# ITK FLOW SENSOR QUICK START GUIDE

| PRODUCT | MODEL |
|---|---|
| FLOW SENSOR | FLOW001 |

# Content

**Note**

This document is a quick start guide for the ITK flow sensor. For more details on this device, please refer to the "ITK Flow Sensor: technical specifications" document (available on demand).

# Regulatory Information

## 47 CFR Part 15 Regulation Class B Devices

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

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

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

## RF Radiation exposure statement

This device complies with FCC RF radiation exposure limits set forth for general population.

This device must be installed to provide a separation distance of at least **20cm** from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## FCC Regulatory Approval

ITK Flow Sensor
FCCID: 2AUIF- FLOW001

# Safety Notices

## Lithium Battery

A lithium battery located within the product provides power to the Flow sensor. This battery has an estimated life expectancy of three years. When this battery starts to weaken, transmission may be incorrect.

Battery is not user replaceable. If the battery fails, the device must be sent back to ITK SAS for battery replacement.

ITK SAS confirms that the Lithium batteries used in the ITK SAS product referenced in this manual comply with Provisions for International Transportation.

**CAUTION:** Risk of explosion if this battery is replaced by an incorrect type. Dispose of batteries according to instructions.

# Installing the flow sensor

The flow sensor has been designed for drip irrigation systems of watered crops. Its purpose is to measure the total **amount of water** served on a drip line during an irrigation phase. The flow sensor embeds a wireless technology to send measured data to a dedicated receiver: the **AgTech gateway**.

The installation of the flow sensor is done in **4 steps**:
- Pairing the flow sensor to the AgTech gateway
- Choosing where the flow sensor will be installed
- Checking wireless connectivity
- Connecting the flow sensor to the drip line

## Pre-requisites

Here are the pre-requisites before starting the installation of the flow sensor:
- An AgTech gateway must be properly configured, with a LoRa hub connected and with all required software installed *(see AgTech gateway manual).*
- An external LoRa antenna must be connected to the gateway, at least 15 feet above ground.
- The AgTech gateway must be **switched on**, with status LED flashing in a **heartbeat pattern**.

## Pairing to the AgTech gateway

> **Warning**
> The gateway discovery must be launched **for a single flow sensor at a time**. If the gateway discovery process is launched simultaneously on multiple flow sensors, this may result in device impairment (see Troubleshooting section). **No water** should flow in the sensor during gateway discovery.

**Principle**
The flow sensor embeds a wireless technology to send the measured volume of water to a dedicated receiver: the **AgTech gateway**. To work properly, the flow sensor must first be paired to a unique AgTech gateway: this operation is called "**gateway discovery**". It can be done at the warehouse, with the flow sensor being close to the AgTech gateway.

**Launching gateway discovery**
The gateway discovery is launched by approaching a magnet (included in the pack) close to the flow sensor body, as shown on Figure 1 and Figure 2. After gateway discovery (max 60 sec), a first "heartbeat" message is sent by the AgTech gateway to the distant application server. The flow sensor is then definitely paired to the AgTech gateway.[1][2] If the gateway discovery fails, see **Troubleshooting** section.

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[1] If needed, the flow sensor can be paired at any time to a new AgTech gateway by relaunching the gateway discovery process.
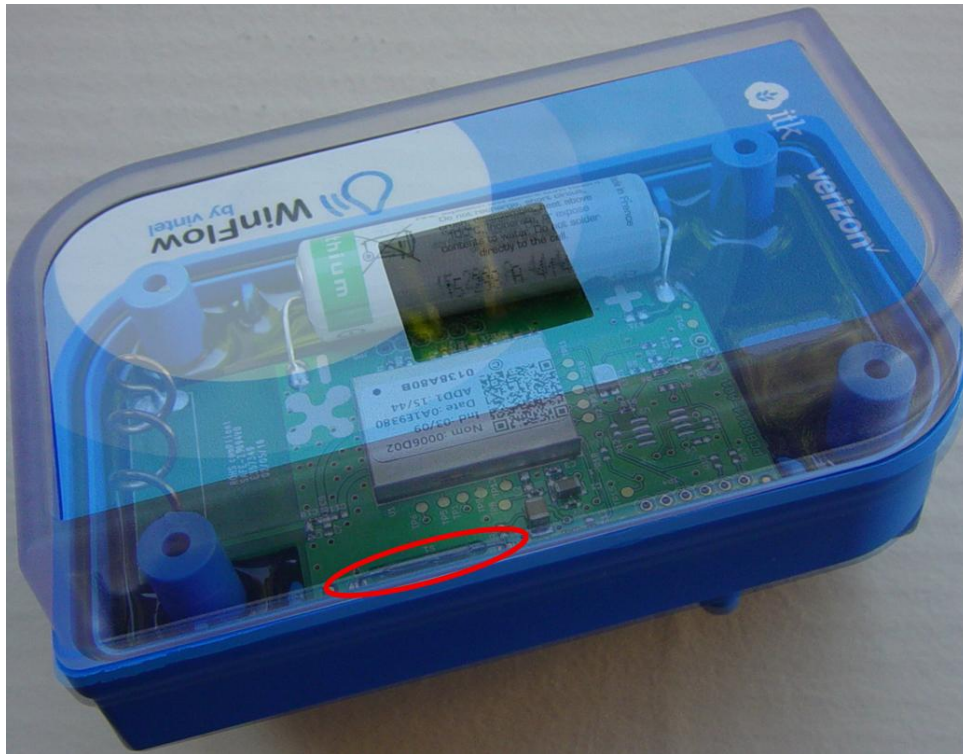
**Figure 1.** Magnet must be placed on the blue part of the flow sensor body, in front the "reed switch''.



inlet — outlet

**Magnet** **> 3s**

1. Approach magnet **more than 3 seconds.**
The red LED switches on when the magnet is close to the ITK-FlowSensor body.

blink

2. Start of **gateway discovery** process.
Maximum discovery duration of 60s.
Red and green LED blinks slowly.

5s

3. If gateway discovery **succeeds**, the green LED switches on for 5 seconds.

5s

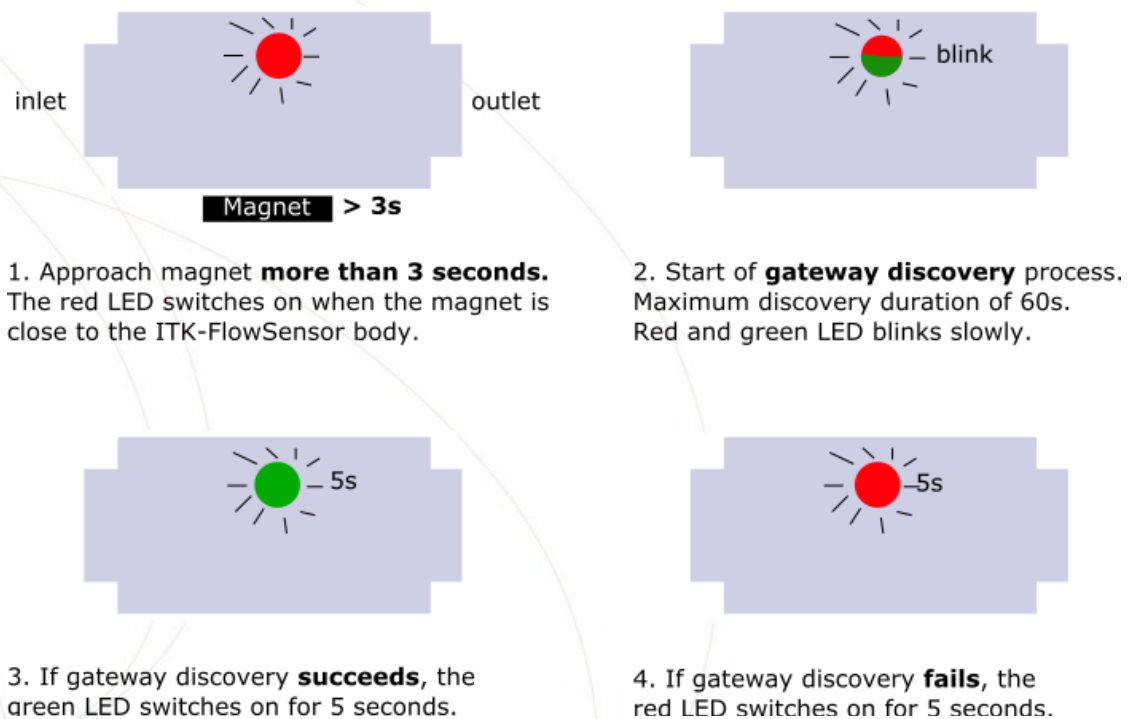4. If gateway discovery **fails**, the red LED switches on for 5 seconds.

**Figure 2.** Gateway discovery

## Choosing location

Once the flow sensor is paired to the AgTech gateway, one must decide where to install it. Here are some guidelines.

**General guidelines for flow sensor location**
- Each block should be equipped with **3 flow sensors** for information redundancy.
- The 3 flow sensors should be **evenly distributed** in the block (Figure 3)
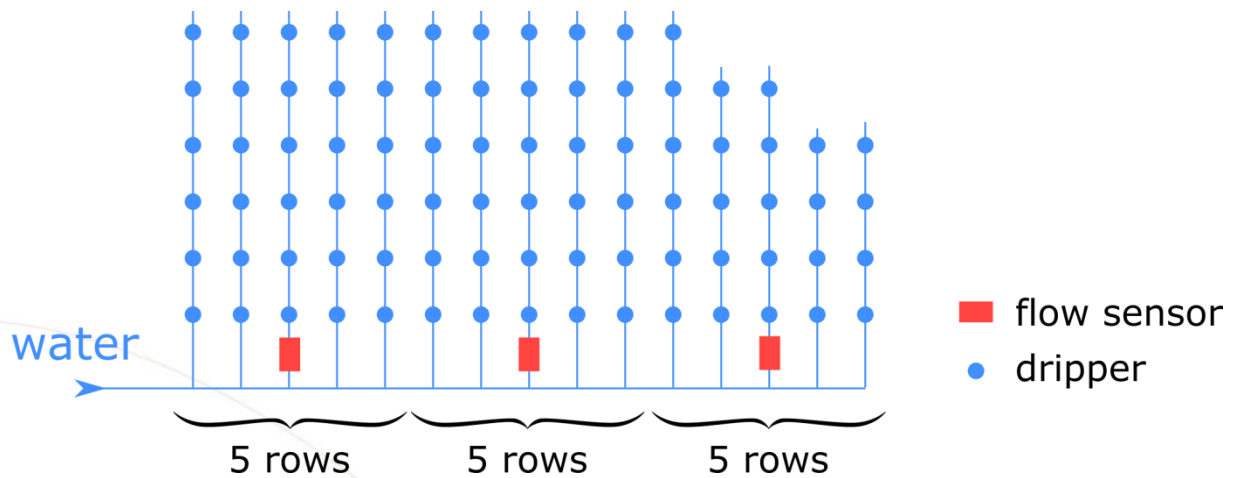- Minimum flow rate in the flow sensor is **80 gallon per hour**.



**Figure 3.** Example of a vineyard block with 15 rows.

# Checking wireless connectivity

Before choosing the exact location of the flow sensor, the wireless connectivity between the flow sensor and the AgTech gateway must be checked.

| Warning |
| --- |
| The "link check" process must be launched **for a single flow sensor at a time**. If it is launched simultaneously on multiple flow sensors, this may result in device impairment. **No water** should flow in the sensor during link check. |

**Quality of radio signal**
The maximum distance between the flow sensor and the AgTech gateway depends on the quality of the radio signal. Maximum distance is 2 miles in an open environment with receiving antenna 5m above floor, and typically 1 mile in a vineyard. However, this distance may be shortened by the presence of elements which are known to disturb the radio signal: metallic pieces, buildings, hills.

**"Link check" process**
The *link check* process can be used anytime to test the LoRa® wireless communication between a flow sensor and its paired AgTech gateway. The link check process is explained on Figure 5.
- If the wireless connectivity between the flow sensor and the AgTech gateway is good at the chosen location, the green LED on the flow sensor will stay on for 2 seconds. The AgTech gateway will then send a "heartbeat" message to the distant server.
- If the radio signal between the flow sensor and the AgTech gateway is not good enough, the "link check" process may fail (red LED stays on for 2 seconds). In that case, try to move the flow sensor to another location where the radio signal will be better.
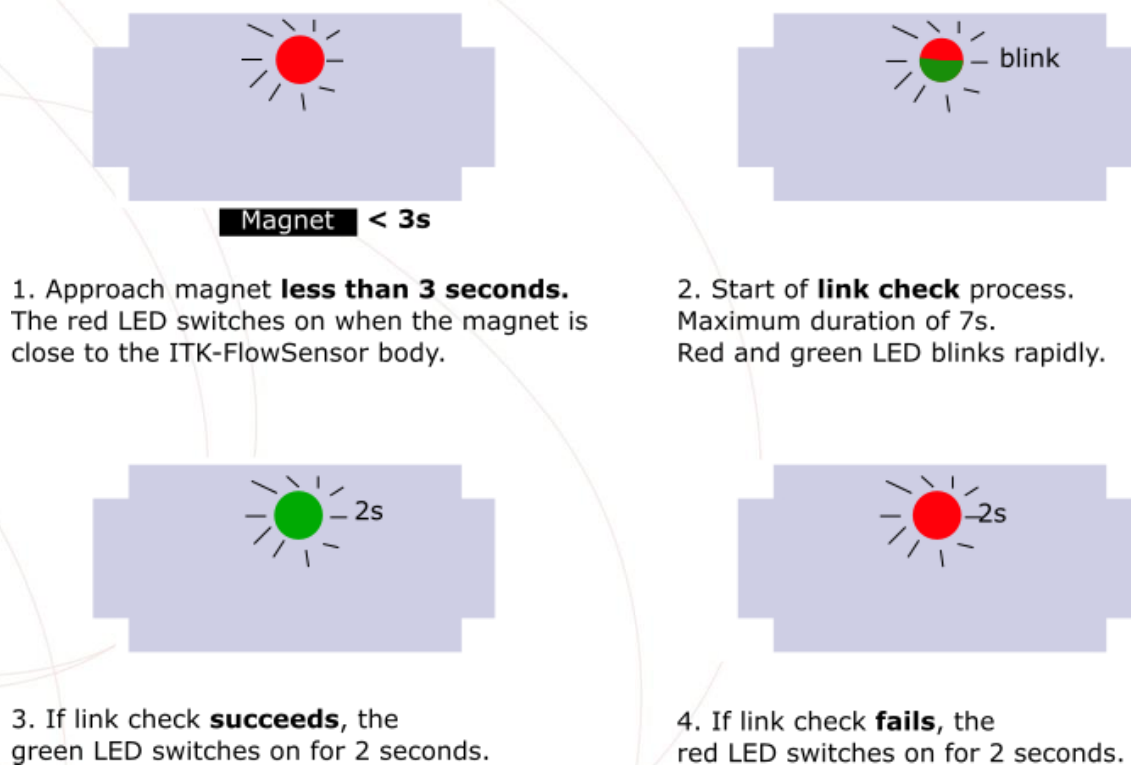


1. Approach magnet **less than 3 seconds.** The red LED switches on when the magnet is close to the ITK-FlowSensor body.

2. Start of **link check** process. Maximum duration of 7s. Red and green LED blinks rapidly.

3. If link check **succeeds**, the green LED switches on for 2 seconds.

4. If link check **fails**, the red LED switches on for 2 seconds.

**Figure 5.** Link check process

# Connecting to the drip line

The flow sensor should be connected to the drip line only after checking the wireless connectivity with the AgTech gateway (see previous paragraph).

**Direction and orientation of the flow sensor**
When installing the flow sensor to a drip line, connect the flow sensor inlet to the outlet of the pump, and connect the delivery hose into the flow sensor outlet. It is important to **respect the flow direction** looking at the arrows on the flow sensor body (Figure 6).
Besides, the flow sensor must be installed in a **horizontal** position. The top screen of the flow sensor must look upwards to ensure the best performance of radio signals emitted by the device (Figure 7).

**Pipe threads**
The flow meter is threaded 1" BSP-G female both at inlet and outlet. It can be connected to any pipe commonly used for drip irrigation of watered crops using female sleeves (Figure 8).
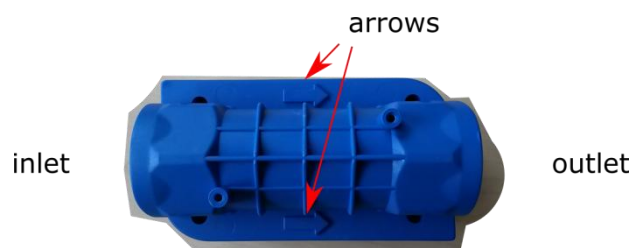


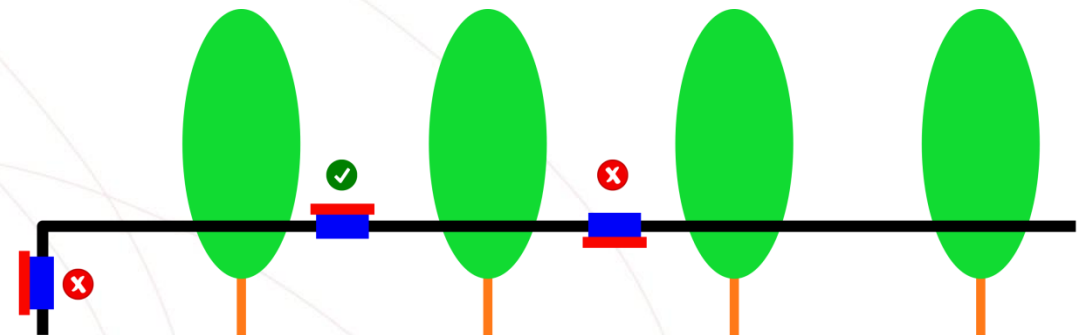**Figure 6.** Respect the flow direction displayed on the flow sensor body.



**Figure 7.** Flow sensor must be installed in a horizontal position, with the top screen looking upwards.

**Figure 8.** Flow sensor installed on a ⌀16mm flexible hose using barbed connectors (not included).

# Measurement of water flow

**Measuring system**

Water volume is measured with a magnetized turbine (2 magnets fitted into the turbine) combined with a reed switch that deliver pulses to count turbine rotations. The number of counted pulses is converted to a water volume in milliliters[3].

**Measurements sent during irrigation**

During an irrigation phase, the flow sensor will spontaneously send to the AgTech gateway 3 different types of messages:

- *Irrigation start* **message**

  The Flow sensor detects the start of an irrigation phase when it has measured a minimum water amount of **1L** flowing with a minimum flow of **1.5 L/min**.[4] When an irrigation phase has started, the flow sensor sends an *irrigation start* message to the AgTech gateway. The *irrigation start* message contains a timestamp in UTC and the amount of water (in mL) that has flown through the flow meter during the irrigation start period.

- *Irrigation update* **message**

  During an irrigation phase, the flow sensor sends an *irrigation update* message **every 15 minutes** to its paired AgTech gateway. The *irrigation update* message contains a timestamp (UTC) and the amount of water that has flown through since the start of the irrigation phase.

- *Irrigation stop* **message**

  The flow sensor detects the end of an irrigation phase when at least two consecutive pulses are separated by more than 1s. When an irrigation phase has ended, the flow sensor sends an *irrigation end* message to the AgTecg gateway. The *irrigation end* message contains a timestamp (UTC) and the total water amount (in mL) that was measured during this irrigation phase.

**Transmission delay**

All irrigation measures transmitted by the flow sensor to the AgTech gateway are sent after a delay ranging from 0 seconds to 7 minutes --- a different delay is set for each unique flow sensor, in order to avoid any collision issues. The duration for transmitting one single message is 2.5 seconds.

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[3] The conversion factor depends on the turbine model. For the current version of the product, it is 38 pulses / L.
[4] More precisely, the irrigation start is detected when the flow sensor has counted a sufficient number of pulses (38 pulses by default) with less than 1s between two consecutive pulses.

# Heartbeat

The purpose of the "heartbeat" message is to check daily that the flow sensor is still on and able to send data to the AgTech gateway.

**Heartbeat every 12 hours**
Outside the irrigation phases, the flow sensor sends a *heartbeat* message **every 12 hours** to the AgTech gateway. The heartbeat message contains a timestamp and the amount of water (in mL) that has flown through the flow meter since the last *irrigation stop* event. This residual amount of water can be due to small leaks in the irrigation system or to measurement noise. The heartbeat frame transmission is deactivated during irrigation phases.

**Heartbeat at gateway discovery**
During flow sensor installation, if the gateway discovery is successful, the gateway sends a first "heartbeat" message to the distant server. See **Installation** section for more details.

**Heartbeat after the "link check" process**
During flow sensor installation, if the "link check" process is successful, the gateway sends a "heartbeat" message to the distant server. See **Installation** section for more details.

# Technical specifications

Please refer to the ITK flow sensor technical specifications for more details.

**Model:** Flow sensor "1st generation"

**Dimensions & weight:** 72 mm x 117mm x 66mm - 0.25 kg
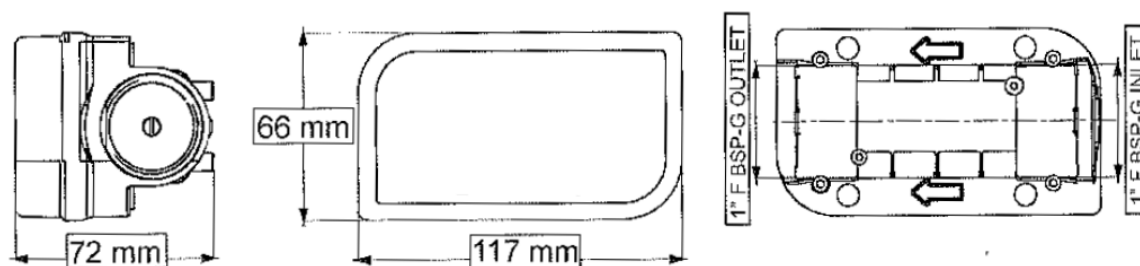


**Line sizes:** The flow meter is threaded 1" BSP-G female both at inlet and outlet.

**Housing:** Model: ILFOOD/ADAM PUMPS. Impermeability rating: IP 65

**Turbine:** Magnetized turbine (2 magnets fitted into the turbine)

**Sealing:** Sealing is made using O-ring 30x3 70Sh.

**Measuring range:** 3 – 150 lpm

**Permanent Pressure Loss:** < 1.5 PSI

**Operating conditions**
Temperature of use: -10°C to +50°C
Max pressure of use: 3.5 bar (50 psi)

**Power consumption**
Power supply: AA lithium battery (welded to the PCB)
Operating voltage: 3.6V nominal

**Lifespan:** Lifespan of the battery is > 3 years for the nominal use case.

**Radio Frequency**
ISM bands: 902-928 MHz (FCC compliant).

**Radio range**
Up to 2 miles Loss-Of-Signal with receiving antenna 5m above floor.
Typically 0.5 miles in a vineyard.

**Communication protocol**
Clover-Net® protocol (private LoRa radio network).

# Troubleshooting

**There is water leaking.**
- The flow meter is threaded 1" BSP-G female both at inlet and outlet. It can be connected to any hose commonly used for drip irrigation of watered crops.
- Make sure to use proper female sleeves depending on hose size (Figure 8).
- A Teflon® coating can be used on the pipe threads to ensure perfect sealing.


**The flow sensor turbine is not rotating when water flows.**
- Make sure that the flow sensor direction is correct, as shown on Figure 6.
- Besides, the flow sensor must be installed in a horizontal position (Figure 7).
- Minimum flow rate is 3L/min (= 50 gph): below this flow rate, the turbine won't rotate.
- Turbine rotation can sometimes be blocked due to limescale or sediments in the water. In that case, just shake the flowmeter firmly and blow it.


**Magnet placed on the flow sensor: LED does not switch on (nor green, nor red)**
- Check that the magnet is placed on the right part of the flow sensor body as shown on Figure 1.
- The magnet must touch the flow sensor body.
- The magnet must be powerful enough: only use the magnet which was provided with the ITK flow sensor.
- If it is still not working: see "Flow sensor is out of order" paragraph below.


**LED stays on for more than a minute, or blinks continuously (green or red)**
The flow sensor is out of order and must be replaced. One possible reason is that multiple "gateway discovery" or "link check" processes were launched simultaneously using the same AgTech gateway.


**Gateway discovery fails**
If the red LED stays on for 5s at the end of the gateway discovery, it means that the flow sensor was not able to successfully be paired with an AgTech gateway (Figure 2). Possible reasons are:
- The AgTech gateway is not running: switch the gateway on and relaunch gateway discovery.
- The radio connectivity is not good enough: see **Bad radio connectivity** paragraph below.
- The AgTech gateway is not properly configured (software, LoRa hub…): contact technical support.


**"Link check" fails**
If the red LED stays on for 2 seconds at the end of the "link check" process, it means that the flow sensor was not able to successfully check its wireless link with the AgTech gateway (Figure 5). Possible reasons are:
- The AgTech gateway is not running: switch the gateway on and restart the "link check" process.
- The flow sensor is not paired to the AgTech gateway: first follow the "Gateway discovery" instructions as shown on Figure 2, and then restart the "link check" process.
- The radio connectivity is not good enough: see **Bad radio connectivity** paragraph below.

- The AgTech gateway is not properly configured (software, LoRa hub…): contact technical support.

**Bad radio connectivity**

Here are some hints that will help to improve the radio connectivity between the flow sensor and the AgTech gateway:

- Check that the LoRa antenna is properly connected to the AgTech gateway.
- Check that the LoRa antenna is installed in the outside, at least 15 feet above ground.
- Check that the distance between the flow sensor and the AgTech gateway is less than 1 mile.
- Keep the flow sensor away from any element that could disturb the radio signal: metallic pieces, vehicles, buildings, hills.

**Flow sensor is out of order (no LED light, no radio connectivity)**

Possible reasons are :

- Battery is down.
- Firmware bug.
- Electronics has been damaged by excessive operating temperatures.
- Electronics has been damaged by excessive humidity (sealing problem).

In any of these cases, the flow sensor must be replaced by a new device.

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