User Manual

LoRaWAN Fill Level Sensor

Version: 3.0

Version control

Version:	Date:	Description:	Author:
1.0	3 December 2019	Publication of the first draft	I. Heideman
1.1	10 March 2020	Addition of transmitting power	I. Heideman
1.2	12 March 2020	Product specifications adjusted	I. Heideman
1.3	21 March 2020	Various changes	I. Heideman
1.4	13 May 2020	Addition of the method of mounting bracket	I. Heideman
1.5	1 March 2021	Addition of new contact details and explanation of the re-join procedure	I. Heideman
2.0	October 21, 2022	Addition of "long-distance" mode and reading of temperature and humidity.	I. Heideman
2.1	March 22, 2023	Addition of example negative temperature	J. Lageschaar
3.0	11 June 2025	Update and clarification, addition of FAQ	I. Heideman

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Register

Understanding:	Definition:
LoRaWAN	Abbreviation for: Long Range Wide Area Network. A Low Power, Wide Area (LPWA) network protocol specifically designed to wirelessly connect battery-powered 'things' to the internet in regional, national or global networks. (For more information, see: www.lora-alliance-org/about-lorawan).
Node	A node is a device equipped with a transmitter. This transmitter uses LoRaWAN modulation, which gives the device the ability to communicate via the LoRaWAN network.
Gateway	A device that takes care of the translation and therefore the connection of two incompatible networks to each other. In this case, the gateway provides the connection between the LoRaWAN network in question and the internet.
Backend	A backend is a program or part of a program that is invisible to the user. It can be addressed via a command-line interface. The interaction with users does not take place directly with the backend but via the graphical user interface or frontend of the program.
OTAA	Abbreviation for Over the Air Activation. With OTAA, a join procedure is used to activate a node on a network.
Uplink	A LoRaWAN message sent by the node to the gateway.
Downlink	A LoRaWAN message sent from the gateway to the node.
Hexadecimal	Sixteen digit system with digits 0 to F, is indicated by 0x before the number. Example: 0xFF is a hexadecimal notation of the decimal number 255.

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1. Foreword

This document is intended as a user manual for the LoRaWAN fill level sensor from Teneo Sales B.V. The purpose of this document is to provide a clear overview of how the LoRaWAN fill level sensor can be installed, used and maintained.
In addition, any dangers and/or risks are pointed out in order to inform the user as well as possible about the LoRaWAN fill level sensor.

Figure 1: 3D impression LoRaWAN fill level sensor.

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2. Introduction

2.1. Product description

The LoRaWAN fill level sensor is intended for use in waste bins, which can be used to determine how full the waste bin in question is based on the sensor.
The sensor measures the distance to the waste in the waste bin (in centimeters), after which this distance is transmitted via LoRaWAN. This distance indicates the filling level of the respective waste bin.

The maximum distance (depth) that can be measured by the sensor is 4 meters.

2.2. Product specifications

Category:	Part:	Specification:
Physical	Dimensions	55 x 82 x 32 mm (housing)
	Material	PC
	Weight	± 130 grams
	Measuring range	0 – 400 centimeters
	IP Rating	Standard: IP53 *Optional: IP68*[1]
Conditions of use	Temperature	- 20 ºC to 55 ºC
LoRaWAN	LoRaWAN specification	V1.0.3.
	Transmission power	10 dBm
	Class	A (baseline)
	Activation method	OTAA
	Frequency	EU 868 MHz (863 – 870 MHz)
	Encryption	AES128
Nutrition	Battery	LiFePO4, rechargeable
	Voltage	3.2V
	Battery life	5 years at measurement and uplink frequency 4x per 24 hours.
Wireless charging	Qi Wireless Charging	1.1.
	Frequency	100 – 300 kHz
	Temperature	0 ºC to 30 ºC

[1] IP68 rating can be provided by fully potting the sensor, this potting is carried out at an additional cost and must be explicitly indicated when ordering.

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3. Operation

3.1. Installation/Assembly

	Warning!
	The LoRaWAN fill level node is equipped with a laser sensor, from laser 'Class 1'. A class 1 laser is safe under all normal operating conditions, but misuse of the sensor or use under abnormal conditions may result in damage from the environment. 

	Warning!
	In the event of extreme heat (temperature > 70 ºC), the node and the battery may be damaged. Therefore, do not use gas burner(s) near (<1.5 meters) of the node.

Before installing/mounting the sensors, it is advisable to check whether the sensors at the relevant location have LoRaWAN coverage via the backend of The Things Network (TTN for short) or KPN.
In addition, it is recommended to also test the connection with the backend to be used with at least one sensor.

When installing/installing the sensor, it is important that the 'eye' of the sensor points straight down into the waste bin; This is important because otherwise the sensor may be able to measure against the side of a waste bin, instead of on the waste itself. This is depicted in figure 2 for clarification.

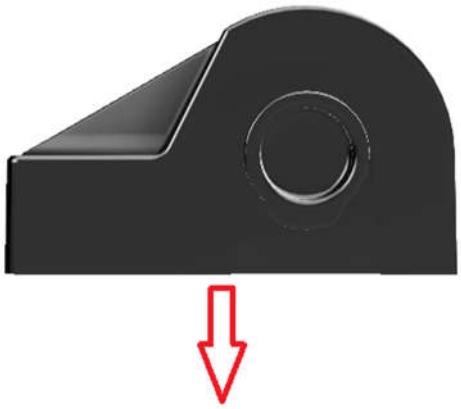

Figure 2: Housing side view node fill level.

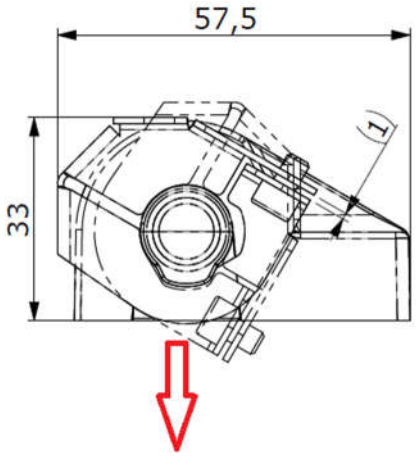

Figure 3: Side view housing node including hanging bracket.

To be able to aim the sensor properly in the waste bin, it is possible to purchase a hanging bracket, with which the sensor can be adjusted at an angle to ensure that the sensor is aimed as straight as possible at the waste bin. We also see this bracket in figure 3.

The sensor is supplied with the bracket already attached to the sensor. To install the sensor in existing bins, it is first of all necessary to fix the sensor in the waste bin; For example, on the lid of the waste bin. This can be done by means of the two hanging holes attached to the top of the bracket. These hanging holes are marked with blue circles in figure 4.

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Figure 4: Sensor including bracket, with indication of hanging holes.

The screws for fixing through the suspension holes are not included in the delivery of the fill level sensors. Screws with a diameter of ± 4 millimeters can be used for the hanging holes .

The distance between the two mounting holes of the bracket is approximately 88 millimeters (c.t.c.).

To be able to aim the "eye" of the sensor perpendicularly in the waste bin, as also shown in figures 2 and 3, the sensor in the bracket can be adjusted.
Due to the variety of waste bins, the sensor can be rotated as you see fit.

The moment the sensor "looks" perpendicular into the waste bin, the bracket can be tightened, clamping the sensor in the bracket. This can be done by means of the two rear clamping screws in the bracket of the sensor; These clamping screws are indicated in green circles in Figure 5 for clarification.

After the sensor is clamped in the bracket, it is not possible to adjust the sensor without opening it.

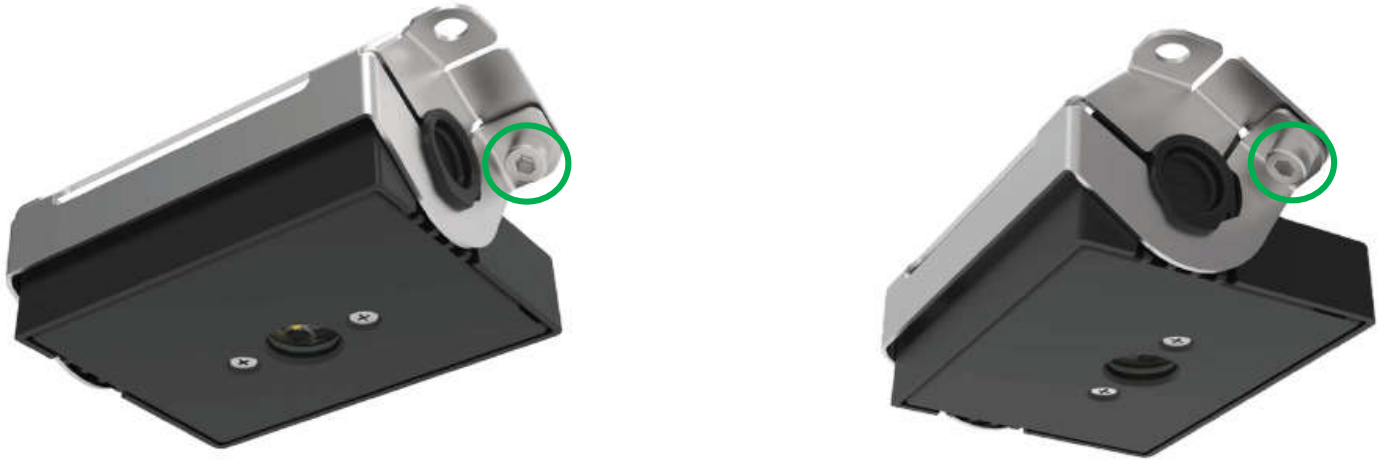

Figure 5: Sensor including bracket, with indicator of clamping screws.

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3.2. Use

When the sensors are delivered, they are already switched on, but it may be that the sensors still have to be registered with a LoRaWAN network (such as The Things Network, KPN or your own private network) via a so-called "join procedure".

If the sensors are not yet connected to a LoRaWAN network, they will automatically execute a join request once every 24 hours. This provides enough time to enter the keys that are included with the LoRaWAN node(s) at a LoRaWAN network server. These keys are unique and not transferable to other sensors. The moment the keys are correctly entered at the LoRaWAN network server and the nodes are in range of a gateway, they will have to report to the network in question within 24 hours.
In addition, it is possible to trigger a join request by placing the LoRaWAN node on a charging path. For the way in which this should be done, we refer to heading 3.4.1. Battery charging.

3.3. Error messages

The fill level node is equipped with the functionality to indicate status messages. The node does this by sending a status message on Port 223; For more information, see also chapter 5.1 of this manual.

3.4. Maintenance

3.4.1. Battery Charging

When a node's battery is low, the node repeatedly alerts the user by means of a LoRaWAN uplink message on Port 223; See also chapter 5.1.

To be able to recharge the battery of a node, the nodes have a wireless charging option.

The node can be charged by means of Qi wireless charging pads. If desired, a charging pad can be purchased from Teneo IoT.

To charge the node, it must be placed with the left corner (seen from the top) in the middle of the charging pad.
To clarify, a photo of proper placement of the node on the charger has been added below.

Figure 6: Sensor fill level on a charging pad (incl. 3D. printed attachment.

Figure 7: Top view of sensor fill level with charger indication.

To ensure correct placement, a template has been drawn (as shown in figure 8) which, depending on the size (ranging from 70 mm diameter to 100 mm diameter) of the charging pad in question, can be cut out and placed on the pad.

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The outline indicates where the node should be placed. It should still be taken into account that the node is placed in the center of the pad with the left corner (seen from the top).

The template must be printed in actual scale.

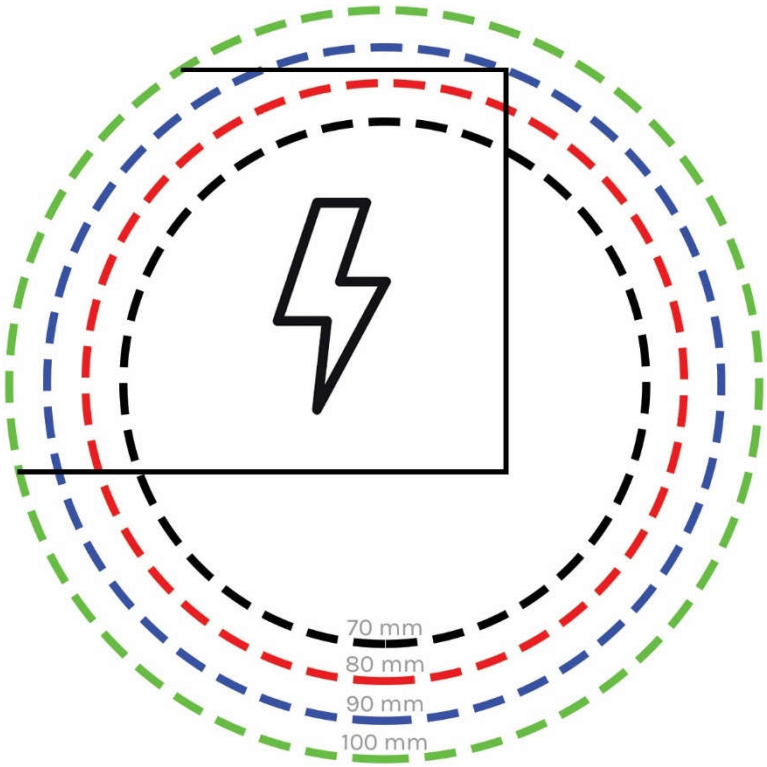

Figure 8: Template charging pads for correct node placement.

Figure 9 below shows how the node is correctly placed on the charging pad. In addition, Figure 10 shows how the node is not properly placed (the top left corner is not on the center of the charging pad).

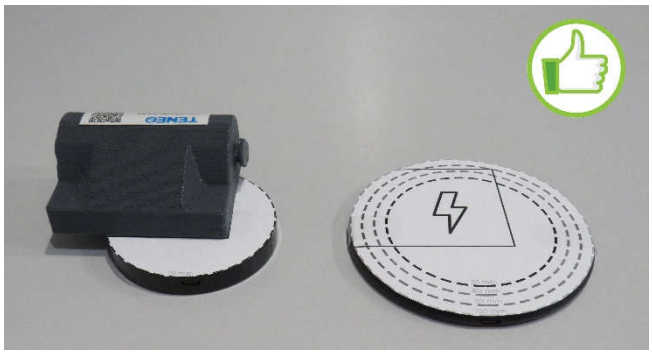

Figure 9: Node well placed on the charging pad.

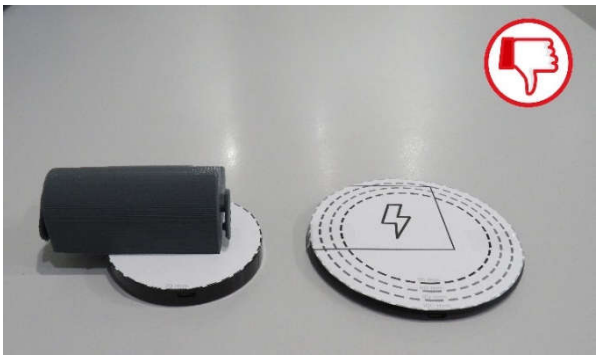

Figure 10: Node incorrectly placed on small charging pad.

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Many charging pads also have an LED that indicates the status (charging/not). In many cases, a red LED means that the node is not charging and a blue or green LED indicates that the node is charging.

We recommend that you do not leave the node charging for more than 36 hours at a time: after 36 hours, the battery should be full again and charging for longer may cause problems.

In addition, the node also sends a LoRaWAN uplink with the confirmation that the battery is being charged. Such a charging message is sent on Port 3, for more explanation see 5.1. Uplinks.

3.4.2. Cleaning

The node "eyelet" can be cleaned with a goggle cloth or makeup cleaning wipe, as shown in Figure 11 below for illustration.

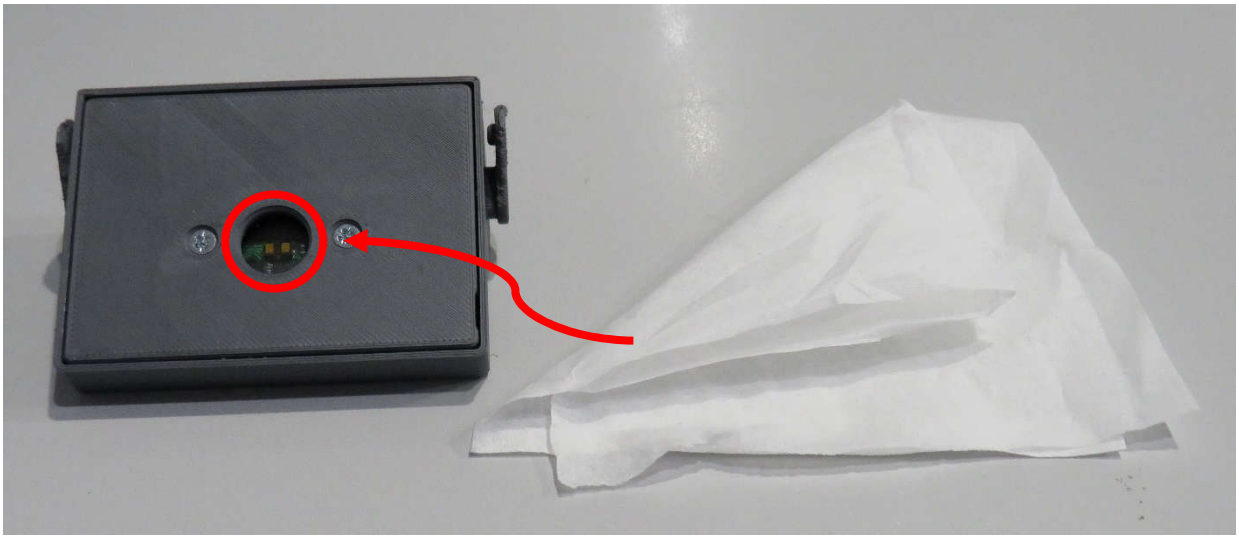

Figure 11: Node with cleaning cloth.

It is absolutely **not allowed** to clean the node with liquid or abrasive.
In addition, **do not use scouring pads or other materials that** can scratch the "eyelet".

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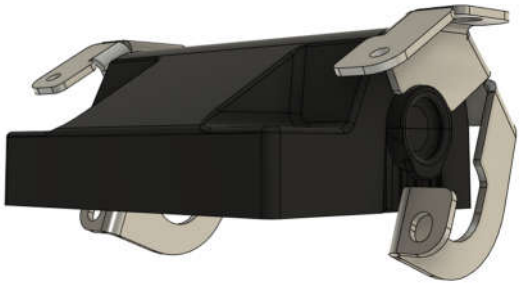
3.5. Decommissioning

When the fill level is replaced or removed, for example because the battery needs to be charged or because the sensor no longer functions, the sensor can be removed from the bracket.

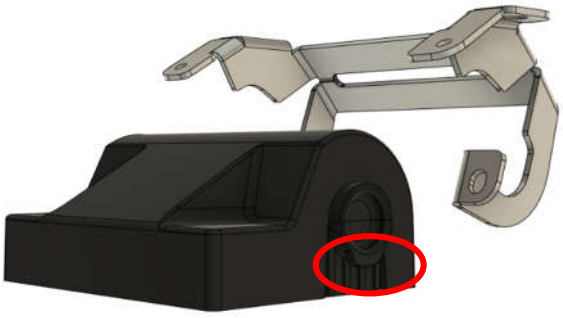
Below is a brief explanation of how to remove the sensor from the bracket and place it back in another bracket.

1) Unscrew both anti-theft screws completely from the bracket:

2) Bend the bracket all the way open:



3) Remove the sensor:



When removing, pay attention to the plastic earphones of the case. These are fragile and can break off in the worst case if used incorrectly! These "earphones" are **circled** in red above.

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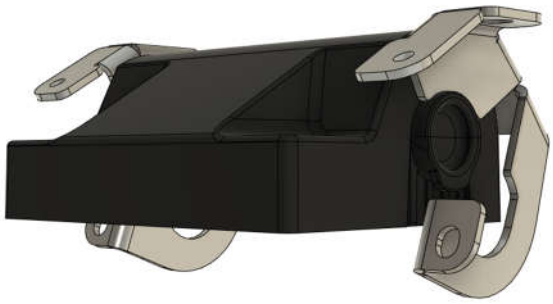
4) (Re)place the sensor elsewhere:



5) Bend the bracket closed and then screw the bracket closed with the anti-theft screws:

When bending closed, make sure that the bracket is behind the plastic earpieces of the case. See above **circled** in red.
It is important that the screws are tightened firmly. This prevents the sensor from rotating in the bracket.

The battery of the node cannot be replaced, only charged. If the node no longer functions, the entire node must be replaced.

For other information, see also section 7.1.2. WEEE 2012/19/EU.

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4. LoRaWAN

4.1. Sensor Login to LoRaWAN Network Server (LNS)

The fill level sensor is equipped with LoRaWAN for the communication of the sensor data to the user. The sensor is configured to the band EU 863-870 MHz.

With LoRaWAN, the node has a so-called 'join procedure' in which the node registers on the relevant LoRaWAN network. There are two ways in which a node can join the network; by means of Over the Air Activation (abbreviated: OTAA) or Activation by Personalization (ABP). Teneo nodes only and exclusively support the OTAA process. OTAA is generally seen within the LoRaWAN protocol as the most solid and secure way of joining on the network.

For the purpose of setting up the sensors in a LoRaWAN backend and for the unique identification of each sensor on the LoRaWAN network, a set of unique 'keys' is used: namely the DevEUI, AppKey and AppEUI.

The DevEUI and AppKey differ for each device separately, while the AppEUI can be the same per set of sensors (this is the case with Teneo and allows different types of sensors to be distinguished from each other).

These different keys are structured and recognizable as follows:
- DevEUI, for example: 70B3D5CDD0000001 (EU-64);
- AppKey, for example: 2B4D6251655468576D5A713474377721;
- AppEUI, for example: 70B3D5CDD000000044 (EU-64);

Nodes manufactured and supplied by Teneo can be identified by the prefix 70B3D5CDD, which is issued to Teneo by the IEEE SA. This makes all DevEUIs unique and traceable back to Teneo.
A DevEUI is assigned by Teneo only once to a node and is provided to the buyer upon delivery of the sensors.

These three keys are all pre-configured by Teneo and cannot be changed by the user. These keys are made available to the user for linking the sensors to a specific backend.

The DevEUI of each sensor is also mentioned on each sticker, as shown below.

Legend sticker:

1) DevEUI;
2) Model number;
3) Certification logos (CE and WEEE); 4) Firmware version (for internal reference);

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4.2. Join Procedure

Sensors supplied by Teneo are already on when they are delivered.

If the sensors are not yet linked to a LoRaWAN network server (LNS for short), users still need to do so before placing the sensors in the field.

To do this, the keys can be added to the LNS and then the sensor, provided it is in range of a gateway of the network server in question, will execute a join request within 24 hours.
The node then sends a join request every 15 minutes and repeats this 5 times (so in total it performs 6 join requests per day), until it has joined a network.

If the node is joined by a network, it will send an "alive" message (see chapter 5.1 "Uplinks") and then send the first regular uplink.

The sensor only executes a join request when it is not joined with an LNS, in addition, the node checks every few messages whether it is still connected to an LNS. To do this, the node must receive a confirmed message from the LNS.
If the node has not received it after a number of times, the node will also perform the join procedure as described above.
The advantage of this setting is that nodes can be transferred remotely from one LNS to another, without the need to actually go to the node (in the field).

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5. Payload

5.1. Uplinks

Uplinks consist of three components, namely the Port, Header and the message (also called the "payload").

5.1.1. Ports

The port is a number in the range of 1 through 223. The value of the port indicates the type of the message.

5.1.2. Header

Our firmware provides a header for each message as the first byte of the payload. The header consists of a type and parameters:

Bit	Description
7..6	Header Type
5..0	Parameters

Header Type:

Value (bit)	Name	Description
00	Default	If a standard message is sent, this header type is used. This header type has no parameters.
01	MultiMessage	LoRa messages have a limited length. With MultiMessage, an entire message is divided over multiple uplinks because it does not fit into 1 uplink. The current version of the program will not exceed that. MultiMessage does not occur.
10	Status	Status messages are given when the node starts up or something has gone wrong. These messages always go to port 223.
11	Power	When battery protection is used, these messages indicate what condition it is in. These messages always go to port 223

Default message:

Bit number	Name	Description
3..0	Battery voltage	Indicates the voltage of the node. Calculation: Voltage = 2 + Battery voltage / 10.

The most commonly used header is a standard header with a battery voltage. This header will be used by default, unless otherwise described. For example, the default header looks like this: binary: 0x0C or binary 0000 1100.

The first two bits (**0000 1100) mean that it is a default message. The second two bits (0000** 1100) have no meaning. The last four bits (0000 **1100**) represent the battery voltage. The last four bits represent the number 12. This means that the voltage is: 2 + 12/10 = 3.2 volts.

Other header types

The MultiMessage is not explained because no large messages are sent.
The status and power header are described in the chapter "port 223: Status" because they only occur there.

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5.1.3. Uplink Post Types:

With regard to uplink messages, we distinguish the following different messages:

Fport:	Post type:	Description:
1	Fill level	This message contains the measured degree of fill value (in centimeters).
2	Fill level unsuccessful	This message indicates that the fill level could not be measured.
3	IsCharging	This message is sent when the node is placed on the charger and then repeats every 5 minutes as long as the node is still on the charger.
223	Status	Status messages are sent on port 223. These can be alive or power status messages. For further explanation, see the heading "Port 223: Status".

Port 1 – Fill level message:

From firmware version 2.00 and newer (i.e. higher number), our fill level sensor has a "long distance" mode, allowing distances to be measured up to 4 meters depth.

Below you can find how a Fport 1 message is structured

Byte:	Length:	Name:	Description:
0	1	Header	Default header
1-2	2	Distance	The distance between the sensor and the bottom in cm. (Big Endian)
3	1	Status code	Information about the standard deviation of the measurement.
4-5	2	Temperature	*Optional:* measured temperature on the fill level sensor (i.e. under the lid of the waste bin).
6-7	2	Humidity	*Optional:* can only be sent for sensors that have IP 53 rating (and are therefore not waterproof). Otherwise, the default value is here; 0xFFFF.

Comments:

1) Because a sensor with a measuring range that is suitable for the different types of bins has been chosen, the maximum distance must ultimately be determined for each bin. (The maximum distance of a bin depends on the content of each specific waste bin).
2) When the distance is 0 cm, it can be determined that a waste bin is full (= 100% full). 0 cm

With firmware versions with V.1##, a Port 1 uplink is five bytes shorter, the measured distance is only sent in one byte and everything from the status code (as mentioned above) is not sent in the Port 1 uplink.

The status codes that can be sent are:

Status code:	Description:
00	Distance measured correctly, the measured distance is within the specifications of the sensor.
01	Measured distance may deviate slightly more than the standard deviation according to the sensor specifications.

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Example:

Fport	*Payload*
1	*0F002B0000C3FFFF*

This payload is divided into the following pieces: 0F|002B|00|00C3|FFFF

The meaning of these pieces in this example message is as follows:
- 0x0F = battery voltage: 3.5V;
- 0x002B = measured distance: 43 centimeters;
- 0x00 = status code: 00: distance is well measured;
- 0x00C3 (unsigned) = decimal 195, the temperature is then 195 / 100 = 1.95 °C;

Optionally, the humidity can be set on the fill level sensor in addition to the temperature.

When these are sent by the sensor, this data can be found in the following bytes:

Byte:	Length:	Name:
4-5	2 bytes	Temperature
6-7	2 bytes	Humidity

The temperature can be negative, to convert it you have to look at the MSB (Most Significant Bit) and divide it by 100 regardless of negative or positive.

If this MSB is 1 then the temperature is: - (65536 – temperature value) / 100.
If this MSB is 0 then the temperature is: temperature value /100.

For example, for value 0x0753: is binary: **0001 0001 0100 1101, last bit is 0** so:
0x0753 = decimal 1875: the temperature = 1875/100 = 18.75 degrees Celsius.

For example, for value 0xFCE0: is binary: **1111 1100 1110 0000, last bit is 1** so:
0xFCE0 = decimal 64736: the temperature = - (65536 - 64736) / 100 = -8.00 degrees Celsius.

The humidity is also measured by the node, this value cannot become negative. The value should only be divided by 100.

Example:

Fport	*Payload*
1	*0x0F010500093A141C*

093A: temperature in decimals: 2362/100 = 23.62 degrees Celsius.
141C: humidity in decimals: 5148/100 = 51.48% relative humidity.

When one of these two is enabled, the other value (which is off) is presented as a default value, which is default value:
- Temperature: 0x7FFF
- Humidity: 0xFFFF

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Port 2 – Unsuccessful Message Fill Rate:

Byte:	Length:	Name:	Description:
0	1 byte	Header	Default header
1	1 byte	Error	A code that reports to the sensor why the measurement failed.
2-3	2 bytes	Temperature	*Optional*
4-5	2 bytes	Humidity	*Optional*

Port 3 - Is Charging:

Byte:	Length:	Name:	Description:
0	1 byte	Header	Default header

Example:

Fport Payload
3 0x0B
Header byte is 0B, meant at Port 3; Power, is charging; battery voltage = 2 +(11/10) = 3.1V

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5.2. Downlinks

In order to be able to control the node remotely, for example to be able to adjust settings, downlinks can be sent to the node.
The port, as with the uplinks, indicates what type of message it is, but no header needs to be sent.

5.2.1. Downlink message types:

FPort:	Post type:	Length:	Description:
1	PeriodTime	4 bytes	This message allows you to adjust the node measurement frequency (in seconds) cycle time. The maximum is 30 days.
4	Bandwidth & Repeat	2 bytes	With this message, the bandwidth of distance change can first be set; or after how many cm of change the node has to send a LoRaWAN message again. In addition, this message can also be used to set how many repeating measurements (repeat) that are all within the bandwidth the node should always send the measured value.
5	MaxDistance	1 byte	This setting can specify the maximum distance below which the node does not need to send messages. Default to maximum: 0xFF

Remark:
1) All other downlink FPort numbers outside of 1, 4 and 5 can be used internally by Teneo IoT. Sending downlink messages to these other FPort numbers can disrupt the node.

FPort 1 - PeriodTime:

Index:	Length:	Contents:	Description:
0	4 bytes	Value	The new period time in seconds. (Big Endian)

Comments:
1) Setting the period time should be done with extreme care, if mistakes are made accidentally, the period time of the node can be set to extremely long. Such an error cannot be corrected with a new message to the node.
2) Setting the period time will affect the battery life; Shorter period times mean shorter battery life. See 2.2. Product specifications.

Example:

Fport Payload
1 0x00015180
Period time: 1x per 24 hours → 24 hours x 60 minutes x 60 seconds = 86,400 seconds. The hexadecimal representation is 0x00015180.

FPort 4 - BandWidth & Repeat:

Index:	Length:	Contents:	Description:
0	1 byte	BandWidth	The new bandwidth in centimeters.
1	1 byte	Repeat	The number of times the bandwidth is ignored and a measured distance is always sent.

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Example:

Fport Payload
4 0x1407
BandWidth: bandwidth 20 cm (0x14), this means that a change from the previous transmitted measurement is not controlled if it is maximally smaller or maximally larger than the previous transmitted value. (Suppose the previous sent value is , then a message will be sent if the new measurement is outside the range of -.). 10 cm10 cm60 cm50 cm70 cm
Repeat: 1x every 7 measurements (0x07), with a period time of 1x per day this means that the repeat is set to 7 days. If the distance does not change, you will always receive one message every 7 days.

FPort 5 - MaxDistance:

Index:	Length:	Contents:	Description:
0	1 byte	MaxDistance	The maximum distance in centimeters that is sent. In combination with bandwidth and repeat, measurements are only sent after the distance is less than the MaxDistance.

Comments:

1) If the bandwidth is set to 0 or when the number of repeat periods is over, the measured distance will always be transmitted, regardless of the MaxDistance setting.
2) When working with different types (depths) of waste bins and, for example, you only want to receive messages from 50% filling, this means that the maximum distance must be set separately for each waste bin.

Example:

Fport Payload
5 0x3C
Suppose a waste bin is 120 cm deep and we only want the distance sensor to send a measurement when it is at least half (50% >) full. Half of is , with which the MaxDistance can be set to (0x3C). From now on, measurements will only be sent if the bin is at least half full, or if the bandwidth is at 0 or if the repeat periods are over.120 cm60 cm60 cm

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6. Frequently Asked Questions (FAQ)

Q: *From the sensor we continuously receive a short distance or a distance of 80% or fuller. What could be wrong with this sensor?*

A: It is possible that the security screws of the sensor are not properly tightened, so that the sensor has shifted in the bracket and now measures against the side/edge of the waste bin or against a wall.
If that is not the case, it may be that the eye of the sensor is a bit dirty. Cleaning with a cloth or cotton swab could remedy this.

Q: *What does it mean if I receive an uplink from the sensor on Fport 2?*

A: An uplink on port 2 indicates that the fill level sensor has not been able to take a measurement. The error code provided can provide insight into the cause, such as obstruction or reflection. Often a Fport 2 uplink is something that occurs sporadically. If this occurs structurally, this error code can be shared with Teneo for further analysis of the possible cause.

Q: *What is the average battery life of the fill level sensor (without intermediate charging)?*

A: That depends very much on which measurement interval (period time) the sensor is set and on which data rate (spreading factor) the fill level sensor sends its uplinks. On average, with uplinks on SF12 (Data Rate 0), we assume that the sensor can last 5 years on a battery at an interval of 1 – 4 times a day. Depending on the weather conditions and the number of times the node loses its network connection, this number of uplinks can be a bit lower (e.g. around 1 uplink per 24 hours) with a battery life of 5 years. However, it is good to realize that if the battery is empty, the sensor does not have to be thrown away, but that it can be recharged, after which it can be used again.
This charging functionality also offers the possibility to temporarily use the sensor for asset management with a higher measurement interval (e.g. 1x per hour) because the sensor can be recharged afterwards.

Q: *When do you recommend ordering the fill level sensor with IP68 waterproofing (i.e. potted)?*

A: This also depends on the (weather) conditions in which the sensor has to function. When the sensors are in an environment close to the sea (with salty air), we definitely recommend opting for potted sensors. In addition, the use of potted sensors can also be wise if the sensors are mounted in parts of the waste bin that wear out due to use (e.g. in the door) or when there is a chance that the waste bin or underground container will fill up with water (e.g. in extreme rainfall or if the container is underground).

Q: *How long do I need to charge the battery if the node has sent a message that the battery is completely empty?*

A: If the sensor has indicated through messages on Fport 223 that the battery is really empty, we recommend that you put the sensor on the charger for the full period of 36 hours. Depending on the period time of the sensor, this will have to be carried out once every 3 (with a measurement 1x per 4 hours) to 5 years (with a measurement of 1x per 24 hours).
If the sensor is removed from the ground after each growing season (e.g. in winter), the battery will not be completely empty and it will be sufficient to put the sensor on the charging pad for 24 hours, for example.

Q: *Can I use a wireless charging pad from you in combination with a power bank?*

A: Yes, the wireless charging pads that we optionally sell with the sensor work in combination with a power bank. However, the capacity of the power bank does determine whether it is able to charge a sensor, for example, for the full 36 hours.

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Q: *How do I know if the level sensor is charging correctly?*

A: When properly placed on a Qi charging pad, the sensor will send an "IsCharging" uplink on Fport 3. In addition, the LED indicator on the charger (e.g. green) can indicate that the node is charging.

Q: *If I choose potted sensors, can I still charge the battery wirelessly?*

A: Yes, you can, that functionality is retained!

Q: *Can I replace the battery myself?*

A: No, the battery is not replaceable. However, it can be charged with a Qi charging pad. If the battery is defective, the entire node must be replaced.

Q: *Is it also possible to attach the sensors to the bins with sealant or magnets?*

A: Yes, that is certainly possible, but this requires a slight adjustment of the mounting bracket and this entails a certain additional cost per sensor. However, we strongly advise against the use of magnets in environments where you can see the sensors well or where there is a risk of theft; For example, in very densely populated (center) areas. In that case, if you really don't want to use rivets because you have to drill in the waste bins, sealant is better suited. The use of magnets as attachment is always at your own responsibility, as theft is not covered by our warranty.

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7. Regulations

7.1. CE Certification

7.1.1. EU Declaration of Conformity

Manufacturer:	Teneo Sales B.V.
Product:	LoRaWAN Filling Sensor
Designation:	01DST
Batch/Serial Number:	TBV-01DST-01LR

Teneo Sales B.V. hereby declares that the "LoRaWAN Filling Sensor 01DST" complies with the Radio Equipment Directive (2014/53/EU).

The full text of the Declaration of Conformity is available on our website: www.teneo-iot.nl/vulgraadsensor/downloads .

7.1.2. WEEE 2012/19/EU:

The node, including all components, must not be disposed of with household and/or industrial waste. Users are obliged to dispose of the node at the end of its life in accordance with the requirements of the WEEE (Waste Electronic and Electrical Equipment) Regulation in order to contribute to the protection of the environment and the reduction of waste (recycling).
For further information on how this can be done, please contact a certified collection party.

The node contains a Lithium battery, which must be recycled separately.

In order to comply with its obligations as a producer, under the WEEE Regulations, Teneo Sales B.V. is affiliated with Wecycle and Stichting Stibat.

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