DS3 Data Acquisition System

User's Manual

Updated on May 23, 2016

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1 Introduction

The **DS3** data acquisition system is part of a series of products sold by Sensorscope SARL.

Thanks to its modular core built around daughter boards, the DS3 offers a great flexibility to the user who can, at any time, change the set of connected sensors and thus adapt the system to his needs without reprogramming anything. It features as well a radio communication system, used to create groups of measurement points composed of multiple DS3 devices monitoring large areas.

The DS3 device is highly energy-efficient, and is thus simply powered by four AA batteries charged through a solar panel located inside the lid of the case, making the device easy to move and to set up. It is energy-autonomous and can operate even during day with low sunshine.

This manual will help you getting your DS3 up and running. You will learn how the system operates and how to set it up before installing it in the field. Throughout this document are warnings in red boxes. Please make sure to pay attention to these warnings: Ignoring them may lead to malfunction or even to **permanent damages** to the device.

2 System Overview

2.1 Master or Slave Station

A DS3 device may be set up as a **master** or a **slave** station. This notion of master/slave is very important to manage the operation of the system.

A master station operates autonomously and can manage a whole network of slave stations. It can retrieve the current time to send it to its network, in order to timestamp the gathered data. It sends the set set of data gathered by itself and its network to the Internet, to allow for a remote access.

A slave station depends on a master station to operate. Without a radio link to a master station, a slave station does absolutely nothing: It will not retrieve the current time, and will not gather any data.

A slave station cannot operate without a master station.

If you install a single station at a given location, it has to be a master station. Only additional points, if at a reasonable communication range from the master station, may be covered by slave stations. The operation of radio communications is described in Section 7 .

2.2 Data Gathering

Unless otherwise indicated, all sensors are sampled precisely **every minute** (8.00, 8.01, 8.02…). The date used for timestamping is retrieved by the master station, for instance through the cellular network when a GPRS communication board is used, and then sent to all the slave stations connected to this master station. This date is exactly the same same for all stations in the world, thus certifying that data is gathered simultaneously by all stations, being geographically closed to each other or not.

Gathered data is sent from slave stations to the master station, which then stores them in an internal memory until being sent to Sensorscope's servers. The transmission delay to the servers is around **fifteen minutes**. A given point of data will thus be available on Climaps around fifteen minutes after the measurement.

2.3 Flexibility

The DS3 device has been designed to offer a great flexibility to the user.

The device itself is mainly comprised of a mother board that provides only the basic radio communication feature. Other functionalities are provided by daughter boards which can be installed on the main board using the dedicated connectors.

There are two types of connectors:

- **Three connectors for sensors** that can be used to connect sensor boards. For each sensor to be used, the corresponding sensor board must first be installed on the mother board. The sampling of the sensor is performed by the sensor board: Without sensor board, you cannot connect sensors to the DS3 device.

- **A communication connector** which can be used to turn your device into a master station. If for instance you connect a GPRS communication board, your DS3 will automatically be configured as a GPRS master station. If you don't install any communication board, your DS3 will be a slave station.

This flexibility allows you to modify your device at will, according to how your needs change over time. If you decide at some point to move a slave station far from its master station, you can turn it into a master station by simply connecting a communication board. If you have to connect a new sensor on a station in the field, you just have to install the corresponding sensor board before connecting the sensor.

These modifications do not have to be planned while purchasing your system, and do not require any programming or configuration of your device.

If you want to install many sensors and three connectors are not enough for your application, you just have to install multiple DS3 devices which will automatically communicate together through their radio chip without configuring anything.

2.4 Radio Communications

A key feature of the DS3 device is its ability to perform **multi-hop** communications, which makes it possible to install some of the slave stations outside of the communication area of the master station.

In most radio networks, a device acts as an access point (such as a Wi-Fi access point for instance) and all other devices must be placed within its communication range. If that range is 200 meters at most, then all other devices must be located within 200 meters from the access point. If a larger area is to be covered, other access points must be installed.

Thanks to the multi-hop technology developed by Sensorscope, slave stations form a chain of repeaters to forward data up to the master station, which can then transmist everything to Climaps through the Internet. Thus, with a single master station, a large area can be covered by a set of slave stations.

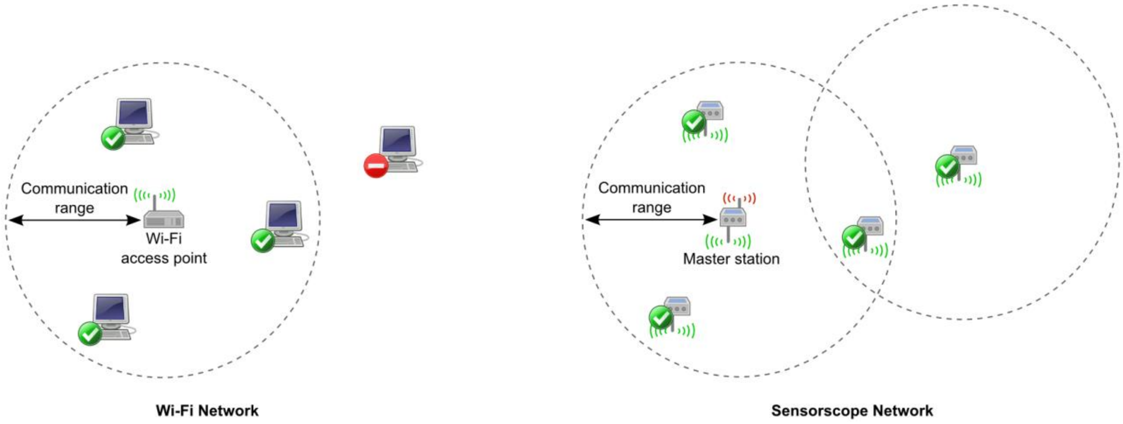

Figure 1 – On the left, a traditional radio network: The computer on the right is outside of the communication range of the Wi-Fi access point and cannot communicate with it. On the right, a Sensorscope multi-hop network: The DS3 device inside the intersection of the two circles acts as a relay for the device outside of the communication range of the master station. In this example, all the DS3 devices belong to the same network and send their data to the master station.

The possibilities of the Sensorscope technology are presented in Figure 1. While in the case of the Wi-Fi network an additional access point should be installed to cover the computer on the right, a single master station is enough for the Sensorscope network.

The creation of the multi-hop network is automatic, and does not require any **programmation or configuration** from the user. It is enough for the devices to be close enough for the network to be created without any action on the user’s side.

2.5 Accessing the Data

Data gathered by DS3 devices are sent by the master station to Climaps through the Internet. How this transmission is performed depends on the type of communication board installed in the master station: With a GPRS communication board, data is transmitted through the cellular network thanks to the GPRS technology.

Once this data stored on the servers, it can be access using the Climaps web application using any Internet-enabled device, such as a computer or a smartphone.

You are the only user who can access the data transmitted by your devices, in addition to the users to whom you explicitely give the right to. Using the website is described in its own manual which can be downloaded from Climaps.

3 Preparing the Device

Before installing the device in the field, it must be properly prepared and tested. To do this, please make sure you have:

- A cross-shaped screwdriver of size 2 (screws of the case).
- Another cross-shaped screwdriver of type Phillips 1 (screws of the sensor boards).
- A M15 wrench, or an adjustable wrench.

3.1 Description of the Mother Board

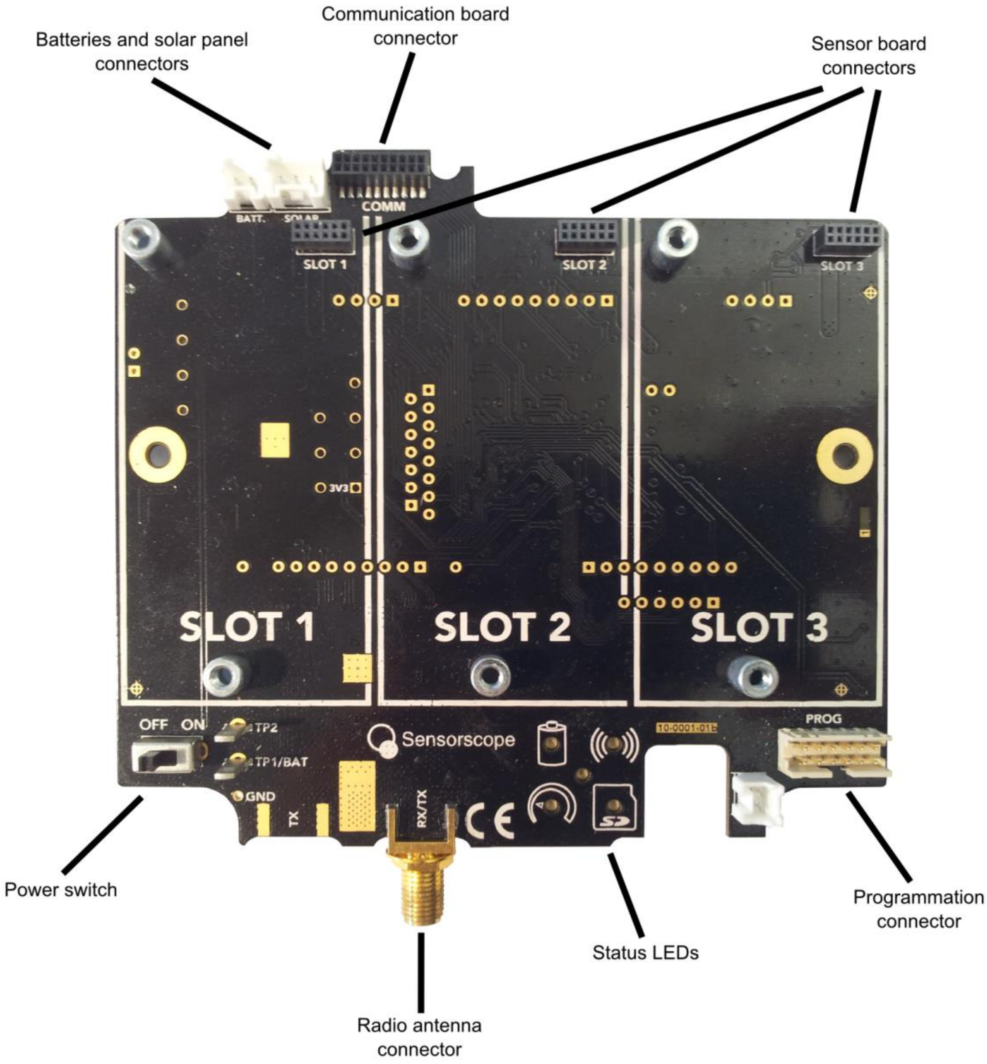

Figure 2 – General overview of the DS3 mother board outside of its case.

3.2 Connecting Sensors

If it still present, first remove the shrink-wrap over the lid of the case, and then unscrew the four screws around the lid. Once opened, remove the second shrink-wrap covering the solar panel and lift it up to access the mother board.

Make sure that the power switch on the bottom left is off (see Figure 2), and then gently insert the sensor board in one the available connectors. Both three connectors are similar, so you can use any of them.

However, connectors are generally used from the left to the right. Once the board connected, screw the two screws on the sensor board in order to tie it to the main board.

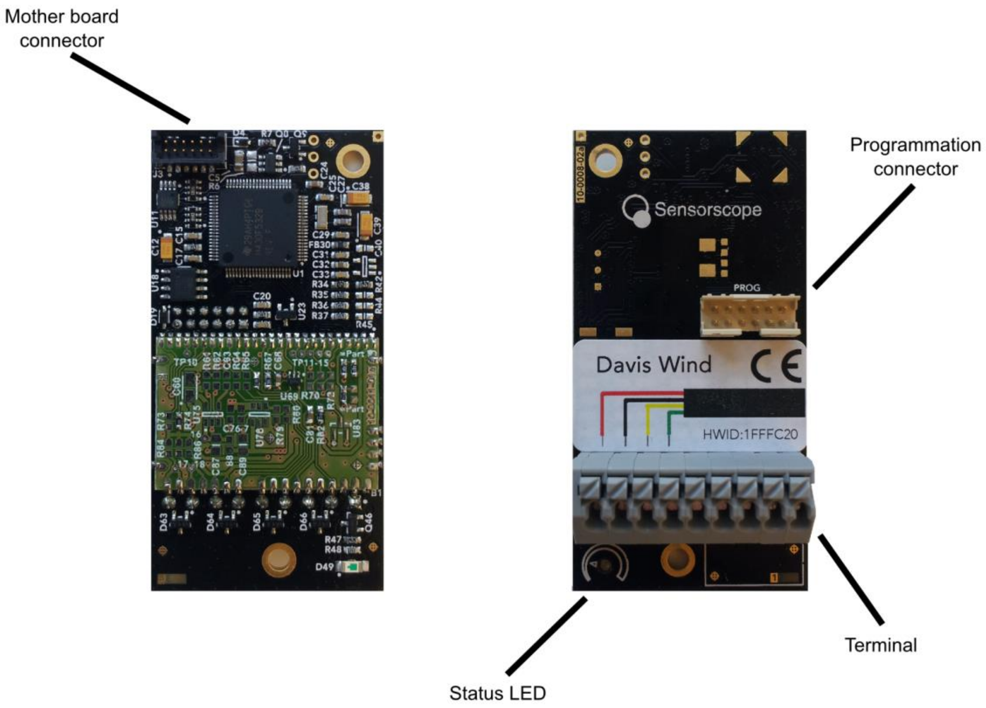

Figure 3 – General overview of a sensor board. Some of the details may change depending on the actual type of sensor board, such as the size of the terminal or the sticker.

If not already done, strip the wires of the sensor and tin them: Tinning is not mandatory but is recommended to ensure a good connection to the sensor board. Loosen the packing box in front of the board, push the wire through the hole and connect the wires to the terminal following the indications on the sticker (voir Figure 3). Once done, tighten the packing box to ensure the waterproofness of the case.

Be careful: A sensor incorrectly connected to the sensor board may create short-circuits and permanently damage the device.

Repeat the same operation for each sensor to be connected to the device.

3.3 Connecting the communication board

If you want to turn your device into a master station, you have to connect the communication board you want to use. Otherwise, your device will be a slave station (refer to Section 2.1 for more details).

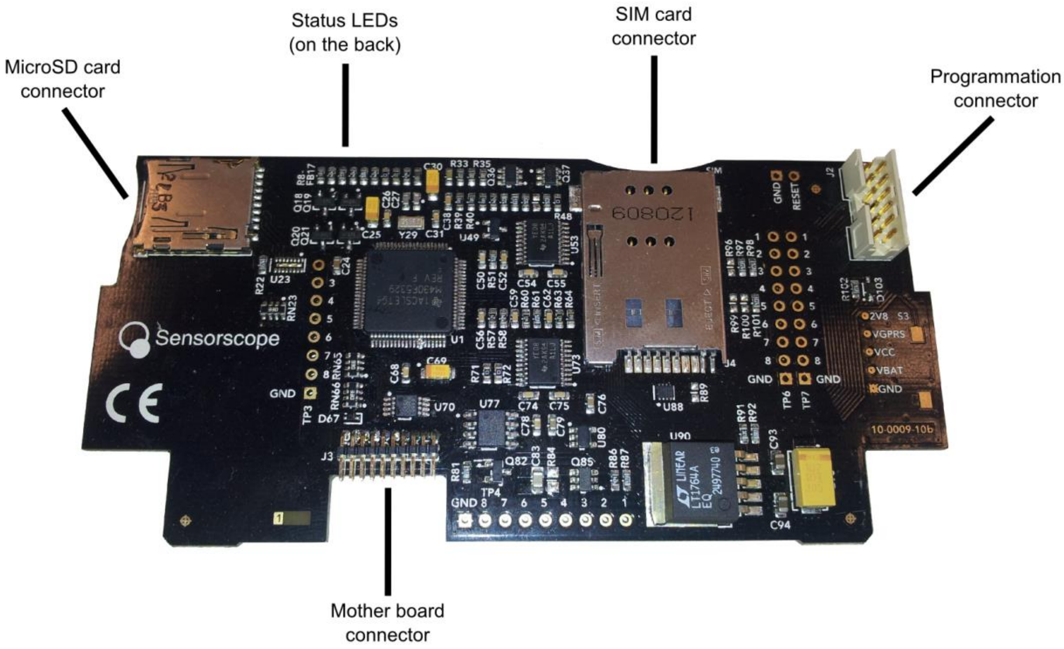

Figure 4 – A typical communication board.

The communication board shown in Figure 4 is a GPRS communication board. Each type of communication board has a specific operation: Refer to Section 4 for a specific description of how the board you would like to use operates.

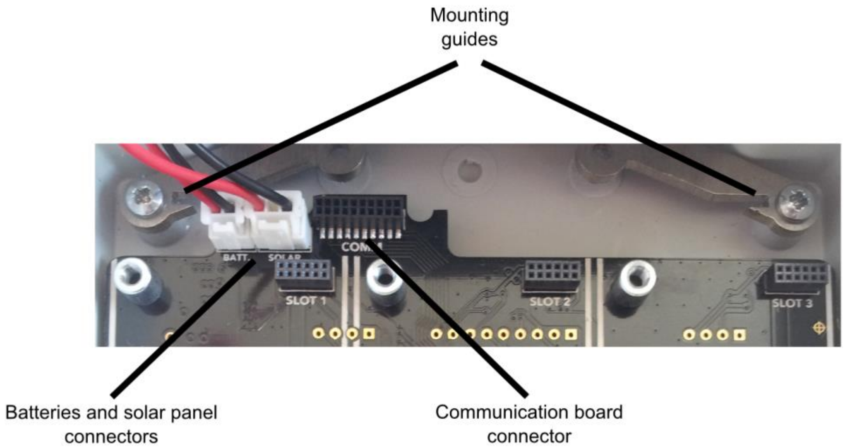

Figure 5 – Mounting guides are available on the mother board to insert the communication board.

To connect the board, first unplug the batteries and the solar panel from the mother board (refer to Figure 5). Vertically insert the communication board in the upper part of the case and connect it to the mother board using the communication board connector (see Figure 4 and Figure 5). The board should easily fit in the case: If that is not the case, do not force the insertion and try to move it slightly until the connectors are in front of each other. Once the board connected, plug the batteries and the solar panel into the mother board.

Some communication boards **must be configured** in order to operate properly: This is the case of the GPRS board. Please refer to Section 4 before continuing in order to perform this configuration.

3.4 Connecting the radio antenna

If the radio antenna is not already plugged, screw it to the antenna connector on the DS3 device (see Figure 2). Once tighly screwed, a small space (1 to 2 mm) is left between the antenna and the case: Do not worry about it, it is normal and this space does not jeopardize the radio communication or the waterproofness of the case.

This antenna is used for radio communication between stations, and is not used by the communication board. Even if you do not need the radio communication feature (e.g., a single master station), the antenna must be connected to prevent the connector from being oxidized.

Without the antenna, radio communication between stations does not work.

3.5 Powering the Device

To power the device, move the power switch to the *on* position. The five status LEDs (four blue LEDs and one red LED at the center) blinks three times to indicate that the device is starting. If the three blinks do not occur, please refer to Section 9 in order to determine what is happening.

After a short internal self-tests, the communication with the different daughter boards is established. While doing this, the blue LED of each daughter board blinks slowly (approximately one blink per second).

Once the communication established with a daughter board, the LED of that board stays still for four seconds before being switched off. If the LED continues to blink and is switched off after approximately fifteen seconds without staying still, this means that the board has not been recognized. Please refer to Section 9 to solve it.

It is **very important** to check that everything goes well each time the device is powered, most notably once the the device is installed in the field.

3.6 Checking the Status

The case is equipped with an external button located below the packing boxes. A short push on this button when the station is turned on generates a report of the device status thanks to the five LEDs located in the lower part of the mother board.

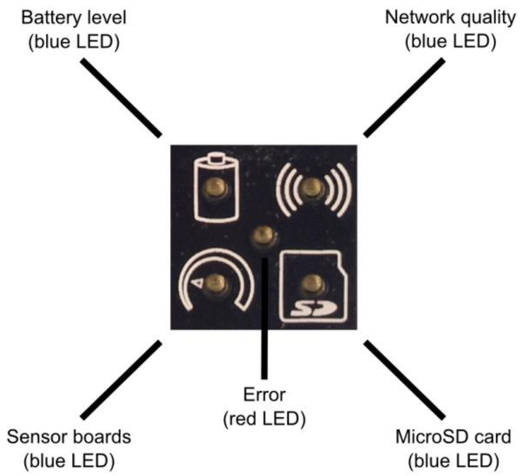

Figure 6 – The five status LEDs on the mother board.

The status is given by the successive blinks of the LEDs:

- **The "sensor boards" LED** (bottom left) blinks as many times as the number of sensors boards connected to the mother board. If two sensor boards were detected, the LED blinks two times. If no board were detected, the LED blinks once together with the error LED (blue and red at the same time).

- **The "battery level" LED** (top left) blinks one to three times to reflect the battery level. Three blinks indicate that the batteries are sufficiently charged, one blink indicates that the battery level is low. If the LED blinks once together with the error LED (blue and red at the same time), the batteries are almost depleted. It is recommended to replace them in this case (refer to Section 8.1).

- **The "network quality" LED** (top right) blinks one to three times to reflect the quality of the radio connection. For a slave station, the quality of the radio network is reported. For a GPRS master station (firmware >= v3.2.0), the quality of the connection to the GPRS network is reported (at least one GPRS connection must have occurred). Three blinks indicate that the quality is very good, one blink indicates that the quality is very poor and should be improved. If the LED blinks once together with the error LED (blue and red at the same time), there is no connection available. This is a serious issue that must absolutely be fixed for the device to operate properly.

- **The "microSD card" LED** (bottom right) indicates whether a microSD card has been detected. If the LED blinks once, a card has been detected and is being used for local backup (refer to Section 5 for more details). If the LED blinks once together with the error LED (blue and red at the same time), no card were detected.

3.7 Testing the Device

If the status reported by the device is good, it is ready to be used.

To check that you device is properly operating, connect to Climaps and check that the data reported match with testing conditions (such as the temperature if your device is equipped with a temperature sensor). You can do some tests yourself as well, for instance by blowing on a wind sensor or by moving a solar radiation sensor near a window.

Please note that the first chunk of data is transmitted only during the second connection of the master station to the servers (approximately 15 mn after the starting up for a GPRS communication board). Please note as well that to access the data sent by your device, you must have previously activated it using the activation code you received in the package. This process is described in the Climaps documentation.

Once the tests are done, it is recommended to turn the device off using the power switch, until it is installed in the field.

Take the time to check that your device is properly operating before installing it in the field.

4 Communication Boards

4.1 GPRS Communication Board

The GPRS communication board requires a small configuration in order to operate properly.

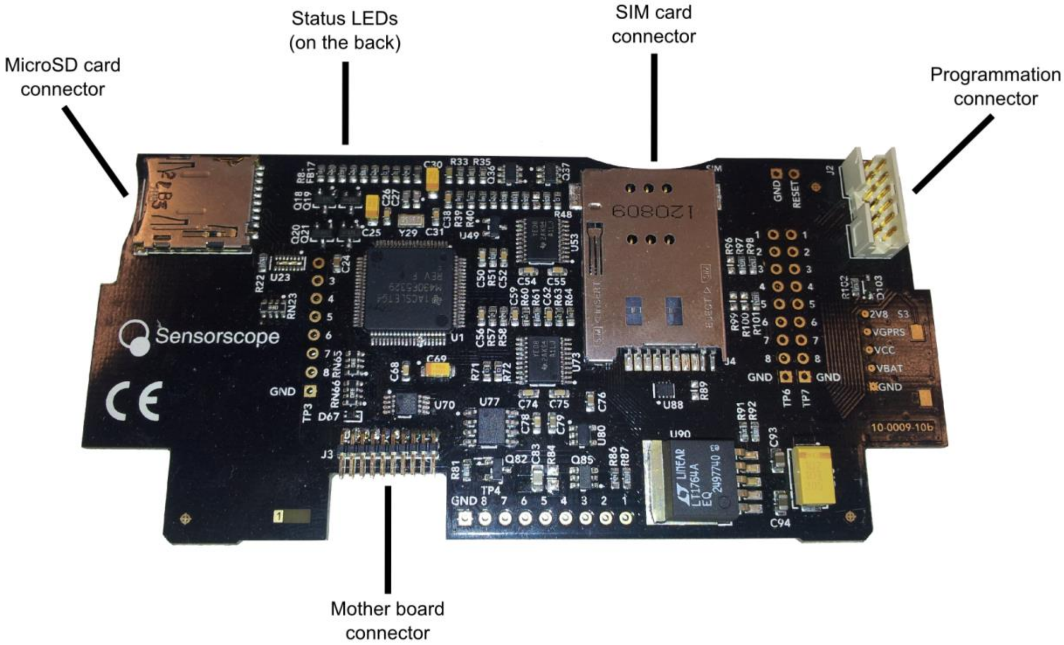

Figure 7 – A GPRS communication board. The status LEDs are located on the upper edge, on the back of the board, so that one can see them blinking when the case is closed.

4.1.1 SIM Card

The first step is to get a SIM card compatible with one the cellular networks available at the installation location. Any standard SIM card (not micro or nano) is suitable if it provides data transfer.

Once the SIM card acquired, **remove the PIN code** with a mobile phone and insert it in the connector of the board (see Figure 7). It is a *push-push* connector: You push to insert the card, and you push again to free it from the connector.

If you do not remove the PIN code of the SIM card, the card cannot be used by the device.

Please note that the DS3 device is subject to the same network quality as a standard mobile phone. If you want to avoid connection issues with your device (and thus data transfer issues), make sure to use a SIM card from an operator whose network quality is as good as possible at the installation location. You can do this using the quality reported by a mobile phone connected to the network you would like to use for example.

Please also note that the GPRS communication board is not compatible with 3G and 4G networks. Only the quality of the GPRS network (also referred to as "EDGE") is taken into account. Generally a GPRS network is available as well when a 3G network is available.

The amount of data sent by a master station depends on the number of slave stations associated to it and on the number of installed sensors. Furthermore, many mobile operators charge data by chunks of 10 Kb: If a master station transfers only 2 Kb of data, 10 Kb are nevertheless charged. Considering a master station with ten slave station all equipped with three sensors, a 100 Mb/month plan should be enough.

4.1.2 Configuration

Connection to the GPRS network requires the use of a GPRS access point, which depends on the chosen network operator. Three parameters must be known to use this access point: **Its name, a login and, a password**.

These parameters are provided by the network operator and must be sent to the GPRS communication board in order to connect to the GPRS network. All GPRS communication boards are preconfigured for operation with all Swiss operators (Swisscom, Orange Suisse and Sunrise, as well as all virtual operators such as M-Budget). If you use a SIM card provided by one of these operators, **no further configuration is required**.

Otherwise, configuration is done by sending a text message to the SIM card to be used in the DS3 device, before turning it on. The contents of the text message must follow this template:

```
/SensorScope-GPRS/NAME/LOGIN/PASSWORD/
```

The text in red must be replaced by the parameters provided by the network operator. For instance, for Swisscom, the name of the access point is "gprs.swisscom.ch", the login and password being empty strings of characters. The text message would be:

```
/SensorScope-GPRS/gprs.swisscom.ch///
```

Please note that although login and password are empty strings, the "/" charcters must be present in the text. Once the text message sent to the SIM card, it will be received and processed during the first connection of the device to the GPRS network.

If you make a mistake, **first erase the wrong text message from the SIM card** using a mobile phone, and then send the correct message. It is important to note that the device uses the first available configuration text message on the SIM card. If you send a second text message, it will be silently ignored while the first message will be present on the SIM card.

4.1.3 Status

Once the device turned on, the GPRS communication board connects to Sensorscope server every 15 mn to send the data. However, the first connection occurs a few seconds after the power up: This connection is required to retrieve the current time to timestamp the data as described in Section 2.2. Until the first connection, **no data** is gathered by the device or by the slave station connected to it. It is thus of prime importance to make sure that the GPRS board is able to connect to the servers.

No data is gathered if the GPRS board cannot connect to the servers.

While connecting to the servers, the green status LED of the GPRS board blinks slowly (approximately once per second). This indicates that a connection is ongoing: This operation can last for a few minutes the first time after the powering of the device. Once the connection established the green LED blinks faster. Once the communication is over, the blinking stops until the next connection.

If a connection cannot be established, the red status LED of the GPRS board blinks a given number of times to provide the code of the error that occurred. For instance, three blinks indicate that the error 3 has occurred.

The GPRS error codes are as follows:

Error code	Description
1, 2	**The GPRS chip does not seem to work.** Please check the battery level: If it is too low, the GPRS board cannot operate properly. If you keep getting this error, the device may be damaged and may need to be fixed.
3	**Cannot register to the mobile network.** Please check that the SIM card is operational (not disabled by the network operator) and that it is not protected by a PIN code.
4	**Cannot initiate a GPRS session.** If you have configured yourself the GPRS parameters, please make sure they are correct. This error may also occur when the mobile network is overloaded.
5, 6, 7	**Cannot connect to Sensorscope servers.** This may happen when the server are temporarily unavailable.
8	**The SIM card could not be detected.** Please check that you have correctly inserted the SIM card into the connector of the GPRS board.

5 Local Data Backup

The GPRS communication board features a microSD card reader so that local data backup at the master station is possible if you ever need it. This is an added functionality to the basic operation of the system: Even with local data backup enabled, **data is still sent to the Sensorscope servers** by the master station.

5.1 Installation

If a microSD card is inserted in the connector (see Figure 7 on page 12), it is automatically used to back up data from the master station and its associated slave stations. If you check the status of the device, the "microSD card" LED blinks once to indicate that local data backup is enabled (refer to Section 3.6).

The disk space required for local backup varies a lot according to the size of the network of slave stations associated to the master station, and to the type of sensors actually connected to them. In the typical case of a master station and ten slave stations all equipped with ten sensors, **a 2 GB microSD card can store around five years of data**. The available disk space can be looked up on Climaps.

5.2 Extracting Data

The device uses a proprietary format to store data, and the card does not need to be formatted beforehand on a computer to be used. To extract data written by a DS3 device, you must use a specific application named "Backup Extractor", which can be downloaded from the Sensorscope website.

The data format being proprietary, the card will not be recognized by Windows which will ask you whether you would like to format it. You must ignore this warning and must not accept to format the card. Should you format the card, all backed up data would be definitely lost.

Do not let Windows format your microSD card.

While extracting data, the application generates a text file for each station with data backed up on the card. Each line of these files provides a single value reported by a sensor, together with the timestamp of the data. This timestamp is an "epoch time" (elapsed seconds since Janury 1st, 1970). The slot number of the sensor is provided as well (0 for slot 1, 1 for slot 2, and 2 for slot 3).

6 Installation

6.1 Choosing the Location

The DS3 is a sensing device, but it is as well a communicating and energy-autonomous device. The installation location must thus:

- Provide the required measurements.
- Provide enough solar power.
- Provide a good-quality communication.

The first criterion depends on your needs, and may or may not be flexible. Measuring the temperature in a greenhouse does generally not a strict placement of the device. On the contrary, a soil moisture measurement often requires the device to be placed at a very specific location. In any case, you should make sure that the exposure and communication criteria are as optimal as possible.

6.1.1 Exposure to Solar Radiation

If possible, the front face of the case should be directed to the South to maximize the amount of energy provided by the solar panel. In the case of a master station, two or three hours a day of direct exposure to the sun is enough to ensure the autonomy of the device. A slave station requires only one or two hours a day.

In a greenhouse, the solar radiation is lesser but is sufficient if the daily exposure is longer. If the chosen location does not fir this criterion, an external powering solution could be used. Please contact your vendor for more information.

6.1.2 Communication

In the case of a GPRS master station, you must ensure that the coverage of the GPRS network is good enough at the location of installation. You can use a simple mobile phone to do this, as explained in Section 4.1. Please note that if GPRS coverage is not available at the location of installation, **the master station and its slave stations will not work at all**.

In the case of a slave station, the quality of the radio network to the master station must be good enough to ensure the proper operation of the device. It is possible to get a real-time feedback of that quality by pushing the status button of the DS3 (refer to Section 3.6 for more details). Similarly to the case of a master station, it is of high importance for the slave station to be able to communicate properly with the master station and its associated network. If that is not the case, **no data is gathered at all**.

6.2 Waterproofness

Once your device installed in the field, please make sure that the case is tightly closed and that no cable (batteries or solar panel) prevent it from being properly closed. Ensure as well that the packing boxes are tightly screwed on the cables of the sensors.

It is of very high importance to make sure that the waterproofness is ensured, otherwise humidity or even water may penetrate into the case, causing short-circuits that could definitely damage the device. The case is IP67 and thus protects the electronic part from the bad weather, but only if it is properly closed.

⚠ **Please check the waterproofness of the case before leaving the field.**

7 Radio Network

In order to optimally use the radio communication capabilities of the Sensorscope system, it is important to master some concepts linked to the multi-hop techonology.

7.1 Topology

As explained in Section 2.4, the Sensorscope multi-hop technology offers a large flexibility in the placement of the devices, on the contrary to a traditional radio network in which all devices must be located in the same communication range.

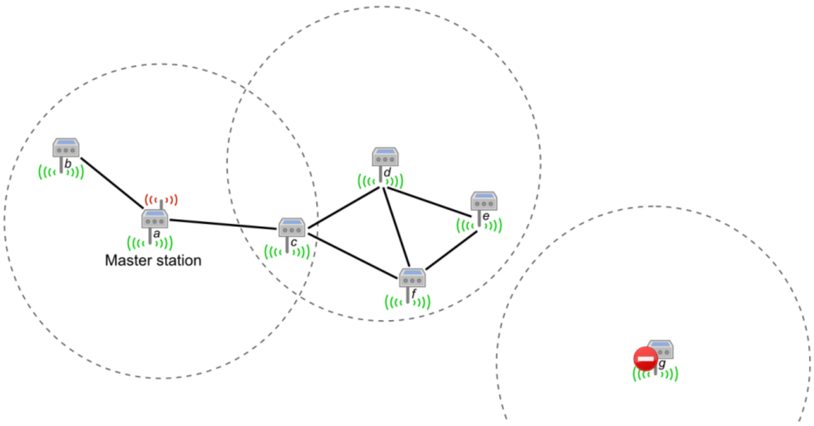

Figure 8 – Example of a multi-hop Sensorscope network.

In Figure 8, plain lines represent the communication links between the stations: If there is a link between two stations, then they are able to communicate with each other and exchange data. When station *f* wants to send its data, it sends it to station *c* which in turn sends it to the master station *a*. Since the data gathered by *f* require two transmission to arrive at the master station ($f \rightarrow c \rightarrow a$), *f* is said to be at a **two-hop distance**.

In the same figure, stations *a*, *b*, *c*, *d*, *e*, and *f* are all connected together and form a network capableof sending data to the server. Station *g* is however not connected to the others and does not belong to the network. Furthermore, since *g* is a slave station, it can't get the current time, **and does not gather any data** no matter how many sensors are connected to it.

7.2 Radio Link Quality

The existence of links such as the ones in Figure 8 depends on a lot of factors. The main one is of course the distance between the two stations: The higher the distance between two station, the less likely a radio link will exist between them. However, many other factors have to be taken into account, such as the height of the device (the higher the device, the more likely a link will exist) or the presence of obstacles in the environmment.

An important notion is the quality of radio links. Intuitively, it is similar to the quality reported by a mobile phone: The higher the quality and the better the communication. On the contrary, if the quality is poor, there will be frequent interruptions during communications.

The quality of a radio link is measured in **dBm**. A quality of -40 dBm is way better than a quality of -80 dBm. Radio link qualities are sent by the stations and can be monitored on Climaps. The quality reported by the "network quality" LED during a status report (see Section 3.6) is based on this measurement in dBm.

The number of blinks is computed as follows:

Blinks	Quality	Meaning
3	Above -85 dBm	**The quality is excellent.** The device should be able to communicate with the network and transfer its data without any problem.
2	Between -85 and -93 dBm	**The quality is average.** The radio communication should work, but changes in the environment (*e.g.*, a car parking close to the devices) could result in communication issues.
1	Less than -93 dBm	**The quality is bad.** Communication may work, but with frequent interruptions. The slightest modification in the environement may disconnect the device.

7.3 Placing the Devices

While the location of the devices is generally dictated by the data to be gathered, it is possible to optimize the location of the devices by minimizing the maximum number of hops in the network.

Figure 9 – A "line network", optimized to minimize the number of hops in the bottom example.

For instance in Figure 9, the maximum number of hops in the top network is four (*e* → *d* → *c* → *b* → *a*) while it is only two in the bottom network (*e* → *d* → *c*). In both cases the device are located at the same places, but the communication board has been inserted into station *c* instead of station *a*, such that it location is central in the network. This reduces the probabilities of communication issues and makes the network more robust: If station *b* fails, only station *a* will be disconnected from the network. In the top network, stations *c*, *d* et *e* would have been disconnected. Following this advice, station *c* would have been a better master station in Figure 8.

As a general advice, it is recommended to avoid having a large number of devices depending on a single station to communicate with the master station. Whenever that is possible, multiple routes must exist to the master station. In Figure 8, station *e* has two routes to the master station, and can communicate either with *d* or *f*. Station *c* is still a weak point: If it fails, three stations (*d*, *e*, and *f*) will be disconnected from the network.

8 Maintainance

8.1 Replacing the batteries

If batteries are damaged or depleted, you can easily replace them. It is recommended to replace them as well every year: The charge/discharge cycles decrease the capacity of the batteries, and after some time, the lifetime of the device will be affected as well, especially during periods of low sunshine such as the winter.

You must use NiMH AA 1.2 V batteries, with a capacity of at least 2000 mAh.

They can be easily found in electrical good stores. Please make **to not use** non-rechargeable AA batteries: While they share the same format, they can't be charged and would not stand the incoming solar power.

Never use non-rechargeable AA batteries:
They could explode and cause serious injuries.

8.2 Cleaning

It is important to make sure that the transparent cover of the case is not covered by elements (*e.g.*, leaves, snow) which could prevent the solar panel from being exposed to the sunshine.

It is recommended to regularly check the case once the device installed and to clean the cover if needed. A solar panel badly exposed to the sunshine will not provide enough energy to the batteries. Once the batteries depleted, the device stops logging data.

Similarly, sensors have to be maintained in order to provide correct data. For example, a tipping bucket rain gauge with leaves blocking the water will no longer provide correct data.

It is important to maintain the hardware to make sure it is fully operational.

9 Solving Issues

9.1 The device does not start

First make sure that the batteries are properly connected to the mother board (see Figure 2). If that is the case, check that the batteries are sufficiently charged for the device to operate and replace them if needed (refer to Section 8.1 to do this).

If the device still does not work, turn it off with the switch on the mother board, remove all daughter boards (sensor and communication boards) and then try to switch it on again. If that solves the issue, a daughter board may be the culprit. In this case, try to connect them one by one to find the faulty one.

9.2 The red LED blinks at boot

If the red LED blinks instead of the usual boot sequence (see Section 3.5), it is an error code and the number of blinks provides the code (this code is repeated every two seconds).

Error Code	Meaning
1	**Batteries are depleted.** This happens when there is enough energy for the device to boot, but not enough to operate properly. Replace the batteries or charge them to solve this issue. You can as well leave the device in the direct sunshine and wait for the solar panel to charge the batteries.
2	**Internal memory is corrupted.** This can only be solved by a technician. Contact your reseller to solve this issue.
3	**The radio chip is faulty.** The radio chip does not operate properly an cannot be used to communicate with other devices. Contact your reseller to solve this issue.

9.3 A sensor board is not detected

If the blue LED of a sensor board blinks for fifteen seconds and then turns off without staying still for four seconds, then the board could not be detected by the mother board. In this case, the sensor connected to this sensor board will not be used by the device.

Most often, this is caused by the sensor being wrongly connected to the sensor board: If the board cannot detect the sensor, it does not respond to the mother board.

Make sure that the sensor is properly connected to the board, and that the wires are sufficiently stripped. Please also make sure that the sensor connected to the board matches the sticker on that board.

9.4 The GPRS board cannot connect to the servers

When the board cannot connect, it displays an error code by blinking the red LED. Please refer to Section 4.1.3 to find what is happening and how to solve the problem.

9.5 The microSD card is not recognized by Windows

The format of the data stored on the card is proprietary and cannot be directly read by Windows, which offers to format the card. Do not accept and refer to Section 5.2 for a detailed explanation on how to extract the data.