Subject	Starting Guide	Project nr	C19-001
Project	NEON Valve sensors	Date	April 1st 2020

Version	Author	Changes	Date
1.0	JP	Initial document	01-04-2020

Introduction

Thank you for your interest in the TWTG NEON sensor product line. In this starting guide you will find the information needed to install and deploy the sensors and find directions to the relevant product documentations.

The TWTG NEON valve sensor comes in two variants:

1. Quarter-turn valve sensor: suitable for ball valves
2. Multi-turn valve sensor: Suitable for gate valves

Product overview

NEON Quarter-turn valve sensor

The TWTG NEON Quarter-turn valve sensor can accurately determine the closed position of ball valves. It does so by measuring the rotation of a magnet which is connected to the stem of the valve. For compatibility please refer to: *TWTG-NEON_Valve-sensor-QT_Product-Sheet*

NEON Multi-turn valve sensor

The TWTG NEON Multi-turn valve sensor can accurately determine the closed position of gate valves. It does so by measuring the vertical movement of a magnet which is connected to the stem of the valve. For compatibility please refer to: *TWTG -NEON_Valve -Sensor-MT_Product-Sheet*

Getting started

All TWTG'S Neon IIoT products use LoRaWAN as a communication method and are fully compliant with the LoRaWAN standard. In order to use these sensors a network with LoRaWAN coverage is needed on their location.

TWTG advises to use private hosted networks where possible in order to make the most use of all capabilities of the NEON products and their security measures. The devices are however capable to be used on public hosted LoRaWAN networks.

When the sensors are shipped the Over The Air activation keys will be shared securely.
Using these keys in the backend of your LoRaWAN network server (check the manual of the service you use) you need to pre-register the devices to the network in order to make the rest of the installation to go smoothly.

Documentation references

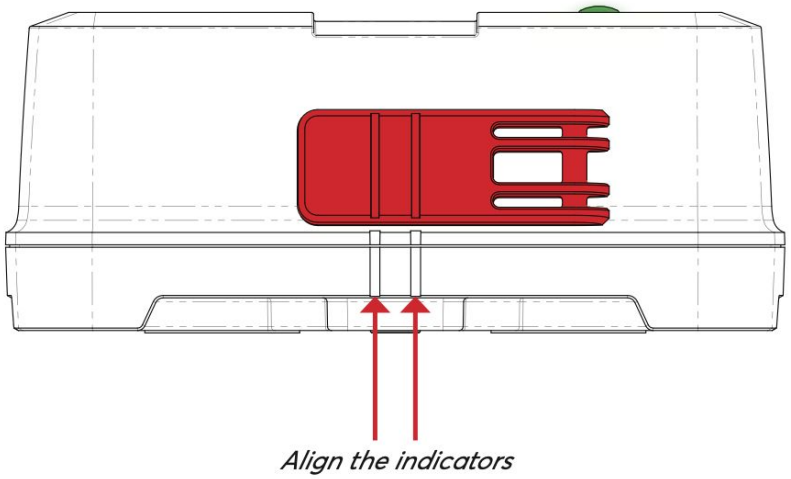
The following documentation is required for installation, deployment and use. In this starting guide you will find references to these documents.

1. Product manuals
2. Installation manuals (mounting kits for valves)
3. Communication Protocols
4. Product sheets

User interface

The NEON Valve sensors can be operated by holding a magnet key near the 2 indication lines on the side of the product. This mechanism works much like a physical push button but restricts unauthorised or accidental operation. The RGB LED on top of the product will give feedback and instructions in the steps of the menu.

The magnet key can be either tabbed or held in place for a certain period of time in order to walk through different steps of the menu. E.G. push or hold like with a push button. The complete instructions can be found in product manual:
603_P18-023_Product-Manual-VS & *602_P19-005_VS-MT-Product_Manual*



Software

The NEON valve sensors accurately detect the rotation and vertical movement of a magnet which is mounted on the moving part of the valve; the stem. The sensor will measure at set intervals to determine if the state has changed outside of the threshold. When this change has been detected, an event message will be sent containing the position of the valve; Open or Close.

The sensor can be configured to send regular updates on its status within set intervals. Next to this, the sensor will send an event message when the state of the valve has changed from open to close or vise versa.

1. Status message
2. Event Message

For the complete description (ranges, units possibilities) of settings please refer to:
Communication protocol - P18-023 - VS-QT & *Communication protocol - P18-023 - VS-MT*

LoRa Communication

The NEON valve sensor operates on the EU868 or US915 frequency band. In line with the LoRaWAN protocol, the communication can be 2 ways following the command/response process.

The following message types FROM the sensor are used:

1. Event message
2. Status message
3. Boot message: After a reboot the sensor will send a message containing information regarding the reboot reason amongst others. During normal operation the sensor will only reboot when communication has been persistently absent or when network performance is low.

NOTE: all messages that are send FROM the sensor can be acknowledged by the server. The default setting for this ON. To turn this functionality OFF, please refer to communication protocol in section “device configuration”: *Communication protocol - P18-023 - VS-QT* & *Communication protocol - P18-023 - VS-MT*

The following message types TO the sensor are used:

1. Device configuration
2. Application configuration

Explanations on possible configurations, units, ranges and defaults please refer to “Device configuration” and “Application configuration” in: *Communication protocol - P18-023 - VS-QT* & *Communication protocol - P18-023 - VS-MT*

Decoding the messages

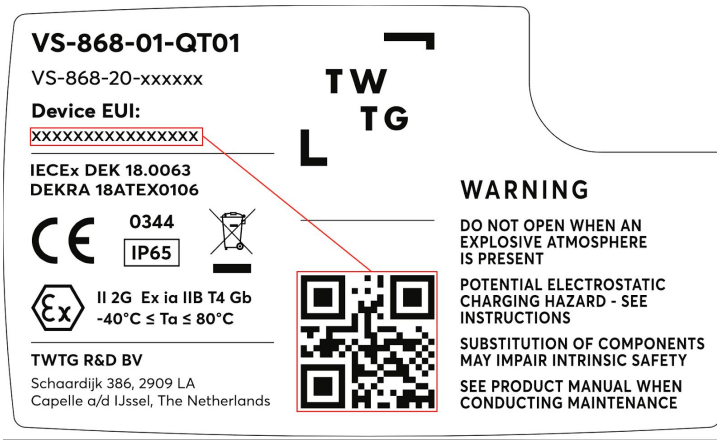
Messages that are received from the sensor can be decoded using a javascript decoder. The JSON structure can be found in: *Communication protocol - P18-023 - VS-QT* & *Communication protocol - P18-023 - VS-MT*

Encoding the massages

Messages that are send to the sensor can be encoded using a javascript encoder.The JSON structure can be found in: *Communication protocol - P18-023 - VS-QT* & *Communication protocol - P18-023 - VS-MT*

Recognising your sensor

Each NEON sensor can be recognised using the unique identifier. This identifier, called Dev EUI, can be used to identify you sensors in your LoRa server. The Dev EUI is present on the the product label in numbers/letters and inside the QR-code.



Battery Health

The condition of the battery can be determined by using the Voltage measurements that are included in the status message. For an accurate determination TWTG supplies the Solid Red module. When a less accurate determination is sufficient the below approach can be used.

The message includes the following parameters:

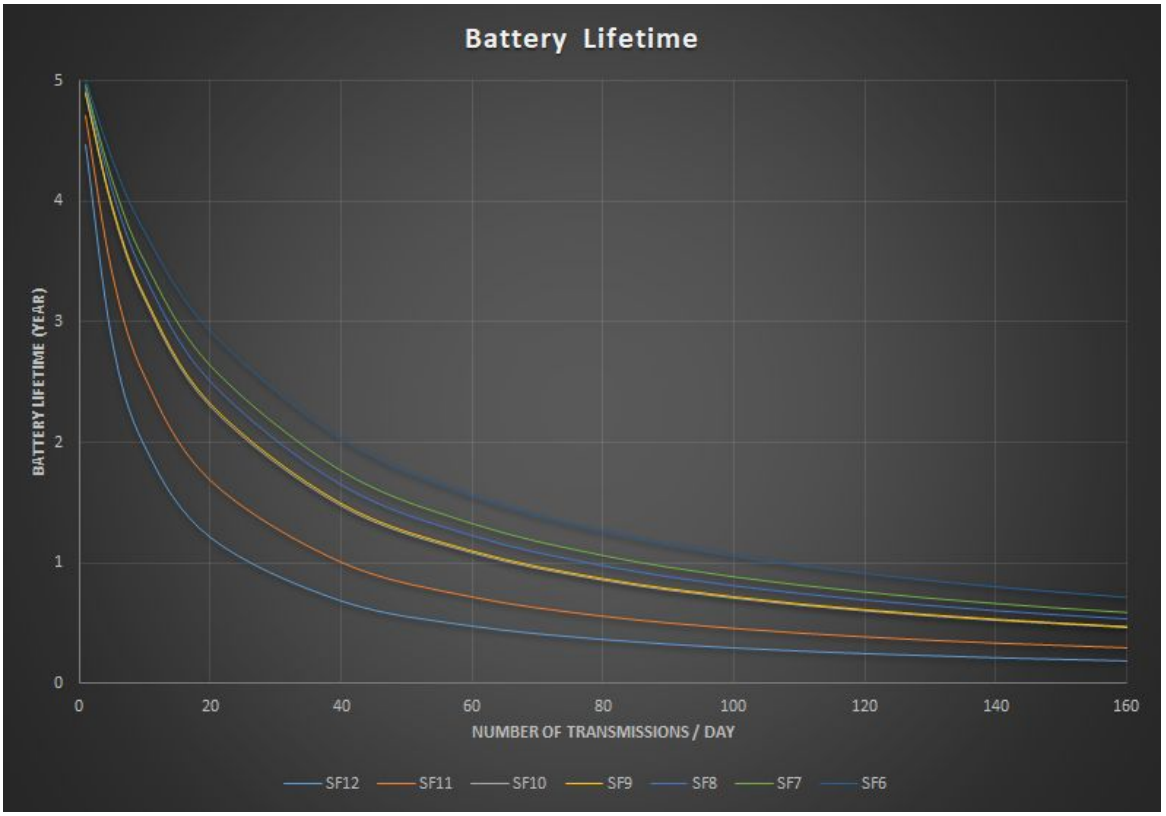
1. Battery voltage (low consumption) Voltage measurement in millivolt during low load
2. Battery voltage (high consumption) Voltage measurement in millivolt during high load
3. Battery voltage (settle after high consumption) Voltage measurement in millivolt right after high load.

When the voltage #2 is constant at around 3,3 V over time, the battery is in good health. An possible indicator for an almost depleted battery is a voltage below 3 V.

Notes:

1. Battery voltage is temperature dependant (current temperature and previous Environmental conditions). Above mentioned is for a temperature of 20℃.
2. Battery voltage is dependent on message frequentie.
3. The drop in voltage from 3,3V to below 3,0V can occur within a short time period.

Chosen configurations & battery life



The lifetime of the battery is (mostly) depending on the number of messages that are sent and at which spreading factor this is done. In general the higher the spreading factor the longer it takes

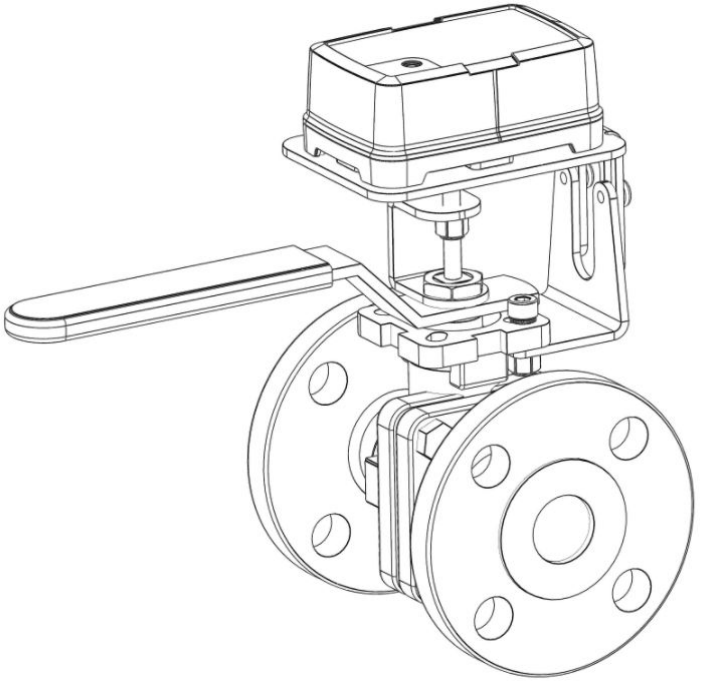
to send a message and the more energy will be used. The spreading factor will be automatically increased when the network environment between sensor and gateway requires it. In general, when the network quality is sufficient, the spreading factor will be between 6 and 8 and at average 4 - 6 messages per day the battery life will be between 3 and 5 years.

Installation

The NEON valve sensors are mounted on the valve using metal brackets. These brackets come in different sizes to accommodate the various sizes of valve.

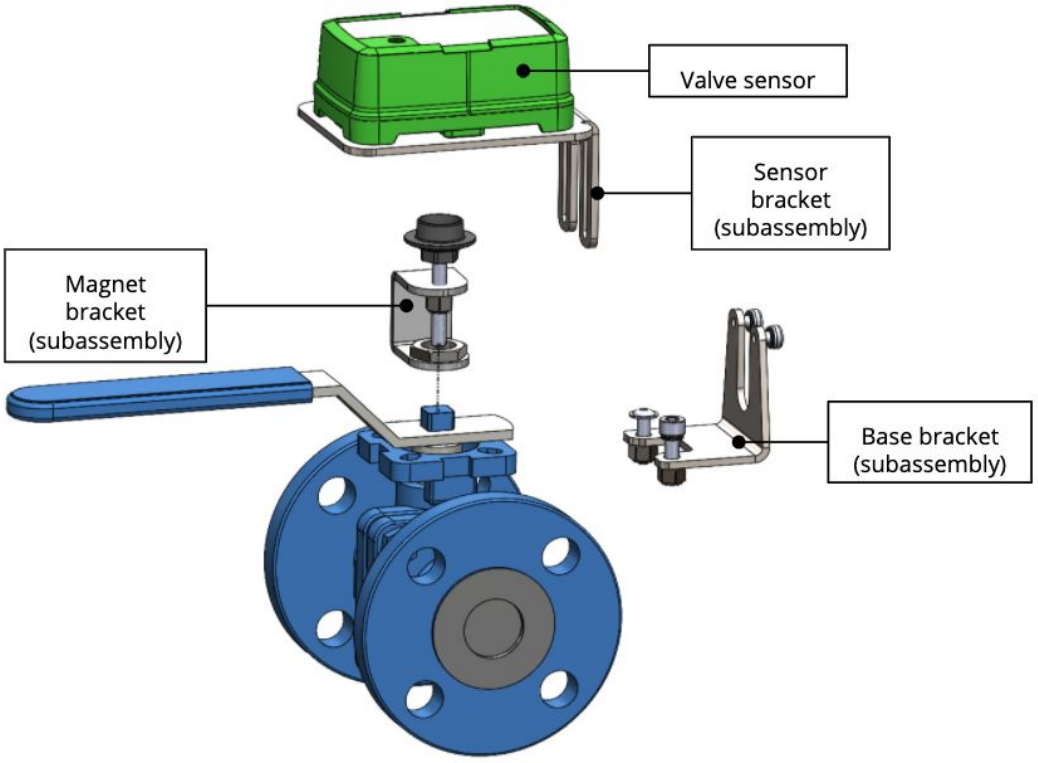
Quarter turn

Mounting kits for ISO 5211 compatible quarter turn valve are available in the size range of F03 - F10. Below is an example F03 valve with mounting kit and NEON valve sensor.



The ISO 5211 kits consist of 3 parts/assemblies

1. The flange bracket that is designed according the ISO 5211 standard
2. The sensor bracket. This bracket is the same for all F-sizes
3. The magnet bracket. This bracket comes in different sizes to accommodate the different diameters of stems that are found across the F-size range.

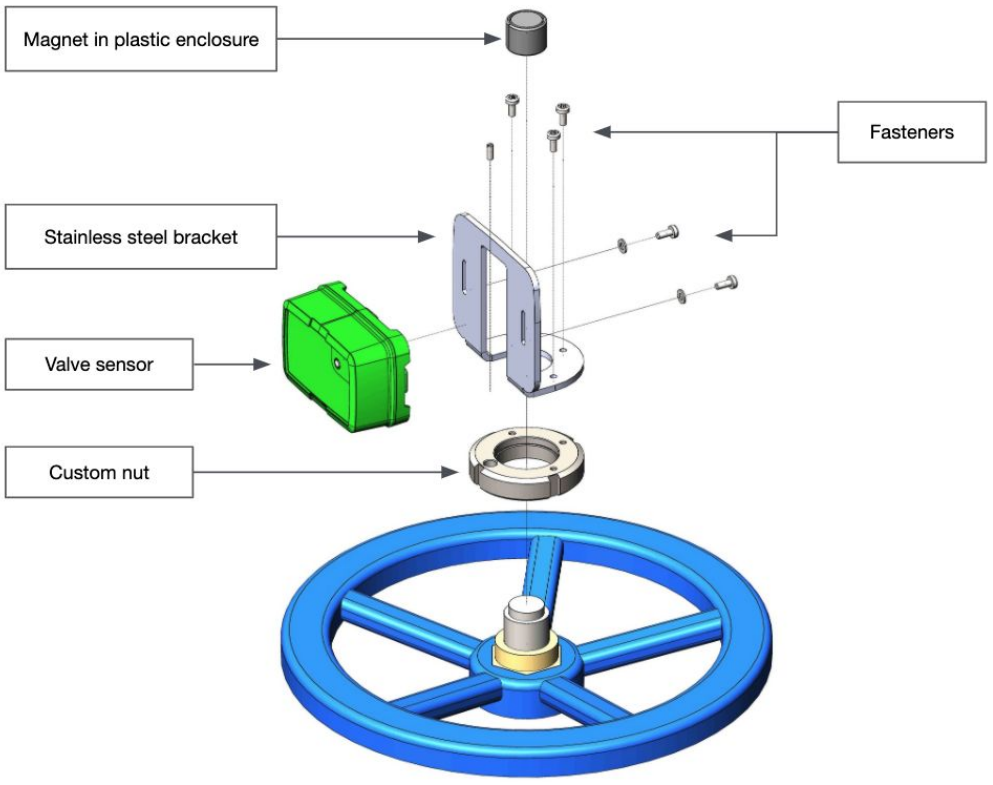


When ordering brackets it is important to know the Fxx-size(#1) and the diameter (#3) you intend to mount the sensor on.

Valves that are not compatible with the ISO 5211 standard can be accommodated with a possible custom solution. For an example of a custom solution please refer to: *P18-023 - Installation Manual MK-A-002*

Multi Turn

The multi-turn valve sensor is attached to the handwheel by replacing the existing nut and adding a bracket.



A plastic enclosure containing the magnet is mounted on the stem. When opening the valve magnet will move vertically along with the stem. The sensor can be adjusted in the slots of the bracket. This is to compensate for possible installation margins. In general the lowest setting can be used.

For an example of a mounting for multi turn valves please refer to:
601_P19-005_VS-MT_Install_Manual