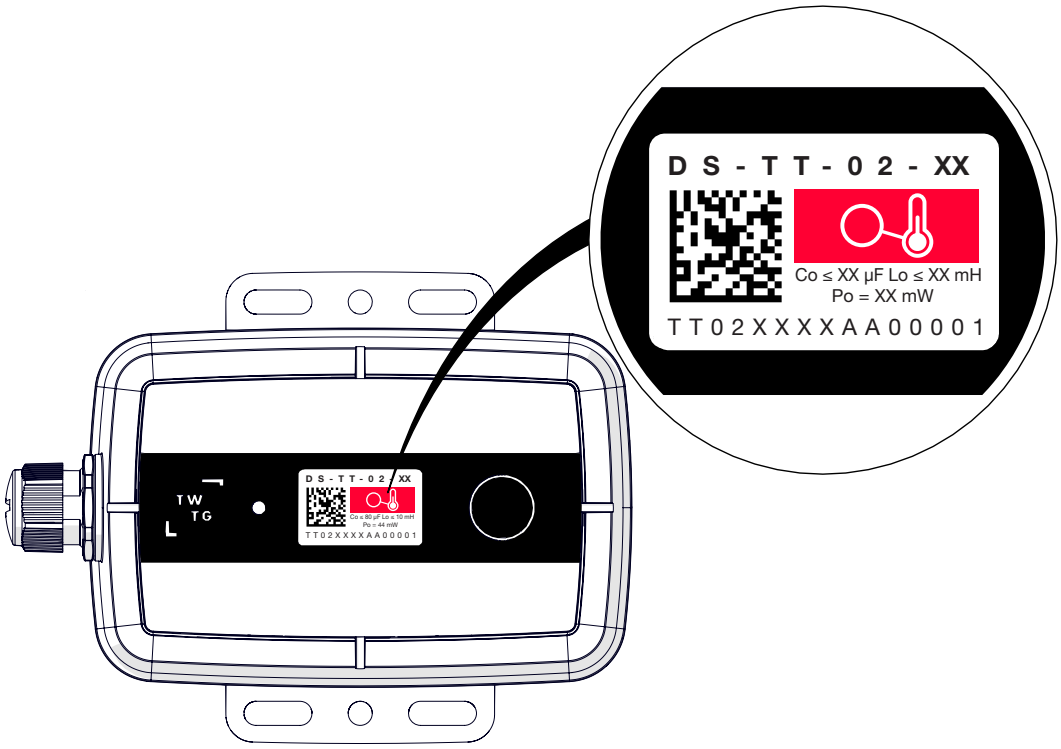
NEON Temperature Transmitter

Product Manual

This document applies to version 2 of the NEON Temperature Transmitter (DS-TT-02-XX)



Revision	B1
Date	07-11-2024
Document	NEON_Temperature-Transmitter_Product-Manual_DS-TT-02-00_4001_B1

Contents

1 TWTG NEON

1.1 NEON Product Introduction

NEON stands for a standardized approach to collecting data points from the operational environment and in doing so, creates a general approach to integrated data collection within existing IT ecosystems.
The TWTG NEON product range supports all industrial customers moving towards LoRaWAN as the Industrial IoT network of the future.
The LoRaWAN network gives industrial operations a secure solution, which scales-up to tens of thousands of sensors, covers complete sites with only a small amount of gateways and best of all, the low-power approach means that the lifetime of the NEON products is extended dramatically.

1.2 Related Products

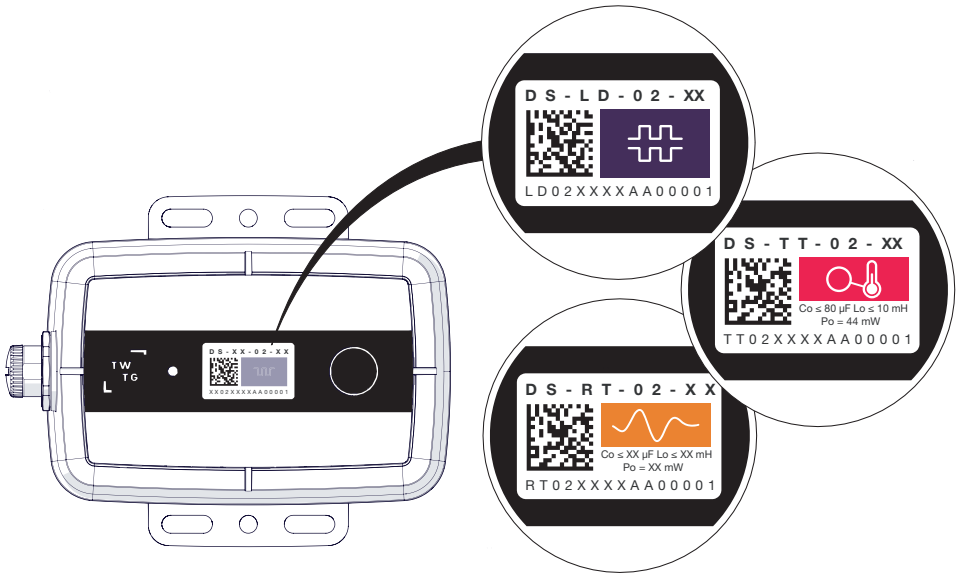


Figure 1.1: Related products

1.3 What you will need

In order to deploy the NEON product range, a compatible and operational LoRaWAN network architecture is required. This manual does not contain any instructions of how to setup and install LoRaWAN networks.

TWTG offers radio network planning and IT-architecture design services to fully integrate the products in the NEON product line. For more information go to https://www.twtg.io/products/solidred/

1.4 Service Desk for NEON products

In case you have any technical questions, or an issue to report please use the https://twtg.io/servicedesk/

2 Getting Started

This manual is meant to be used with products from a specific production batch;

- See Product Identification for an explanation on how to retrieve the production batch code from the serial number;
- See chapter Product Identification to determine the revision of the product.

2.1 Related Documents

Table 2.1: Related Documents

Document name	Document number
NEON Data Sheet Temperature Transmitter	6015_N02-09_Data-Sheet-NEON-Temperature-Transmitter
NEON Communication Protocol	4003_N02-09_Communication-Protocol-NEON-Temperature-Transmitter

All product documentation from the TWTG NEON product line can be found on;
https://github.com/TWTG-R-D-B-V/neon-product-documentation/

2.2 What is in the box

When the product is delivered check the components for damage and whether all box items mentioned below are included;

Table 2.2: Box Items Temperature Transmitter

Box Items Pressure Gauge	(DS-PG-02-XX)
NEON Transmitter	1 battery assembly (included in the product) 1 mounting bracket (mounted on the product) M12 connector (mounted on the product)
Declaration of Conformity	Declaration of Conformity, containing a link to latest version of this product manual and other relevant product documentation

3 Product Specifications

Product name	
Product name	NEON Temperature Transmitter
Type identification transmitter	DS-TT-02-00

3.1 Product Specifications Transmitter

Environmental Conditions	
Operating temperature range	–40 °C .. 70 °C (–40 °F .. 158 °F)
Operating humidity range	0% RH .. 100% RH
Storage temperature range	10 °C .. 30 °C (50 °F .. 86 °F)
Water and dust resistance	IP66
Altitude	Up to 3000 m (9842 ft)
Usage	Indoor and outdoor
Mechanical	
Enclosure material	Molded plastic
Weight (including mounting bracket)	330 g (11.64 oz)
Dimensions	106 mm × 86 mm × 57 mm (4.17" × 3.39" × 2.24")
Maximum cable length	Limited by equipment output parameters
Installation	
Transmitter	Band clamp or bolts (not included)
Power supply	
Battery rated voltage	3.6 V
Battery rated capacity	17 Ah
Battery	
Battery type (replaceable)	1x Type D
Battery life	10 years, at 25 °C (77 °F) (Depending on average ambient temperature and network quality)
Conditions, at 25 °C (77 °F)	Message interval: 1 message / hour Measurement interval: 1 measurement / 5 min
Connectivity	
Protocol	LoRaWAN (private LoRaWAN)
Frequency band	868 MHz, 915 MHz and 923 MHz compatible
Maximum RF output power	+14 dBm
Provisioning	
Data matrix code/ Serial number	Serial number (read only)
NFC	Serial number (read only)

3.2 Supported Sensors

Supprted Sensor	
Temperature sensors	Thermocouple Type-K (other types configurable over LoRa)
Functional specifications	
Input	M12 Connector; 4 Pins, A coded, female (Use the assessed connectors for the thermocouple installation)
Functionality	
Independent event-based message triggers	1. Above 2. Below 3. Increasing 4. Decreasing
Adjustable measurement interval	1 min - 240 min
Adjustable Message interval	0 - 1008 measurements
Thermocouples	
Sensor Type (<T/Cs>) B E J K N R S T	Input range: 400 °C to 1820 °C (752 °F to 3300 °F) -100 °C to 1000 °C (-148 °F to 1830 °F) -100 °C to 1200 °C (-148 °F to 2190 °F) -180 °C to 1372 °C (-290 °F to 2500 °F) -180 °C to 1300 °C (-290 °F to 2370 °F) -50 °C to 1760 °C (-58 °F to 3200 °F) -50 °C to 1760 °C (-58 °F to 3200 °F) -200 °C to 400 °C (-328 °F to 752 °F)
Accuracy (value whichever is greater)	+/- 0.1% of span
Temperature effects / 10 °C (value whichever is greater)	+/- 0.5 % of span
Units	°F (°C can be supported on request)
Open circuit monitoring	Yes
Calibration	Factory calibrated
Cold junction compensation	Integrated digital measurement

Supprted Sensor	
Temperature sensors	RTD PT100
Functional specifications	
Input	M12 Connector; 4 Pins, A coded, female (Use the assessed connectors for the thermocouple installation)
Functionality	
Independent event-based message triggers	1. Above 2. Below 3. Increasing 4. Decreasing
Adjustable measurement interval	1 min - 240 min

Continues on next page

Adjustable Message interval	0 - 1008 measurements
Resistance Temperature Detector RTD	
Sensor Type (<T/Cs>) Pt100	Input range: -200 °C to 400 °C (-328 °F to 752 °F)
Accuracy (value whichever is greater)	+/- 0.1% of span
Temperature effects / 10 °C (value whichever is greater)	+/- 0.05 % of span
Units	°F (°C can be supported on request)
Interface	Three-wire system (Reference current <-1.0 mA)
Open circuit monitoring	Yes
Short circuit monitoring	Yes

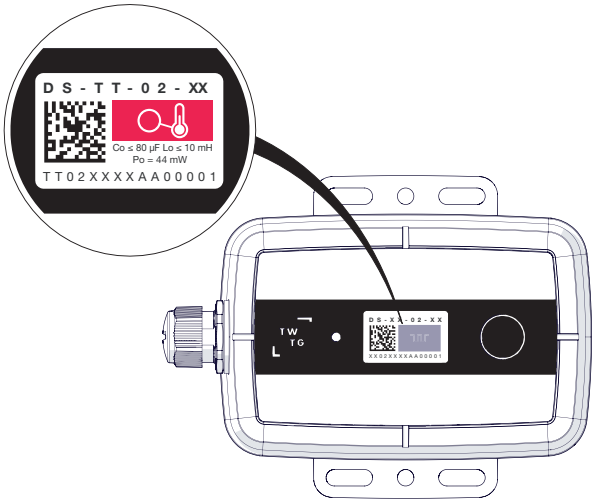
3.3 Certifications

Certifications	
ATEX/IECex rating	Ex II 1G Ex ia IIC T4 Ga
ATEX/IECEx standards	EN/IEC 60079-0:2018 EN 60079-11:2012 IEC 60079-0:2017 IEC 60079-11:2011
ATEX/IECEx certificates	22ATEX0004X / DEK22.0004X
cFMus Rating	IS Class I, Division 1, Group ABCD T4 Class I, Zone 0 AEX/Ex ia IIC T4 Ga
cFMus standards	FM Class 3600 FM Class 3610 FM Class 3810 ANSI/UL 60079-0 ANSI/UL 60079-11 CAN/CSA-C22.2 No. 61010-1 CAN/CSA-C22.2 No. 60079-0 CAN/CSA-C22.2 No.60079-11
cFMus certificates	FM22US0061X / FM22CA0043X
CE	EN 300 220-1 V3.1.1 EN 300 220-2 V3.2.1 EN 301 489-1 V2.2.3 EN 301 489-3 V2.1.1 EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019 EN 62311:2020 EN 60529:1911+A1:2000+A2:2013
UKCA	Radio Equipment Regulation 2017
WEEE	Directive 2033/108/EC
RoHS	2011/65/EU

4 Product Identification

4.1 Product Identification

- The NFC label is located in the identification sticker and programmed with the serial number of the device. The serial number read from the NFC can be used as unique identifier for provisioning and registration.
- The Data Matrix Code label also represents the serial number of the device. The serial number can be used as an unique identifier for provisioning and registration. See Section 4.1 for a detailed label description.



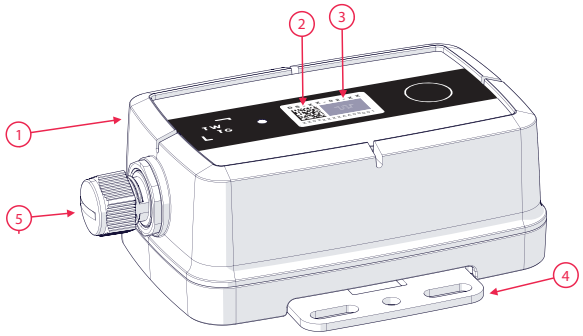
AA-BB-CC-DD	
AA - Product Family	DS
BB - Product Variant	TT = Temperature Transmitter
CC - Main Revision	E.g. 02
DD - Region	E.g. 00 = Global

Product Nomenclature

AA-BB-CC-DD-EEEEE	
AA - Product Variant	TT = Temperature Transmitter
BB - Product Revision	E.g. 02
CC - Production Year	E.g. 22 = 2022
DD - Region	E.g. 00 = Global
EE - Production Batch	E.g. AA
FFFFF - Serial Number	E.g. 00001

Serial Number

Figure 4.1: Transmitter product identification



AA-BB-CC-DD	
1	Neon Transmitter
2	Data Matrix Code
3	NFC
4	Mounting Bracket
5	M12 Connector Dust Cap

Product Nomenclature

Figure 4.2: Transmitter product identification

4.2 Product Dimensions

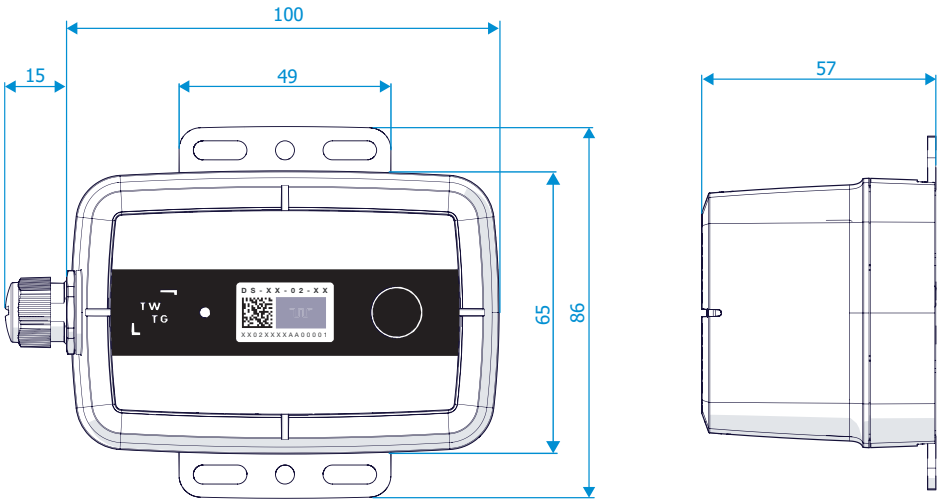


Figure 4.3: Neon Transmitter Dimensions (mm)

5 Warnings

5.1 Specific Conditions of Use

WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD

- For safe installation and use, read and adhere to all safety warnings in the instruction manual;
- The product shall be installed in such a way that the risk for electrostatic discharges is minimized;
- The connector of this equipment may only be used with external equipment as listed in the *Product Matrix*;
- When the equipment is used in hazardous locations, avoid any actions which generate electrostatic discharge;
  - Cleaning: The equipment shall only be cleaned using a wet cloth;
  - Installation: Touch non-metallic parts with an insulating object;
  - Environment: Do not use the product in environments with powerful charge generating processes.

5.2 Installation

WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATHMOSPHERE IS PRESENT

- Under no circumstances shall the equipment enclosure be opened within a hazardous area;
- This equipment shall be installed according to EN-IEC 60079-14 and the installation instructions;
- Ensure that the transmitter is earthed according to EN-IEC 60079-14;
- Ensure that the sensor is earthed according to EN-IEC 60079-14;
- Field devices earth shall be isolated from device M12 connector earth with an dielectric strength of 500 VAC min^{-1};
  - DS-TT-02-XX: The thermocouple or PT100 shall either be earthed or have an infallible isolation to earth with an dielectric strength of 500 VAC min^{-1};
- This equipment is intended for fixed installations only;
- This equipment is intended for use in restricted access areas only;
- To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5.3 Operation

- The connector of this equipment shall not be connected when an explosive atmosphere is present;
- This equipment shall only be used in environments where electromagnetic field strength is limited according to EN-IEC 60079-14;
- This equipment is only intended for use in combination with NFC Forum Tag 2 Type technical specification compatible readers;
- This transmitter shall only be used within ambient temperatures between –40 °C .. 70 °C;
  - DS-VB-02-XX: This sensor shall only be used within ambient temperatures between –40 °C .. 80 °C;
  - DS-PS-02-XX: This sensor shall only be used within ambient temperatures between –25 °C .. 85 °C;
  - DS-PG-02-XX: This sensor shall only be used within ambient temperatures between –30 °C .. 80 °C.

5.4 Service

- This equipment shall only be opened by TWTG or by a competent instructed person;
- The battery is serviceable by said persons;
- Only replace the battery in a non-hazardous location;
- Only use Tadiran S1P1/SL-2780/323/TWT battery assembly;
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment;
- If damage to the enclosure is evident, a trained and competent person shall be immediately informed, who shall remove the device from service as soon as possible;
- If the equipment is or has been in contact with chemical materials, clean it appropriately.

5.5 Transport and Storage

- The product must be kept in its original packaging until it reaches the installation site to prevent damage while in transit;
- The storage location must be dry;
- The product must not be exposed to vibrations or impact during storage.

5.6 Warranty

- The warranty covers the period noted on the quotation;
- If the device doesn't function as documented, the customer should contact TWTG and provide the following information;
  - Model specification;
  - Serial number;
  - Circumstances under which the problems developed;
  - Any previously generated data;
- The party responsible for the costs of solving the problem shall be determined by TWTG on the basis of an investigation conducted by TWTG.

5.7 Warranty will be void in case of

- Malfunction due to ignoring the design specifications;
- Malfunction due to modification of the product carried out by the user;
- Deferred maintenance of the product or the installation location.

5.8 Output parameters

The maximum output parameters are limited by the NEON Transmitter. When selecting the temperature sensor to be used with the transmitter, the following values must be taken into account:

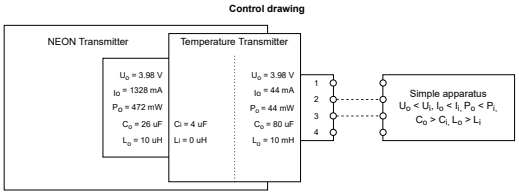


Figure 5.1: Intrinsic Safety Limiting Values

6 Avertissements

6.1 Conditions spécifiques d'utilisation

ATTENTION – RISQUE POTENTIEL DE DECHARGES ELECTROSTATIQUES

- Le produit doit obligatoirement être installé de manière à minimiser le risque de décharges électrostatiques;
- Le connecteur de cet équipement ne doit être utilisé qu'avec un équipement externe tel qu'indiqué dans le "product matrix";
- Lorsque l'équipement est utilisé dans un environnement dangereux, évitez strictement toute action générant une décharge électrostatique;
  - Nettoyage: L'équipement doit être nettoyé uniquement à l'aide d'un chiffon humide;
  - Installation: Toucher les parties non métalliques qu'avec un objet isolant;
  - Environnement: N'utilisez pas le produit dans des environnements générant de fortes charges d'électricité.

6.2 Installation

ATTENTION – NE PAS OUVRIR DANS UNE ATMOSPHÈRE EXPLOSIVE

- Le boîtier de l'équipement ne doit en aucun cas être ouvert dans une zone dangereuse;
- Cet équipement doit être installé conformément à la norme EN-IEC 60079-14 et aux instructions d'installation;
- Assurez-vous que le transmetteur est mis à la terre conformément à la norme EN-IEC 60079-14;
- Assurez-vous que le capteur est mis à la terre conformément à EN-IEC 60079-14;
- La terre des appareils de terrain doit être isolée de la terre du connecteur M12 de l'appareil avec une rigidité diélectrique de 500 VAC min^{-1};
  - DS-TT-02-XX:Le thermocouple ou PT100 doit être mis à la terre ou avoir une isolation infaillible à la terre avec une rigidité diélectrique de 500 VAC min^{-1};
- Cet équipement est uniquement destiné aux installations fixes;
- Cet équipement est uniquement destiné à être utilisé dans des zones à accès restreint;
- Pour se conformer aux limites d'exposition RF FCC/IC pour la population générale/exposition non contrôlée, la ou les antennes utilisées pour cet émetteur doivent être installées de manière à fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doivent pas être colocalisées ou fonctionner en conjonction avec toute autre antenne ou émetteur.

6.3 Fonctionnement

- Le connecteur de cet équipement ne doit jamais être connecté dans une atmosphère explosive;
- Cet équipement ne doit être utilisé que dans un environnement où l'intensité du champ magnétique est limitée conformément à la norme EN 60079-14;
- Cet équipement est uniquement destiné à être utilisé en combinaison avec des lecteurs compatibles dont les spécifications techniques respectent la norme des tags NFC de Type 2;
- Ce transmetteur ne doit être utilisé qu'à des températures ambiantes comprises entre –40 °C .. 70 °C;
  - DS-VB-02-XX:Ce capteur ne doit être utilisé qu'à des températures ambiantes comprises entre –40 °C .. 80 °C;
  - DS-PS-02-XX:Ce capteur ne doit être utilisé qu'à des températures ambiantes comprises entre –25 °C .. 85 °C;
  - DS-PG-02-XX:Ce capteur ne doit être utilisé qu'à des températures ambiantes comprises entre –30 °C .. 80 °C.

6.4 Entretien

- Cette pièce d'équipement ne doit être ouverte que par TWTG ou par une personne compétente et selon le guide d'utilisation;
- La batterie peut être mise à neuf par ces personnes;
- Ne remplacez la batterie que dans un endroit sans danger;
- Utilisez uniquement l'ensemble de batterie Tadiran S1P1/SL-2780/323/TWT ;
- Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler le droit de l'utilisateur à utiliser l'équipement;
- Si le boîtier est endommagé, informez immédiatement une personne compétente pour qu'elle vienne récupérer l'équipement;
- Si l'équipement est (ou a été) en contact avec des substances chimiques, nettoyez-le de manière appropriée.

6.5 Transport et stockage

- Le produit doit être conservé dans son emballage jusqu'à ce qu'il atteigne le site d'installation pour éviter tout dommage pendant le transit;
- Le lieu de stockage doit être sec;
- L'appareil ne doit pas être exposé à des vibrations ou à des chocs pendant le transport et le stockage.

6.6 Garantie

- La garantie couvre la période indiquée sur le devis;
- Si l'appareil ne fonctionne pas comme prévu, le client doit contactez TWTG et fournir les éléments suivants;
  - Spécifications du modèle;
  - Numéro de série;
  - Les circonstances dans lesquelles les problèmes sont survenus;
  - Toutes les données précédemment générées;
- La partie responsable des coûts de résolution du problème sera déterminée par TWTG sur la base d'une enquête privée menée par TWTG.

6.7 La garantie sera annulée dans les cas suivants:

- Non-respect des spécifications du modèle;
- Modification du produit effectuée par l'utilisateur;
- Entretient non conforme aux spécifications du produit.

6.8 Paramètres de sortie

Les paramètres de sortie maximum sont limités par l'émetteur NEON. Lors de la sélection du capteur à utiliser avec le transmetteur, les valeurs suivantes doivent être prises en compte:

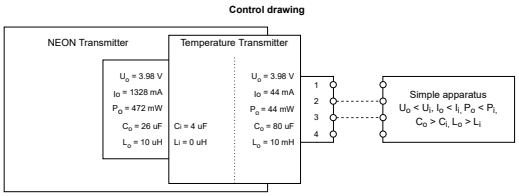


Figure 6.1: Valeurs limites de sécurité intrinsèques

7 Provisioning

7.1 User Interface

The product contains one Light Emitting Diode (LED) to communicate with the user. In order to interact with the device a button is present on the right side of the NFC label.

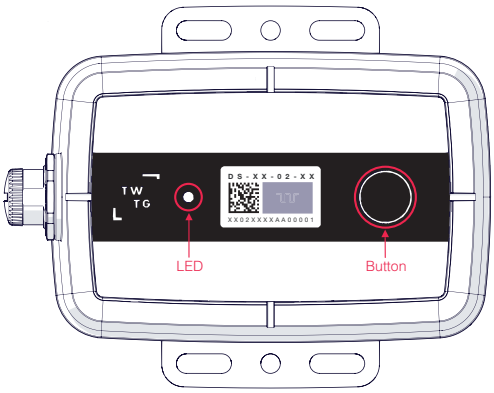


Figure 7.1: NEON Ratiometric Transmitter Interface

7.2 Operating the Device

Press and Release

Press and Hold

Release

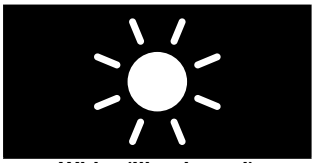
Red (Illuminated 2 s)
Deactivated

Red (Illuminated)
Failed

Green (Illuminated 2 s)
Activated

Green (Illuminated)
Passed

White (Blinking)
Connecting



White (Illuminated)
Calibrating

Blue (Illuminated)
Action / Handling Required

Blue (Flashing each second)
Button is being hold

7.2.1 Read device status

1. Press & release the button and the device will immediately show its status:

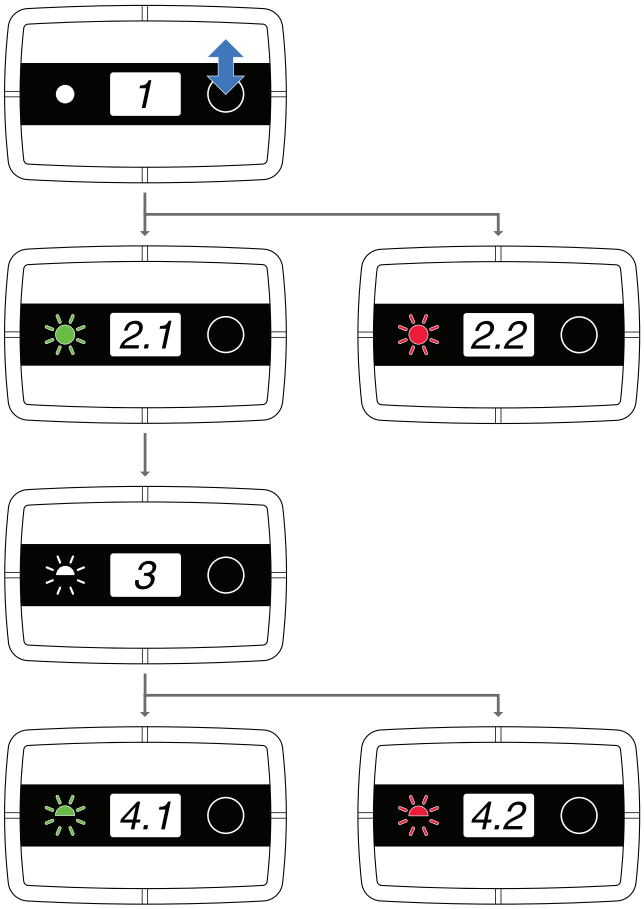
- **2.1 Green (Illuminated):** Device is activated
- **2.2 Red (Illuminated):** Device is deactivated

If the device is activated it will try to send the Device Status message over LoRa (using default configuration):

- **3. White (Blinking):** Connecting to network

Within a typical maximum of 3 minutes*, the device will show:

- **4.1 Green (Blink 2x):** Message sent, or
- **4.2 Red (Blink 2x):** Failed to connect to send message / connect to network



Notes:

- *The NEON Transmitter can be configured to send a Sensor Data message upon a button press. In this configuration the Sensor Data message will be sent after the Sensor Event message;*
- **All timeout and retry values are valid for the default configuration, the maximum timeout might be longer when process is performed repeatedly due to RF duty cycle limitations.*

7.2.2 Device Activation

1. Press & hold the button for 5 seconds
During the button hold the LED will blink Blue each second.

2. After holding the button for 5 seconds the device will first check the LoRa network:

- **3.1 White (Blinking):** Checking LoRa network

4. Within a typical maximum of 3 minutes* the device will show:

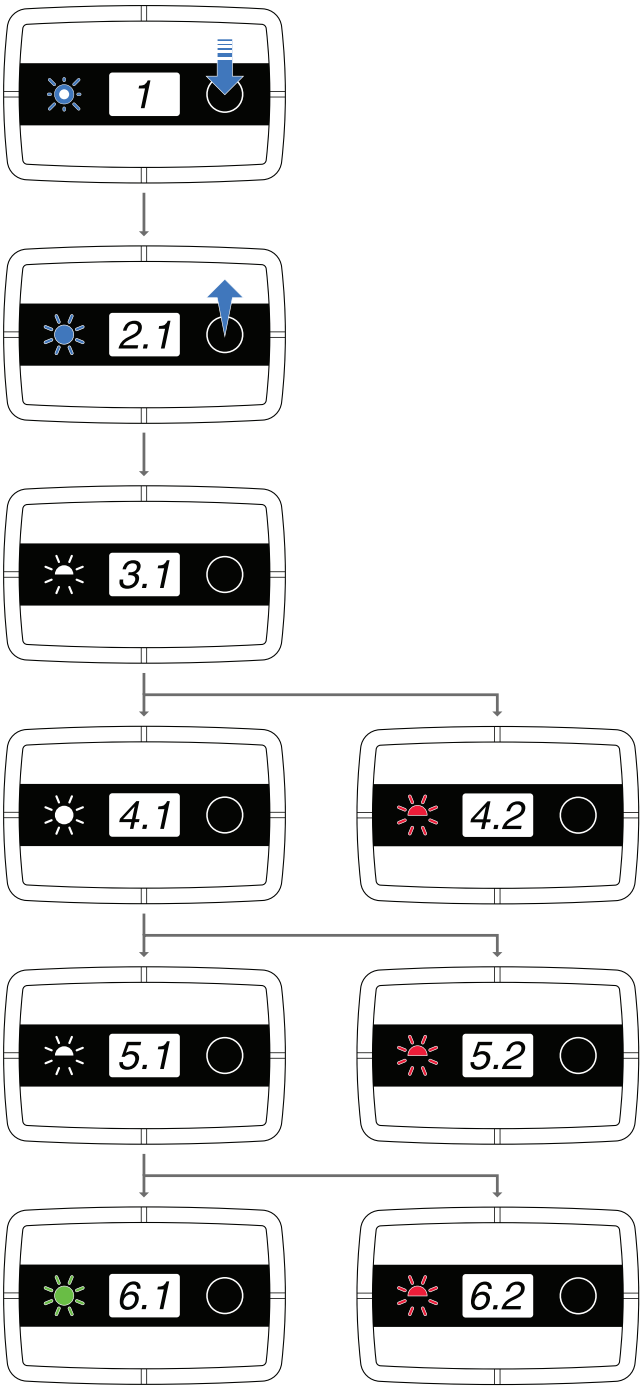
- **4.1 White (Illuminated):** Checking sensor communication
- **4.2 Red (Blink 2x):** Check network

5. Within 30 seconds max. the device will show:

- **5.1 White (Blinking):** Sending activation over LoRa
- **5.2 Red (Blink 2x):** Check sensor

6. After communicating over LoRa, within a typical maximum of 3 minutes*, the device will show:

- **6.1 Green (Illuminated):** Activated, or
- **6.2 Red (Blink 2x):** Check network



Notes:

- **All time out and retry values are valid for the default configuration, the maximum time out might be longer when process is performed repeatedly due to RF duty cycle limitations.*

7.2.3 Device Deactivation

1. Normal Configuration
During the button hold the LED will blink Blue each second.

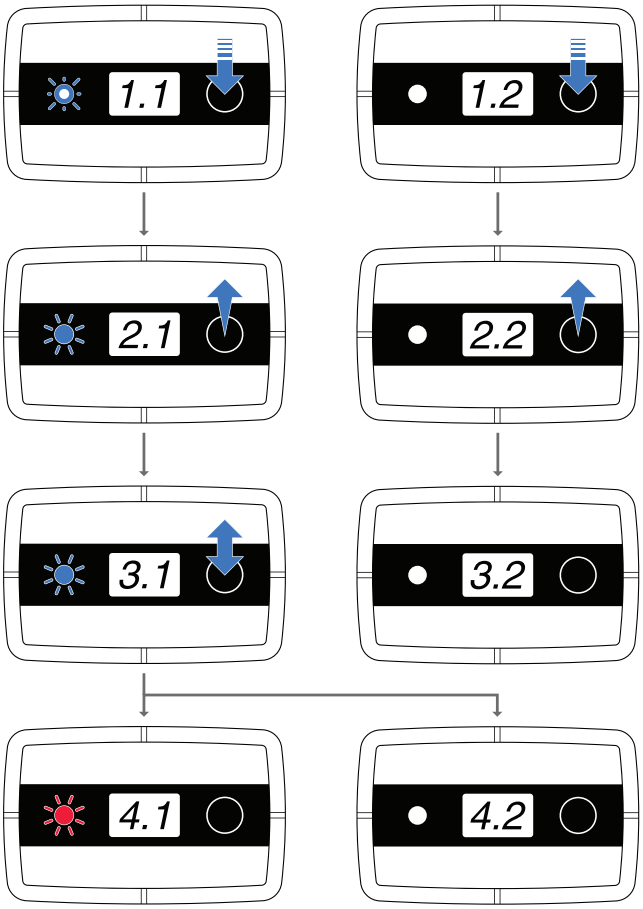
2. After holding the button for 5 seconds the device will show:

- **2.1 Blue (Illuminated):** Action required

3. The user can now release the button and press and release within 5 seconds:

4. If the button isn't pressed & released within these 5 seconds:

- **Red (Illuminated):** Deactivated
- **No LED:** Deactivation canceled



Notes:

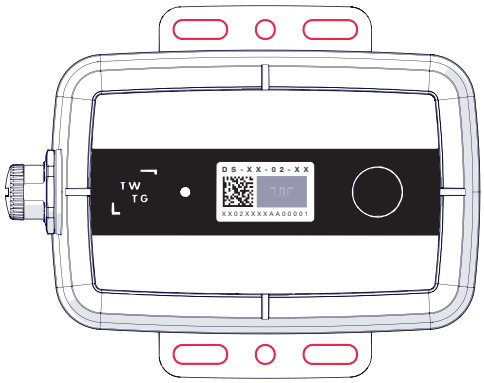
- *Secured Configuration*
  - *If the device is in Secured Configuration it is not possible to deactivate the device using the button. The device will not react to a press and hold of the button and the LED will stay off. See Diagram 1.2, 2.2 and 3.2 and* Communication Protocol *in Table 2.1.*

8 Installation Transmitter

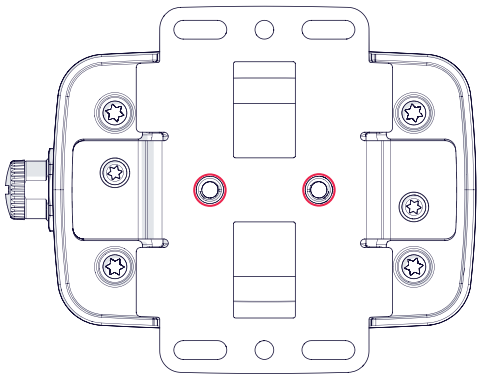
WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD

- Avoid placing wiring close to noise sources such as large motors or power supplies;
- To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter;
- Only connect the M12 connector to the Transmitter when there is no explosive atmosphere present;
- The equipment must be installed in accordance with EN 60079-14.

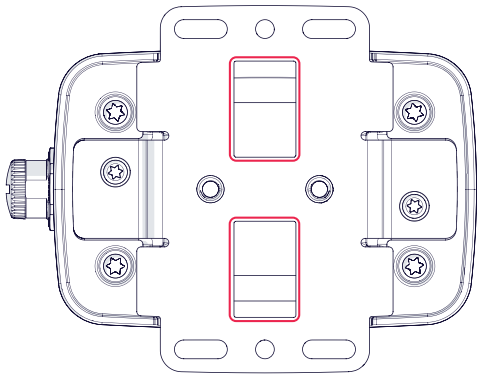
8.1 Installation methods



(a) Mounting holes (M4)



(b) Threaded mounting holes(M5)



(a) Bandclamp (14mm)

9 Installation Sensor

WARNING

- Avoid placing wiring close to noise sources such as large motors or power supplies;
- To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter;
- Only connect the M12 connector to the Transmitter when there is no explosive atmosphere present;
- The equipment must be installed in accordance with EN 60079-14.

9.1 Using the Temperature Transmitter with Thermocouples

9.1.1 Cold Junction Compensation

The interface to the NEON Temperature Transmitter uses an M12 connector with Type-A polarisation.
This interface can be used for reading out both thermocouples and RTDs.
For use with thermocouples the Temperature Transmitter has a built-in cold junction compensation (CJC):

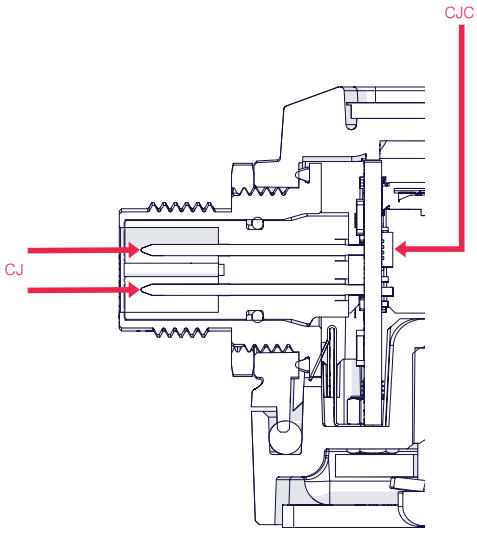


Figure 9.1: CJC section detail

The temperature transmitter uses the copper pins of the M12 connector as the cold junction, as seen in figure **??**. The cold junction compensation uses the temperature of the copper contacts as measured by the internal reference temperature sensor. The internal reference temperature is directly in thermal contact with the cold junction.

9.1.2 Assessed Connectors

The following connectors have been assessed by TWTG and can be used in combination with the Neon Transmitter:

Table 9.1: Compatible M12 connectors

Manufacturer	Part Number	Type
Phoenix Contact	1424656	Push-in, metal, right angle (female) connector
Phoenix Contact	1424655	Push-in, metal, straight (female) connector

9.1.3 Selecting a thermocouple wire

A suitable thermocouple wire needs to be assessed as simple apparatus and needs to be assessed as safe with regards to thermal and spark ignition.

Select a cable with cross section of 0.14 mm^2 .. 0.75 mm^2 with a round outer shell with a diameter of 4 mm .. 8 mm. If the sensor is mounted in a noisy environment a shielded cable can be used.

WARNING

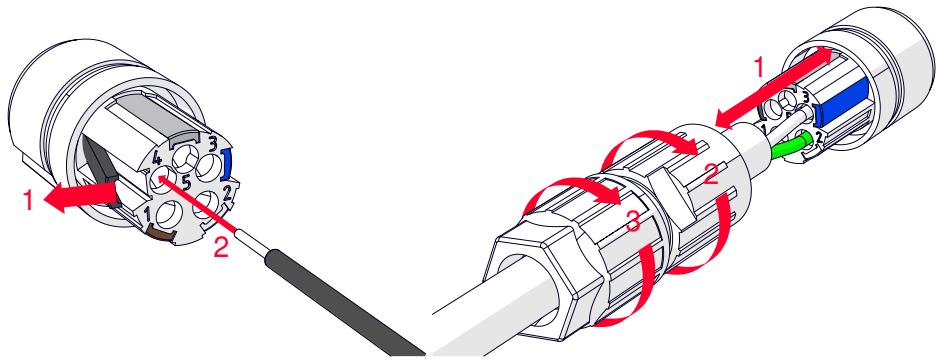
- Do not connect the shield to the M12 connector shield to prevent a multi-point ground, only connect the shield at the thermocouple junction.

Use the values as listed in table 9.2 to determine compliance. The maximum permitted cable length is determined by cable L_i and C_i and limited to the maximum installation cable length of 3 meters.

Table 9.2: Thermocouple limiting values

	Limiting Value	Thermocouple wire requirements
C_o	18 µF	$C_i < C_o$
L_o	10 mH	$L_i < L_o$
P_o	464 mW	Assess heat-up of cable with P_o and U_o parameters for all lengths between 0 meter and required cable length
U_o	3.9 V	Assess heat-up of cable with P_o and U_o parameters for all lengths between 0 meter and required cable length

9.1.4 Connecting a thermocouple wire to the temperature interface



(a) Open the locking lever and insert wire **(b)** Connector with levers closed

Figure 9.2: Cable connection example

Table 9.3: Thermocouple pinout

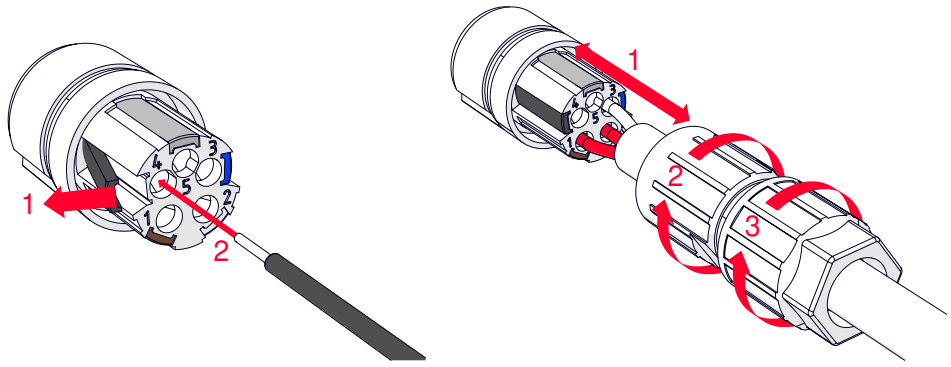
Pin	Connection
Pin 1	Not used
Pin 2	Thermocouple Positive Connection
Pin 3	Thermocouple Negative Connection
Pin 4	Not used

1. Strip the wires down by 7mm;
2. Insert the cable through the waterproofing O-Ring and cable gland nut;
3. Open the locking lever of the push in connector;
4. Press the thermocouple wire in the connector, use Table 9.3 to verify polarity. Do not use excessive force;
    - Ensure the correct polarity, as the device will not function properly with reversed polarity;
5. Close the locking lever of the push in connector;
6. Tighten the nut with the O-Ring.

9.2 Using the Temperature Transmitter with a RTD (3-wire)

The Temperature Transmitter can be used in combination with a 3-wire RTD. To do so, the default configuration of the device needs to be changed. See *Communication protocol* (Table 2.1).

9.2.1 Connecting a RTD (3-wire) sensor to the temperature interface



(a) Open the locking lever and insert wire **(b)** Connector with levers closed

Figure 9.3: Cable connection example

Table 9.4: RTD pinout 3-wire

Pin	Connection
Pin 1	RTD Sense (red)
Pin 2	RTD + (red)
Pin 3	RTD - (white)
Pin 4	Do not use

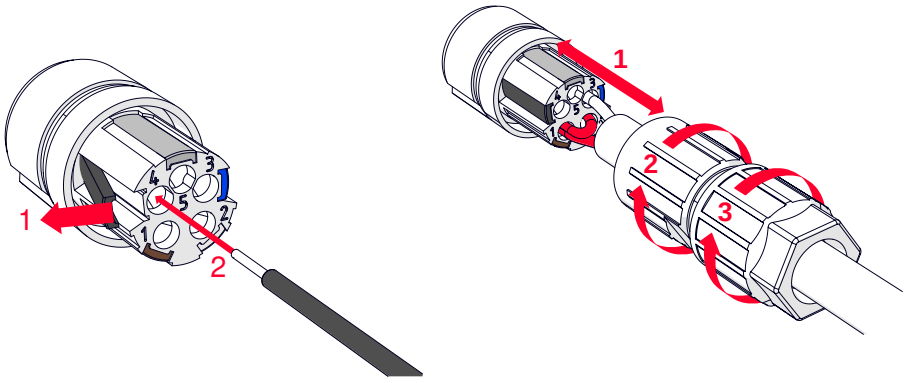
1. Strip the wires down by 7 mm;
2. Insert the cable through the waterproofing O-Ring and cable gland nut;
3. Open the locking lever of the push in connector;

4. Press the RTD wire in the connector, use Table 9.4 to verify polarity. Do not use excessive force;
    - Ensure the correct polarity, as the device will not function properly with reversed polarity;
5. Close the locking lever of the push in connector;
6. Tighten the nut with the O-Ring.

9.3 Using the Temperature Transmitter with a RTD (2-wire)

The Temperature Transmitter can be used in combination with a 2-wire RTD. To do so, the default configuration of the device needs to be changed. See *Communication protocol* (Table 2.1).

9.3.1 Connecting a RTD (2-wire) sensor to the temperature interface



(a) Open the locking lever and insert wire **(b)** Connector with levers closed

Figure 9.4: Cable connection example

Table 9.5: RTD pinout 2-wire

Pin	Connection
Pin 1	RTD + (red)
Pin 2	Short-circuit to Pin 1
Pin 3	RTD - (white)
Pin 4	Do not use

1. Strip the wires down by 7 mm;
2. Insert the cable through the waterproofing O-Ring and cable gland nut;
3. Open the locking lever of the push in connector;
4. Press the RTD wire in the connector, use Table 9.5 to verify polarity. Do not use excessive force;
    - Ensure the correct polarity, as the device will not function properly with reversed polarity;
    - Add a cable to short-circuit Pin 1 with Pin 2;
5. Close the locking lever of the push in connector;
6. Tighten the nut with the O-Ring.

10 Product Functionalities

A detailled description of setting-up communication and configuring device settings can be found in *Communication protocol* (Table 2.1).

10.1 Application Event Message

The Temperature Transmitter measures and reports the temperature either by set intervals (a timer-based trigger) or a condition-based trigger.

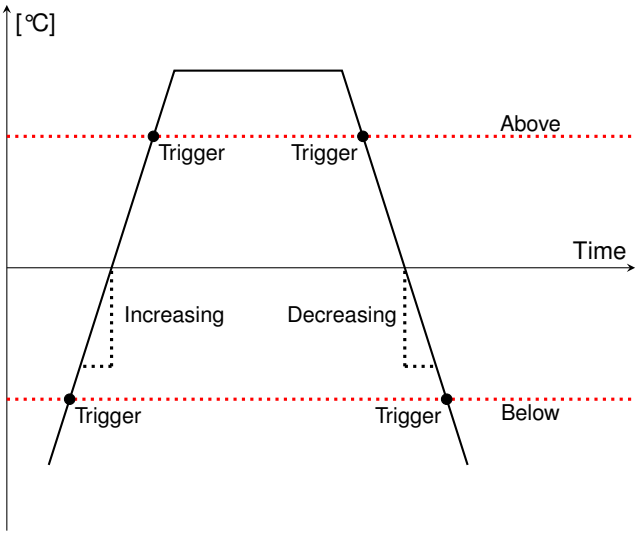


Figure 10.1: Application trigger event message

10.1.1 Event-triggers

Event-messages are triggered on one of the following triggers.

- **Timer (periodic)**:
  The timer trigger is configurable through the following configurations:
  - *temperature_measurement_interval_seconds*
    Interval in seconds, at which the temperature sensor is read.
  - *periodic_event_message_interval*
    Interval in the number of measurements at which the application event messages are periodically sent. The periodic counter is reset on every event message.

- **Condition**:
  A condition-based trigger can be either of the following triggers:
  - *Above*
    If the maximum temperature is above the temperature_threshold then the condition is true. A transition of the condition from false to true or true to false will trigger an event message.
  - *Below*
    If the minimum temperature is below the temperature_threshold then the condition is true. A transition of the condition from false to true or true to false will trigger an event message.
  - *Increasing*
    The condition is true when the current temperature is at least temperature_threshold higher than the minimum temperature in the measurement_window (The maximum number of measurements to observe delta temperature to trigger an event). A transition of the condition from false to true or true to false will trigger an event message.
  - *Decreasing*

The condition is true when the current temperature is at least temperature_threshold lower than the maximum temperature in the measurement_window (The maximum number of measurements to observe delta temperature to trigger an event). A transition of the condition from false to true or true to false will trigger an event message.

10.1.2 Content application event message

- **Temperature**
  The connected sensor temperature in units of 0.1 ℃:
  - Maximal;
  - Average;
  - Minimal.
- **Trigger**
  Source of the trigger for the application event message:
  - "timer" (0);
  - "condition_0" (1);
  - "condition_1" (2);
  - "condition_2" (3);
  - "condition_3" (4).
- **condition_n**
  The current state of each condition.

10.2 Device Status

Besides reporting the application temperature as discussed previously, the Temperature Transmitter also reports on the device status itself. This is done through a device status messages. A device status message is sent periodically and includes a range of device health parameters, including the following:

- event_counter;
- battery_voltage;
- PCB temperature;
- tx_counter;
- avg_rssi;
- avg_snr.

See *Communication protocol* (Table 2.1) for a detailed explanation.

10.3 Default Configuration

The Temperature Transmitter is delivered with a default configuration. The default configuration includes:

- Measurement interval of 15 min;
- Event-based message at the time of each periodic trigger with an interval of 15 measurements. (15*15= 225 min);
- Device status message interval of 24 hours;
- Enabled confirmation message on all messages.

See *Communication protocol* (Table 2.1) for a detailed explanation of all default configuration values.

11 Maintenance

11.1 Battery Specifications

Table 11.1: Battery Specifications

Specifications	
Manufacturer	Tadiran
Part number	Tadiran S1P1/SL-2780/323/TWT
Quantity	1
Battery Type / Size	Type D
Chemistry	Lithium Thionyl Chloride
Terminal Type	Standard
Dimensions	61 mm × 32.5 mm
Battery Life	5 years, at 25 °C (77 °F)[1]

[1] Applicable for default configuration. Battery lifetime depends on average ambient temperature, network quality and device configuration.

11.1.1 Battery Replacement

The battery can be replaced using the battery replacement kit. See Section 12.1. This kit consists of the following parts:

- 1x Tadiran S1P1/SL-2780/323/TWT
- 4x O-Ring
- 1x Gasket

11.1.2 Required tools

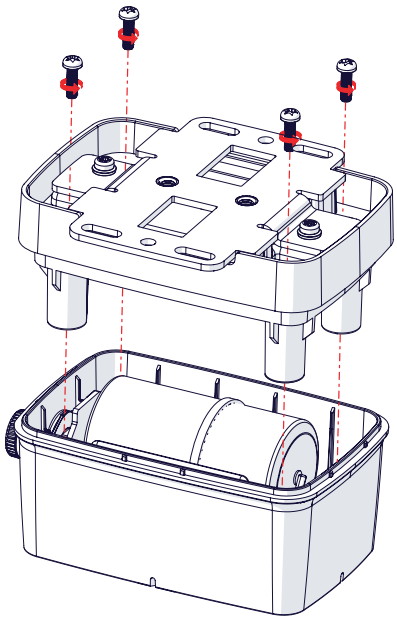
- Torque screwdriver with TX10 bit;
  - See Section 12.2 for torque settings;
- ESD strap.

IMPORTANT: ESD Sensitive Electronics

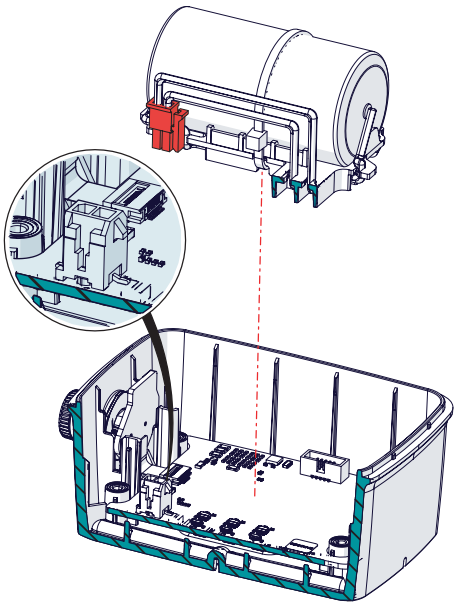
- Take proper precaution such as a grounded wrist strap and avoid touching the electronics board.

WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATHMOSPHERE IS PRESENT

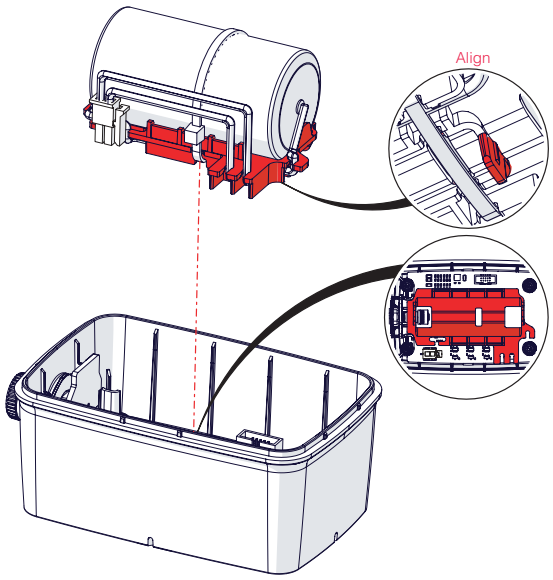
- This equipment shall only be opened by TWTG or by a competent instructed person;
  - The battery is serviceable by said persons;
  - Always disconnect M12 connector from Transmitter before replacing battery assembly.



Step 1: Remove the four M3 screws and remove the bottom housing



Step 2: Before removing the battery assembly, disconnect the battery connector (marked in red)



Step 3: Place the new battery assembly using the rib on the battery cradle (marked in red) to align with designated cut-out in the top housing. Connect the new battery connector

11.1.3 Built-In Self-Test Procedure

When the device is deactivated a built-in self-test is performed upon insertion of the battery. This test is not executed when the device is already activated. Use the deactivation sequence as described in Section 7.2.3 and reinsert the batteries if a self-test is needed.

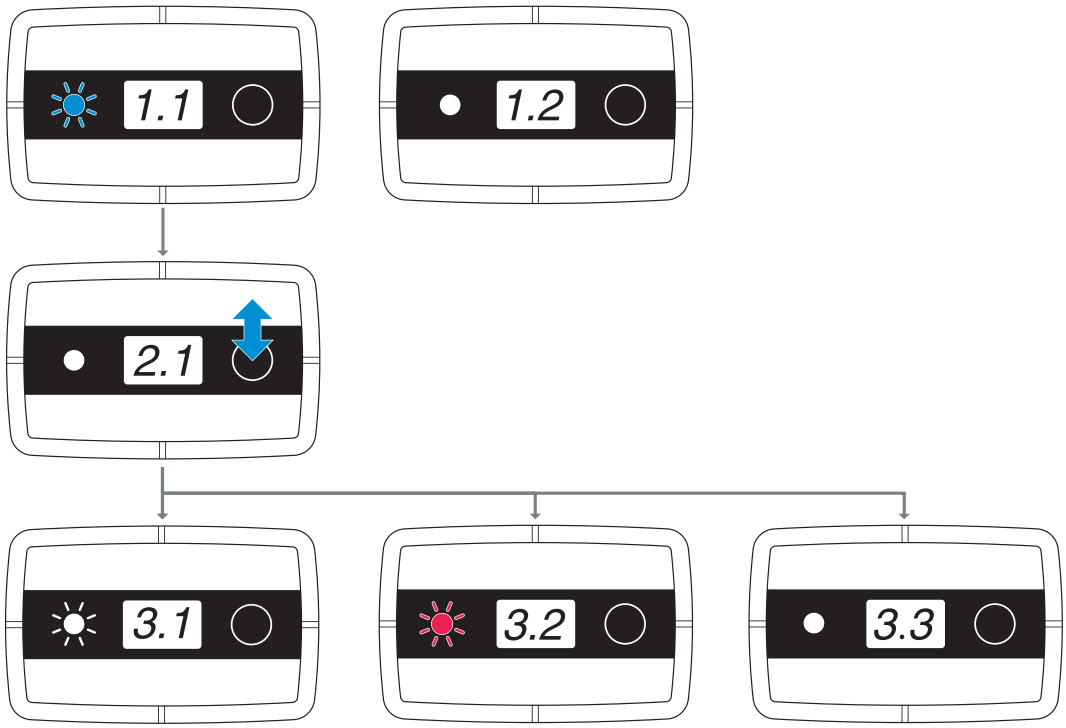


Figure 11.1: Built-in self-test

1: After successful replacement of the battery the device will go into self-test mode. This mode is activated for 30 seconds;

1.1: A BLUE LED will show after inserting the battery;

1.2: If no LED is shown, check the battery and / or device;

2: Start the test;

2.1: Press and Release the button;

3: Test Results;

3.1: LED turns bright WHITE for 5 seconds. Self test passed;

3.2: LED turns RED, self test failed. Check device;

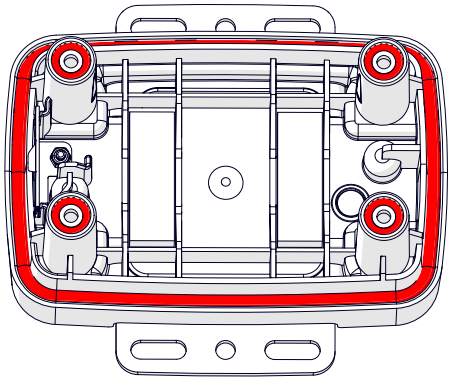
3.3: No LED, no response from device. Check device.

After pressing the button once and passing the self-test the device will exit the self-test mode. Pressing the button again will show the device status, as explained in Read device status.

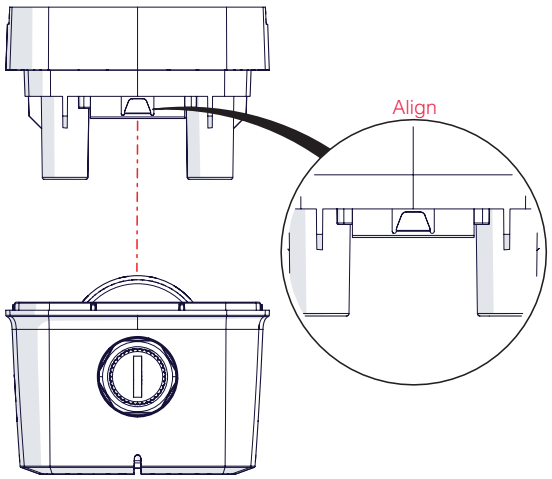
11.1.4 Assembly of Device

IMPORTANT - USE THE SPECIFIED TORQUE SETTINGS

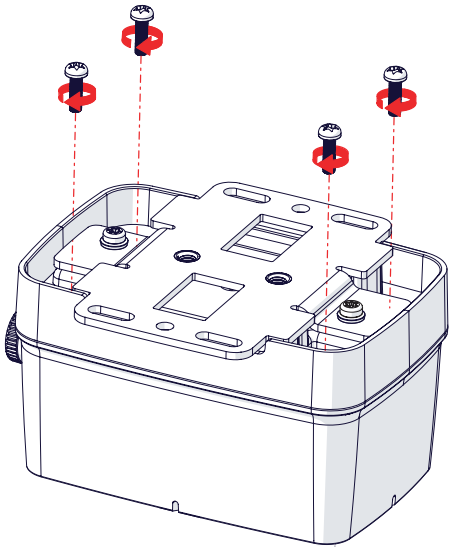
- Use a torque screwdriver to verify the applied torque;
- Failure to do so can result in water ingress;
- Improper assembly will void the warranty.



Step 1: Replace the 4 o-rings surrounding the screws and the gasket in the outer edge of the bottom housing



Step 2: Place the bottom housing back onto the top housing. For correct orientation; make sure that the bottom housing grounding plate is aligned with the top housing M12 connector



Step 3: Tighten the four M3 screws to fix the bottom housing. Use a torque screwdriver to set the maximum torque to 1.5 Nm

12 Accessories and Spare Parts

12.1 Accessories

Type	Order code	Description
DS-XX-02-XX	MKT-DS-XX	Magnet kit temp. installation (for Transmitter) - including 2 magnets, 4 washers, 4 screws
DS-TT-02-XX	TCC-F02	Thermocouple connector - straight (f)
DS-LD-VB-02-XX	MAG-VB-01-38	Magnet installation (for Sensor) - curved surfaces (38mm)
	MAG-VB-02-38	Magnet installation (for Sensor) - flat surfaces (38mm)
	MAG-VB-03-38	Magnet installation (for Sensor) - curved surfaces (38mm) methric thread
	MAG-VB-04-38	Magnet installation (for Sensor) - flat surfaces (38mm) methric thread
	ADA-VB-01	Adapter installation (for Sensor) - chemical bonding

Table 12.1: Accessories

12.2 Spare Parts

Type	Order code	Description
DS-XX-02-XX	BATT-DS-PM	Battery replacement kit - including 1 battery assembly, 4 O-rings, 1 gasket
DS-RT-02-XX	DS-EC-02-AB03	RT Sensor cable

Table 12.2: Spare Parts

13 Legal

13.1 Declartion of Conformity EU

Hereby, TWTG R&D B.V., declares that this equipment is in compliance with;

- ATEX Directive - 2014/34/EU;
- Radio Equipment Directive - 2014/53/EU;
- WEEE Directive - 2003/108/EC;
- RoHS - 2011/65/EU.

The full text of the EU Declaration of Conformity is available at https://www.twtg.io/legal/

13.2 Declartion of conformity UK

Hereby, TWTG R&D B.V., declares that this equipment is in compliance with;

- ATEX Directive - 2014/34/EU;
- Radio Equipment Regulation - 2017;
- WEEE Directive - 2003/108/EC;
- RoHS - 2012/19/EU.

The full text of the UK Declaration of Conformity is available at https://www.twtg.io/legal/

13.3 FCC and ISED Declarations

FCCID: 2ATYF-DS02B This device complies with part 15 of the FCC Rules and to RSS of Industry Canada. 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de Classe B est conforme à la norme Canadienne ICES-003.
CAN ICES-003(B) / NMB-003(B).

The full text of the FCC and ISED Declarations are available at https://www.twtg.io/legal/

13.4 Manufacturer information

Table 13.1: Manufacturer information

Manufacturer information	
Name	TWTG R&D BV
Address	Schaardijk 386 2909 LA Capelle a/d IJssel The Netherlands

For more information please visit https://www.twtg.io/

13.5 Trademarks

Customer is responsible for selecting appropriate Products for desired application, testing and validating such application and ensuring that implementation is in compliance with rules and (safety) requirements as listed in the data sheet, instruction manual or equivalent. Supplier allows use of Products only for the primary purpose of each device. If Customer adapts or processes or makes changes to any Product delivered without prior written authorisation from the Supplier or does not use the Products in accordance with the instructions for use as listed in the respective Data Sheet, instruction manual or equivalent and to be found within the TWTG github or allows these to be used improperly, any warranty, if applicable, lapses. The Customer is not permitted to remove/hide any trademark/logo/warning /information applied by the Supplier from / to the Product. Supplier disclaims responsibility for, and Customer will fully indemnify Supplier and its representatives against, any claims, damages, costs, losses, and liabilities arising out of wrongful or intentionally wrong use of the Products. Supplier disclaims responsibility for any actions taken by Customer staff or third parties as a result of the data provided by Products. The Customer indemnifies the Supplier from any claims for damages and claims by third parties resulting from non-compliance on the part of the Customer of the obligations stipulated in this manual.

Revision History

Revision	Date	Description
A1	29-07-2022	Concept version
A2	05-10-2022	Updated product specifications and ratings Added French warnings
A3	24-11-2022	Updated FCC/ISED declaration
A4	21-02-2023	Updated UI
A6	12-06-2023	Updated Product Dimensions
A7	22-08-2023	Added 2-Wire
A8	19-09-2023	Added Magnet Kit & updated output power
B1	07-11-2024	Unified user manuals Corrected pinout of 2-wire PT100