

Smartrek monitoring

Thank you for purchasing! This document contains a how-to guide and general information to help you get the most out of this product. Look here first for answers and to get started.

Smartrek monitoring

Quick Start Guide

Most Smartrek turnkey monitoring system include a Starter kit along with the sensors.

In the starter kit, you will find:


1. a Gateway
2. an Android tablet with the Sugarheld App already installed. In most cases, stop steps can be skipped if the tablet has been previously preconfigured. You will know that the tablet hasn't been set up yet as an installation Wizard doesn't appear when launching the Sugarheld App.

Unboxing

Step 1

Plug the Gateway and open it by pressing on the ON/OFF button. Look at the LED flashing. It should blink a few times, stop then start blinking at a regular pace. Everytime this light blinks, it means that the Smartrek system is sending/receiving data.

Step 2

Open your tablet. Look for the Sugarheld App icon , either on the main screen or by pressing on Applications and swiping through the pages. Open the Sugarheld App

Step 3

After the main splash screen, you will either enter into the App or get the option to follow an installation Wizard. If you are not comfortable setting up the system manually, then follow through the steps of the Wizard to get your system operational.

Installation Wizard

Starting with a fresh install of the Sugarheld App (**not an update nor a preconfigured tablet**), the Installation Wizard will automatically launch when the App starts. You can skip anytime in the Wizard except at the end, when the finish button has been pressed. This step will automatically be skipped if

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your tablet was preconfigured.

If you skip the Wizard, it will automatically re-launch the next time the app is opened, as long as there is no gateway or handheld registered yet in the app. Once there are master components registered in the database (gateway or handheld units have been scanned and added in the app), then the Wizard can only be launched manually by going to the Cfg. tab, under Installation Wizard. From there you will have Launch Wizard, which will start the Wizard right away. You also have another option with a checkbox, Launch Wizard at next boot. If enabled, the Wizard will start everytime that the app is launched, until the Wizard is completed (or the option is disabled).

Note that you will need to be connected to an internet network for the Wizard to configure your maps properly as it will download all the relevant satellite maps for you.

Wizard - step 1 - Name device

Name your device (your Android device). By giving a name to your Android device in the app, you will find the process of transferring database (sensors list) from one device to another much easier (your default device name is DEVICE)

Wizard - step 2 - Enter your address

Enter your address (the location of the system installation). It could be a zip code (or for Canadian customers, the 3 first digits of the postal code). Then tap on Search Address. The address found will be used as the center location of the maps that will be downloaded. It is important to enter the correct location or the maps downloaded won't be relevant (only maps surrounding your area will be saved to your device).

Wizard - step 3 - Remote use

Now you'll be asked whether you wish to use the system locally only or locally and remotely (i.e. use the system outside of the network, to view your system at home, at work or anywhere in the world). If you answer Yes, then the wizard will guide you through some extra steps to configure the remote access

Wizard - step 4- Configure Google Account

Then, you need to configure a Google Account (either choose an existing one or create a new one). Most of our services use Google functionalities (such as Google Drive) so that's why we're asking for an account.

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Wizard - step 5 - Configure Alarms

Next, you can customize the basic alarms settings. You can disable/enable:

- Sound alarms on errors and warnings (you will be able to set the error limits on each sensor later on)
- Use Text-to-speech ability of your phone so that errors and warnings are read to you

Wizard - step 6 - Configure Units

Next, you can customize the units that will be used throughout the app. You can choose either Metric or Imperial units or tap on Customize Units to choose the right unit for each of your measurements.

- Metric units : distance in m, height in cm, temperature in °C, positive pressure in bar, negative pressure or vacuum in in Hg, volume in L, flow in gpm (UK gallons)
- Imperial units : distance in ft, height in in, temperature in °F, positive pressure in psi, negative pressure or vacuum in in Hg, volume in gal (US), flow in gpm (US gallons)

Wizard - step 7 - Choose Application

Next, you will be prompted to select the main use of the Smartrek system. Choose general application if you are unsure.

Wizard - step 8 - Reader or Writer

Then, you will be asked to choose how the app will gather data from the Smartrek system:

- 1) by pairing with a Gateway
- 2) by pairing with a Handheld
- 3) if you answered yes at step 3 (you are going to use the system remotely), by reading data from the cloud

Wizard - step 9 - Install gateway

Now it's time to install the device that you have chosen in step 8. Tap on scan if applicable to scan the barcode of your gateway or handheld. Then, name your gateway/handheld device. The next two steps will configure the gateway settings (if applicable) depending on the configuration of your bush.

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Wizard - step 10 - Define system

Enter the distance of the farthest node from the gateway (from your main location). In other words, what will be the radius of your Smartrek network if the center is at the gateway.

Wizard - step 11 - Configure Performance

Choose how you would like to optimize the system:

- 1) Save batteries (low data-rate). You should choose this option if you do not currently need very high data rate to save your battery life. When saving batteries, the system will respond slower than with the high performance option. You will still get a lot of data, but not once every second.
 - 2) High performance (high data-rate). You can choose this option if you are currently monitoring a critical operation. The system will respond very fast and consume a lot more batteries.
- You can choose to run on the Save Batteries mode at all time. You should still have plenty of data. Once the wizard is over, you can still change these options manually without having to re-run the Wizard. To do so, go to the Node tab in the Sugarheld App. Tap on your activated gateway. Change the duty cycle from 5% (battery saving mode) to any higher value (e.g. 10%, 15%, 20%...).

Wizard - step 12 - Enable features

There are a few features that are only available for handhelds users. If you plan on using handheld devices in your system deployment, then check the Handheld use. Then, you will have two more options available:

- 1) Enable Chat/DB sync/Synced Notes on map: select this option if you wish to chat within the Smartrek network with your workers or if you wish to sync your DB (sensors' list) in the field using handheld devices. With DB syncing, you can add nodes in the woods using a handheld and they will sync on the man tablet. You can also add notes on the map that will also sync to all tablets/smartphones (connected to a gateway or a handheld).
- 2) Enable Equipment control through Handhelds: select this option if you wish to control your equipments from tablets/smartphones connected to handhelds.

Wizard - step 13 - Choose Theme

Choose the look of your app. For those who are getting used to the old interface (prior to 2017), select the Legacy theme. For the best experience however, select Modern theme.

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Wizard - last step (14) - Finish

You can now commit your preferences and click on Finish, or if you can cancel by pressing Skip (no changes will be made). Wait until your preferences are being applied. The Wizard will also take care of downloading the satellite map for you. Once completed, the app will restart and you should be ready to start adding sensors to your network and enjoy the system!

Installing Sensors in the field

Sensors can be installed using two different methods. Method 2 can only be used if you have handhelds. If you do, then you can skip to the Installing Nodes section from this User manual.

If you do not have any other Android tablet or smartphone, then follow these instructions.

1. Check that your tablet is receiving GPS signal by going to the Map tab, and looking on the map. If your map position match  your current position then you can continue. Else, check your tablet settings to enable GPS and wait for your tablet to lock on the GPS signal. This is only required if you want your sensors to show at the right location on the App's map.
2. Screw an antenna on the antenna connector (if needed) and turn the sensor On by pressing on the ON/OFF button. The PROGRAM LED indicator will start blinking. The first sequence of blinks represents the Channel that the sensor is currently on (e.g. 3 blinks = channel # 3). Then the ON/OFF LED light will start blinking at the same rate as your gateway once it is connected (after a few seconds to a few minutes).
3. Install the sensors starting from the nearest ones (from the gateway). Go to the exact location where the Sensor will be installed with your tablet. Again, if you do not need the sensors to show at the right location on the map, then all these steps can be done before deploying the nodes in the field. The system will still work fine, but the sensors will all show up at the exact same location on the map.
4. If the LED on the ON/OFF button of the sensor is still blinking regularly, then you can install your Smartrek sensors at that location (LED blinking means that the sensor is still connected to the network). If the LED is not blinking as fast as the gateway, then you are out of the network. Place other sensors first that are more likely to be inside of the current network (near the gateway). Since the sensors are relaying messages to the gateway, installing other sensors first might put that location back into the network later on. Install repeaters as needed to connect the sensor back to the network.

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In the Sugarheld app (on the tablet):

1. Go to the Nodes tab, swipe left to right or right to left until the displayed page is that of the node to be installed. If your tablet was preconfigured, then all unused sensor types might be hidden. You can unhide them by going to the Cfg. tab, tap on Select Active sensors and check all sensor types that you wish to show.
2. Optionnaly, you could check on the map to see if you are at the correct location (GPS is working)
3. Tap on the Menu button of the Android device and tap on Add node.
The menu button varies depending on the Android device and can be toggled by clicking or long-clicking any of the following buttons (or other)



4. Select the scan barcode button



5. Scan the barcode on the sensor, turning on the flashlight if needed



6. Tap the Name field and name the sensor accordingly. Tap the Ok button



7. The sensor has now been installed and the sensors icon should have appeared in the sensors list and on the Map tab as well.
8. Repeat steps 1-7 for all nodes to be added to the network, always using the same Android device (tablet) to add/remove nodes
9. You will start getting your readings once you get back next to your gateway (until the tablet can communicate with the gateway via a bluetooth link)

Your system should now be up and running. If the sensors' page headers are greyed out and the



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gateway is highlighted in red, then your tablet has not been paired with the gateway. To pair, click and hold on the gateway's name. In the menu, scroll down and tap on Activate. The app will restart, this time with a bluetooth connection with the gateway. After a few seconds, the sensors' tabs will change color and you will start seeing data.

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1. Smartrek Automation and Monitoring system features

1.1 Definition of a Wireless Sensor Network





A wireless sensor network (WSN) can be viewed as a network of autonomous microsystems (battery operated) scattered in a given space and communicating with each other via a wireless link. In such a network, the user can communicate with the sensors via a gateway node which is the interface between the WSN and the machine.

1.2 Topology of the WSN







Smartrek WSN uses a mesh topology communication strategy with multi-hops and multi-paths. When a sensor sends its measurements to the gateway node, the data is repeated several times through multiple nodes, thereby ensuring system reliability via redundancy.

1.3 System components

1.3.1 Icons

	Main controller device (Lenovo Yoga Tab 3, NVidia Shield, Nexus 9 tablet, Samsung Tab E LTE) (Nexus 5, Nexus 6, Samsung Galaxy Rugby LTE, S4, S5, S6 smartphones)	
	Portable computing device (Nexus 5, Nexus 6, Samsung Galaxy Rugby LTE, S4, S5, S6 smartphones)	

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	Gateway node	
	Handheld node	
	Repeater node	

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Single port vacuum/temperature
sensor node (2014)



Single port vacuum/temperature
sensor node (2015)



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Dual ports vacuum/temperature
sensor node (2014)



Dual ports vacuum/temperature
sensor node (2015)



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	Level sensor node	
	Remote controls (Relay) node	
	Auxiliary inputs for remote controls	

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Refractometer










Pressure/temperature





Tensiometer

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	Flowmeter	
	Piezometer	
	Temperature RTD	
	Reverse Osmosis	
	High Power Ultrasonic Level	Coming soon

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	Soil Moisture	Coming soon
	Soil Tension	Coming soon

1.3.2 Main controller device

The main controller device is the main graphical user interface (GUI) enabling user interaction with the system (control, reading data, configuring settings), and is the brain of the whole system.

The controller computer communicates to the system via its Bluetooth connection to the gateway node and thus, both devices have to be installed near each other. Typically, the gateway and the main computer are installed in the main production building (sugarhouse).

The main controller is either an Android tablet (Lenovo Yoga Tab 3, Samsung Galaxy Tab E LTE, NVIDIA Shield, Samsung Galaxy Tab A...), or a smartphone (Nexus 5, Samsung Galaxy S4, S6...). Here is a partial specification table:

	Samsung S4	Samsung S6	Samsung Tab A 8	NVIDIA Shield K1
Display size	5.0 in	5.1 in	8.0 in	8 in
Dimensions (HxWxD)	136.6 x 69.8 x 7.9 mm	143.4 x 70.5 x 6.8 mm	209.3 x 137.9 x 7.4 mm	221 x 126 x 9.2 mm
Android OS	4.2.2 (Jelly Bean), upgradable to 5.0 (Lollipop)	5.0.2 (Lollipop) upgradable to 6.0.1 (Marshmallow)	5.0 (Lollipop)	5.0 (Lollipop), upgradable to 6.0.1 (Marshmallow)
Camera	Front/Back	Front/Back	Front/Back	Front/Back
Bluetooth
NFC	.	.		

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SIM card (phone & SMS)
Micro SD
RAM	2 GB	3 GB	2 GB	2 GB
CPU	Octa-core 1.6 Ghz & 1.2 Ghz	Octa-core 2.1 Ghz & 1.5 Ghz	Quad-core 1.2 Ghz	Quad-core 2.2 Ghz
TV-out	MHL			HDMI
Battery	Li-ion 2600 mAh	Li-ion 2550 mAh	Li-ion 4200 mAh	Li-ion 5200 mAh

	Samsung S7	Samsung Tab E LTE	Lenovo Yoga Tab 3 8.0	Lenovo Yoga Tab 3 Plus
Display size	5.1 in	8.0 in	8.0 in	10.1 in
Dimensions (HxWxD)	142.4 x 69.9 x 7.9 mm	212.1 x 126.1 x 8.9 mm	209.8 x 145.8 x 7 mm	247 x 179 mm
Android OS	6.0 (Marshmallow), upgradable to 7.0 (Nougat)	5.1.1 (Lollipop) upgradable to 7.1 (Nougat)	5.1 (Lollipop)	6.0.1 (Marshmallow)
Camera	Front/Back	Front/Back	Front/Back	Front/Back
Bluetooth
NFC	.			
SIM card (phone & SMS)	.	.		
Micro SD
RAM	4 GB	1.5 GB	1 GB	3 GB
CPU	Octa-core 4x 2.3 Ghz & 4x 1.6 Ghz	Quad-core 1.3 Ghz	Quad-core 1.1 Ghz	Octa-core 4x 1.8 Ghz & 4x 1.4 Ghz
TV-out				
Battery	Li-ion 3000 mAh	Li-ion 5000 mAh	Li-ion 6200 mAh	Li-ion 9600 mAh

The following devices are compatibles and officially supported : Rugby LTE, Nexus 5, 7, 9, 10, Nvidia

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Shield. The following devices are compatibles, but without official support: Nexus 4, 6, Samsung Galaxy S2, S3, S4, S5, S4 Active, S5 Active, Sony Xperia Z2.

1.3.3 Portable computer device

The portable computer (an Android device) provides the graphical interface that allows the user to view sensor data anywhere within the area served by the system (within range of a node inside the WSN).

The computer communicates to the system via its Bluetooth connection to the handheld device.

1.3.4 Gateway

The gateway node links all system components together. It is the main device because it synchronizes nodes communication.

The main computer, the handheld node as well as all the sensors and remote controls are connected and send data to the gateway node.

1.3.5 Handheld

The handheld node is a battery operated gateway set as a sniffer of the WSN. Its purpose is to link a portable computer to the whole network. As a listener of the network, it allows the user to roam within his WSN and view data from his smartphone (portable computer).

The handheld device is connected to the gateway via the mesh network.

The portable computer is, in turn, connected to the handheld device.

1.3.6 Repeater node

The repeater node serves as a mesh network extender. Its sole purpose is to repeat the signal and relay communication over long distances. The repeater node connects to the gateway via the mesh network.

1.3.7 Vacuum sensor node

The vacuum sensor node can measure up to two different pressures when connected on a tubing system. The node is completely autonomous and operates on 3x D cells batteries (that can be easily replaced after 3-7 seasons, depending on the speed of data acquisition selected by the user).

All vacuum sensors connect to the gateway via the mesh network.

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1.3.8 Level sensor node

The level sensor provides a tank level ultrasonic measurement (the sensor head is not in direct contact with the sap). A battery operated version is available. The level sensor connects to the gateway via the mesh network.

1.3.9 Remote controls (Relay)

The remote controls node is connected to contactors and allows for remote triggering of electrical equipments (motors, pumps, etc..) and can control up to two devices. It is not battery operated. The remote controls sensor connects to the gateway via the mesh network.

1.3.10 Auxiliary inputs

The auxiliary inputs device is to be used with a 2013 or older remote controls node. The device allows the user to measure current from up to two electrical devices. It also comes with a limit switch to be used as a releaser activation counter or to view the state of a valve, for example. The auxiliary inputs device is not needed for the more recent remote controls nodes.

1.3.11 Pressure sensor node

The pressure sensor is used for the measurement of high or low pressure in liquids or harsh environments. The sensor head features a rugged stainless steel body with a NPT 1/4" termination for easy connection with standard fittings. The available measuring ranges are: (-1 bar to 0 bar), (-14 psi to 100 psi), (0 psi to 300 psi), (0 psi to 1000 psi). Other ranges are available upon request. The pressure sensor connects to the gateway via the mesh network.

1.3.12 Flowmeter sensor node

The flowmeter sensor can be used with any types of flowmeter (paddlehweels, magmeters, etc.) provided that they have conditioned pulse output. The flowmeter node can be purchased with the recommended paddlewheel or magmeter upon request. The flowmeter sensor is 100% battery operated when used in combination with the recommended magmeter. The flowmeter sensor connects to the gateway via the mesh network.

1.3.13 Refractometer sensor node

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The refractometer sensor is used for process monitoring in the control of mixing, concentration, fermentation, and control of the concentration of water-based or alkali-based detergent, etc. The sensor is not battery operated. Two versions are available: (0 - 80 Brix), (0 - 33 Brix) with temperature compensation. The refractometer sensor connects to the gateway via the mesh network.

1.3.14 Piezometer (Temperature Depth) sensor node

The piezometer sensor measures temperature and hydrostatic depth. It is commonly used for groundwater monitoring. Measurement is compensated with an on-board barometric sensor. Available ranges are 10 m, 30 m, 60 m, 120 m. Simultaneous logging on the Smartrek system and in the sensor head is possible. The piezometer sensor connects to the gateway via the mesh network.

1.3.15 Tensiometer sensor node

The tensiometer sensor measures the soil matric potential and is commonly used for precision irrigation. The measuring range is 0 to 100 cbar vacuum. The sensor can replace the analog manometer of existing tensiometers. The tensiometer sensor connects to the gateway via the mesh network.

1.3.16 Temperature sensor node

The temperature sensor connects to any PT100 probe for precise measurement of temperature. The temperature sensor connects to the gateway via the mesh network.

1.3.17 Reverse Osmosis sensor node

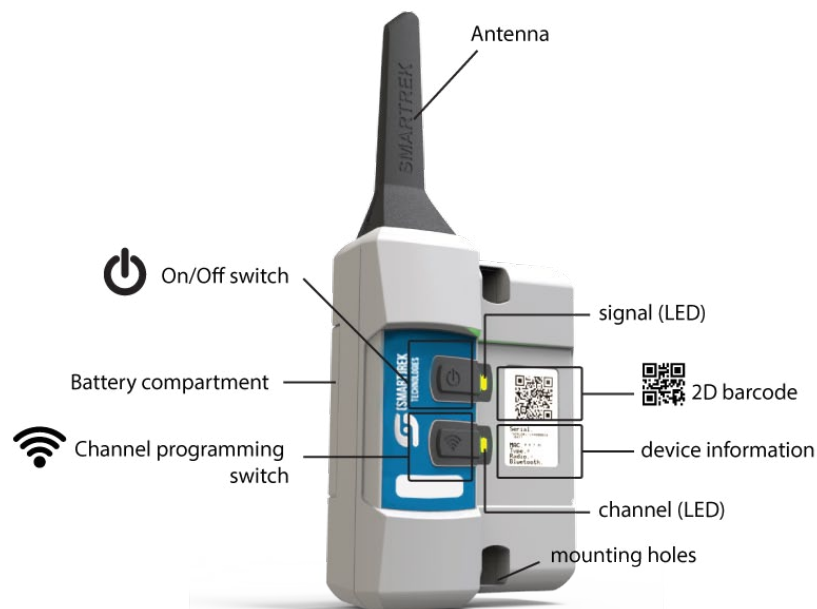
The reverse osmosis node is compatible with H2O innovation's machines. It allows for the monitoring and control of: concentration cycle, desugaring cycle, rinse cycle, wash cycle, membrane pressure, pre-filter pressure, after-filter pressure, concentrate flow, permeate flow, sugar content input, sugar content output, conductivity, current. The node is not battery operated and connects to the gateway via the mesh network.

1.3.18 High Power Ultrasonic Level sensor node

The high power ultrasonic level sensor provides level measurement of liquid, powder, pellets, etc. It features a self-cleaning cycle. It can thus measure in harsh environments (with dust and/or condensation). The level sensor connects to gateway via the mesh network.

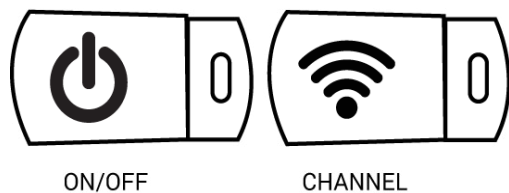
2. Sensor node

2.1 Overview of a typical sensor



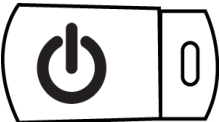

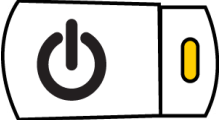

2.2 Understanding the LEDs

There are generally two switches (ON / OFF) and (PROGRAM) on most sensor node, with yellow LED indicators to view the device status.




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2.2.1 Legend icon definitions

Status	Description
	Unpressed button LED indicator off
	Pressed button LED indicator off
	Unpressed button LED indicator on
	Pressed button LED indicator on

2.2.2 Powering the device ON and OFF



Status	Description
	To power the device on, press and hold the ON/OFF button until the LED indicator blinks

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To power the device off, press and hold the ON/OFF button for 5 seconds until the LED indicators stop blinking

2.2.3 How to read the LED indicators

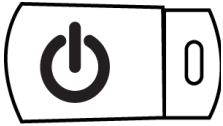
LED indicators status		Description
ON/OFF LED	Channel LED	
		

Off	Off	Device turned off
On	Off	Device in programming mode
Blinking steadily	Off	After bootup sequence: indicates proper communication with the network. Device is online
Off	Blinking steadily	After bootup sequence: indicates that the device is turned on but cannot communicate with the network. Device is offline
	Blinking	At bootup: the number of flashes indicates the channel number to which the device belongs (i.e. 3 flashes indicates that the device is programmed on channel number 3)

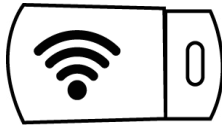
2.2.4 Normal boot sequence

Smartrek monitoring

ON/OFF LED



CHANNEL LED



Device is off

ON/OFF LED

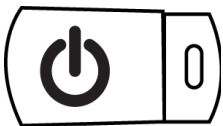


CHANNEL LED



Press the (ON/OFF) button.
The ON/OFF LED indicator turns on and blinks

ON/OFF LED

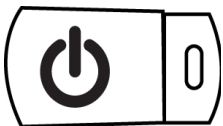


CHANNEL LED



The Channel LED indicator turns on and flashes to indicate the channel number to which the device belongs

ON/OFF LED



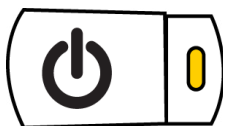
CHANNEL LED



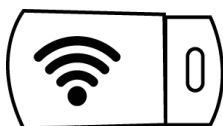
After initial blinking sequence, both LED indicators turn off. Then, the Channel LED flashes three times every few seconds: the device is attempting connection to the network

Smartrek monitoring

ON/OFF LED



CHANNEL LED



The ON/OFF LED indicator turns on and blinks steadily: the device is now connected to the network and the LED indicator blinks whenever the device is exchanging data

2.2.5 Programming a node on a channel

All nodes are factory set to channel 1. All nodes that must communicate with a given gateway (installed in the main building) must be configured on the same channel as that gateway.

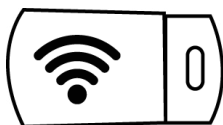
Changing the channel of a given network can be necessary in the case that:

1. The user wants to have multiple independent networks for a given operation with multiple locations
2. When there might be conflicting networks (with neighbors)

ON/OFF LED



CHANNEL LED



The device is OFF

ON/OFF LED



CHANNEL LED



Press and hold the Channel switch, then press the ON/OFF switch to power up the device

Smartrek monitoring

ON/OFF LED

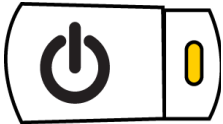


CHANNEL LED



Wait for the Channel switch LED indicator to light up, indicating that the node has successfully entered programming mode

ON/OFF LED

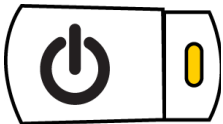


CHANNEL LED



Release both switches

ON/OFF LED



CHANNEL LED



Press the Channel switch the required number of times corresponding to the number of the network on which the device must be programmed

ON/OFF LED



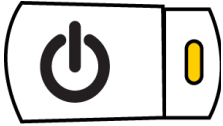
CHANNEL LED



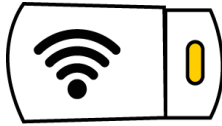
Press again the Channel switch, holding it down. The ON/OFF LED indicator blinks to indicate the end of programming.

Smartrek monitoring

ON/OFF LED



CHANNEL LED



The ON/OFF LED is lit and Channel LED indicators blink to indicate the new channel number (e.g. 3 blinks = channel 3)

ON/OFF LED



CHANNEL LED



Wait 5 seconds, then turn the device off by pressing and holding the ON/OFF button for 5 seconds

Turn the device on again and watch the Channel switch LED indicator blinking sequence to ensure that the unit has been reprogrammed properly

Smartrek monitoring

2.3 Changing the batteries

Most battery operated sensors are powered by 3 D-cells alkaline batteries. The batteries can last up to 5-7 years, depending on the type of sensor and the data polling rate.

When the battery level indicator on the Android device displays a low battery icon (🔋) or flat battery (🔋), the batteries should be replaced:

Touch an electrical ground to discharge any lingering body static electricity (see Section xx for the detailed procedure) before opening a node to avoid damage from electrostatic discharge into the electronic board.

1. With a Phillips screwdriver, unscrew the lid
2. Remove flat batteries



Avoid touching the electronic board!

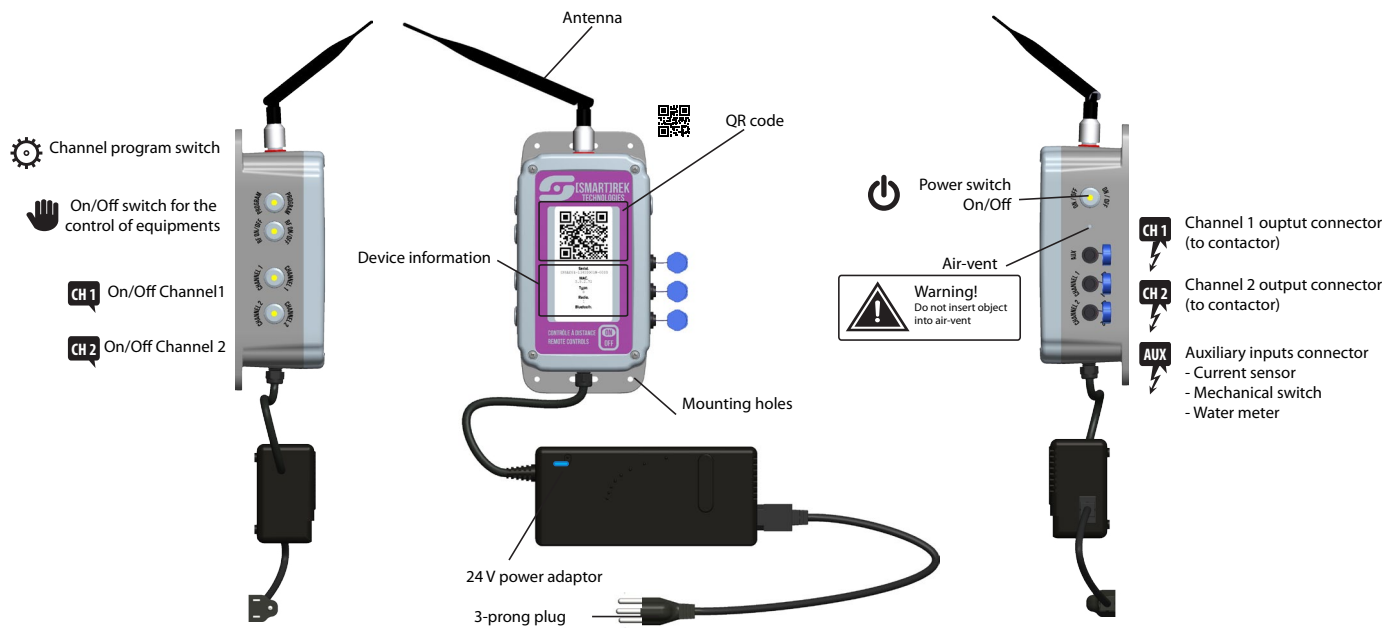
3. Replace with new D-cells batteries
4. Close the lid
5. With a screwdriver, tighten the screws (do not overtighten)

The use of an electrical device to tighten the screws is not recommended. The threaded brass insert may become dislodged.

3. Relay (remote controls)

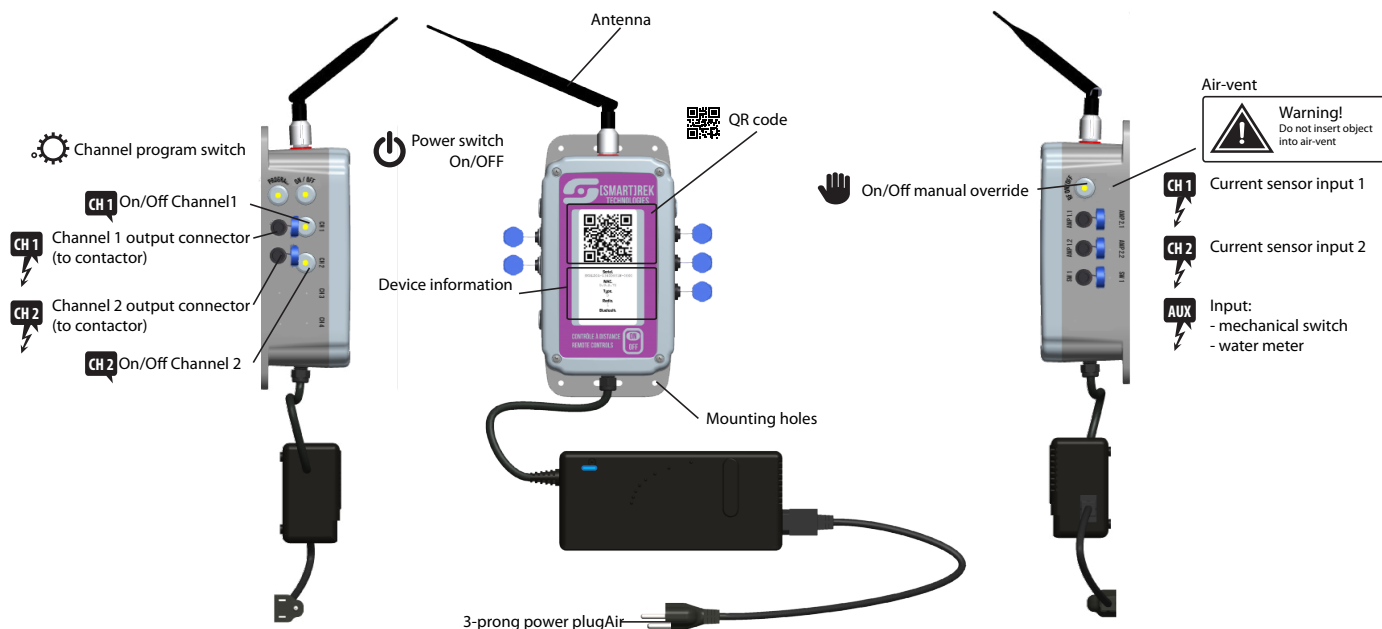
3.1 Overview (2013 model)

Smartrek monitoring



3.2 Overview (2015 model)

Smartrek monitoring



3.3 Warnings



Avoid touching electronic board and components

Possible failure of electrostatic sensitive components



Do not insert object into air-vent

May compromise weatherproofness of the device



For sensors that require the installation of an antenna, grease generously the antenna connector with the provided dielectric silicone grease MG 8462
<http://www.mgchemicals.com/products/greases-and-lubricants/dielectric-grease/silicone-8462/>

To ensure proper system operation in humid environment










Smartrek monitoring



When screwing the lid on, do not use high-torque drills. It is suggested to use a screwdriver

May dislodge the threaded brass inserts

Smartrek monitoring

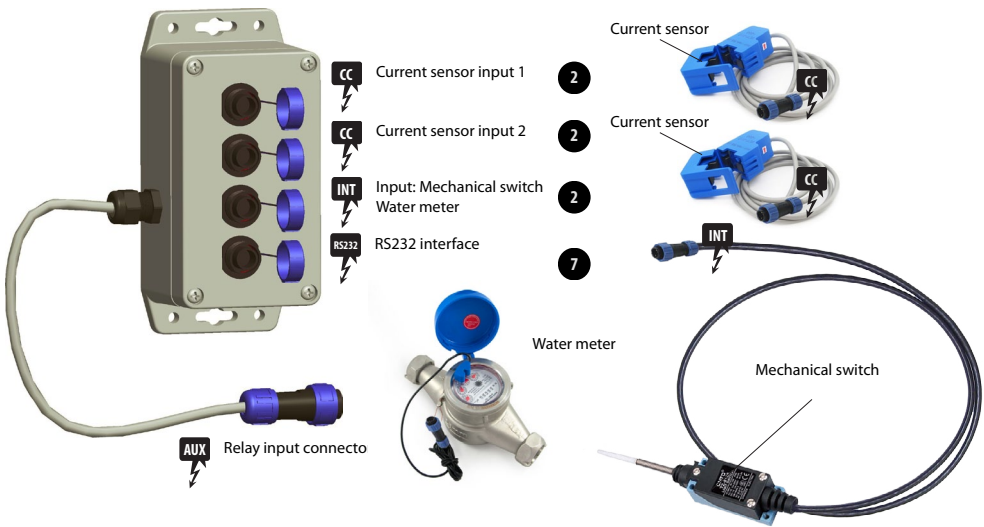
	12A		18A		32A	
Contactor						
	Spec.	Fuji 12A 3-pole 24VDC 43mm	Spec.	Fuji 18A 3-pole 24VDC 43mm	Spec.	Fuji 32A 3-pole 24VDC 54mm
	Model	SC-E03G- 24VDC	Model	SC-E04G- 24VDC	Model	SC-E1G- 24VDC
	Sug. Price	36.50 \$	Sug. Price	43.00 \$	Sug. Price	56.00 \$
Surge protector						
	Spec.	24-48 AC/DC	Spec.	24-48 AC/DC	Spec.	24-48 AC/DC
	Model	SZ-Z1	Model	SZ-Z4	Model	SZ-Z31
	Sug. Price		Sug. Price		Sug. Price	29.00 \$
Thermal overload						
	Spec	9-13A	Spec	16-22A	Spec.	24-36A
	Model	TK-E02-1300	Model	TK-E02-2200	Model	TK-E02-3600
	Sug. Price		Sug. Price		Sug. Price	51.00 \$



3.4 Available inputs for the Remote Controls device (Relay)

All Remote Controls devices released prior to 2013-2014 have an Auxiliary Inputs connector that can be connected to the box of the same name, which enables the use of several accessories (such as current sensors, mechanical switches, water meter).







All models released after 2014 are not meant to be used with the Auxiliary Inputs Box. All Remote Controls accessories can be directly connected to the node.

Available Remote Controls accessories are :



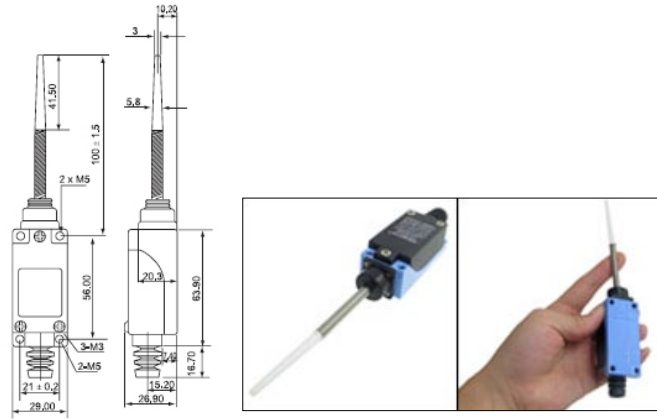
	100 A	200 A	
Current sensor			

Smartrek monitoring

	(Call for more information)	(Call for more information)	
	limit	fluid level trigger	Other...
Mechanical switch			
	(Call for more information)	(Call for more information)	(Call)
	NPT 3/4"	NPT 1"	
Water meter			
	(Call for more information)	(Call for more information)	
	NPT 1 1/2"	NPT 2"	
			
	(Call for more information)	(Call for more information)	

3.4.1 Mechanical limit switch

Smartrek monitoring



3.4.2 Current sensor 100A

Current transformers (CTs) are sensors that measure alternating current. The split core type as the CT in the picture above, is clipped onto either the live or neutral wire coming into the electrical equipment. The sensor cannot be clipped to both wires at the same time (the measured current will be 0). A connector is attached to the other end of the sensor for the connection to the Remote Control unit. The measured current might not fit with readings from other devices (such as multimeters, ammeters, etc.) as both devices may not measure the same thing. To get comparable measurements, set both devices on same measurement quantity: effective current (RMS), peak current, or peak-to-peak. The measurement type can be set within the Smartrek app in the Cfg. tab, under Units.



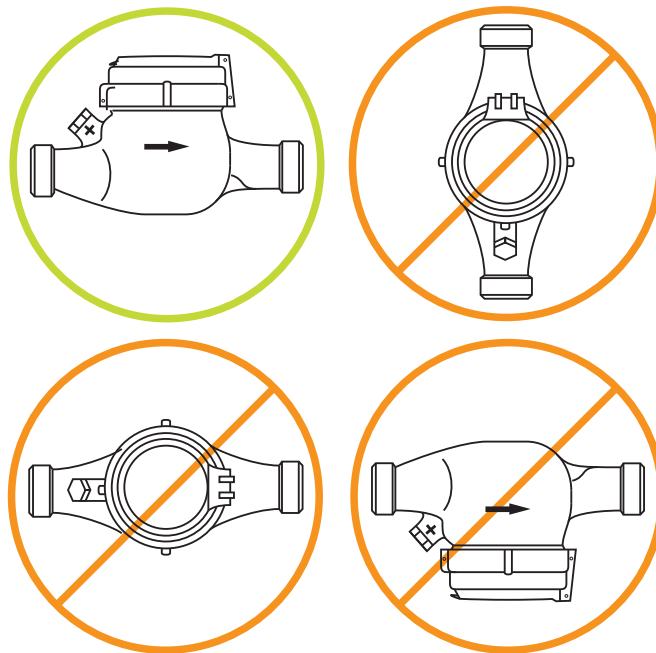
Smartrek monitoring

3.4.3 Water meter

The water meter measures the water volume flowing through the pipe on which it is mounted. It can be used standalone or with a Remote Control unit for the remote monitoring.

Installation

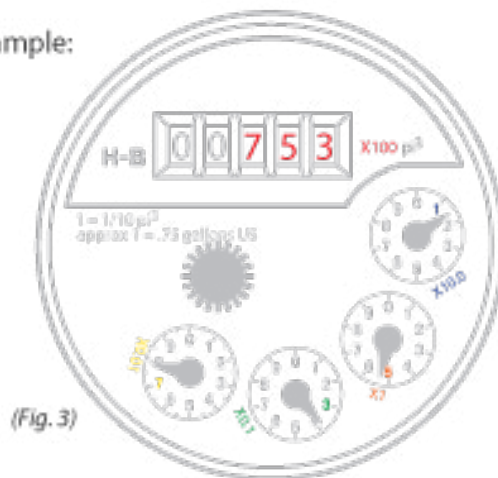
1. Install horizontally with the dial facing upwards
2. Use teflon tape or pipe dope when connecting pipe fittings to the meter's NPT threads.



To read the meter on the face dial:

Smartrek monitoring

Example:



(Fig. 3)

$$\begin{aligned} & (753 \times 100) \\ & + (1 \times 10) \\ & + (5 \times 1) \\ & + (3 \times 0.1) \\ & + (7 \times 0.01) \\ & = 75,315.37 \text{ ft}^3 \end{aligned}$$

$$75,315.37 \times 1 = 75,315.37 \text{ ft}^3$$

$$75,315.37 \times 7.48052 = 563,398.09 \text{ US gallons}$$

$$75,315.37 \times 0.0283168 = 2,132.69 \text{ m}^3$$

$$75,315.37 \times 28.3168 = 2,132,693.78 \text{ L}$$

Conversion Multipliers:

Cubic Feet: x1

US Gallons: x 7.48052

Cubic Meters: x 0.0283168

Liters: x 28.3168

Overview of the Sugarheld App

The Sugarheld app allows Android devices to connect to the Smartrek system for data reading and for configuration and remote control of the system.

The Sugarheld app was reported to be compatible with many **not recommended and/or unsupported** Android smartphones and tablets.

The minimum requirements of an Android device for use with the Sugarheld App:

1. Android OS 4.0+ (ICS, Ice Cream Sandwich)
2. Bluetooth 2.0+
3. Wi-Fi
4. Camera
5. Can accept microSD cards, or has an emulated SD storage space (such as in Nexus tablets)
6. GPS

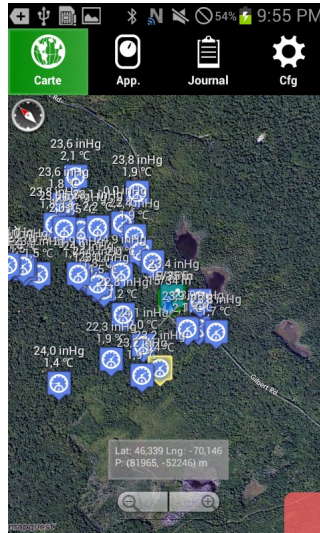
Smartrek technologies is *not liable* for any bugs or malfunction of the application/system when used with a non recommended/unsupported device.

3.5 Overview of the Map tab

The Map tab shows the road map or satellite map with the Smartrek System. All nodes can be displayed


Smartrek monitoring

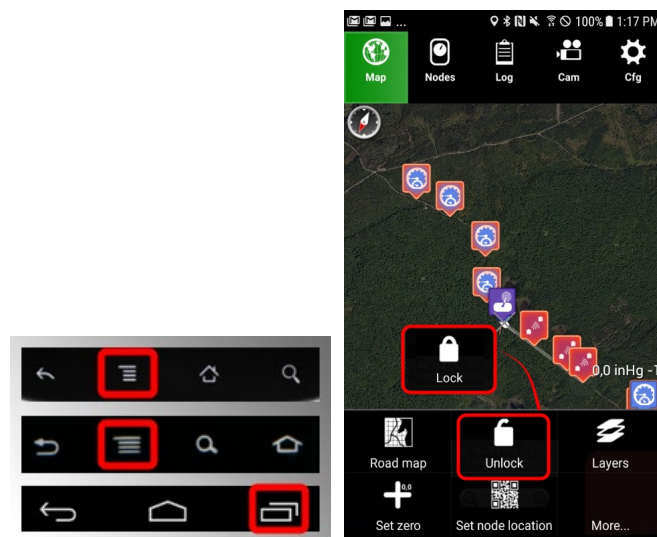
at their scanned location.





3.5.1 Downloading road and satellite maps

Road and satellite maps are downloaded into the microSD card from the Android device:

1. Press the menu button on the android device. Then unlock the auto-centering feature of the map on the current GPS position of the Android device by tapping the icon .



Smartrek monitoring

2. Use the magnifying glass tool and finger drag on the map to move it around so that the cursor (X) is centered on the map location to be downloaded. Alternately, it is possible to position the cursor with it being locked on the GPS location, which will be indicated by a blue pawn icon, in which case said cursor will be forced on top of said blue pawn icon.
3. Press the Menu button, then tap Set Zero. This will set the system center to the chosen geographical location.
4. Download the base map. Press the menu button. Tap More ... and Cache base map to download the base map to the memory card (the Android device must be connected to internet). Downloading the map can take several minutes, depending on internet connectivity.
5. To download the satellite map, switch to Sat Map if the map is currently on Road map (toggle the  icon). Press the menu button. Tap More... and Cache sat map to download the satellite map to the memory card (the Android device must be connected to internet). Downloading the map can take several minutes, depending on internet connectivity.
6. To download the road map, switch to Rd Map if the map is currently on Sat map (toggle the  icon). Press the menu button. Press More... and Cache road map to download the road map to the memory card (the Android device must be connected to internet). Downloading the map can take several minutes, depending on internet connectivity.

The map tiles are now in the following Android device directories:

- Smartrek/CachedMaps/Mapquest, for the road map
- Smartrek/CachedMaps/MapquestSat, for the satellite map



If currently applied theme is MODERN, then the following buttons will be reversed:

Smartrek monitoring



- Satellite Map/Road Map
- Lock/Unlock

For example, if the Unlock button is pressed, then the map will unlock from the current GPS position.

3.5.2 Map display options

The displayed map can either be a road map or a satellite map. To change the map type:

Theme LEGACY:

1. Press the Menu button. Toggle the Sat map icon  to switch from the satellite map to a road map. Or toggle the Road map icon  to switch from the road map to a satellite map

Theme MODERN:

1. Press the Menu button. Tap on Sat Map to switch to satellite map. Tap on Road Map to switch back to the road map.

3.5.3 Transferring maps to another Android device

Once downloaded to an Android device, the map configuration (map zero) can be transferred to another device :

Method 1 - Wi-Fi transfer


Press the menu button. Touch More ... ,and tap Transfer... to send the map to another device via wi-fi (both devices have to be connected to the same network)

Method 2 - NFC transfer

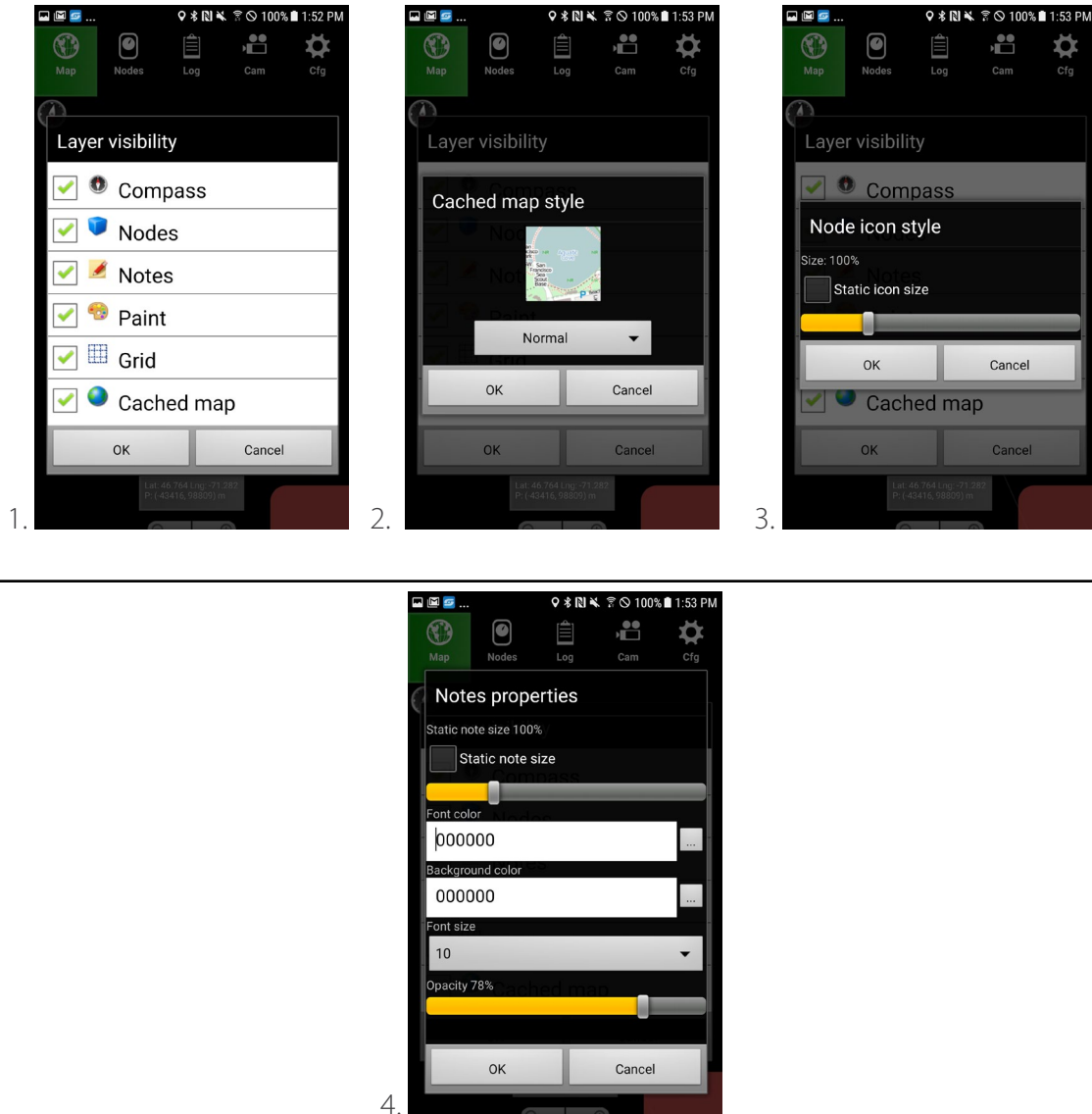
In the Map tab, put the two Android devices back to back and tap the center of the screen of the device that is holding the maps in its memory card.

3.5.4 Other display options

The displayed items in the Map tab can be customized:

1. Press the Menu button. Tap the Layers icon . Check all options to be displayed.
2. Each layer can be configured using advanced options. To do so, long press one of those layers in order to view configurable options. A few available options are: grid color, map image filters, node icon size, note appearance customization etc.

Smartrek monitoring

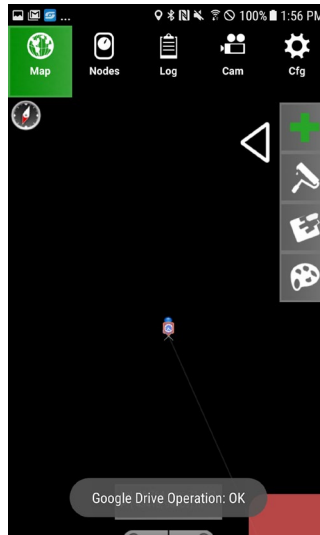





3.5.5 Drawing on a map


To manually draw on the map or to draw by the GPS location, show the drawing tool:

Press the Menu button. Tap More... and then tap Show paint editor. The ◀ icon appears on the right side of the map. Tap the icon and swipe to the left to open the paint menu.

Smartrek monitoring



When activating the Brush tool , tracing on the map begins. Colour, transparency and brush diameter can be chosen in the palette tool . The eraser tool  is used to erase drawings manually.

If the map is locked  on the Android device GPS location, then the Brush tool draws a line corresponding to the path of the Android device. To draw the mainlines by the GPS location, activate the Brush tool, lock the map and start walking the mainlines with the Android device in hand.

To erase the entire drawing, press the Menu button, then tap More... erase the Clean paint.

3.5.6 Deferred map download

A given road/satellite map can be downloaded at any location, even if the Android device used to do so is not on site (a case where the GPS chip fails to indicate the right location to initialize the zero coordinates of the map), even if manually align the cursor on an empty map proves to be too difficult a task to accomplish. To do so:

1. Make sure that the device has Internet access. Then, go to Google Play, and find an app called Fake GPS.
2. Install and open said app.
3. By default, the device development option checkbox 'Mock locations' is not enabled. If that is the case, the app will warn user of this problem, in which case, tap OK.
4. The device configuration pane will open, in the Debugging sub-section of the Developer options.

Smartrek monitoring

Find the item 'Mock locations', and check that item.

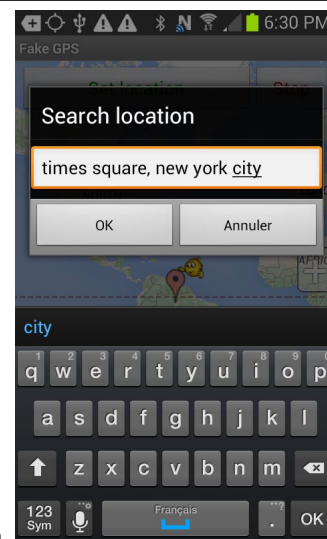
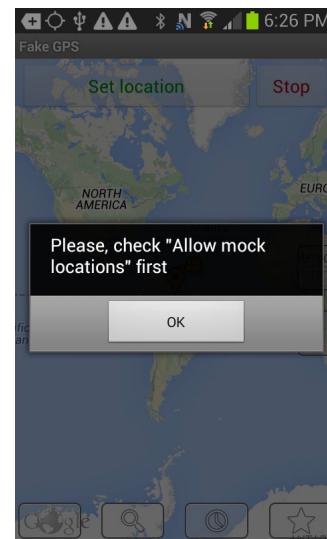
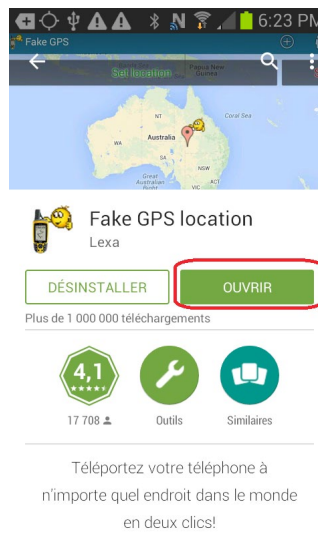
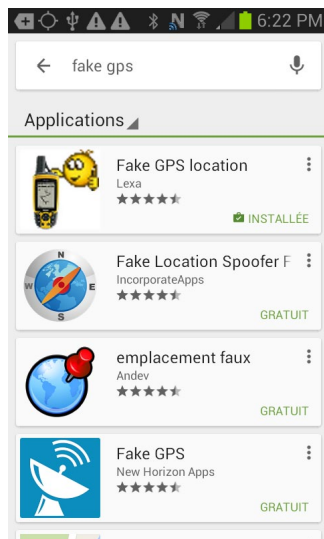
5. Press Back, then tap the magnifying glass icon.

6. Enter the desired map address. The red position icon will be set to the GPS coordinates of that map address, if everything goes according to plan.

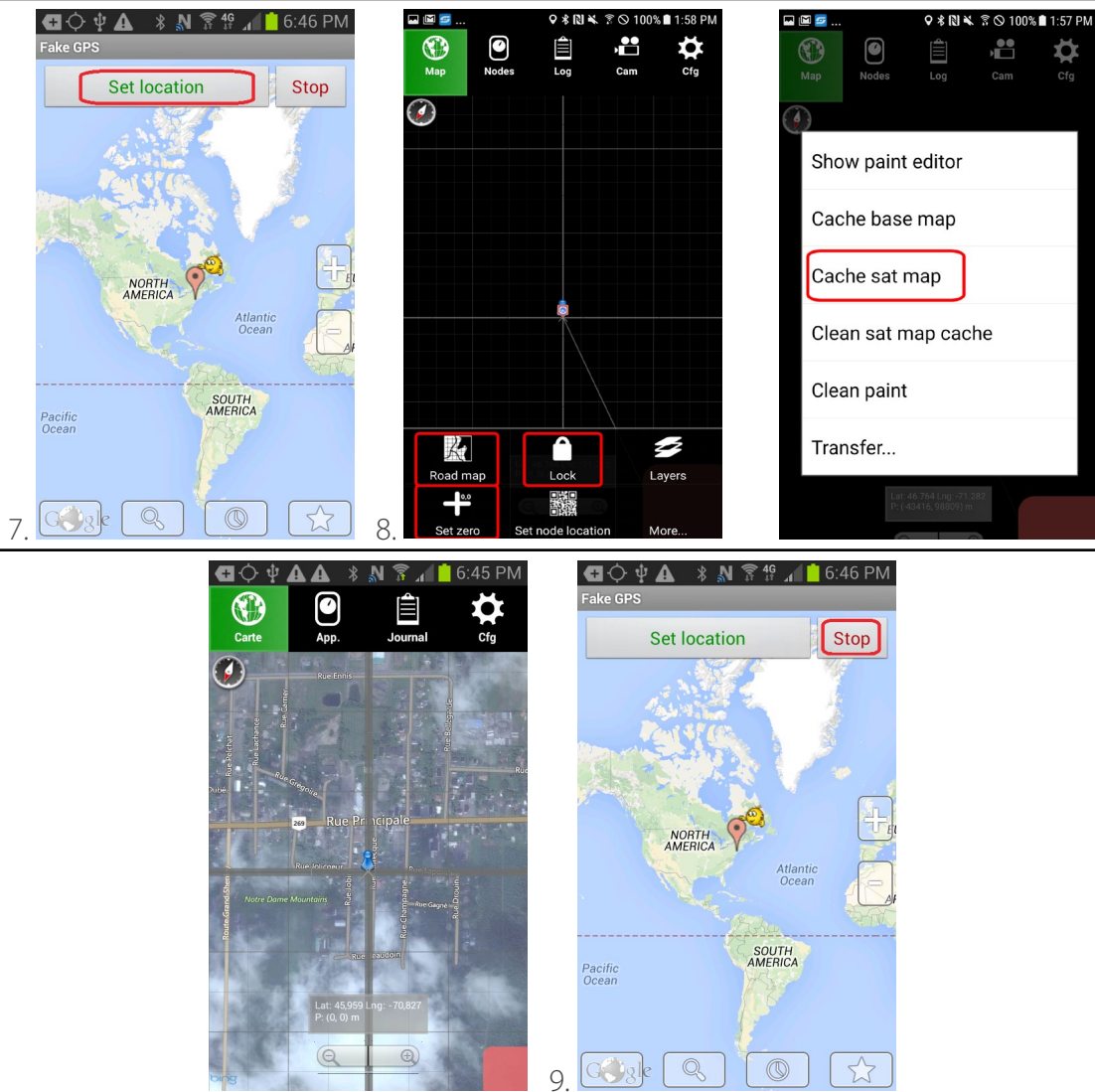
7. Tap Set Location.

8. Go back to Sugarheld, and follow the normal download procedure as outlined previously (with the map tab locked to the GPS).

9. Go back to Fake GPS, and tap Stop.

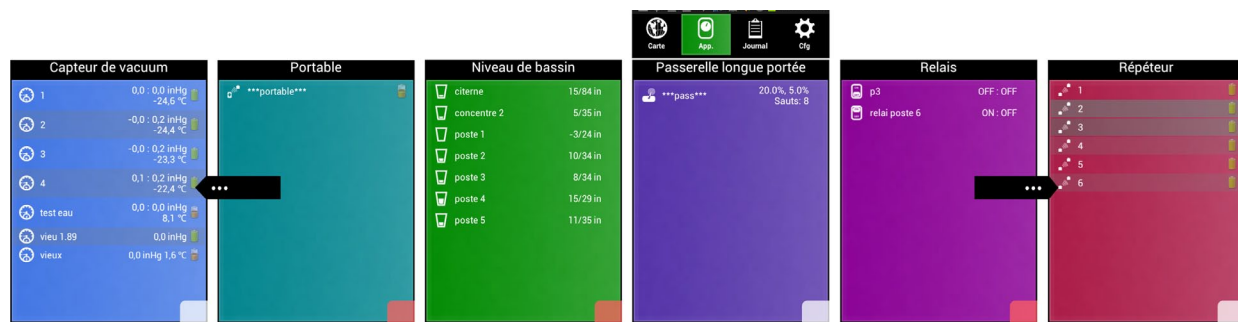


Smartrek monitoring



3.6 Overview of the App tab


Data recorded from all nodes are displayed in the App tab.




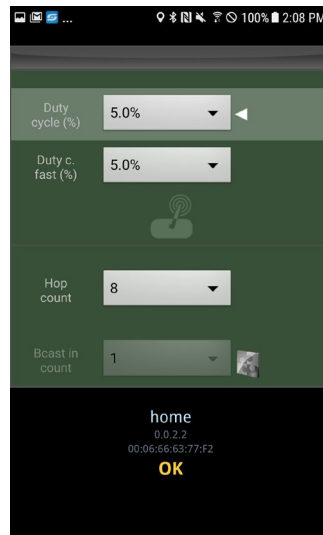
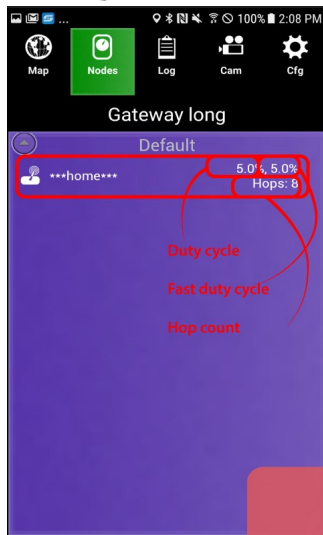
Swipe the screen left to right or right to left to view another device type.

Smartrek monitoring

Touch a node (row) to view its detailed information and readings.

To view the history of a node over time, tap the  icon and enter the starting (most recent) date of the data to be fetched, then tap Apply. Note that the History option in the Cfg (config pane) must be enabled (see Section xx).

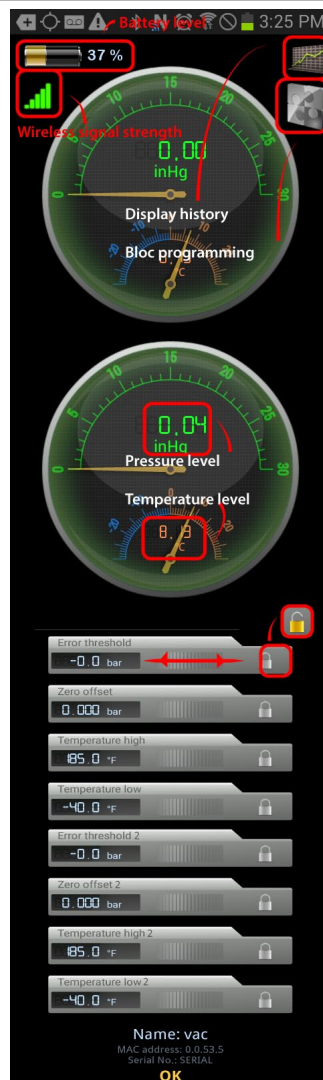
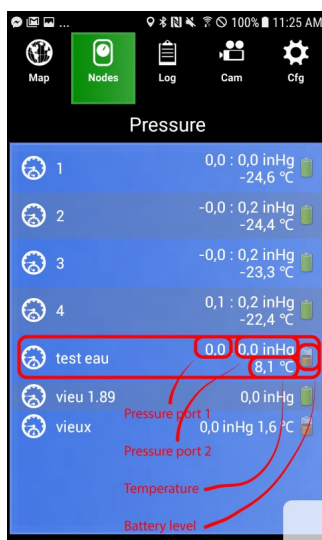
To automate the system using sensor readings, the programming pane can be accessed by tapping on the  icon.



Gateway Node

Refer to Section 5.4 Configuring the gateway for detailed information on how to setup the gateway.

Smartrek monitoring




Pressure/Vacuum/Tensiometer/ Temperature sensors

To calibrate a pressure/tensiometer/
vacuum/temperature sensor, let's look at
the example of the vacuum sensor. Open
the details page of the vacuum sensor,
press the Menu button, then tap the Set
zero option.

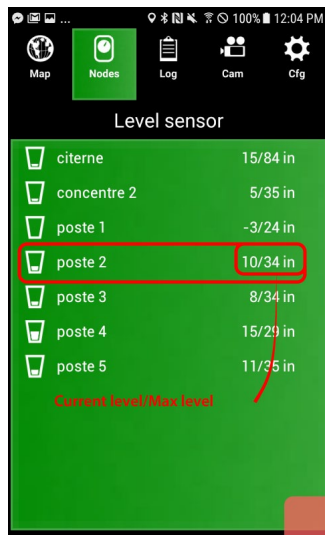
To reset calibration to factory default, press
the Menu button, then tap Reset to default
option.



Calibration can also be done manually by
unlocking the adjustment widget  :

- Error threshold & Error threshold 2 to
configure vacuum alarms thresholds
- Zero offset & Zero offset 2 to calibrate
vacuum sensors
- Temperature high & Temperature low, to
set the temperature alarms thresholds

Smartrek monitoring

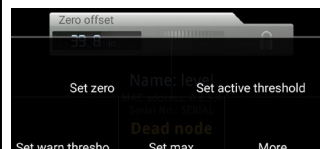



Level sensor

To calibrate the empty and maximum level of a tank level sensor, press the Menu button, then tap the Set zero and Set max options.

To calibrate the alarms thresholds, tap Set warn. threshold.

To calibrate the fast refresh threshold, tap Set active threshold. Once the tank level has reached the fast refresh threshold, the gateway will enter its fast duty cycle mode so that data from that level can be refreshed more often.



Calibration can also be done manually by unlocking the adjustment widget  :

- Error threshold to configure the maximum tank level allowable
- Warning threshold to set the level alarm threshold
- Fast polling threshold to configure the level that triggers the gateway fast refresh mode (fast duty cycle)
- Zero offset to configure an empty tank

Smartrek monitoring

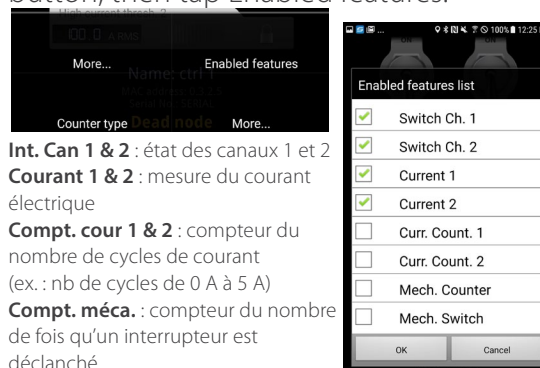


Relay (Remote controls) sensor

Channels CH1 et CH2 of the relay device are remotely controlled using the switch.



To select alternate features, press the Menu button, then tap Enabled features.



Int. Can 1 & 2 : état des canaux 1 et 2

Courant 1 & 2 : mesure du courant électrique


Compt. cour 1 & 2 : compteur du nombre de cycles de courant (ex. : nb de cycles de 0 A à 5 A)

Compt. méca. : compteur du nombre de fois qu'un interrupteur est déclenché

Int. méca. : état d'un interrupteur mécanique

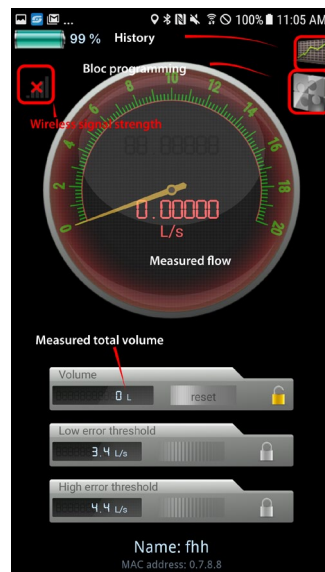
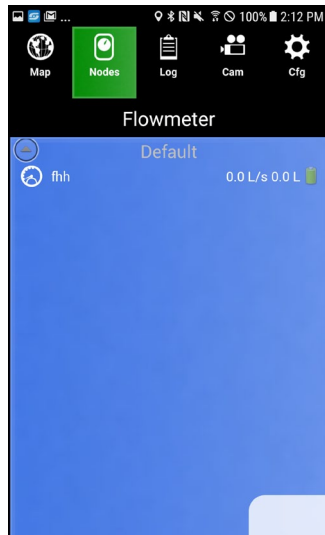
If a counter is used, select whether it is a mechanical or water counter in the menu under Counter Type.

Automation programs can be selected and applied by tapping the Select firmware option.

Calibration of the alternate/auxiliary inputs alarms can be done manually by unlocking the adjustment widget .

Smartrek monitoring

Smartrek monitoring



Flowmeter sensor

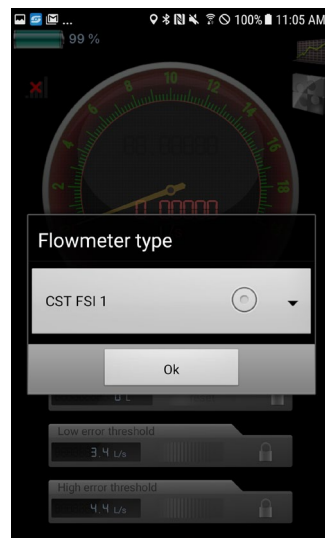
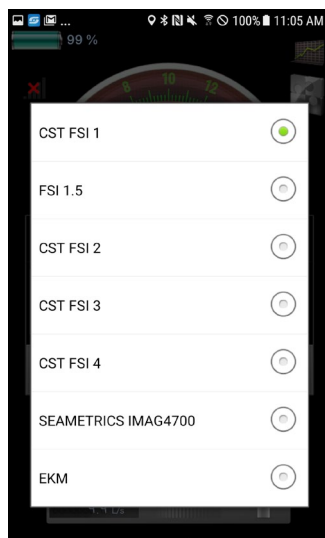
The flowmeter sensor node can be used with any flowmeter sensor provided that it has properly conditioned adjustable pulse output. CST paddlewheels flowmeters and Seametrics IMAG4700 magmeters are two supported flowmeter sensors available with the Smartrek system. The user has to configure the flowmeter node by choosing the right type of sensor that is connected to the node:


- CST FSI (1", 1.5", 2", 3", 4" diameters)
- SEAMETRICS IMAG4700

Additionally, for most magmeters including the SEAMETRICS IMAG4700, the pulse output has to be configured in the magmeter itself to:

- 0.1 gpm/pulse (US gal)

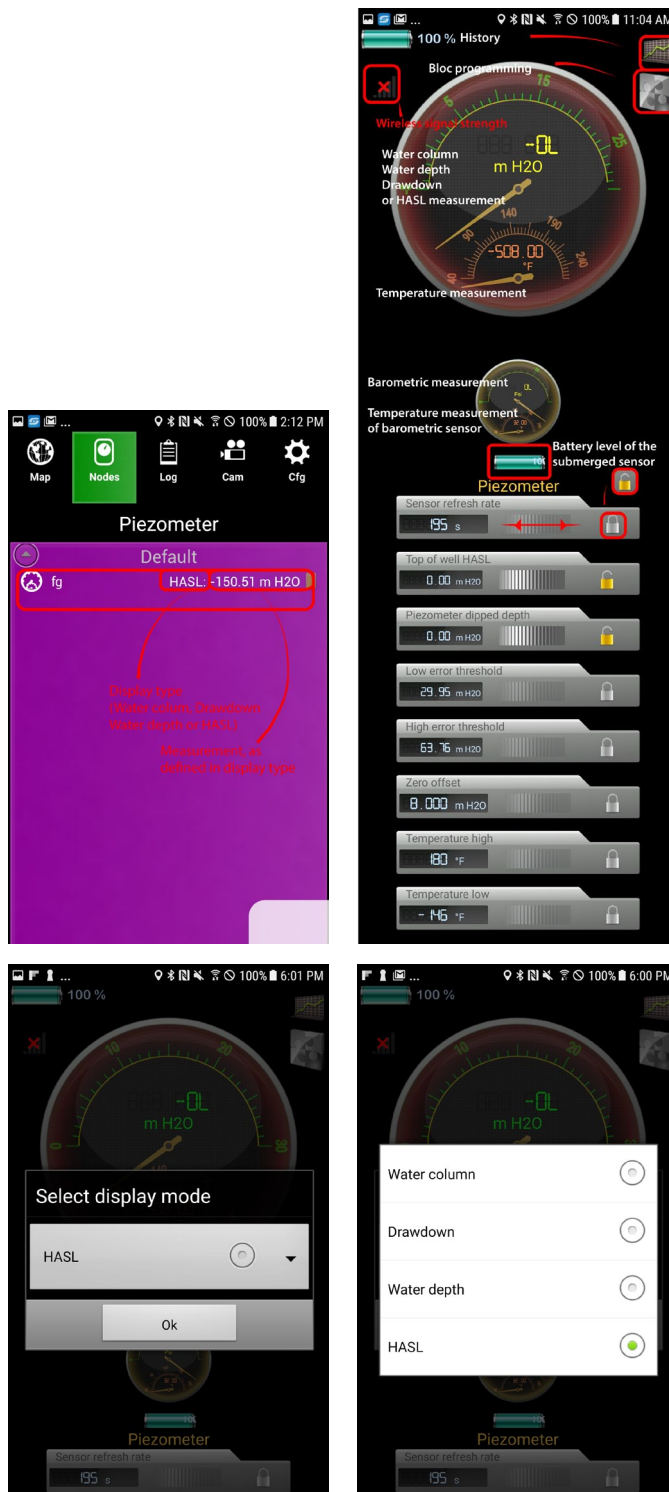
To reset the total volume counter, press the Menu button, then tap Reset zero or use the reset button under the flowmeter gauge after unlocking the lock.



Thresholds can be modified by unlocking the adjustment widget , then change

- Low flow error threshold
- High flow error threshold

Smartrek monitoring

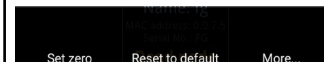


Piezometer sensor (Temperature/Depth)


The piezometer sensor node measures both temperature and hydrostatic pressure that is displayed in height H2O. That height is compensated by an internal barometric sensor. The value displayed can be set to:

- Water column
- Water table depth
- Drawdown
- HASL (height above sea level)

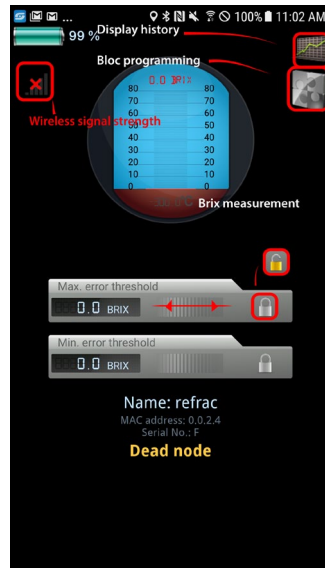
The display mode is changed by opening the Menu, then tap on More... and select Select display mode. Then, choose the desired display mode.



The values required to calculate depth/drawdown/HASL should be input in the fields under the gauges (Top of well HASL, Piezometer dipped depth, Nominal water table height, Max. depth, depending on display mode)

These values as well as the thresholds can be modified by unlocking the adjustment widget  and inputting the new values. Zero calibration of the sensor is also done using the same method.

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Refractometer sensor

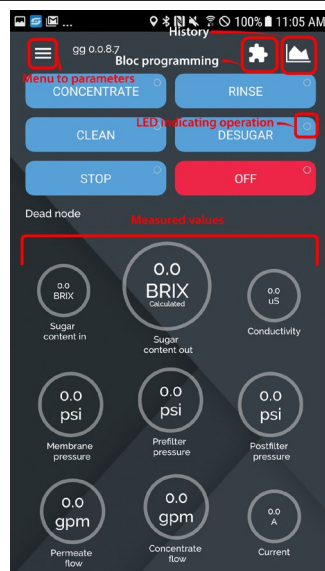
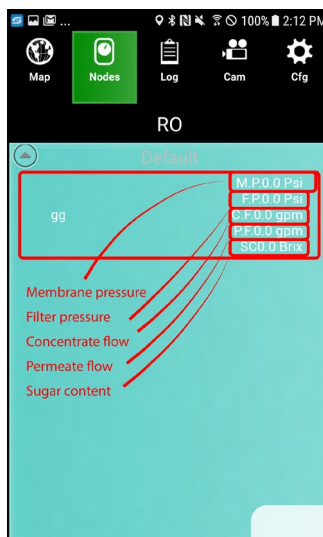
To set the temperature unit of the refractometer, open the details page of the refractometer sensor, press the Menu button, then tap the Set T unit option.

To set the scale of the refractometer gauge in the Android App, press the Menu button, then tap Set Scale and enter the upper scale value.



Adjustment of the thresholds can be done manually by unlocking the adjustment widget  :

- Max error threshold
- Min error threshold

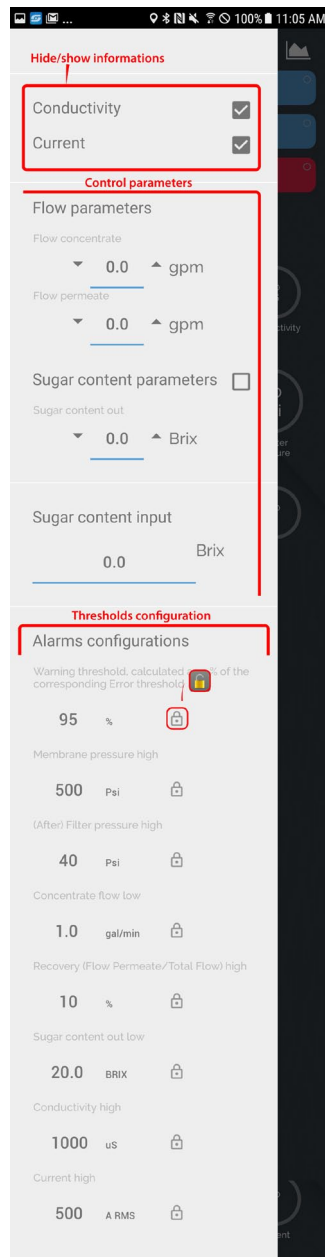


Reverse Osmosis sensor

To start/stop a reverse osmosis cycle, open the details page of the sensor and tap on the corresponding button: Concentration, Rinse, Clean, Desugar, Stop, Off. The LED at the top right corner of the button indicates that the cycle is in progress. A green LED indicates normal operation.

To change the controlling parameters of the RO and the alarm thresholds, tap on the menu icon at the top left corner of the page

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Reverse Osmosis sensor (continued)

The parameters menu contains 3 sections.

1) The conductivimeter and current sensor are optional on the RO automation unit. You can show/hide parameters if they are not of interest.

2) The control parameters. When inputting a new value, the RO sensor will send a command back to the RO machine in order to change its operation to the specified value. The control options are:

- Concentrate flow
- Permeate flow
- Sugar content output

The sugar content input has to be entered manually whereas the sugar content output can be either calculated or measured if a refractometer is connected to the RO automation unit.


3) The alarms thresholds limits can be set in the third section. There are two alarms level: warning and error. The warning threshold is set as a percentage of the error value.

Available thresholds are: High membrane pressure, High after filter pressure, Low concentrate flow, High recovery, Low sugar content output, High conductivity, High current.

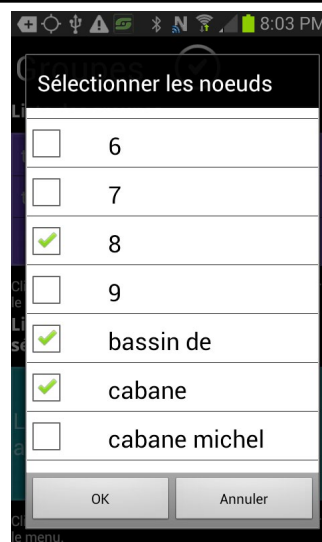
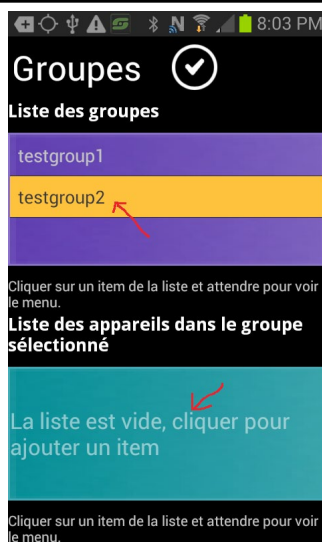
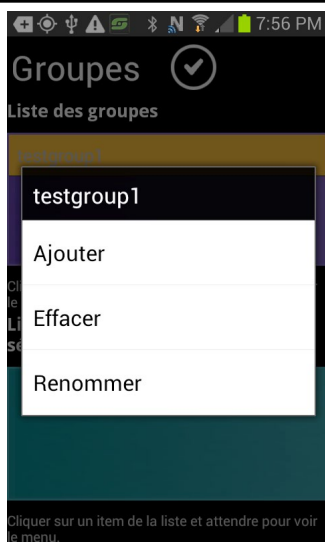
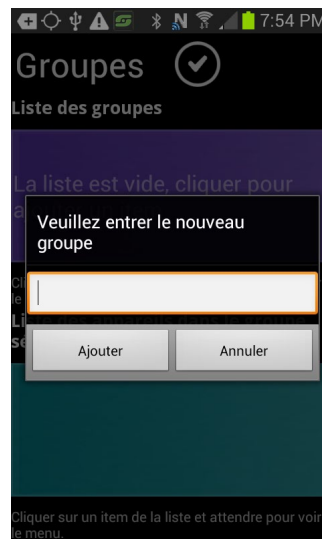
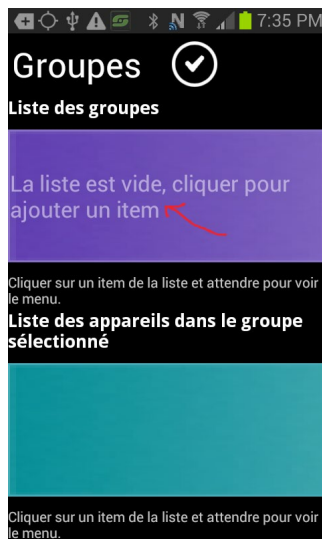
3.7 Node grouping

3.7.1 Group settings

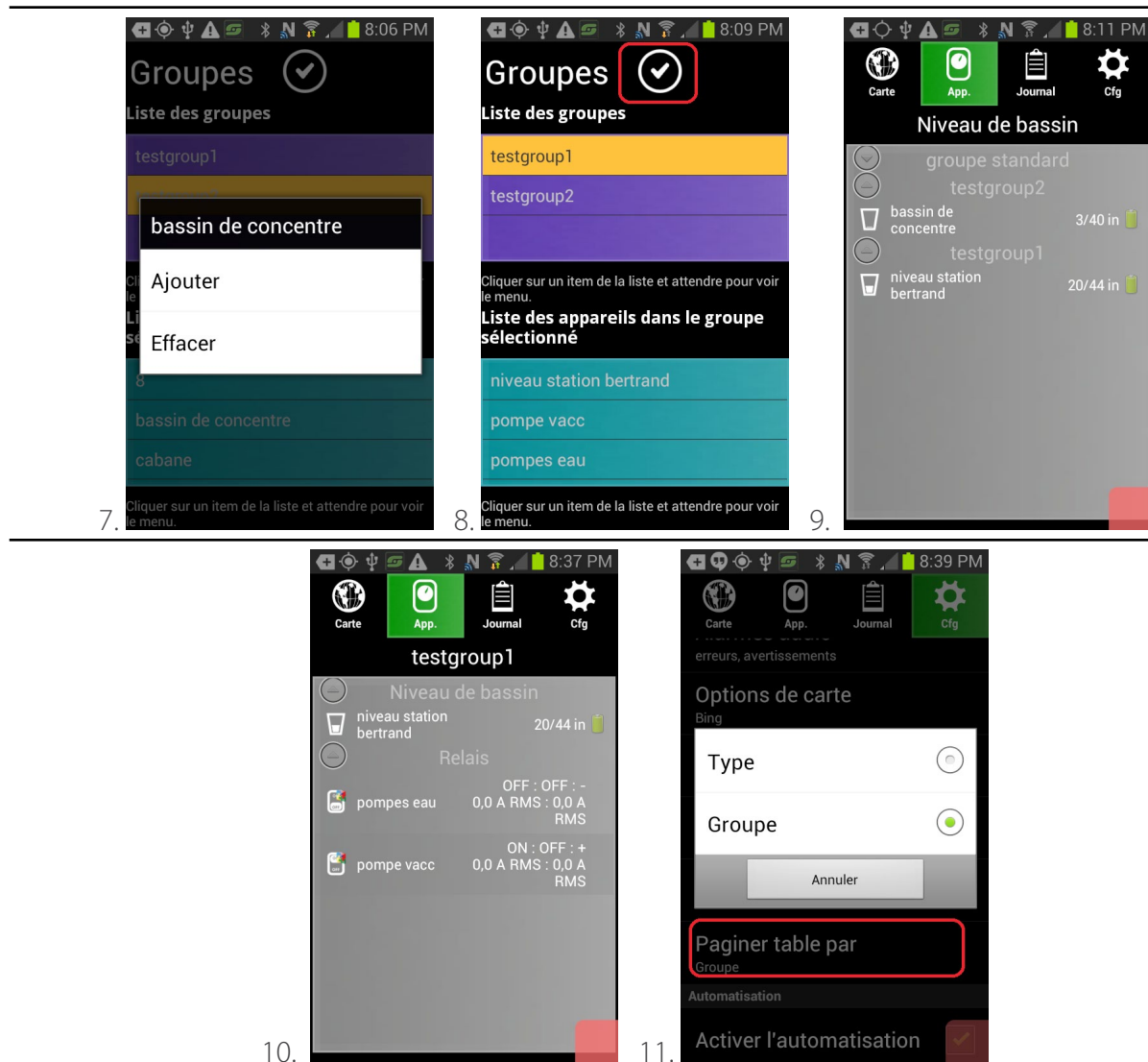
The App tab can also organize sensors into groups. To do so, the following procedure applies:

1. Press the Menu button. A menu appears. Tap on Groups.
2. If the group list is empty, long press on "The list is empty click to add an item". A dialog appears to add a new group.
3. Enter the group name, and tap OK to confirm.
4. If the group list is not empty, long press a group item. An option context list will appear, allowing to either add a group, erase the selected group, or rename said group.
5. After groups are properly entered, tap on a specific group. This will select that group. If no sensor is linked to that group, a message will appear in the bottom list, allowing to add sensors to it ("The list is empty click to add an item").
6. After tapping on this message, a sensor list will appear. Simply check sensors that are to be linked to this group, and uncheck the rest. Tap OK to confirm.
7. If there are already sensors in the bottom list, long press on a sensor. An option list will appear to either add other sensors or to erase the currently selected sensor.
8. To confirm changes, tap the top right button.
9. Sensors will now be separated according to their groups in each page, if page segregation mode is by type. Each group section can be expanded or collapsed by tapping on the little arrow icon near a given group name.
10. If the page segregation mode is by group, then each group will have its own page, and sensors will be separated in collapsable sections within a page by type instead.
11. Note: to change page segregation mode, go in the Cfg tag (configuration)  and modify the following preference: "Page table by".

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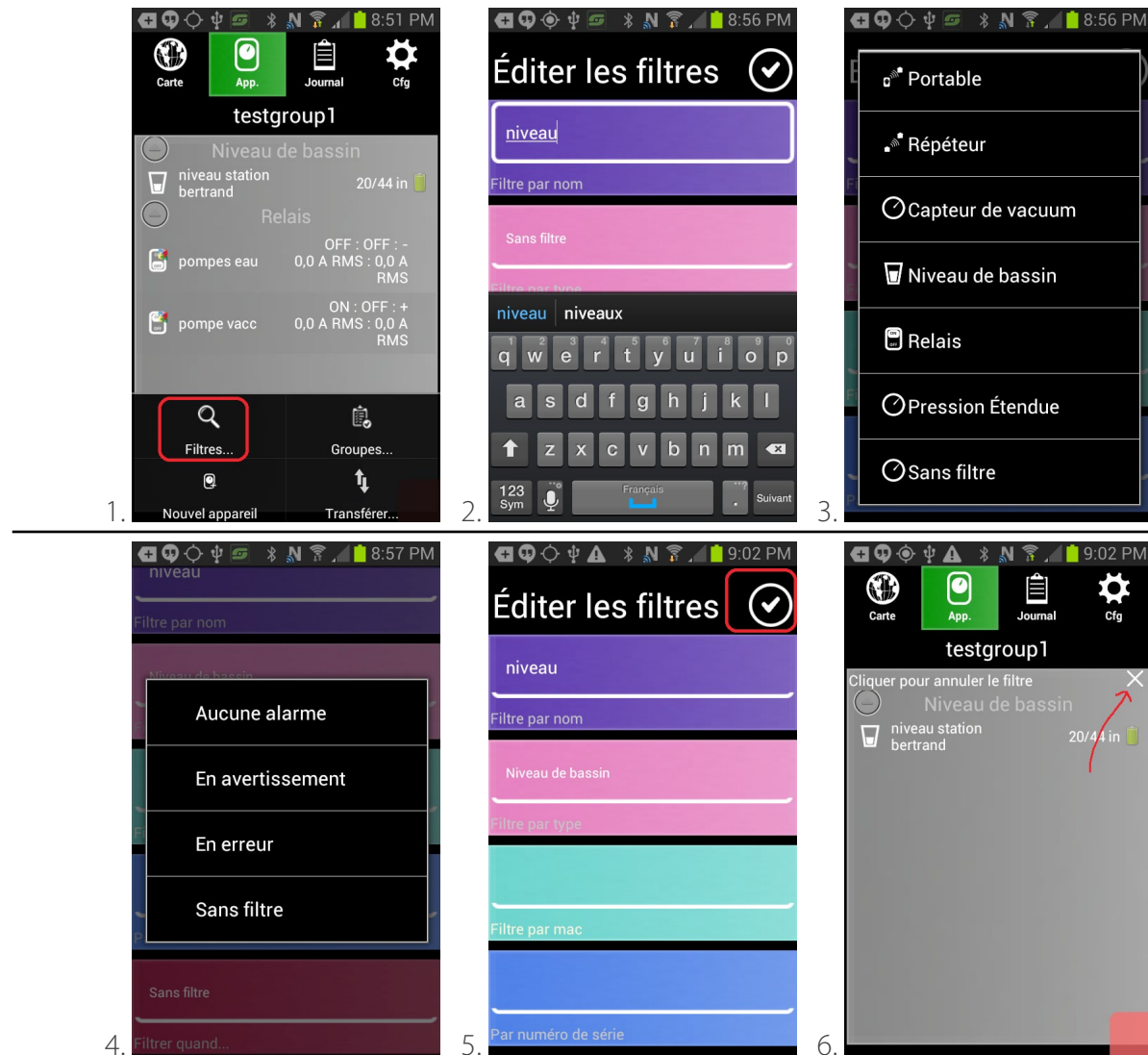
3.7.2 Table filtering

The principal table allows filtering in order to facilitate management and sensor analysis by the user. Here is a typical procedure to activate a filter:

1. Press the Menu button. A menu appears. Tap Filters...
2. A set of fields appear, with many filtering options. For text fields, filtering will be applied as follows: any item containing the word defined in the filtre (case sensitive) will be listed in the table.
3. Filtering can also be done by sensor type/group. In that case, go to the field "Type/Group filter" and select the right filter setting. Choose "No filter" to remove that filter.

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4. Alarm filters can also be set up, by selecting the desired alarm type. Choose "No filter" to remove that filter.
5. After filters are configured properly, tap the button on the top right of the screen to accept changes.
6. To remove an active filter, simply click on the X on the top right corner of a table page.



4. Installing the Sugarheld app

This section describes the required steps to install the Sugarheld application on an Android smartphone or tablet. Recommended Android devices are listed in Section 1.3.2.

4.1 Getting started

1. Have the Android device on which the application has to be installed on hand
2. If the device is used for the first time, follow the instructions to configure first use and to synchronize the device with an email account (refer to the device documentation)

4.2 Transferring the installation file to the device

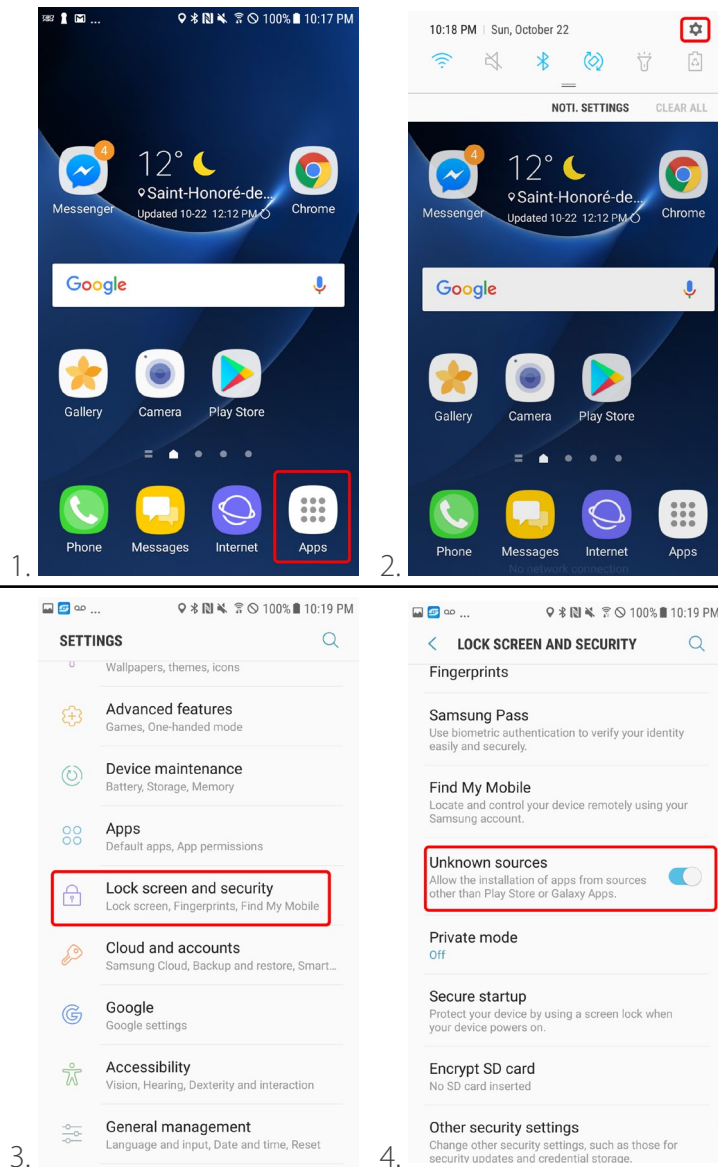
1. Turn the Android device On.
2. Connect the Android device to a computer using the provided USB cable
3. Transfer the installation file into the device using a file explorer

If the device is connected to the Internet, the installation file `NwkBasestation.apk` can be downloaded directly from the web. The following sections will describe this in more detail.


4.3 Configuring security options of the Android device

1. In the main Menu, tap the App icon (applications, actual icon appearance varies from device to device)
2. Find and tap the Settings icon
3. Tap on Security option
4. Enable "Unknown Sources to authorize the installation of an application that wasn't downloaded from Google Play Store".

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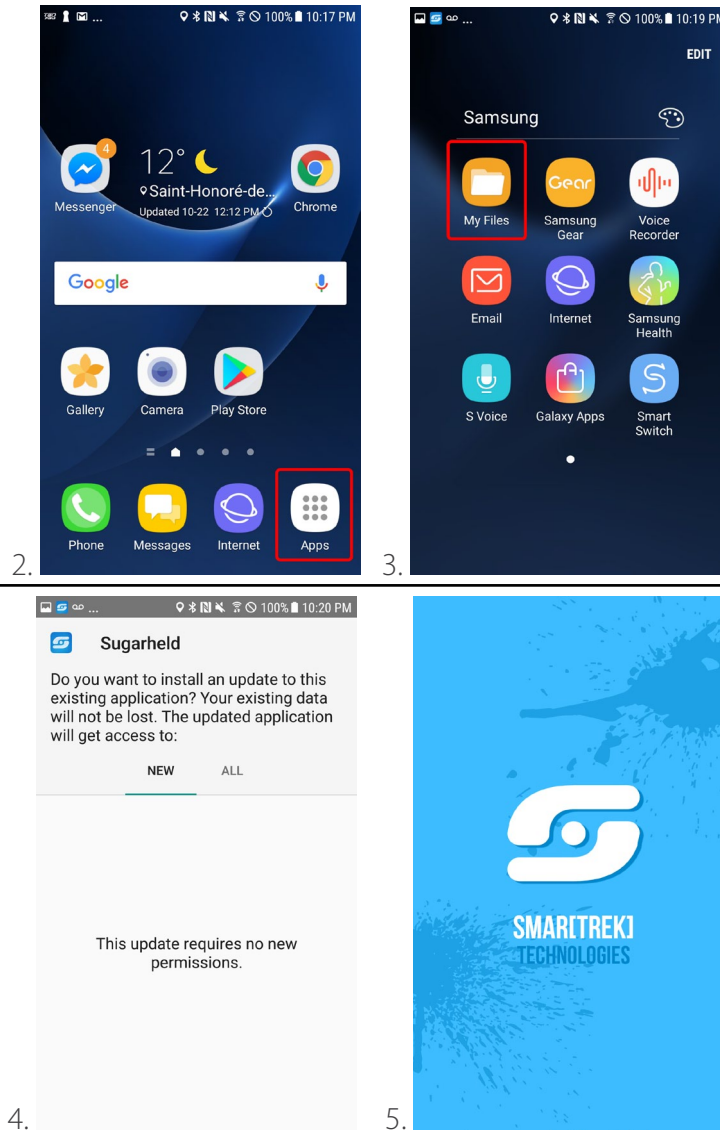


4.4 Installing the Sugarheld app from a file from a local computer

1. Go to the main menu by pressing the home  button of the Android device
2. Tap the App (applications) icon
3. Tap the My files icon
4. Find the installation file NwkBaseStation.apk in the folder where it has been transferred from the local computer
5. Tap on the NwkBaseStation.apk file to launch the installation. Grant permissions to the application.
6. The application is successfully installed after a few seconds when the confirmation message appears.
7. The application launches. After the initial splash screen, the app is up and running on the App. tab.

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To shut down the application, press the Back button on the Android device. To reopen, look for the Smartrek Sugarheld icon in the App drawer (applications).



Installing the Sugarheld app from the web

With a working internet connection on the Android device, the Sugarheld application can be installed directly from the web.

1. Open the Android device Browser
2. Open the website <http://www.smartrektechnologies.ca/download>, by copying the former web

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address

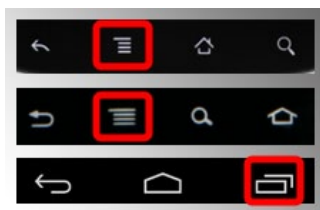
3. Scroll down and Click on the download icon (arrow) of any file with name beginning with NwkBaseStation
4. The download will start. You can follow the progression of the download in your tablet's/ smartphone's notification bar.
5. Once completed, click on the downloaded file to open the installation file

4.5 Launching the Sugarheld app


Before launching the Sugarheld application, verify that it is not already running. To do this, long press the Menu button (the procedure to access applications running in the background may vary depending on the device make).

Refer to the Android device user manual of the Android device to find out how to access already opened applications).

Look for the Sugarheld app thumbnail. Tap the icon to view the already running Sugarheld app.



If the Sugarheld app thumbnail is not available, the application is not currently running, in which case:

1. Return to the main menu by pressing the home  icon of the Android device
2. In the main menu, tap on the App icon (Applications)
3. Scroll for the Smartrek Sugarheld icon and tap to launch the application

5. Installing nodes to the Smartrek network

This section provides the steps to configure a new network. The network is normally configured to default channel 1 (and changes to the network channel is possible but is not normally required. Section


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5.8 explains the use of different channels).




5.1 Installing the gateway

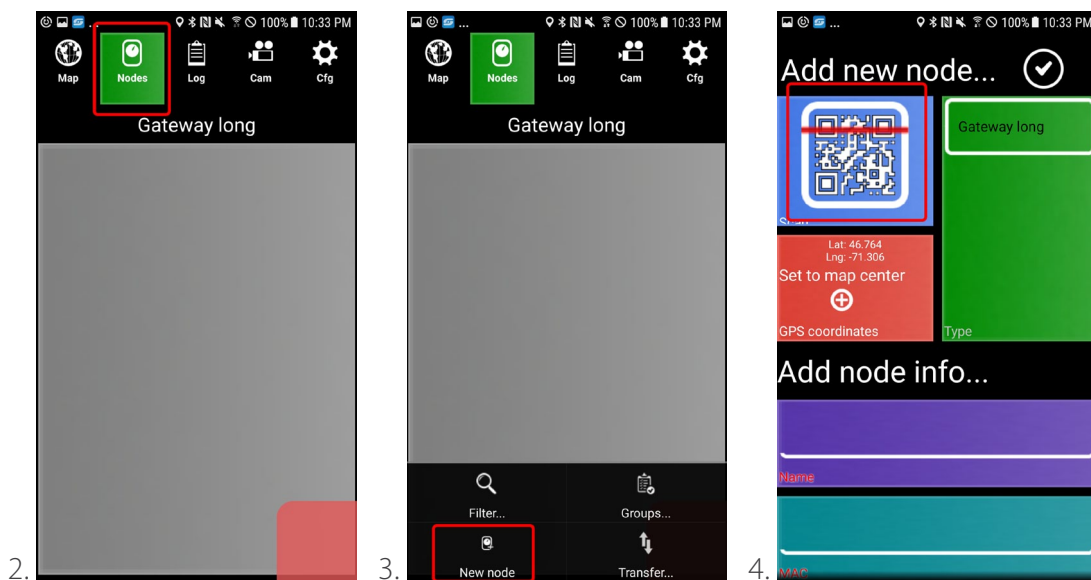
Installation of a properly configured gateway is automatically done when the Sugarheld App has been previously set up using the Installation Wizard. The Smartrek system may also be purchased with the gateway pre-installed and pre-configured. If that is the case, you will already notice a gateway device in the Gateway Long page such as pictured in step 7 below. If the gateway has not been prepared yet, then follow the next steps or launch the Installation Wizard (refer to Section 6).

On the gateway:

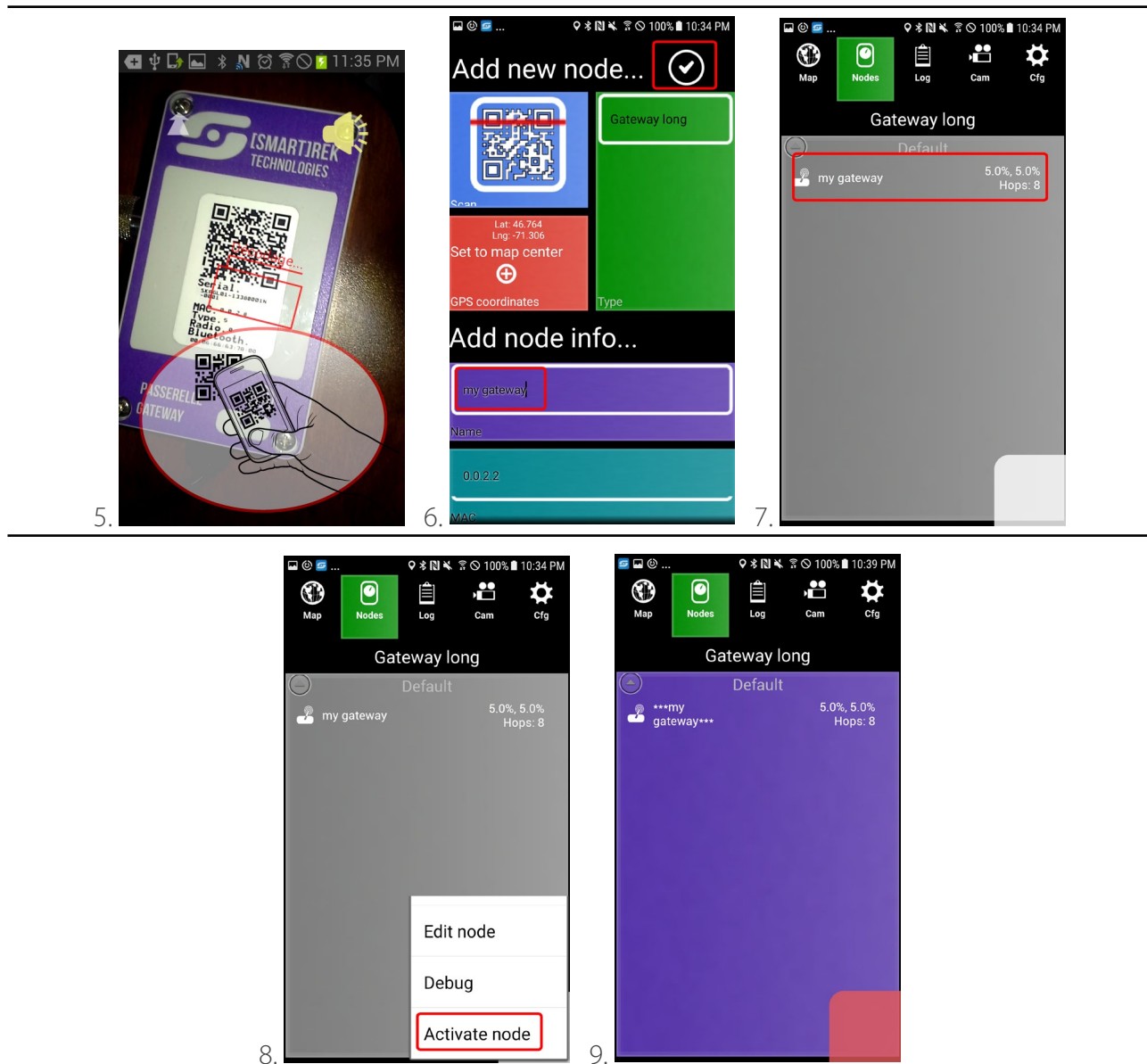
1. Generously grease the antenna connector with the provided dielectric silicone grease. Screw a whip antenna on the connector. Do not over-tighten.
2. Connect the wall plug adapter.
3. Press the  On/Off button to turn the device On.

On the main Android device (at the main building): 

1. Launch Sugarheld if it is not already running
2. Tap the Nodes tab
3. Press the Menu button on the Android device and select the Add node  option
4. Select the Scan button to scan the barcode label on the node to be added to the network 
5. Scan the barcode located on the label on top of the gateway.
6. Name the gateway by tapping the Name field, then tap the Ok button 
7. The newly installed gateway should now be listed. Long press on the gateway.
8. Tap on Activate. Tap Ok. The Sugarheld app should restart and the App pages should be coloured once the gateway is connected to the Android device.



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5.2 Installing end nodes ...

End nodes are: tank level sensors, vacuum sensors, relays (remote controls), repeaters, etc. These nodes can be installed using two different methods. Method 2 is used when a handheld device is available to check for the signal strenght of the network to place the nodes strategically.


After adding a new node to the network, for the system to acknowledge its existence, the main Android device at the main building must also be aware of that newly added node. Else, the main Android device will not send data requests to that specific node.

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5.2.1 1st Method

Make sure that the gateway is On and already installed on the network (in the Sugarheld application)

The end node:

1. Screw an antenna on the antenna connector (if needed)
2. Install the end node at the appropriate location
3. Turn the end node On by pressing the On/Off  button
4. Look for the (PROGRAM) switch LED indicator blinking sequence to verify that the node is programmed to the desired channel (it is normally programmed to channel 1). 3 blinks = channel # 3. The node must be programmed to the same channel as the gateway for communicate to happen.

In the Sugarheld app:





1. Go to the App tab, swipe left to right or right to left until the displayed page is that of the node to be installed
2. Check that the Android device is receiving GPS signals
3. Tap on the Menu button of the Android device and tap the Add node icon 
4. Select the scan node barcode button 
5. Scan node barcode, turning on the flashlight if needed 
6. Tap the Name field and name the node accordingly. Tap the Ok button 
7. The end node has now been entered in the Android device and the node icon appears in the nodes lists and on the Map tab as well.
8. Repeat steps 1-7 for all nodes to be added to the network, always using the same Android device to add/remove nodes
9. If the device used to scan the nodes is not the main Android computer (installed at the main building), you must then synchronize the new list with this Android device. To do this, put the two devices (the one that has been used to add nodes and that carries the most up-to-date nodes list and the main Android device at the sugarhouse) back to back and wait for the devices to request for database transfer. Refer to Section 5.5 for detailed instructions on ways to transfer data from an Android device to another.
10. Touch the screen of the Android device with the most up-to-date nodes lists (the device that will send its database) to transfer the nodes lists (database)
11. The Sugarheld App restarts and the main Android device has now updated its database to match the other Android device (used to scan the nodes)

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5.2.2 2nd Method

Make sure that the gateway is On and already installed on the network (in the Sugarheld application)

In the Sugarheld app:

1. With the sugarheld app already opened in the main Android device (typically the one installed in the sugarhouse or the main building) go to the App tab, swipe until the corresponding end node list appears
2. Tap on the Menu button of the Android device and tap the Add node icon 
3. Select the scan node barcode button 
4. Scan the node barcode, turning on the flashlight if needed 
5. Tap the Name field and name the node accordingly. Tap the Ok button 
6. The end node has now been entered in the Android device and the node icon appears in the nodes lists and on the Map tab as well.
7. Repeat steps 1-6 for all nodes to be added to the network, always using the same Android device to add/remove nodes


The end node:

1. Screw an antenna on the antenna connector (if needed)
2. Turn the end node On by pressing the On/Off  button
3. Look for the (PROGRAM) switch LED indicator blinking sequence to verify that the node is programmed to the desired channel (it is normally programmed to channel 1). 3 blinks = channel # 3. The node must be programmed to the same channel as the gateway for communicate to happen.
4. After waiting 10-20 seconds, the (ON/OFF) switch LED indicator blinks at the same rate as the gateway, indicating that the end node is now connected to the gateway
5. With the end node turned on and connected to the gateway (blinking) in hand, walk over to the location where the node is to be installed. Watch the blinking rate of the end node carefully. The signal strength is still good if the LED indicator does not skip more than 1 blink per 30 blinks. The end node can be placed at any location where the signal strength is good. Refer to Section 12 for detailed instructions on the node installation in the woods.
6. Install the end node at the appropriate location (see Section 12 for detailed installation guidelines)

In the Sugarheld app:

1. In the Sugarheld application, go to the App tab, swipe to node list corresponding to the end node type to be installed
2. Find the row corresponding to the node to be installed

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3. Long press the node (row) and tap on Edit
4. Check that the Android device is receiving GPS signal
5. Tap on the Place on map  icon to configure the node to the current location
(The nodes can also be manually placed on the map without the use of the GPS signal.)


6. If the device used to scan the nodes is not the main Android computer (installed at the sugarhouse or the main building), you must then synchronize the new list with this Android device. To do this, put the two devices (the one that has been used to add nodes and that carries the most up-to-date nodes list and the main Android device at the sugarhouse) back to back and wait for the devices to request for database transfer. Refer to Section 5.5 for detailed instructions on ways to transfer data from an Android device to another.

7. Tap the screen of the Android device with the most up-to-date nodes lists (the device that will send its database) to transfer the nodes lists (database)
8. The Sugarheld application restarts and the Main Android device has now updated its database to match the other Android device (used to scan the end nodes)





5.3 Installing handhelds

The handheld node operates on a rechargeable Li-Poly battery that can last up to 24 hours.

The handheld node:

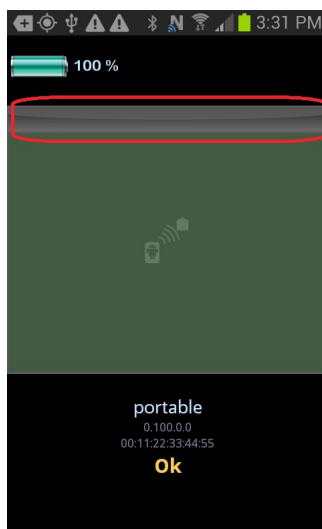
1. Generously grease the antenna connector (if applicable). Screw an antenna on the connector. Do not overtighten
2. Turn the handheld on by pressing the  switch. A LED indicator should light up inside of the enclosure.

In the Android device (typically a smartphone carried around and used outdoors):

1. Launch the Sugarheld application if it is not already opened
2. Go to the App tab.
3. Press on the Menu button of the Android device
(Refer to Section X.X) and tap on the
Add node icon 
4. Select the Scan node button 
5. Scan the node barcode, turning on the flashlight if needed 
6. Tap the Name field and name the node accordingly. Tap the Ok button 
7. The newly installed handheld should now be listed. Long press on the handheld
8. Tap on Activate. Tap Ok. The Sugarheld app should restart and the App pages should be coloured once the handheld is connected to the Android device.
9. Verify that the Android device is not using Google Drive nor DropBox. In the Cfg tab, verify that the Select Online Folder preference is set to None.

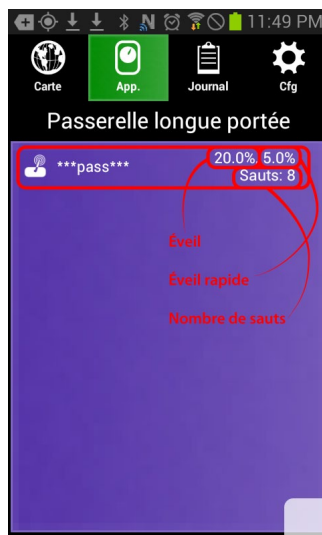
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Here is the handheld window showing its status. The seek bar on top, when flashing, shows the radio signal strength (normalized RSSI in %) of the last packet received by the device. This signal strength can widely vary if multiple packets coming from different neighboring nodes at different distances are contributing to the received signal.



5.4 Configuring the gateway


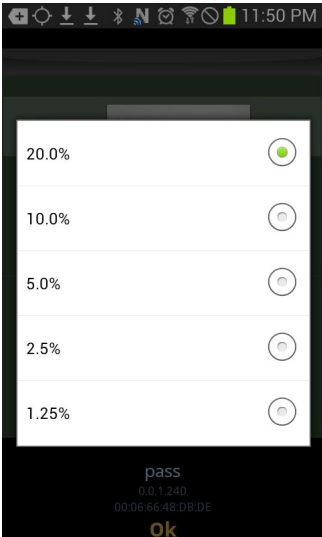
The gateway controls the network and is the master device used to manage communication within the network. The gateway must be adjusted according to the current use of the system (fast or low data rates) and its parameters should be properly configured to allow communication between nodes in the entire node deployment. To access the settings menu, tap on the row containing the gateway to be configured.




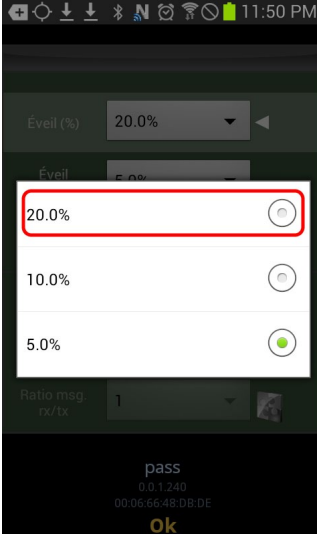
There are three configurable parameters in the gateway settings page. Tap on a given parameter to

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change its current value.

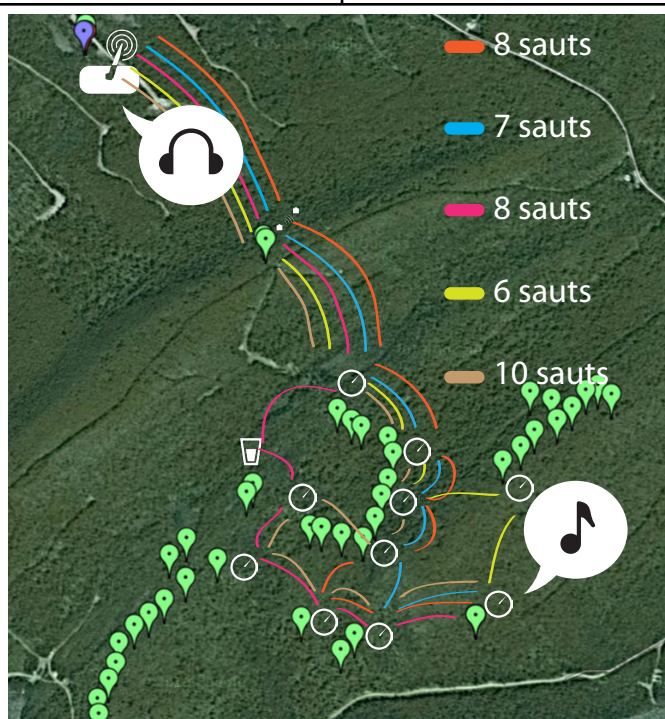
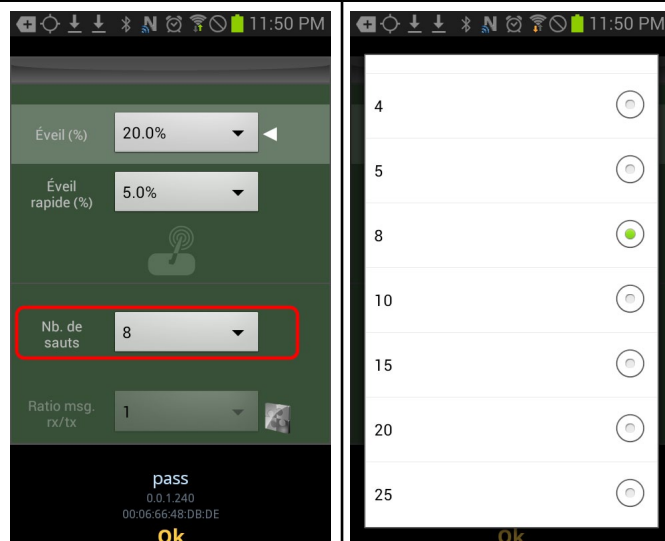
Parameter	In the app	Values	Description
Duty cycle (%)			<p>The Duty cycle (%) option sets the data acquisition rate (when the user is not requesting readings from a specific sensor node).</p> <p>For instance, at 20%, the end nodes are awake and send new data 20% of the time, and are sleeping (to minimize energy consumption) 80% of the time.</p> <p>Recommendations :</p> <p>10% à 20% : only to be used when high polling rate is required (update every second) when the system has to be used</p> <p>20% : to be used when installing new end nodes in the field, in order to rapidly assess signal strength and link quality</p> <p>2.5% à 5% : the most stable option overall, to be used when frequent data readings is not required</p>

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<p>Duty cycle fast (%)</p>			<p>The duty cycle fast (%) sets the data acquisition speed when the user requests readings from a particular device</p> <ul style="list-style-type: none">- when a sensor has reached its fast refresh threshold <p>The higher the duty cycle (%), the faster data are refreshed.</p> <p>Note that the refresh rate is at the maximum possible setting when the application is opened in the details page of a specific sensor node (excepted for gateways and handhelds).</p>
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Hop count



The Smartrek network is meshed and cooperative: every message originating from a remote sensor is flooded to the network. The message is propagated to all peers within range. These peers, in turn, repeat the message to all their respective peers within range.

Thus, the network is flooded and the message propagates toward the recipient. The number of message repetitions is the hop count.

The required hop count can be determined by trial and error. It should be noted that increasing the number of hops results in a slower refresh rate of the sensor readings. Thus, the ideal hop count is the smallest hop count that results in a stable and reliable network.

If we take, for example, the configuration on the left, the number of hops required has to be at least 10 to allow for the most distant nodes to communicate through multiple paths, for better reliability and stability.

5.5 Transferring database between two Android devices



Transferring the database between two Android devices can be done using NFC (when both devices are NFC enabled) or using Wi-Fi (when there is an available network).

The most up-to-date database has to be in the gateway-bound Android device for the system to work properly.


5.5.1 1st Method, using NFC

Backup the old database on the Android device that will receive the new database (see Section 5.6) if necessary. This table can be restored in the future.

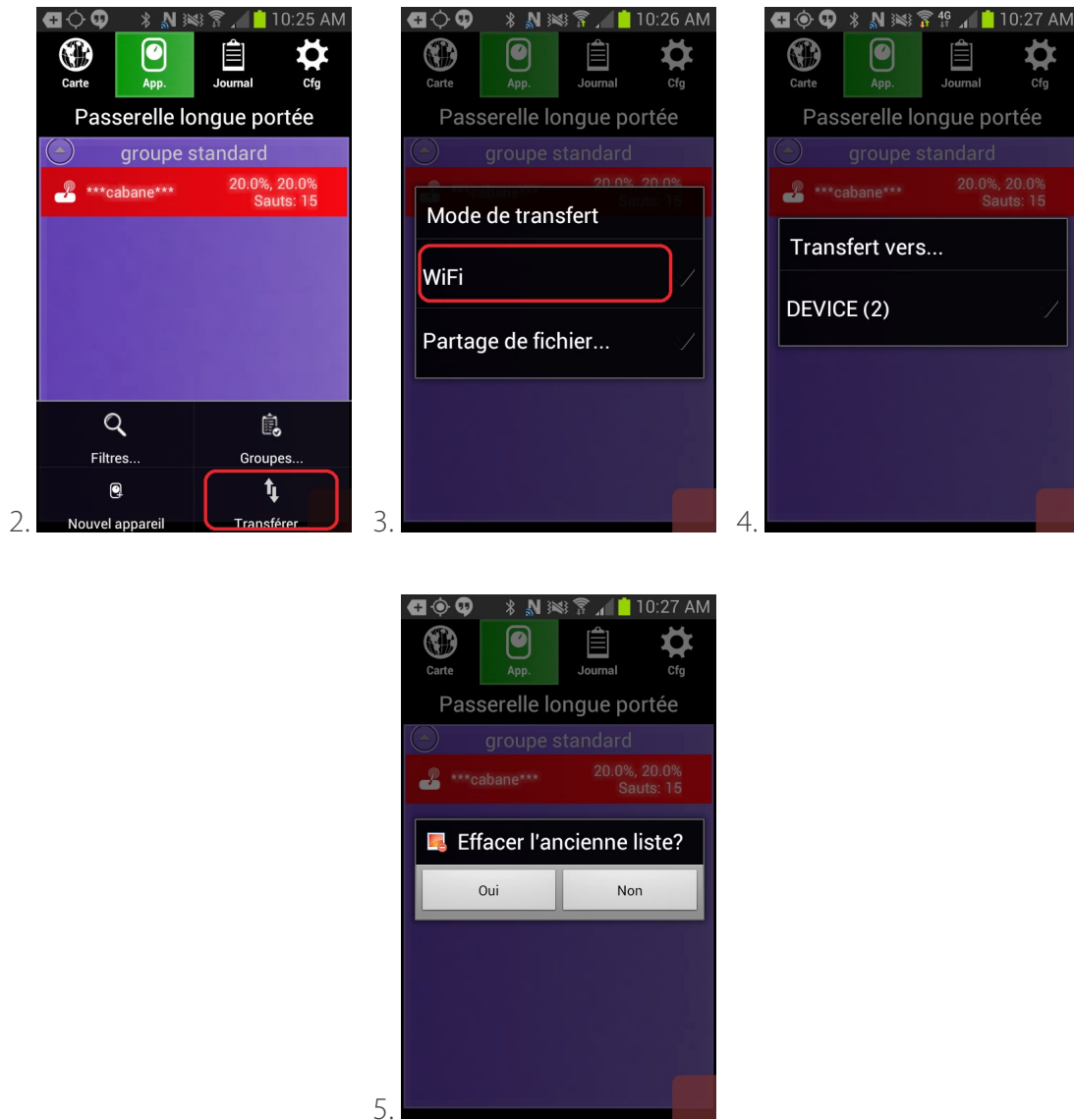
1. Put both devices back to back and wait for the devices to request for the database transfer
2. Tap on the middle of the screen of the Android device with the most up-to-date database (the device that sends the data) to transfer the list (database)
3. The Sugarheld app on the device receiving the new database prompts for a confirmation that the old database can be overwritten. Tap Yes to confirm.
4. The application restarts with the new database.

5.5.2 2nd Method, using Wi-Fi

Backup the old database on the Android device that will receive the new database (see Section 5.6) if necessary. This table can be restored in the future.

1. Connect both devices to a common Wi-Fi network.
2. Tap the Menu button on the Android device and tap on the Transfer icon 
3. Select: WiFi.
4. A dialog box appears with the name of all devices running Sugarheld and connected to the same Wi-Fi network. Select the device to which the database should be transferred.
5. Touch on Yes, on the device receiving the new database to confirm the transfer.

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5.5.3 3rd, via Sharing

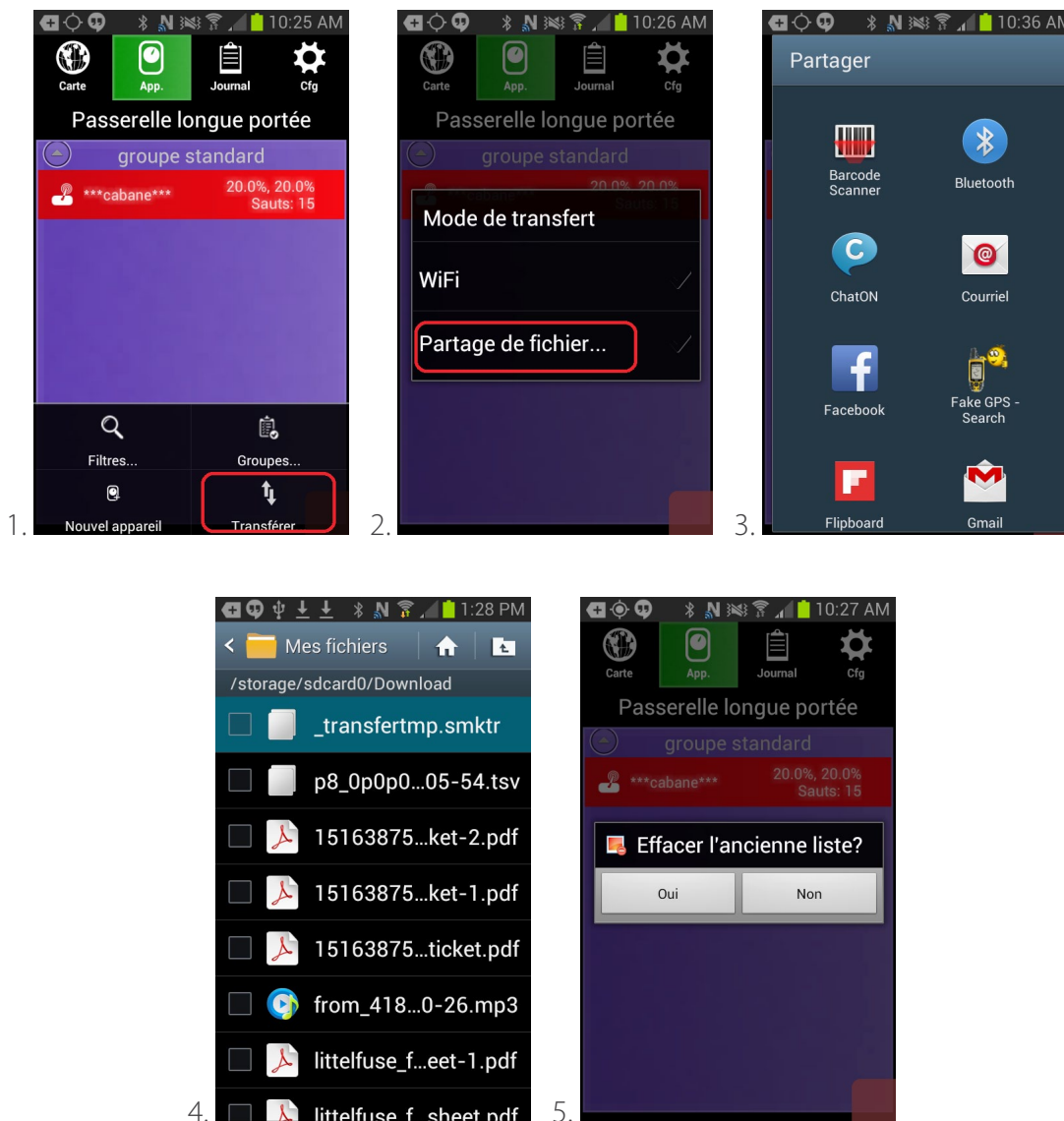
Backup the old database on the Android device that will receive the new database (see Section 5.6) if necessary. This table can be restored in the future.

1. Tap the Menu button on the Android device and tap on the Transfer icon
2. Choose Share via file.
3. A dialog box appears with multiple sharing choices. The most common choice is Gmail, in which case the user can enter a destination e-mail address.
4. In the receiving device, open the downloaded file, that was fetched from the chosen method

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(usually GMail), from a file manager (ex.: the Astro file manager, which is a Play Store app), while the Smartrek Sugarheld app is still running in the background.

5. Tap Yes on the receiving device to confirm database transfer.



5.6 Backup and restore database

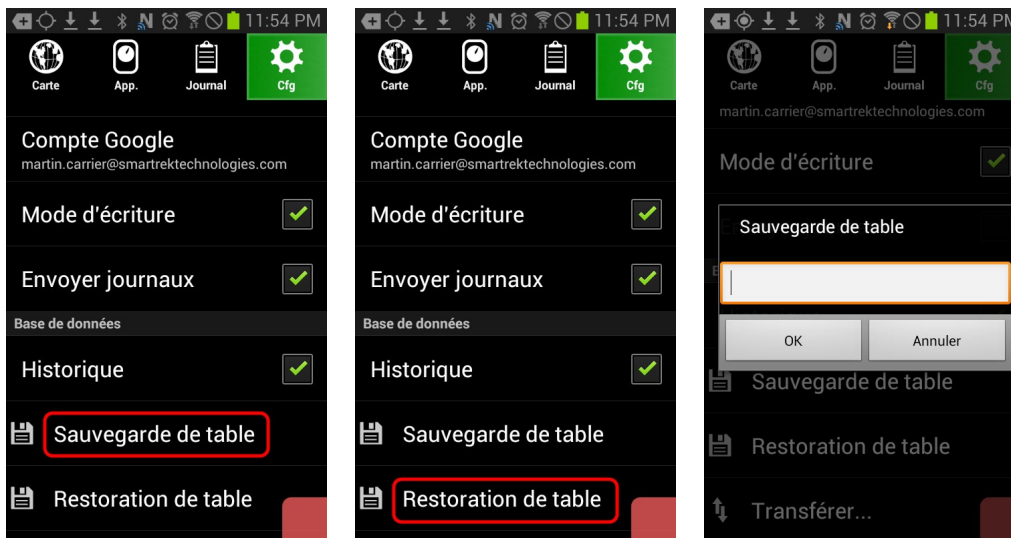
To backup a database :

1. Go to the Cfg tab (configuration)  and tap Backup DB
2. Enter a name for the database file to be saved. Tap OK to confirm.

To restore an old database:

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1. Go to the Cfg tab (configuration) ⚙️ and tap Restore DB
2. Select the name of the database file to be restored. Tap OK to confirm.



sauvegarde

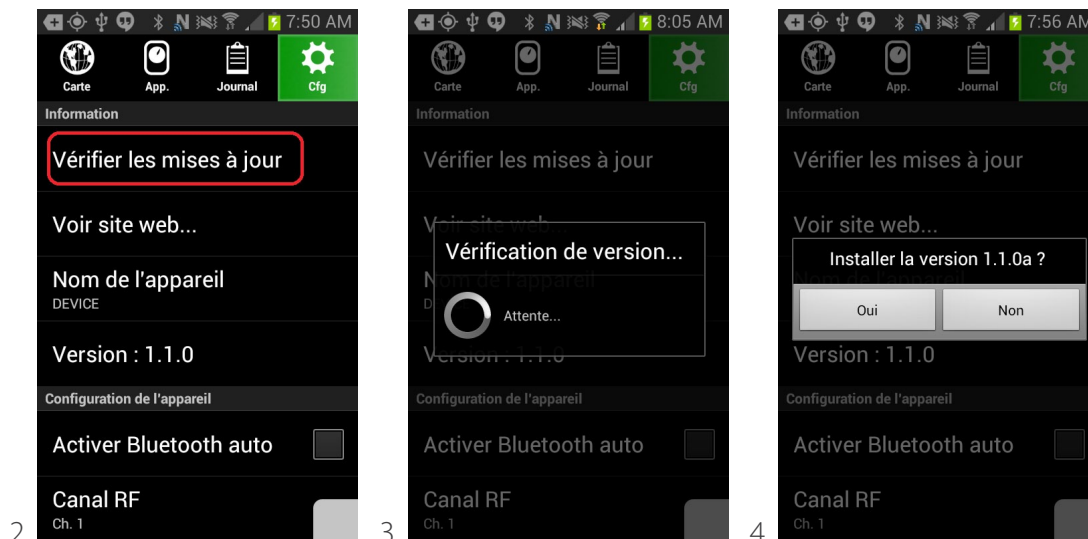
restoration

5.7 Updating the Sugarheld application

Updating the Sugarheld application is recommended for proper system operation. However, it's up to the user to choose when the update should be performed. To check the availability of a new version and install updates:

1. Tap the Cfg tab (configuration) ⚙️
2. Under Information, tap Check for update to start looking for available updates
3. If updates are available, a dialog box appears asking if Sugarheld should install new updates. Tap Yes to install.
4. Restart the application and in the same Cfg tab, check that the version number has changed.

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5.8 Changing channel

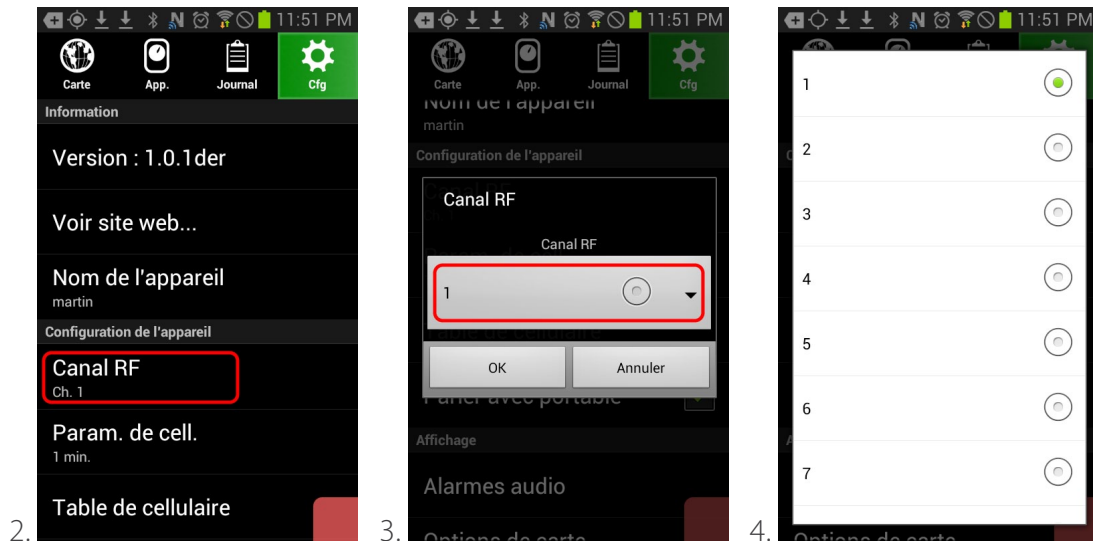
Changing the Smartrek communication channel to another channel than channel 1 (default) may be necessary if:

- The user network is close to another neighboring Smartrek network
- The user wants to split the network into several subnets managed by different gateways (for faster data acquisition speed when the system has to poll many devices, or to view each network independently over the internet or on different screens).

There are 16 channels available (1-16). To change a network to another channel:




1. Change all end nodes to the new channel, following the step-by-step instructions in Section 2.3.4
2. Configure the gateway on the new channel. To do so, go to the Cfg tab (configuration) . Under Device Configuration, tap RF channel.
3. Touch the menu to scroll the available channels
4. Choose the desired channel to match the end nodes channel. The gateway is now configured to a new channel.

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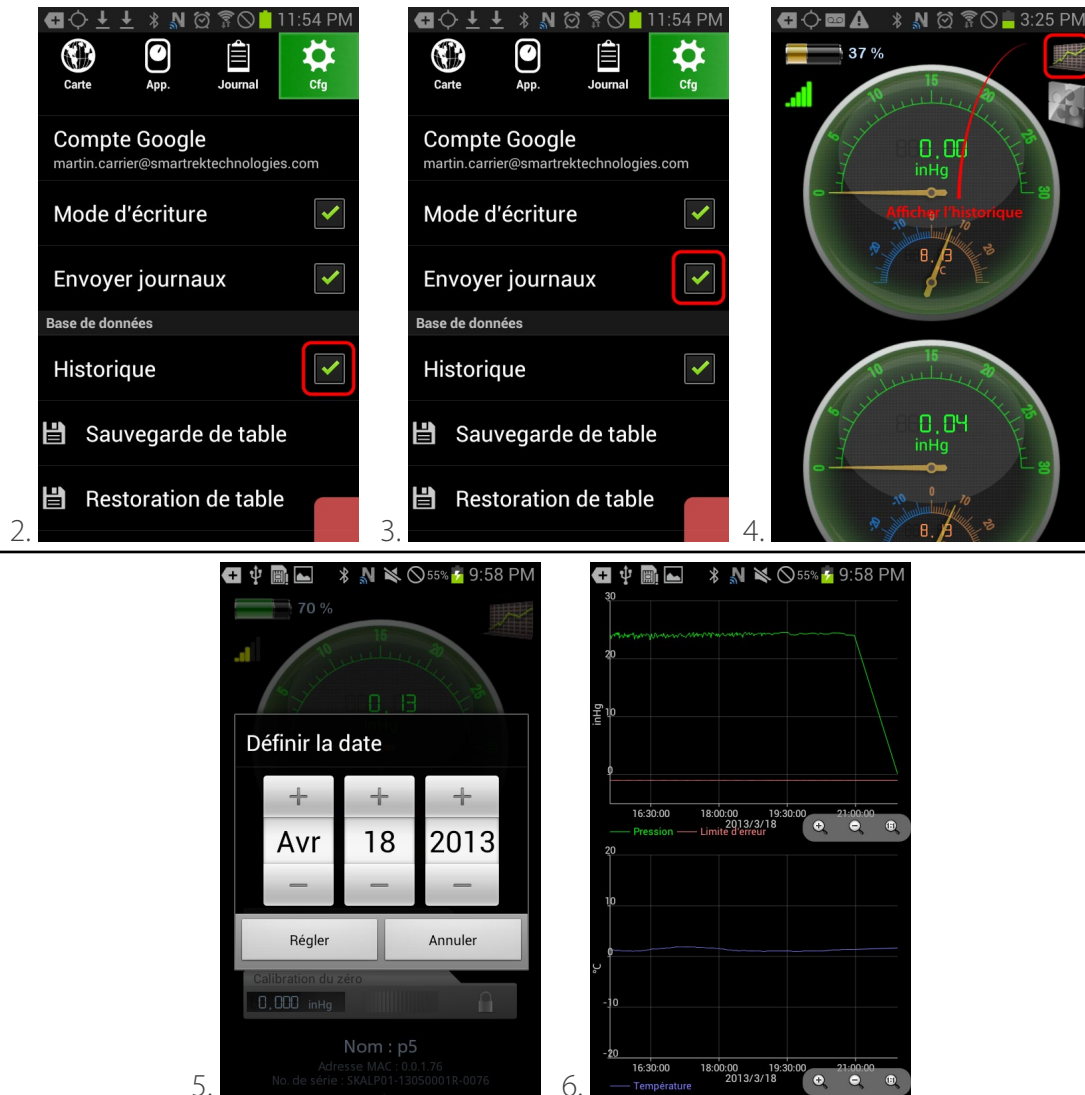


5.9 Enabling sensors data history

To view a particular sensor history, the automatic logging of the sensor readings feature must be enabled.

1. Tap the Cfg tab (configuration) 
2. Scroll down the page, and check the Enable History checkbox
3. In order to access history remotely on a web browser, enable Send logs features so that Sugarheld sends the sensor data to Google Drive.
4. Go back to the App tab  and open the details page of a sensor by tapping the row containing that sensor. Tap on the icon  to open the history graphs for that particular sensor
5. Enter the starting (most recent) date of the history graphs to be displayed
6. The sensor history is displayed via graphs of the relevant sensor data (e.g. vacuum, temperature, level) showing their evolution over time.

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6. Installation Wizard

6.1 Launching the wizard

The installation wizard will launch automatically after a fresh installation of the Sugarheld App and will keep launching as long as there is no gateway entered in the App. If a gateway has already been installed, then you can still launch the Installation Wizard manually by opening the Cfg. tab, then under Installation Wizard, tap on Launch Wizard to open the tool. Or, check the Launch wizard on next boot so that the Wizard starts the next time the App restarts.

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Once the Wizard has been launched, you can close it anytime and finish later.

6.2 Going through the wizard

Note that you will need an internet connection for the Wizard to configure properly your satellite maps.

6.2.1 Step 1 - Name device

Name your device (your Android device). By giving a name to your Android device in the app, you will find the process of transferring database (sensors list) from one device to another much easier (your default device name is DEVICE)

6.2.2 Step 2 - Enter your address

Enter your address (your main location's address). It could be a zip code (or for Canadian customers, the 3 first digits of the postal code). Then tap on Search Address. The address found will be used as the center location of the maps that will be downloaded. It is important to enter the correct location or the maps downloaded won't be relevant (only maps surrounding your area will be saved to your device).

6.2.3 Step 3 - Remote use

Now you'll be asked whether you wish to use the system locally only or locally and remotely (i.e. use the system outside of the network, to view your system at home, at work or anywhere in the world). If you answer Yes, then the wizard will guide you through some extra steps to configure the remote access

6.2.4 Step 4 - Configure Google Account

Then, you need to configure a Google Account (either choose an existing one or create a new one). Most of our services use Google functionalities (such as Google Drive) so that's why we're asking for an account.

6.2.5 Step 5 - Configure alarms

Next, you can customize the basic alarms settings. You can disable/enable:

- Sound alarms on errors and warnings (you will be able to set the error limits on each sensor later on)

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- Use Text-to-speech ability of your phone so that errors and warnings are read to you

6.2.6 Step 6 - Configure Units

Next, you can customize the units that will be used throughout the app. You can choose either Metric or Imperial units or tap on Customize Units to choose the right unit for each of your measurements.

- Metric units : distance in m, height in cm, temperature in °C, positive pressure in bar, negative pressure or vacuum in in Hg, volume in L, flow in gpm (UK gallons)
- Imperial units : distance in ft, height in in, temperature in °F, positive pressure in psi, negative pressure or vacuum in in Hg, volume in gal (US), flow in gpm (US gallons)

6.2.7 Step 7 - Choose application

Next, you will be prompted to select the main use of the Smartrek system

6.2.8 Step 8 - Reader or writer

Then, you will be asked to choose how the app will gather data from the Smartrek system:

- 1) by pairing with a Gateway
- 2) by pairing with a Handheld
- 3) if you answered yes at step 3 (you are going to use the system remotely), by reading data from the cloud

6.2.9 Step 9 - Install gateway

Now it's time to install the device that you have chosen in step 8. Tap on scan if applicable to scan the barcode of your gateway or handheld. Then, name your gateway/handheld device. The next two steps will configure the gateway settings (if applicable) depending on the configuration of your network.

6.2.10 Step 10 - Define network

Enter the distance of the farthest node from the gateway (from your main building). In other words, what will be the radius of your Smartrek network if the center is the gateway

6.2.11 Step 11 - Configure performance

Choose how you would like to optimize the system:

- 1) Save batteries (low data-rate). You should choose this option if you do not currently need very

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high data rate to save your battery life. When saving batteries, the system will respond slower than with the high performance option. You will still get a lot of data, but not once every second.

2) High performance (high data-rate). You can choose this option if you are currently monitoring a critical operation. The system will respond very fast and consume a lot more batteries.

You can choose to run on the Save Batteries mode at all time. You should still have plenty of data. Once the wizard is over, you can still change these options manually without having to re-run the Wizard. To do so, go to the Node tab in the Sugarheld App. Tap on your activated gateway. Change the duty cycle from 5% (battery saving mode) to any higher value (e.g. 10%, 15%, 20%...).

6.2.12 Step 12 - Enable features

There are a few features that are only available for handhelds users. If you plan on using handheld devices in your system deployment, then check the Handheld use. Then, you will have two more options available:

1) Enable Chat/DB sync/Synced Notes on map: select this option if you wish to chat within the Smartrek network with your workers or if you wish to sync your DB (sensors' list) in the field using handheld devices. With DB syncing, you can add nodes in the woods using a handheld and they will sync on the man tablet. You can also add notes on the map that will also sync to all tablets/smartphones (connected to a gateway or a handheld).

2) Enable Equipment control through Handhelds: select this option if you wish to control your equipments from tablets/smartphones connected to handhelds.

6.2.13 Step 13 - Choose theme

Choose the look of your app. For those who are getting used to the old interface (prior to 2017), select the Legacy theme. For the best experience however, select Modern theme.

6.2.14 Step 14 - Finish

You can now commit your preferences and click on Finish, or if you can cancel by pressing Skip (no changes will be made). Wait until your preferences are being applied. The Wizard will also take care of downloading the satellite map for you. Once completed, the app will restart and you should be ready to start adding sensors to your network and enjoy the system!


7. Other options

7.1 Bluetooth auto-enable

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For users wishing to employ a smartphone synchronized to the main controller device via Internet (using either Google Drive, Dropbox, or others), and who wish to reduce battery drainage of said smartphone, the Bluetooth auto-enable option, which is on by default, can be deactivated, in which case the app will cease to force permanent activation of the Bluetooth chip. This option should nevertheless remain activated if the device is to be connected to either a gateway or a handheld node.

To deactivate this option:

1. Go in the Cfg tab (configuration) 
2. Uncheck the option Bluetooth auto-enable



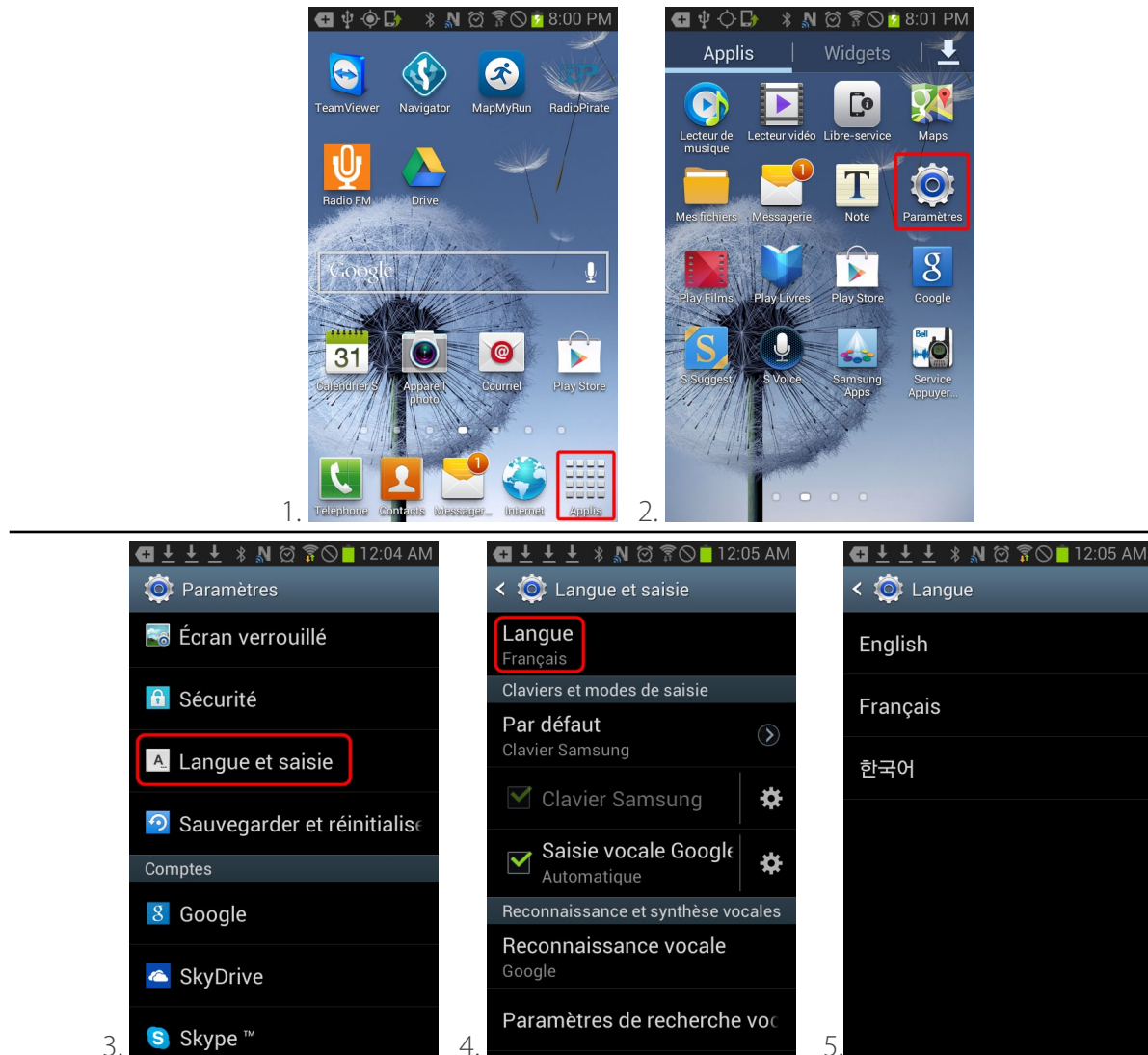
7.2 Changing language

Sugarheld can be configured in English or French. The application is always displayed in the same language as that which is currently enforced in the Android device OS. If, for example, all menus and icons on the Android device are displayed in English, then Sugarheld will also automatically configure itself in English language.

To change to another language, changes must be made in the language setting in the Android device settings (not directly in the application):

1. From the main menu of the Android device, tap the Apps (Applications) icon
2. Search and tap on the Settings icon
3. Scroll down and tap the Language and Input option
4. Tap on Language
5. Select the desired language

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7.3 Warning and Error alarms




The alarms and warnings can be disabled / enabled as needed. The error / warning messages can be read aloud by the application when the option synthesizing voice is enabled.

To activate and deactivate the alarm options, warnings, and voice synthesis:


1. Go to the Cfg tab (configuration) ⚙️
2. Tap on Sounds and Alarms
3. Select the options to be enabled

7.4 Displaying real-time location of the handheld node

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The exact position of the handheld node  can be displayed on the map. This location can be viewed at the sugarhouse or main building, on the Android device  connected to the gateway .

To enable real-time positioning of the handheld node:


1. Go to the Cfg tab (configuration) 
2. check the Enable handheld query box

7.5 Notification bar visibility

The notification bar is an external widget to the Sugarheld application. It contains general information for the use of the phone/tablet. In the case of a smartphone, it will display notifications of new voice or text messages. It also provides shortcuts to enable/disable networks (Wi-Fi, Bluetooth, etc...) It is useful when the Android device used as a Smartrek computer also needs to be used to take phonecalls as a regular cellphone. You can access this notification bar by swiping it down:




This notification bar can be hidden/shown:

1. Go to the Cfg tab (configuration) 
2. Tap on Notification bar.
3. Choose desired visibility settings

7.6 Node list order


The sensor list can be sorted according to the following keys: by ID (i.e. the initial order with which the sensors were entered in the table by user), by radio MAC address, by S/N alphabetic ordering, and by name alphabetic ordering. To choose the ordering setting:

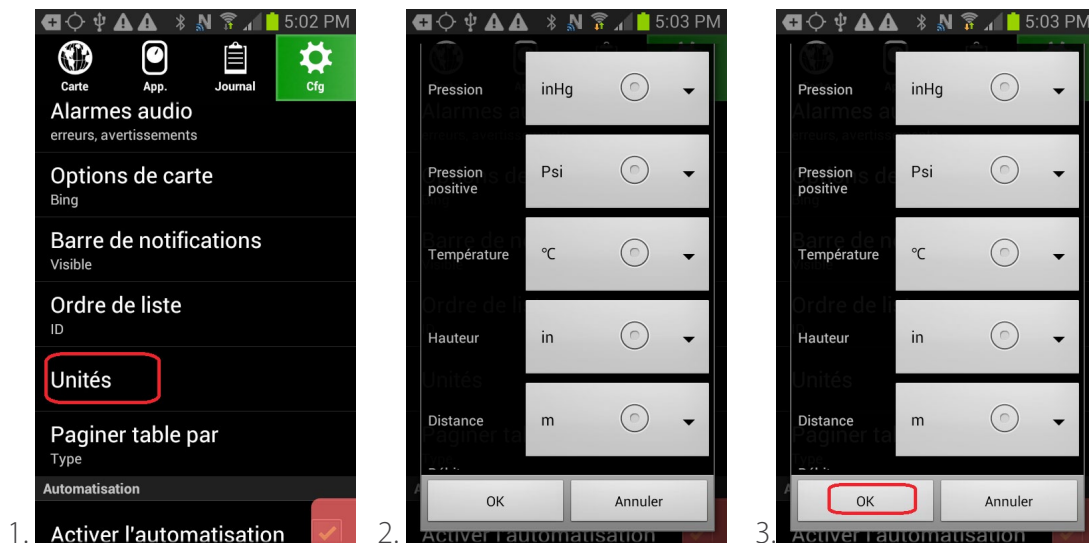
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1. Go in the Cfg tab (configuration) , and tap the option Node list order.
2. Choose the ordering type, and tap OK to confirm.


7.7 Unit settings


The Sugarheld app can be configured to use various display units, according to the user tastes. To do so:

1. Go in the Cfg tab (configuration) , and tap the Unit settings option.
2. Choose the units for each measurement type. Note: for AC current measurements, there are 3 different choices: 'A RMS' for RMS current, 'A P' for peak current, and 'A P-P' for peak-to-peak current. Choosing one of those options will affect the displayed measurement for nodes employing such measurements, such as for a relay box.
3. Tap OK to confirm.



7.8 Table page modes

The App tab  pages can be used to segregate nodes according to 2 different properties: either by type, or by group. To choose the desired display mode:

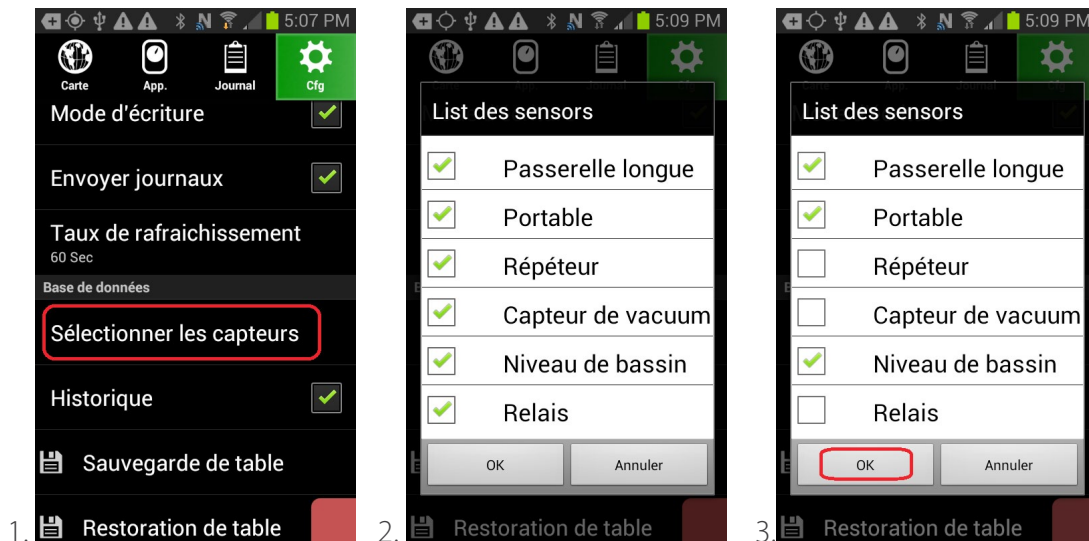
1. Go in the Cfg tab (configuration) , and tap the option named Page table by.
2. Choose the desired mode (Type or Group). Tap OK to confirm.
3. Pages will now be segregated according to node type, or according to which group the nodes belong to (if applicable).

7.9 Selecting displayed sensor types

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The user can choose which sensor page will be visible, by selecting the visible sensor types. To do so:

1. Go in the Cfg tab (configuration) ⚙️, and touch the option named Select active sensors.
2. Check all sensors that must be displayed. Uncheck the rest.
3. Tap OK to confirm.



8. Periodic reports

The Smartrek system can send periodic reports via SMS or e-mail, the latter being also useful as a method of sending text message to cell phones from a device without cell phone capabilities.

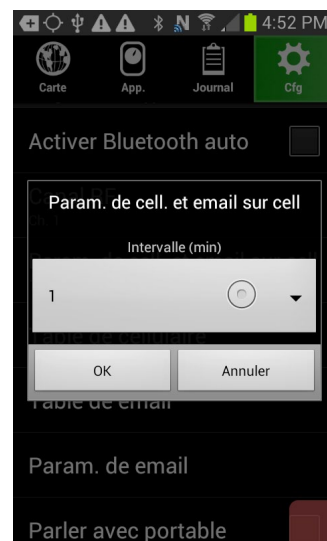
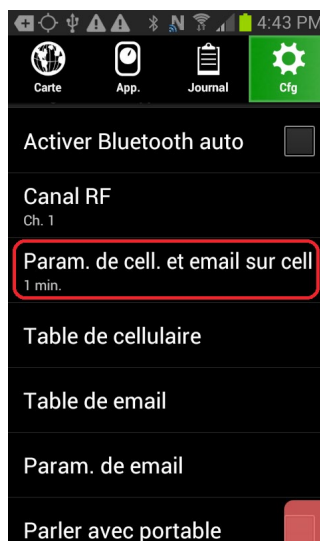
8.1 Normal SMS mode

To activate the periodic SMS sending mode (requires a SIM card with texting available) :

1. Go in the Cfg tab (configuration) ⚙️, and tap on Cell phone map.
2. Tap a table row.




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3. Enter a cell name, a cell number, and choose Mode: SMS. Tap OK to confirm.
4. Note: deactivating a number is possible, by simply changing its mode to Mode: Inactive.
5. To configure the minimum time interval between SMS sends, go in the Cfg tab (configuration) ⚙️, and tap on Cell and email on phone param.
6. Select the minimum desired time interval, in minutes. Tap OK to confirm.

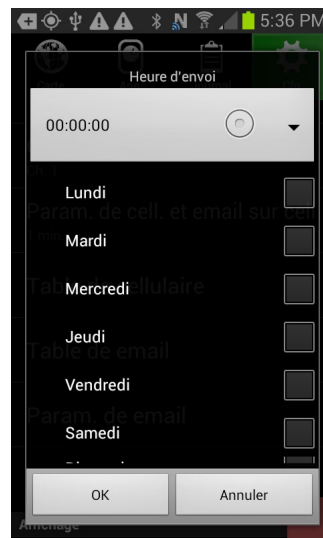
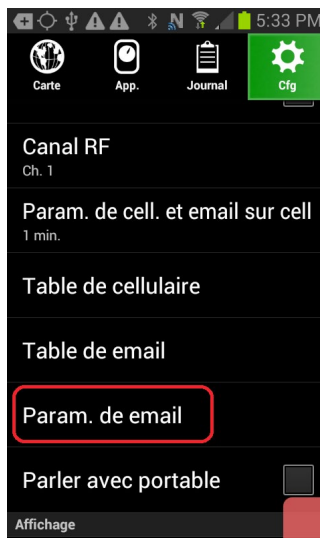
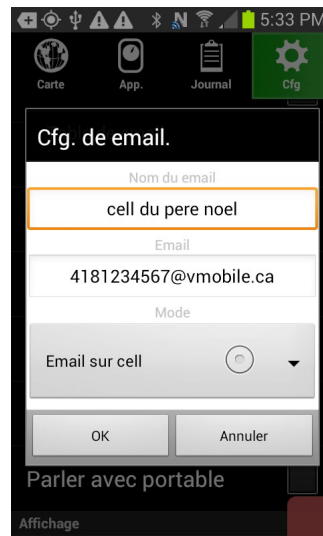
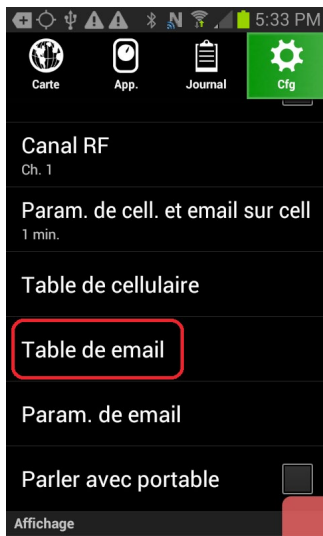


8.2 E-mail mode

To enable the periodic e-mail sending mode (typically requires an Internet connection, either via Wi-Fi or via a cellphone data plan) :

1. Go in the Cfg tab (configuration) , and tap on Email map.
2. Tap a table row.
3. Enter a recipient name, a recipient e-mail address, and choose the send mode; the mode Regular email sends long periodic reports, and the mode Email on phone is optimized for short but frequent message sends (so that they can be easily received by a recipient cellphone).
4. Note: it is possible to deactivate an e-mail, by changing its mode to Inactive.
5. To configure the time interval between periodic reports (mode Regular email), go in the Cfg tab (configuration) , and tap on Email param.
6. Select the report send hour, and check the sending days. Tap OK to confirm.
7. To configure the minimum time interval between sends if the Email on phone mode was chosen, go in the Cfg tab (configuration) , and tap on Cell and email on phone param, select the desired minimum interval in minutes, and tap OK to confirm (see section SMS mode for further details).

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Here is a non exhaustive table with typical e-mail address format for the Email on phone mode. Those address might change at any notice. For more information, please consult your local telecom service provider:

Telecom company	Country	Format
Rogers Wireless	Canada	#####@pcs.rogers.com
Fido	Canada	#####@fido.ca
Telus	Canada	#####@msg.telus.com
Bell Mobility	Canada	#####@txt.bell.ca
Kudo Mobile	Canada	#####@msg.koodomobile.com
MTS	Canada	#####@text.mtsmobility.com
President's Choice	Canada	#####@txt.bell.ca
Sasktel	Canada	#####@sms.sasktel.com
Solo	Canada	#####@txt.bell.ca
Virgin	Canada	#####@vmobile.ca
AT&T	USA	#####@txt.att.net
Qwest	USA	#####@qwestmp.com
T-Mobile	USA	#####@tmomail.net
Verizon	USA	#####@vtext.com

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Sprint	USA	#####@messaging.sprintpcs.com OU #####@pm.sprint.com
Virgin Mobile	USA	#####@vmobl.com
Nextel	USA	#####@messaging.nextel.com
Alltel	USA	#####@message.alltel.com
Metro PCS	USA	#####@mymetropcs.com
Powertel	USA	#####@ptel.com
Suncom	USA	#####@tms.suncom.com
U.S. Cellular	USA	#####@email.uscc.net
Cingular	USA	#####@cingularme.com

9. Configuring remote access using Internet (Google Drive)

The Smartrek system can be accessed remotely, at the office, or on the go. If the system has been configured using the Installation Wizard then the remote access configuration has already been done properly. If that is not the case, then either run the Installation Wizard or configure manually. In order to do this:

- The main building hosting the gateway must provide access to a stable internet connection, either through a Wi-Fi router or 3G/4G cellular connectivity.
- Internet access should also be available at the remote location, office, 3G on the go, etc.

Data can be read directly via a web interface in any web browser (Google Chrome, Mozilla Firefox, Internet Explorer, etc..) Or on an Android device, directly within the Sugarheld application.

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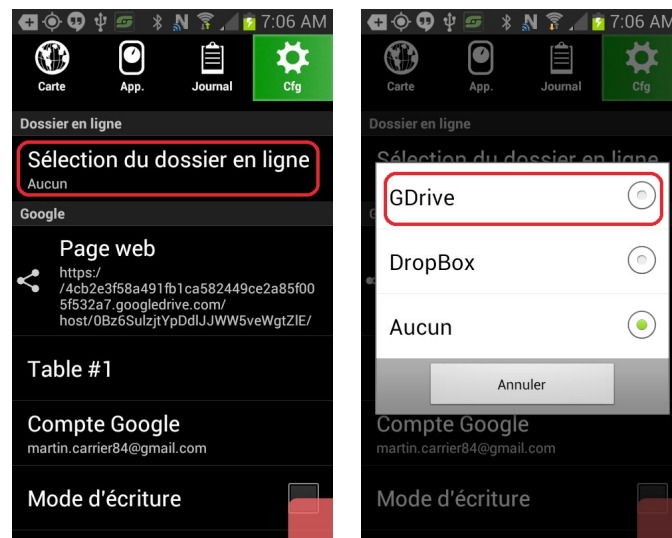
Remote access mode	via auto-generated Web interface	via Smartrek Web interface	via Sugarheld app
Data reading	.	.	.
Remote control	.	.	.

Data are sent to the cloud, into the Google Drive cloud service. Once it has been established that there is a stable internet connection at the main building, the remote access can be configured. Begin by creating a Google account after enabling the Google Drive option

9.1 Step 1 - Enable Google Drive mode

To enable Google Drive mode:

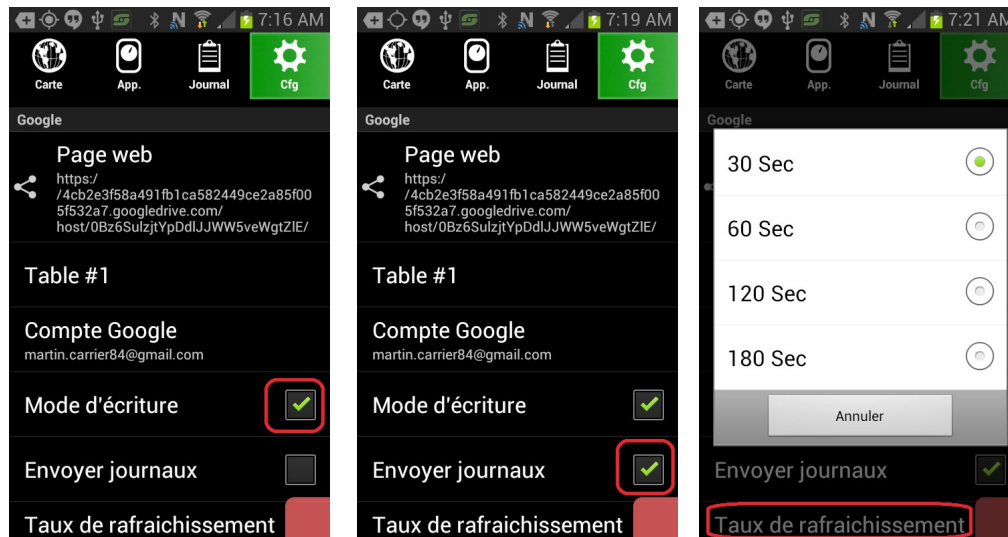
1. Go to the Cfg tab (configuration) , tap on Online folder selector, and choose GDrive.



On the Android device connected to the gateway :


2. Check the Writer mode box so that the device starts sending its data to the Cloud.
3. (Optional) change the table # to the desired # (default: Table #1).
4. If applicable, check Send logs (to send history data to Google Drive, if the history option is also enabled).
5. To modulate refresh rate (so as to avoid excessive bandwidth consumption, if applicable), choose the refresh rate by tapping on Refresh Rate, and then choosing the desired data synchronization refresh rate.

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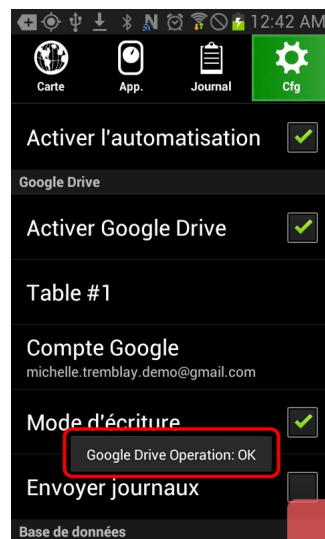
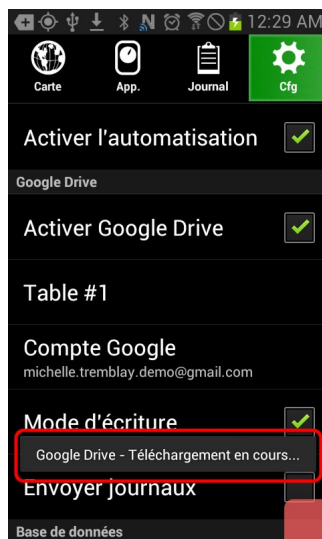
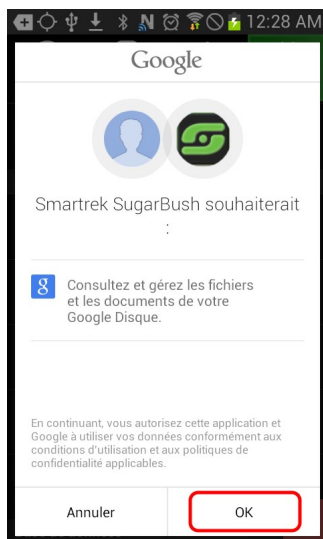
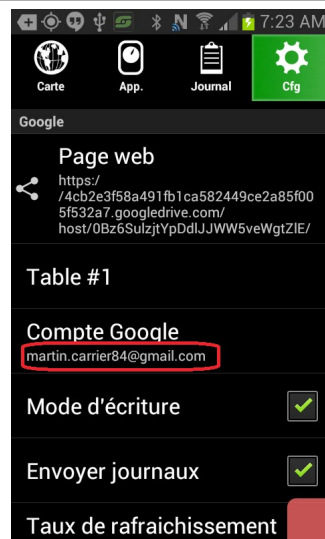
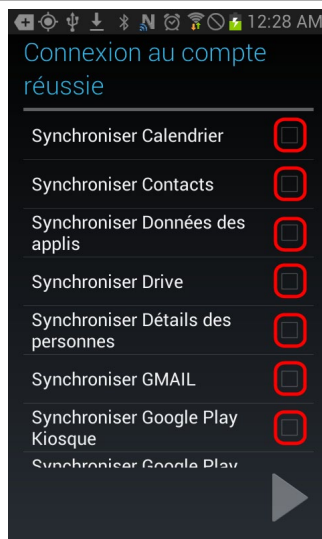
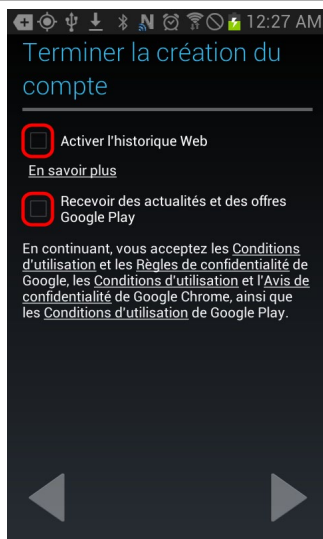
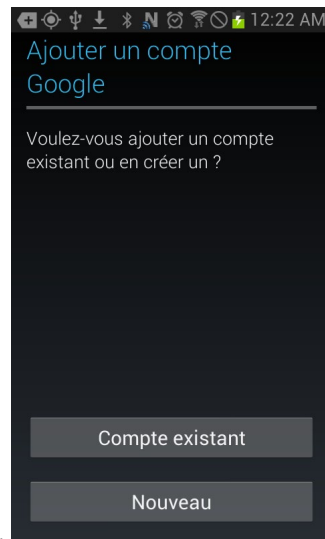
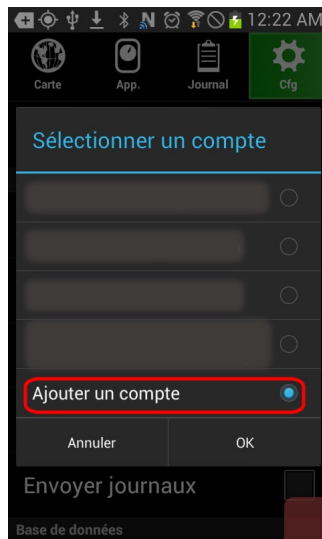
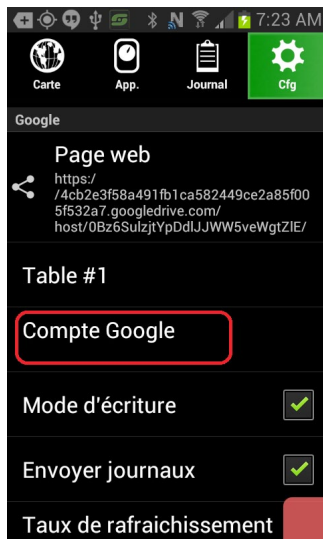


9.2 Step 2 - Create a Google account

To create a new Google account directly from the Sugarheld app:

1. Go to the Cfg tab (configuration)  and tap on Google Account
2. A dialog box appears. Tap on Add new account. Tap OK to confirm.
3. The application asks whether an existing account should be used or a new one has to be created. Choose the applicable option.
4. To create a new account, follow the instructions and remember the user name (e-mail address) and password for later use
5. When the account has been successfully created, uncheck all synchronization options of the created account to the Android device (optional).
6. After getting back to the Sugarheld application, in the Cfg pane, under Google account, verify that that the Sugarheld app is writing to the newly created account.
7. A dialog box prompts the user to grant permissions to the Sugarheld app so that it can access the Google Drive account. Tap OK to confirm.
8. After getting back to the Sugarheld main screen, a downloading/uploading confirmation message should appear. Wait for the download to finish before continuing to the next step. The download is successful after a few minutes elapse, and the remote access is ready when the message *Google Drive operation : Ok* appears.

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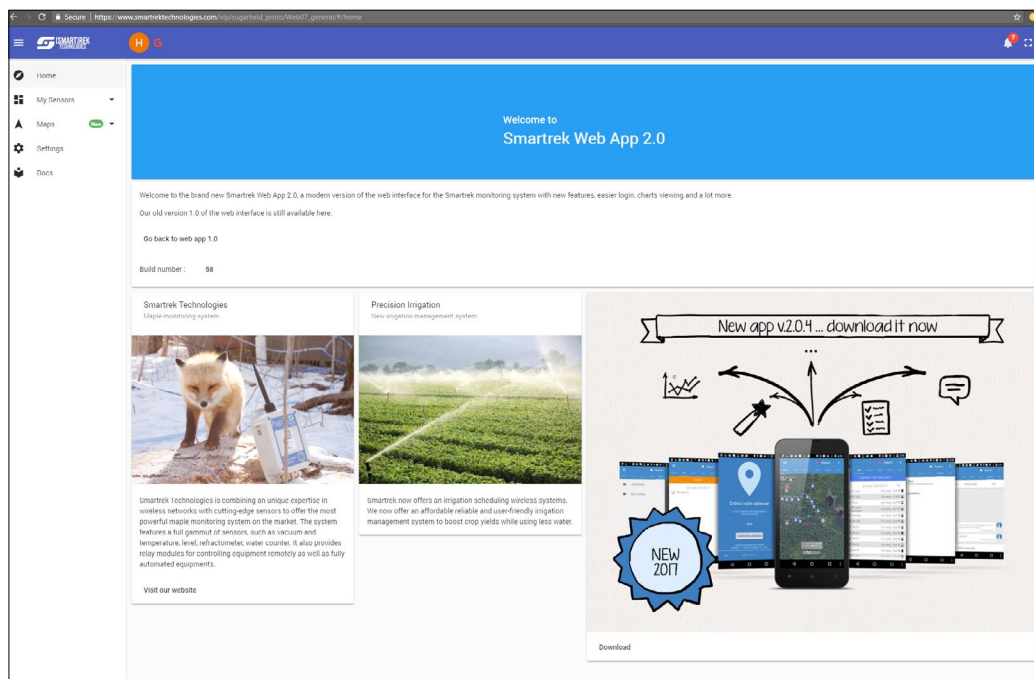
9.3 Accessing the Smartrek Web App 2.0

The Smartrek Web App 2.0 allows full web control of sensors and equipments as well as their alarm thresholds and can be accessed on a Google Chrome browser using the following link:

https://www.smartrektechnologies.com/vip/sugarheld/Web07_general

Please note that this web application is being updated regularly. To make sure that you are using the latest version, go to <http://www.smartrektechnologies.ca> and in the menu under support, click on Web portal 2.0.

Once you have opened the website, a “LOADING” message should appear and the page will take some time to load. Then you should be on the main welcome page of the Smartrek Web App.

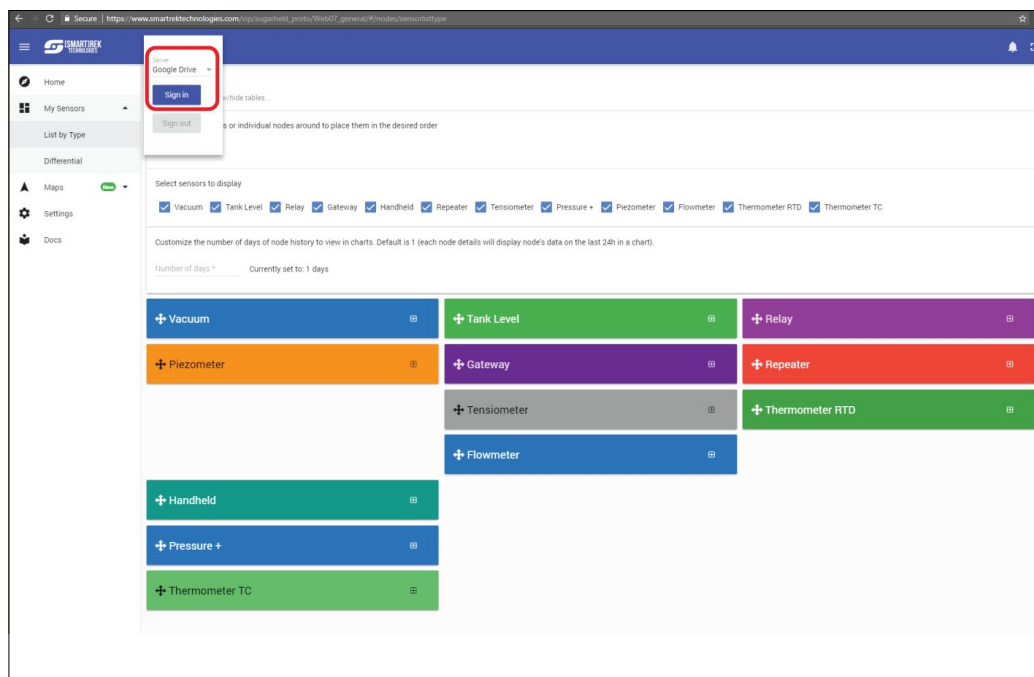
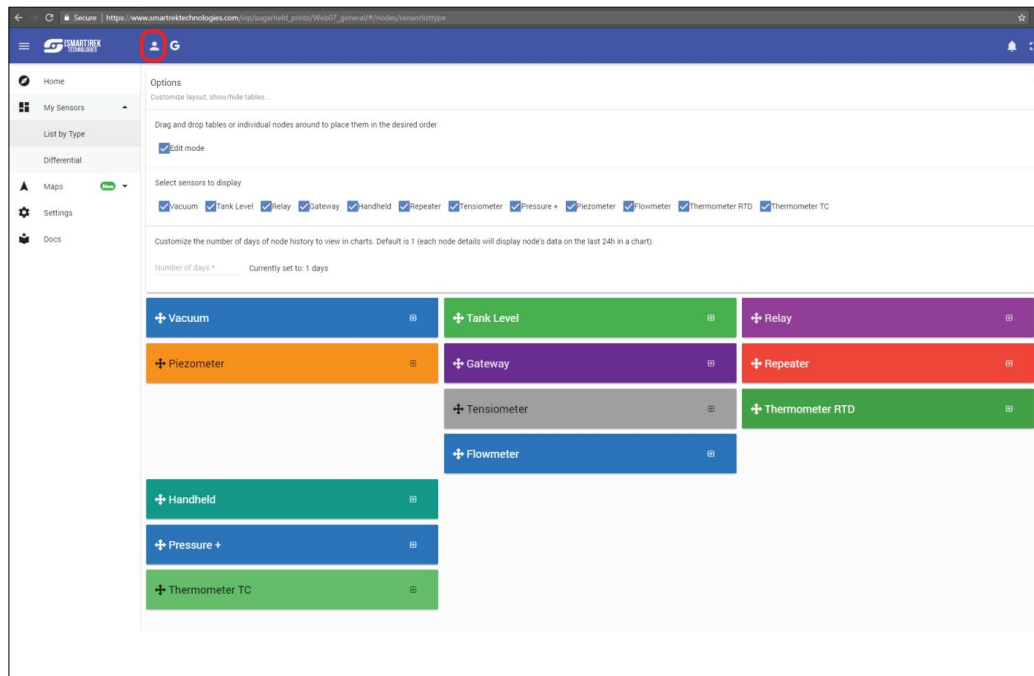


9.4 Connecting to your account

To connect to your account, click on the user icon at the top of the page, next to the Smartrek logo. A menu will open and you will have the choice of the server (Google Drive or Dropbox) and you will also see a Sign in button. Click on it and enter your account information. The first time that you

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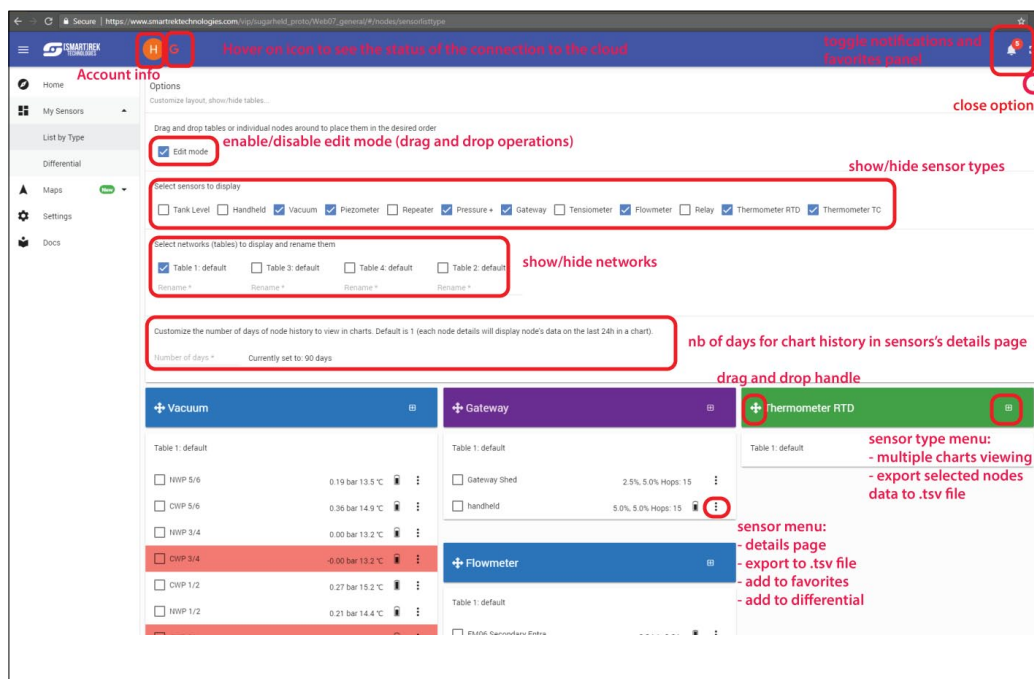
login, the page will ask for your permission to manage your Google Drive account. Accept and finish logging in. Once you are done, you will start to see some activity on the page (and a green progress bar moving at the top of the page).



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9.5 The dashboard

To view the dashboard, open the menu by clicking on the Menu icon at the top left corner of the page. Then, click on My sensors, then on List by type. After a few seconds, the page will populate itself with the sensors that are currently on your Smartrek network.

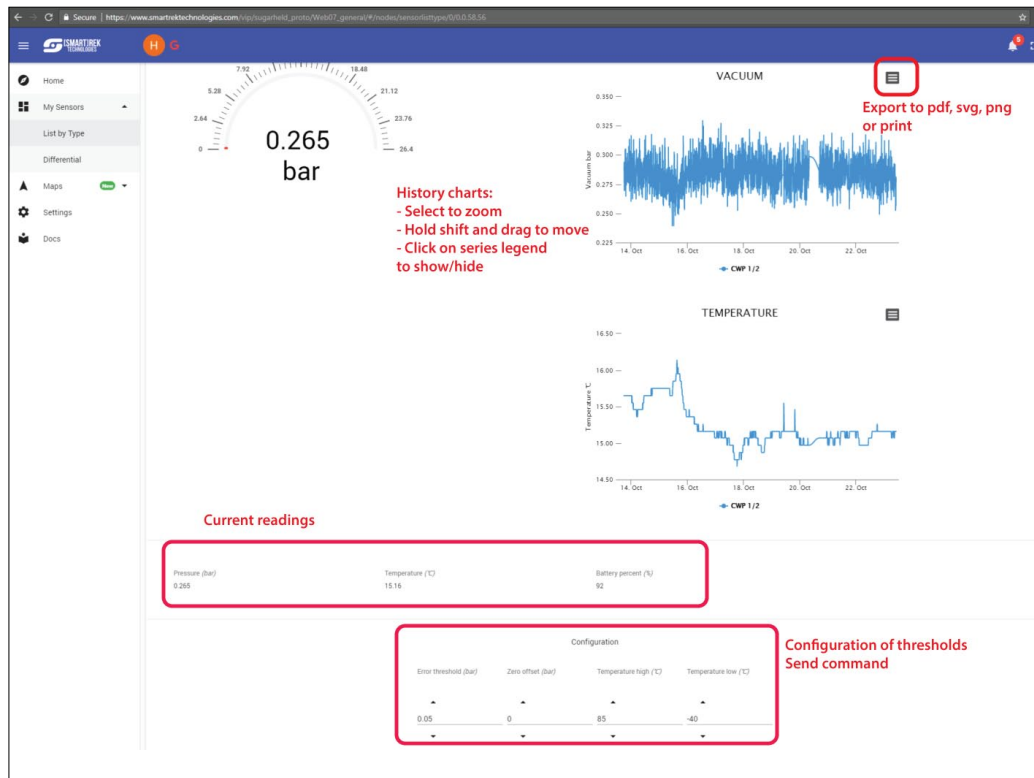


You can customize that page by moving the elements on the page (with drag-and-drop operations). You can also show/hide Tables (networks, if you have multiple sites) and sensor Types. You will also find an input field to change the number of days that the history chart of each details page should show.

9.6 The details page

Current readings, history charts, thresholds configuration are in the sensor's details page. Click on the three vertical dots menu next to the sensor of interest. Select Details.

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The length of the history charts can be customized by going back to the List By Type page and change history length in the Options at the top of the page. If the history shows no data, then check the configurations in the Android App paired to the Gateway. In the Cfg. tab, scroll down and check both options Send Logs and Enable History.

Alarm thresholds can be set directly from the Web App. Command can also be sent to control equipments remotely.

9.7 Exporting data to an Excel spreadsheet

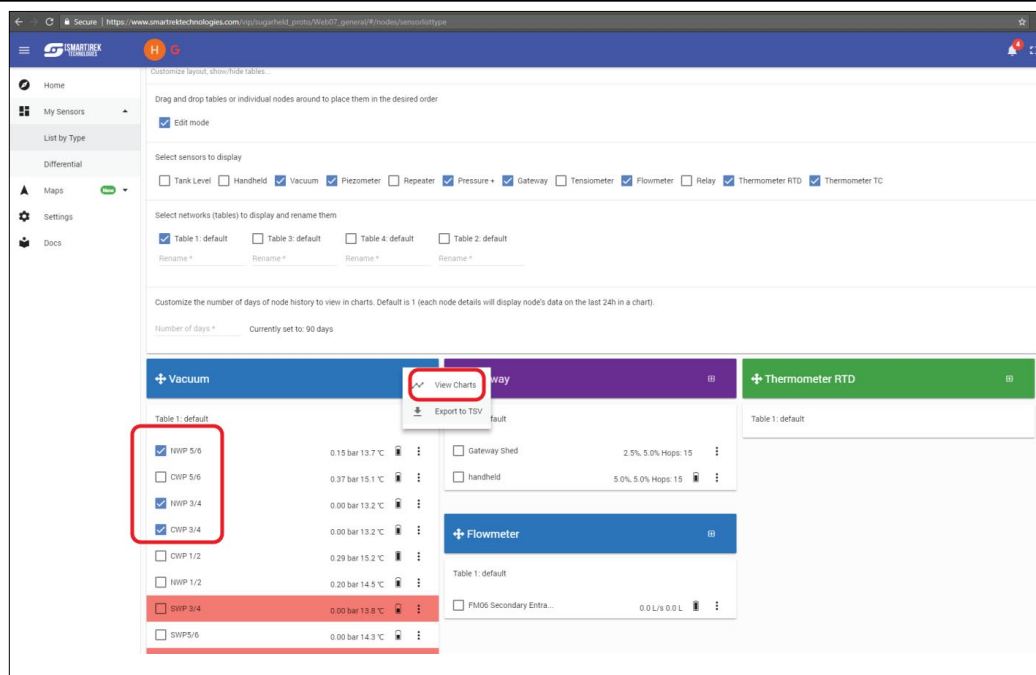
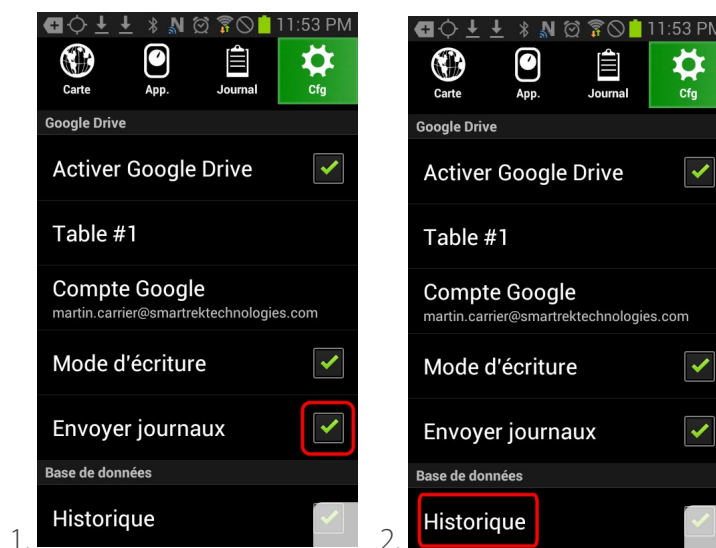
To export data to a MS Excel file:

1. In the Sugarheld application, under the Cfg tab (configuration), on the Android device set on the Writer mode, check the Send logs box
2. Check the Enable history box

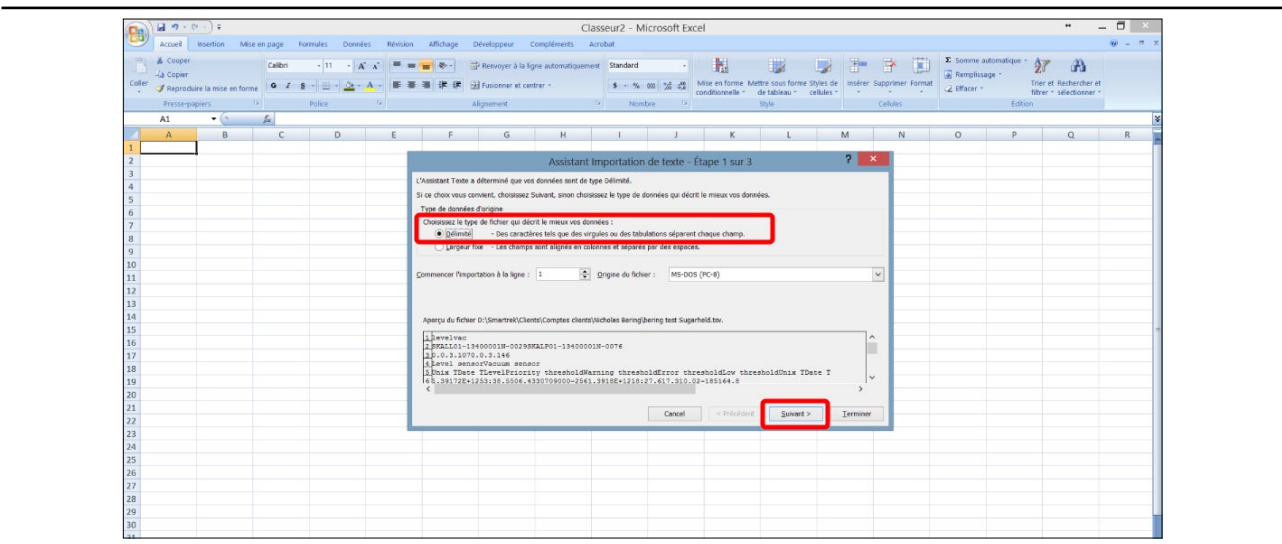
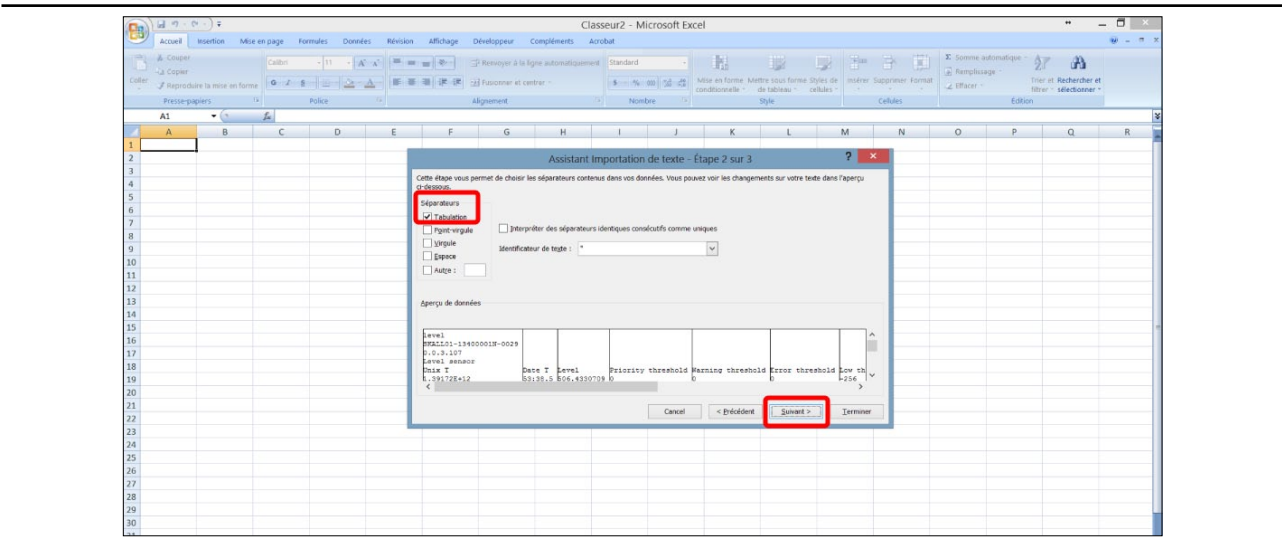
Your data is now being saved and sent to the Google Drive.

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3. Go to the webpage of the system
4. Check the boxes of all nodes historical data to be fetched
5. On the sensor list menu, click on the (+) button and select Export to TSV
9. Open MS Excel or any other table enabled software
10. Go to File > Open > the exported file (with .tsv extension)
11. Set the columns delimiter, Finish



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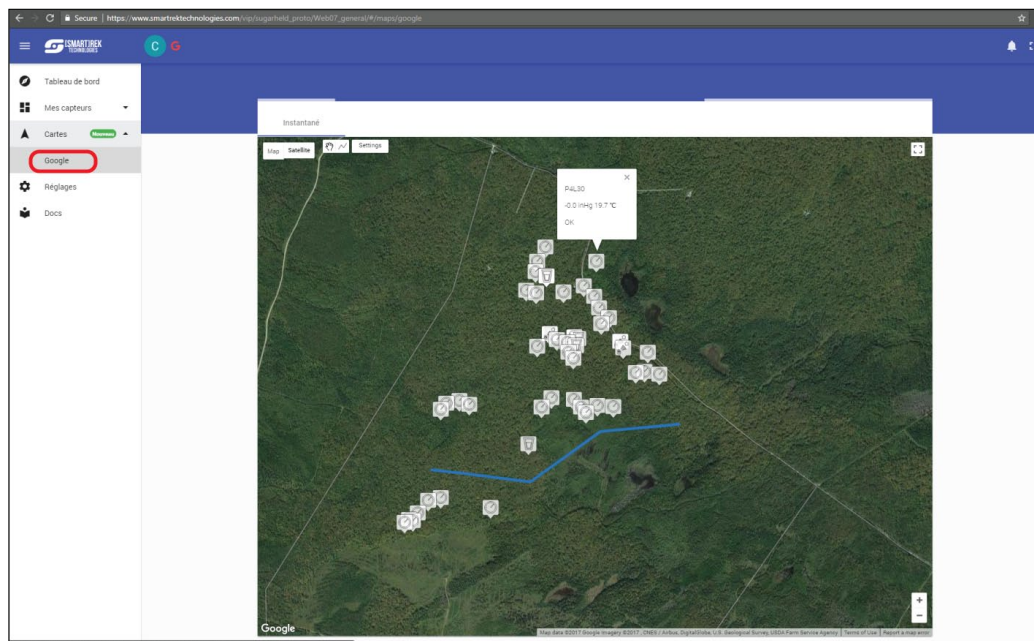
9.8 Generating the satellite map of the system with related data (Web mode)

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To display a satellite map with the nodes at their exact location:

1. Go to the Web app
2. On the left hand side menu, click on Maps > Google

The map will appear, with all installed nodes and their state being displayed.



9.9 Step 3.2 - Accessing your data using the Sugarheld app

Your data are being sent to the Google Drive and can be retrieved back into the Sugarheld app, in another Android device:

1. In the Cfg tab (configuration), configure the Google Account to the same Account where data is being written
2. Enable Google Drive mode
3. Select the table to be retrieved (default: table #1). This table # must be the same as that of the corresponding Writer device whose data needs to be transferred to this Android device.
4. (Optional) choose the desired reading refresh rate by going into the option Refresh Rate.
5. Do not check the Writer mode box. The device has to be configured as a Reader. The Android device is now downloading data from Google Drive and is displaying the most up-to-date sensors readings in the Sugarheld app. It may take a few minutes before the update can be done successfully. Wait for the confirmation message *Google operation : OK* and check that the retrieved table is the right one.

10. Configuring remote access using Internet (DropBox)

The DropBox web access mode is an alternate method to Google Drive. Note that this method does not auto-upload a website to DropBox (because DropBox does not support static webhosting anymore). Thus, system access using DropBox can be via the following methods:

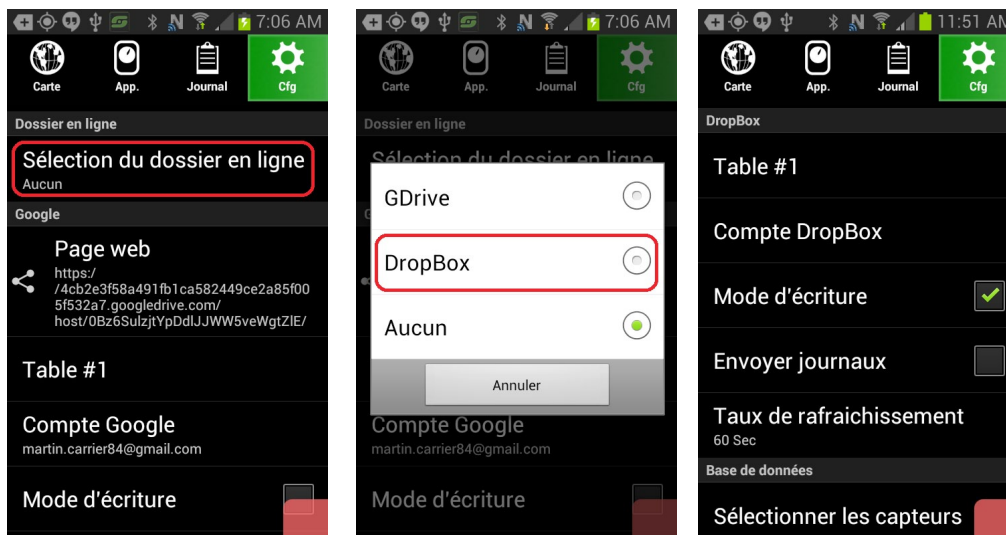
Remote access mode	via Smartrek Web interface	via Sugarheld app
Reading data	•	•
Remote control	•	•

Data are again sent to the Cloud into a DropBox account. Once Internet connectivity is deemed good enough, remote access set-up can proceed, beginning with the creation of a new DropBox (after activating DropBox mode).


10.1 Step 1 - Enable DropBox mode

Pour activer le mode DropBox :

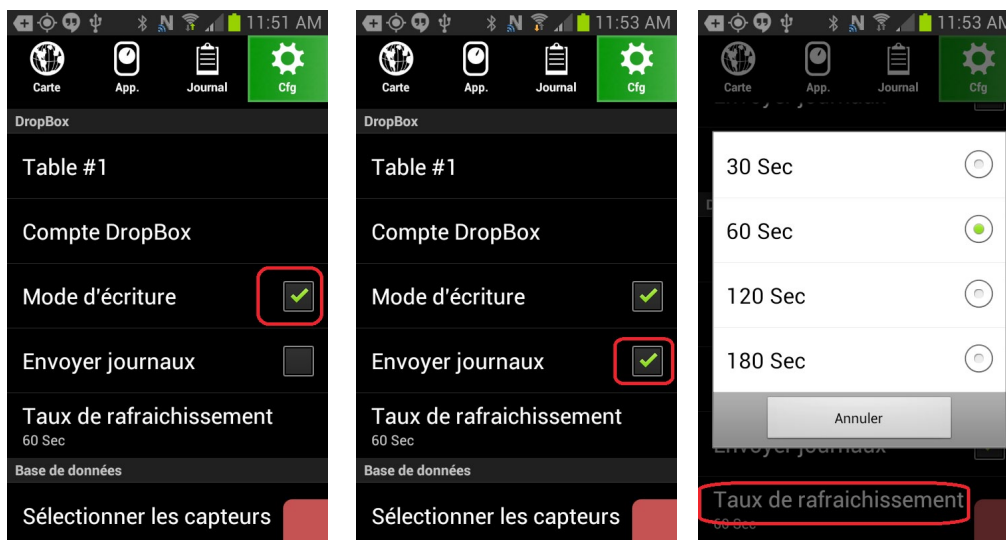
1. Go to the Cfg tab (configuration) ⚙️, tap on Online folder selector, and choose DropBox. A new configuration sub-section named DropBox will appear below the Google Drive sub-section.



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The subsequent procedure steps are similar to those used for Google Drive.
On Android device connected to the gateway :

2. Check the Writer mode box so that the device starts sending its data to the Cloud.
3. (Optional) change the table # to the desired # (default: Table #1).
4. If applicable, check Send logs (to send history data to DropBox, if the history option is also enabled).
5. To modulate refresh rate (so as to avoid excessive bandwidth consumption, if applicable), choose the refresh rate by tapping on Refresh Rate, and then choosing the desired data synchronization refresh rate.



10.2 Step 2 - Create a DropBox account

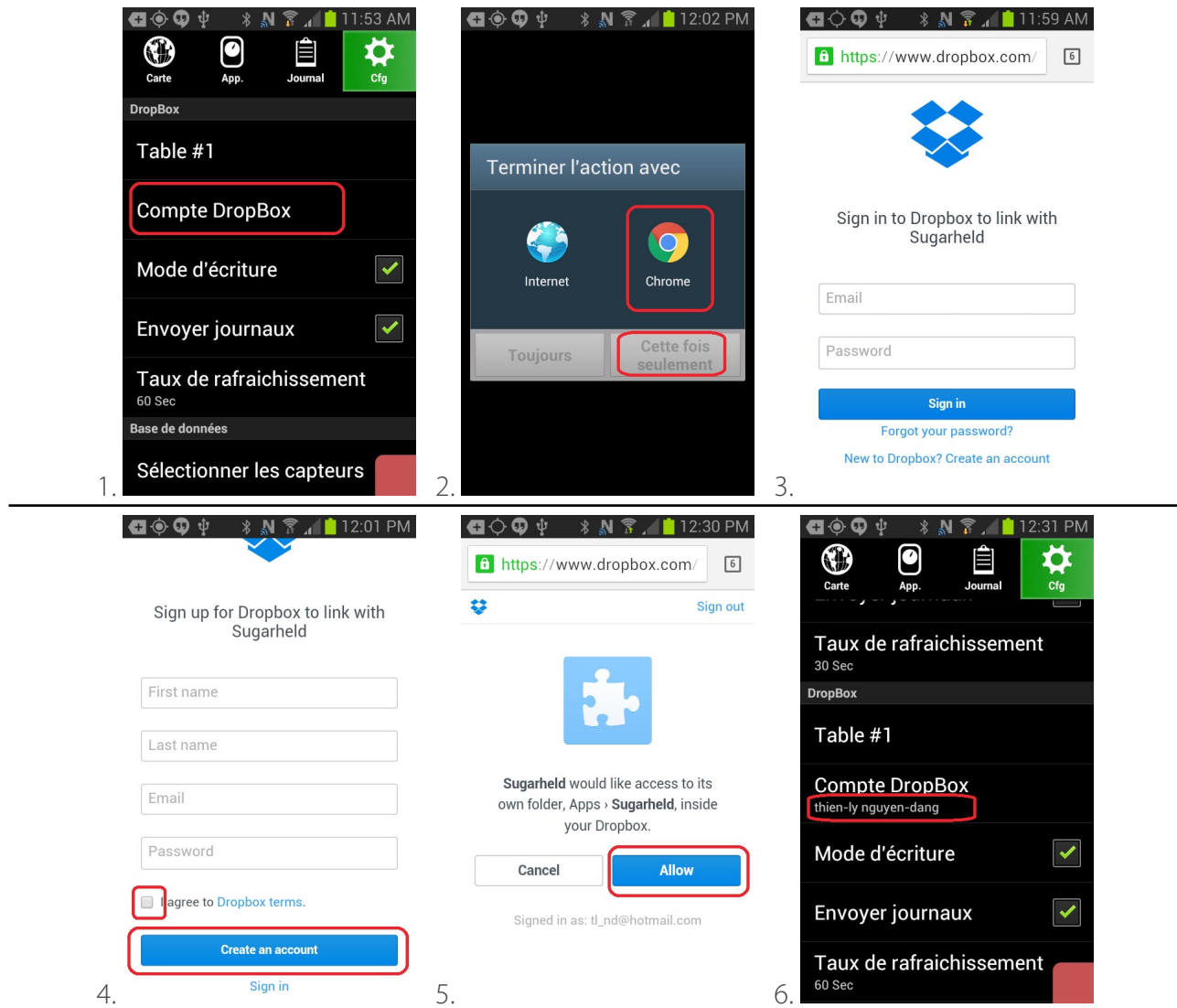
To create a DropBox account from the Android device:

1. Go in Cfg tab (configuration)  and tap on DropBox Account.
2. A dialog box appears. Select Chrome (or an equivalent browser) if a browser selection window appears.
3. The DropBox login page appears, asking for credentials. On the bottom of that page, there is also an option to create a new account.
4. If a new account creation is required, follow the DropBox instructions on screen, and note the username employed (e-mail address, typically), as well as the password. Check the checkbox to accept the DropBox EULA terms.
5. once the account is created, the browser might ask to memorize password for user. If so, accepting is recommended. Then, allow the Sugarheld app to access the DropBox account, when it asks for permission.
6. When back to the app, under the line DropBox Account, verify that the account name corresponds

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to the right one.

7. Back in the Sugarheld app, a message *DropBox: Ok* should appear shortly (once the data has been successfully pushed to the Cloud).




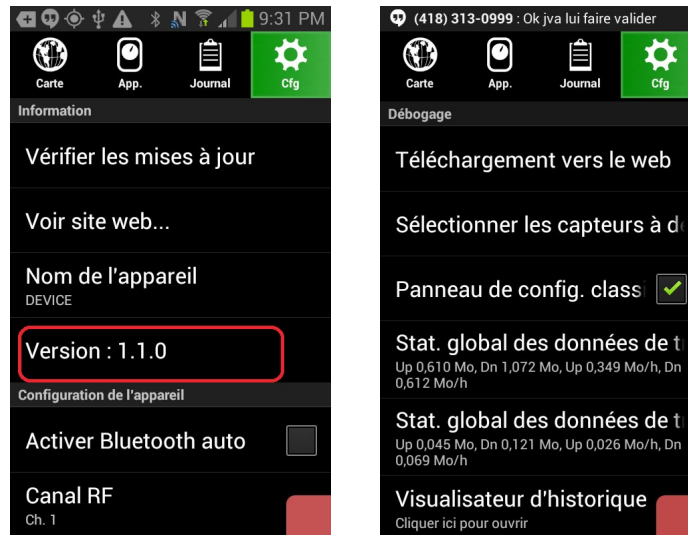
11. Development mode

The development mode allows testing of prototype functionalities.

11.1 Activating development mode

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To activate the development mode, go in the Cfg tab (configuration)  and tap 8 times on the software version number. A new development menu (called Debugging) will appear on the bottom of the Cfg tab page.



11.2 Web API upload/download mode

A special data synchronization mode via Smartrek servers is available. Note that this method does not allow data access via a Web browser, nor does it allow transfer of node logs. However synchronization, a la Writer/Reader style found in Google Drive/DropBox mode, is available.

To enable this data synchronization mode, here is the correct procedure :

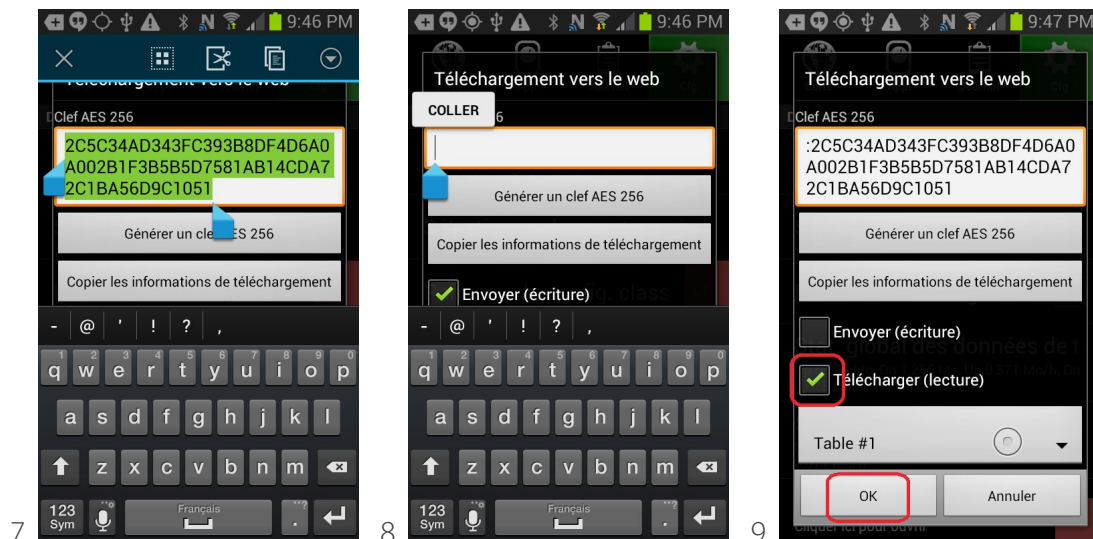
1. Go in the Cfg tab (configuration)  and tap Web API Settings.
2. A dialog box appears to configure synchronization parameters. Assuming the device to configure is connected to a gateway, and thus needs to send the data to the Smartrek servers, an AES key must be generated (if this is not already done).
3. Check Enable upload (writer), leave unchecked Enable download (reader), and make sure that the Enable AES 256 encryption is enabled. Optionally, select the table # and the data send frequency (this is similar to Google Drive). Tap on the button named: Copy download information.
4. In the window that appears, select GMail.
5. Choose a recipient e-mail address, and send the message. Back to the previous dialog box, tap OK to confirm configuration parameters.
6. Now, for a device that must read that data from Smartrek servers, go in the option Web API Settings. Then, go into GMail, open the newly received e-mail, and select the AES 256 key by long pressing the key string in the e-mail message. Tap the copy icon (top right corner).

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7. Back in the Smartrek app, in the Web API dialog box, select the current key, and erase it.
8. Long press the empty AES key field. A paste option appears. Choose that option.
9. Check the checkbox Enable download (reader), and clear the checkbox Enable upload (writer).
Optionally, select the desired table # as well as the read frequency (like Google Drive). Tap OK to confirm.



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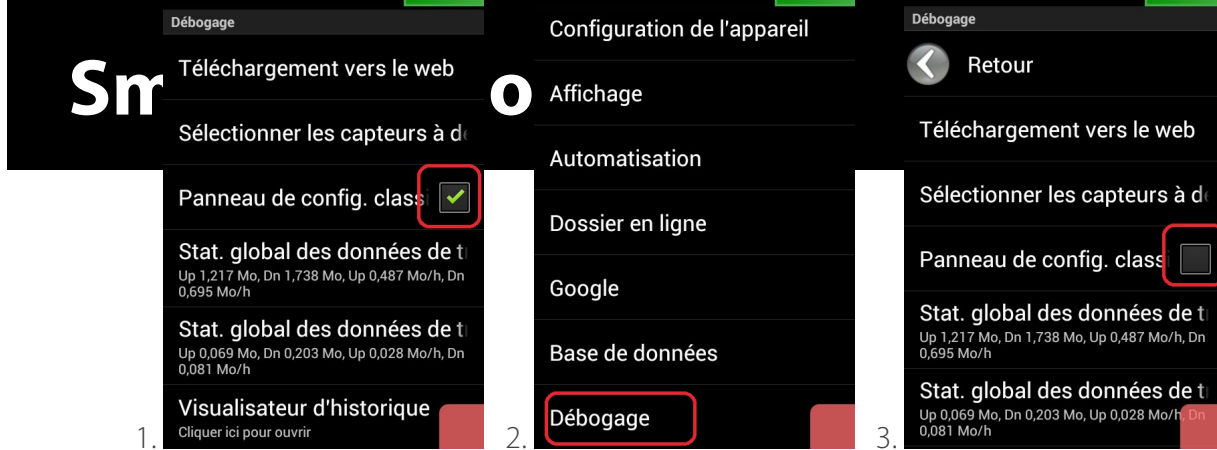
11.3 Selecting displayed prototype sensor types

Prototype sensors, which by default are hidden from users, can be shown in the table pages by going in the Cfg tab (configuration) ⚙️, then by tapping Select active sensors (in Debugging section). A window appears, exactly like the regular Select active sensors preference dialog, in which prototype nodes can be set visible or invisible.


11.4 Modern-style configuration tab

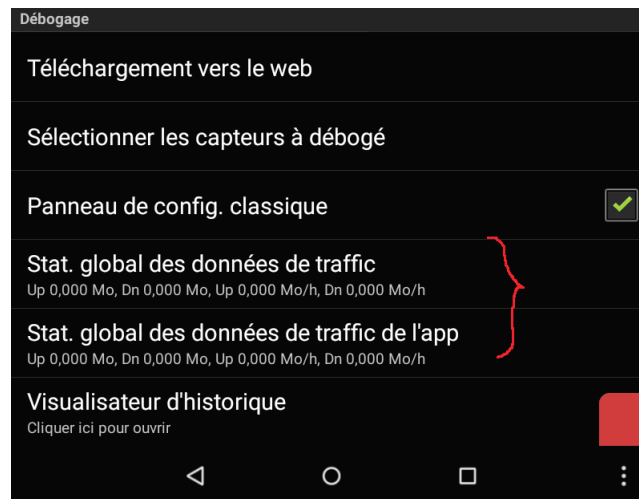
Alternate appearance and styling for the Cfg tab (configuration) ⚙️ can be selected by checking or unchecking the option Classic config pane.

1. Go in Cfg tab (configuration) ⚙️ and uncheck the Classic config pane checkbox. The app will restart, and subsequently the Cfg tab will regroup sub-sections into collapsable and expandable rows.
2. To restore the old Cfg tab appearance from the new style Cfg tab, go in the sub-section Debugging.
3. Re-check Classic config pane option.




11.5 Data bandwidth stats

Data bandwidth consumption stats by the app and globally by the phone can be measured in the Cfg tab (configuration) , sub-section Debugging. The top traffic preference item measures global consumption, and the bottom item measures app consumption. Each counter can be reset by a single tap.

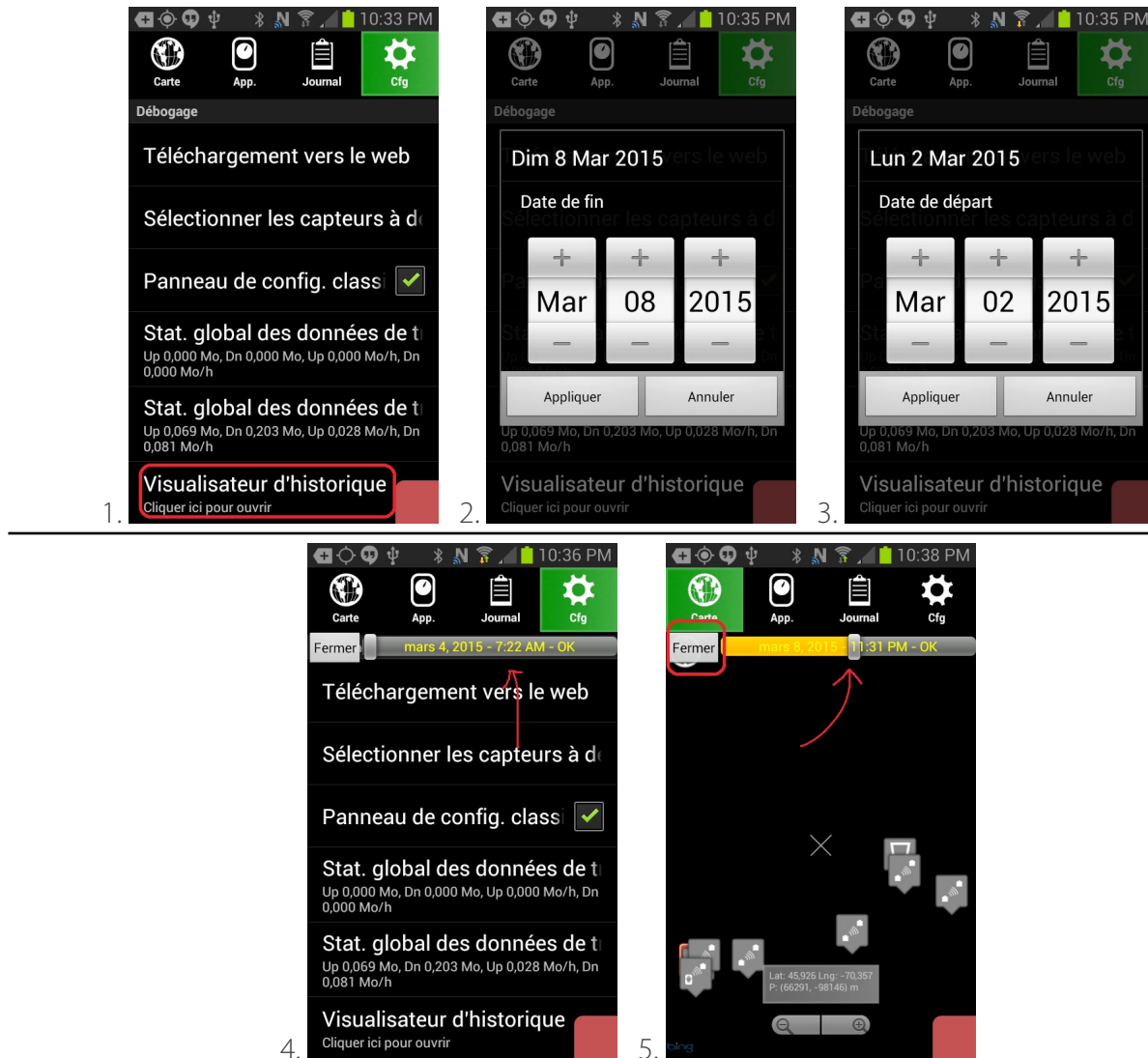


11.6 DB Replay

The DB Replay functionality allows visualization of the whole sensor network state on the Map and App tab, for a given date and time (if data history for sensors at this selected date and time exists). Here is the procedure for activating this log visualization tool :

1. Go in the Cfg tab (configuration)  and tap DB Replay.
2. Choose an end date.
3. Choose a begin date.
4. Wait a few seconds. The software will analyze the whole history in between those two date timestamps. Then, a seekbar will appear close to the tab icons, allowing display of network state for a given timestamp.
5. Tap on the seekbar to select an exact timestamp. Click on the Close button to the left of that seekbar to close the DB Replay mode, and to restore regular system operation.

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12. Sensor network deployment

12.1 Installing a vacuum sensor in the Smartrek network


Required materials:

1. Smartrek sensor
5. Screws
6. Misc. Tools (drill, fitting tools)

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With the gateway already installed, go to the desired installation location. The sensor must be installed within range of another device to be connected to the network. In woods conditions, the max range between two devices will be approximately 250m - 500m, depending on the density and the type of trees. In direct line of sight, the distance between two devices can be more than 10km. In cities, distance will vary greatly depending on occlusions and noise.

The recommended installation is as follow:

- 1 . On the main Android device, connected to the gateway, set the duty cycle to 20% (see Section 5.4) and adjust the hops count accordingly
- 2 . Install the antenna (if applicable), greasing generously the antenna connector with the provided dielectric silicone grease supplied before screwing on the antenna
- 2 . Walk with the sensor to the installation location
- 3 . Turn on the sensor by pressing the  On/Off switch and check that no other devices (not yet installed) is running nearby
- 4 . After the booting sequence , the On/Off switch LED indicator should blink at the same rate as the gateway's LED indicator: the sensor is then connected to the network. If the light does not blink at the same rate as the gateway, the sensor is not connected to the network. The node then blinks at every connection attempt to the network: bring the vacuum sensor back to the network boundaries until the connection strenght is good (blinking steadily without skipping too much).
- 5 . Once the sensor is connected to the network , watch the On/Off switch LED indicator and verify that it is blinking steadily (less than 1 skip per 20-30 blinks) . If the node is not blinking steadily , bring the sensor back inside of the network boundaries .
- 6 . Install a support at this location
- 7 . Install the sensor on the support using a screw to hook the sensor. **Do not screw at each corner of the sensor on a pole or rounded support.** The enclosure will bend slightly, allowing moisture and water to enter.
- 8 . Make sure the antenna is upright

12.2 Optimizing range between neighboring nodes

Here is a table summarizing typical ranges expected between neighboring nodes, depending on environmental conditions:

Environmental conditions	Approximative range
LOS (ligne de vue)	> 13km, depending on node height
Sparse woodland, without softwood	400-500 m
Heavy woodland, without softwood	200-400 m

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Softwood	100-200 m
Electrical lines	10-50 m
Shack & building walls	10-100 m
Metal walls	0-10 m

It is also important to consider the potential impact of other environmental factors such as air humidity (especially fog), presence of fluid flow (e.g. sap flow in trees), height of snow banks vis a vis sensor height. All those factors can potentially dynamically reduce the maximum range between two neighboring nodes. Thus, it is advisable to use a security factor when deploying nodes in optimal conditions(e.g. during the month of November, without leaves on trees, and without snow).

In the special case where a radio transceiver must be moved inside a building, and must communicate with outdoor sensors, positioning that transceiver (if possible) near a window usually helps. If signal attenuation due to walls is too high, some nodes that have an external RP-SMA connector can use an antenna extension cord in order to connect to an omnidirectional antenna on a rooftop, for instance. Each of those supplementary radio components must be rated for an impedance of 50 Ohms, and any antenna used should have a gain of 2-3dB max.

It would indeed be possible to employ an antenna with more directionality than a standard dipole, but in this case, deployment difficulty would be increased because the RF link quality would be more sensitive to difference between antenna orientation between two neighboring nodes.. It is thus advisable to only restrict oneself to dipoles, because those antennas are optimized for mesh networks since they are relatively tolerant to imperfect antenna orientation. It is thus usually advised to use a dipole antenna at 90 degrees orientation with respect to ground surface. Here is a diagram showing the typical signal strength of a transmitted/received packet according to signal direction relative to the node dipole antenna:

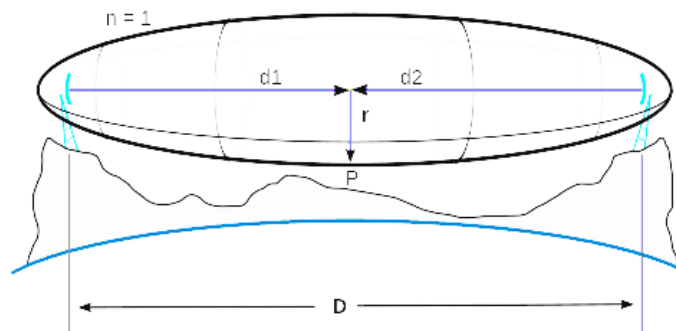


Note that the RF system operates at roughly 900 MHz, and thus its range is highly sensitive to node height relative to ground, according to a rule named the “first Fresnel zone”. Any occlusion to the

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first Fresnel zone of 2 neighboring nodes can potentially vary during the winter season, especially in windy conditions which provoke high levels of snow accumulation. Those conditions are usually found in mountainous terrain (such as in the Canadian Shield). It is thus important when deploying nodes in such cases to take into account a security factor for the node height between 3 to 6 ft.

The minimum height to ensure a good Fresnel zone vary according to distance between two neighboring nodes. Here is a diagram and a corresponding table describing optimal minimal heights for a given distance between a pair of nodes:



Distance between 2 sensors (in meters)	Optimal height at midpoint between two sensors r (in meters)
10	0.91
25	1.44
50	2.04
100	2.89
150	3.53
200	4.08
300	5.00
400	5.77
500	6.45
800	8.16
1000	9.13
2000	12.91
5000	20.40

Realistically, a sensor is typically deployed at heights closer to the 3 meters mark, or less. Thus, optimal ranges are usually not obtained. Nevertheless, this table allows an approximative determination of the proper height strategy to adopt (especially for longer LOS distances between 2 sensors, in which case

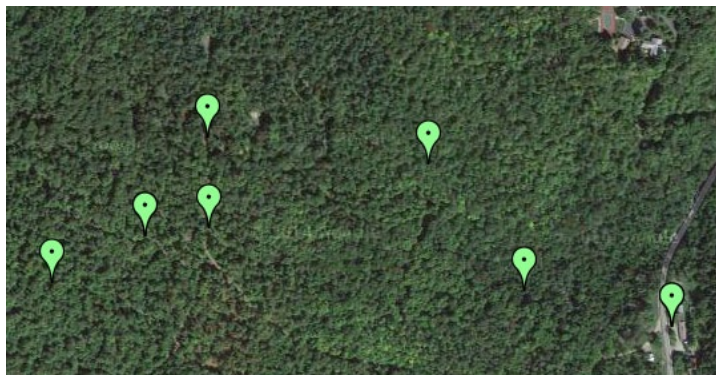
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deployment on telephone poles or on hills might be necessary).

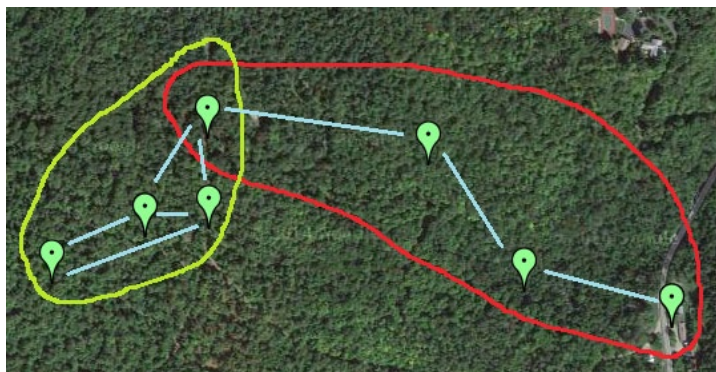
12.3 Network topology strategy tailored for reliability

The key for a reliable network is not only an appropriate distance between neighboring nodes in order to obtain an acceptable link quality, but also mainly due to the redundancy principle.

In effect, the strength of a mesh network resides on its ability to tolerate a single point failure of a random sensor, if the radio signal can be redistributed around the weak link. Here is an example of a topology with a bottleneck, in which reliability would be dubious at best:



In such a case, the rightmost sensors can only employ one single possible communication route, since they all have second neighbors that are too far away to be able to directly communicate with them, in the sporadic case where a packet from the immediate neighbor is missed due to signal weakness.



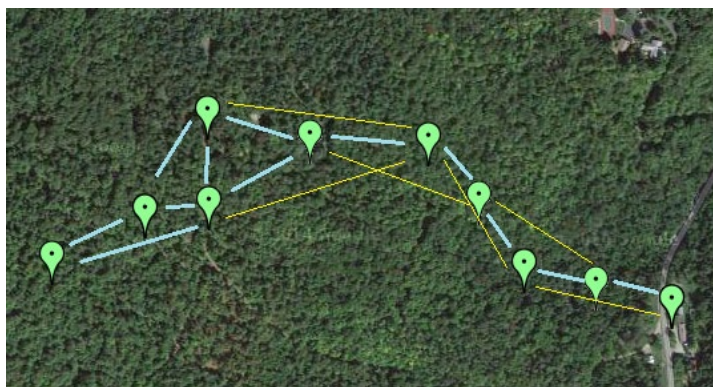
Circled in green: sensors with at least 1 supplementary redundancy level, and thus reliability is considered acceptable. Circled in red: a bottleneck which should be corrected.

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Here is a possible minimal corrective action with only 2 supplementary sensors, if the signal strength between the rightmost sensors is acceptable (i.e. consistently higher than 30%, as measured by a handheld node). In such a case, the hop count required to reach the green node group stays below 3, except for special cases where a radio packet cannot pass through via the shortest path possible. It would thus be advisable, among the corrective actions, to increase the hop count of the gateway by at least 3 hops, in order to accomodate the supplementary alternate paths:



If the link quality is too weak between the rightmost sensors (circled in red), then the network would occasionally fall dead and connect back again, intermittently, depending of environmental conditions. In this case, the aforementioned corrective action would not solve the weak signal issue (due to vegetation density, in this specific case), since distances between the added nodes are comparable to the original distances between the nodes circled in red. A better hypothetical correction would be to add 1 supplementary node between each neighbor circled in the red zone to the right. In this specific case, 3 sensors would have to be added. Here is the resulting network topology:

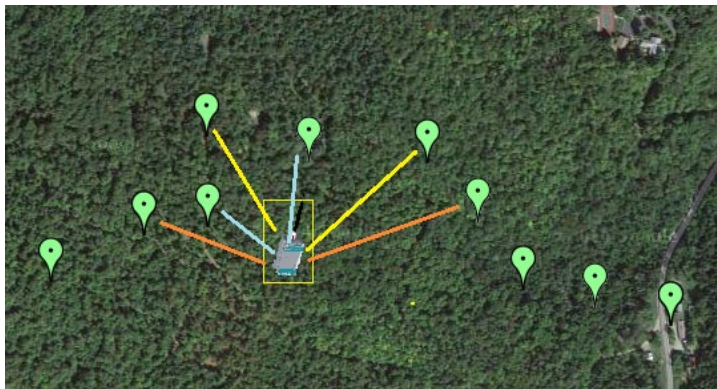


In blue: paths with acceptable link quality. In yellow: shortest paths possible, but with lower link quality. We see that inserting 3 supplementary sensors create multiple possible alternate paths, thereby greatly increasing redundancy. In this case, the strongest path (in blue) would require at least 3 more hops, relative to the weaker (but shorter) paths. It would thus be critical in this case to increase to hop count of the gateway by at least 3.

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12.4 Impact of the required hop count

When deploying a new network, or when diagnosing an existing network, determination of the minimum hop count setting of the gateway in order to ensure a reliable system is critical. This is also useful when attempting to determine whether a weak node in a bottleneck exists, among others, and also in order to gauge the signal strength in the midst of a field of active nodes with a handheld device. In effect, let us consider a handheld node in the following location, with the gateway located in the shack configured for 10+ hops:






In this precise case, it would be nearly impossible for a tester to determine the source of each radio packet received by said handheld. Moreover, if the tester verifies the strength of the received signal by opening the detailed handheld pane, the signal shown on the seekbar would fluctuate imprevisibly between 35-50% (blue signals), 30-35% (yellow signals) and 20-30% (orange signals).

To debug such a network, the easiest method is by (1) activate the development mode of the app (see precedent sections), and then (2) by testing the signal strength, starting with a very low hop count, and increasing that hop count value progressively.

It is possible to change the gateway configuration remotely with a smartphone, via Google Drive, DropBox, or Web API. Alternately, if precise signal strength assessment using a handheld is not needed, verification of the impact of a given hop count setting can be assessed within the comfort of the shack housing the gateway itself, by changing the gateway hop count parameter progressively, and by noting which node stays OK (in green in the following demo diagrams), which node is intermitten (shown in yellow), and which are disconnected (in orange).

Here is a test sequence example:

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Hop count(gateway)	Test results (green = OK, yellow = intermittent, orange = disconnected)
1	
2	
3	
4	etc.

This is a general method for qualifying the required minimum hop count in order to obtain a completely connected network to the gateway. In general, if it is determined that the minimum hop count is N, then it is useful to consider the possibility of increasing the hop count settings to N+6 or higher, since this would allow farther nodes to receive more packet retries from their neighbors, which would then increase system reliability..

Also note that the use of a reduced hop count allows the tester to verify signal strengths with a

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handheld more easily, since it would then be geographically easier to determine the real link quality values by progressively going further and further from the gateway. For instance, with a gateway configured at $2+1=3$ hops, the non-measurable zone via a handheld is in blue in the following diagram, and the rest are valid assessment zones. Note that we employ 3 hops for this test example, since sensors that are online at the 3 hops setting (see previous table) cannot repeat the signal towards the handheld, and therefore cannot possibly contribute to the signal received by the latter.:



It is worth noting that the handheld also acts like a repeater, as with any other sensor (except for the gateway). This means that a tester must be prudent when using a handheld in the field to assess signal strength, since the handheld can potentially re-emit a packet received from another node. If the guidelines for a reduced hop count test are followed, as in the aforementioned diagram, then the handheld will never be able to repeat a given signal to another sensor, and thus the test will be conclusive.

12.5 Deploying nodes with and without handhelds

It is always advised to have a handheld in hand when first deploying nodes in the field. The procedure which consists in progressively deploying sensor nodes by fanning them outwards from the gateway applies here, in order to successfully being able to determine signal link quality at all times before deploying any given node. If this is a first deployment, then the reduced hop count strategy outlined above might not be needed, since there will not be many sensors in the deployment zone that can interfere with the handheld node used to determine link quality.

Note that it is important to ensure that at least 1 active node is registered in the database of the Android device connected to the gateway. It is also important to ensure that this device is Bluetooth connect to said gateway, that the max. hop count for is enough, and that the app is currently trying to connect to sensors; if one observes the sensor table, animations flashing from left to right indicate that the gateway is sending a packet outward to request data from a specific sensor, and flashing animations from right to left indicate that this same gateway is receiving data from one given node.

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The same observations apply for a handheld-connected Android device that is currently sniffing the network.

In the special case where the user has no available handheld device, there is an alternate ad-hoc method to approximately qualify whether link quality is acceptable. To do so, a normal sensor is replacing the handheld as the link assessor, and is carried about by the tester at all times.

If the node blinking LED is observed (a blink corresponds to a packet transmission from that node), two properties of that LED can be analyzed: (1) whether that LED blinks in a stable and periodic fashion, without skipping a blinking cycle, and (2) when that LED is blinking within what one might call a "broadcast cycle", whether this LED is rapidly oscillating 3 times during a fixed interval (around 100 msec).

Note that this rapid "oscillation", or rapid blinking, is at a frequency of 33 Hz, and is thus visible to the naked eye. It is even possible for certain users to count the number of rapid oscillations (between 0 and 3 max.). For a sensor situated at hop N, and for a gateway configured to a max. hop count M, then the expected oscillation count is dependent on the difference D between the hop #, N, and the max hop count M:

Difference $D = M - N$	LED rapid oscillation count (ideal conditions)	Sensor state
< 0	0 (no blinking at all)	Disconnected
0	0 (no blinking at all)	Connected
1	1	Connected
2	1	Connected
3	1	Connected
4	2	Connected
5	2	Connected
6	2	Connected
7+	3	Connected

When progressively deploying nodes by fanning outwards from a gateway, it is thus useful to employ a value $D > 6$ to ensure that every single sensor can oscillate 3 times if its received signal is strong enough, in which case, determining approximate link quality can be done by observing the LED with the following procedure:

1. Is the light blinking in a stable and periodic fashion, between broadcast cycle (what is considered stable is 1 missed blink interval every 30 broadcast cycles).
2. Is the LED oscillating 3 times for the vast majority of broadcast cycles? That LED should only miss an

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oscillation beat every 5 broadcast cycles, or more.

If those two conditions are not respected (expecially condition 1), then it would be wise to consider a network topology change in order to reduce distances between affected sensor node, and/or deploy more sensors in order to increase fault tolerance

13. Troubleshooting

Device	Symptom	Diagnosis
Android	The barcode cannot be scanned correctly.	Verify that the barcode is inside the central square. Verify that there is enough contrast (possibly by ensuring that ambient brightness is sufficient). Verify that there is no specular reflection back into the camera lens. Verify that the lens is not dirty, and that there is no plastic membrane covering it. Change your device orientation and try again. Verify with another barcode on another node, to ensure that the original barcode tested is not broken.
Android connected on gateway/ handheld	My table is completely gray (the gateway and handheld pages included). Nothing happens.	No radio devices are activated, neither gateway nor handhelds. Long press the row of the device to be activated, and choose Activate node.
Android connected on gateway/ handheld	My table is gray except for the gateway or handheld page. One error is showing: Dead node.	There is a problem with the Bluetooth communication between your Android device and your gateway/handheld. Verify that the gateway/handheld is turned on, and that the Bluetooth chip of your Android device is on. For a handheld: verify that the battery level is high enough. Restart both devices if this still does not work.
Android connected on gateway/ handheld	My table intermittently changes color, and shows the message: Network glitch.	There is an intermittent Bluetooth communication problem between the Android device and your gateway/handheld node. Restart both the smartphone/tablet and your gateway/handheld. Try again.
Android connected on gateway	My table shows correct colors, but there are no animations showing in my node table nor in my map tab.	The Android device probably has an active Google Drive/DropBox/Web API mode, set up as a reader, and thus data from Internet is overriding the connection with your gateway. If you are using Internet synchronization facilities, change the configuration so that the Android device is set as a writer device instead.

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Android connected on handheld	My table shows correct colors, but there are no animations showing in my node table nor in my map tab.	The Android device probably has an active Google Drive/DropBox/Web API mode, set up as a reader, and thus data from Internet is overriding the connection with your handheld. Deactivate Internet synchronization (to use a handheld properly, Google Drive/DropBox/Web API modes must be disabled).
Android device used to scan nodes outside	I am scanning my sensors, but they disappear from the map or table after a while.	The Android device used to scan the nodes is probably connected to Internet via Drive/ DropBox/Web API. Deactivate any Internet synchronization mode, and make sure that when you are done scanning, that you transfer the data from the scanner device to the main tablet connected to your gateway, via NFC/WiFi/Sharing.
Android device used to scan nodes outside	I am scanning my sensors, but they are not located in the right place on my map.	Make sure that (1) your GPS is active and functional, and (2) your Map tab cursor is locked to the GPS (press the Menu button, and verify if it is locked).
Android	I am attempting to transfer my data via NFC by putting two devices back to back, but nothing happens.	Make sure that NFC mode is enabled in the global Android settings. Make sure that both devices actually have the required NFC hardware (which is not the case for many Samsung tablets, as well as various other branded tablets). Try to transfer via the WiFi or Sharing methods.
Android	I am attempting to transfer my data via WiFi, but the other device is undetected.	Make sure that both devices are connected on the same WiFi router. Restart the Smartrek app on both devices, and try again.
Sensors	A large subset of my sensors cannot connect to my gateway, even if they are right next to it.	Your gateway is probably on a different RF channel than your sensors. Read the section <i>Votre passerelle est vraisemblablement sur un canal RF différent de celui de vos capteurs</i> . Read section <i>Understanding the LEDs</i> to verify that the RF channels of your sensors do correspond to the RF channel as configured in your Cfg tab (default: channel 1).

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Sensors	My system was nominal, but suddenly a subset of my sensors fell dead, or became intermittent. I did not change my system topology.	There was probably a weak link in your system, which was adversely affected by environmental conditions (snow, sap, fog, etc.), and the rest of your network probably rely on this weak bottleneck link to transfer their data back to the gateway. Read the section Sensor Network Deployment for more details, as well as debugging suggestions.
Sensors and Gateways/Handhelds	I connected a gateway and/or a handheld configured as a gateway (in the menu Add node, this is a modifiable option). And now, a subset of my sensors fall dead and only sporadically reconnect (or even never reconnect).	You probably activated another gateway (or equivalent) on the same radio channel than another active gateway, and now both are vying for control of your sensor network. Ensure that there is no physical overlap between all networks controlled by different gateways, or else ensure that each sub-net are configured with different RF channel settings.
Sensors	A sensor fell dead, and only reconnect when it is very very close to another functional sensor (only a few dozens of feet at most).	Your sensor probably has an antenna problem. Please call tech support.
Sensors	I had dead node issues due to my network topology, and now, even after applying corrective actions, many of my sensors are either dead, or show unreliable values.	When a sensor is not correctly connected to a gateway, it goes into seek mode. This mode prevents the node from sleeping, and thus it starts consuming between 5 to 30 times more energy than normal, and so if your system remained unconnected for too long, you might have to deal with low voltage battery problems. In this case, please replace batteries in affected nodes.
Android	I tried to download the map many times, but the map at my location seems to stay blank.	Your map zero is probably not set at the right location (should be at the location of the gateway). Make sure that this map zero is set to the right location, prior to downloading maps. Alternately, maybe a map layer was inadvertently deactivated. Thus, please make sure that all relevant layers are enabled correctly.

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Android	I tried to draw on my map, but when I deactivate the drawing tool, my drawing becomes invisible.	Your Paint layer is probably deactivated. Re-enable it.
Android in Internet Reader mode	My telephone auto-activates Bluetooth when I try to deactivate it.	If you do not need Bluetooth because you are using the Android device as an Internet reader device, then you can deactivate the Bluetooth Auto-Enable feature in the Cfg tab.
Android in Internet reader mode (Google Drive/DropBox)	I have stale (old) data issues, and I have sporadic messages popping up on the bottom of my screen indicating that my system is not OK.	Verify that you have Internet access with this Android, with an acceptable Internet speed, by going in a browser in order to test browser an Internet website of your choice. Also verify that the app version number is the same for all Android devices you are using (else the Google Drive synchronizer will refuse to synchronize your devices with the data on the Cloud). Finally, verify that you are indeed configured in Reader mode, and that the Select Online Folder option in the Cfg tab is indeed set to either GDrive or DropBox, whichever is applicable..
Android in Internet reader mode (Web API)	I have stale (old) data issues, and I have sporadic messages popping up on the bottom of my screen indicating that my system is not OK.	Ibid. Also verify that your AES 256 key (if applicable) is the same on both your Reader and Writer (connected to gateway) devices.
Android	I can't access my data history.	Check that the Enable History option in the Cfg. tab is checked. Note: for a Reader device connected to Internet, data history only works since version 1.1.0+.
Internet via browser with Google Drive/ DropBox	I have local access to my node data history, but not from a browser (Excel export mode).	Make sure that the option Enable History, as well as the options Send Logs (for either GDrive or DropBox, whichever is applicable) are checked in your Cfg. tab.

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Android in Internet reader mode (Google Drive/DropBox), or Internet via browser	System seems OK but my data is stale (old).	The newest app version should show you an error message indicating that you have stale data. Notwithstanding, old data show that your Android device connected to your gateway is either badly configured for GDrive/DropBox as Writer mode, or has Internet connectivity issues (this can happen due to a defective router, or when using a weak signal 3G/4G data connection).
Android in Internet writer mode	I have frequent Internet connection errors (sparse or no OK messages appearing on the bottom of my screen).	Ibid. (read above). Also note that some tables using WiFi have a known firmware issue with Android 4.x+, which has a negative impact on WiFi stability. Install the WiFi fixer app on your Android device (available in the Play store). 
Android / Internet via browser	I tried to diagnose many times my GDrive/DropBox Internet synchronization setup, and the servers seem unstable.	In the case when all possibilities are exhausted, and debugging procedures yield no results, it could happen that there are temporary Cloud problems on a server close to your location. Also verify that you have the last version of the app running in all your Android devices. Also verify that your tablets and gateways are connected onto a stable electrical infrastructure (you can deploy UPS to protect your sensitive electronics). Worse case, you can temporarily change your synchronization method to alternatives (2 choices for access via browser: GDrive and DropBox, and 1 choice for Android-bound access: Web API).

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Vacuum sensor	Indicated temperature is often higher than predicted, according to my local thermometer.	<p>Ensure that your sensors are not unduly affected by sunlight. To do so, make sure that they are mainly oriented toward the North, and/or inside of shadow zones. Note that a minor temperature difference is normal due to external factors such as solar irradiation, shadowing, wind, etc., even if a sensor is properly oriented at the North face of a tree.</p> <p>There also exist hot and cold air drafts and corridors locally in a deployed sensor network zone (often depending on local topography), which thus influences temperature gradients throughout the deployed sensor zone.. Also note that the temperature chip normal measuring tolerances are $\pm 1.5^{\circ}\text{C}$.</p> <p>For a higher precision, a dedicated temperature sensor (such as a ground humidity sensor, for instance) might be necessary. Also note that there are errors in measurement from conventional thermometers, which also need to be taken into consideration when comparing sensor temperature readings.</p>
Vacuum sensor	The vacuum reading is lower than expected.	Verify joint and tube leakage close to the sensor head. You can also verify leakage status of the internal flex tubes inside of the box, which should also be leak-free.
Vacuum sensor	I have completely erratic value readings that do not make sense.	This can happen if your batteries are too weak. Below 20% battery level is a good threshold to replace your batteries.
Tank level sensor	When my tank is empty, a negative or invalid value shows on my screen.	Verify that your level zero calibration is correctly set.

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Relay box	I am trying to activate a control channel, but it refuses to obey.	Verify that your box is not in local control only (bypass) mode. Also verify that there is no running automation code that is currently forcing channel state for this particular box. To do so, you can temporarily deactivate global automation by unchecking the option Enable Automation in your Cfg. tab. If this solves your problem, it is really a question of one of your custom block programming code seizing control of your box. In which case program modification might be necessary.
Relay box	The CH1 and CH2 LEDs on the box indicate that the control channels are operating correctly. Nevertheless I am measuring a voltage that stays at 0V between the two wires of my channel(s)	Verify that both fuses in the box are functional.
Gateway	My gateway is always in fast polling mode, never in regular polling mode. This forces excessive battery consumption.	The fast polling mode is enabled when special conditions on certain nodes are true. Often, this is a case of a configuration issue for a level sensor, where the calculated level value is higher than the Priority threshold of said sensor. Verify that your calibration and thresholds for your sensors are correctly set.

14. Block programming

14.1 General properties of a block program

A block program is a program linked to any node that allows it (certain sensors, such as vacuum sensors, level sensors, relay boxes, a gateway). A block program must be rapidly executed to completion, and this execution time must be faster than the time between 2 broadcast cycles.

When the Enable Automation option in the Cfg.tab is enabled, a program will be executed according to certain event triggers. Note that automation will only function on an Android device connected to a gateway, and only applies to any sensor and any gateway controlled by said device. Because there can only be 1 program per gateway/sensor, this unique program can be executed following many different even trigger (there are certain block elements that can be used to discriminate between event triggers, within the same program):

Event	Executed block program
Gateway is broadcasting (sends a request towards a certain node N)	Gateway program Node N program
Node N is broadcasting (sends its data back to gateway)	Gateway program Node N program

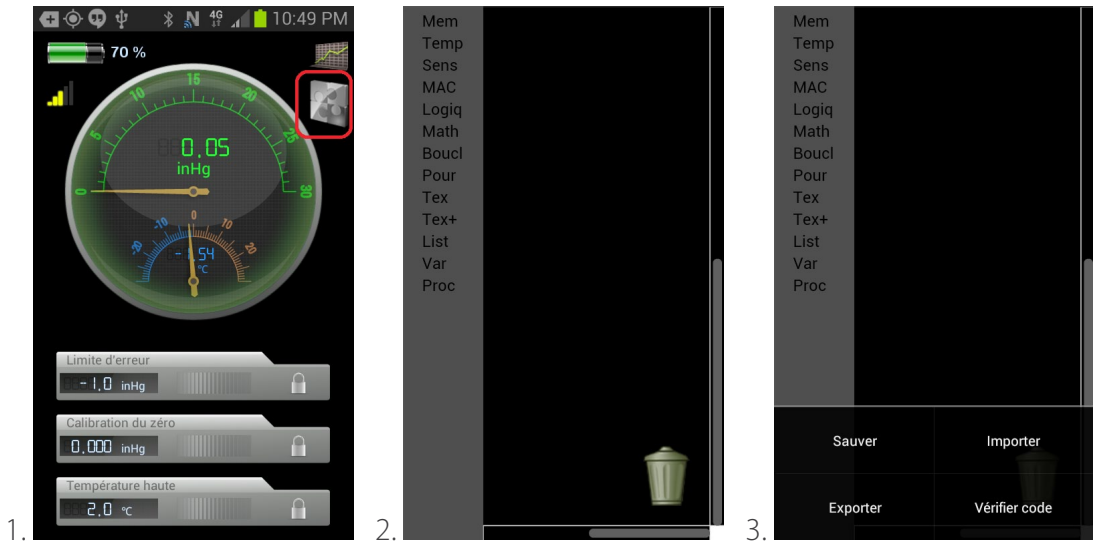
Note that a program is only executed if it exists for a given sensor node, and if the global automation enable flag is enabled. In the sensor pane, the automation icon is colorized if a program exists, and is grayed out otherwise. If the global automation option is enabled in the Cfg. tab, then small automation icons, also colorized, will appear near sensor icons for each table line (if a program exists for this sensor).

Icon	Node state
	No program
	Has program

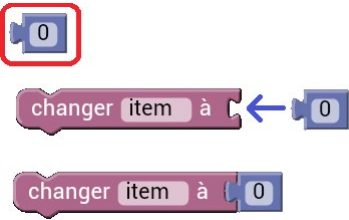
It is not possible to edit a program while a gateway is active, for security reasons. Therefore, in order to edit a program, any active node must first be deactivated (gateway or handheld). To do so, follow the same procedure than for activating a gateway (see section Installing the gateway).

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1. In the main sensor pane, tap on the blocks icon.
2. A program editor window appears, with a column on the left containing groups of blocks for programming, and a trash icon on the bottom right to erase a block.
3. To import, export or save (and thus confirm program modification for a node), press the Menu button of the Android device, and tap on the menu item corresponding to the desired choice.



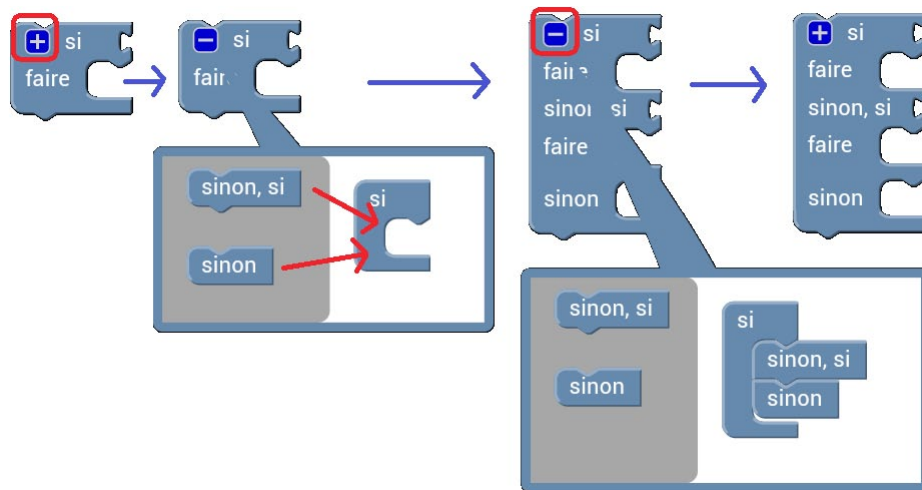
A program is a collection of blocks, and the execution order is always from top to bottom. Each instruction can be attached to one or more instructions, like puzzle pieces. There exists 2 instruction types: statements and functions:

	Description	Block example
Function	Returns a value (whose type depends on the block type).	

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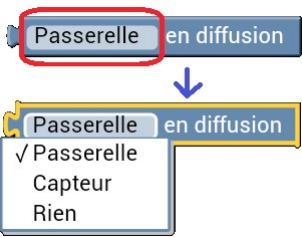
Statement	<p>Executes some operation. Another statement can precede or follow it.</p>	
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Some blocks can change shape depending on what user needs. Those blocks have a + icon, which, when tapped on, open a small window that allows modification of its shape, using other blocks:

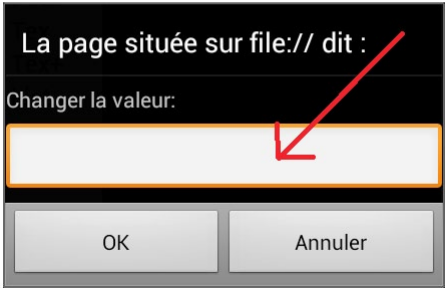


Some blocks have selectable properties. Those that have selectable option lists can be configured by tapping on said option lists:

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Other blocks have modifiable properties by tapping on the modifiable field in order to enter a value in the dialog box that appears:




14.2 Value types

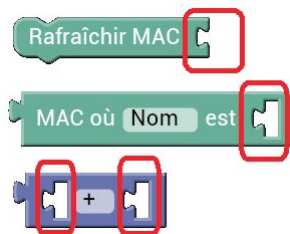
A program can deal with multiple value types:

Value types	Description	Function block example returning this value type
Number	A standard mathematical number (floating point)	
Logic	Can take 2 possible values: true or false	
Text	A set of readable characters	

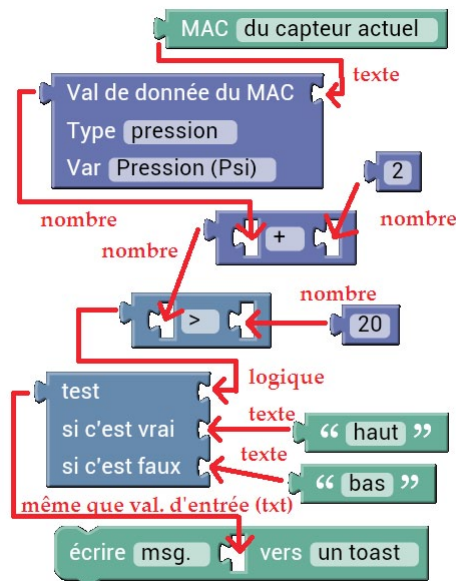
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List	Used to store a list of objects of arbitrary types	
------	----------------------------------------------------	------------------------------------------------------------------------------------

A block, either a statement or a function, can accept an arbitrary number of arguments (values). The valid type for a given argument depend on the statement/function:

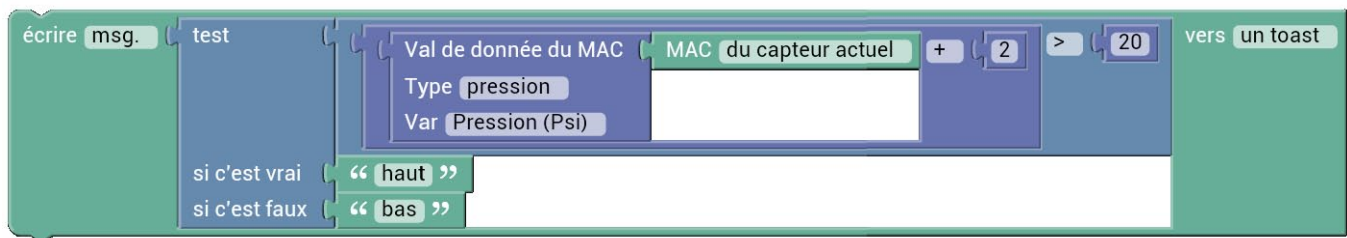


Because a return value of a function is a value of a certain type, this return value can be employed as input argument for another statement or function:



The result of such a combination becomes a monolithic bloc, as shown here:

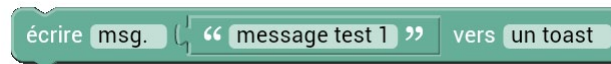
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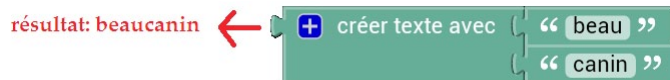
14.3 Text

A text value is a combination of multiple readable characters. This type is useful mainly for defining constants, such as global variable names, message strings to be printed, and also to store MAC addresses.

To debug a block program, the simplest method is simply to print out temporary messages to the screen. A block statement that does this is as follows:



To concatenate a string with another one, here is the operation to be used:



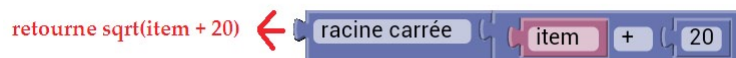
Another useful operation consists in finding the length of a given string:



Those base operations are necessary in order to use more advanced functionalities, such as for extracting sub-strings, for instance.

14.4 Number

A number value is a mathematical floating point number which can be manipulated using regular mathematical operations:



Data and configuration values from a given sensor are often stored as numbers (except for certain binary logical values, such as channel state for relay boxes).

A common and useful operation is to compare a number with another number in order to execute some action if that condition is true:




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condition vraie si
(item1 + 20) < item2



14.5 Logical operations

As precedently demonstrated, logical operations are necessary for the majority of programs, in order to execute an action depending on certain conditions. Some operations over logic values (true or false) can be combined with logical operators, which usually take 1 or 2 arguments (logic input values), and return a logic value (true/false):

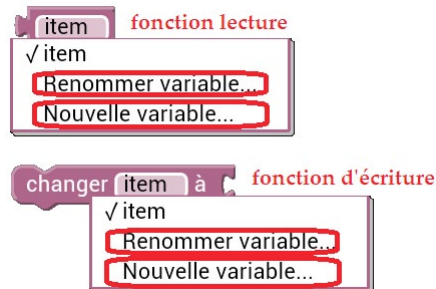
Name	Description	Block
AND	Returns true if both arguments are true. Else returns false.	
OR	Returns true if one of the arguments is true. Else returns false.	
NOT	Invert the input argument (if input is true, returns false; if input is false, returns true).	

14.6 Local variables

It is possible to store arbitrary values inside of local variable, in order to ensure program readability and to avoid code duplication. Those local variables are only valid during program execution, and are destroyed once the executed program ends.

To create a variable with a new name, simply place a local variable block, tap on the option menu, and choose New variable... To Rename a variable, tap the same menu, and choose Rename variable...

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Here is a simple example that uses 2 local variable in order to separate mathematical operations into their sub-parts:



14.7 Global variables

If one intends to store values in a variable that stays within the memory of the Android device, even after a program terminates, then the use of global variables is necessary (a typical use case would be, for example, to program a hysteresis threshold on a relay box, and to tie multiple programs for many nodes together).

The use of global variables is similar to that of a local variable, except that the user must manually define the variable name using a text string.

Here is the math example above, but using global variables instead:



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If the same blocks program must be re-used for many sensors, with global variables that must not conflict with each other from sensor to sensor (an hysteresis implementation is a typical example that needs this), then a viable strategy is to define a global variable name using the current sensor MAC address (the sensor for which a program is currently executing). This would avoid global variable conflicts (because those are shared between all executed programs).

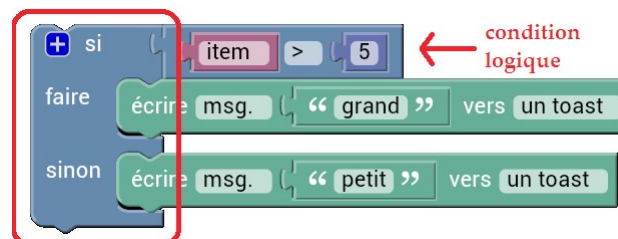
Here is an example of such a strategy: a global variable is created by combining the text string 'hyster1' with the MAC address of the current sensor (also a text string). For instance, for a node with MAC = 0.0.1.3, the global variable thus defined would be: "hyster10.0.1.3". In the following blocks example, the value 24 is then written into the created global variable.



Note that a global variable is only destroyed when the Sugarbush app is closed.

14.8 Conditions

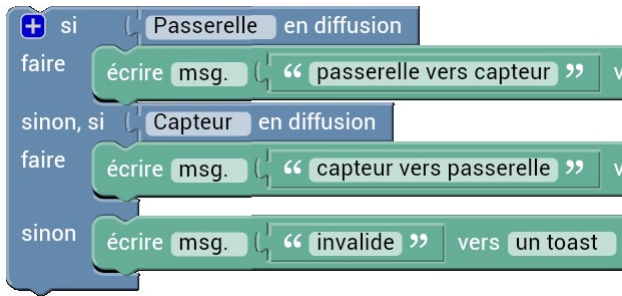
A blocks program can use special condition blocks, which execute a statement or another, depending on the state of a certain logic argument (true or false). The following example demonstrates such a simple condition: if variable "item" is bigger than 5, then print a temporary message "grand" to the screen. Else, print a temporary message "petit":



14.9 Global interaction with the mesh network

It is possible to determine which event trigger caused a program to execute. Here is an example that executes 2 different code sections depending on the broadcast direction of a radio packet:

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It is also possible for a program to schedule a broadcast polling cycle for a specific sensor. A typical use case of this would be, for instance, in order to verify the value of a given sensor consecutively, by asking close by sensor updates, so as to ensure that this data value is valid, before executing a critical action.



For instance, a program, if it detects a water tank level higher than a pre-determined threshold, could ask consecutive sensor updates for this particular tank level sensor, in order to filter any potential sensor glitches, before activating a transfer pump.

14.10 Read and write to sensors

To interact with a sensor, the first step is to obtain its MAC address. Here is a table listing possible ways for obtaining such a MAC address:

Name	Description	Block
Direct text block	Enter MAC address directly.	
Find the MAC address of a sensor with a known name	Accepts a selectable argument: either the name, S/N or BT MAC, and returns the radio MAC address of a sensor matching the query string or 0.0.0.0 if the sensor cannot be found.	

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