

Supplementary information for EU Devices in the LoRaWAN® Showcase catalogue. Version 1.0

### Version of Questionnaire form from the Customer/ Device Manufacturer

Version	Date	Author	Update
1.0	06-05-2021	Inou Heideman	Initial release from manufacture
1.1	08-05-2021	Jasper Lageschaar	Updated technical hardware details
1.2	15-05-2021	Mart Bent	Updated software details

### Supplementary Information on certified device

1 Supplementary information	
1.1 Manufacturer or Brand name	Teneo IoT
1.2 Website	<a href="http://www.teneo-iot.nl">www.teneo-iot.nl</a>
1.3 Sales / Marketing contact person, email:	Inou Heideman, <a href="mailto:i.heideman@teneo-iot.nl">i.heideman@teneo-iot.nl</a>
1.4 Technical contact person, email:	Erik Prange, <a href="mailto:e.prange@teneo-iot.nl">e.prange@teneo-iot.nl</a>
1.5 Commercial Product name	Filling Level Sensor
1.6 Product code used when ordering / article number	TBV-01DST-01LR
1.7 Product Version : Hardware version: Firmware version:	01DST id1987984_D V1.12
1.8 In what countries is the product available	European Union
1.9 What date was / is the market introduction for this device / product?	
1.10 Is the device already working on a public LoRaWAN network. If yes specify at which public operator, country and number of deployed devices on that network:	<input type="checkbox"/> Yes: <input checked="" type="checkbox"/> No
1.11 What functionality does the device provide and which sensor(s) does it contain?	Use case: Waste Management  Short behavior description: The sensor measures the amount of litter in a garbage can and sends this measurement through via LoRaWAN.
1.12 Accuracy & resolution for every sensor or measurement made by the device	
Name: sensor accuracy (incl. unit): +/- resolution (incl. unit): measurement parameter: measurement range	Time of Flight sensor 20 mm 1 mm Distance of closest object underneath device 3600 mm
Name: sensor accuracy (incl. unit): +/- resolution (incl. unit):	Temperature +/- 0.3 °C 0.04 °C

measurement parameter: measurement range	Ambient temperature -40 – 125 °C
Name: sensor accuracy (incl. unit): +/- resolution (incl. unit): measurement parameter: measurement range	Humidity 5 %RH 0.04 %RH Air humidity 0 – 100 %RH
Name: sensor accuracy (incl. unit): +/- resolution (incl. unit): measurement parameter: measurement range	
Name: sensor accuracy (incl. unit): +/- resolution (incl. unit): measurement parameter: measurement range	
1.13 Uplinks are:  Periodic: Period: Explanation:  Keep alive message period: Event triggered how:	<input checked="" type="checkbox"/> 24 hours. Default period time can be changed with a LoRaWAN data downlink.
1.14 Parameter configuration of device (e.g. transmission or measurement interval, threshold levels, etc.)	<input type="checkbox"/> Remotely: <input checked="" type="checkbox"/> Over-the-air with LoRaWAN data downlinks <input type="checkbox"/> Specify if other:  <input type="checkbox"/> Locally: <input type="checkbox"/> Via CLI: specify type of connector:  <input type="checkbox"/> Via NFC:  <input type="checkbox"/> Specify if other:
1.15 Does the application server send downlinks to the devices?	<input checked="" type="checkbox"/> Yes: (why/how often/typical size) Not periodically, only when a customer sets a downlink for the device. Typical size is often between 1 and 4 bytes. <input type="checkbox"/> No
1.16 Operating temperature of device - x °C to + x °C	Minimum -20 °C Maximum + 55 °C
1.17 Is the payload structure available for decoding?	<input checked="" type="checkbox"/> Yes: <input type="checkbox"/> No Please attach the payload structure (+example of decoded payload)
1.18 Is there a decode-API available	<input type="checkbox"/> Yes: <input checked="" type="checkbox"/> No Please attach the API documentation
1.19 Is the firmware upgradeable and how?	<input type="checkbox"/> Yes: (how)

<p>1.20 How can the device be reset to factory default settings?</p>	<p>Via a reset LoRaWAN downlink, which is being provided in the manual and payload structure.</p>
<p>1.21 How can the device be forced to re-initiate the join procedure?</p>	<p>Via a LoRaWAN downlink</p>
<p>1.22 Product certifications (IP rating, ATEX, ...)</p>	<p>1. IP rating: IP33                  2. ATEX compliance:                  Other:</p>
<p>1.23 Which regulatory certifications are available (RED, CE, EMC)?</p>	<p><input checked="" type="checkbox"/> RED  <input checked="" type="checkbox"/> CE  <input checked="" type="checkbox"/> EMC                  Attach proof of certification to the mail in which this document is sent to a public operator</p>
<p>1.24 Power Supply</p>	<p><input type="checkbox"/> External power supply:                  connection:                  voltage:                  amperage:</p> <p><input checked="" type="checkbox"/> Internal battery:                  battery type: LiFePO4                  chemical composition: Lithium Iron Phosphate                  Battery self-discharge (%/year): &lt;5%                  Battery shelf life: 1 year                  capacity: 3000 mAh                  weight: 75 grams                  rechargeable: <input checked="" type="checkbox"/> Yes: <input type="checkbox"/> No</p>
<p>1.25 Powering device on and off                  How is the device turned ON ?                  How is the device turned OFF ?</p>	<p>The device is turned on by default and can't be switched off.</p>
<p>1.26 Dimensions of device                  (Length x width x height)</p>	<p>5,5 x 8,2 x 3,2 cm</p>
<p>1.27 Weight of full device</p>	<p>130 g</p>
<p>1.28 Mounting of device                  1. How to mount?                  2. How to mount for best antenna propagation</p>	<p>The device is provided together with a mounting bracket, with this mounting bracket the sensor can be attached to the lid of a garbage can. Due to this mounting bracket the antenna propagation is the best immediately.</p>

2 LoRaWAN Device Information

<p>2.1 DevEUI Range (IEEE Compliance)</p>	<p>70-B3-D5-CD-D                  From : 0-00                  To : F-FF                  (We bought a MA-S assignment at the IEEE and potential all MAC addresses can be used as DevEUI).</p>
<p>2.2 LoRaWAN Class</p>	<p><input checked="" type="checkbox"/> Class A  <input type="checkbox"/> Class B  <input type="checkbox"/> Class C</p>
<p>2.3 For Class C Device: Device Under Test restores previous RF settings at boot?</p>	<p><input type="checkbox"/> Yes  <input type="checkbox"/> No</p>
<p>2.4 In what LoRaWAN region/frequency ranges is the product available</p>	<p><input checked="" type="checkbox"/> EU863-870   <input type="checkbox"/> US902-928   <input type="checkbox"/> AS923   <input type="checkbox"/> IN865-867  <input type="checkbox"/> KR920-923   <input type="checkbox"/> Other</p>
<p>2.5 Is the LoRaWAN test mode supported?</p>	<p><input type="checkbox"/> Yes  <input checked="" type="checkbox"/> No, why not                  In our production device the test mode is not supported, in order to save memory.</p>
<p>2.6 Tested and certified against which LoRaWAN Specification(s)</p>	<p><input type="checkbox"/> V1.0   <input type="checkbox"/> V1.0.1   <input checked="" type="checkbox"/> V1.0.2 revB   <input type="checkbox"/> V1.0.3  <input type="checkbox"/> V1.1.x   <input type="checkbox"/> Other :</p>
<p>2.7 Link to document on the LoRa Alliance website</p>	<p>Link:</p>
<p>2.8 Which TX power is used in production devices by default?</p> <p>- if LW 1.0.2 rev A or older is used:</p> <p>- if LW 1.0.2 rev B or newer is used</p>	<p><input type="checkbox"/> TXPower 0 (20dBm)  <input type="checkbox"/> TXPower 1 (14dBm)  <input type="checkbox"/> TXPower 2 (11dBm)  <input type="checkbox"/> TXPower 3 (8dBm)  <input type="checkbox"/> TXPower 4 (5dBm)  <input type="checkbox"/> TXPower 5 (2dBm)  <input type="checkbox"/> other TXPower (        dBm)</p> <p><input checked="" type="checkbox"/> TXPower 0 (MaxEIRP)  <input type="checkbox"/> TXPower 1 (MaxEIRP-2dB)  <input type="checkbox"/> TXPower 2 (MaxEIRP-4dB)  <input type="checkbox"/> TXPower 3 (MaxEIRP-6dB)  <input type="checkbox"/> TXPower 4 (MaxEIRP-8dB)  <input type="checkbox"/> TXPower 5 (MaxEIRP-10dB)  <input type="checkbox"/> TXPower 6 (MaxEIRP-12dB)  <input type="checkbox"/> TXPower 7 (MaxEIRP-14dB)</p> <p><input type="checkbox"/> other TXPower                  (Max EIRP :        dB)</p>

<p>2.9 Which TX powers are supported by the device in production</p> <p>- if LW 1.0.2 rev A or older is used:</p> <p>- if LW 1.0.2 rev B or newer is used</p>	<p><input type="checkbox"/> TXPower 0 (20dBm)  <input type="checkbox"/> TXPower 1 (14dBm)  <input type="checkbox"/> TXPower 2 (11dBm)  <input type="checkbox"/> TXPower 3 (8dBm)  <input type="checkbox"/> TXPower 4 (5dBm)  <input type="checkbox"/> TXPower 5 (2dBm)</p> <p><input type="checkbox"/> other TXPower (        dBm)</p> <p><input checked="" type="checkbox"/> TXPower 0 (MaxEIRP)  <input type="checkbox"/> TXPower 1 (MaxEIRP-2dB)  <input type="checkbox"/> TXPower 2 (MaxEIRP-4dB)  <input type="checkbox"/> TXPower 3 (MaxEIRP-6dB)  <input type="checkbox"/> TXPower 4 (MaxEIRP-8dB)  <input type="checkbox"/> TXPower 5 (MaxEIRP-10dB)  <input type="checkbox"/> TXPower 6 (MaxEIRP-12dB)  <input type="checkbox"/> TXPower 7 (MaxEIRP-14dB)</p> <p>(Max EIRP :        dB)</p>
<p>2.9 Which LoRaWAN Specification is currently supported on the production devices?</p>	<p><input type="checkbox"/> V1.0  <input type="checkbox"/> V1.0.1  <input type="checkbox"/> V1.0.2 revA  <input checked="" type="checkbox"/> V1.0.2 revB  <input type="checkbox"/> V1.0.4  <input type="checkbox"/> V1.1.x  <input type="checkbox"/> Other:</p>
<p>2.10 Will you re-certify your device when a new major LoRaWAN specification version is released</p>	<p><input type="checkbox"/> Yes.  <input checked="" type="checkbox"/> No, why : We will re-certify if we change our firmware due to a new major LoRaWAN specification released and in case if we aren't able to use our old (certified) firmware anymore.</p>
<p>2.11 Has Interoperability prequalification testing been done?</p>	<p><input checked="" type="checkbox"/> Yes.  <input type="checkbox"/> No, why :</p> <p>Which Network Servers</p> <p><input type="checkbox"/> Actility  <input type="checkbox"/> Loriot  <input type="checkbox"/> TTI  <input type="checkbox"/> Other: Specify: LoraWAN Certification testing tool (LCTT)  Please attach all the test reports.</p>
<p>2.12 Is Activation Type OTAA the default</p>	<p><input checked="" type="checkbox"/> Yes.  <input type="checkbox"/> No, why :</p>

<p>2.13 For OTAA, is AppKey unique for each device?</p>	<p><input checked="" type="checkbox"/> Yes. <input type="checkbox"/> No.</p>
<p>2.14 Is ADR implemented? Recommendation: ADR should always be activated. Exceptions can be made for moving devices but will need to be explained.</p>	<p><input checked="" type="checkbox"/> Activated <input type="checkbox"/> Deactivated, why :  <input type="checkbox"/> Configurable by user (recommendation: Activated by default) <input type="checkbox"/> Mixed, explain:</p>
<p>2.15 What values did you implement for: - ADR_ACK_LIMIT: - ADR_ACK_DELAY:</p>	<p>64recommended value: 64 32recommended value: 32</p>
<p>2.16 Do you use unconfirmed and/or confirmed uplinks and what is the data rate, timing and power back off algorithm?  Upon reception of a confirmed downlink message, is the next uplink sent immediately after the downlink ?Answers (radio buttons)</p>	<p><input type="checkbox"/> unconfirmed <input type="checkbox"/> confirmed, when and why: <input checked="" type="checkbox"/> Both, which is used when and why: Once every week to check if the device is still connected to a network Data rate, timing and power back-off algorithm (only if you use confirmed uplinks):  <input type="checkbox"/> Yes. <input checked="" type="checkbox"/> No, why : It is piggybacked on the next uplink to minimize power consumption</p>
<p>2.17 Is the device doing a periodical rejoin? (only for OTAA)</p>	<p><input type="checkbox"/> Yes (frequency): By default period time. <input checked="" type="checkbox"/> No. Why? How to trigger a rejoin? If the confirmed message is not acknowledged for 5 times (See above) a rejoin will be triggered</p>
<p>2.18 Is the first join request sent on SF12?</p>	<p><input checked="" type="checkbox"/> Yes. <input type="checkbox"/> No, why: Explain the JoinRequest sequence if no JoinAccept is received - data rate, timing and power back-off algorithm.</p>
<p>2.19 On what SF and power setting is the first uplink (after join procedure) done?</p>	<p>SF: 12 TXPower: 0</p>
<p>2.20 Are you doing periodically reset of Uplink frame counter?</p>	<p><input type="checkbox"/> Yes (frequency/why): <input checked="" type="checkbox"/> No.</p>
<p>2.21 If LoRaWAN 1.0.x, DevNonce behaviour :</p>	<p><input checked="" type="checkbox"/> Based on a random value <input type="checkbox"/> Monotonically increasing never-wrapping counter</p>
<p>2.22 Uplink DataRate (0-7 supported)</p>	<p>Min: SF12BW125 Max: SF7BW250</p>
<p>2.23 RX1 Data Rate Offset</p>	<p><input checked="" type="checkbox"/> Default LoRaWAN in regards of ISM band <input type="checkbox"/> Other:</p>

2.24 RX1 Delay	<input checked="" type="checkbox"/> Default LoRaWAN in regards of ISM band <input type="checkbox"/> Other:
2.25 RX2 Data Rate	<input checked="" type="checkbox"/> Default LoRaWAN in regards of ISM band <input type="checkbox"/> Other:
2.26 RX2 Frequency	<input checked="" type="checkbox"/> Default LoRaWAN in regards of ISM band <input type="checkbox"/> Other:
2.27 RX1 Delay on JoinRequest (OTAA devices only)	<input checked="" type="checkbox"/> Default LoRaWAN in regards of ISM band <input type="checkbox"/> Other:
2.28 Mobility Profile (how your device moves)	<input checked="" type="checkbox"/> Near static <input type="checkbox"/> Walking speed <input type="checkbox"/> Vehicle speed <input type="checkbox"/> Random
2.29 Frame Counters Up To 32-bits	<input checked="" type="checkbox"/> Frame counter-up <input checked="" type="checkbox"/> Frame counter-down
2.30 Which MAC commands does the device support	<input checked="" type="checkbox"/> LinkCheckReq / LinkCheckAns <input checked="" type="checkbox"/> TXParamSetupReq / TXParamSetupAns <input checked="" type="checkbox"/> LinkADRRReq / LinkADRAns <input checked="" type="checkbox"/> DutyCycleReq / DutyCycleAns <input checked="" type="checkbox"/> RXParamSetupReq /RXParamSetupAns <input checked="" type="checkbox"/> DevStatusReq / DevStatusAns <input checked="" type="checkbox"/> NewChannelReq / NewChannelAns <input checked="" type="checkbox"/> TXTimingSetupReq / TXTimingSetupAns
2.31 LoRaWAN Stack Type (optional)	<input type="checkbox"/> Semtech/Stackforce <input type="checkbox"/> Semtech/Stackforce with modifications <input type="checkbox"/> IBM <input type="checkbox"/> IBM with modifications <input checked="" type="checkbox"/> Proprietary- Other, name it: BMS
2.32 LoRaWAN Stack Version (optional)	
2.33 LoRa Radio Hardware (optional)	<input type="checkbox"/> Proprietary: SX chip used: <input checked="" type="checkbox"/> LoRaWAN Modem/Module: Manufacturer: HopeRF Part Number: RFM95W Firmware revision:
2.34 Multicast support (optional)	<input type="checkbox"/> Yes: Multicast DevAddr: Multicast AppSKey: Multicast NwkSKey: Payload: Port: <input checked="" type="checkbox"/> No.





**3 Radio Frequency Information**

<p>3.1 Type of Antenna</p>	<p><input type="checkbox"/> Wire  <input checked="" type="checkbox"/> PCB  <input type="checkbox"/> External  <input type="checkbox"/> Other: (which type)</p>
<p>3.2 Antenna gain [dBi or dBd]</p>	<p>dBi or                  -7,3 dBd</p>
<p>3.3 Did you measure and take into account the loss between the modem and the antenna?</p>	<p><input type="checkbox"/> Yes,          dB loss  <input checked="" type="checkbox"/> No, why: PCB trace to PCB antenna is designed to be as short as possible at just a few millimeters, which minimizes loss</p>
<p>3.4 For LW 1.0.2 rev A or older devices: which TXPower setting should be used on the network for your device*:</p>	<p><input type="checkbox"/> TXPower 0 (20dBm)  <input type="checkbox"/> TXPower 1 (14dBm)  <input type="checkbox"/> TXPower 2 (11dBm)  <input type="checkbox"/> TXPower 3 (8dBm)  <input type="checkbox"/> TXPower 4 (5dBm)  <input type="checkbox"/> TXPower 5 (2dBm)  <input type="checkbox"/> other txpower          (          dBm)</p>
<p>3.5 Did you calibrate your device with the antenna gain and measured loss in between the chipset and antenna? This so that your device emits with maximal power when using TXPower 1 for LW 1.0.2 rev A or older devices (= 14dBm) and TXPower 0 for LW 1.0.2 rev B or newer devices (= MaxEIRP or 16.15dBm EIRP)*.</p>	<p><input type="checkbox"/> Yes,          dB loss  <input checked="" type="checkbox"/> No, why: we don't yet have the means to confidently calibrate the antenna in house and the CE certification tests were performed using the current (not perfectly calibrated) setup</p>

**4 Battery and TX Power Information**

Please indicate if you do not want Section 4 displayed on the LoRa Alliance Website  Yes  
 If yes please supply contact details for the operators to request the information for Section 4

<p>4.1 Battery consumption of the device (including modem, sensors and all other electronics)</p>	<p>TX current: 150 mA                  RX current: 10 mA                  Idle time current: 0.005 mA</p>																																				
<p>4.2 Estimated battery life in years based on the number of transmissions (including sensor readings) at SF7, SF10 &amp; SF12 with your battery self-discharge and aging over time taken into account.</p> <p><b>Assumptions:</b></p> <ul style="list-style-type: none"> <li>- Product shelf life before use: Maximum 1 year.</li> <li>- At an environment temperature of 20°C.</li> <li>- LoRaWAN specification used for battery life calculation:</li> <li>- TX power setting (txpower) used for battery life calculation:</li> <li>- Payload size used for battery life calculation (should be average payload size of production device):</li> <li>- Additional assumptions or comments on battery life (Typical usage)</li> </ul>	<table border="1"> <thead> <tr> <th colspan="4">Battery life in years</th> </tr> <tr> <th>Transmission Periodicity (transmissions/day)</th> <th>SF7</th> <th>SF10</th> <th>SF12</th> </tr> </thead> <tbody> <tr> <td>144</td> <td>3,2</td> <td>1,0</td> <td>0,3</td> </tr> <tr> <td>96</td> <td>4,6</td> <td>1,5</td> <td>0,5</td> </tr> <tr> <td>48</td> <td>8,0</td> <td>3,0</td> <td>0,9</td> </tr> <tr> <td>24</td> <td>13,0</td> <td>5,5</td> <td>1,8</td> </tr> <tr> <td>12</td> <td>18,9</td> <td>9,4</td> <td>3,5</td> </tr> <tr> <td>4</td> <td>27,0</td> <td>18,2</td> <td>8,6</td> </tr> <tr> <td>1</td> <td>32,1</td> <td>28,1</td> <td>19,7</td> </tr> </tbody> </table> <p> <input type="checkbox"/> LW1.0.1  <input type="checkbox"/> LW1.0.2 revA  <input checked="" type="checkbox"/> LW1.0.2 revB  <input type="checkbox"/> Other :                 </p> <p> <input type="checkbox"/> LW1.0.1  <input type="checkbox"/> LW1.0.2 revA  <input checked="" type="checkbox"/> LW1.0.2 revB  <input type="checkbox"/> Other :                 </p> <p>3 bytes</p>	Battery life in years				Transmission Periodicity (transmissions/day)	SF7	SF10	SF12	144	3,2	1,0	0,3	96	4,6	1,5	0,5	48	8,0	3,0	0,9	24	13,0	5,5	1,8	12	18,9	9,4	3,5	4	27,0	18,2	8,6	1	32,1	28,1	19,7
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4	27,0	18,2	8,6																																		
1	32,1	28,1	19,7																																		

<p>4.3 Which TX power setting (TXPower) was used in the RF test?</p> <p>- If LW 1.0.2 rev A or older device:</p>    <p>- If LW 1.0.2 rev B or newer device:</p>	<p><input type="checkbox"/> TXPower 0 (20dBm)</p> <p><input type="checkbox"/> TXPower 1 (14dBm)</p> <p><input type="checkbox"/> TXPower 2 (11dBm)</p> <p><input type="checkbox"/> TXPower 3 (8dBm)</p> <p><input type="checkbox"/> TXPower 4 (5dBm)</p> <p><input type="checkbox"/> TXPower 5 (2dBm)</p> <p><input type="checkbox"/> other TXPower (        dBm)</p> <p><input checked="" type="checkbox"/> TXPower 0 (MaxEIRP)</p> <p><input type="checkbox"/> TXPower 1 (MaxEIRP-2dB)</p> <p><input type="checkbox"/> TXPower 2 (MaxEIRP-4dB)</p> <p><input type="checkbox"/> TXPower 3 (MaxEIRP-6dB)</p> <p><input type="checkbox"/> TXPower 4 (MaxEIRP-8dB)</p> <p><input type="checkbox"/> TXPower 5 (MaxEIRP-10dB)</p> <p><input type="checkbox"/> TXPower 6 (MaxEIRP-12dB)</p> <p><input type="checkbox"/> TXPower 7 (MaxEIRP-14dB)</p> <p><input type="checkbox"/> other TXPower (MaxEIRP-        dBdBm)</p>
<p>4.4 Is this the same TX power setting (TXPower) used by default in production devices (before network ADR)?</p>	<p><input checked="" type="checkbox"/> Yes,</p> <p><input type="checkbox"/> No, why:</p>
<p>4.5 Maximum ERP measured: (ERP = EIRP - 2.15 dB; LoRaWAN allows 14 dBm ERP)</p>	<p>                dBm</p>
<p>4.6 TRP measured: (TRP is based on EIRP) This gives an idea about the directivity of the antenna.</p>	<p>                dBm</p>
<p>3.10 TIS measured on RX1:</p>	<p>For RX1-SF12BW125 on 868.3MHz        dBm</p>
<p>3.11 TIS measured on RX2</p>	<p>For RX2-SF12BW125 on 869.525 MHz:        dBm</p>