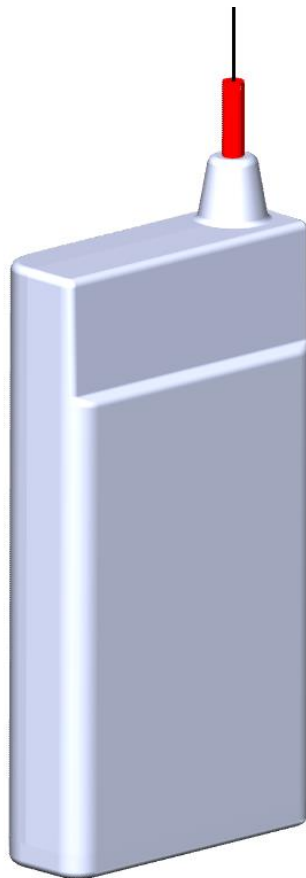
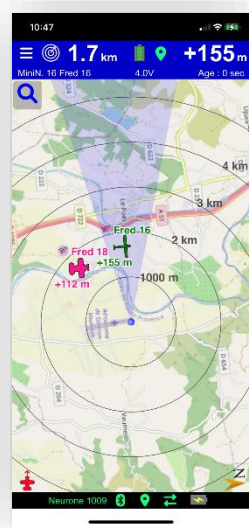




MiniNeurone V1.2

User's Manual

MiniNeurone



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Modifications

Version	Date	Description
1.0	31/05/2022	First edition
2.0	24/12/2022	Modification for MiniNeurone v1.1
3.0	1/6/2023	Modification for MiniNeurone v1.2

Contents

This document details the installation, configuration, and use of the **MiniNeurone**.

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1 News

1.1 Version 1.2

- Reduction in consumption of up to 50% compared to version 1.1.
- Barometric height display.
- Display of the strength of the radio signal allowing a very precise search in dense vegetation.
- 40% reduction in altimeter reading time.
- Addition of "end of battery" mode. The GPS is switched off, but the **MiniNeurone** periodically sends the last position calculated before switching off.
- Various fixes.

2 Tips and tricks

Consult the [FAQs in the support section of the Flying Neurons site](#). Various tips are added regularly to use the **MiniNeurone** optimally.

3 Presentation

The **MiniNeurone** is an ultra-miniaturized 2.7-gram device that allows the geolocation of all types of aircraft: aeromodelling, drones, etc. Its small size and very low weight allow it to be placed on extremely light aircraft.

It also makes it possible to remotely control the end of flight of the aircraft (RDT), either by direct control of a servomotor, or, in the context of free flight aeromodelling, by direct control of the electronic timer. Remote control of flashes is also possible.

The **MiniNeurone** incorporates an altimeter which makes it possible to record altitude curves in the context of Free Flight aeromodelling. These altimetric curves are dated to the nearest second and are associated with a precise location.

In the context of free flight competitions, the **MiniNeurone** altimeter is EDIC certified by the FAI.

Using the **MiniNeurone** requires 3 units:

- The **MiniNeurone**
It periodically transmits its position by radio. The periodicity of the transmission depends on the movement of the aircraft.
It is placed on the aircraft to be located and requires a power supply.



- The **Neurone**

It receives position information from all **MiniNeurones** and **Neurones** and transmits it via Bluetooth to the Smartphone or tablet.

Pressing one of the two buttons triggers end of flight (RDT) or turns flashes ON or OFF.

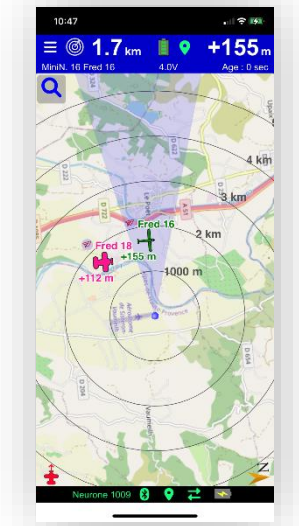
- Smartphone (or tablet)

Equipped with the **NeuroFly** or **NeuroTrack** application, it displays the position of all **Neurones** or **MiniNeurones**. It is possible to select a particular one and visually follow its heading, distance, and altitude.

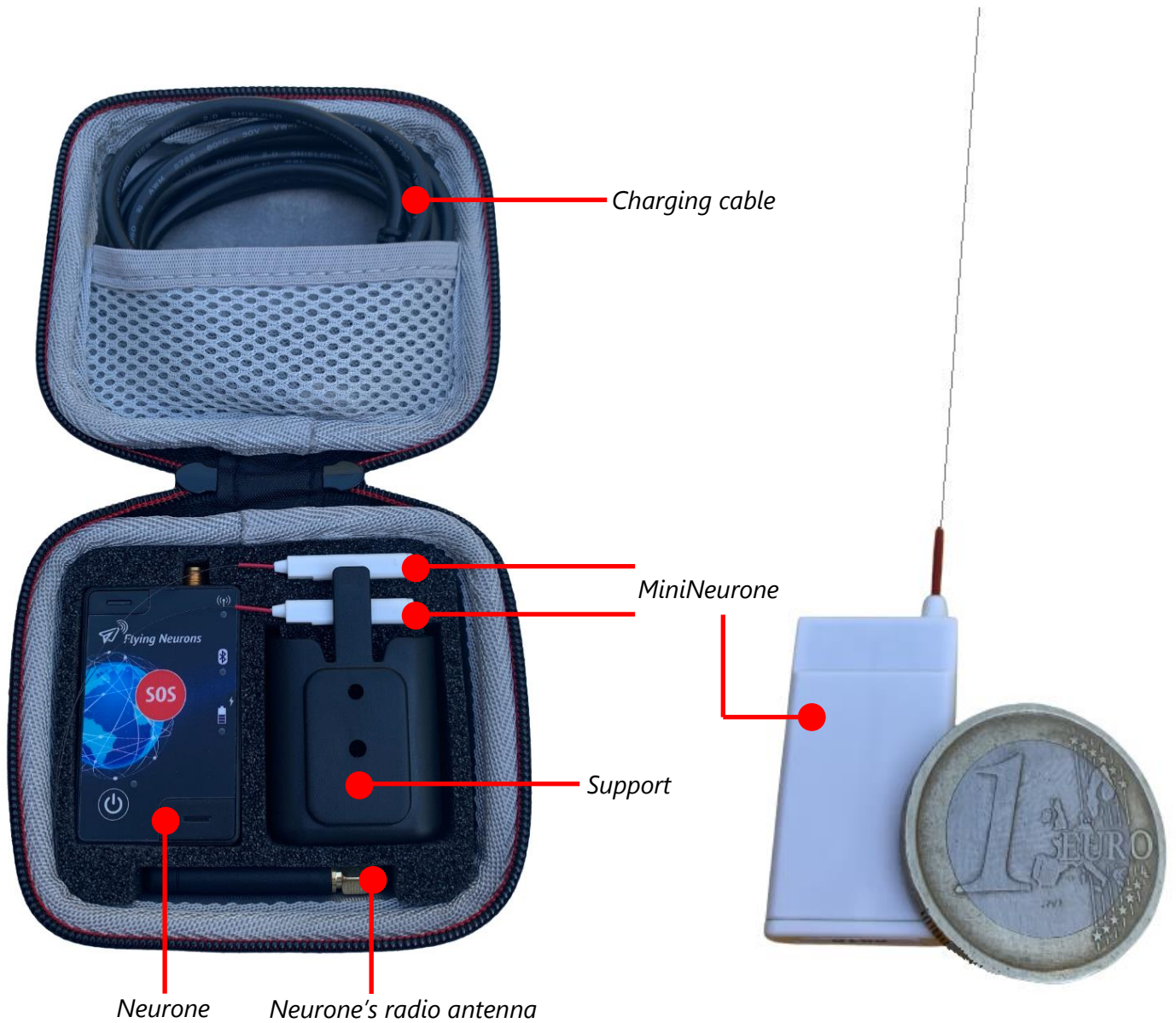
It also makes it possible to read the altitude histories.



Note that the smartphone or tablet does not need to be connected to the mobile network for the tracking to work.

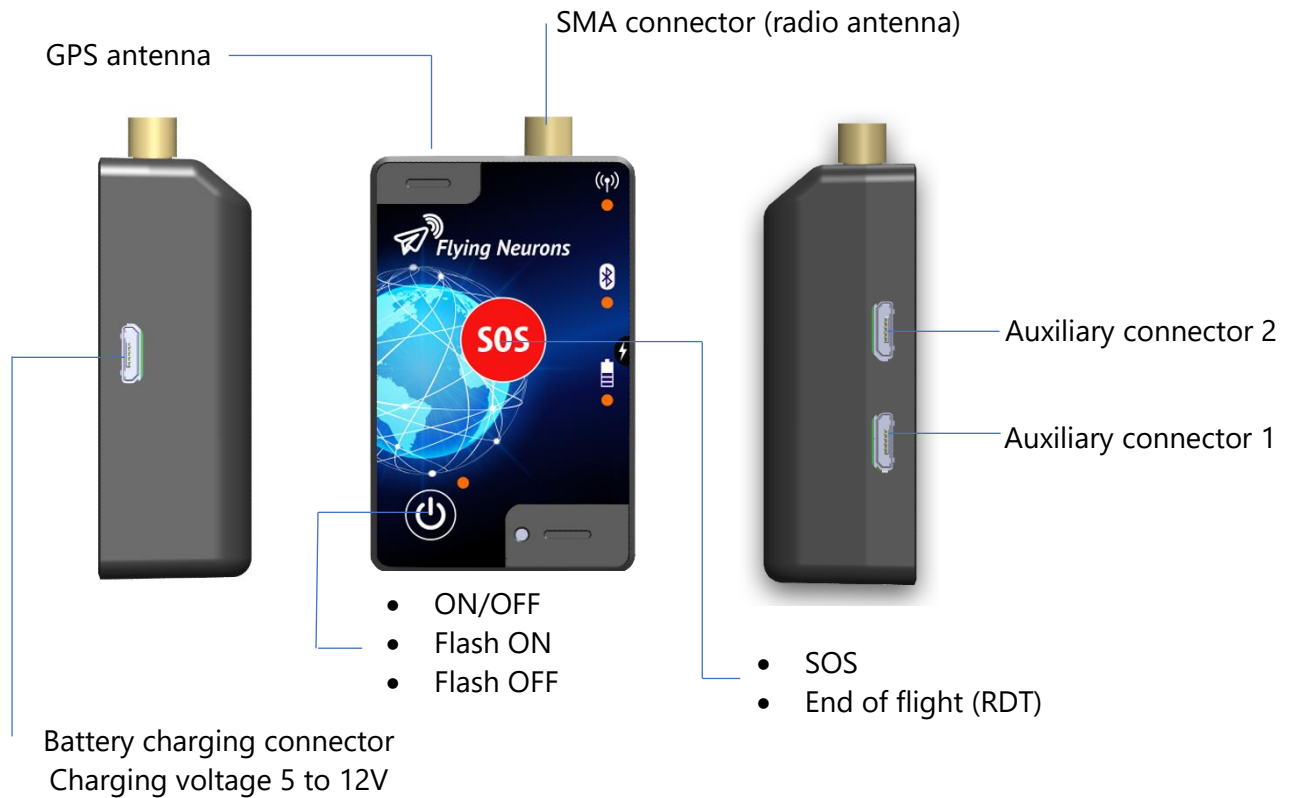


4 Material description



5 Installation

5.1 Neurone



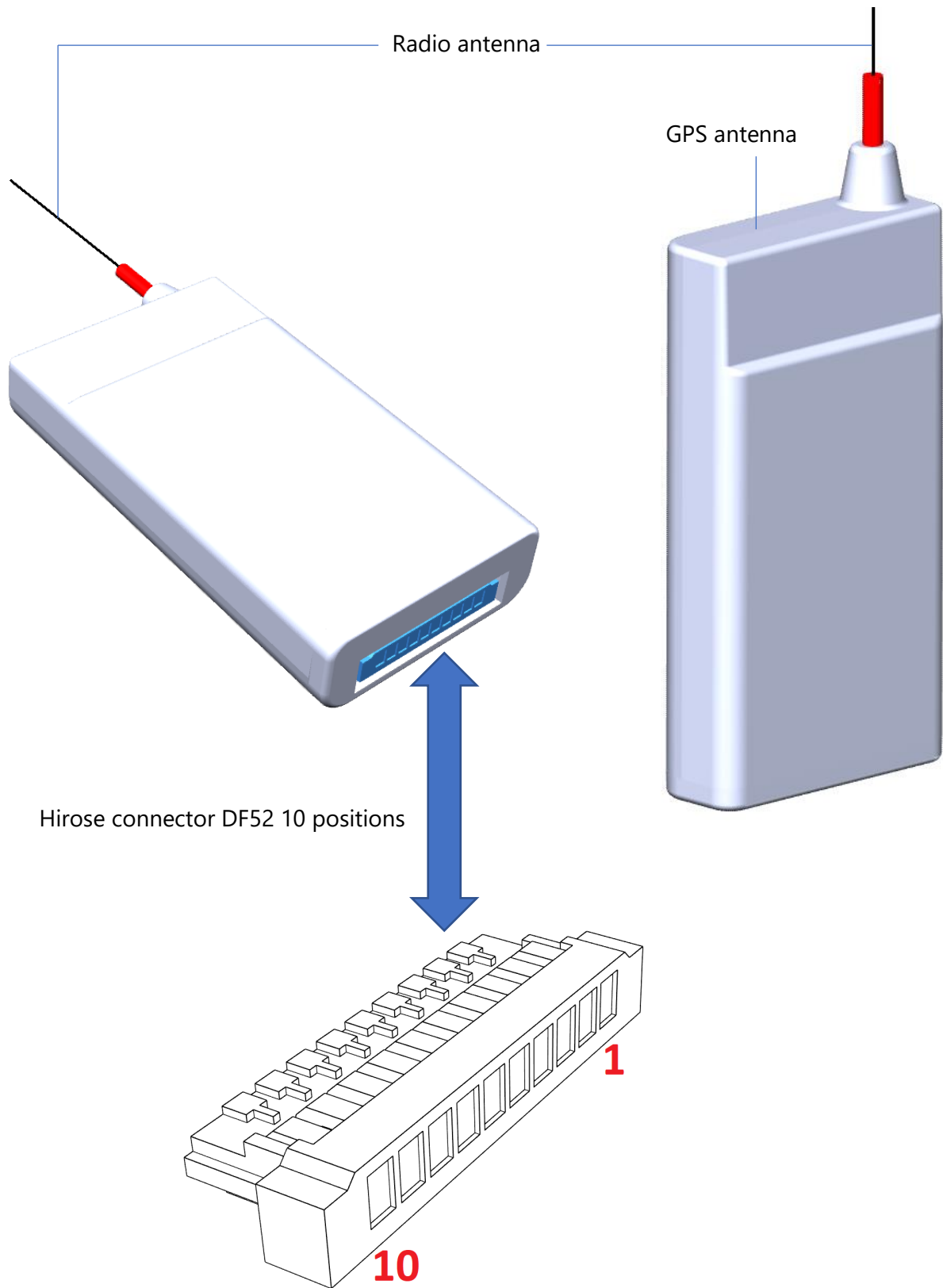
The various peripherals are connected to auxiliary connectors 1 and 2.

The **Neurone** can be placed in a pocket, an armband, or any other place. Contact of the antenna with the human body reduces the radio range. The radio range is better with the vertical antenna.

For more comfort, a more flexible antenna can be used, contact **Flying Neurons** if you wish.



5.2 MiniNeurone

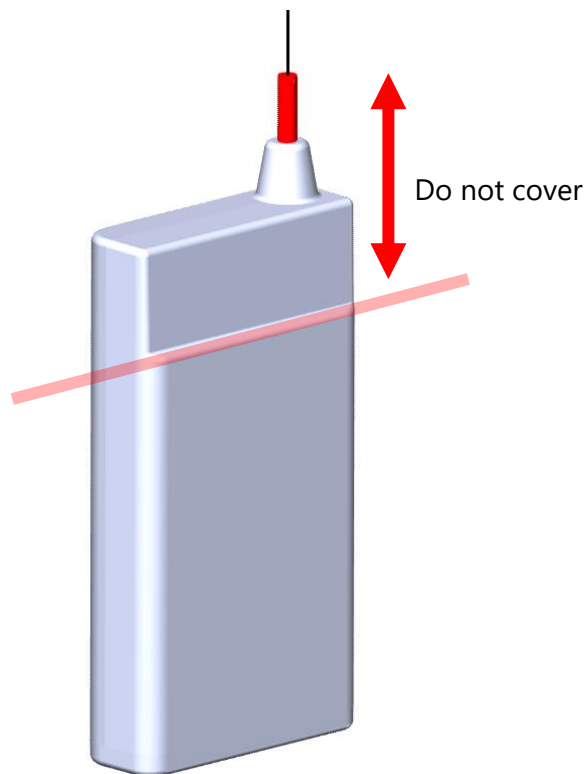


5.2.1 Installation on the aircraft

The **MiniNeurone** must be installed vertically to obtain a good radio range.



The upper part of the **MiniNeurone**, located above the box step, contains the GPS antenna, and must not be covered by a metal or carbon part.



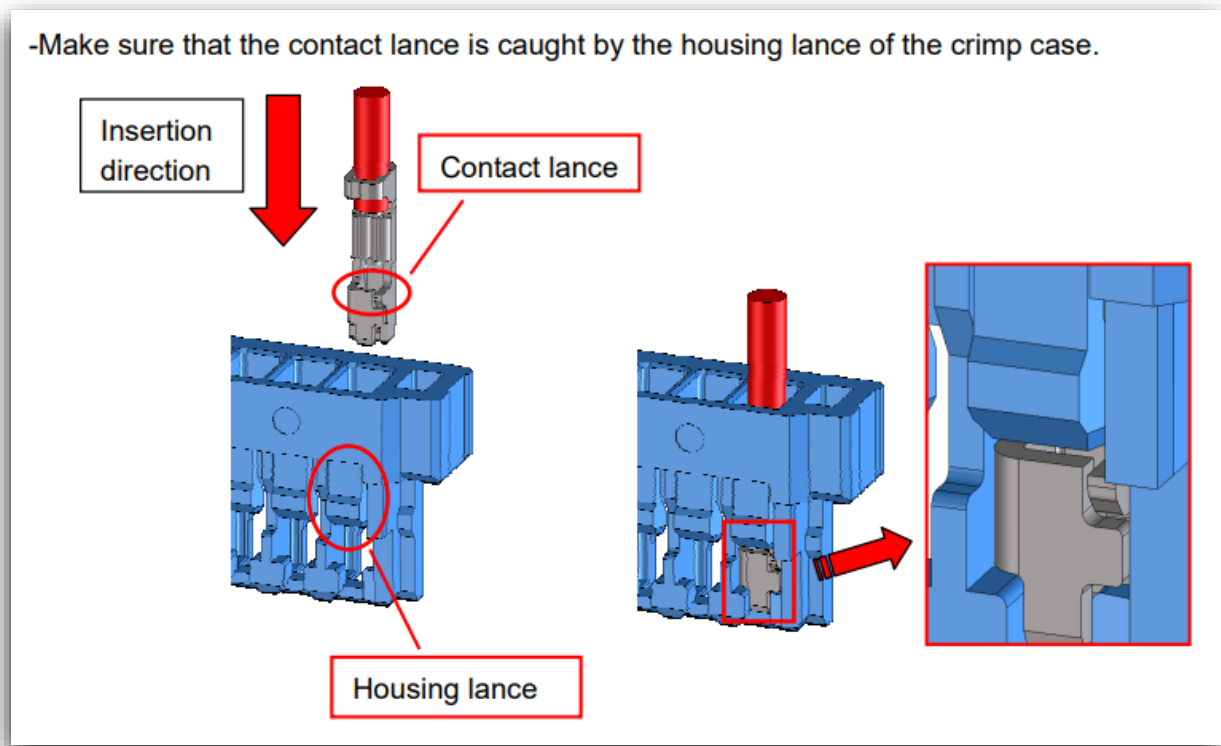
5.2.2 Connector description

Hirose DF52 10 positions connector		
Positions	Function	Description
1	VBAT (3.3 to 5V)	+Battery or other power supply
2	VBAT (3.3 to 5V)	+Battery or other power supply
3	Ground	- Battery or other power supply
4	Ground	- Battery or other power supply
5	No connection	
6	No connection	
7	SIGNAL	End of flight signal (RDT)
8	No connection	
9	FLASH	The lighting sequence is configurable
10	SERVO_POWER	Servo power

References	Connector	Cabled wires
Manufacturer www.hirose.com	DF52-10P-0.8C	DF52-2832PF1571-28A9-300
Distributor www.digikey.com	H125089-ND	
Distributor www.mouser.com	798-DF52-10P-0.8C	668-9001-0

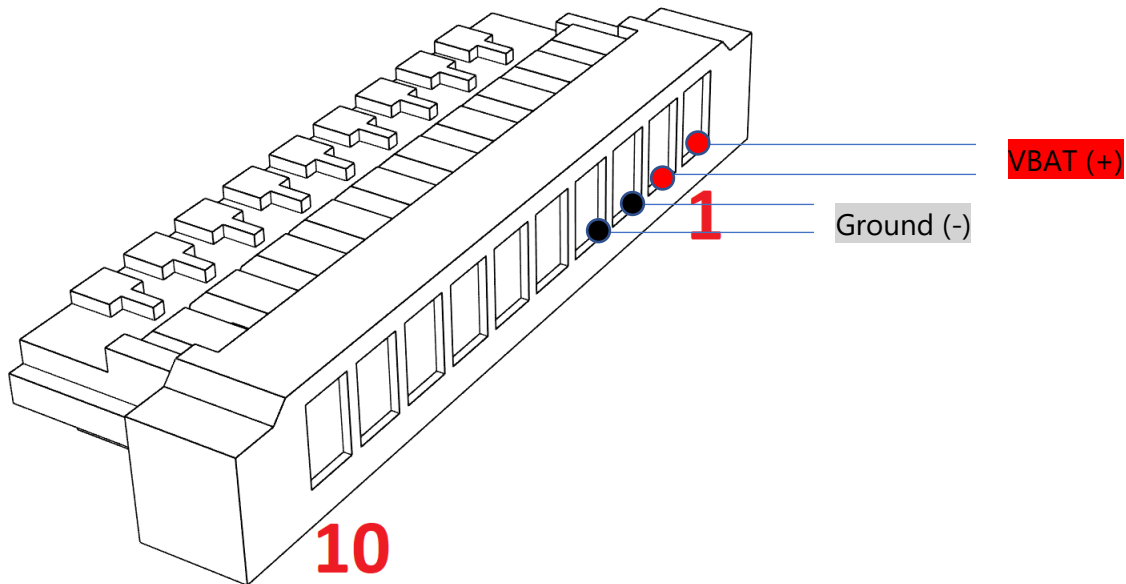
5.2.3 Mounting the wires in the connector

Use the hardwired wires referenced above. They have a contact at each end. The connector manufacturer provides [documentation](#) for inserting these wires into the connector.



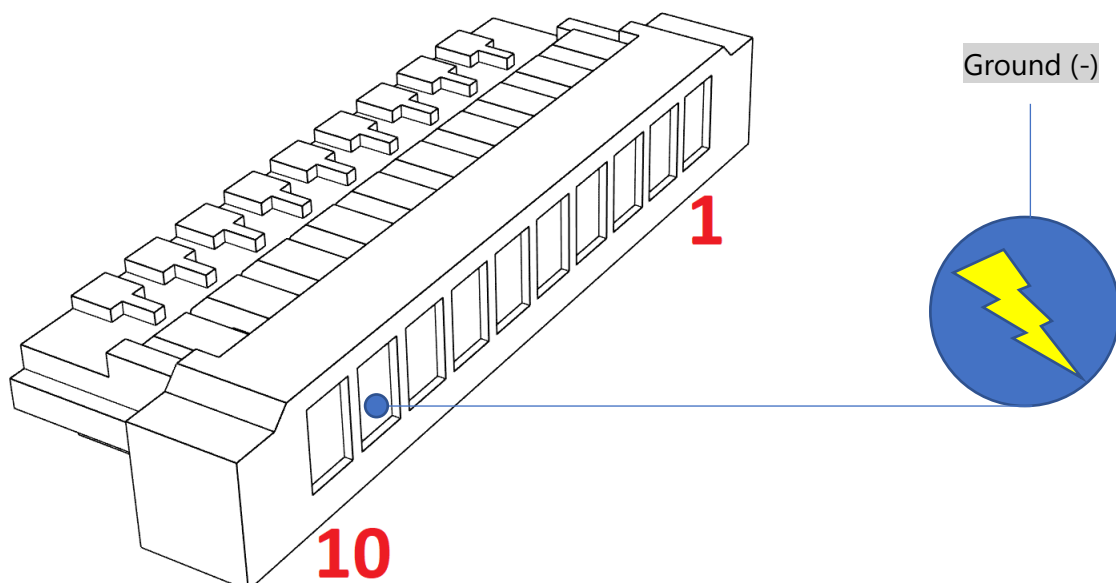
5.2.4 MiniNeurone power supply

The **MiniNeurone** can be powered by any source between 3.3V and 5V. The ideal is to power it with a 1S lithium battery. The power connection is doubled to ensure safety in the event of a cut wire or poor connection.



5.2.5 Connecting flashes

Flashes can be controlled by the **MiniNeurone**. They will be directly powered by the VBAT voltage. Check that they are compatible with this voltage. The flash ignition sequence can be configured by the **NeuroFLY** or **NeuroTrack** application. The flashes are connected between pin 9 of the **MiniNeurone** and ground.



5.2.6 End of flight connection (RDT)

The **MiniNeurone** can control 3 end-of-flight systems (RDT).

5.2.6.1 Driving a servo

The **MiniNeurone** can directly manage the movement of a servo by simply pressing the **SOS** button on the **Neurone**.

We can thus:

- Trigger the RDT in model aircraft with a simple servo, without any other electronic device.
- Trigger the opening of a parachute for a drone.
- Any other actions...

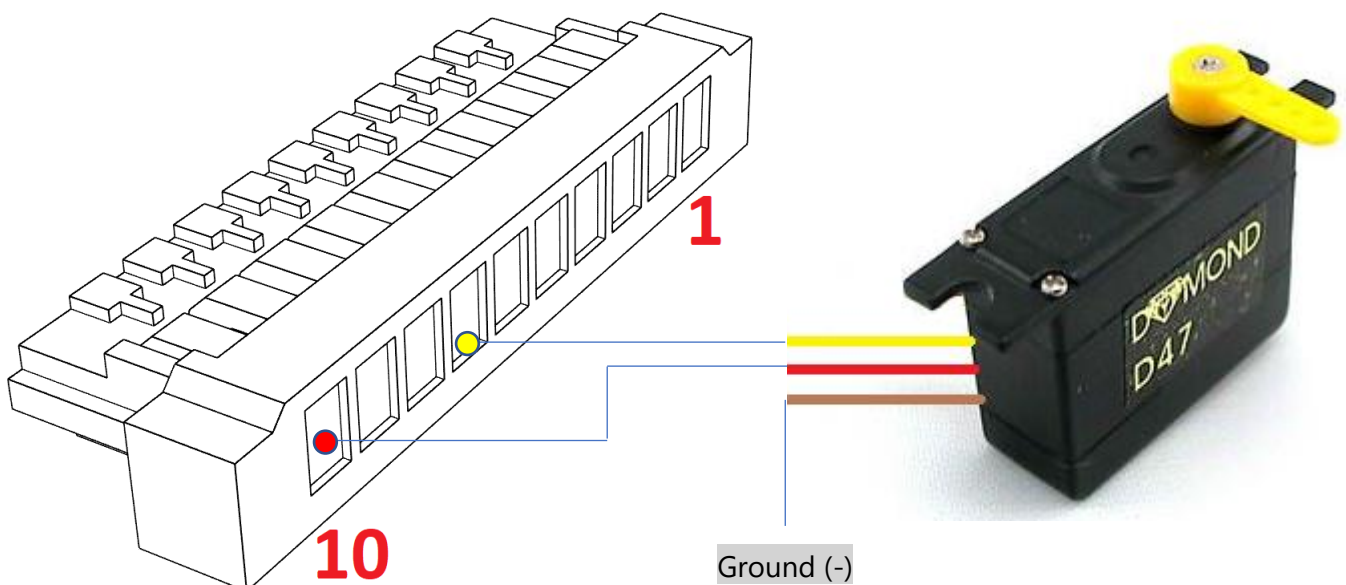
The servo power supply must be connected to pin 10 of the **MiniNeurone**.



When the servo is powered, the supply voltage is VBAT. Check that your servo is compatible with this voltage.

The servo signal must be connected to pin 7 of the **MiniNeurone**.

The movement of the servo is entirely configurable by the **NeuroFly** or **NeuroTrack** application.

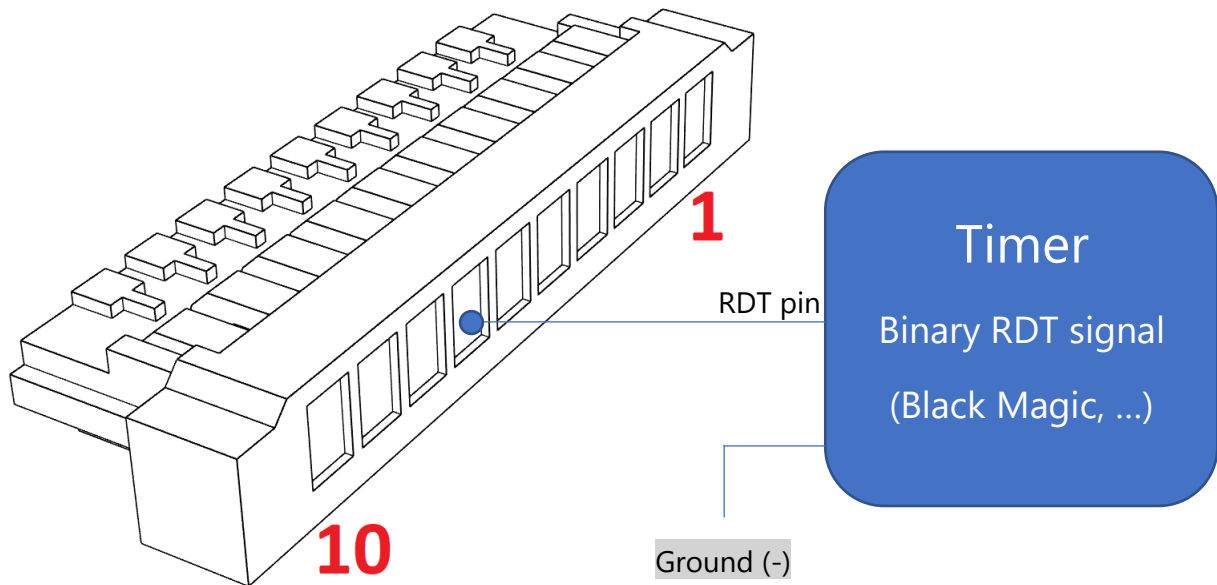


5.2.6.2 Connection to a Free Flight aeromodelling timer by binary signal

Most free flight timers activate the RDT by receiving a high or low logic level on a pin. This is particularly the case with the "Black Magic Timer".

The **MiniNeurone** generates this signal by pressing the **SOS** button on the **Neurone**.

The signal is generated on pin 7 of the **MiniNeurone**. The polarity as well as the duration of the signal can be configured by the **NeuroFly** or **NeuroTrack** application.

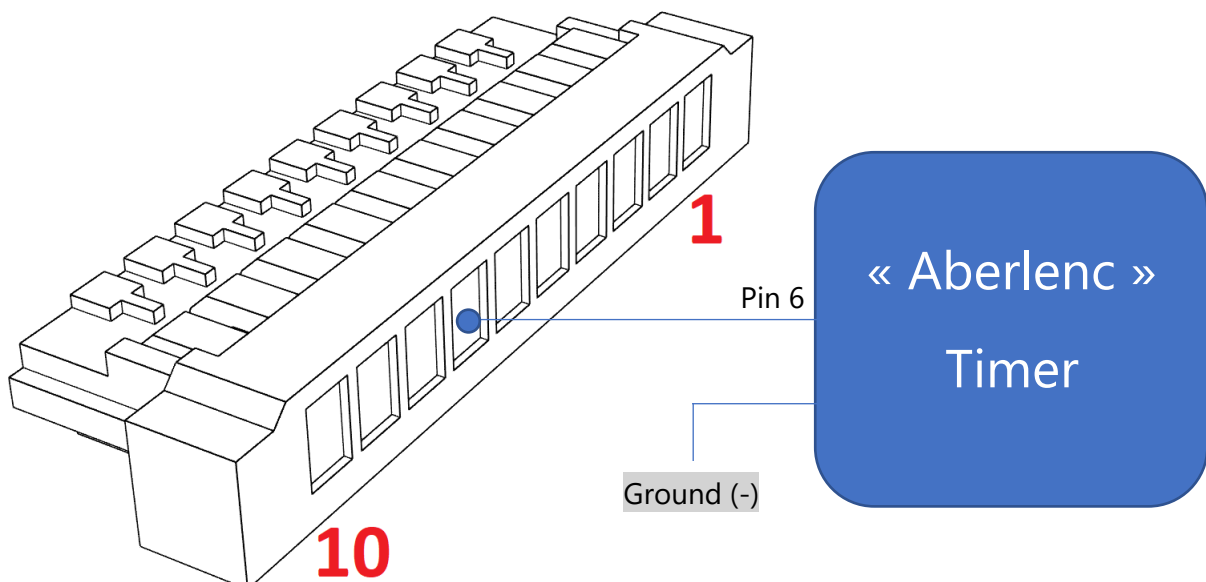


5.2.6.3 Connection to an "Aberlenc" timer

The **MiniNeurone** can be interfaced with these timers. The code needed to control the timer can be configured in the **NeuroFly** or **NeuroTrack** application.

Pin 7 of the **MiniNeurone** must be connected to pin 6 of the timer.

Attention, the ground of the **MiniNeurone must be Pin 16 of the Timer (ground of battery 1).**



6 Operation of the Neurone



6.1 Antenna mounting

The antenna connector is of the female SMA type. You can mount antennas of all kinds, directly, or deport them via coaxial cable.

6.2 Manual start

Press the **ON/OFF** button for 3 seconds. The red LED flashes quickly then more slowly. The flashing remains red until the **Neurone** determines its position. The flashes then change to green. The **Neurone** needs a good view of the sky to determine its position.

6.3 Manual shutdown

Press the **ON/OFF** button for 3 seconds.

6.4 The 2 buttons

You can reconfigure the role of the 2 buttons on the front panel.

The **SOS** button can have the following functions:

- Send an SOS (default).
- Control the end of flight of a drone or a model aircraft (RDT).

When pressed briefly, the **ON/OFF** button can have the following functions:

- Turning ON or OFF remote flashes.

Whatever the configuration of the buttons, a long press of 3 seconds controls the start and stop of the **Neurone**.

6.5 LEDs

They allow to control the state of the **Neurone**:

- **Yellow LED**: signals the reception of a radio message from another **Neurone** or from a **MiniNeurone**.
- **Blue LED**: flashes when the **Neurone** is connected via Bluetooth to a smartphone or tablet.
- **Orange LED**: flashes during battery charging.
- **Red / green LED**: flashes green if the position of the **Neurone** is determined, red otherwise.

6.6 Battery charging

It is done via the micro-USB connector near the battery icon. The charging can be done when the **Neurone** is running or not:

- running **Neurone**
 - **Orange** flash every 5 seconds.
- Stopped **Neurone**
 - **orange** flash while charging.
 - Flashing **orange / green** rapidly at the end of charging.



6.7 Sound

The **Neurone** emits sounds:

- At each radio reception.
- In various configurations.
- When pressing the buttons.
- During Bluetooth connections or disconnections.
- ...

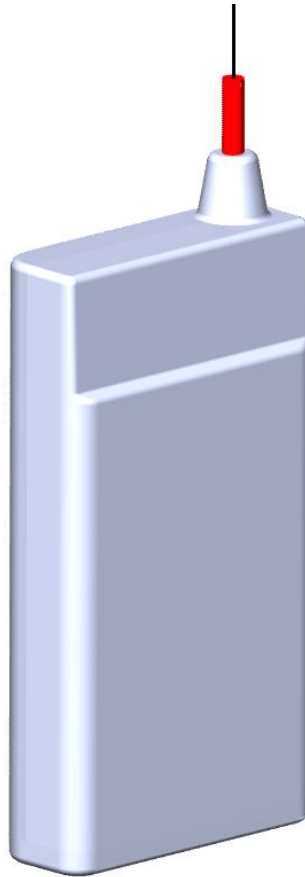
Sound can be disabled.

6.8 Neurone Reset

If the **Neurone** does not work, you can reset it by pressing with a fine point such as a paper clip, in the reset hole. The **Neurone** flashes in all colors for a few seconds then restarts.



7 Operation of the MiniNeurone



7.1 Starting and stopping

The **MiniNeurone** starts as soon as it is powered and can only be stopped by disconnecting it from its power supply.



The **MiniNeurone** stops working if its supply voltage is lower than 3.0V.

7.2 LEDs

They are used to check the state of the **MiniNeurone**:

- **Yellow LED:** not used.
- **Blue LED:** not used.
- **Red / green LED:** flashes green if the position of the **MiniNeurone** is determined, red otherwise. The green LED flashes slowly after the start of a continuous recording of altitudes (see the chapter «[using the altimeter](#)»)

8 NeuroTrack or NeuroFly configuration

The **NeuroTrack** application is intended for aircraft tracking. The **NeuroFly** application is intended for anti-collision in general aviation.

8.1 NeuroTrack

After downloading the **NeuroTrack** application from GooglePlay for Android or App Store for iOS.

- Click on «**App configuration**».
- Choose a sufficient «**Watch area**» in altitude and distance. Aircraft outside this area will not be displayed.
- Activate or not the «**Auto-zoom**». If it is active, the zoom constantly adapts to the position of the aircraft being tracked.
- Choose the «**Map**» you prefer.
- Choose the «**Units**» you prefer.
- Choose your «**Language**».

8.2 NeuroFly

After downloading the **NeuroFly** application from GooglePlay for Android or App Store for iOS.

- Click on «**App configuration**».
- Select the «**Tracking**» mode.
- You can give a name to your station made up of your **Neurone**, your first name for example.
- Choose a sufficient surveillance area in altitude and distance. Aircraft outside this area will not be displayed.
- «**Portrait**» orientation.
- Activate or not the «**Auto-zoom**». If it is active, the zoom constantly adapts to the position of the aircraft being tracked.
- Choose the «**Map**» you prefer.
- Choose the «**Units**» you prefer.
- Choose your «**Language**».

9 Neurone configuration

- Start the **Neurone**.
- Click on «**My Neurone**».
- For your first connection:
 - Click on «**Find a Neurone**».
 - Click on the detected **Neurone number**.
 - Click on the **ON/OFF** button of the **Neurone** when prompted for this action.
 - Wait for connection.
- Click on «**Configure**».
- Choose the action of the buttons:
 - SOS button: **End of flight (RDT)**
 - ON/OFF button: **Flash**
- Radio commands: choose a **password** (6 characters maximum). Only **MiniNeurones** with this password will receive the commands from this **Neurone**.
- Leave the other settings unchanged.

10 MiniNeurone Configuration

10.1 With NeuroTrack

- Start the **Neurone** and the **MiniNeurone**.
- Connect to the **Neurone**.
- Click on «**My MiniNeurone**».
- If necessary, add your **MiniNeurone** to the «**My MiniNeurones**» list.
 - Click on «**+Add**».
 - Specify the serial number of the **MiniNeurone**.
 - Choose a name for the **MiniNeurone**. Your **MiniNeurone** will appear everywhere with this name. A good practice is to combine your surname or first name with the serial number (example «John 36»).
- Select the **MiniNeurone** to configure.
- Click on «**Configure**».
- Choose the «**Aircraft type**».
- Activate or not the altimeter.
- If the altimeter is activated, choose **the starting altitude**:
 - 60 meters for F1A or similar.
 - 10 meters for F1B, F1C or similar.
- Commands reception: enter the **radio command password** defined for your **Neurone**.
- Flash: set your flash sequence. Spacing is the time between two consecutive sequences.
- End of Flight: Choose your End of Flight (RDT) system and settings.

10.2 With NeuroFly

- Start the **Neurone** and the **MiniNeurone**.
- Connect to the **Neurone**.
- Click on «**My MiniNeurone**».
- Enter the **MiniNeurone id**.
- Click on «**Configure**».
- Choose the «**Aircraft type**».
- Activate or not the altimeter.
- If the altimeter is activated, choose **the starting altitude**:
 - 60 meters for F1A or similar.
 - 10 meters for F1B, F1C or similar.
- Commands reception: enter the **radio command password** defined for your **Neurone**.
- Flash: set your flash sequence. Spacing is the time between two consecutive sequences.
- End of Flight: Choose your End of Flight (RDT) system and settings.

11 Use

11.1 General remarks

11.1.1 Battery life

It is recommended to power the **MiniNeurone** with a 1 cell (1S) Lithium polymer battery.

The autonomy of the battery depends on the movements of the **MiniNeurone** which consumes half as much when it is not moving.

With a 350 mAh Lithium Polymer battery, the autonomy obtained is as follows:

- 10 trips of 6 minutes during the day and the rest stationary: 11 hours of autonomy.
- Permanent movement: 7 hours of autonomy.

With such a battery, the autonomy is therefore between 7 and 11 hours.

It should be noted that, during the towing of a glider, the **MiniNeurone** consumes as much as in flight since it is in motion.

The **MiniNeurone** has 4 operating modes:

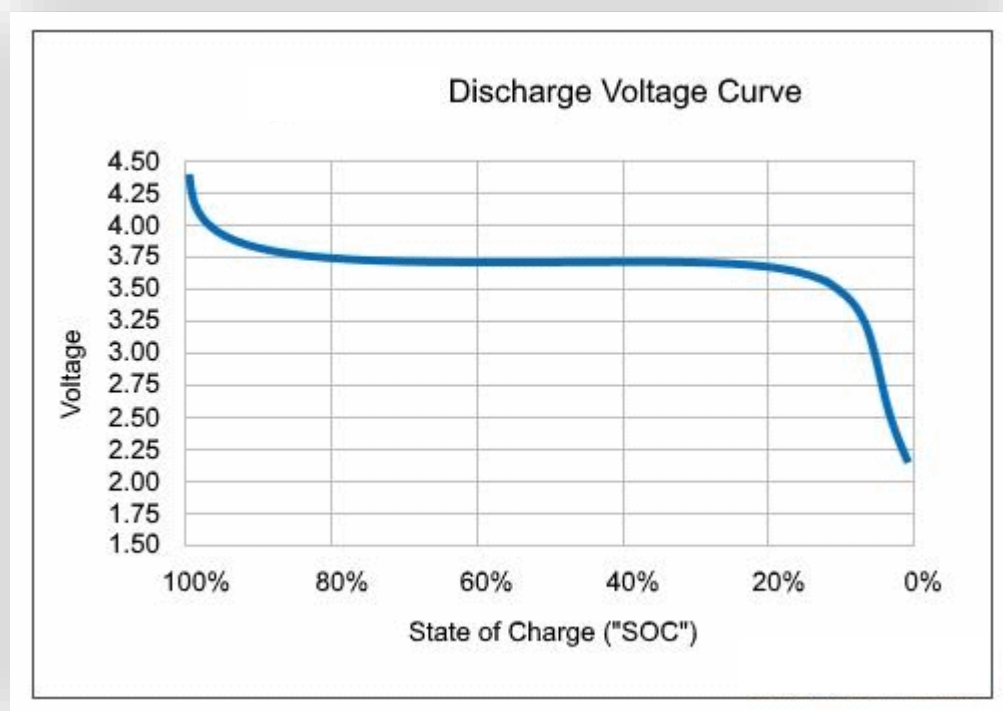
- Motion mode:
 - The **MiniNeurone** is moving: the consumption is around 50 mA.
- Stationary mode:
 - The **MiniNeurone** does not move: the consumption is approximately 25 mA.
- End of battery mode:
 - The **MiniNeurone** battery voltage is between 3.0V and 3.3V.
 - Consumption is approximately 12 mA.
 - The **MiniNeurone** switches off its GPS but continues to send the last position calculated before the GPS was switched off. This mode makes it possible to significantly increase the search time for a device.
- Off mode:
 - The battery voltage is less than 3.0V: the **MiniNeurone** is off and consumes less than 1 mA.

It is important to have time to find an aircraft that has flown too long or has landed in a remote or difficult to access location.



For this, it is advisable to change the battery when it reaches 3.7V. This still leaves 50% autonomy to the **MiniNeurone**.

Here is a typical discharge curve for a Lithium Polymer battery. We see that as soon as the voltage drops below 3.6 volts, the battery drains very quickly.



11.1.2 Transmission period

When it is stationary, the **MiniNeurone** transmits its position every 30 seconds.

When in motion, it transmits:

- Every 50 meters move.
- At each loss of altitude of 10 meters.
- At least every 30 seconds.

This methodology ensures precise location of the aircraft, in particular during the rapid descent or crash phase.

11.1.3 Positioning of the antennas

To temporarily increase the radio range of the system, hold the **Neurone** high and vertical.

11.1.4 Precautions

The **MiniNeurone** antenna is made of Nitinol, a shape memory alloy. It returns to its original shape after any stress. Take care of it and avoid twisting it in all directions.

11.1.5 Find a lost Neurone

The **Neurone** transmits a position regularly. It is therefore possible, using another **Neurone**, to geolocate a lost **Neurone**.

11.2 Search for an aircraft

For this task, it is better to use the **NeuroTrack** application.

Once your **Neurone** is connected to the application, you can view all the **MiniNeurones** and **Neurones** around you.

To follow one in particular, you have 2 options:

- Click the magnifying glass icon and enter the id of the **MiniNeurone** to follow.
- If the **MiniNeurone** appears on the map, click on it then click on "**Follow**".

A blue cone shows you the direction of the aircraft. The top banner shows you the distance, the altitude difference or the barometric height of the aircraft, the battery status of the **MiniNeurone** and the age of the last reception.

An audio message repeats the information from the banner.

As soon as one of the parameters in the banner is abnormal, it is displayed in red. Please pay attention to this:

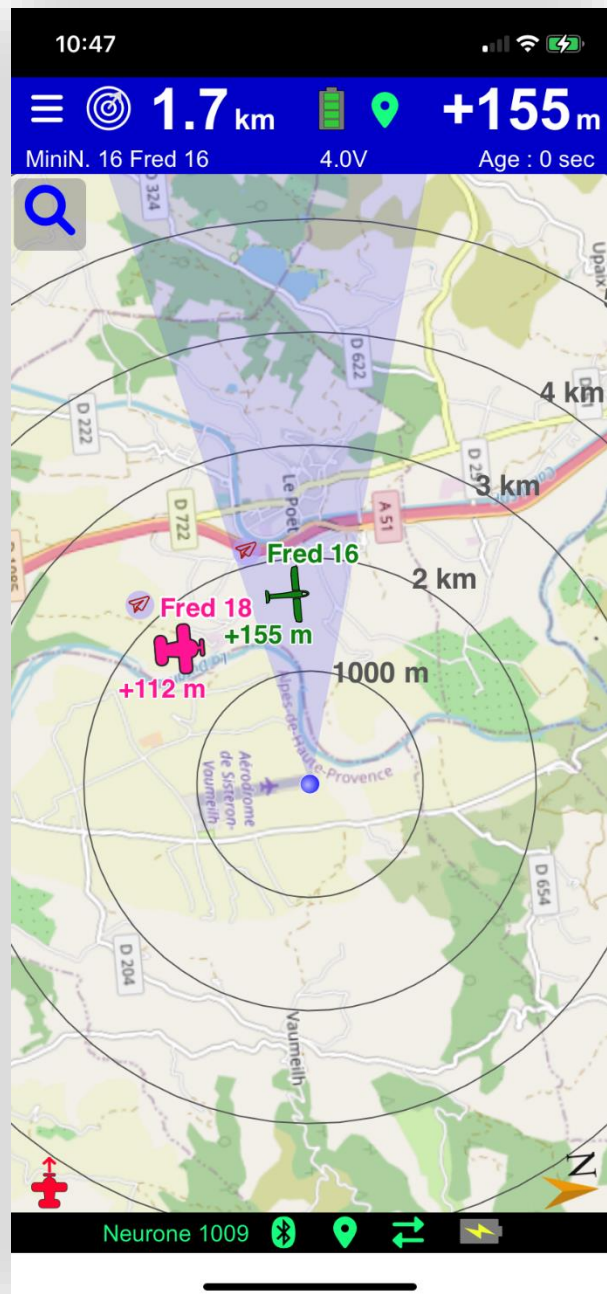


- The **MiniNeurone** is unable to determine its position: the position symbol is red.
- The **MiniNeurone** battery has a low voltage.
- The **MiniNeurone** is out of radio range or not working. (The age of the last reception is displayed in red).

If the **MiniNeurone** altimeter is activated, the altitude is replaced by the barometric height, provided it is between 0 and 250 meters.

This height, determined by measuring the ambient pressure, is accurate to less than one meter, unlike the GPS altitude whose accuracy is of the order of 20 meters.

The **MiniNeurone** estimates that it is at a height of 0 meters when the ambient pressure is constant for 60 seconds. Subsequently, the barometric height displayed is relative to this ground height.



11.3 Searching in very dense vegetation

The accuracy of the GPS is of the order of 10 meters. In very dense vegetation, this accuracy may be insufficient to locate a **MiniNeurone**.

Click on the icon representing your **MiniNeurone**. The "**signal strength**", between 0 and 100%, allows you to know the distance between the **Neurone** and the **MiniNeurone**. This value is updated each time the **MiniNeurone** transmits, i.e., every 30 seconds.

Move gradually to increase this force. At 90% you are less than 2 meters from the **MiniNeurone**.

You can also use your body to obstruct the signal and find a direction. Press the **Neurone** against your stomach. With each signal strength update, rotate a little around you. When the force is minimal, the **MiniNeurone** is behind you.

How do I hold the Neuron while searching?

The **Neurone** can be placed anywhere, pocket, armband, ...

However, near the **MiniNeurone** to be searched for, it is advisable to take the **Neurone** out of the pocket to obtain an accuracy of a few meters. This allows the **Neurone** to have a better view of the sky.

11.4 Trigger end of flight (RDT)

To trigger an end of flight (RDT), you must have previously configured:

- The same command password for your **Neurone** and your **MiniNeurones**.
- **SOS** button of the **Neurone** as «**End of flight (RDT)** ».
- An end-of-flight system for your **MiniNeurones**.

Press the **SOS** button on the **Neurone** to send an end of flight. All **MiniNeurones** with the same password as the **Neurone** will end their flight.

11.5 Control Flashes

To control the flashes remotely, you must have previously configured:

- The same command password for your **Neurone** and your **MiniNeurones**.
- **ON/OFF** button of the **Neurone** as «**Flash**»
- A flash sequence for the **MiniNeurone**.

Press the **ON/OFF** button on the **Neurone** to start or stop the flashes. All the **MiniNeurones** having the same password as the **Neurone** will carry out the command.

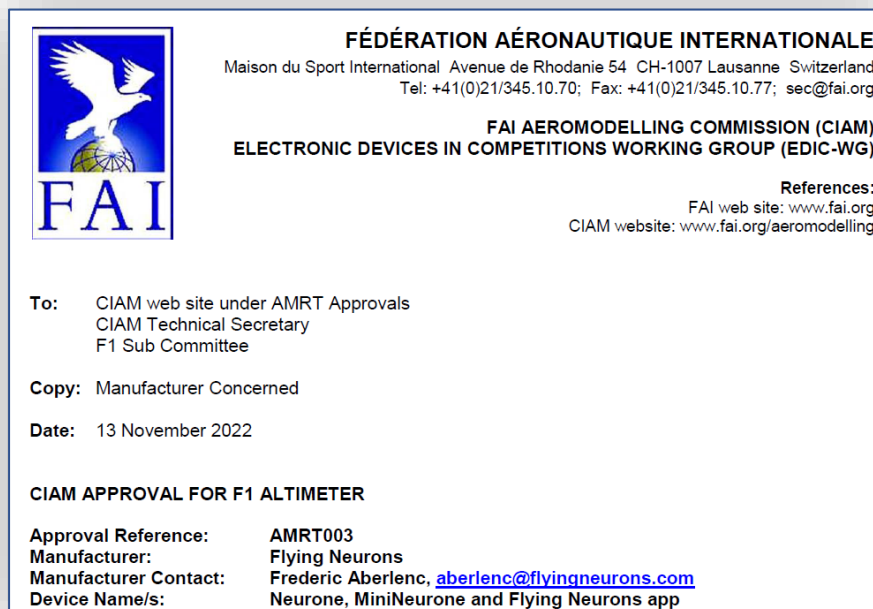
Note that 10 minutes after an ignition request, the flashes go out.



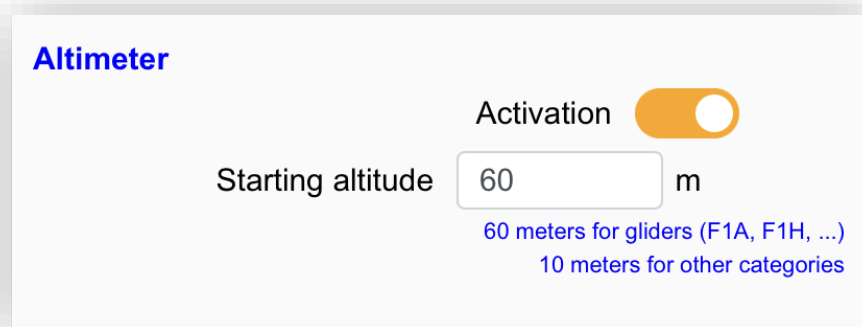
11.6 Use of the altimeter

The altimeter can only be used with the **NeuroTrack** application.

The **MiniNeurone** altimeter is EDIC certified by the FAI.



For the altitude histories to be recorded, you must activate the altimeter of the **MiniNeurone** (refer to the chapter [MiniNeurone configuration](#)).



There are 2 types of recording:

- Automatic recording.
- Continuous recording.

11.6.1 Automatic recording

Define a «**Starting altitude**» in the configuration of the **MiniNeurone**. It is an altitude relative to the ground.

As soon as your model exceeds this altitude, automatic altitude recording begins, including the previous 10 seconds.

It is recommended to define:

- 10 meters for models such as F1G, F1B, F1C, F1H, F1S, drones, ...
- 60 meters for gliders with 50 meters of cable.



Do not take a value that is too low because the altimeter may start before the start of the flight, due to fluctuations in the altimeter measurements.

The end of flight is automatically detected when the altitude remains constant.

Ten flights can be registered. Any new flight automatically erases the oldest one.

To view the last flights, there are 2 possibilities:

- Click on the icon of your model then on «**Altimeter**».
 - The last flight is then displayed.
- Go to the «**My MiniNeurone**» menu.
 - In the «**Flights log**» section, click on «**Display**».
 - Choose the number of flights to display (between 1 and 10).
 - Flights are displayed.

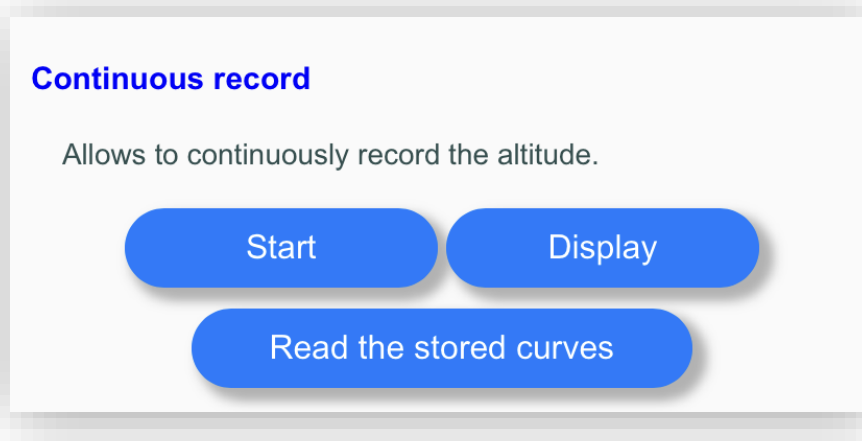
11.6.2 Continuous recording

Continuous recording allows the altitude to be permanently recorded, whether the model is in flight or not. It **complies with FAI EDIC certification**.

The advantage of continuous recording compared to automatic recording is that in case of non-detection of the departure (glider released lower than 60 meters for example), the recording will be effective.

The downside is that it must be started manually and requires manual curve analysis in order to extract the flight you are interested in.

To activate continuous recording:

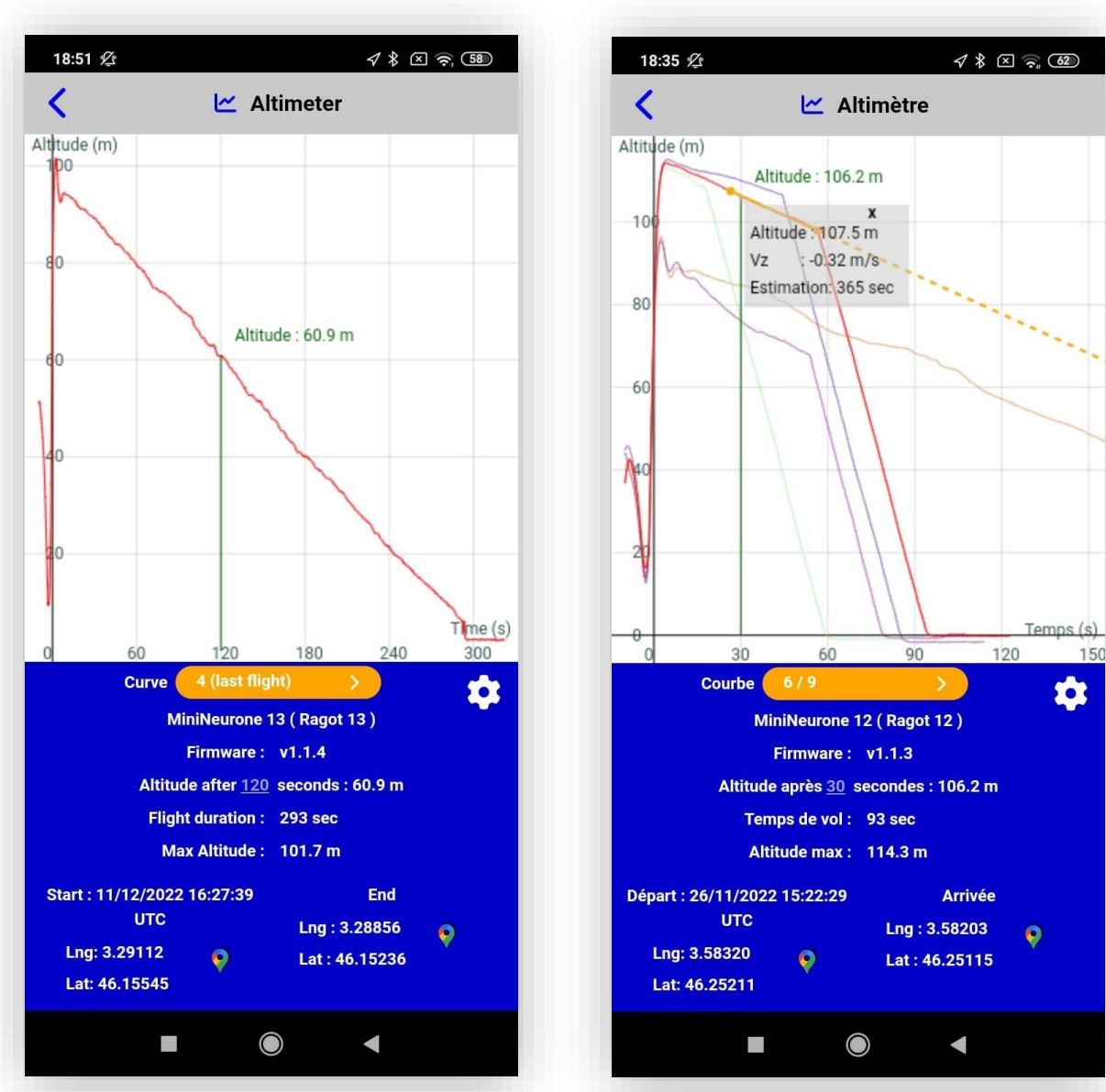


- Go to the «**My MiniNeurone**» menu.
- In the «**Continuous record**» section, click on «**Start**».
- An audio message confirms the start.
- The **MiniNeurone** **flashes green** with a periodicity of 1 second.

The **MiniNeurone** can store more than 2 hours of altimetric information.

To view the recording, click on «**Display**». The recording is displayed but it continues. It is stored in the memory of the smartphone or tablet so that it can be consulted later without requiring the use of the **MiniNeurone**.

11.6.3 Viewing Altitude Records



Many tools are then available:

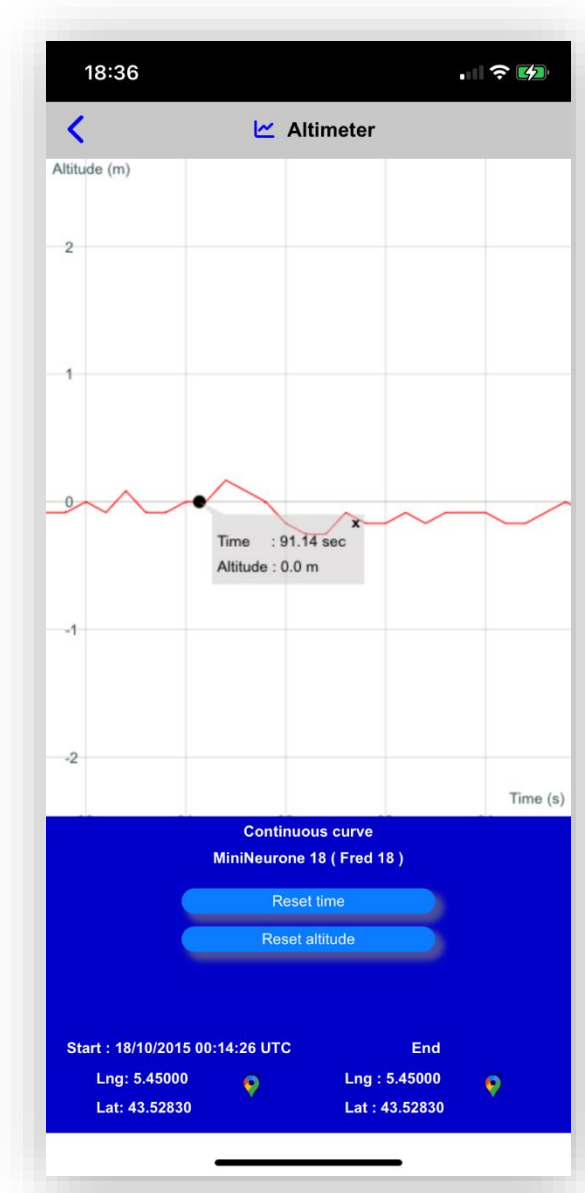
- Choice of flight if several flights are displayed. The curve of the selected flight appears in **red**. Click on **the orange tab** to choose another flight.
- Choice of flight time defined by the organizer for fly off based on altitude. Click on the **time value in blue** to modify it.
- Location of the start and end of the flight by clicking on the Google Map icon.
- Study of Vz and estimation of time of flight without DT by clicking on a point of the curve. The duration used for the estimation can be modified by clicking on the settings icon (wheel).

It is possible to zoom or move in the graph with the fingers.

The flights are timestamped and geolocated to avoid any dispute if they are used in competition.

For continuous recordings, it is necessary to define the altitude of the ground as well as the start time:

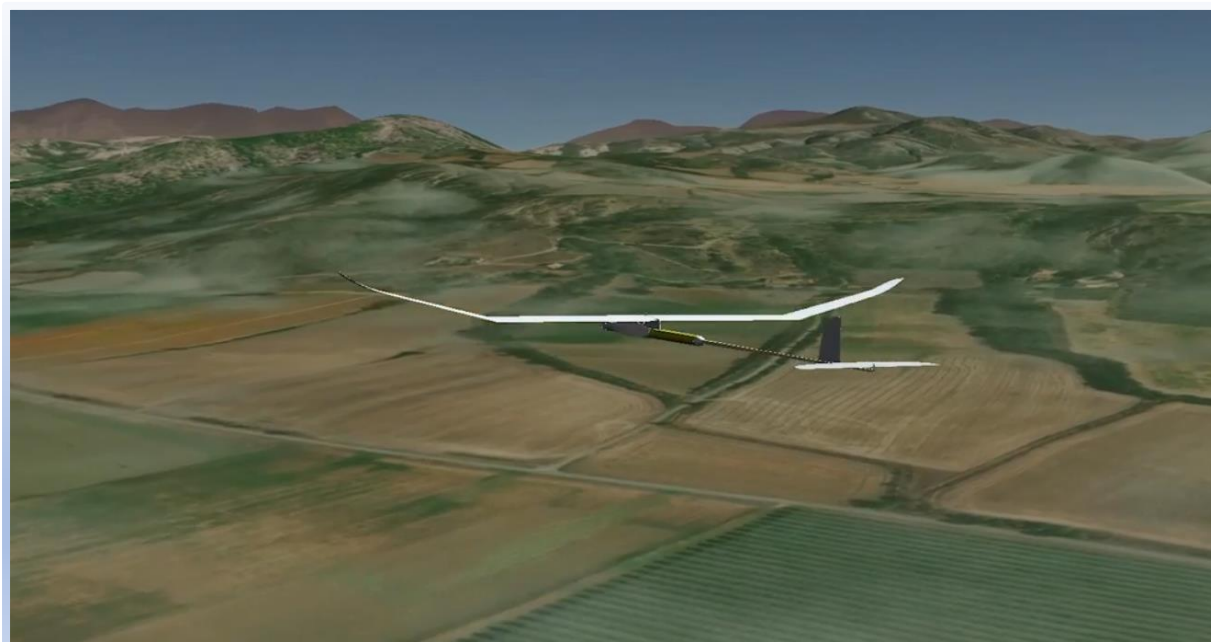
- Walk the curve until you find a point corresponding to the altitude of the ground.
- Click on this point.
- Click on «**Reset altitude**».
- Walk the curve again to find the start of the flight.
- Click on this point.
- Click on «**Reset time**».



11.7 Visualization in NeuroSky

When your Smartphone is connected to the mobile network, all flights of aircraft equipped with **Neurones** or **MiniNeurones** are recorded on the **Flying Neurons** servers. You can prohibit this recording by requesting privacy in your account settings.

Your flights can be viewed in 3D, live, or delayed, in [NeuroSky](#). Click on [NeuroSky](#) on the **Flying Neurons** website.



12 MiniNeurone update



During the update of the **MiniNeurone**, it is advised not to call or use other applications on the Smartphone or tablet carrying out the update. Likewise, do not move the Smartphone or tablet away from the **Neurone**.

When you select a **MiniNeurone** to follow, the application searches if the **MiniNeurone** needs to be updated. If so, the update is offered to you. It is advisable to accept in order to benefit from the regular improvements.

You can also, at any time, request an update:

- Start the **Neurone** as well as the **MiniNeurone** to update.
- Connect to the **Neurone**.
- Click on «**My MiniNeurone**».
- Choose the **MiniNeurone**.
- Click on «**Update**».
- Answer «**Yes**» to indicate that the **MiniNeurone** is functioning normally. The update starts and requires approximately 2mn30.

12.1 MiniNeurone blocked following an update

If the update process has not been completed (application shutdown, disconnection, etc.), it is possible to restart it. The procedure is identical to that described above, but you must answer «**No**» when asked if the **MiniNeurone** is functioning normally.

13 Neurone Update



During **Neurone** update, you are advised not to call or use other applications on the smartphone or tablet performing the update. Likewise, do not move the Smartphone or tablet away from the **Neurone**.

The update operation takes approximately 1 minute and 30 seconds.

13.1 Automatic update

Neurone updates are automatically offered to you when you connect to the application. We advise you to accept them because they bring new features and corrections.

13.2 Manual update

You can trigger an update of the **Neurone**.

- Click on «**My Neurone**».
- Click on «**Advanced**».
- Click on «**Update**».

13.3 Neurone blocked following an update

If the update process has not been completed (application shutdown, disconnection, etc.), it is possible to restart it. The procedure is identical but answer «**No**» to the question «**Can you connect to the Neurone?** », fill in the id of the **Neurone**, then click on «**OK**».

If the update does not work, contact **Flying Neurons**.

14 Technical characteristics

14.1 Neurone

Dimensions (excluding antenna)	55*35*20 mm
Weight without antenna	44 grams
Autonomy at 20°C (without peripherals)	17 hours
Operating temperature	-20°C to 80°C
Battery charging time at 20°C	3 hours
Temperature range for charging	0°C to 45°C
Charging voltage	5 to 12 Volts
Charging current	500mA
Radio range (with supplied 50 mm antenna)	More than 15 km
Radio frequency	ISM band 868 MHz
Transmitted radio power (with supplied 50 mm antenna)	500mW
Battery	1200mAh Lithium Polymer
Radio antenna connector	SMA female. Impedance 50 ohms
Positioning Constellations	GPS, GLONASS, BEIDOU, GALILEO
Bluetooth	Bluetooth Low Energy (BLE)
Sensors	Acceleration, Compass, Pressure, Temperature
Peripheral connectors	2 micro-USB connectors
Charging connector and USB 2.0	1 micro-USB connector
LEDs	6 indicator LEDs
Sound	Micro-speaker
Waterproof	No

14.2 MiniNeurone

Dimensions (excluding antenna)	29*15*5.7 mm
Weight	2.7 grams
Voltage	3.3 to 5 Volts
Autonomy at 20°C powered by a 350 mAh Lithium battery	7 to 11 hours depending on movement
Operating temperature	-20°C to 80°C
Radio range	More than 15 km
Radio frequency	ISM band 868 MHz
Transmitted radio power	500mW
Connector	Hirose DF52-10P-0.8C
Positioning Constellations	GPS, GLONASS, BEIDOU, GALILEO
Sensors	Pressure, Temperature
LEDs	4 indicator LEDs
Waterproof	No