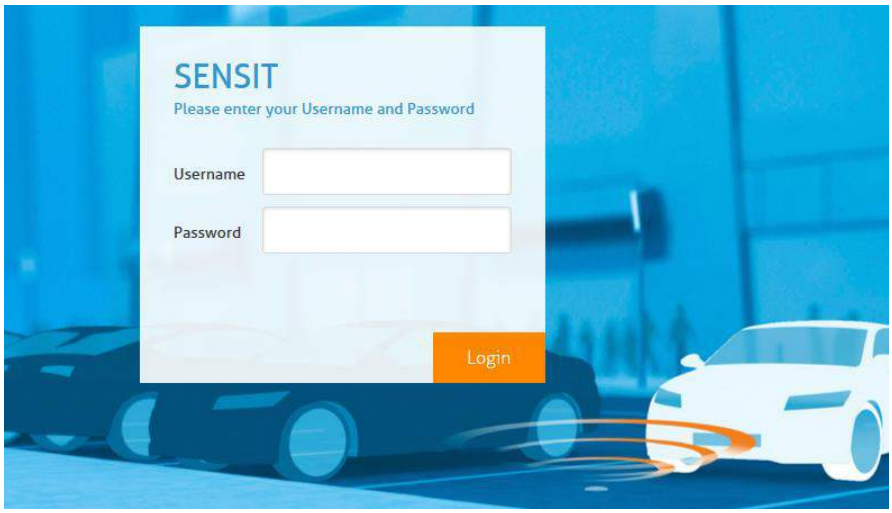


Figure 39: Login screen

17.2.2 DEFAULT LOGINS

User: sensit
The SENSIT user has reduced functionality in the software. Only a subset of these options is available via the user login. Basically this login is available to check the status of the system. It does not allow changing the configuration or any other settings.

User: parkingapp
This login has reduced functionality in the software and is used for the Nedap parking app.

User: integrator
This user has reduced functionality in the software, used for third party integration via REST or SOAP.

User: sensitadv
This user has advanced functions and configuration possibilities.

The initial username and password are provided to you by Nedap.

17.2.3 LOGOUT

Click 'Logout' when you want to close the application.

17.3 SUPPORT WIDGET

The Web Widget enables you to answer your questions without leaving the SIS webpage. You can get quick access to and search for knowledge base articles or send a question to our support. .

The support button appears in the top corner of every SIS page, just beside the logout button. When you click the Support button a search window appears in the bottom right corner, here you can type your search phrase, see figure below.

Note
The Support Widget is only available at Nedap hosted SIS installation.

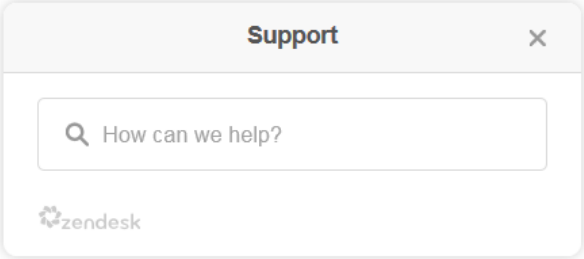


Figure 40: Support knowledge base search

When this knowledge base doesn't answer your question you can easily contact the helpdesk by filling in a contact form to submit a ticket, see figure below. After sending the question you will receive a confirmation by email with a new ticket number.

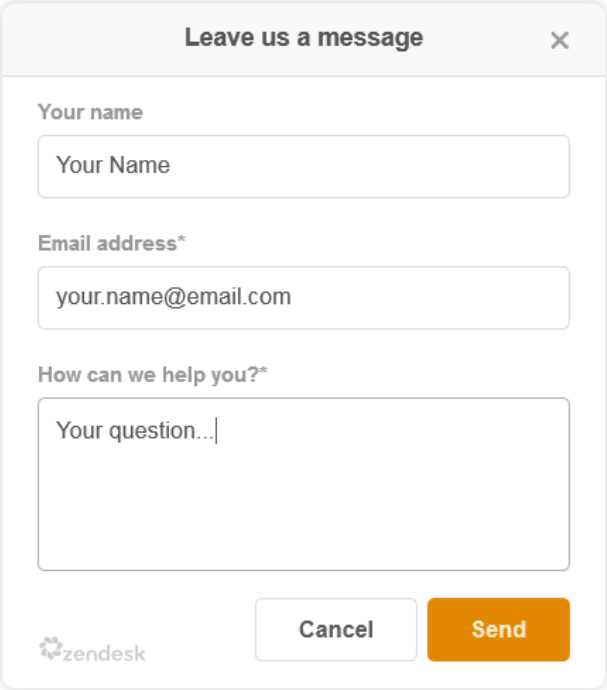


Figure 41: Contact form

17.4 DASHBOARD

The Dashboard is designed to give the user an overview on how the SENSIT system is performing. The Dashboard page contains several Widgets. A Widget summarizes and displays the actual state of SENSIT system.

Note
Configuration is only available under sensitadv login.

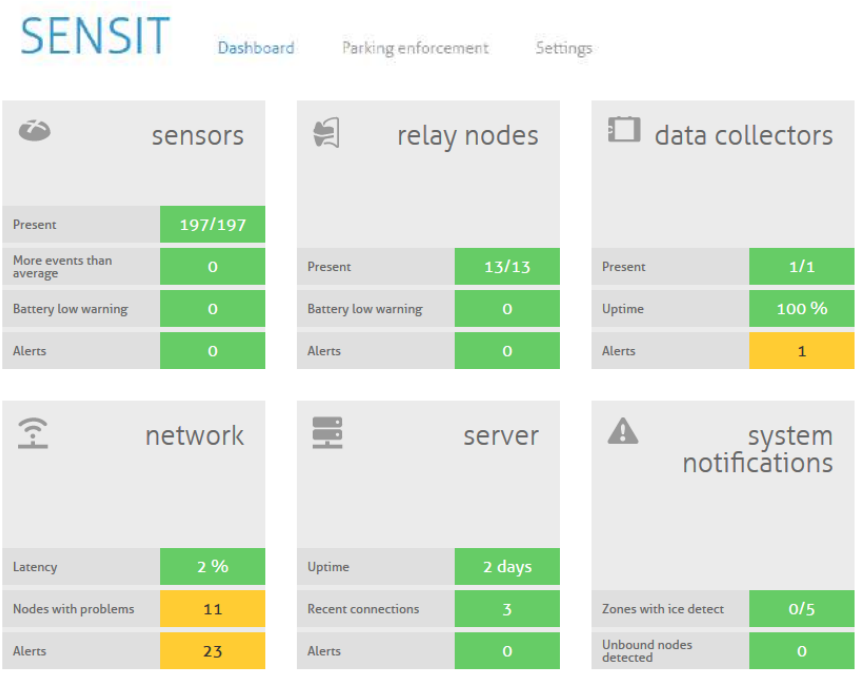


Figure 42: Dashboard screen

The Dashboard contains six main Widget categories: SENSIT sensor, Relay Nodes, Gateways, The wireless Network, the Server and system notifications.
The functions of the Dashboard are self-explaining by hover over pop-ups and help balloons when needed. Every widget can be configured via the configuration symbol at the right corner of every widget, see figure below. The configuration symbol will automatically show if you move your mouse to the specific widget. In this screen you can change the different widget settings.

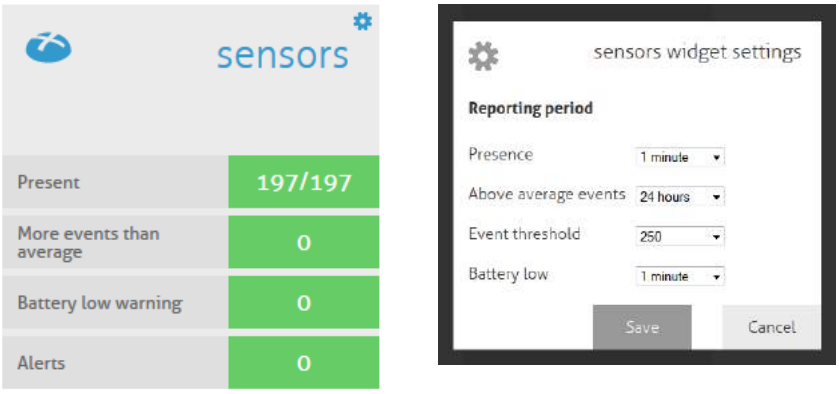


Figure 43: Configuration symbol and widget settings screen

17.5 PARKING ENFORCEMENT

The Parking enforcement is a secondary dashboard, designed to give the user an overview on all parking enforcement related information. This parking enforcement dashboard summarizes and displays the actual status of a specific parking zone.

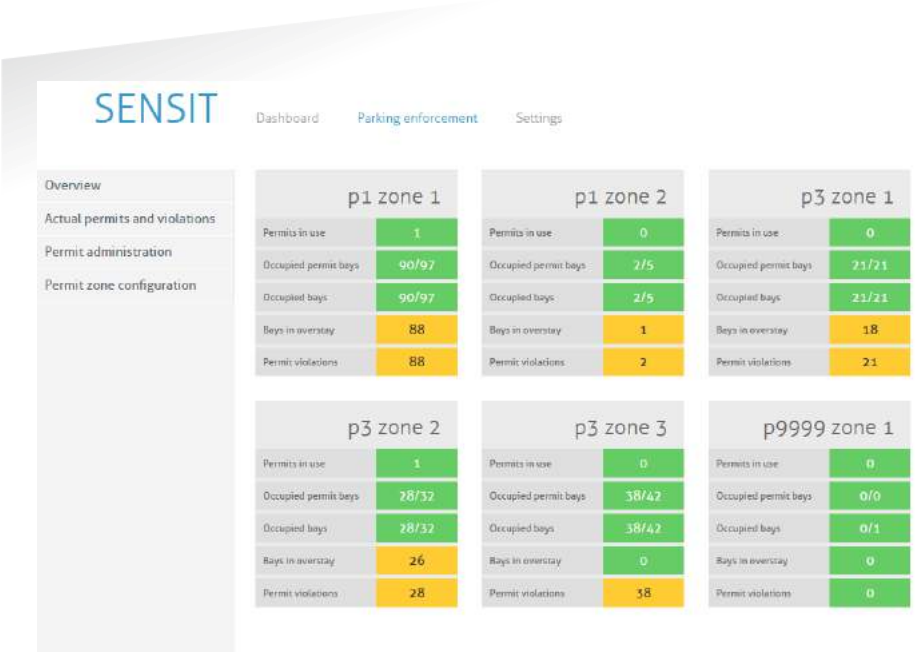


Figure 44: Parking enforcement dashboard screen

Different enforcement information of all parking zones are displayed: Permits in use, Occupied permit bays, Occupied bays, Bays in overstay and the Permit violations.

The Electronic Parking License (EPL) is a hardware device that is physically placed inside a vehicle or it is an App that is running on a smartphone. Whenever the vehicle with EPL hardware stops moving for a specific period of time, the EPL considers the vehicle to be parked. In that case, the EPL hardware will search for a SENSIT wireless network. If a network is detected, the EPL will make itself known to the network. As a result the unique EPL identifier is registered within the SENSIT Server system. The user of the EPL App is doing the same, it activates the parking action with it smartphone.

When a parking bay that requires a license, becomes occupied, the SENSIT system is notified. The system will calculate the odds of the parking bay being occupied by an unauthorized vehicle.

Note
An EPL is only valid for a selected (blue highlighted) Permit zone.

17.5.1 PERMIT ADMINISTRATION

In these screens all permit administration is performed. A permit is issued to a person and it can be a hardware EPL or an EPL App installed on a smart phone.

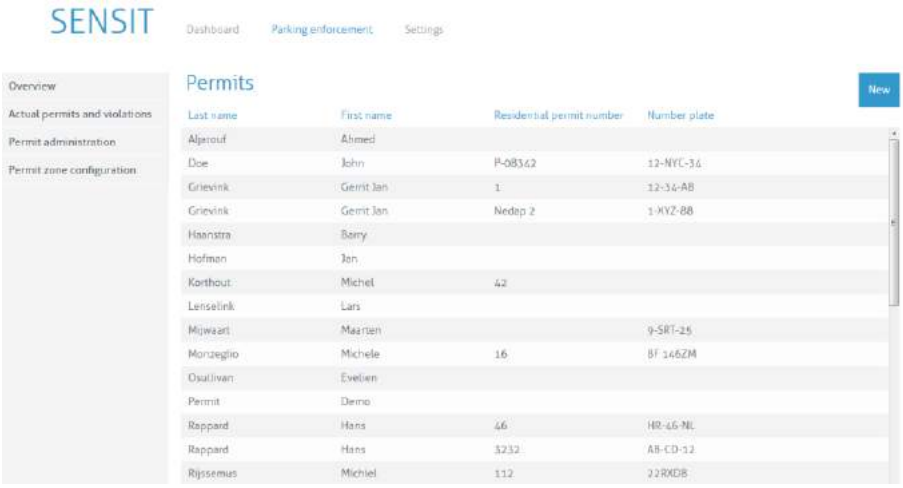


Figure 45: Permit administration screen

New permits can be added and existing permits can be edited or removed. A Residential permit number can be enter, name, license plate number and the EPL node ID in case of a issued hardware EPL. The permit can be disable and an expiration date can be used, an empty expiration date means valid forever. Than one or multiple parking zones can be selected where the permit is valid. Zone creation is explained in the next paragraph.

Figure 46: Edit permit screen

After creating a new permit, by filling in all needed details, a QR-code is automatically generated. The EPL App needs this QR-code. The QR-code contains the URL of the SIS where the permit is created and a unique identifier.

17.5.2 PERMIT ZONE CONFIGURATION

In these screens all permit zone configuration is performed. A permit zone is a selection of one or multiple parking bays. A list of all available, already entered, zones are displayed in the screen below.

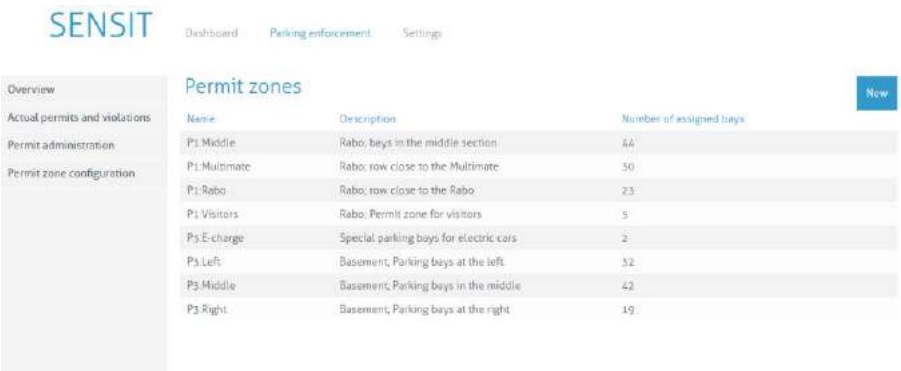


Figure 47: Permit zone configuration screen

New permit zones can be added and existing permits zones can be edited or removed. A permit zone name and description can be entered and the bays can be assigned in the selection screen.

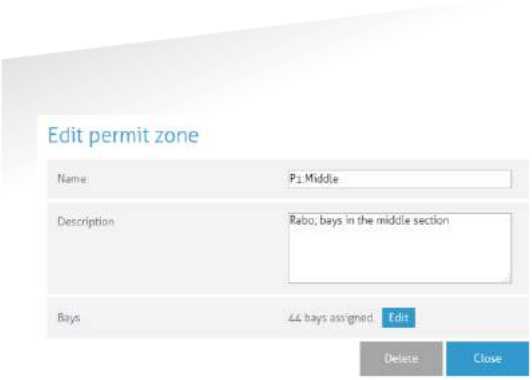


Figure 48: Add/Edit a permit zone screen

A permit zone can be a parking lot(s), a parking zone(s), one or a selection of bays. This can easily be selected in the screen below.

Figure 49: Permit zone bays assignment screen

17.6 DETECTION

17.6.1 SENSIT GATEWAY

In the SENSIT Gateway menu you can configure communication gateway settings between the SENSIT Gateways and the SENSIT Server. Furthermore the screen provides an overview of the current SENSIT Gateway settings. The list of SENSIT Gateways is automatically updated.

Gateway server setting

Select 'enabled' to enable the connection from SENSIT Gateway to the server. Enter the TCP port (or SSL port), to accept connections from the SENSIT Gateway(s). For a remote hosted SENSIT Server, the port number should not be changed. Because the port numbers are assigned by the Nedap system administrator.

SENSIT Gateway connection settings

In this menu you can set 'Host name' and communication 'Port' for the SENSIT Gateway. The SENSIT Gateway is displayed as a node, see below. The hostname of the SENSIT Gateway can normally be found on the housing. The SENSIT Server will try to establish a connection with the specified SENSIT Gateway. This does not work on remote hosted SENSIT Servers. See gateway server settings above.

The screen provides an overview of the current SENSIT Gateway settings. When entering new SENSIT Gateways, the table is automatically updated.

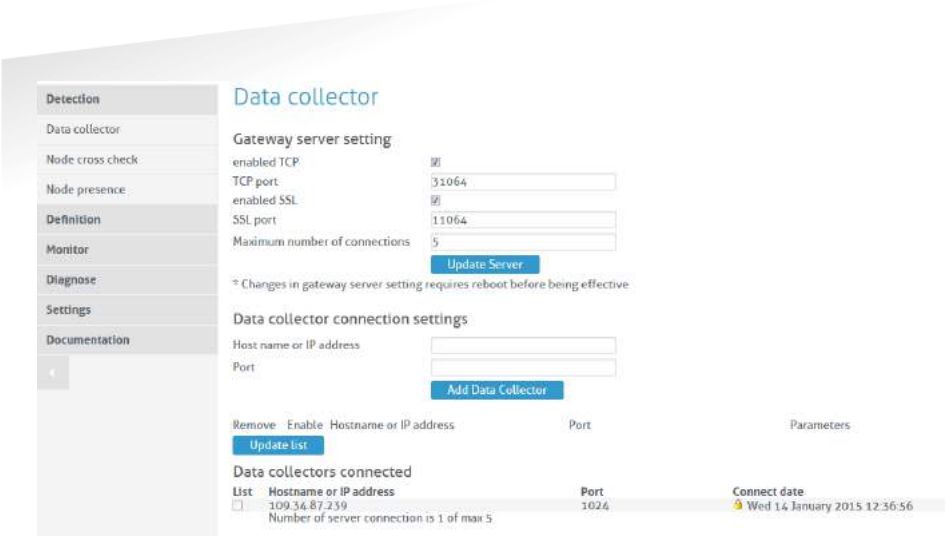


Figure 50: SENSIT Gateway server settings

17.6.2 NODE CROSS CHECK

The menu option 'Node cross check' displays all nodes currently visible in the system that are not allocated to a parking bay. These could be new or replaced SENSITs, but also the Relay Nodes and SENSIT Gateways are shown here. Moreover this screen also displays parking bays without a node (if this information is entered via the parking bay configuration).

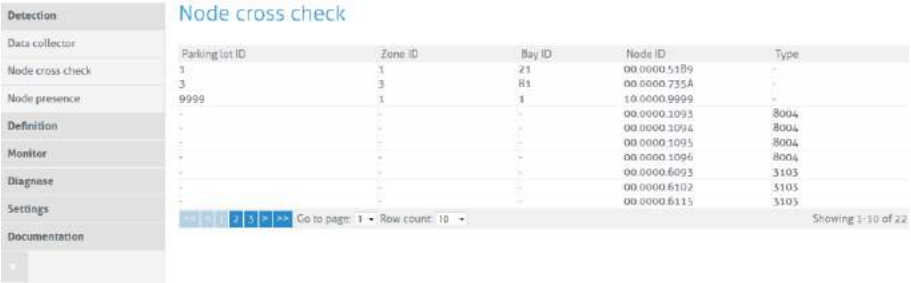


Figure 51: Node cross check

17.6.3 NODE PRESENCE

This screen will display information on the last received message from each node present in the network. It will outline the Node ID, type number, version and the timestamp of the last received message.

Node presence check (min)

If a node does not respond within a certain time period after transmission of the last message, the SENSIT Server will check if the node is still available. In this menu option you can select the time after receiving the last message (in minutes) when to send the Node presence check.

Node presence check retry

The 'Node presence check retry' specifies the number of times the SENSIT Server shall try to connect to the node.

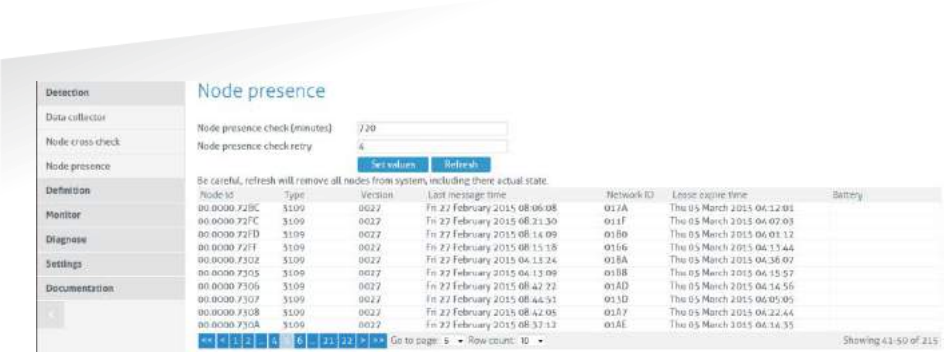


Figure 52: Node presence

In the screenshot above several nodes are listed in the node cross check.
For example node id 00.0000.72BC is a SENSIT IR (type 3109). Every different type of node has its own Type code, see below the general use types:

000c	Data Collector
0017	SENSIT Gateway
0018	Relay Node 2G
3003	Relay Node 1G
3109	SENSIT Flush Mount or SENSIT IR
310D	SENSIT Flush Mount or SENSIT IR
310E	Electronic Parking License (EPL)
8004	WSN Display

17.7 DEFINITION

17.7.1 RELAY NODE CONFIGURATION

You can click the Refresh button and verify if the Relay Node ID appears in the Current Relay Nodes list.

Figure 53: Relay Node configuration screen

The Relay Node ID is laser engraved on the Relay Node. There is also a 125kHz passive RFID label embedded into the Relay Node. This can be used for verification of the Relay Node or to localize Relay Nodes that are already installed in the field.

17.7.2 PARKING BAY CONFIGURATION

In the menu 'Parking bay configuration' SENSITs are allocated by their Node ID to individual parking bays.

The data is imported into the system via a csv-file (comma separated values). The following information should be entered into the csv-file separated by a comma (' , '). Note that the combination of parking lot-id and bay-number must be unique.

Column 1	Parking lot ID (number indicating the parking lot).
Column 2	Zone ID (number indicating zone on the parking lot the bay is

	located in) Zone ID is also used to identify Relay Node (RN) or Gateway/DataCollector (DC).
Column 3	Bay number (number indicating individual parking bay). Bay number is also used to number a Relay Node or Data Collector
Column 4	Node ID. (SENSIT, Relay Node or Gateway/DataCollector)
Column 5	GPS, Latitude (optional, decimal degrees with max. 6 decimals).
Column 6	GPS, Longitude (optional, decimal degrees with max. 6 decimals).
Column 7	GPS, Altitude (optional, decimal degrees with max. 6 decimals).

Note
Ensure that the filename and file path do not include any spaces.

```
1,DC,1,00.0000.7608
1,RN,1,00.0000.C4C5
1,RN,2,00.0000.C4C2
1,1,1,00.0000.601C,52.037617,6.623928
1,1,2,00.0000.8664,52.037613,6.623889
1,1,3,00.0000.60CC,52.037613,6.623853
1,1,4,00.0000.8662,52.03761,6.623819
1,1,5,00.0000.C02E,52.037605,6.623785
1,1,6,00.0000.8663,52.037605,6.623748
```

Figure 54: Example parking bay configuration csv-file

Select the csv-file by clicking the 'Browse'-button, then click 'Import' to import the selected file.

When the csv-file is imported, the screen will display the information. At each given moment you can verify in this table the allocated SENSIT / Parking bay bindings. Refer to the node cross check display to verify if all SENSIT are assigned to a parking bay (see chapter 17.6.2). It is possible to incrementally expand the Parking bay configuration list by importing only additional allocation information (Parking lot ID, Zone ID, bay/place number and Node ID) via a new csv-file.

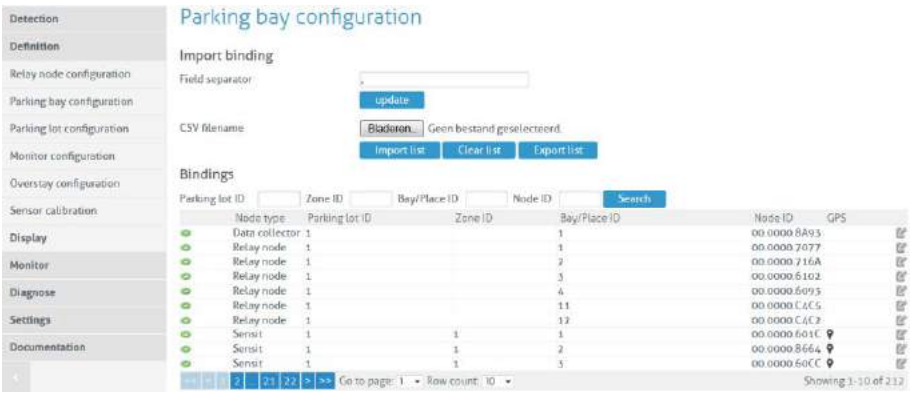


Figure 55: Parking bay configuration

Click the small green checkbox icon to (temporarily) inform the system that the parking bay is unavailable. Click the small pencil at the end of a row, an Update Node ID screen shows up, here you can change the Node ID number and the GPS coordinates. This can be used to replace a SENSIT or to correct a mistake.

Note
The order of parkinglotid in the Monitor configuration screen determines the order of TABs in the Monitor map screen.

Figure 56: Update Node ID

17.7.3 PARKING LOT CONFIGURATION

The parking state logging feature periodically saves occupancy status in the database. This feature must be enabled for the occupancy chart feature described in chapter 17.9.2.

Enable the 'parking lot state logging on' checkbox to start logging occupancy status of the parking lot in the database. The parking lot state logging interval setting selects the logging period in minutes. By default this is set to 60 minutes.

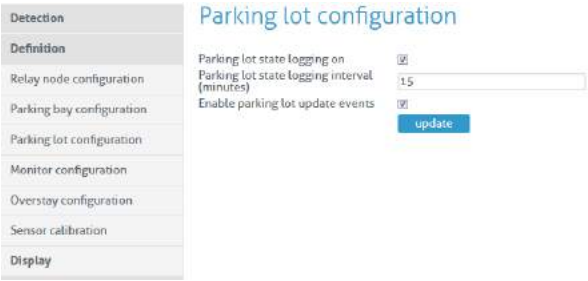


Figure 57: Parking lot configuration

17.7.4 MONITOR CONFIGURATION

Site Name

Fill in here the site name.

Monitor Color Mapping

Configure here the color mapping for the actual monitor status (free, occupied, overstay, and disabled).The selected colors are used in the monitor screen.

Map List

Here you can load the parking lot graphic file (SVG-format) into the system and assign it to a parking lot. The SVG-file can be created with Inkscape (http://inkscape.org). Nedap has an extension available for Inkscape that should be used to define where the parking bays are located on the map. See the advanced section, chapter 18.1 for more explanation and the workflow about the Inkscape program.

When the SVG-file is created, enter the ParkinglotID and the title. Then select the svg-file by clicking the 'Browse'-button and click Upload' to upload the selected file into the system.

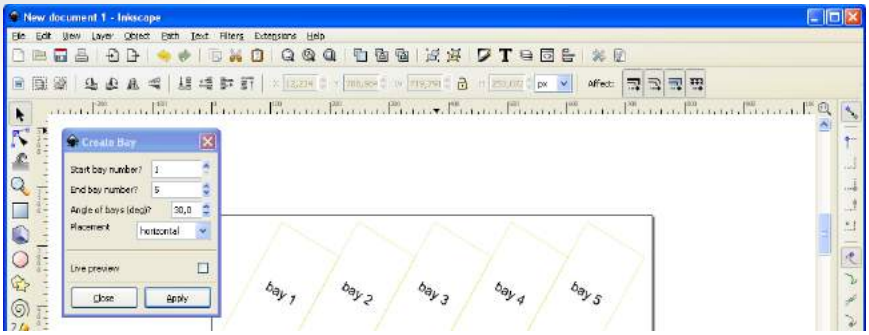


Figure 58: Inkscape

17.7.5 OVERSTAY CONFIGURATION

The SENSIT Server can be used for overstay applications, specifically where there is a need for a maximum time limit for free parking. The menu 'Overstay configuration' allows you to set several overstay parameters.

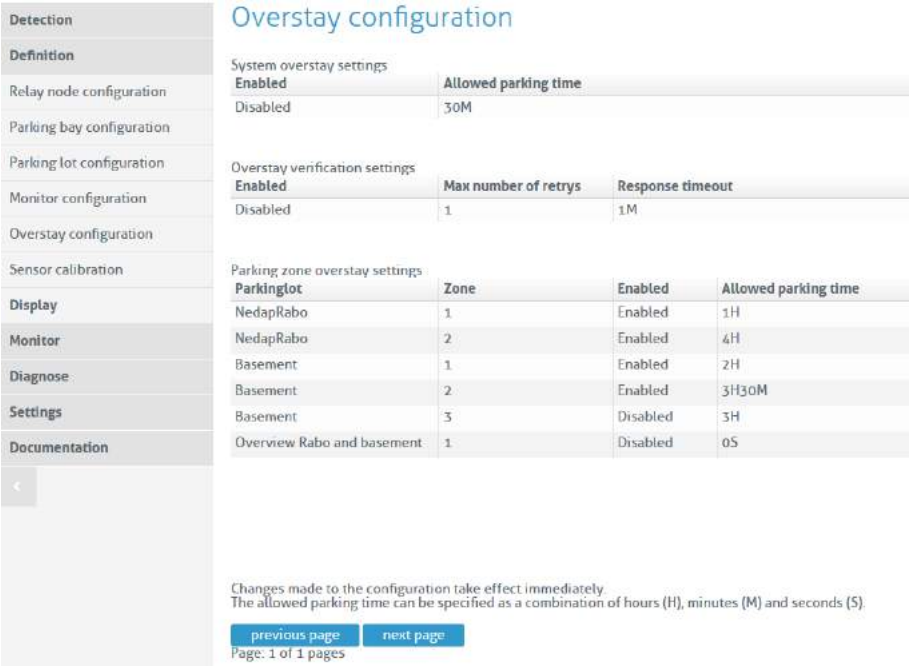


Figure 59: Overstay configuration

System overstay settings

With this option the global overstay function can be enabled. The settable Allowed parking time is the overstay time for all SENSIT sensors defined at the SENSIT Interface Server. This setting determines how long a parking bay should be occupied before an overstay situation occurs.

Overstay verification settings

When enabled, the SENSIT Interface Server will ask the SENSIT sensor if all state events are received in case of an overstay. The last state event message is transmitted again to the SENSIT Server to verify the overstay.
The Max number of retries (max value is 5) can be set. If an overstay verification fail it retry to receive the last state event message. If the final overstay verify attempts fail an unverified overstay event is generated.

17.7.6 SENSOR CALIBRATION

To ensure reliable operation of the system the SENSIT sensors should be calibrated before commissioning. Calibration values can be set for the magnetic detection in each axis (x, y and z). Default calibration values are 50 mGauss in each axis. The default value for the IR sensitivity is 9, the maximum. The IR sensitivity is only lowered in case of a ceiling or other coverage of the SENSIT sensors.

Note
The SENSIT nodes can only be calibrated when the specific bay and neighboring bays are not occupied by vehicle. When all SENSIT nodes need to be calibrated the parking lot must be completely empty.

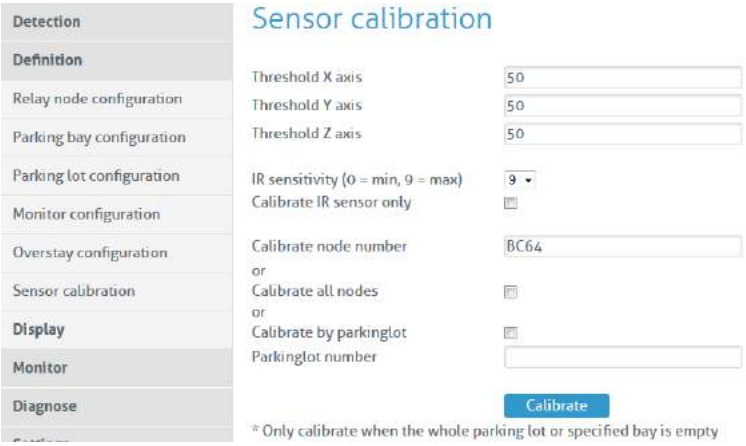


Figure 60: SENSIT sensor calibration

SENSIT nodes can be calibrated individually. This by entering the Node ID of the specific sensor you want to calibrate into the field 'Calibrate node number'.

Alternatively you can calibrate all nodes or the nodes from a specific parking lot. When you click 'Calibrate all nodes' all SENSIT sensors in the network will automatically be calibrated.
Click the 'Calibrate' button to start the calibration. In the menu an update message will start to keep you update on progress.

Incorrect occupied spaces can be indicated if a vehicle parked in the neighboring parking space activates the magnetic sensor. If the percentage of incorrect occupied (so actually free) is too high over the parking lot, the magnetic values can be adjusted by selecting a higher value e.g. 60 mGauss. If the percentage of incorrect free (actually occupied) spaces is too high the sensitivity of the magnetic threshold can be reduced to lower value e.g. 40 mGauss.

17.7.7 DISPLAY

Display Configuration

The 'Display configuration' screen allows you to control a display via the node network. This without any physical communication wiring. Only a power supply is required. The communication with a display is realized via a display node. Note that this functionality is only available for specific displays. Contact Nedap for more information. The display node is part of the network and can therefore communicate wirelessly via the node network. A maximum number of 2 displays can be controlled in a wireless mesh network of 500 sensors. Use of more displays will increase the communication latency.

The update of a Display can be enabled and the update interval can be set. A choice can be made either to subtract the full threshold from the display value on forehand or to set the display at zero when the threshold value is reached.

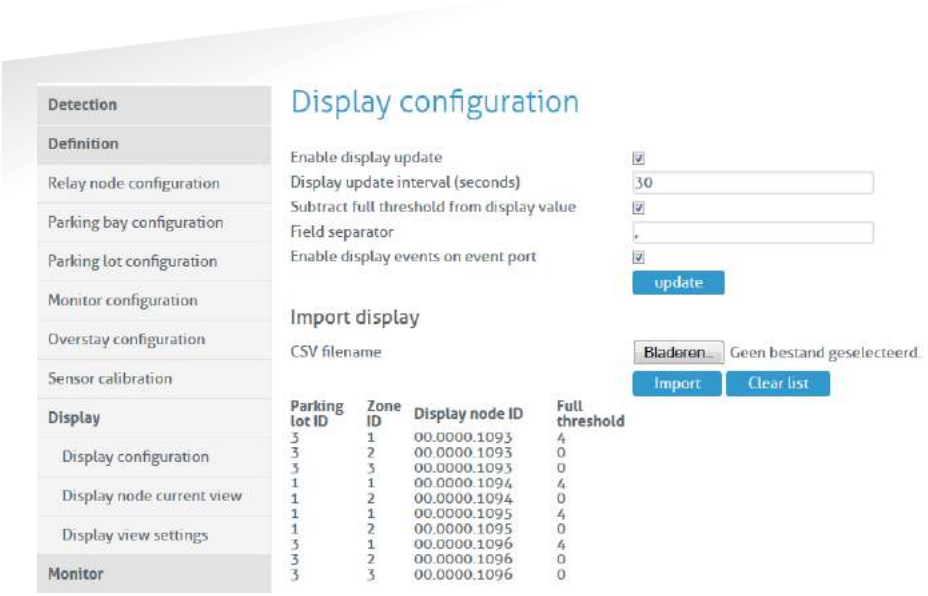


Figure 61: Display configuration

The display will show the total number of available spaces on all the parking zones and parking lots it has been assigned to. In case you want to display information on individual zones, we advise you to allocate one display node to each parking zone.

The display configuration information is imported into the system via a csv-file (comma separated values). The following information should be entered into the csv-file separated by a comma (' , ').

- Column 1 Parking lot ID.
- Column 2 Zone ID.
- Column 3 Display node ID.
- Column 4 Full threshold. When less parking places are available, the display will indicate FULL.

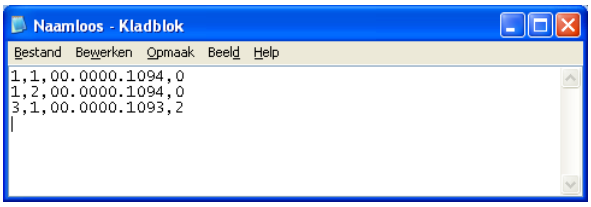


Figure 62: Example display configuration csv-file

Select the csv-file by clicking the 'Browse'-button, then click 'Import' to import the selected file.

Display Current View

The display current view shows the actual display information per display node.

Display View Settings

The display view settings allow configuring the weekdays and time periods during which the display information should be updated. This can be used for example in cases where the display should be off during nighttime.

17.8 MONITOR

17.9 OCCUPANCY REPORT

The occupancy report displays the actual number of occupied bays in a parking lot.

Figure 63: Occupancy overview

17.9.1 OCCUPANCY LIST

The occupancy list shows the actual occupancy information per parking bay.

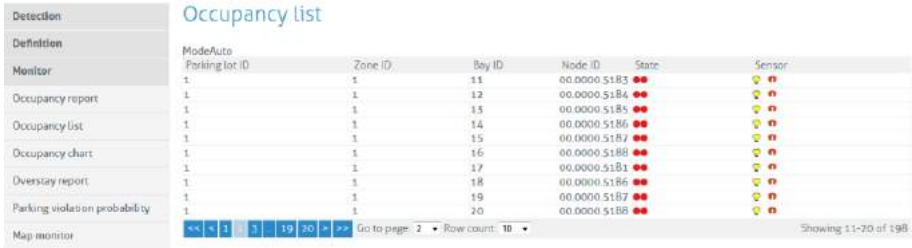


Figure 64: Occupancy list

Please find below a small table, which explains the different symbols:

State	Description
	Occupied
	Free
	Overstay

Sensor	Description
	Optical and Magnetic occupied
	Magnetic occupied
	Optical occupied
	Free

17.9.2 OCCUPANCY CHART

The occupancy chart shows a graphical display of the occupancy status of the parking lot during specified time. By filling in the parking lot ID number and the requested time period. A graphic will be generated displaying the occupancy of the parking lot. The graphic is generated based on history stored in the local database. Please note that the occupancy state logging must be enabled, see chapter 17.7.3.

Figure 65: Occupancy chart

Click and drag in the chart to zoom into more detail.

17.9.3 OVERSTAY REPORT

The overstay report shows all the parking bays that currently are in overstay. Moreover it also visualizes the parking start time for each parking bay.

Figure 66: Overstay report

17.9.4 PARKING VIOLATION PROBABILITY

The parking violations probability overview shows a list of all occupied parking bays that require a license. The calculated violation probability is shown.

Figure 67: Parking violations overview

Third party applications can pick up items from this table using the documented SOAP or REST interface. For more information on specific SOAP commands see the SENSIT Software Integration Developer Guide. The REST API is explained at the left side under Documentation. Violations that exceed a certain violation probability

threshold can trigger enforcement or more generic follow up activity.

17.9.5 MAP MONITOR

The monitor will show the actual parking lot status on an overview map. The SENSIT are placed on the map and their colors indicate the actual status.

Click on Graph - Sensor Draw Mode to show more sensor information details.
Click on Graph – Network Draw Mode to show network details (green=passive, red=active).
Click on Graph – Network Uptime Mode to show network uptime details (green=good, red=not good). Status reading must be enabled, see chapter: Status Reading Interval Settings.

See chapter 17.7.4 how to configure the overview map.

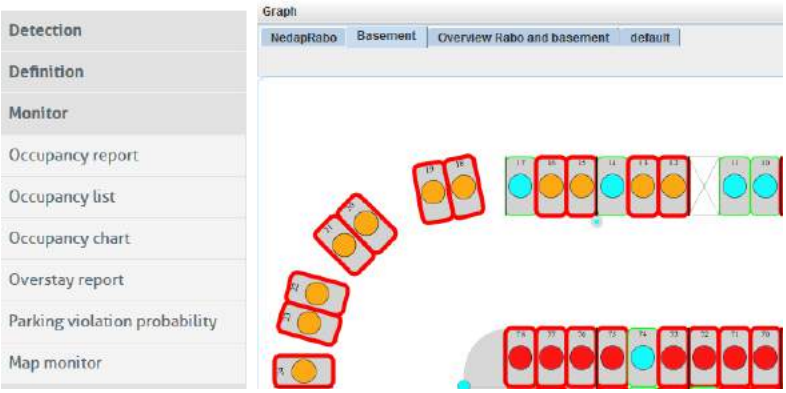


Figure 68: Map Monitor

17.10 DIAGNOSE

17.10.1 ICE DETECT MODE

In this list the automatic global ice detection situation of the system is shown.

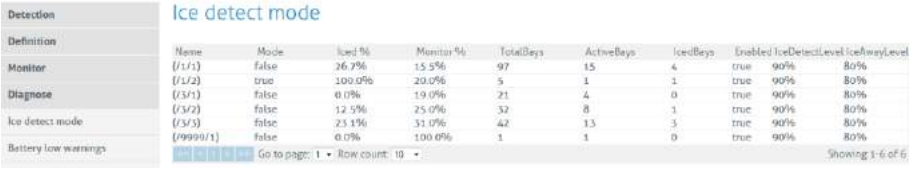


Figure 69: Ice detect mode

17.10.2 BATTERY LOW WARNINGS

In this list all SENSIT with a low battery voltage are mentioned. These warnings show up whenever the battery voltage of a SENSIT drops below the 3 Volt (Alarm level).

Figure 70: Battery low warnings

17.10.3 BATTERY PLOT

This screen gives a graphical overview of the battery voltage of a single SENSIT.

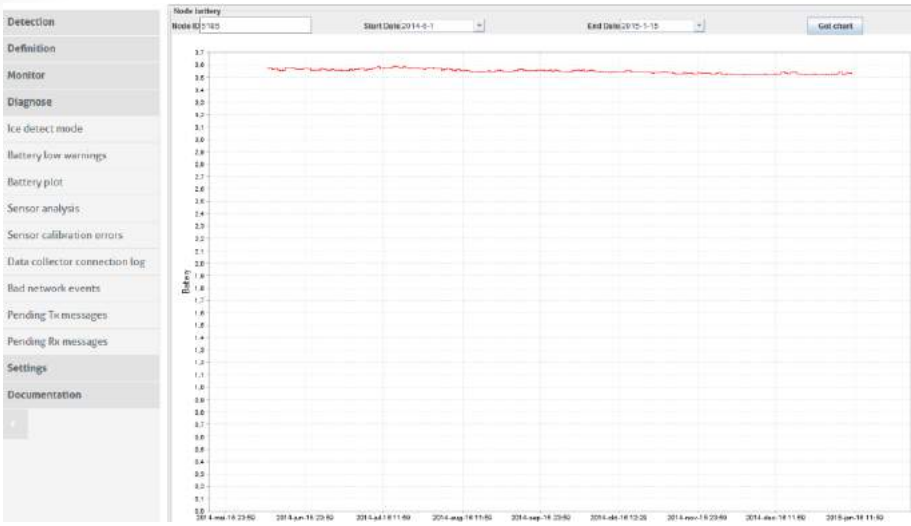


Figure 71: Battery plot

17.10.4 SENSOR ANALYSIS

The sensor analysis is a tool to check the reliable operation of the SENSIT nodes in the system. The Sensor analysis provides information on the functional operation of a specific sensor during a specific time period.

The following information is displayed in the chart.

- X, Y, Z: Magnetic measurement values for X, Y and Z-axis.
- ITP, IRS: Infrared transmitter value (ITP) and infrared receiver (IRS) values (only for SENSIT IR).
- State: Occupancy state (red = magnetic sensor, blue = infrared sensor)

Click and drag in the chart to zoom into more detail.

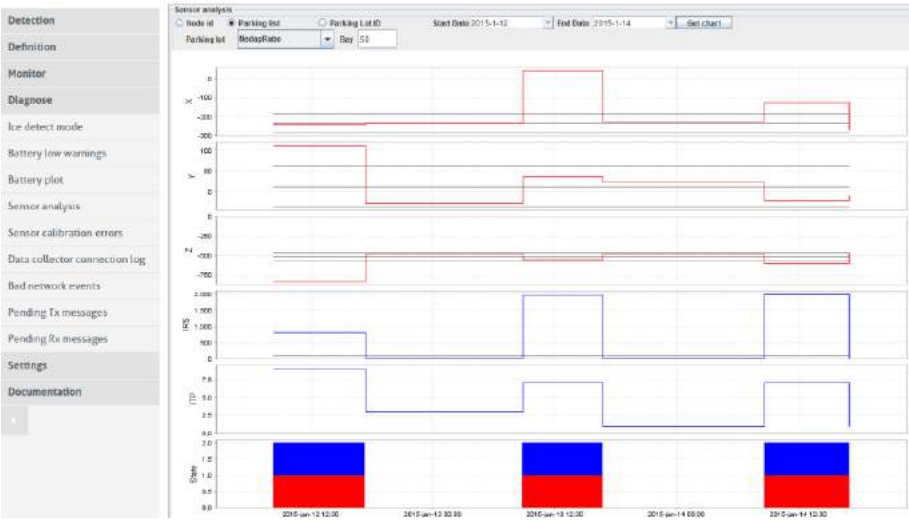


Figure 72: SENSIT sensor analysis

Note
The measurement values are only updated when the SENSIT sensor transmits an event to the server.

17.10.5 SENSOR CALIBRATION ERRORS

This screen indicates the SENSIT nodes that do not transmit any state event messages. For example, an event is created when a vehicle enters the parking bay and a difference in the magnetic field is has been detected. When the difference in

the magnetic field does not result in a state change event, in other words no change in the occupancy, this might indicate that the SENSIT has not properly been calibrated. The screen indicates the number of events received from a specific SENSIT without a state change.

17.10.6 GATEWAY CONNECTION LOG

This screen shows a list of all connects and disconnects of the SENSIT Gateways in the system.

Figure 73: SENSIT sensor analysis

17.10.7 BAD NETWORK EVENTS

This table shows all events that a SENSIT generates, when it detects possible problems in the wireless communication.

Figure 74: Bad network events screen

17.10.8 PENDING TX MESSAGES

This table show all message in the transmit queue.

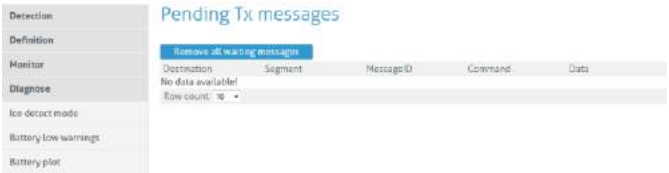


Figure 75: Pending TX messages screen

17.10.9 PENDING RX MESSAGES

This table show all message in the receive queue.

17.11 SETTINGS

17.11.1 USER SETTINGS

Change Password

In this screen the password of the current logged in user can be changed

17.11.2 SYSTEM SETTINGS

System Information

The system information menu offers the user the possibility to download log files and to change system specific settings.

Download log file

This setting is used to provide remote support. The log file contains all the information required for Nedap's engineers to analyze system information.

Download error log file

This setting is used to provide remote support. The log file contains all the information required for Nedap's engineers to analyze system information.

Download properties file

The properties file contains all the system settings. This file can be used for support purposes to verify the system.

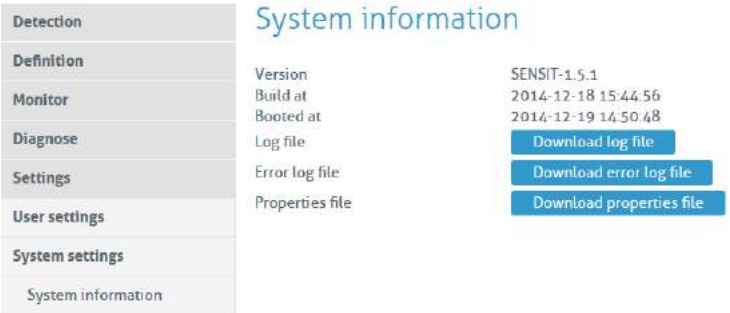


Figure 76: System info

System Reboot

Click the 'Reboot'-button to reboot the SENSIT Server.

Time Configuration

Configure here the time zone settings of the SENSIT Server.

Node Gateway List

Here you can activate if a message for a specific SENSIT is only transmitted via the SENSIT Gateway(s) in the Gateway list. In this way only the involved SENSIT Gateway(s) are transmitting the message into the (local) Wireless SENSIT Network and not too all SENSIT Gateways available in system. If a specific SENSIT doesn't communicate for in this case 24 hours the Gateway list will be clear for this SENSIT and a message for this specific SENSIT will be transmitted via all available SENSIT Gateways.

Figure 77: Node gateway list screen

Local Configuration

Store events in database

Select this option to store events in the database of the SENSIT Server. Normally this option should be selected.

Recover lost messages

The event messages have a sequence number. With this sequence number, the SENSIT Server can determine if messages were lost. When this happens the SENSIT Server can ask the SENSIT to resend these lost messages. Enable the checkbox if this is desired.

Message recovery retry time

Message recovery retry time (in minutes) is the repeat time the system will search for events it has not yet received. The search will be repeated after the set time.

Restore received messages at startup

Select this option if you want to restore events at SENSIT Server startup.

Number of lost messages to recover at startup

You can select the maximum number of messages you want to recover per node (max. 32 messages).

Sensor select mode

This setting selects which sensor determines the occupied state.

Auto	Sensor is automatically selected using intelligent algorithms (Recommended setting).
Magnetic	Only the magnetic sensor is used.
Optical	Only the optical (infrared) sensor is used.
MagneticANDOptical	The parking bay is occupied when both sensor detect the vehicle (magnetic + optical).
MagneticOROptical	The parking bay is occupied when at least 1 of the sensors detect the vehicle.

Calibrate error after .. magnetic events when occupied

The SENSIT Server registers when both sensors of a SENSIT-IR disagree about the occupancy state. In automatic mode, the optical sensor has a higher priority. However when the optical sensor is dirty, this will have a negative result on the accuracy. This setting will generate a Calibration error when the optical sensor remains occupied while the magnetic sensor registered state changes several times. See also chapter 17.10.5.

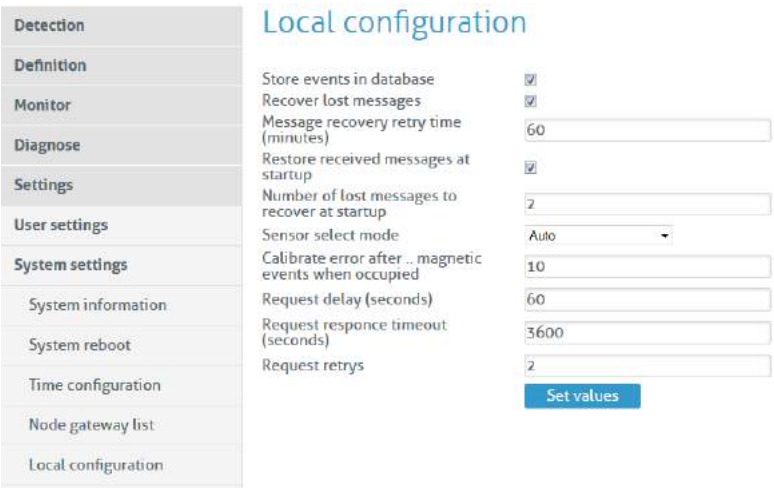


Figure 78: SENSIT local configuration

Active Http Sessions

In this screen you can see all user logged in to the web-server. All active open web sessions are shown.

Status Reading Interval Settings

Enable the status reading to make the SENSIT Server request the network performance statistical counters for every node. Preferably this is done at night when there are relatively few vehicle movements. The status reading can be shown in the monitor, when selecting the Network Uptime Mode. See chapter 17.9.5.

Figure 79: Status reading

17.11.3 EXPERT SETTINGS

Console

The Console menu allows you to directly transmit commands to the SENSIT network. It is not recommended to experiment with the functionalities in this window unless instructed to you by Nedap technical support engineers.

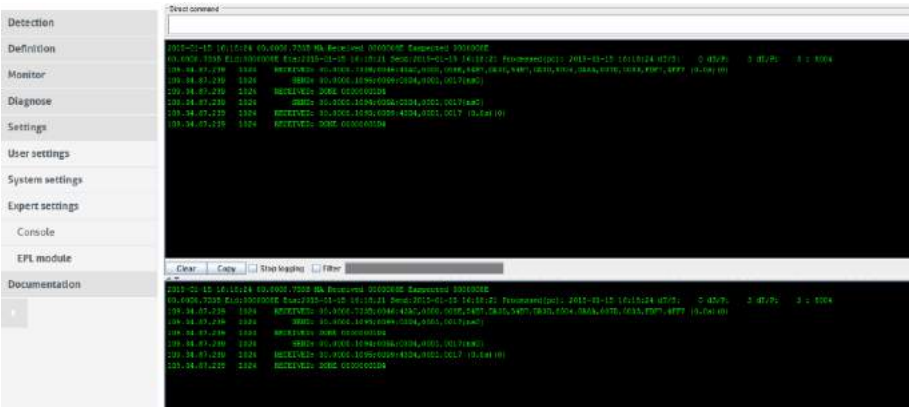
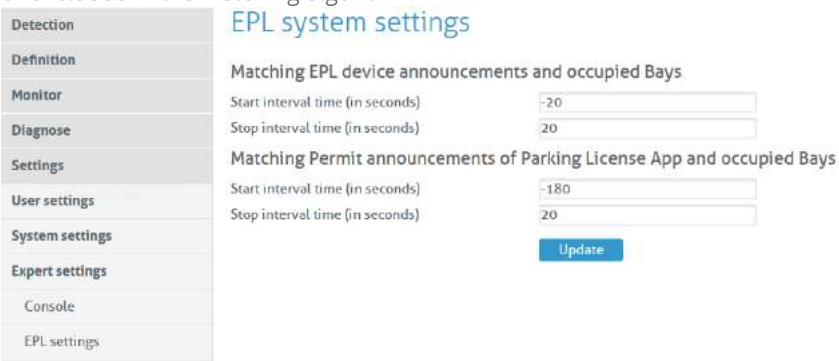


Figure 80: Console

EPL settings

The matching time window is adjustable and can be set differently for the SENSIT EPL and the EPL App. This matching time window specifies the allowed time uncertainty of an EPL or EPL App. Based on this value an EPL or EPL App is included or excluded in the matching algorithm.



EPL old licenses (deprecated)

Via this old EPL licenses menu it is possible to read the previous EPL administration screens. This menu will be removed in the next release. The new major release v1.5.x has a new way of administrating permits; hardware EPL's or EPL Apps. All administration is now group at the Parking enforcement dashboard.

18 ADVANCE CONFIGURATION

18.1 INKSCAPE

The maps for the Monitor map at the SIS must be in a Scalable Vector Graphic image. These SVG-file images can be created with an open-sources program Inkscape (http://inkscape.org). Nedap has an extension available for Inkscape that should be used to define where the parking bays, Relay Nodes and Gateways are located on the map.

After installing Inkscape and the Nedap Inkscape extensions the program can be started. By selecting Extensions -> SENSIT -> Create Bay... bays can be added to the drawing and by selecting Extensions -> SENSIT -> Create Node... nodes (Relay nodes or SENSIT Gateways) can be added to the drawing. See also the figure below.

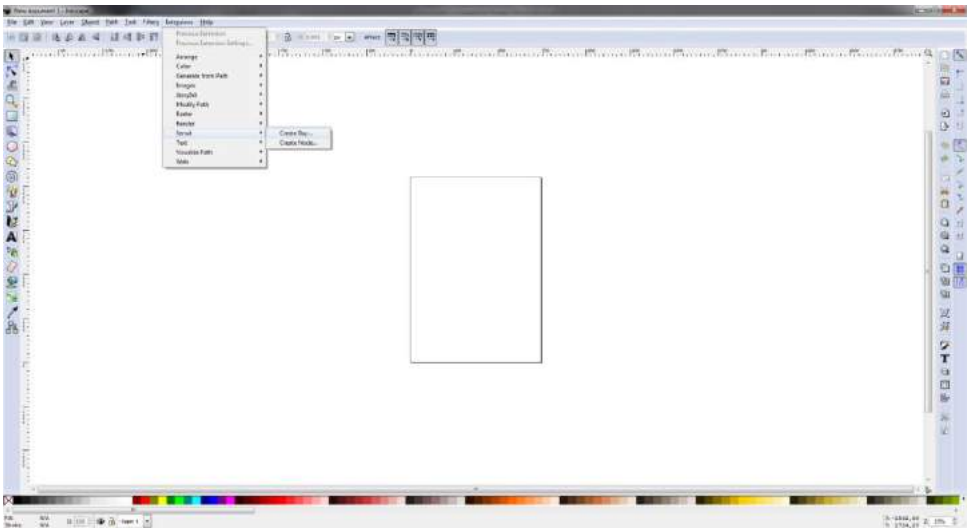


Figure 81: Inkscape SENSIT extensions

After selecting the Create bay... option a pop-up window appears, see Figure 82 below. You can add bays to the drawing. In this way a simple representation of the parking lot can be created. In this example 6 bays (bay number 1 to 6) are created.

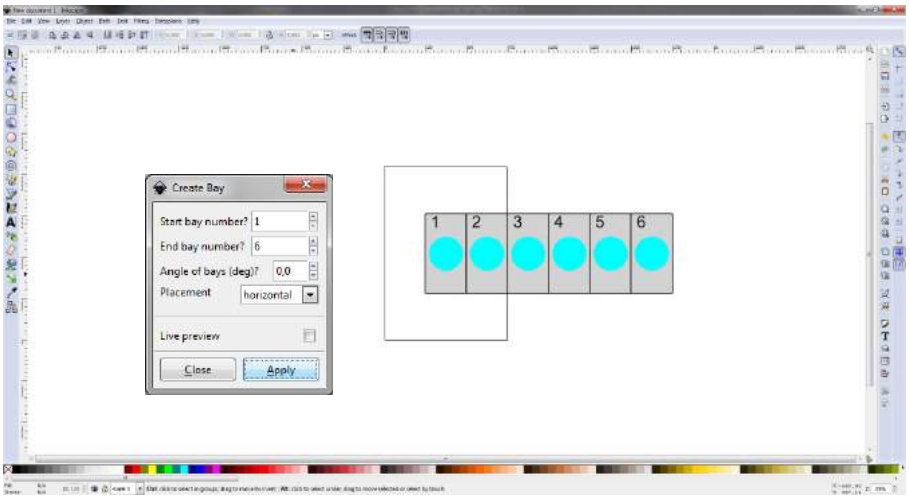


Figure 82: Inkscape, Create Bay

The same for adding Relay Nodes and SENSIT Gateway. By selecting Extensions -> SENSIT -> Create Node... the Create Node pop-up window appears. In the example

below a SENSIT Gateway with ID-number 8AB4 and a Relay Node with ID-number 8A9B is created and place at the right location in the map.

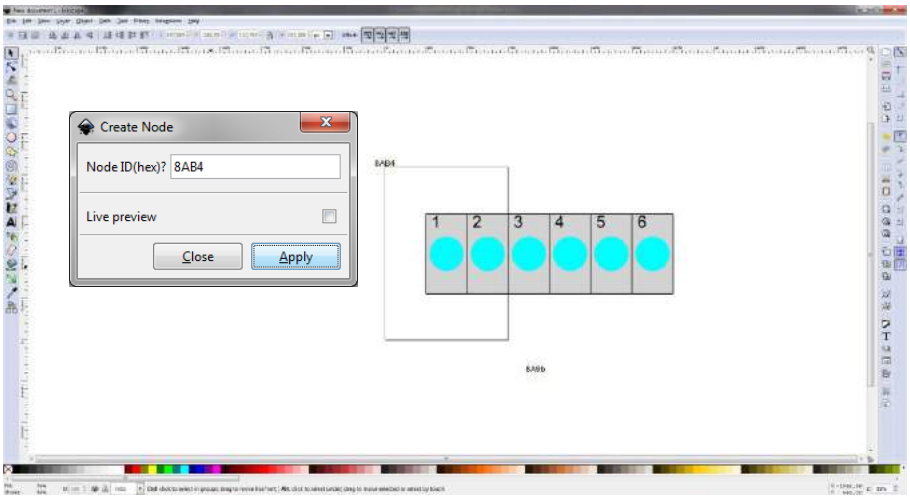


Figure 83: Inkscape, Create Node

When the drawing is finished the next step is to scale the drawing correctly so all bays, Relay Nodes and SENSIT Gateways are nicely places in the map. First select al objects, this can be done easily with Ctrl + A. Select: File -> Document Properties... and then in Custom size, Resize page to content... add some top, bottom left and right margin to the page and select the button Resize page to drawing or selection. See also Figure 84 below.

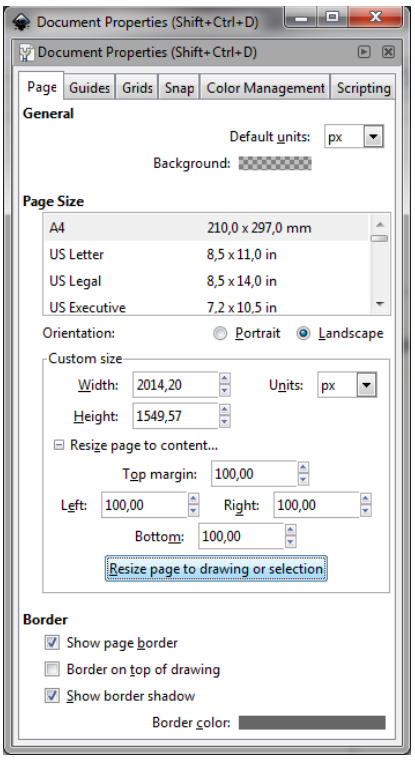


Figure 84: Inkscape, Resize page

Note
Make sure the units is in pixels (px) otherwise the scaling in the monitor map might not work properly.

Further make sure you remove the viewBox item via the XML editor. The XML-editor can be found via the menu Edit -> XML Editor... the viewBox item can be deleted with the marked button, see screenshot below.

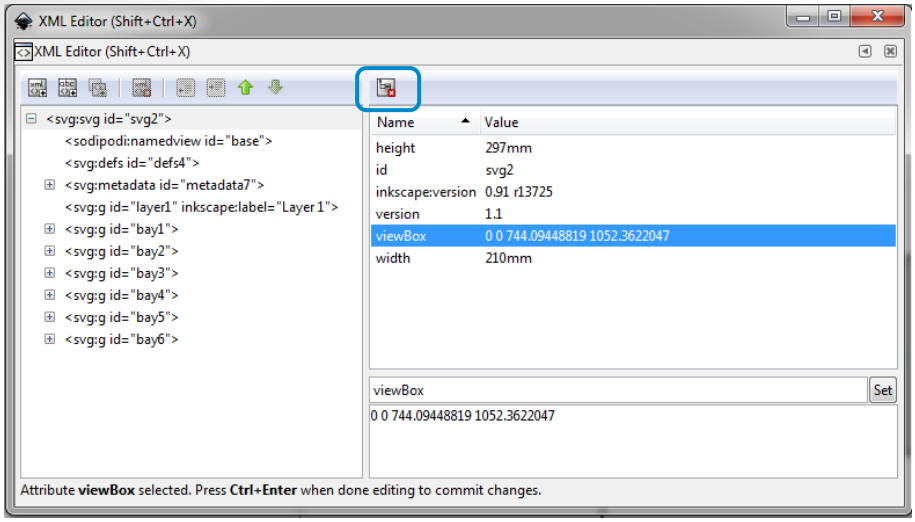


Figure 85: Inkscape, remove viewBox

After resizing the page and removing of the viewBox the file can be saved as a SVG-file make sure you don't use spaces in the filename and after that uploaded to the SIS as described in chapter 17.7.4.

19 FREQUENTLY ASKED QUESTIONS

19.1 GENERAL

What types of SENSIT sensors are available and what is the difference?

There are 3 different types of SENSIT sensors available:

1. SENSIT IR - Magnetic and optical sensor suitable to be built-into the floor of each parking space.
2. SENSIT Flush Mount - Magnetic sensor suitable to be built-into the floor of each parking space.
3. SENSIT Surface Mount - Magnetic and optical sensor for mounting onto the floor of a parking space

What is the accuracy of the SENSIT Flush Mount?

The magnetic sensor can achieve an accuracy of 95%.

What is the accuracy of the SENSIT IR and SENSIT Surface Mount?

The combination of the magnetic and optical sensor has an average accuracy of above 98%.

How scalable is the SENSIT system?

The SENSIT system is quite scalable. The theoretical maximum number of SENSIT nodes in one network is about 65000. In general, large installation need to be divided into smaller sub-networks (segments), which makes it better manageable and easier to understand. Sites that have more than 500 sensors or more than 15 Relay Nodes need segmentation. Please contact your Nedap account manager.

What is the temperature range for the SENSIT and SENSIT IR?

The temperature range for both SENSIT as well SENSIT IR is -40°C to 85°C [-40 to 185°F]. Temperatures below -30°C [-22°F] might affect accuracy of the magnetic sensor. The accuracy on the optical sensor remains unchanged.

How does the energy efficient Wireless SENSIT Network work?

The medium access protocol is based upon time division multiple access (TDMA). Time is divided into time slots, which (Relay) nodes can use to transfer data without having to content for the medium or having to deal with energy wasting collisions of transmissions. After the frame length, which consists of 16 time slots, the (Relay) node again has a period of time reserved for it. We have parameterized the duration of a time slot and the number of time slots. The default timeslot is 100ms and the number of timeslots in a frame is 16. In the US the system uses also Frequency Hop Spread Spectrum (FHSS); a pseudo random frequency hopping scheme every timeslot the SENSIT also changes the frequency. In this way the devices comply with FCC regulations.

If a SENSIT sensor decides to transmit a messages it asks the first Relay Node within reach if it is allowed to transmit a message to this Relay Node, if allowed the Relay Node will receive the message from the SENSIT and retransmits this message to the next Relay Node or directly to the SENSIT Gateway.

Can a SENSIT sensor been used to replace a loop detector?

The SENSIT sensor is designed to detect a changes in either optical or earth magnetic field. A continuous flow of traffic would generate a constant status change. Moreover since the system is based on wireless communication, communication is

slower compared to hard wired loop. We therefore do not advise to use the SENSIT sensor to replace safety loops for critical applications.

19.2 MAGNETIC SENSOR

Is the magnetic sensor influenced by snow or ice?
We have tested the system with about 15 cm (5.9 in) of snow during multiple tests. Snow did not affect the accuracy of the magnetic performance.

Is the magnetic sensor influenced by dirt?
The magnetic sensor is not influenced by dirt like sand, mud or leafs.

How quickly does the magnetic sensor in the node react to a change in status?
Default the magnetic sensor checks its status change every second.

Can the magnetic sensor 'see' the magnetic difference between a car and truck?
In a static parking application a SENSIT sensor cannot observe a difference between a small vehicle and a large truck. The variation in the earth magnetic field changes under a car or truck does not depend on the height of the vehicle but on where a car or truck stops. See also the image below to clarify this in more details.

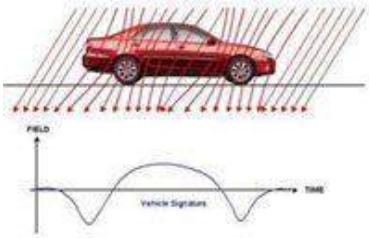


Image 1: Vehicle & earth magnetic field

Image 2: Truck & earth magnetic field

How does the SENSIT sensor detect a car and changes the magnetic status from free into occupied?
The magnetic status of the SENSIT sensor has changed if at any axis (X, Y, and Z) changes more than 50mGauss compared to the stored calibration vector. Normally the earth magnetic field vector is about 500mGauss. This can vary allot from place to place. In order to set the SENSIT sensor to local earth magnetic field we advise to calibrate the sensors.

How can I avoid a vehicle driving over the SENSIT sensor to trigger a status change event message?
When a vehicle is driving over a or multiple SENSIT sensors to reach the final parking bay the overdriven SENSIT sensors will transmit an occupied and free event message. If the overdrive filter isn't set. By default the overdrive filter is set to eliminate these kinds of messages. After setting the overdrive filter the SENSIT sensor will only transmit a status change event if the SENSIT sensor has been occupied of free for the set time.

Note
Setting or changing the overdrive filter affects reaction time.

Note
Default the overdrive filter is set at 8 seconds.

19.2.1 CALIBRATION

Why calibrate?
The local earth magnetic field vector (value and direction) at an installed SENSIT sensor depends on the orientation of the SENSIT sensor, the amount of metal in the neighborhood and the location on the earth. When the calibration is done this local earth magnetic field vector is stored. It is therefore necessary to always calibrate the sensors.

How can I see if the calibration is done correctly?
When connecting the SENSIT Gateway to the SIS, the SIS software will indicate calibration errors for sensors which are not calibrated. In the Sensor data message there is a magnetic un-calibrated bit which warns you if the SENSIT sensor thinks it is not calibrated well.

Does the parking need to be fully empty to calibrate the SENSIT sensors?
Yes, preferably the parking needs to be fully empty in order to calibrate the SENSIT sensors. If you need to calibrate a single parking bay it is sufficient if only all neighboring bays are empty. Easy calibration can be realized through the SIS website.

My parking lot is hardly ever empty, how can I calibrate the sensors?
If it is not possible to calibrate the entire parking lot, we suggest calibrating the parking lot section by section directly after installation of the SENSIT's.

19.3 OPTICAL SENSOR

What is the measuring interval of the optical sensor?
The optical sensors periodically checks once per second if there is a status change. (You can extend battery life by setting slowing measuring intervals.)

Why is the SENSIT IR featured with two detection technologies?
Double detection technology provides a higher accuracy rate. Each detection technology has its advantages and disadvantages. The combination of both ensures a reliable detection product in all circumstances and differentiates our product from any other product in the market. The optical sensor is potentially more accurate but sensitive for dirt, snow and ice. We specify an average accuracy of 95% for the SENSIT Flush Mount (only magnet) and 98% for the SENSIT IR (magnet and optical). In cases of snow or the optical sensor being covered the unit will automatically switch to earth magnetic field detection.

Which sensor is making the decision; occupied or free?
In most cases the optical sensor is indicating the final status. The algorithm inside the SENSIT sensor decides which type of sensor to trust. Of course you can ignore this and decide for yourself which sensor to use, because the state of the magnetic and the optical sensor is available.

What is the detection principal of the optical sensor?
The optical sensor is based on IR reflection. We are using a high power IR LED as transmitter and a sensitive IR diode as receiver. The IR radiation is reflected by the bottom of a car or truck and is received by the IR receiving diode. This means the bay is occupied.

Is the optical sensor influenced by snow or ice?
Yes the optical sensor detects based on something covering the sensor. In case the sensor is covered with snow or frost it will be seen as occupied. In the sensor data message there is a bit that warns you for possible ice on the SENSIT sensor. As the SENSIT IR is featured with dual sensing technology you can also decide to switch the sensors to magnetic detection in winter periods using the SIS software. Beside that on the SIS there is a global ice detection algorithm implemented which automatically can decide to switch to the magnetic sensor in case of ice or snow. See chapter 17.10.1 for more information.

Is the optical sensor influenced by dirt?
The optical sensor is designed to not easily be covered with little amounts of dust or sand and therefore this will not affect the performance. Larger amounts of dirt will disable the optical sensor. At an outdoor parking-lot, the self-cleaning surface of the SENSIT IR ensures that dirt is automatically flushed of and does not easily attach to the SENSIT IR. This makes it a very usable and practical system. The sites world-wide installed outdoors have since installation (in about 2006) never been cleaned.

What happens in case of sandstorms, when the optical sensor is covered?
When the optical is covered with sand the sensor cannot detect reflections of a vehicle that parks over the SENSIT sensor. So the optical sensor will indicate a free bay, the secondary (magnetic) sensor will detect the movement of the different cars above the SENSIT sensor. After a few (default: 10) mismatches between the continuous occupied optical sensor and the magnetic sensor the final status will be indicated by the magnetic sensor. As soon as the optical sensor is clean, the SENSIT sensor will automatically switch back to optical detection again.

Is the SENSIT IR affected by direct sun light?
Normally the optical IR sensor is not affected by sunlight. Only at locations close to the equator when the sun is directly above the SENSIT IR the optical sensor can give an overexposure alert, which will indicate a free bay.

19.3.1 CALIBRATION

What is the maximum range of the optical sensor?
The IR reflection depends very much on the reflection coefficient of surface it radiates at. Ceilings of over 3 meters (9 feet) are seen by the optical sensor. You can set the sensitivity of the optical sensor when applying the sensors for indoor applications.

Can the optical sensor been used indoors?
The optical sensor can be used indoors, for this the IR transmitting power needs to be adjusted (calibrated) to avoid the unit from detecting the ceiling.

19.4 MORE INFORMATION SENSIT AND MOUNTING

What filling material should I use?
The best way to fix the SENSIT sensors into the floor of the parking space is using rapid mortar (eg.TM 5R). Ensure to fixate the SENSIT sensors during curing time, to avoid them from floating in the mortar. When you want to use another brand of rapid mortal please sent us the datasheet so we can analyze this and advise you on use.

Is a SENSIT IR snow plough resistant?
When using the SENSIT IR in environments with snowy weather conditions, we advise to set a tolerance on the snow plough of 2 cm [0.78 in] to ensure the top of the sensor is not damaged by the snow plough. The SENSIT IR is not fully snow plough resistant; however it can withstand a few incidental hits. The SENSIT Flush Mount is snow plough resistant and can be used in areas with frequent snow conditions, at the cost of a bit lower accuracy.

19.5 INSTALLATION

How much time does an installation take?
Based on installation experiences, an estimation of the needed man hours for installing about 100 SENSIT IR is provided below.

Task	Description	Man hours
Preparation	Making a simple drawing of the parking lot and upload it to the SIM	2
Installation SENSIT IR	Determine location of every SENSIT IR, drilling holes and fixing them	8
Installation Relay Nodes	Mounting the Relay Nodes	1
Testing	Making a csv file, upload it to the SIS and verify if all SENSIT sensors are online	4

How do I start?
Please read chapter 3 of this document for a 4-step installation plan.

19.6 BATTERY LIFE

What is the battery life?
The battery life of the SENSIT sensor in a good performing network is 5 years this with default settings of the network and the measurement intervals.

Note
A network uptime below 99% will reduce the battery life significantly.

Can batteries be exchanged?
The SENSIT sensors are fully sealed to ensure reliable operation in the outdoor environment and to avoid any water leakage to the electronics. The batteries cannot be replaced, as this would create water leakage and unreliable operation. The SENSIT sensor needs to be replaced after end of battery life. The batteries of the Relay Node 2G can be replaced, see chapter 10.7.

Can I extend battery life of the SENSIT sensor by adjusting communication settings?
Yes you can extend battery life by adjusting the communication settings. Default the SENSIT sensors are set to 16 timeslots. This communication setting will realize a battery life time of 5 years and will achieve a good latency (fast and reliable communication network). For applications where slower communication (more latency) is allowed 32 timeslots is recommended to extend battery life time. Installations using over 15 Relay Nodes should also be set to 32 time slots.

How can I change the communication settings to extend battery life?
Please consult Nedap how to change the communication settings if your application allows slower communication or if your application needs more than 15 Relay Nodes.

How do we know if a SENSIT sensor runs out of batteries?
The battery voltages will be requested by the SENSIT Interface Server on a regular basis. The SIS will display an icon in the node presence list in the SIS if the battery is low or almost empty. See chapter 17.10.2 and chapter 17.10.3 for more information.

If I keep the product in stock for some time, do the batteries run down?
When shipped the units are in stock/transport mode to save battery life. That is why you need to swipe the SENSIT sensors with a reset magnet to get them out of stock

mode. In stock/transport mode the SENSIT sensors hardly use any power. In this way you can have a SENSIT sensor in stock for e.g. a year without influencing the final battery life.

19.7 RELAY NODES

What is a Relay Node?

A Relay node consists of a SENSIT configured in an active role and a Relay Node mounting set. The mounting set allows for easy mounting of the Relay node onto a lamppost. The Relay node is a normal SENSIT but configured differently, a Relay Node has a more active role in the wireless network compared to a SENSIT. That is why we call a Relay Node an active node and a SENSIT a passive node. The continuous transmitting and receiving of an active node consumes more power than a passive node who is only listening to a few active nodes to stay synchronized and to receive incoming messages. The battery life of the Relay Node will be about 2 to 3 years. The advantage is that a Relay Node is still completely wireless and does not require any power or communication cabling.

Note
Use of Relay nodes is mandatory to ensure a fast communicating, more stable and a less energy consuming SENSIT network.

What is a Relay Node 2G?

A Relay node 2G is a dedicated product for relaying message from the SENSIT sensors to the SENSIT Gateway. The Relay Node 2G has an active role and in the Wireless SENSIT Network. The battery lifetime of the Relay Node 2G is similar as the lifetime of the SENSIT sensors. The Relay Node 2G is wireless and does not require any power or communication cabling.

Why are Relay Nodes required?

Relay nodes are required to ensure a faster communication path to the SENSIT Gateways, a more robust network and less energy consumption. Relay Nodes are required to ensure that SENSIT sensors positioned in the area can communicate directly via the Relay Node back to the central system. If each SENSIT sensor would need to communicate via the other SENSIT sensors installed in the floor, more communication 'hops' are needed. This will cause a slower communicating network, with a higher chance of missing a message and higher energy consumption.

How much Relay Nodes do I need to install?

The number of Relay Nodes depends on various parameters: number of SENSIT sensors, distances and obstructions. A minimum of 1 Relay Nodes and 1 SENSIT Gateway is required per installation to create a 2 path communication possibility for each SENSIT sensor. Nedap can provide you with more detailed information on the amount of Relay Nodes per installation for your site.

Has Nedap a tool to determine the number of needed Relay Nodes?

There is a tool available to make a better estimation of needed equipment, see chapter 4. Please ask your Nedap account manager for more information.

What is the communication distance between Relay Nodes and other components of the system?

Below the maximum recommended distances between the different nodes.

SENSIT Gateway	⇔ Relay Node	25 m	(82 ft)
Relay Node	⇔ Relay Node	50 m	(164 ft)
SENSIT	⇔ Relay Node	25 m	(82 ft)
SENSIT Gateway	⇔ SENSIT	25 m	(82 ft)
SENSIT Gateway	⇔ Relay Node 2G omni-directional	35 m	(115 ft)
SENSIT Gateway	⇔ Relay Node 2G directional	50 m	(164 ft)
Data Collector GPRS	⇔ Relay Node 2G	10 m	(33 ft)
Relay Node 2G	⇔ Relay Node 2G	100m	(328 ft)
SENSIT	⇔ Relay Node 2G omni-directional	35 m	(115 ft)
SENSIT	⇔ Relay Node 2G directional	50 m	(164 ft)

How do I replace a Relay Node?

After end of battery life, the SENSIT can easily be taken out of the Relay Node mounting set. Only the SENSIT sensor configured as Relay Node would need to be replaced. The batteries of a Relay Node 2G can be replaced, see chapter 10.7.

Can the Relay Nodes also be used for indoor car parks?

Yes, the Relay Nodes can also be used for indoor car parks, see also picture below. Indoor car parks might require more Relay Nodes due to mounting height restrictions and influence of concrete on communication.

19.8 SENSIT GATEWAY

What is the SENSIT Gateway?

The SENSIT Gateway is the central unit which collects the events from SENSIT sensors via the Relay nodes and transmits this information to the host system or SENSIT Interface Software.

What is a Data Collector?

The Data Collector is the previous name for the SENSIT Gateway.

Can I implement data from the SENSIT Gateway directly?

No, this feature is not supported and subject to change. For easy integration we advise to use the SENSIT Interface Software.

What is the most critical part of the SENSIT system?

The most critical part is the SENSIT Gateway when the power of the SENSIT Gateway is interrupted or if the SENSIT Gateway is damaged the whole Wireless SENSIT Network will stop working. Only with a good and powered SENSIT Gateway the wireless network will start. By using an UPS, (short) power failure can be solved.

Where do I mount the SENSIT Gateway?
The SENSIT Gateway can be installed within 25 m [84 ft] from the first SENSIT node or Relay Node. Be sure not to position the SENSIT Gateway in a metal enclosure as it will block the RF communication. The SENSIT Gateway can be mounted in a plastic housing, which is transparent for RF signals.

What power wiring (cable specs) do I need for the standard Data Collector?
Power: 100-240 VAC, 50-60 Hz, 180mA,
Power input: 5 VDC, max 1A
Power consumption: 5VA
Communication between Data Collector and SIS: Ethernet Cat 5 E

Can the Data Collector GPRS be powered by a solar panel?
There are already several customers who autonomously power the Data Collector GPRS with a solar panel. Also the Data Collector GPRS at the Nedap test-site is powered by a solar panel (since December 2011).

The autonomous solar panel system at the Nedap test-site is a 30Wp Solar panel, a charge regulator and two 22Ah /12V battery in parallel. See picture at the right

The Data Collector will not consume more than 60mA at 12VDC on average.

Can the SENSIT Gateway be powered by a solar panel?
The SENSIT Gateway can also be powered by a Solar panel and it will not consume more than 120mA at 12VDC on average.

How much data will a the SENSIT Gateway use?
Normally the data usage will be below 250MB per month.

Can I replace the antenna for one that I can mount on top of a metal box and keep the SENSIT Gateway inside this metal cabinet?
As for operational purposes this should not be an issue, on the condition that a suitable antenna is applied. However ETSI and FCC does not allow change of the antenna, and therefore as a manufacturer we cannot approve antenna change for this reason.

How often does the SENSIT sensor send an event to the SENSIT Gateway to alert a status change?
The SENSIT sensor sends an event message immediately after a status change.

The baud-rate of the Data Collector is 115200 can I change it into another value?
The baud-rate of the Data Collector is fixed, you cannot change it.

Can I built the SENSIT Gateway into a pay & display machine?
Yes, when the pay & display machine is featured with Ethernet communication, this communication could be applied. Keep into consideration that the RF antenna of the Gateway should be positioned behind RF transparent material (such as plastic) and not incorporated in metal.

19.9 SENSIT INTERFACE SOFTWARE (SIS)

What is the SIS?

The SIS (SENSIT Interface Software) allows for easy configuration and filtering of event messages received by the SENSIT Gateway. The SIS enables configuration, installation, basic administration and integration of the SENSIT system SIS functionality includes;

- Easy integration via SOAP or REST
- Easy remote support via web interface
- DNNP (Dynamic Node Numbering Protocol)
- Connection of multiple SENSIT Gateways
- Filtering of events
- Easy event configuration
- Easy management of the entire Wireless SENSIT Network
- Automatic calibration
- Debug and analyze tool
- Automatic collection of missing messages
- Configuration of parking bays
- Stand-alone system with control of display per zone.
- Graphics to indicate parking spaces and overstay

Why use a SIS?

Configuration and integration of the data from the SENSIT system becomes much easier. The site can be accessed remotely allowing Nedap to give you better support on the installation.

Can I control a display with the SIS?

Yes using a wireless display node built-into a display, the display can become part of the Wireless SENSIT Network (WSN). You can set in the SIS software which parking zone the display should control and indicate. See chapter 17.7.7 for more information. Using this option a simple standalone application could be created with displays indicating available spaces. No more than 2 wireless displays are allowed in the WSN to make sure the display messages aren't influencing the WSN too much.

How does the overstay sequence work?

The accuracy of detection is of critical importance when using the information for enforcement applications. You want to avoid issuing unjustified tickets. In the table below the whole overstay sequence and how to check an overstay is explained.

Event	T	SENSIT	SIS
Car parked	t1	Detected optical + magnetic	
Overdrive filter (8s) passed.	t2	Event created and transmitted, including; sequence number, t2	
Event at DC	t3		
	t4		Event stored in database, including; t2, t3 and t4. SIS verifies sequence number
No change after 1 hour	t5	Event (created at t2) retransmitted	
	t6		Event already stored, so ignored by SIS
Overstay time elapsed	t7		Bay status changed into: overstay, verify request transmitted
Verify message received	t8	Last event (created at t2) is retransmitted	
Verify event received	t9		Bay status changed into: verified overstay
Enforcement officer is notified and arrives at the bay, enforcer sends verification request			
SOAP request received	t10		Verify request transmitted
Verify message received	t11	Last event (created at t2) is retransmitted	
Verify event received	t12		Bay status answered via the SOAP
Enforcer receives verification and can decide to issue a ticket after his final observations.			

How do we know when a SENSIT or Relay Node is working well?

With the node cross check menu on the SIS you can detect if all SENSIT sensors are still communicating. Logged in as an advanced user it is possible to get a graphical overview of the performance of the wireless SENSIT network. For more information, see chapter 17.9.5.

19.10 NETWORK & COMMUNICATION

How much events can a SENSIT node store?
Every SENSIT node is capable of storing 32 events in its internal memory.

What causes the latency of a SENSIT sensor?
The latency is built up out of different aspects;

- The measurement interval;
  The interval the SENSIT sensor verifies it status changed, default set at 1 second.
- The overdrive filter;
  The overdrive delay set in the SENSIT sensor is by default set at 8 seconds.
- The number of hops;
  The number of hops a message needs to arrive at the SENSIT Gateway, every hop takes about 2 seconds.
- Passive collisions;
  In a busy car park multiple SENSIT sensors want to transmit their status change message simultaneous, which might create passive collisions. In order to reduce this we advise to ensure that each SENSIT sensor can at least communicate with 2 Relay Nodes offering multiple communication paths.

Example with default settings and without passive collisions:

The magnetic and optical sensor measures every second if the status of the bay is changed. The overdrive filter waits 8 seconds before it transmits the event. In this example the event is transmitted via 2 Relay Nodes; first from the SENSIT to the nearest Relay Node and then from this Relay Node to the Relay Node close to the SENSIT Gateway and finally from this Relay Node to the SENSIT Gateway. The total (worst-case) time needed is:
Measurement + overdrive + SENSIT→RN + RN→RN + RN→ SENSIT Gateway = 1+8+2+2+2 = 15s

Example with default settings and with one passive collision:

The magnetic and optical sensor measures every second if the status of the bay is changed. The overdrive filter waits 8 seconds before it transmits the event. In this example the event is transmitted via 2 Relay Nodes; the sequence of transmitting the messages is the same as in the example above but now a collision occurred in the first transmission; another SENSIT transmitted an event at the same time to the Relay Nodes. The total (worst-case) time needed is now:
Measurement + overdrive + collision + SENSIT→RN + RN→RN + RN→ SENSIT Gateway = 1+8+10+2+2+2 = 25s

How many seconds does an event message take in general?
The transfer time is depending on the number of hops and if passive collisions take place. A collision free transfer via one Relay Node takes less than 5 seconds, for every extra hop add 2 seconds. For a busy parking lot take into account at least 10 seconds extra for possible passive collisions.

Is the package number always increasing per SENSIT?
Yes, the package number is automatically increased in sequence number per SENSIT and the message is unique based on a combination of SENSIT ID number and package number.

How do we map the double words corresponding to "Sent time" and "event time" to real dates?
The double word is the time in seconds from January 1st 1970 this is also used within UNIX and therefore also known as 'Unix-time'.

19.11 TECHNICAL MATTERS

What is the MTBF of the various components of the Wireless Space Count system?
In the table below the MTBF, MTTR and MTTF is given, so far this are estimated values.

	MTBF	MTTR without spare	MTTR with spare	MTTF
SENSIT IR	63 years	7 days	1 hour	~40 years
SENSIT Flush Mount	63 years	7 days	1 hour	~40 years
SENSIT Surface Mount	76 years	7 days	1 hour	~40 years
Relay Node	65 years	7 days	1 hour	~40 years
Relay Node 2G	52 years	7 days	1 hour	~40 years
Data Collector	53 years	14 days	1 hour	~40 years
Data Collector GPRS		14 days	1 hour	~40 years
SENSIT Gateway				

20 APPENDIX

A RAPID MORTAR

RAPID MORTAR TM 5R

100706-06

Product description
Rapid mortar TM 5R is produced of a cement with a very high reactivity to water, and quartz sand with a maximum aggregate of 0.4 mm. Special synthetic components provide for good adhesion to the surface. Rapid mortar TM 5R exhibits high strength within a very short period of time.

Application
Rapid mortar TM 5R is used for repairing concrete and concrete units, which have to be back in operation in a short period of time, i.e.:
- repairs of manhole covers and drains in road construction
- assembly of parking meters and road signs

User instructions
Rapid mortar TM 5R is prepared with water until a plastic mortar is obtained. The water is filled into the mixer first, and then Rapid mortar TM 5R is added. For every 25 kg of Rapid mortar TM 5R about 3.75 litres of water are added. Mixing time is about 3 minutes after which the mortar is applied using appropriate tools. The processing time is about 15 minutes at a temperature of 20°C.

Yield
2 kg SchnellMortar TM 5R prepared with water will yield about 1 litre mortar.

Technical data
- State of aggregation: powder
- Colour: grey
- Density (kg/l): n.a.
- pH-Value: n.a.
- max. alkali content (% Na_2O-eq): n.a.
- max. chloride content (%): n.a.
- Colour code: n.a.
- Storage: dry, frost-protected, in closed packaging
- Shelf-life: when stored correctly at least 6 months after date of production

Packaging
Sacks, pallets, big bags.

Preliminary tests for the product's suitability are indispensable

Article number 5115

Tillman B.V. - Julianaweg 12 - 7078 AR Megchelen Gld.NL - tel. +31(0)315377541 - fax. +31(0)315377577 - info@tillman.nl - www.tillman.nl

B MODIFIED SILICON POLYMER

Sabatack Fast
ultra-fastbonding

B.1 Description
Sabatack Fast is an ultra fast-acting 2-component, elastic, humidity-curing, MS polymer-based construction adhesive. Its primary use is bonding with fast hardening, handling after only 2 hours, which makes this product excellent for use in mass production. Sabatack Fast has a medium viscosity and a high modulus elasticity.

B.2 Field of application
Industrial and hand-made vehicle and coachwork construction, marine, ventilation and air conditions, electro-technology, equipment assembly, metal and tin processing, plastics technology, civil & environmental engineering and building & construction. For the elastic bonding of frames, profiles, plates etc. Also for sealing seams, overlaps, joints and cracks. Suitable for interior and exterior use. Excellent for use in mass production.

B.3 Advantages
- fast and controlled curing, high end strength
- adhesion without primer, fast drying
- can be painted wet-on-wet, hardly any shrinkage
- no blistering, almost odorless
- free from solvents, isocyanates and silicones
- UV-stable, high temperature resistance
- certificates: Wheelmark (164.106/1121/WCL MED0326), ISEGA (in connection with HACCP)

B.4 Method of use
For instructions for use, repaint ability and pre-treatment, see the relevant info sheets at www.saba.nl

B.5 TECHNICAL DATA

Order information
Other packaging and colours on request. The shelf life may vary for large packaging.

Safety recommendations
For more information about safety, see the relevant SABA safety data sheet.

Component A	**Component B**
Basis	MS polymer, humidity-curing MS polymer, humidity-curing
Density	(EN 542) approx. 1.380 kg/m3 approx. 1.144 kg/m3
Solids content	approx. 100% approx. 85%
Open time	(23 °C, 50% RLV) approx. 10 minutes
Tack free	(23 °C, 50% RLV) completely after approx. 12 hours
Cure rate	(23 °C, 50% RLV) even after 48 hours
Hardness Shore A	(EN ISO 868) approx. 55
Volume alteration	(EN ISO 10563) < 5%
Modulus at 100%	(ISO 37/DIN 53504) approx. 1.5 N/mm2
Tensile strength	(ISO 37/DIN 53504) approx. 2.6 N/mm2
Elongation at break	(ISO 37/DIN 53504) approx. 330%
Shear strength	(ISO 4587) approx. 1.7 N/mm2
Working temperature	min. +5 °C to max. +35 °C
Storage temperature	min. +5 °C to max. +25 °C
Temperature resistance	min. -40 °C to max. +120 °C
Short temperature resistance	max. +180 °C (30 minutes)
Packaging	dual-cartridge
Contents	490 ml (contains 7 items)
Color	White (RAL 9003) black (RAL 9011)
Article No.	100201 DJW 100862 DJW
Shelf life	9 months (in unopened packaging)

C POLYURETHAN

PERMAPUR® 2654 A/B

Universal Polyurethane liquid adhesive
PERMAPUR® 2654 A/B consists of two components A-component (Polyol) and a B-component (Isocyanate). The resin is supplied in a bi-pack. PERMAPUR 2654 A/B is used as an universal polyurethane resin which can be applied by pouring the fluid. The system is insensitive to moist and shows no blistering and is therefore less critical in processing.

Technical details

Color:	A-component black fluid B component dark brown fluid
Color mix:	Black
Processing time:	10 min / 20°C
Gel time:	15 min / 20°C
Curing time:	24 h /20°C
Viscosity:	4.500 mPa.sec/20°C
Hardness:	45° Shore D
Specific gravity:	1,5 g/cm3
Specific resistance:	1 x 1014 W.cm
Breakdown voltage:	20 KV/mm
Max. Temperature:	-25°C tot +120°C
Water absorption:	<1%
Storage:	At room temperature (20 ° C) in tightly closed Verpa Branching 12 months

D FCC AND IC DECLARATIONS

Compliance statements (part15.19)

This device complies with part 15 of the FCC Rules and with Industry Canada's licence-exempt RSSs. 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.

Warning (15.21)

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

Cet appareil se conforme aux normes RSS exemptés de license du Industry Canada. L'opération est soumis aux deux conditions suivantes:
(1) cet appareil ne doit causer aucune interférence, et
(2) cet appareil doit accepter n'importe quelle interférence, y inclus interférence qui peut causer une opération non pas voulu de cet appareil.

Les changements ou modifications n'ayant pas été expressément approuvés par la partie responsable de la conformité peuvent faire perdre à l'utilisateur l'autorisation de faire fonctionner le matériel.

FCC and ISED Radiation Exposure Statement

This equipment complies with FCC (OET Bulletin 65) and Canadian radiation exposure limits set forth in RSS-102 for a uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme a RSS-102 limites énoncées pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps.

ISED EMC Declaration

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de Classe B est conforme à la norme Canadienne ICES-003.

FCC Information to the user (15.105(b))

Note: This equipment has been tested and found to comply with the limits for a class B digital devices, 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 frequent 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 not cause harmful interference to radio or television reception, which can be determine 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.
• Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
• To ensure compliance with FCC regulations, use only the shielded interface cables provided with the product, or additional specified components or accessories that can be used with the installation of the product

F DISCLAIMER

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G DOCUMENT REVISION

Version	Date	Comment
1.3.3	24-02-2014	Start documents and new corporate style
1.4	14-04-2014	Adjustments for 1.4 release.
1.4.1	12-05-2014	Adjustments for release 1.4.1, RelayNodeTool added, Document renamed.
1.4.2	15-07-2014	Adjustments for release 1.4.2, FCC & IC Declaration and some small textual improvements.
1.4.3	27-10-2014	Adjustments for release 1.4.3, some small textual improvements.
1.5.0	17-12-2014	Adjustments for release 1.5.0; Parking enforcement screens.
1.5.1	17-12-2014	Adjustments for release 1.5.1; DNNP
1.5.2	10-03-2015	Adjustments for release 1.5.2; EPL
1.5.3	28-04-2015	Adjustments for release 1.5.3, some small textual improvements.
1.5.5	12-11-2015	Adjustments for release 1.5.5; EPL improvements, support widget
1.5.6	04-04-2016	Adjustments for release 1.5.6; SG version added.
1.6	xx-xx-2016	Adjustments for release 1.6; SENSIT Gateway, Back up battery, Configuration Tool and SIS Maps.