

Valve Sensor

Product Manual

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V1.5



Table of Content

Product Information	1
Specifications	1
Product Nomenclature	2
Serial number information	2
Product Warnings	3
English	3
French	3
Installation	3
User Interface	4
Magnet Key	4
LEDs	4
Troubleshooting	6
Time-out	6
Blue LED	6
Blinking Yellow LED	6
Yellow LED	6
Device State	7
Request the device state	7
Calibrating the device	8
Step 1: Shut valve	8
Step 2: Connect & measure	8
Step 3: Open & measure	10
Step 4: Shut, measure & send	11
Resetting the calibration	12
Procedure	12
General Notes	13
Don'ts	13
Radio specification	13
Certification information	13
Manufacturer information	13
Regulatory Information FCC	14
RF exposure safety	14
Class B device notice	14

Product Information

Specifications

Product name	LoRa Valve Sensor
Product frequency	868 MHz / 915 MHz
Model name	VS-915-01-QT02
Sensor working principle	Detection of close or open state change of 1/4 turn ball valves
Operating temperature	$-40^{\circ}\text{C} \leq \text{Ta} \leq 80^{\circ}\text{C}$
IECEx explosion rating	IS Class I, Division 1, Group C, D T4 Class I, zone 1 AEx/Ex ia IIB T4 Gb
Water & dust resistance	IP65
Power supply	Battery powered
Product dimensions	96 x 64 x 40 mm
Conditions	The sensor must be calibrated on final location in installed position. Keep metal objects and/or magnetic fields away from the sensor during and after calibration. When the sensor is moved or has been displaced a calibration is required

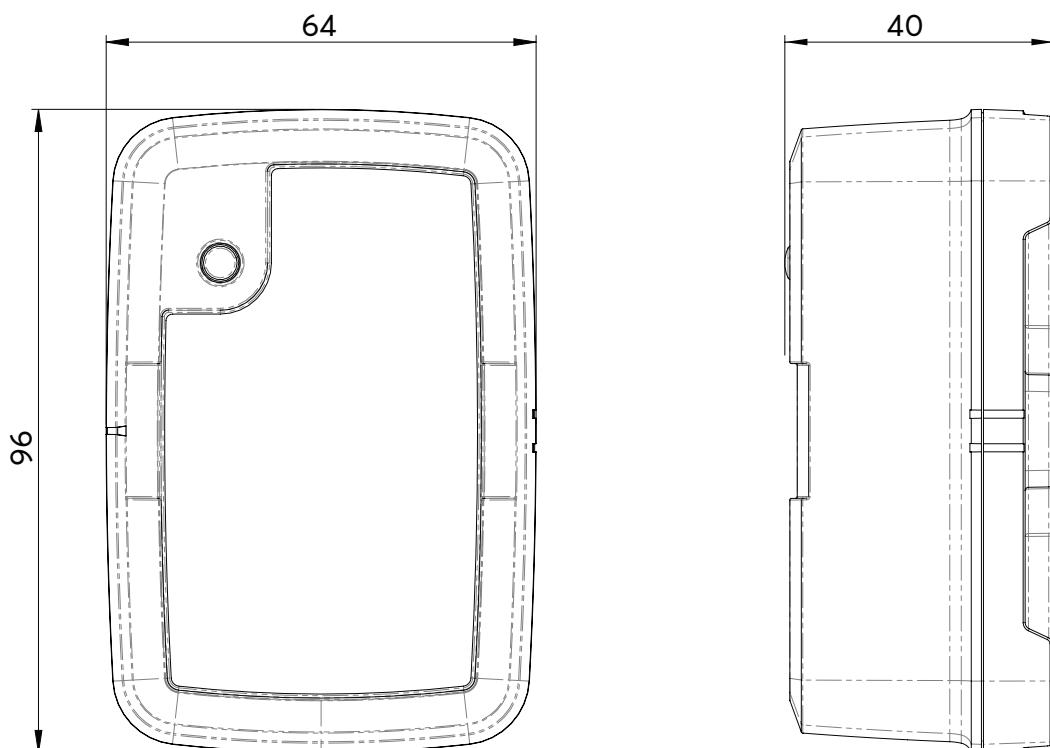


Fig. 1: Product dimensions

Product Nomenclature

aa-fff-cc-xyy

Where:

aa = Product type
 fff = operating frequency
 cc = major revision number
 xx = software functionality
 yy = indicates a regional variant

Serial number information

tt-fff-yy-xxxxxx

Where:

tt = Product type
 fff = operating frequency
 yy = year of manufacture
 xxxxxx = individual identifier

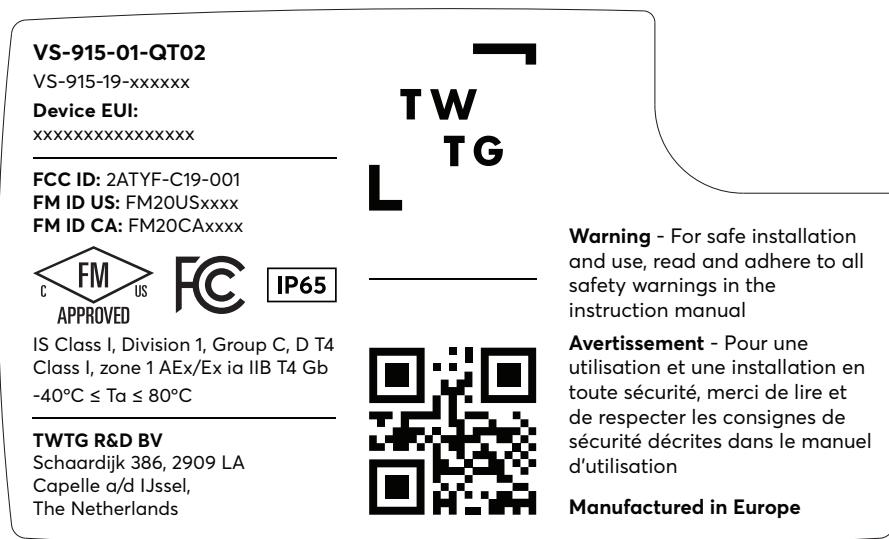


Fig. 2: Product label

Product Warnings

English

- WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD - SEE INSTRUCTIONS
-
- This product shall only be opened by competent and trained technicians. Thus, batteries shall only be replaced by competent, trained and appointed technicians. Please contact the manufacturer.
- There are no user-serviceable parts within the device.
- The device enclosure shall be cleaned only by the use of a water-damped cloth. The use of dry cloths and / or chemical agents shall be prohibited.
- If damage to the enclosure is noticed, the discoverer shall immediately inform a competent and trained person, who shall remove the device from service as soon as possible, and return to the manufacturer.
- This equipment is only intended for use in restricted access areas.
- If the device doesn't function as documented, remove the product from the IECEx / ATEX environment and dispose accordingly by returning it to the manufacturer.
- If a device is no longer connecting with gateways, it shall be returned to the manufacturer for examination.
- If a device is in contact with chemical materials please clean it appropriately

French

- WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD - SEE INSTRUCTIONS
-
- This product shall only be opened by competent and trained technicians. Thus, batteries shall only be replaced by competent, trained and appointed technicians. Please contact the manufacturer.
- There are no user-serviceable parts within the device.
- The device enclosure shall be cleaned only by the use of a water-damped cloth. The use of dry cloths and / or chemical agents shall be prohibited.
- If damage to the enclosure is noticed, the discoverer shall immediately inform a competent and trained person, who shall remove the device from service as soon as possible, and return to the manufacturer.
- This equipment is only intended for use in restricted access areas.
- If the device doesn't function as documented, remove the product from the IECEx / ATEX environment and dispose accordingly by returning it to the manufacturer.
- If a device is no longer connecting with gateways, it shall be returned to the manufacturer for examination.
- If a device is in contact with chemical materials please clean it appropriately

Installation

1. Installation needs to be performed according to IEC 60079-14
2. Installation shall only be carried out by trained and authorised personnel.
3. Installation only as instructed in this installation manual

The sensor must be calibrated in its final installed position. Keep metal objects and/or magnetic fields away from the sensor during and after calibration.

When the sensor is moved or has been displaced a recalibration is required

The device works with LoRa WAN connectivity, a LoRa WAN network must be present for the sensor to operate.

For installation instructions please refer to the valve specific installation manuals at www.twtg.io/valvesensor

User Interface

The device has one LED in the upper right corner to communicate with the user. To interact with the device a magnet switch is present inside the product. To use this switch the user must be in possession of a Magnet Key which should be placed as instructed below. The Magnet Key can be held in position for different actions in the process.

Magnet Key

The Magnet Key is a magnet that can be used to:

1. Request the status of the device
2. Calibrate or reset the calibration of the device

Magnet Key Location:

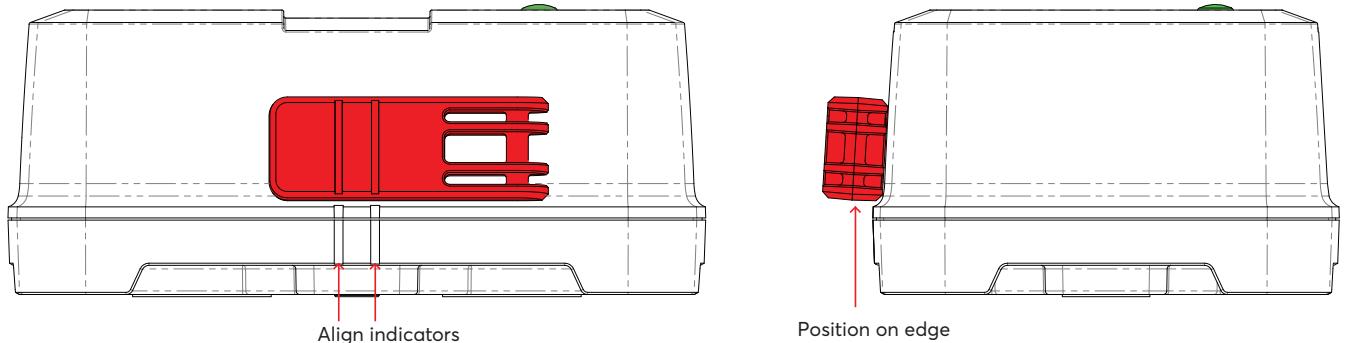


Fig. 3: Magnet Key location

LEDs

The device has a multicoloured LED and each colour and pattern has a different meaning.

Always (on request):

- Red → uncalibrated
- Green → calibrated

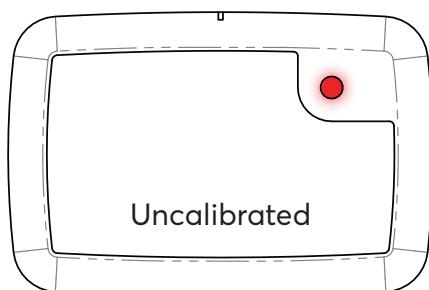


Fig. 4: Uncalibrated

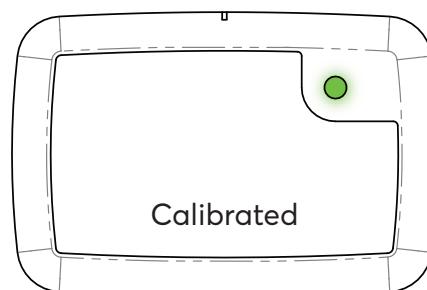


Fig. 5: Calibrated

During calibration / resetting of the calibration:

- Blue → user action required
- Yellow (steady) → measuring / wait... (keep magnet away from the device)
- Yellow (blinking) → connecting / wait...

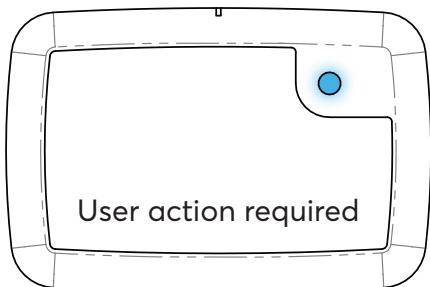


Fig. 6: User action required

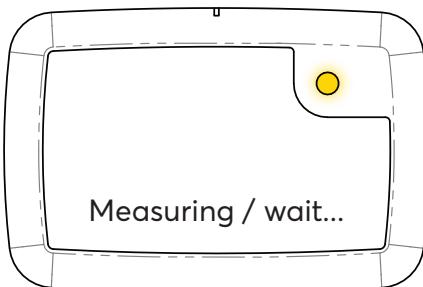


Fig. 7: Measuring / wait...

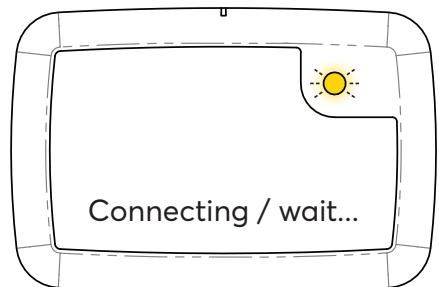


Fig. 8: Connecting / wait...

When Operational:

Open

The handle is turned to the open position (greater than 2.5 degrees), and is kept in this position for at least 3 seconds. The device senses no further movement and determines that the valve has been opened. The LED will show blue / red / blue / red, and then turns off.

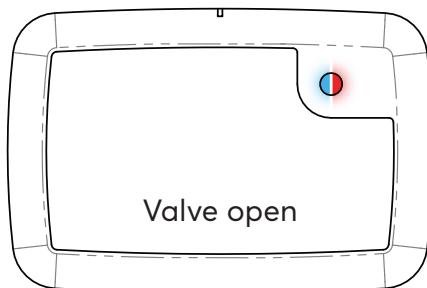


Fig. 9: Valve open

Shut

The handle is turned to the closed position (less than 2.5 degrees), and is kept in that position for at least 3 seconds. The device senses no further movement and determines that the valve has been shut. The LED will show blue / green / blue / green, and then turns off.

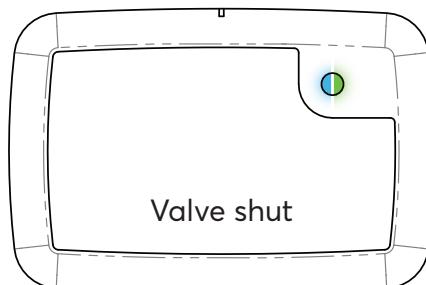


Fig. 10: Valve shut

Troubleshooting

When the device is being calibrated or when the device is operational, in exceptional cases certain steps in the process might not succeed.

When the device is successfully connected to the network and problems occur, the troubleshooting should be performed on the network side. The device is working correctly.

Time-out

A time-out is a time limit for the completion of a certain process step. This can occur in three states:

- when a user action is required (blue LED)
- when the device is connecting to the network (blinking yellow LED)
- when the device is processing (solid yellow LED)

If a time-out occurs, the device will reset the calibration.

Blue LED

The blue LED will stay on for a maximum of 30 seconds; after this time limit, the device will reset the calibration.

- Required user action not completed within 30 s → the device resets the calibration

Blinking Yellow LED

A blinking yellow LED will stay active for a maximum of 2 minutes; after this time limit, the device will reset the calibration.

- Connecting to the network failed → the device resets the calibration

Yellow LED

The yellow LED will stay on for a maximum of 30 seconds; after this time limit, the device will reset the calibration.

- Sensor reading during calibration not stable → the device resets the calibration

Device State

The device state tells the user if it is calibrated or not. This can be recalled using the magnet key.

Request the device state

1. Tap the magnet key on the indicators of the device (Fig. 3 Page 4)

- Red → uncalibrated

OR

- Green → calibrated

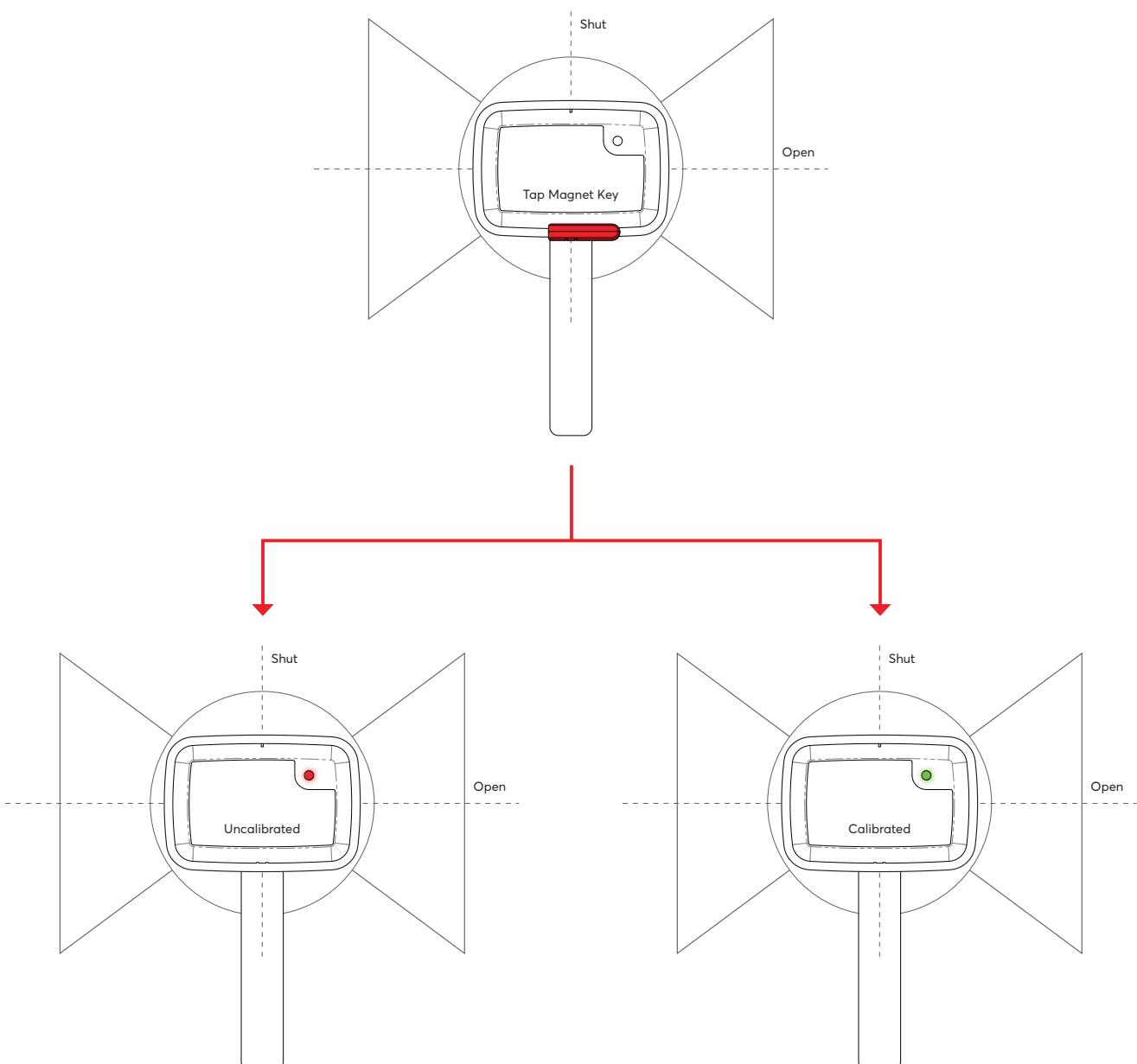


Fig.11: Request the device state

Calibrating the device

1.1

To ensure an accurate measurement, the device needs to be calibrated correctly. This process contains 4 steps:

1. Shut valve
2. Hold magnet → device state → hold magnet for 4 more seconds → connecting to the network → measure shut valve
3. Open valve → tap magnet key → measure open valve
4. Shut valve → tap magnet key → measure shut valve → connecting to the network → calibrated

Step 1: Shut valve

1. Completely shut the valve

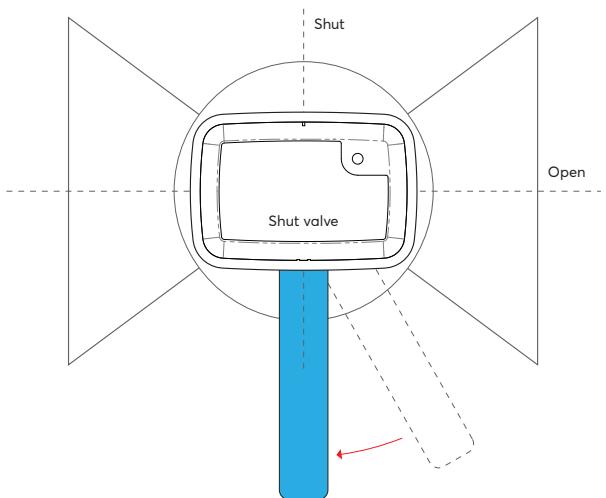


Fig. 12: Shut valve

Step 2: Connect & measure

1. Hold the magnet key on the indicators of the device (Fig. 3 Page 4) and keep holding it, after 1 second the device will show its state

- Red → uncalibrated → proceed

- Green → calibrated → release magnet key → no further steps required

OR

- Green → calibrated → release magnet key → follow the procedure for resetting the calibration

2.1

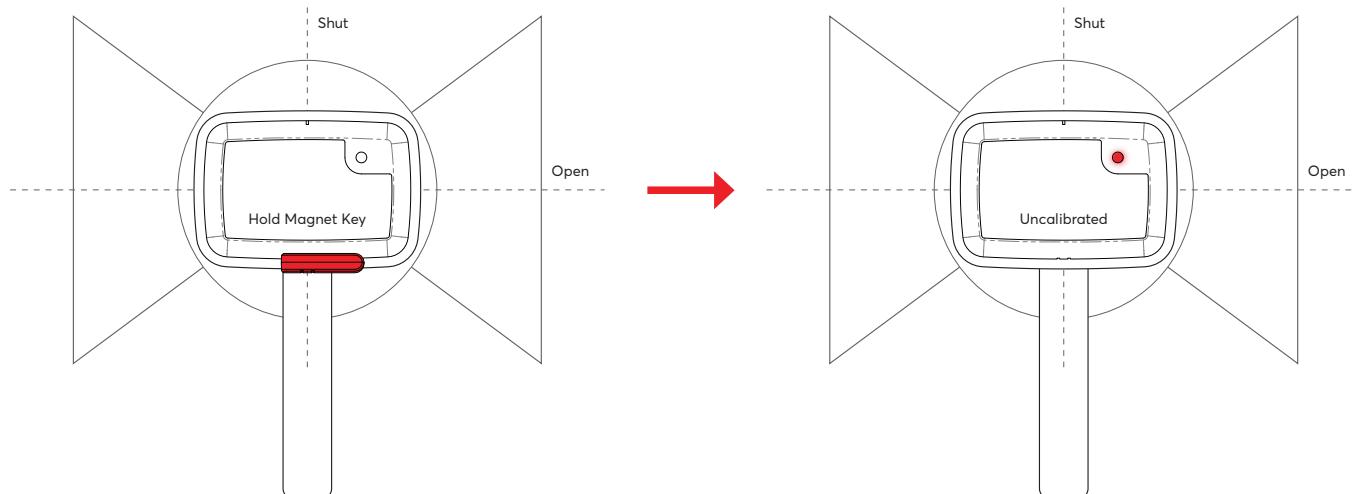


Fig. 13: Hold magnet → Device state

2. Keep holding the magnet key for 4 more seconds

- Yellow (blinking) - connecting / wait... (max. 2 min.)
 - Red → connection failed / time-out → uncalibrated → check network
- Yellow (steady) - measuring / wait... (max. 30 s)
(keep the magnet key away from the device)
 - Red → measurement failed / time-out → uncalibrated → go back to step 1
- Blue → user action required (max. 30 s) → go to step 3
 - Red → time-out → uncalibrated → go back to step 1

2.2

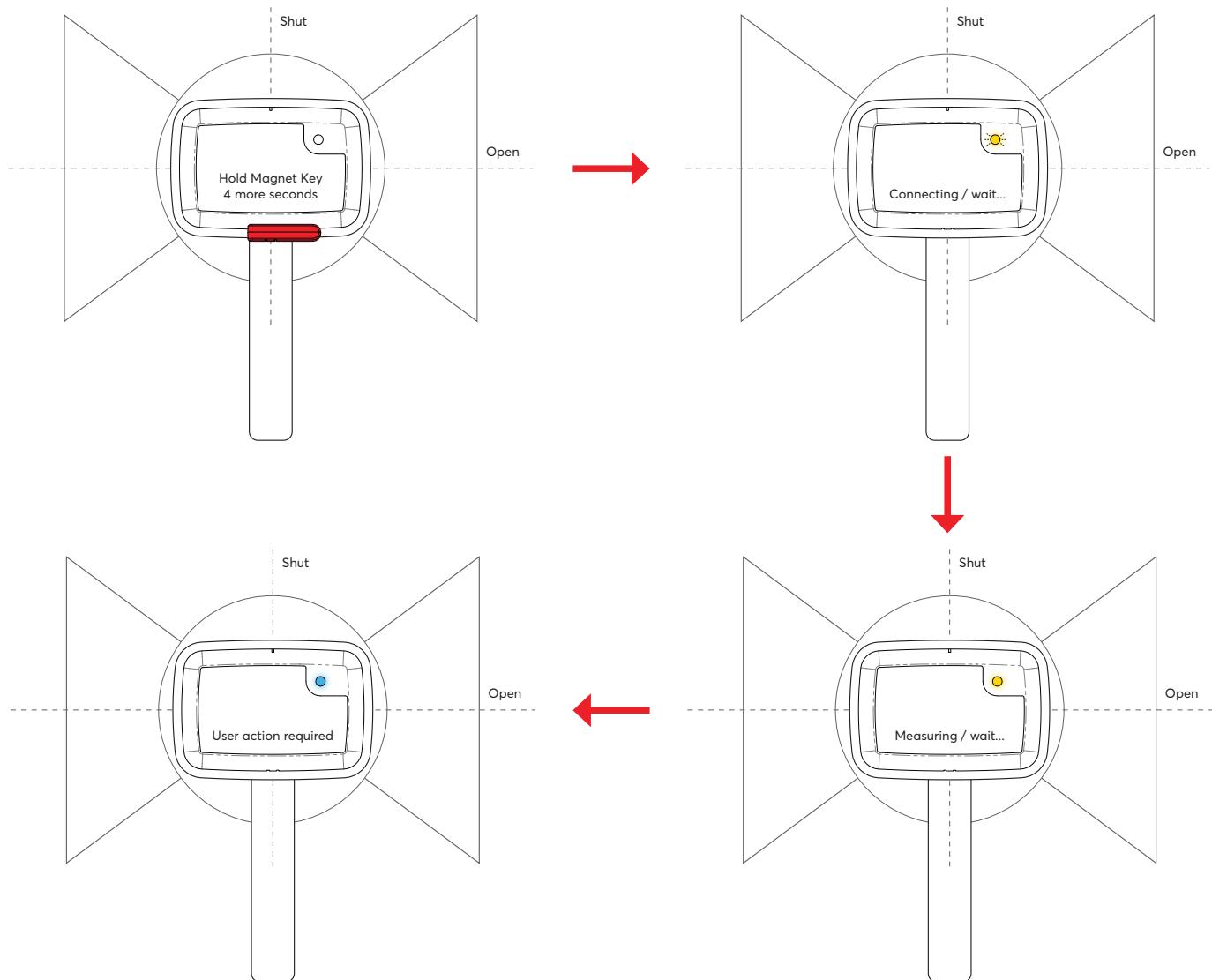


Fig. 14: Hold magnet → Connecting → Measure → User action required

Step 3: Open & measure

3.1

1. Open the valve by turning the handle more than 2.5 degrees
2. Tell the device that the valve is opened by tapping the magnet key
 - Yellow (steady) - measuring / wait...(max. 30 s) (*keep the magnet key away from the device!*)
 - Red → measurement failed / time-out → uncalibrated → go back to step 1
 - Blue → user action required (max. 30 s) → go to step 4
 - Red → time-out → uncalibrated → go back to step 1

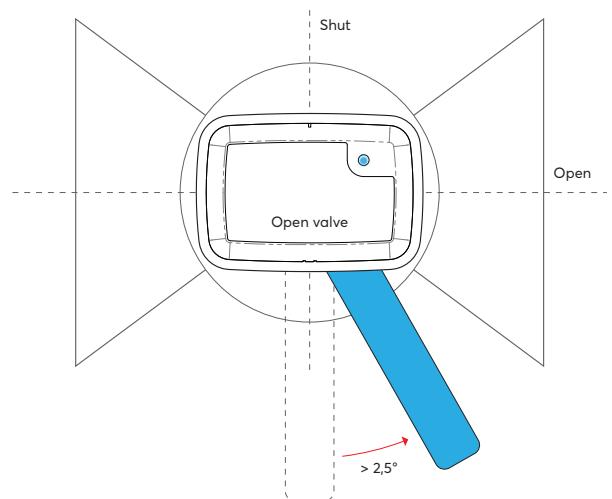


Fig. 15: Open valve

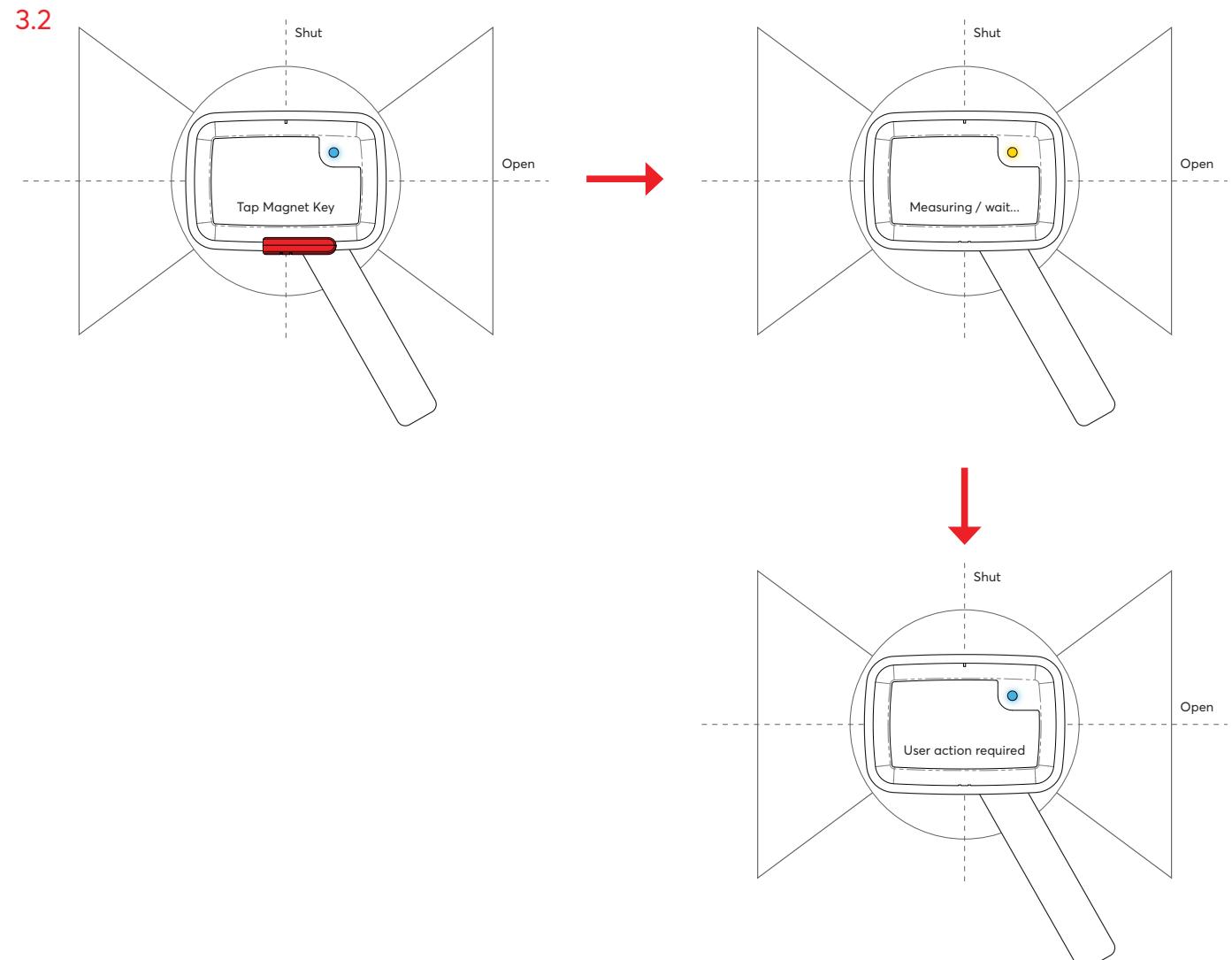


Fig. 16: Tap magnet → Measure → User action required

Step 4: Shut, measure & send

1. Completely shut the valve
2. Tell the device that the valve is shut by tapping the magnet key
 - Yellow (steady) - measuring / wait...(max. 30 s) *(keep the magnet key away from the device)*
 - Red → measurement failed / time-out → uncalibrated → go back to step 1
 - Yellow (blinking) - connecting / wait... (max. 2 min.)
 - Red → connection failed / time-out → uncalibrated → go back to step 1
 - Green - calibrated

4.1

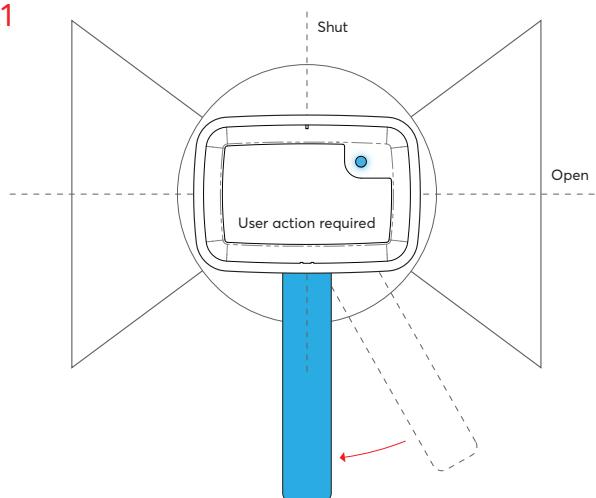


Fig. 17: Shut valve

4.2

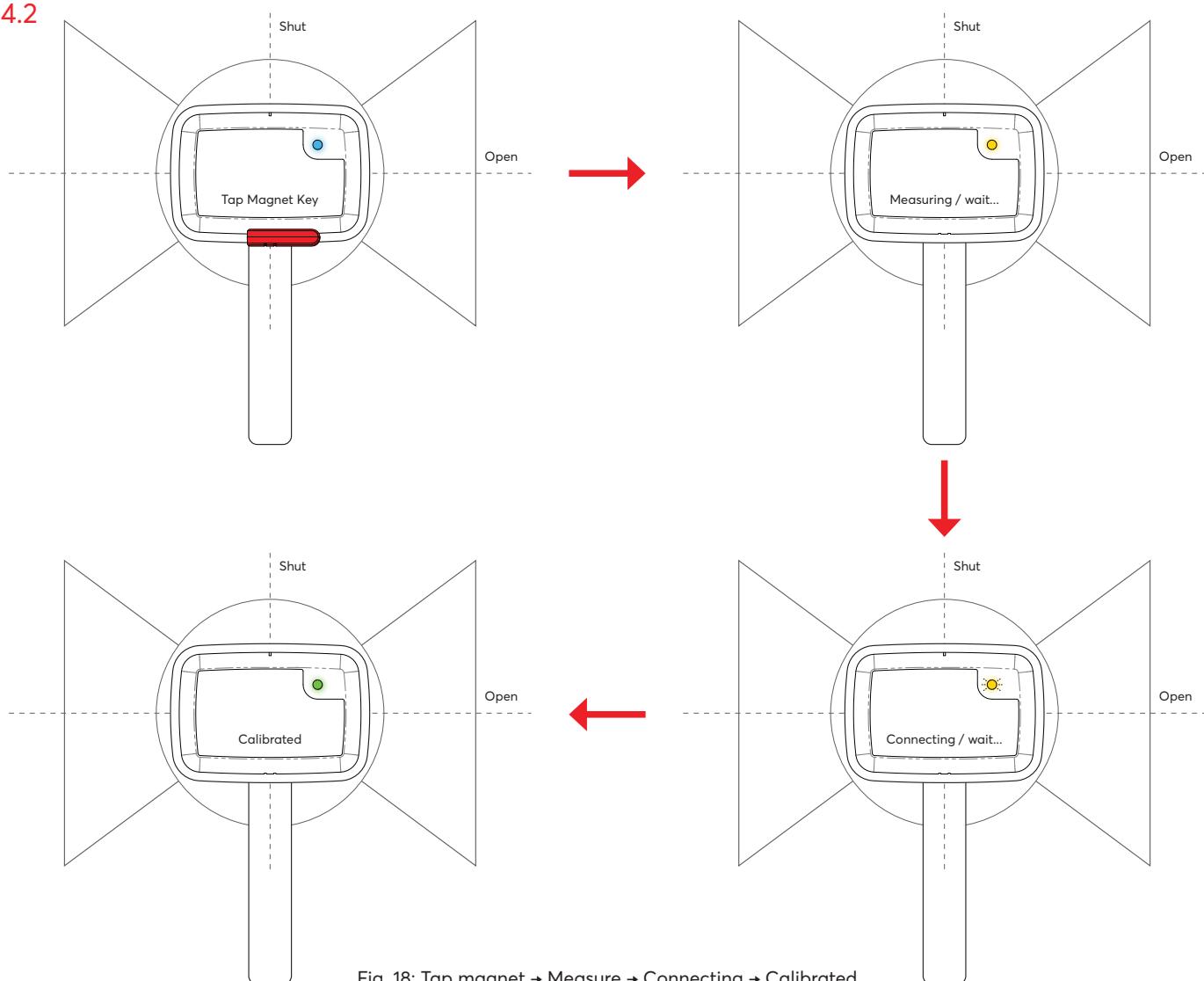


Fig. 18: Tap magnet → Measure → Connecting → Calibrated

Resetting the calibration

In some cases it might be necessary to reset the calibration of the device:

1. When the device is being reinstalled, relocated or removed
2. When the network has changed
3. When the device does not work correctly

Procedure

1. Hold the magnet key on the indicators of the device (Fig. 19 Page 4) and keep holding it, after 1 second the device will show its state
 - Green → calibrated → keep holding the magnet key and go to step 2
 - Red → uncalibrated → release magnet key → no further steps required
2. Keep holding the magnet key for 4 seconds more
 - Red → uncalibrated

1

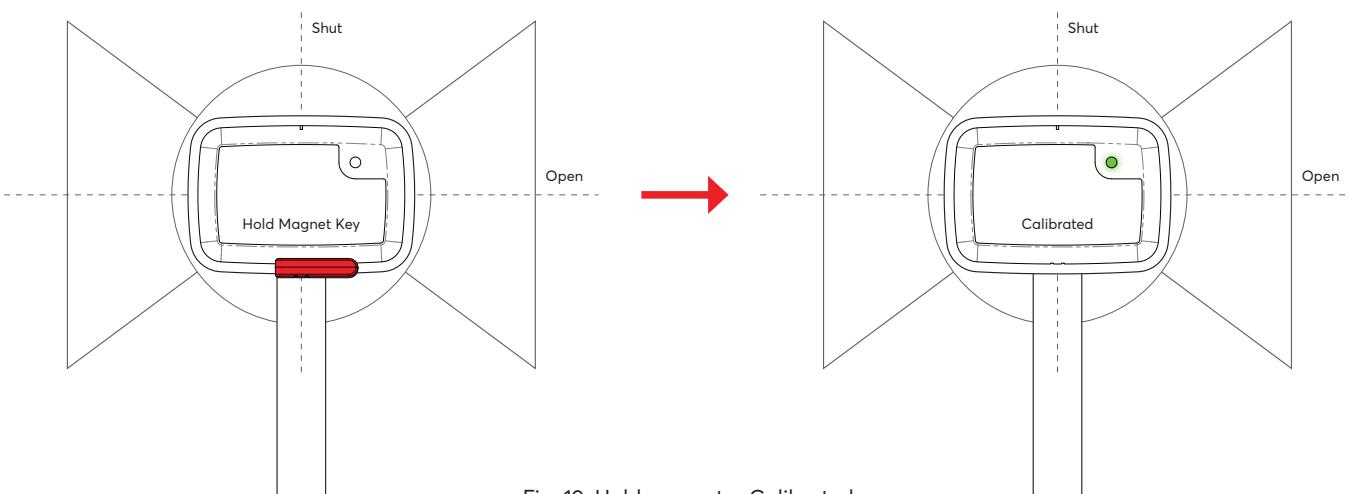


Fig. 19: Hold magnet → Calibrated

2

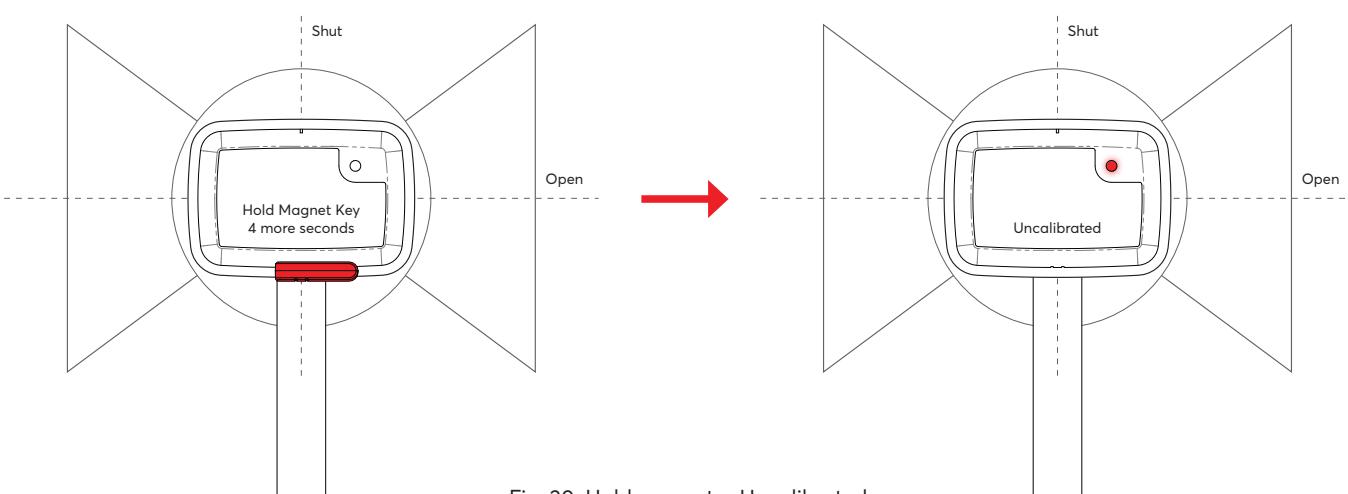


Fig. 20: Hold magnet → Uncalibrated

General Notes

Don'ts

1. Don't leave a magnet key near the device after installation
2. Don't leave anything on the device after installation
3. If the label is damaged, return the device for refurbishment.
4. If product or mounting parts are damaged, return the device for refurbishment

Radio specification

This product contains a LoRa radio modem operating at 868 MHz within the EU. This product requires access to a LoRa gateway in order to function as described. Maximum RF power = 12 dBm (16 mW).

	Frequency range	Maximum power
LoRaWAN 868 MHz	863-870 MHz	12 dBm
LoRaWAN 915 MHz	902-928 MHz	12 dBm

Hereby, TWTG R&D B.V. declares that the radio equipment type "LoRa modem" is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: www.twtg.io/legal

Certification information

IECEx 02 | ATEX 114
 IECEx DEK 18.0063
 DEKRA 18ATEX0106

FCC ID: 2ATYF-C19-001
 FM ID US: FM20USxxxx
 FM ID CA: FM20CAxxxx

Manufacturer information

TWTG R&D B.V.
 Schaardijk 386
 2909 LA Capelle a/d IJssel
 The Netherlands
www.twtg.io



Regulatory Information FCC

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

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

RF exposure safety

This device complies with the FCC RF exposure limits and has been evaluated in compliance with mobile exposure conditions.

The equipment must be installed and operated with minimum distance of 20 cm of the human body.

Class B device notice

NOTE: 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:

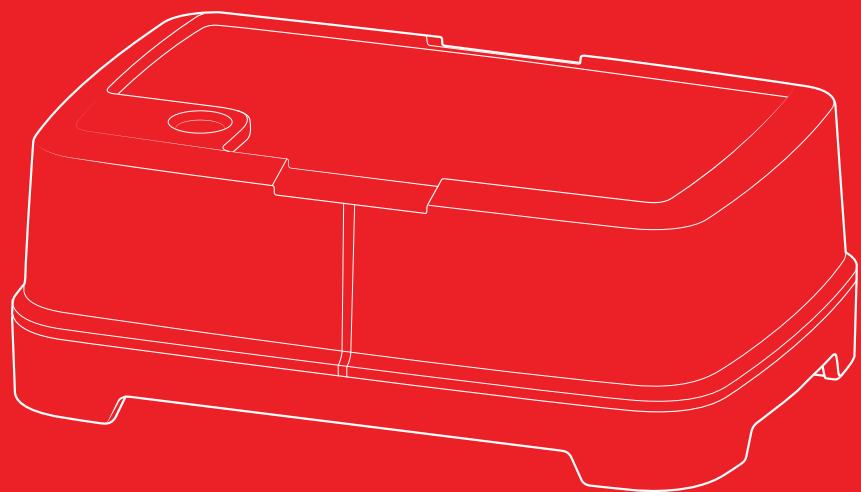
- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help



We're tireless tinkerers - motivated by challenge, curiosity, and changing the status quo. We're the kind of people that used to be called 'inventors'.

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Temperature Sensor

Product Manual

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V1.5

Table of Content

Product Information	1	Turning off the device	8
Specifications	1	Procedure	8
Product Nomenclature	2	General notes for installation	9
Serial number information	2	Temperature Probe notes	9
Product Warnings	3	Installation without adhesive	10
English	3	Necessities	10
French	3	Sequence	10
Installation	3	Installation with adhesive	12
User Interface	4	Necessities	12
Magnet Key	4	Sequence	12
LEDs	5	General Notes	14
Troubleshooting	6	Don'ts	14
Time-out	6	Radio specification	14
Blinking Yellow LED	6	Certification information	14
Device State	6	Manufacturer information	14
Request the device state	6	Regulatory Information FCC	15
Turning on the device	7	RF exposure safety	15
Procedure	7	Class B device notice	15

Product Information

Specifications

Product name	LoRa Temperature Sensor
Product frequency	868 MHz / 915 MHz
Model name	TS-915-01-02
Sensor working principle	Contact probe for measuring surface temperature
Operating temperature	$-40^{\circ}\text{C} \leq \text{Ta} \leq 80^{\circ}\text{C}$
IECEx explosion rating	Ex II 2G Ex ia IIB T4 Gb Class 1 Zone 1 AEx ia IIB T4 Gb
Water & dust resistance	IP65
Power supply	Battery powered
Product dimensions	96 x 64 x 40 mm
Conditions	For accurate temperature readings the sensor must be placed underneath (existing) insulation. For temperature difference applications, installation without insulation could be applied depending on the specific needs. Contact the manufacturer for specific use case and compatibility.

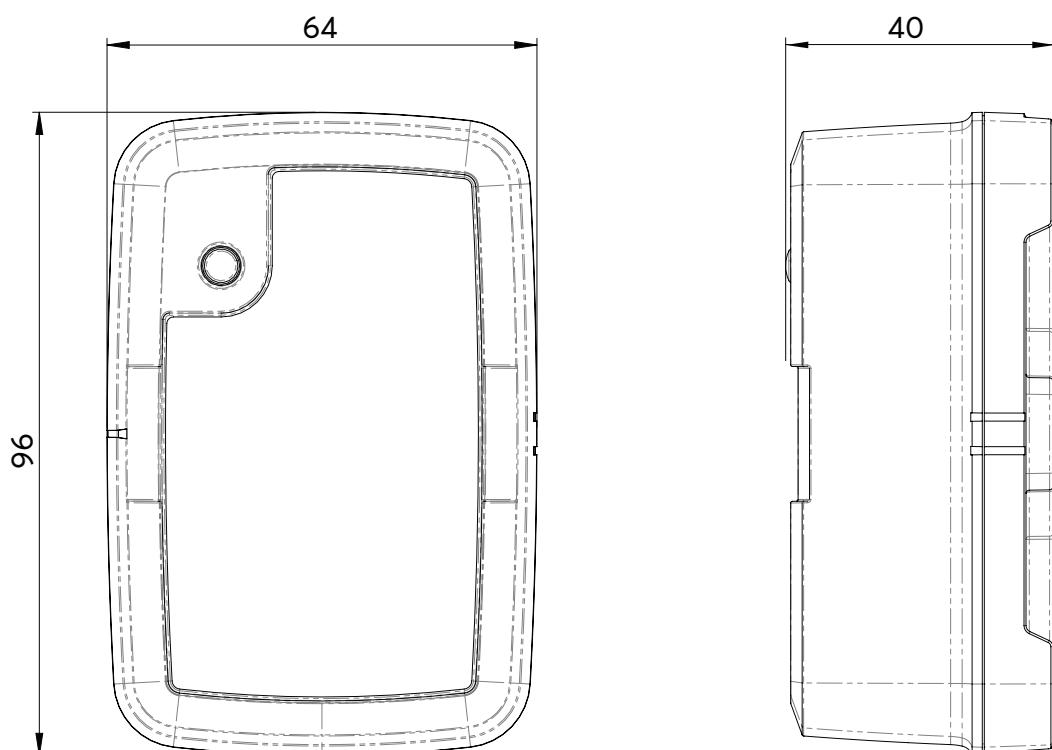


Fig. 1: Product dimensions

Product Nomenclature

aa-fff-cc-xyyy

Where:

aa = Product type
 fff = operating frequency
 cc = major revision number
 xx = software functionality
 yy = indicates a regional variant

Serial number information

tt-fff-yy-xxxxxx

Where:

tt = Product type
 fff = operating frequency
 yy = year of manufacture
 xxxxxx = individual identifier

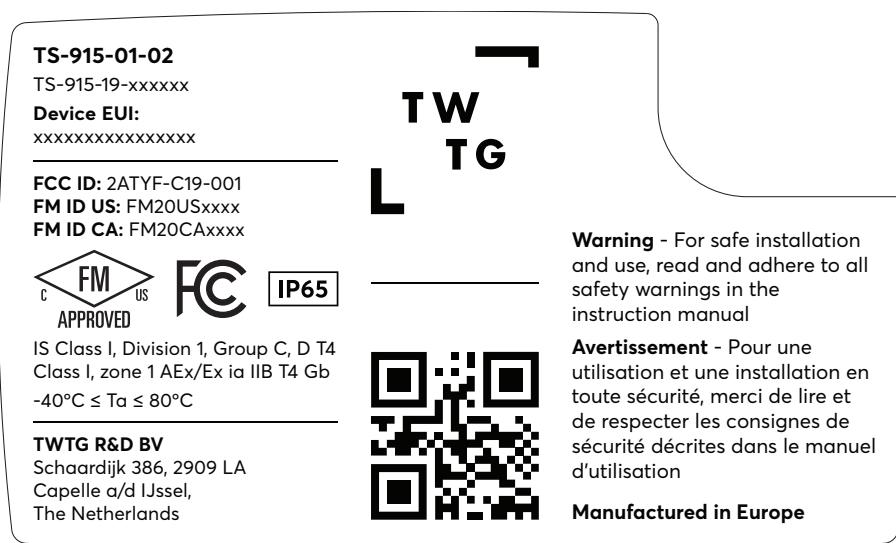


Fig. 2: Product label

Product Warnings

English

- WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD - SEE INSTRUCTIONS
-
- This product shall only be opened by competent and trained technicians. Thus, batteries shall only be replaced by competent, trained and appointed technicians. Please contact the manufacturer.
- There are no user-serviceable parts within the device.
- The device enclosure shall be cleaned only by the use of a water-damped cloth. The use of dry cloths and / or chemical agents shall be prohibited.
- If damage to the enclosure is noticed, the discoverer shall immediately inform a competent and trained person, who shall remove the device from service as soon as possible, and return to the manufacturer.
- This equipment is only intended for use in restricted access areas.
- If the device doesn't function as documented, remove the product from the IECEx / ATEX environment and dispose accordingly by returning it to the manufacturer.
- If a device is no longer connecting with gateways, it shall be returned to the manufacturer for examination.
- If a device is in contact with chemical materials please clean it appropriately

French

- WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD - SEE INSTRUCTIONS
-
- This product shall only be opened by competent and trained technicians. Thus, batteries shall only be replaced by competent, trained and appointed technicians. Please contact the manufacturer.
- There are no user-serviceable parts within the device.
- The device enclosure shall be cleaned only by the use of a water-damped cloth. The use of dry cloths and / or chemical agents shall be prohibited.
- If damage to the enclosure is noticed, the discoverer shall immediately inform a competent and trained person, who shall remove the device from service as soon as possible, and return to the manufacturer.
- This equipment is only intended for use in restricted access areas.
- If the device doesn't function as documented, remove the product from the IECEx / ATEX environment and dispose accordingly by returning it to the manufacturer.
- If a device is no longer connecting with gateways, it shall be returned to the manufacturer for examination.
- If a device is in contact with chemical materials please clean it appropriately

Installation

- Installation needs to be performed according to IEC 60079-14
- Installation shall only be carried out by trained and authorized personnel.
- Installation only as instructed in this installation manual

The device works with LoRa WAN connectivity, a LoRa WAN network must be present for the sensor to operate.

For full specifications and installation manuals please visit: www.twtg.io/temperaturesensor

User Interface

Magnet Key

The Magnet Key is a magnet that can be used to turn on or off the Temperature Sensor.

Magnet Key Location:

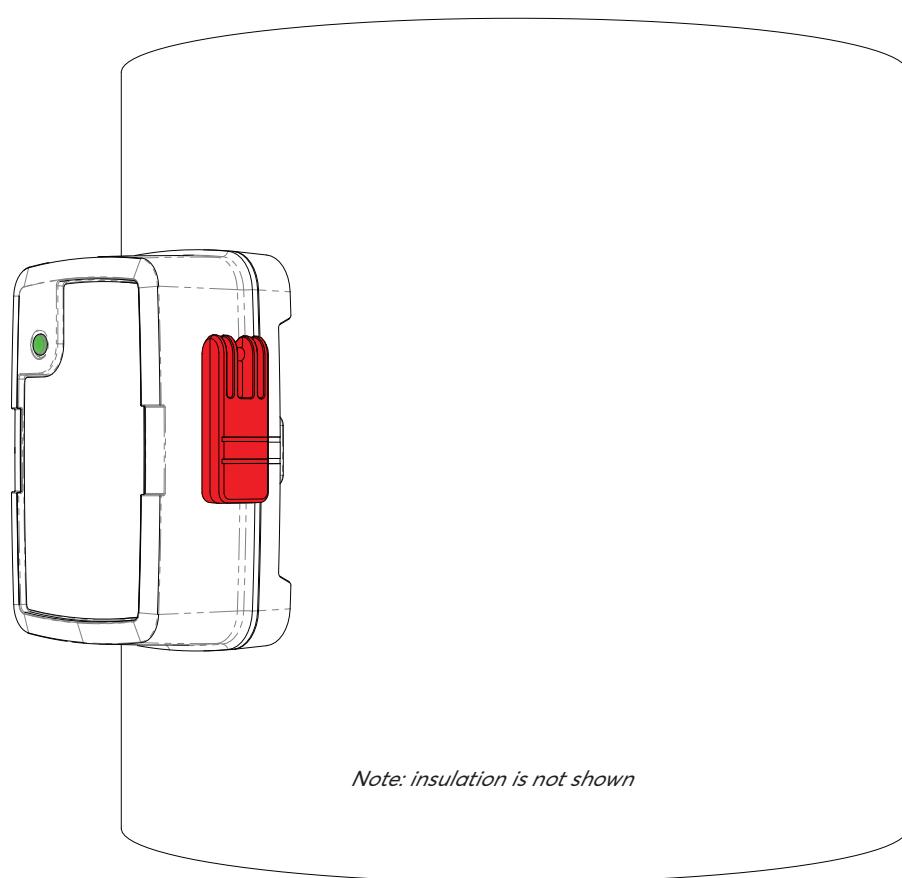
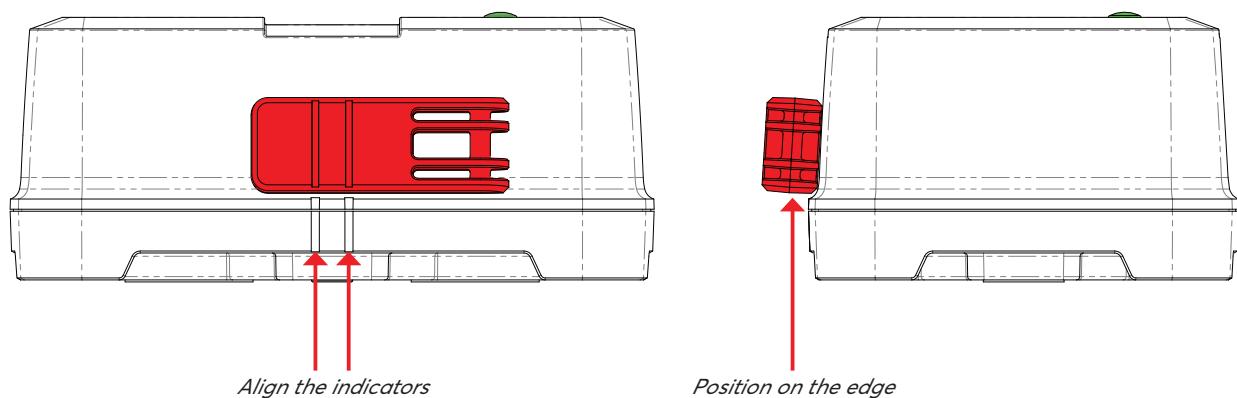


Fig. 3: Magnet Key Location

LEDs

The LED is a multicolour LED. Each colour and pattern has a different meaning.

Always (on request):

- Red → device is turned off
- Green → device is turned on

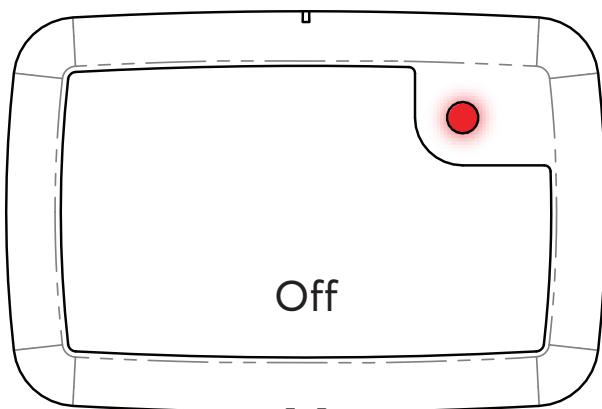


Fig. 4: Device is turned off

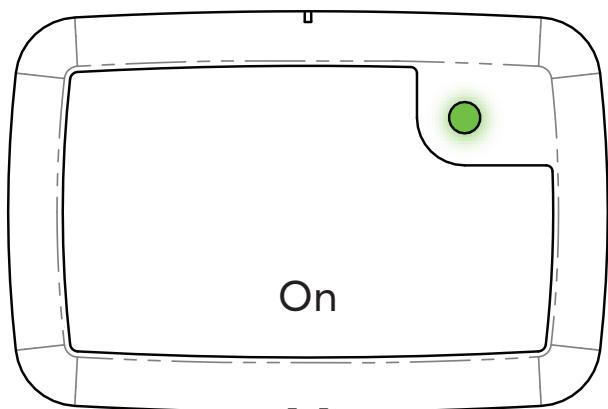


Fig. 5: Device is turned on

During turning on the device

- Yellow (blinking) → connecting / wait...

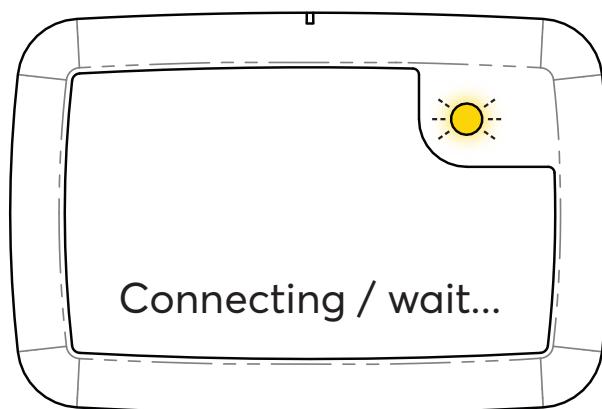


Fig. 6: Connection / wait...

Troubleshooting

In exceptional cases connecting to the network might not succeed.

When the device is successfully connected to the network and problems occur, the troubleshooting should be performed on the network side. The device is working correctly.

Time-out

A time-out is a time limit for establishing a connection. If a time-out occurs, the device will turn off.

Blinking Yellow LED

A blinking yellow LED will stay active for a maximum of 2 minutes; after this time limit, the device will turn off.

Device State

The device state tells the user if the device is turned off or on. This can be done at any moment using the magnet key.

Request the device state

1. Tap the magnet key

- Red → device is turned off

OR

- Green → device is turned on

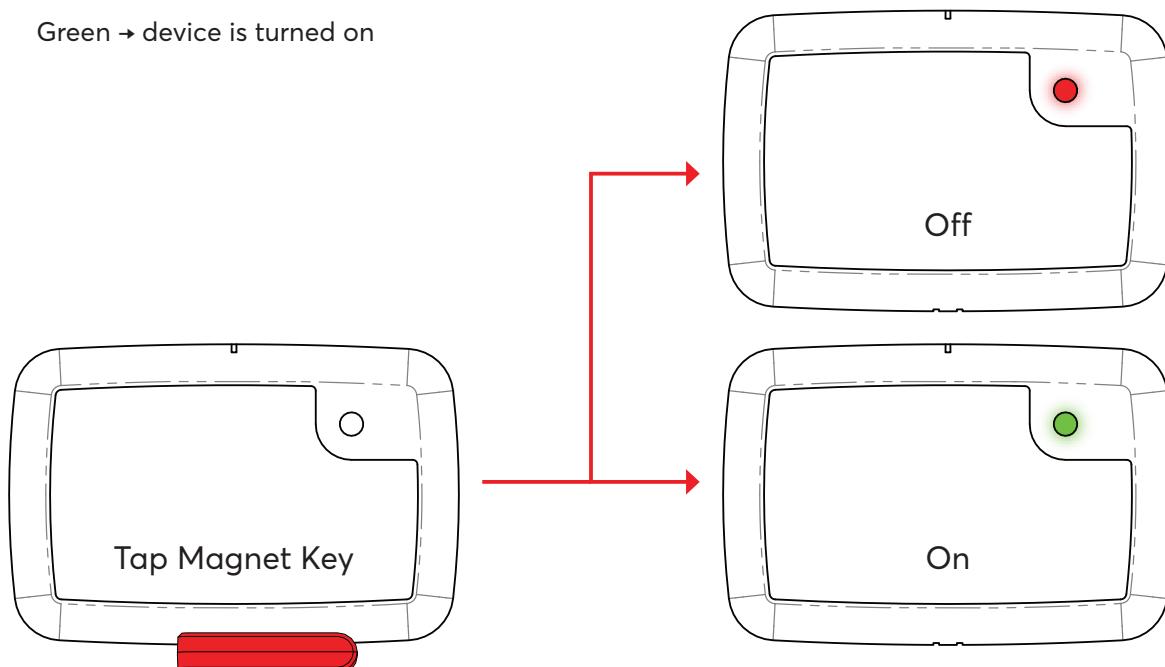


Fig. 7: Request device status

Turning on the device

Procedure

1. Hold the magnet key on the indicators of the device (Fig. 3 Page 4) and keep holding it, after 1 second the device will show its state
 - Red → device is turned off → proceed
 - Green → device is turned on → release magnet key → no further steps required
2. Keep holding the magnet key for 4 more seconds
 - Yellow (blinking) - connecting / wait... (max. 2 min)
 - Red → connection failed / time-out → device turned off → check network
 - Green → device is turned on

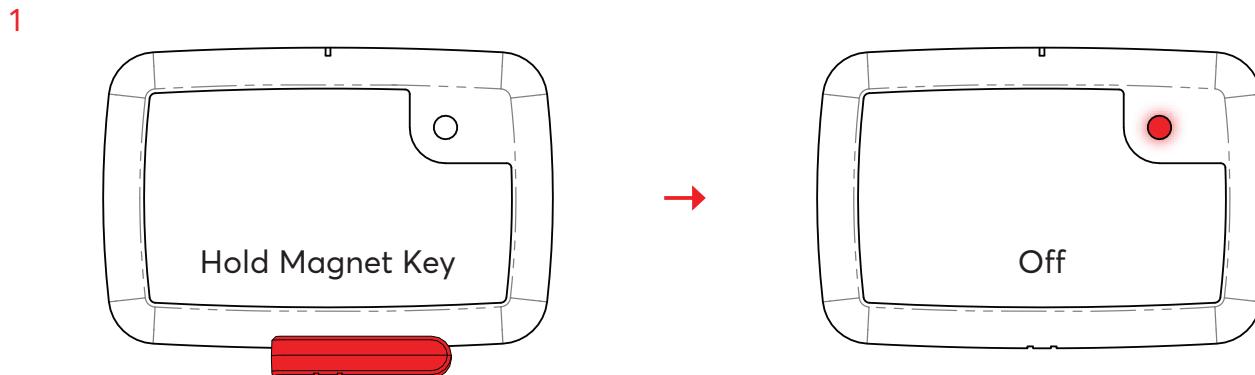


Fig. 8: Hold magnet → Off

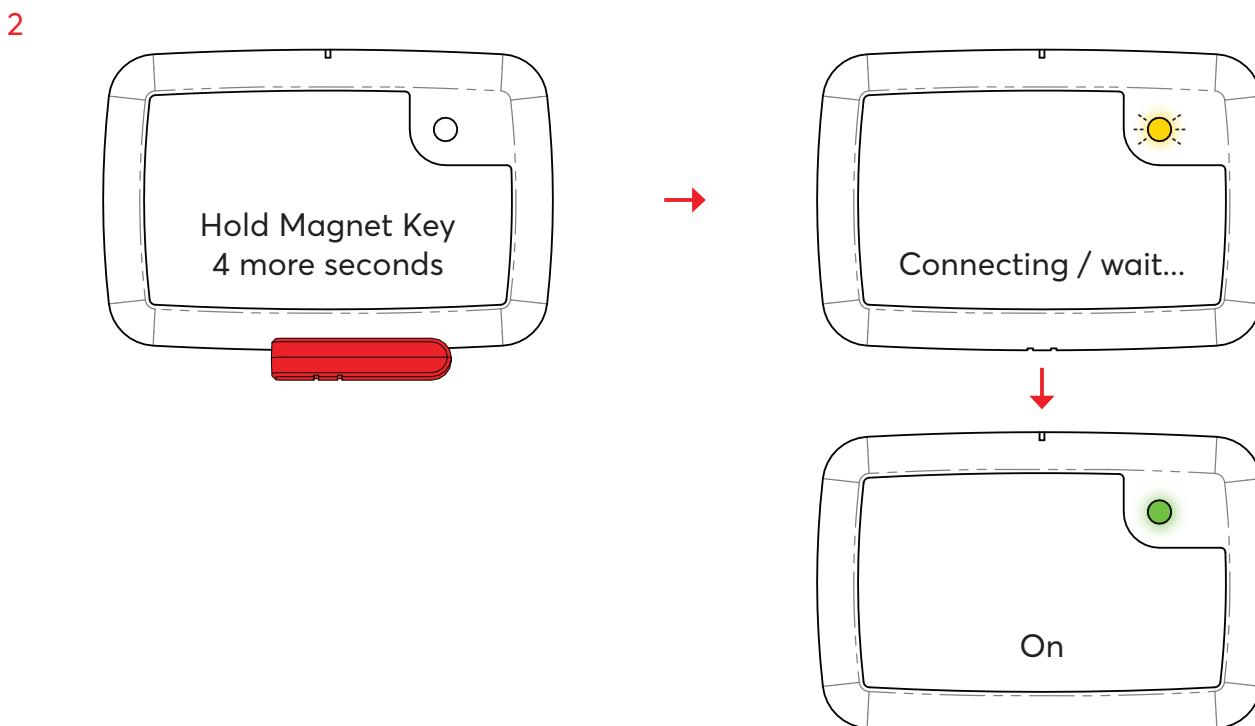


Fig. 9: Hold magnet → Connecting → On

Turning off the device

Procedure

1. Hold the magnet key on the indicators of the device (Fig. 3 Page 4) and keep holding it, after 1 second the device will show its state
 - Green → device is turned on → keep holding the magnet key and go to step 2
 - Red → device is turned off → release magnet key → no further steps required
2. Keep holding the magnet key for more 4 seconds
 - Red → Device is turned off

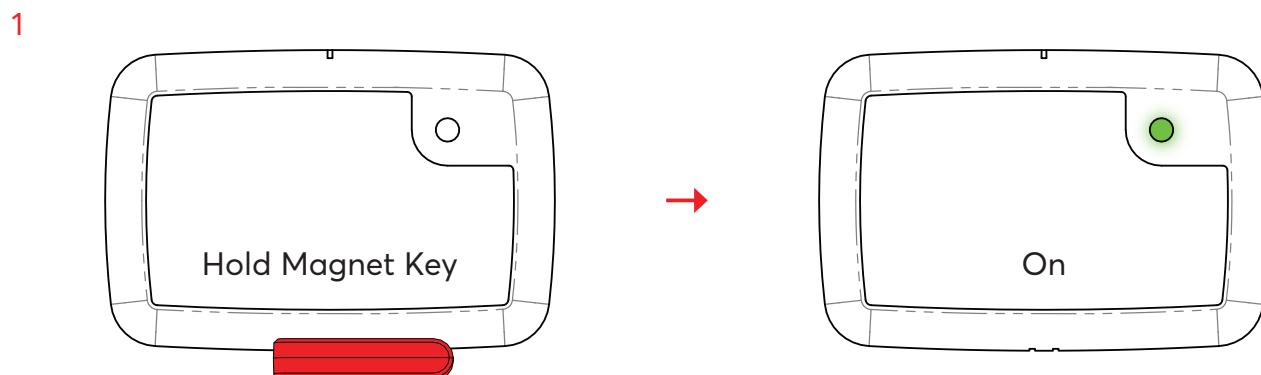


Fig. 10: Hold magnet → Device state

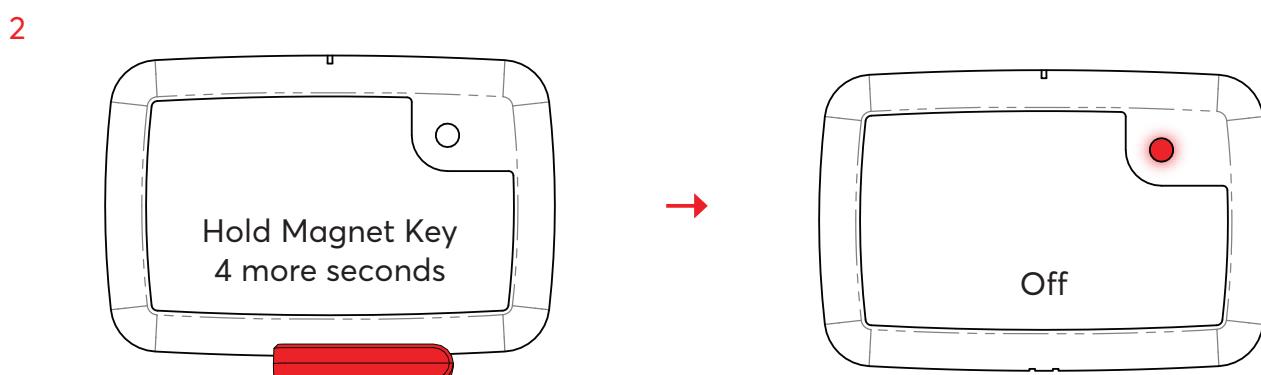


Fig. 11: Hold magnet → Off

General notes for installation

1. For accurate temperature reading both the sensor and the object it is installed on need to be insulated.
2. The sensor measures the temperature of the outside surface it is installed on. The relation to the inside temperature is installation and content dependent.

Installation options

Installation is divided in two options:

1. Installation without adhesive
2. Installation with adhesive

Temperature Probe notes

The Temperature Probe must always be in contact with the surface it is installed on.

The contact surface should be as big as possible. If the surface is very rough the contact surface will be smaller. Dirt and other irregularities will also affect the performance and must be removed.

For optimal thermal performance:

- the probe should always be in contact with the surface it is installed on
- the surface should be clean
- the surface should be smooth
- the surface should be free from any irregularities

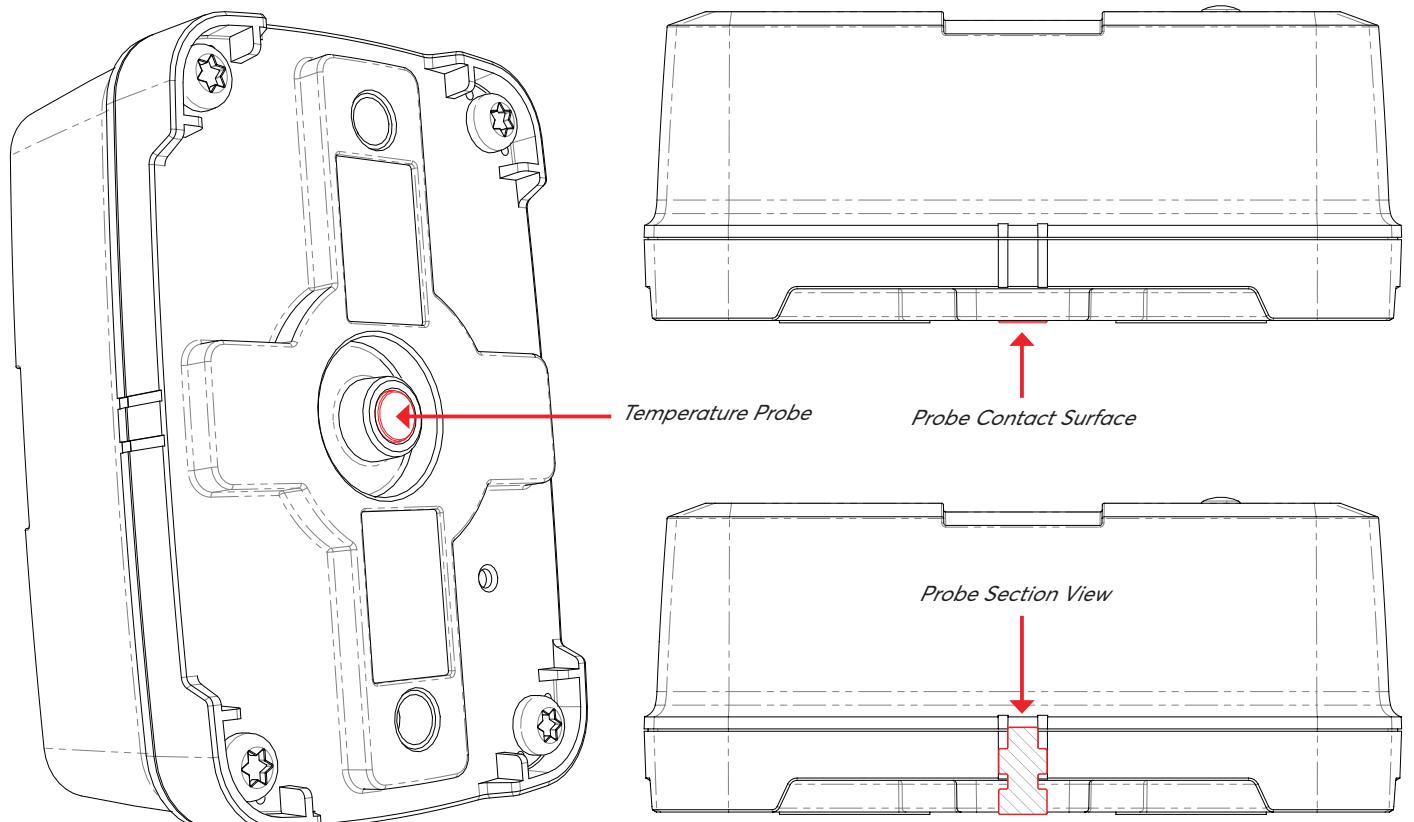


Fig. 12: Temperature Probe

Installation without adhesive

The Temperature Sensor may be placed without adhesive when:

- The device is mounted behind insulation
- The mounting surface is sufficiently magnetic

Necessities

- Sandpaper / Putty Knife
- Cleaning Supplies
- Temperature Sensor
- Magnet Key (P18-023-M_KEY)

Sequence

1. If the surface is not smooth remove any irregularities using a putty knife or sandpaper
2. Clean the surface - make sure dirt and grease is removed
3. Turn on the Temperature Sensor (see chapter "User Interface")
4. Mount the Temperature Sensor using the internal magnets

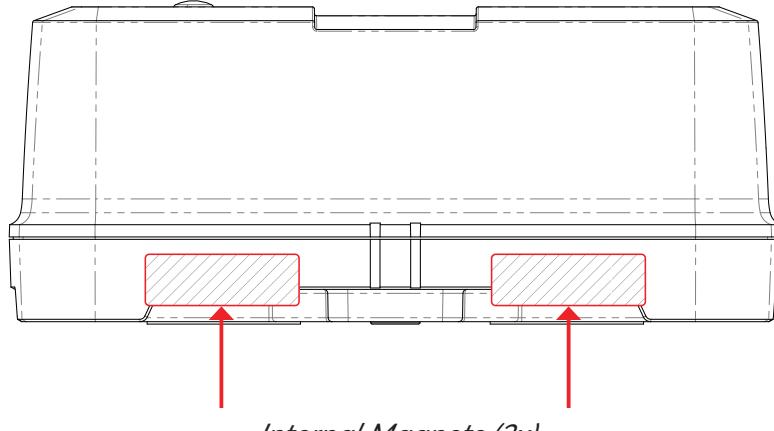


Fig. 13: Internal Magnets

Continue on next page.

5. The Temperature Probe should make full contact with the surface, if this is not the case repeat step 1 and 2

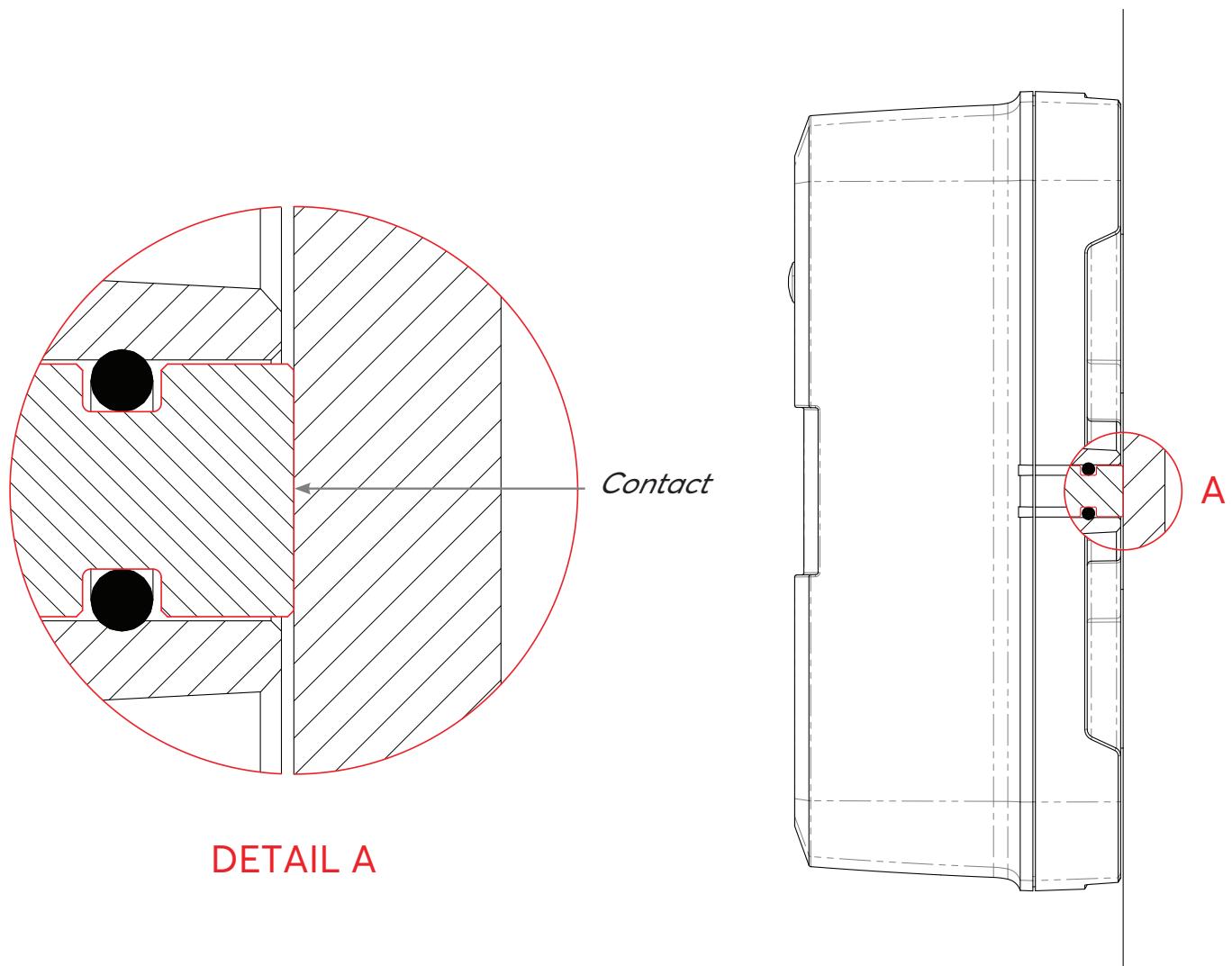


Fig. 14: Temperature Probe Contact

6. Replace original insulation

Installation with adhesive

The Temperature Sensor must be placed with adhesive:

- Mounting surface is not sufficiently magnetic
- When the product is installed at 2m or higher above ground level, the adhesive should always be used

Necessities

- Sandpaper / Putty Knife
- Cleaning Supplies
- Temperature Sensor
- Adhesive
- Magnet Key (P18-023-M_KEY)

Sequence

1. If the surface is not smooth remove any irregularities using a putty knife or sandpaper
2. Clean the surface - make sure dirt and grease is removed
3. Remove the backing material from the adhesive

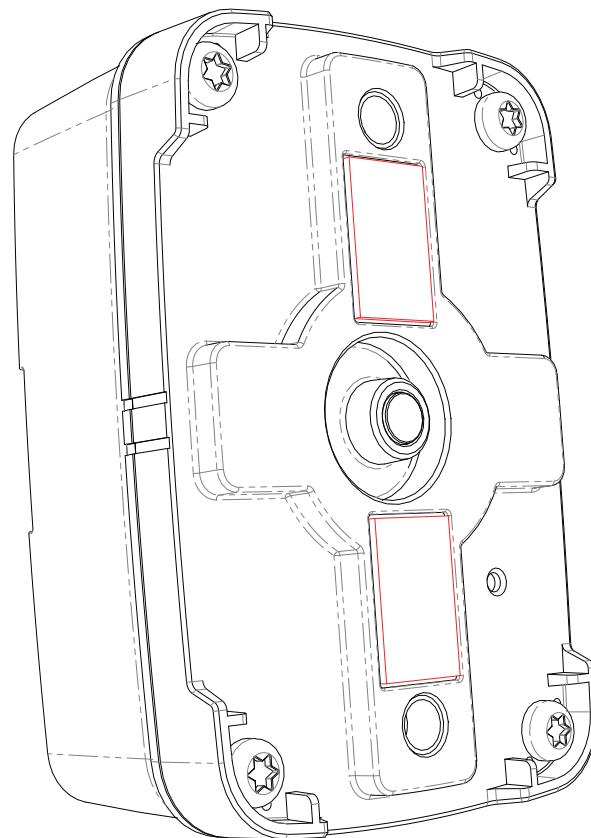


Fig. 15: Remove adhesive backing

Continue on next page.

4. Turn on the Temperature Sensor (see chapter "User Interface")
5. Mount the Temperature Sensor using the adhesive and the internal magnets
6. The Temperature Probe should make full contact with the surface, if this is not the case repeat step 1 and 2

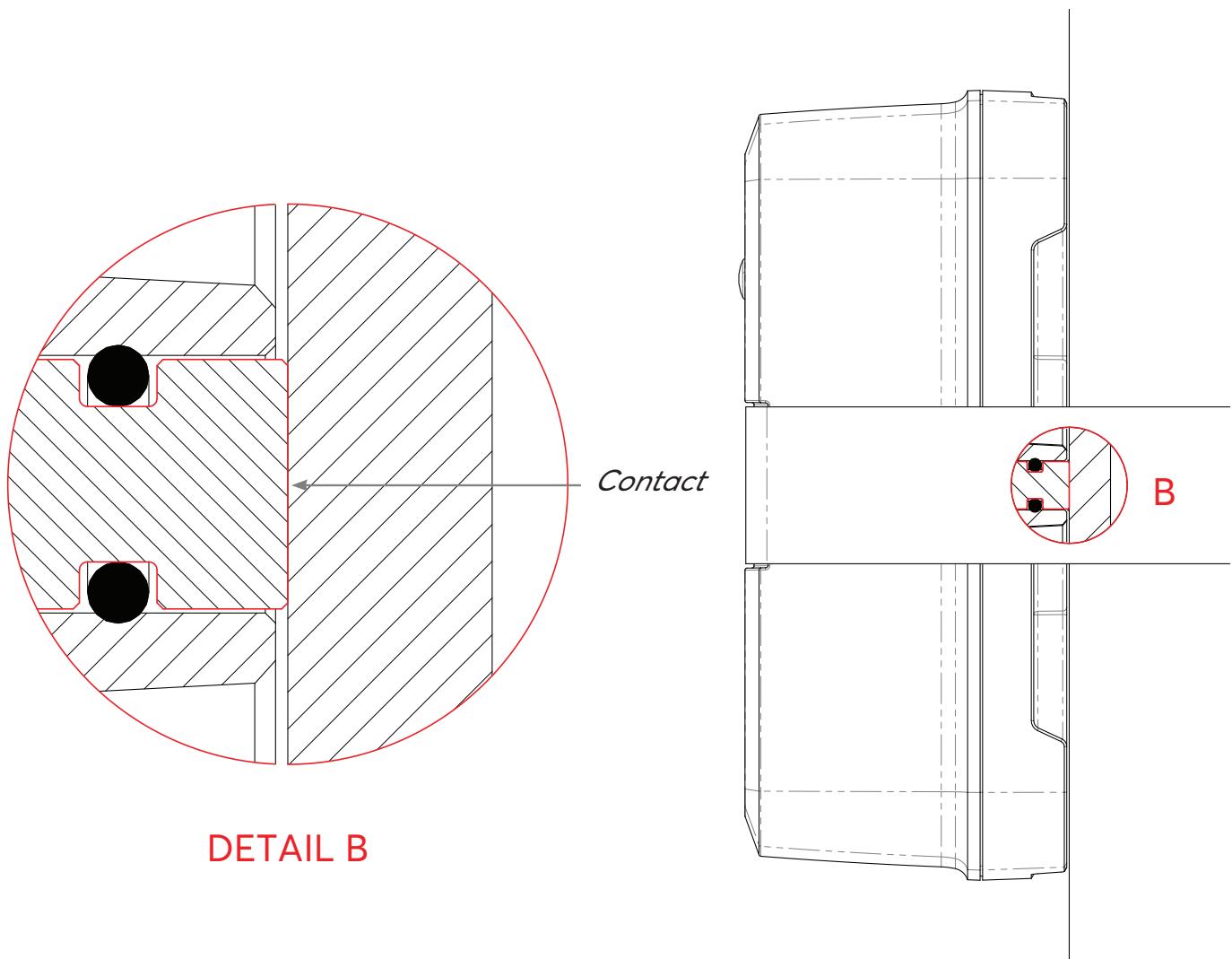


Fig. 16: Temperature Probe Contact

7. Replace original insulation

General Notes

Don'ts

1. Don't leave a magnet key near the device after installation
2. Don't leave anything on the device after installation
3. If the label is damaged, return the device for refurbishment.
4. If product or mounting parts are damaged, return the device for refurbishment

Radio specification

This product contains a LoRa radio modem operating at 868 MHz within the EU. This product requires access to a LoRa gateway in order to function as described. Maximum RF power = 12 dBm (16 mW).

	Frequency range	Maximum power
LoRaWAN 868 MHz	863-870 MHz	12 dBm
LoRaWAN 915 MHz	902-928 MHz	12 dBm

Hereby, TWTG R&D B.V. declares that the radio equipment type "LoRa modem" is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: www.twtg.io/legal

Certification information

IECEx 02 | ATEX 114
IECEx DEK 18.0063
DEKRA 18ATEX0106

FCC ID: 2ATYF-C19-001
FM ID US: FM20USxxxx
FM ID CA: FM20CAxxxx

Manufacturer information

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The Netherlands
www.twtg.io



Regulatory Information FCC

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

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

RF exposure safety

This device complies with the FCC RF exposure limits and has been evaluated in compliance with mobile exposure conditions.

The equipment must be installed and operated with minimum distance of 20 cm of the human body.

Class B device notice

NOTE: 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



We're tireless tinkerers - motivated by challenge, curiosity, and changing the status quo. We're the kind of people that used to be called 'inventors'.

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