Sensoteq®

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Installation Guide

Sensors for Intelliwear monitoring systems
Sensor Model: WMVM
Gateway for Intelliwear monitoring systems
Gateway Model: ANTR2006

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References

Ref	Source
1	Weir VHM / VSM Datasheet
2	Weir Gateway Datasheet

Versions

Ref	Date	Source
1	06/05/2021	Original Release
10	23/08/2023	Updated for App and labels

Nomenclature

Item	Description
Apk	Android Package
App	Application
BLE	Bluetooth Low Energy
DC	Direct Current
DIN	Deutsche Institut für Normung (German Institute of Standards)
ID	Identification
LAN	Local Area Network
LED	Light Emitting Diode
OS	Operating System
PLC	Programmable Logic Controller
RF	Radio Frequency
V	Volts

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Safety and Regulatory Information

WARNING: A WARNING indicates a potential property damage, personal injury, or death

Battery Safety

⚠ **WARNING: The WVMVM sensor contains a battery. The battery is enclosed within the product however if the battery is damaged then the sensor should not be used.**

Safety and Regulatory Information

You can find additional Safety Best Practices and information on REACH, Electromagnetic Compatibility (EMC), Ergonomics, Transportation, and Tuners on the Regulatory Compliance page, **www.sensoteq.com/regulatory_compliance.**

⚠ **WARNING: Use of controls, adjustments, procedures, connections, or signal types other than those specified in your documentation may result in exposure to shock, electrical hazards, and/or mechanical hazards.**

- Sensoteq products are not designed for use in hazardous environments unless purchased as ATEX certified Sensoteq products. If you require ATEX certified products contact Sensoteq for appropriate part numbers.
- Sensoteq product are not designed for use in operating or calibrating machinery. Sensoteq products are monitoring equipment only.

⚠ **WARNING: Do not operate your equipment disassembled. The product should remain as purchased with backing plates and bases etc. installed**

AC Power supplies are not IP rated and must be protected from water ingress.

- Do not use damaged equipment, including exposed, frayed, or damaged power cords.

⚠ **WARNING: Do not attempt to service the equipment yourself, except as explained in your Sensoteq documentation or in instructions otherwise**

Power and Adapter Safety

⚠ **WARNING: RISK OF FIRE or ELECTRICAL SHOCK when using a main plug adapter that is not specified. Use only the Sensoteq-provided AC adapter approved for use with this device. Use of another AC adapter may increase the risk of fire or explosion.**

- Check the voltage rating before you connect the equipment to an electrical outlet to ensure that the required voltage and frequency match the available power source.

The AC adapter may become hot during normal operation of our product. Ensure adequate ventilation and use care when handling the adapter during or immediately after operation of your device.

⚠ **CAUTION:** Your AC adapter has no accessible earthed metal parts, so it is not possible to perform an Earth Continuity Test. The low voltage DC Output Connector Is not an earthed part and should not be subjected to the Earth Continuity Test as this may give an incorrect result and could damage the AC adapter.

Location of Radio Regulatory Labels

For some products, the radio regulatory labels may be found on the bottom or rear of the equipment

Recycling Information

Sensoteq recommends that customers dispose of their used sensors, gateways, and other peripherals in an environmentally sound manner. Potential methods include reuse of parts or whole products and recycling of products, components, and/or materials. For specific information on Sensoteq's worldwide recycling programs, see: **www.sensoteq.com/recycling**.

Waste Electrical and Electronic Equipment (WEEE) Directive

In the European Union, this label indicates that this product should not be disposed of with household waste. It should be deposited at an appropriate facility to enable recovery and recycling. For information on how to recycle this product in your country, please visit: **www.sensoteq.com/recycling.**

Battery Disposal

The WMVM/VSM/VHM sensor contains a Li-SOCl2 (lithium based) battery and must be recycled according to local regulations.

The Gateway can be recycled as electronic waste according to local regulations.

SIMPLIFIED DECLARTION OF CONFORMITY FOR RADIO EQUIPMENT DIRECTIVE 2014/53/EU

Sensoteq Ltd. declares that all CE Marked Sensoteq products incorporating Radio Equipment functionality are in compliance with Directive 2014/53/EU.
The Full text of the EU declaration of conformity is available at the following internet address:
www.sensoteq.com/regulatory_compliance.

In the European Union, this label indicates that the batteries in this product should be collected separately and not be disposed of with household waste. Substances in batteries can have potential negative impact on health and environment and you have a role in recycling waste batteries, thus contributing to the protection, preservation, and improvement of the quality of the environment. You should contact your local authority or retailer for details of the collection and recycling schemes available. Alternatively visit: **www.sensoteq.com/recycling.**

Registration, Evaluation, and Authorisation of Chemicals (REACH)
REACH is the European Union (EU) chemical substances regulatory framework. Information on substances of very high concern contained in Sensoteq Products in a concentration above 0.1% weight by weight (w/w) can be found at: **www.sensoteq.com/REACH.**

Regulatory Notices
For Electromagnetic Compatibility (EMC), **see www.sensoteq.com/regulatory_compliance.**

This device complies with Part 15 of the FCC Rules
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause
undesired operation.
WARNING: Changes or modifications not expressively approved by the party responsible for compliance could void the user's authority to operate the equipment.
This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.
L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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Installation Process

A typical installation follows the process below:

1. Check equipment
2. Download Install App
3. Connect gateway(s) to PLC
4. Gateway setup
5. Using the Sensoteq Install App
6. Assign sensors to gateway(s)
7. Install the sensor(s)
8. Test and install gateway(s)

The best method is to connect each gateway in turn (and add sensors) as the installation progresses, then move onto the next gateway.

1. Checking Equipment

When you receive the Sensoteq equipment please check:
- None of the equipment has been visually damaged during transport
- You have the following equipment:

  - Hose / Spool Kit
    - **Sensor** only
    - **Hose** or **Spool** connection interface (+ seal)
    - **4-Way Connector** with **x4 crimp contacts**
    - **Sensor ID** label sticker
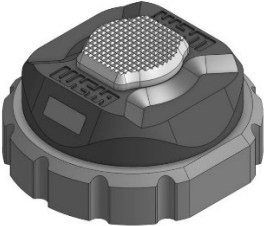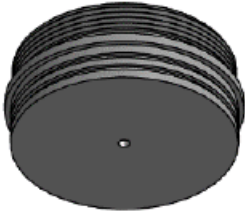
  - Gateway Kit
    - **Gateway** (with DIN rail bracket)
    - **External Antenna** (with bracket)
    - **SMA-SMB RF adapter**
    - **12V power cable**
    - **2m ethernet cable (Cat 5E / Cat 6)**

- You have at least one gateway per group of sensors
  - Typically, one per physical room or large piece of equipment
  - A maximum of 40 sensors per gateway
- A power supply (or connector) for each gateway

Physical Identification

Sensor	Hose Interface	Spool Interface
Screw fit	Screw fit to sensor, Rubber bonded to Hose	Screw fit to sensor, Weld fit to Spool

Order code	Product Kit	Purpose
WM-K0H	Hose kit	Hose Monitoring sensor kit – transmit RF data
WM-K0P	Spool kit	Spool Monitoring sensor kit – transmit RF data

Gateway
Bolted or DIN Rail
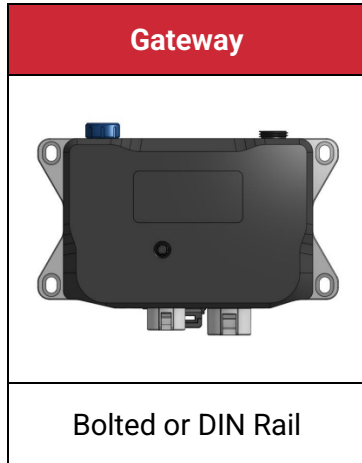
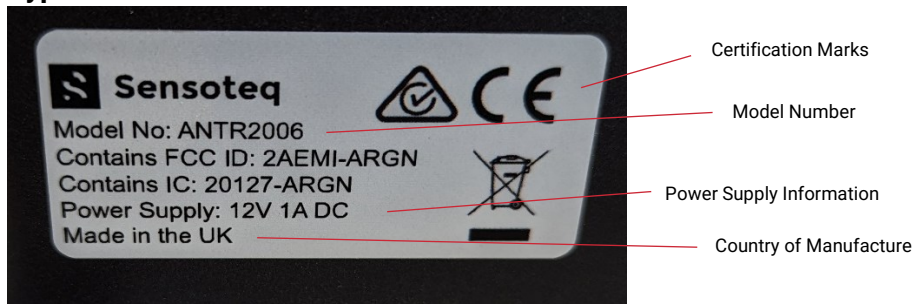| Order Code	Product Name	Purpose
WM-K0G	Ethernet Gateway	Receiving RF data from sensors and transmitting to PLC via Modbus

Type Identification

*Figure 1. Gateway Label*

Additional Equipment

- Tools to affix the gateway or sensors to the equipment
    - Allen key
    - Spanner
    - Paper clip (or Ø1mm x 25mm long tool, e.g. Allen key)
    - DIN rail inside Gateway installation cabinet (not essential)

- A Mobile Device
    - Any phone or tablet running Android OS 9, 10 or 11
    - An iPhone

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2. Download Install App

- The VHM Install app is required to complete the full installation process. This is available from:
    - **Android** – Google Play Store
    - **iOS** – App Store
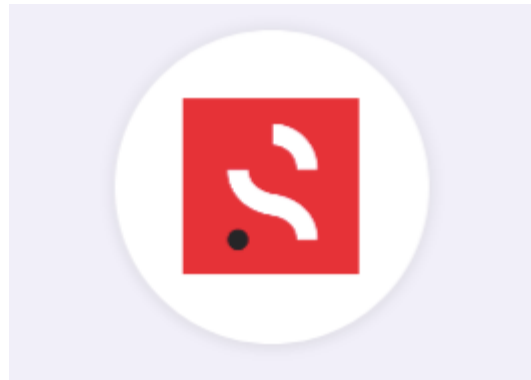
3. Connect Gateway to PLC system

Power gateway using the 12V power supply provided and connect ethernet cable (Cat 5E / Cat 6) from gateway to PLC.

Data from the gateway can be read via the Modbus serial communications protocol.

Modbus is a master-slave system, where the master communicates with one or multiple slaves. In this instance, the PLC is the master, and the gateways are the slaves. The PLC requests (polls) the sensor data from the gateway via ethernet.
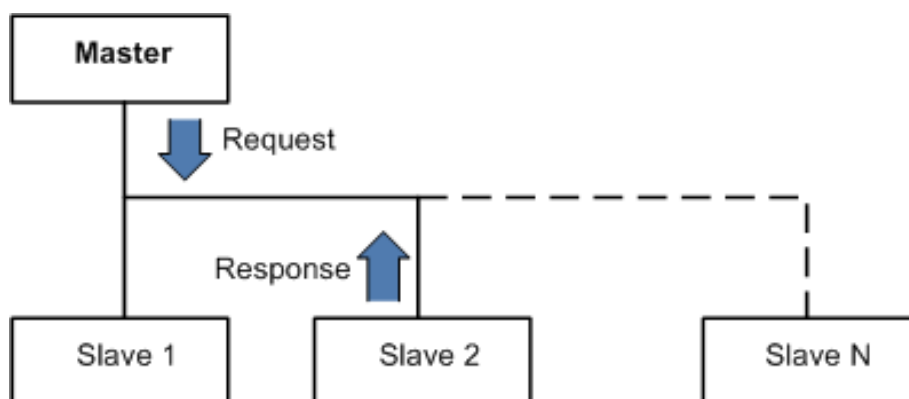
Figure 2. Modbus Overview block diagram

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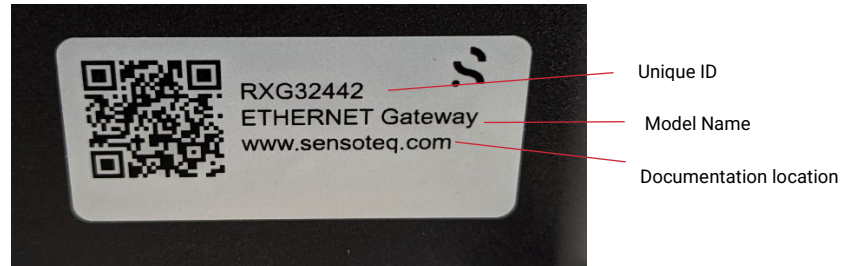
4. Gateway Setup

Figure 3. Gateway ID Label

General process

- Have to hand:
    - Paper clip (or Ø1mm x 25mm long tool, e.g. Allen key)
    - Gateway Unique Part ID
    - Android phone or tablet

It is important to setup the gateway correctly before installing any sensors, as this will ensure that the gateway can successfully receive data from any sensors that are intended to be assigned to it.

Installation Guidelines

Place the gateway close to the proposed location where the gateway will be installed. This exercise is to ensure the proposed gateway location is sufficient to receive data coming from the linked sensors.

- The gateway should be as close to the equipment being monitored as possible
- Place the gateway as high as possible above the level of the equipment
- Direct line-of-sight to the equipment works best, but is not essential
- Objects between equipment and the gateway
    - The gateway will still work with objects between the gateway and the equipment/sensors
    - The thickness, metallic properties and number of objects will have an impact on the ability of the gateway to receive signals from the sensors
    - High voltage/current power lines close to the gateway will negatively impact range
- It may be necessary to move the gateway after the sensors are installed to ensure optimum signal strength
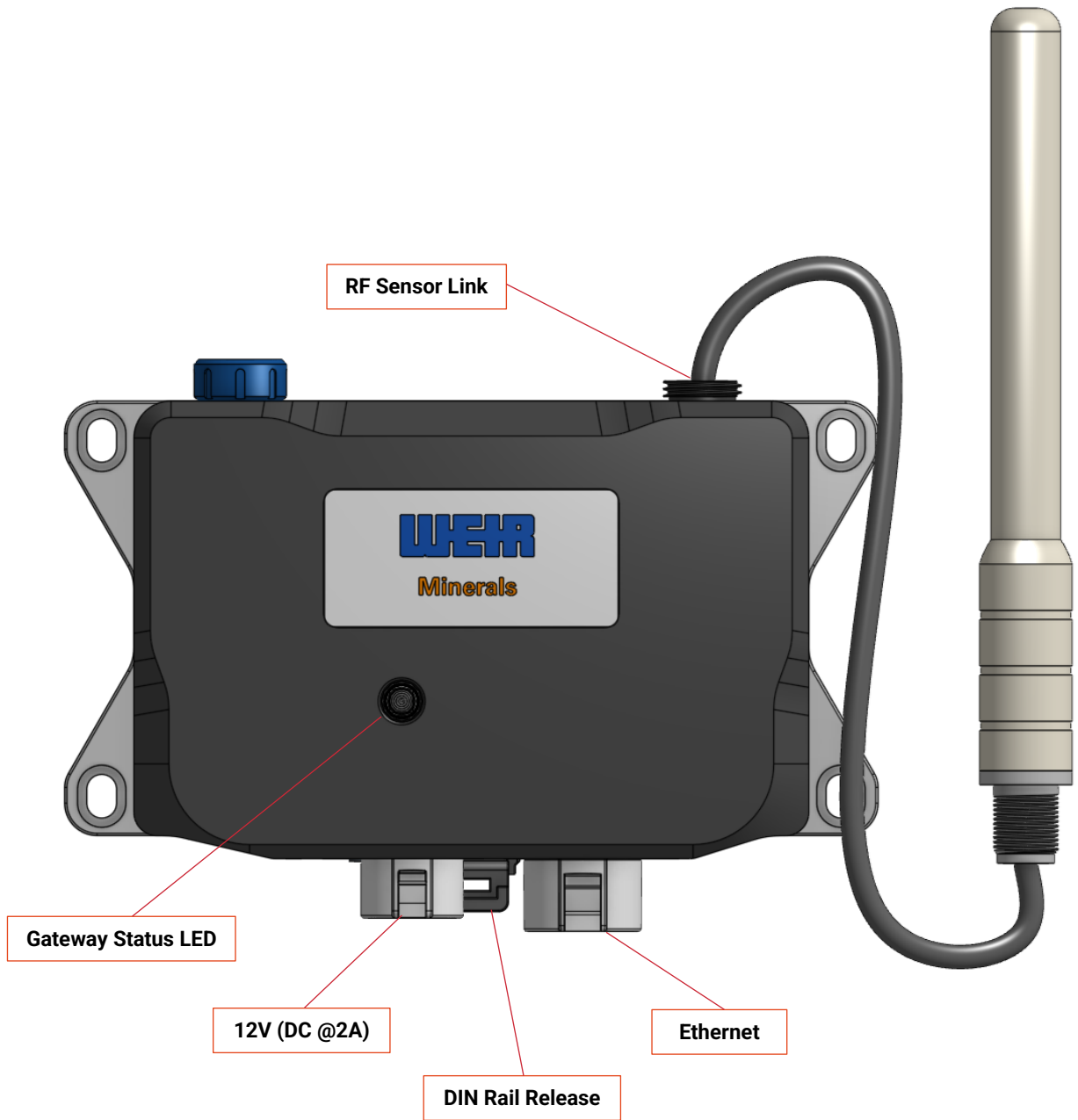- Further information is available in the following sections

Figure 4. Gateway Features

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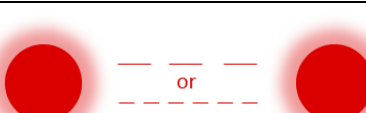**Author** Ciarán Caldwell /
Martin McNeill

Gateway Modes

The first step in setting up a gateway is to understand what mode it is currently in.

1. Power gateway using 12V power cable provided
2. Connect ethernet cable from gateway to PLC
3. Check gateway LED for connection status

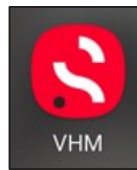Gateways have several modes denoted by the LED colour:

Colour	Description	Meaning
	Dark blue Solid	**Connected to Ethernet (No Internet)** The device is connected to Ethernet with no internet connection. **BLE Listening Mode** The gateway is in advertising mode.
	Dark blue Pulsing	**No Wi-Fi Credentials** No WiFi configured, please connect to the device and set WiFi credentials.
	Cyan Slow "Breathing"	**Connected to Cloud** Working as expected.
	Cyan Fast blink	**Searching for Cloud** The device is connected to WiFi and internet is available. Attempting to connect with Sensoteq cloud services
	Bright Green Fast blink	**Searching for WiFi** The device is attempting to connect to WiFi. If it remains in this state for more than 3 minutes please see your IT administrator.
	Magenta Fast blink	**System: Firmware Updating** The gateway is performing an update of its firmware. This is an automatic process.
	Red Fast blink or Slow Flash	**System: Fault Detected** The gateway will attempt to restart automatically. If this pattern persists, please contact Sensoteq.

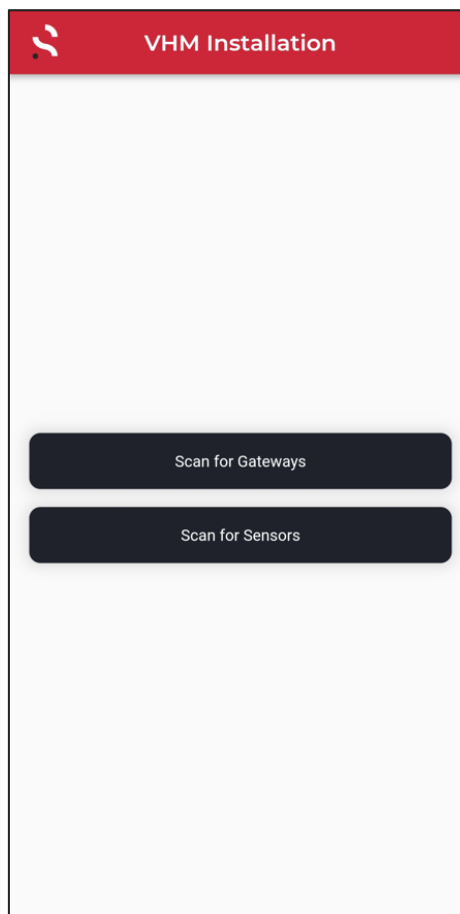Do not disconnect the Gateway power while Firmware update is in progress (Magenta)

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5. Using the Sensoteq VHM App

- Download the Weir VHM App from:

    o Available apk

    o Google Play Store
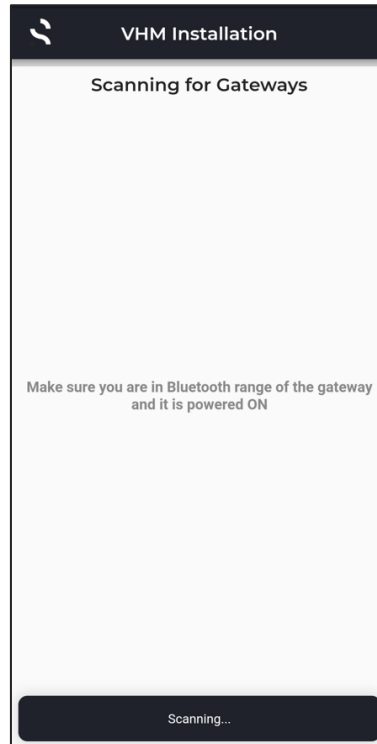
    o App Store

- Open the **Weir VHM App**

- From the **VHM Installation** home screen, there are options to either **Scan for Gateways** or **Scan for Sensors**

a) Connect to a Gateway

- Press the **Scan for Gateways** button on the VHM Installation home screen

- Press the **Scan** button on the Scanning for Gateways screen

- Gateways that have been found will appear in a list. These can be pressed to select or use the scan button to rescan for gateways
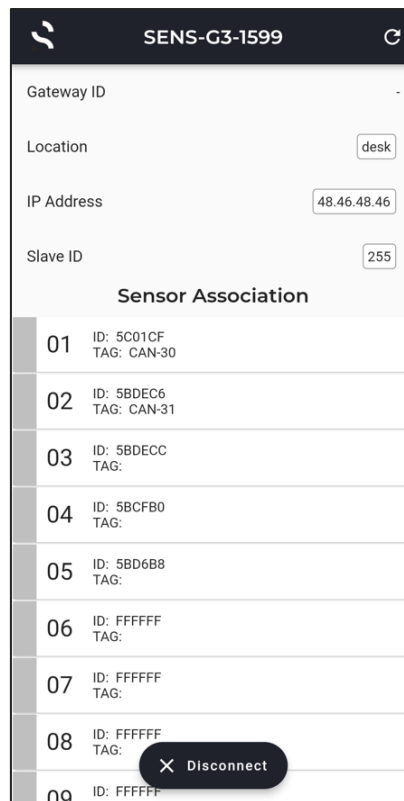
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- When a gateway has been selected, it will display details of the gateway and also the sensors associated to it


- The gateway and sensor details can be modified by selecting the chosen option

- On the Sensor Association list:

    a. Sensors highlighted in **Blue** indicate that sensor data has been updated

    b. Sensors highlighted in **Grey** indicate that the sensor has not been seen for 120 minutes or more

    c. Sensors highlighted in **Purple** indicate that the sensor battery level is low. The low battery tag will take priority over the blue or grey tags

- To disconnect from the gateway, press the **Disconnect** button at the bottom of the screen

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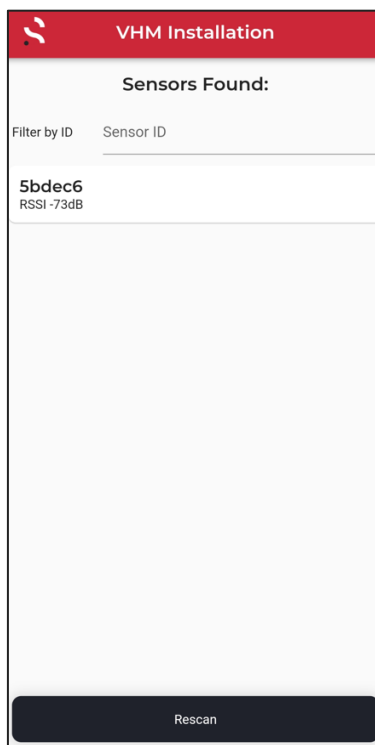**Author** Ciarán Caldwell /
Martin McNeill

b) Connect to a Sensor

- Press the **Scan for Sensors** button on the VHM Installation home screen

- Press the **Scan** button on the Scanning for Sensors screen
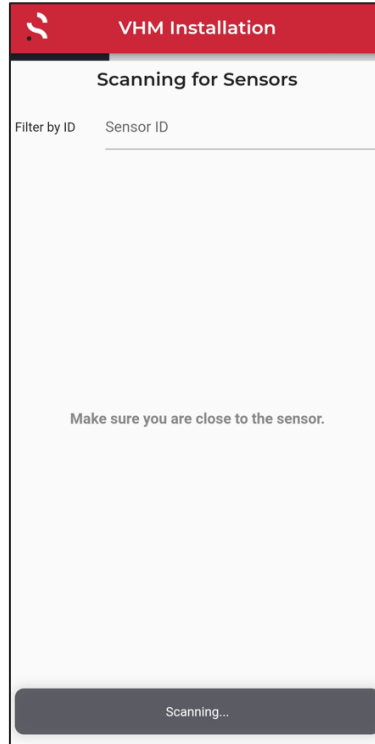
- Sensors that have been found will appear in a list. These can be pressed to select or use the scan button to rescan for sensors
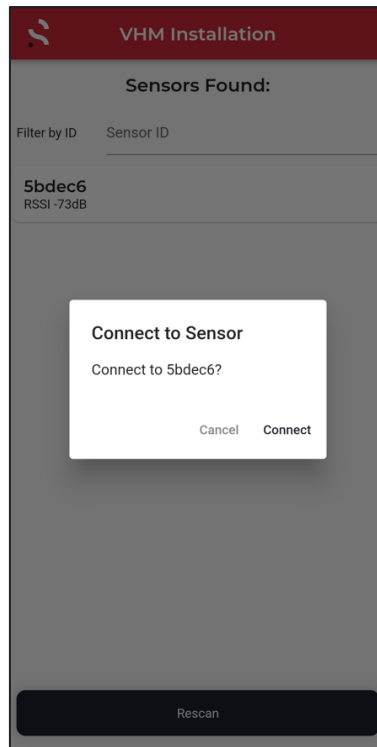
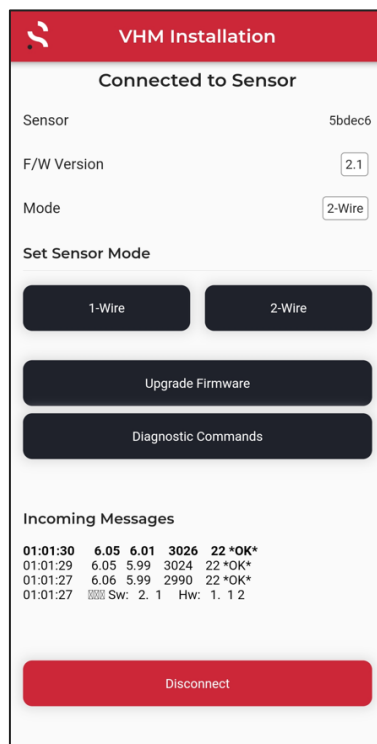- When a sensor has been selected, it will ask you to confirm that you wish to connect to the sensor. Press the Connect button

- When a sensor is connected, it will display details of the sensor and some configuration options

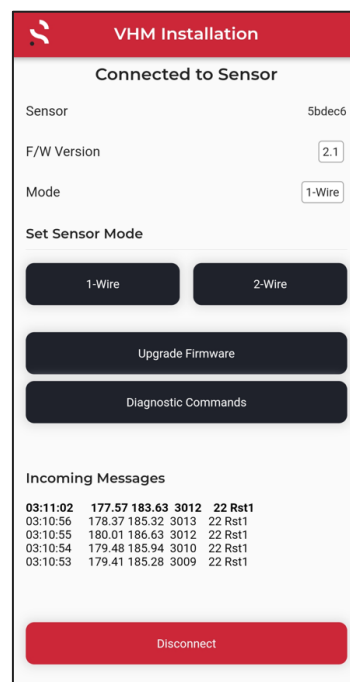- Live Incoming Messages are displayed at the bottom of this screen

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c) Select Sensor Mode

1-Wire Mode

- To put the sensor into 1-wire mode, press the **1-Wire** button
- When a sensor mode has been selected, it will ask you to confirm that you wish to update the sensor mode to '1-Wire'. Press the **Continue** button
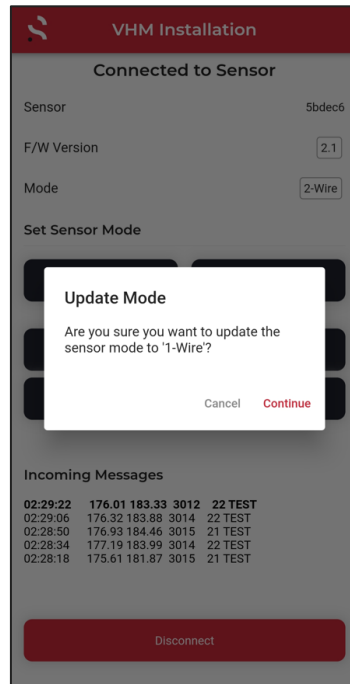
- The sensor mode will update to 1-Wire after a period of time, and the Incoming Messages will show the sensor is set to **Rst1** when there are no valid resistances across either coil
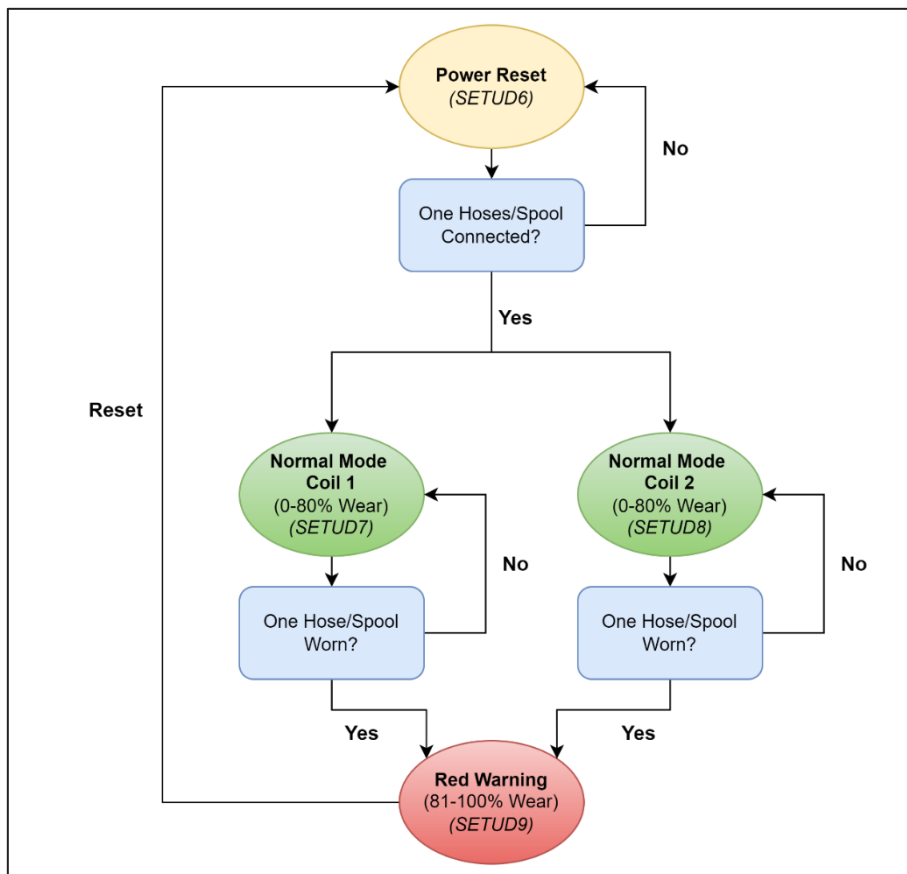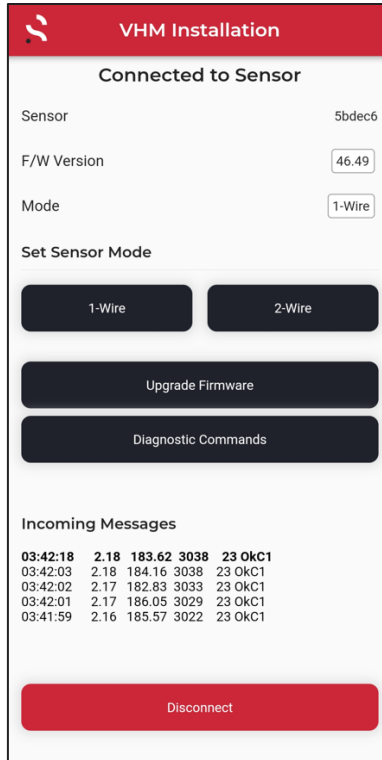
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- The sensor mode will change to **'OkC1'** or **'OkC2'** when 6 valid resistance samples are detected across either Coil 1 or Coil 2 respectively, and the **Green LED** will flash
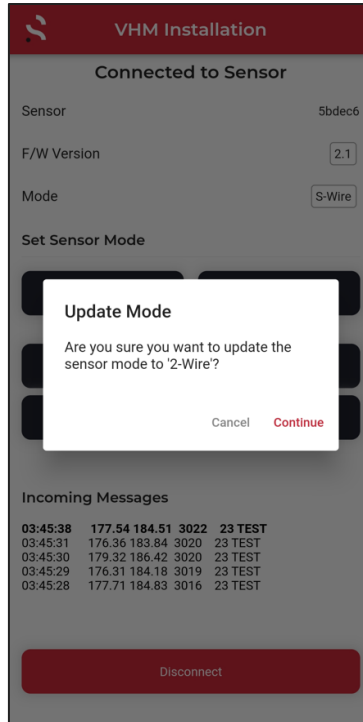
2-Wire Mode

- To put the sensor into 2-wire mode, press the **2-Wire** button
- When a sensor mode has been selected, it will ask you to confirm that you wish to update the sensor mode to '2-Wire'. Press the **Continue** button

- The sensor mode will update to 2-Wire after a period of time, and the Incoming Messages will show the sensor is set to **PRST** when there are no valid resistances across either coil

- The sensor mode will change to **'OK'** when 6 valid resistance samples are detected across Coil 1 and Coil 2, and the **Green LED** will flash

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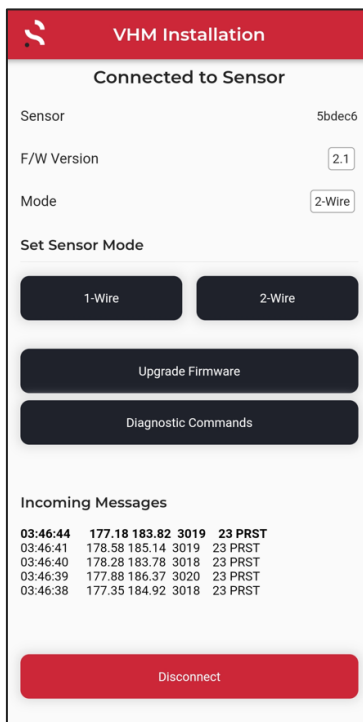**Date** 23/08/2023
Author Ciarán Caldwell /
Martin McNeill

d) Sensor Diagnostic Commands

- To select a sensor diagnostic command, press the **Diagnostic Commands** button

- The diagnostic commands are shown below. Incoming messages are also displayed at the bottom of this screen
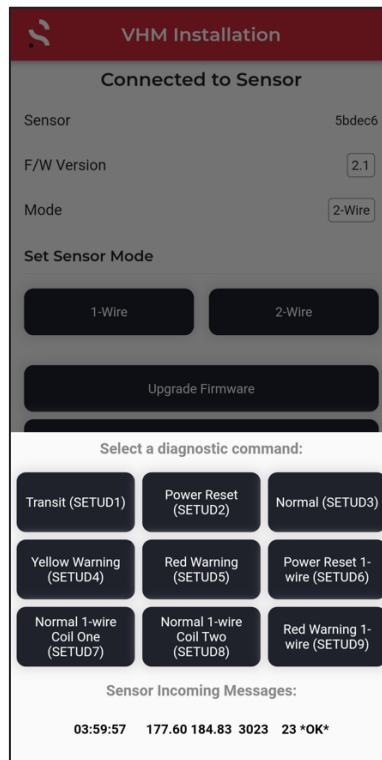
- When an option is selected, the button will turn **red** for a few seconds. The sensor will transition to the selected diagnostic state after 6 valid samples
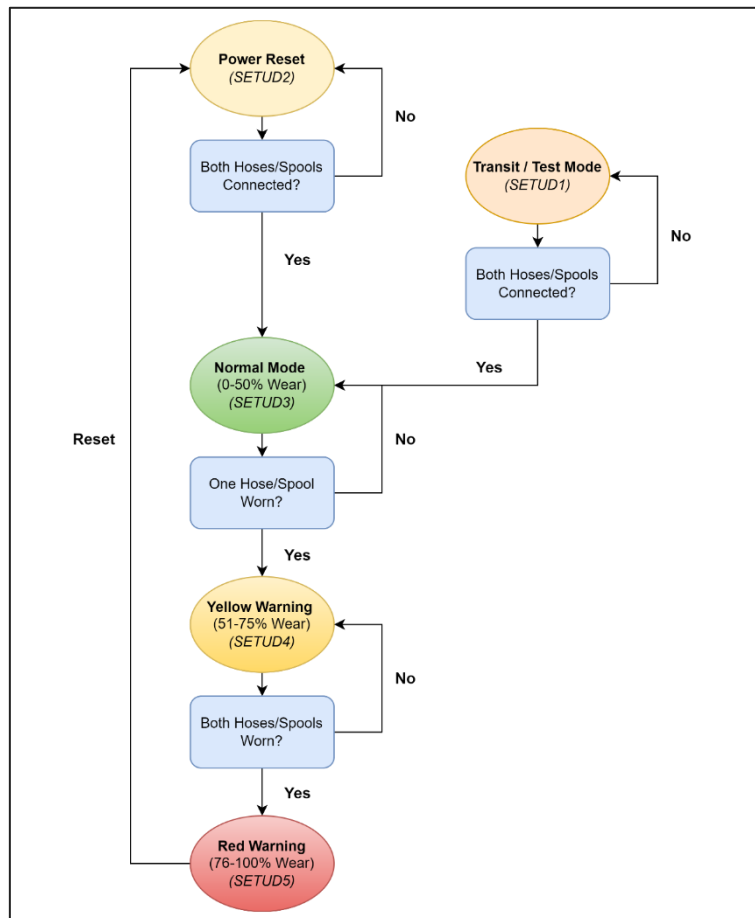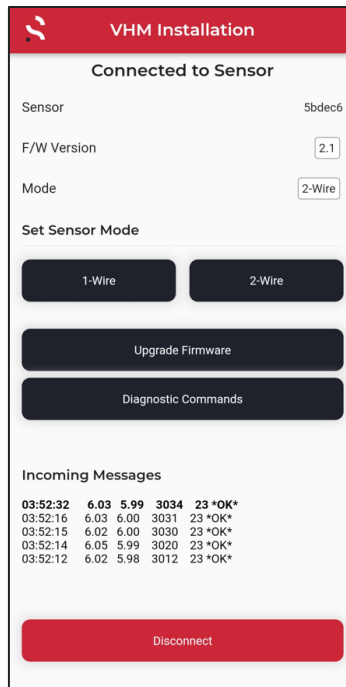
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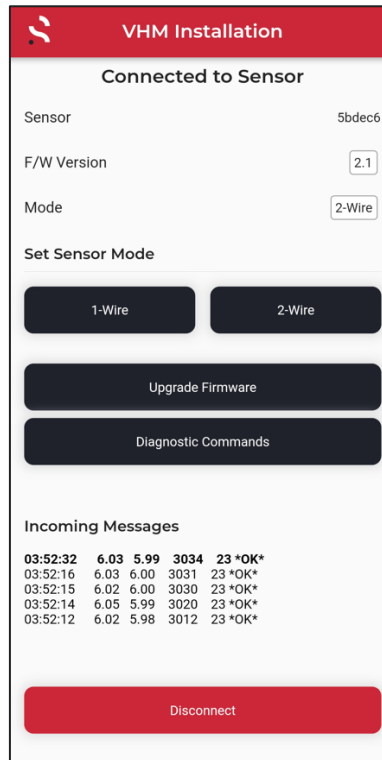**Date** 23/08/2023
Author Ciarán Caldwell /
Martin McNeill

e) Upgrade Sensor Firmware

- To load new firmware onto the sensor, press the **Upgrade Firmware** button from the Connected to Sensor screen
- On the Upgrade Firmware screen, press the **Select File** button

- Select the appropriate zip file
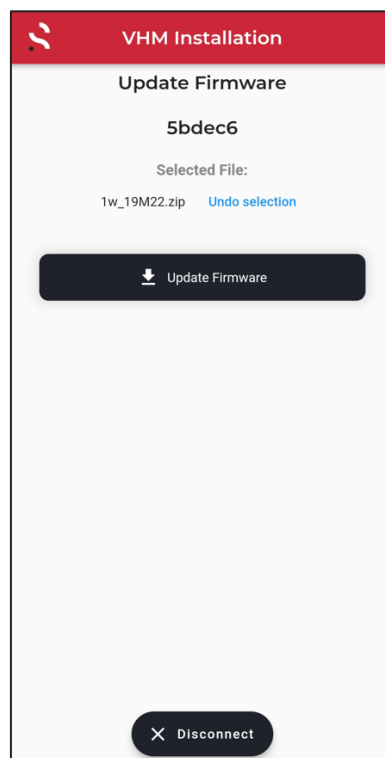
- Press the **Update Firmware** button and the firmware will begin updating. The Sensor will have the **Yellow LED** on for a few seconds during this operation. Once finished, the **Update Complete** message will appear
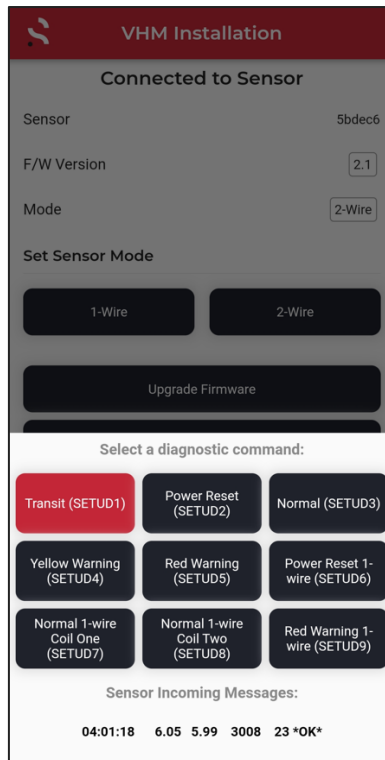
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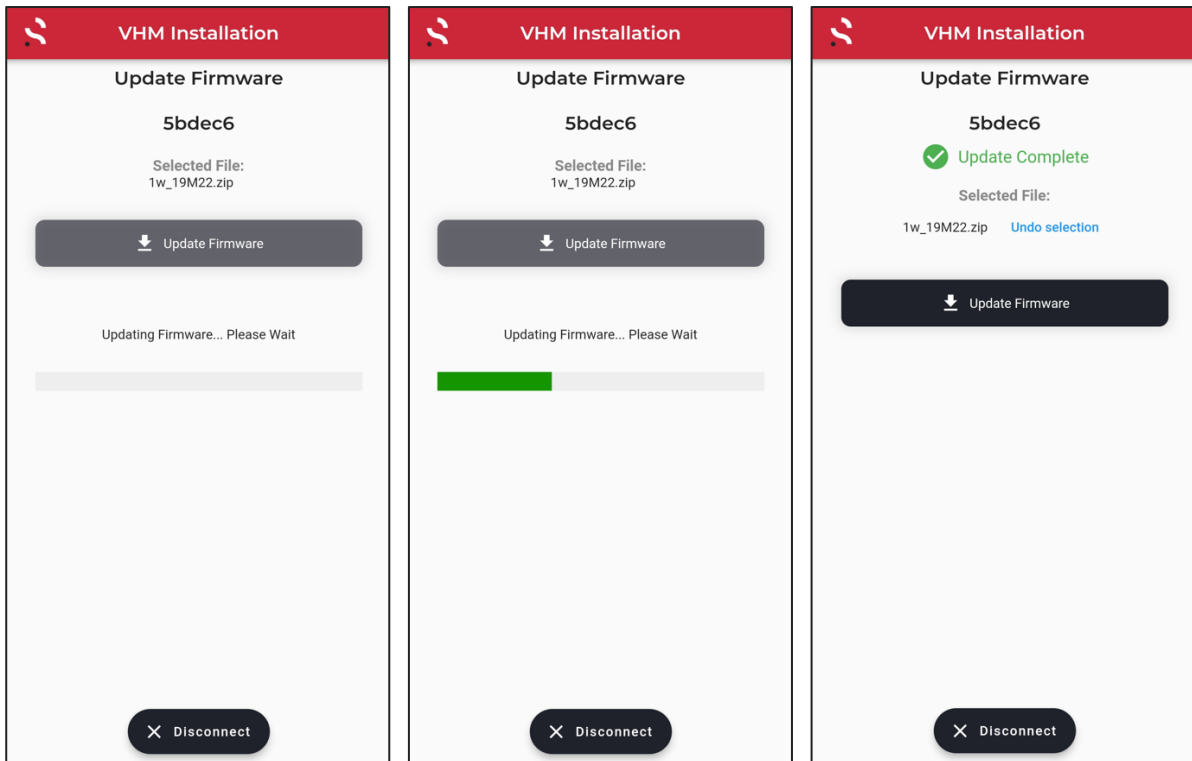
6. Understanding RF Range

Strong Signal

Weak Signal

Line of Sight (LoS)
Direct line of sight between the sensor and gateway will work up to 100m in optimum conditions. As distance increase the RF energy will decrease.

Indirect or structural blockage
Any object that blocks the path from the sensor to the gateway will reduce the range. It is best to place the gateway on the same side of the structure as the sensor.
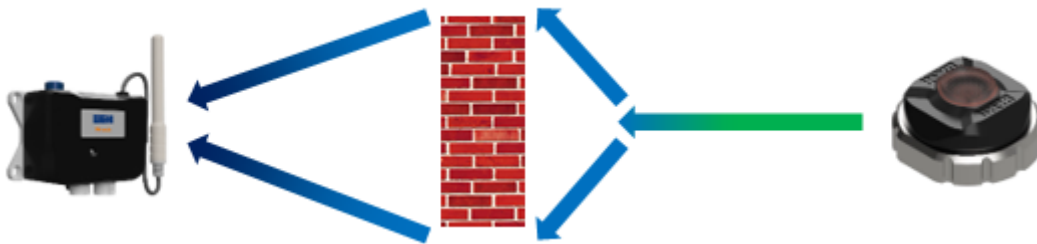
Sensor within protective housing
If the protective housing is made from plastic or a thin gauge metal with ventilation or other holes then there is a good possibility that RF will be received outside the housing. Range will be impacted.

Line of Sight with metal surroundings
Any additional metal surrounding the sensor will attenuate the signal, even if you still have direct line of sight. Range will be impacted.

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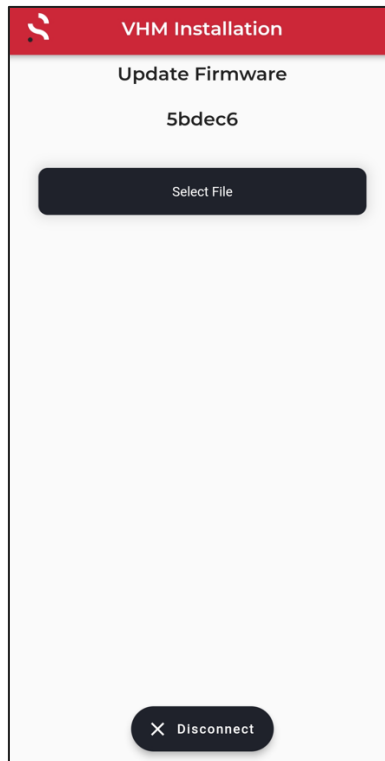**Date** 23/08/2023
Author Ciarán Caldwell /
Martin McNeill

7. Sensor Configuration

The sensor measures the resistance of the wires embedded in the hose/spool. Resistance values of ~12 ohms or less indicate that the wire is unbroken. Values over 12 ohms indicate a broken wire.

The sensor can be configured to measure either 2 wires or 1 wire embedded in the hose/spool depending on the system requirement.

Using the **VHM** app, BLE commands can be sent to the sensor to configure it into the desired mode. These are listed in the following flowcharts (i.e. SETUDX with the X replaced by a number).

Below are a list of the BLE commands that can be sent to the sensor to configure into the desired mode.

'SETUD' | '0 ' - SW reset
        | '1' - Enter Transit mode (TEST MODE, long transit to Normal)
        | '2' - Power Reset mode (Quick transit to Normal)
        | '3' - Normal mode
        | '4' - Yellow Warning
        | '5' - Red Warning
        | **'6' - Power Reset 1-wire (for Quick transit to Normal 1-wire)**
        | **'7' - Normal mode 1-wire Coil ONE**
        | **'8' - Normal mode 1-wire Coil TWO**
        | **'9' - Red Warning 1-wire**

Figure 5. Sensor BLE Commands

There is a delay of around 5 minutes from Reset to normal mode to allow handling time of the sensor.

The Sensoteq VHM app includes buttons pre-set with the above commands and allows for firmware upgrades. The VHM app also allows switching between 1-wire and 2-wire modes.

Note: *Sensors are shipped in Transit mode for battery saving. When wires are connected and the sensor measures a valid resistance, it will stay in Transit mode for 10 minutes (Green LED flashing every 30 seconds) and then transition automatically to Normal mode.*

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2-Wire Mode

In 2-Wire mode the sensor measures the resistance/inductance of 2 wires which are embedded at thicknesses of approximately 50% and 75% in the hose/spool.

Figure 6. 2-Wire Configuration Flowchart

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1-Wire Mode

In 1-Wire mode the sensor measures the resistance/inductance of 1 wire which is embedded at a thickness of approximately 80% in the hose/spool.

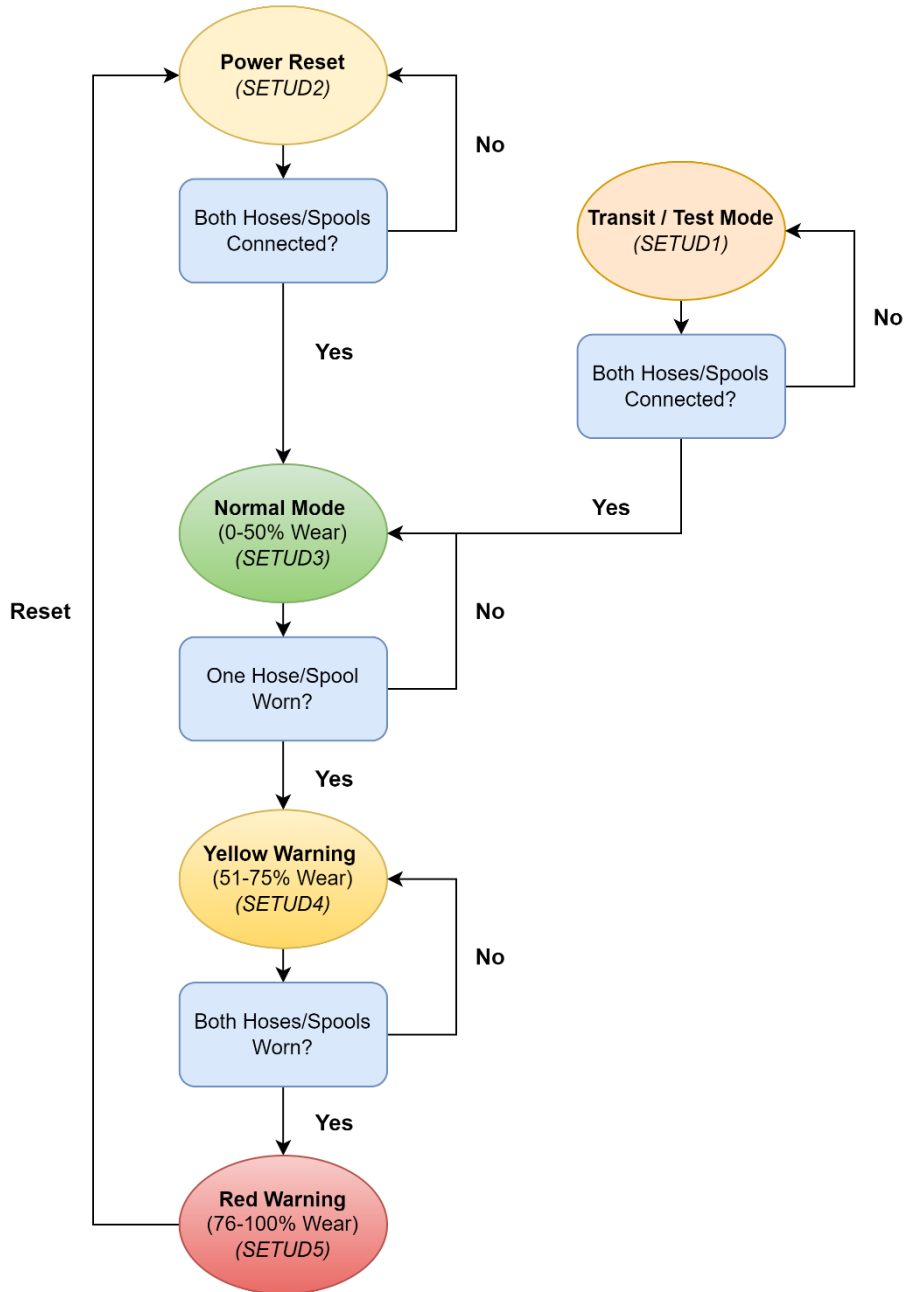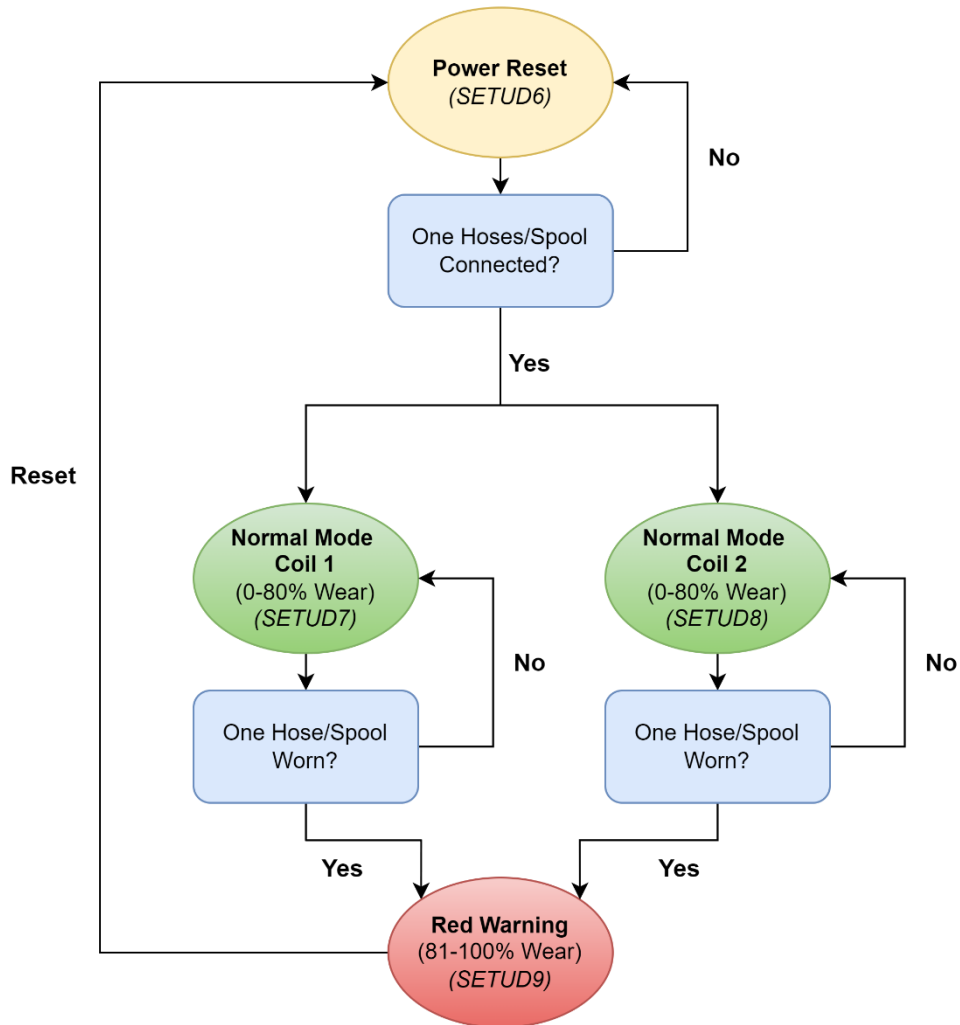*Figure 7. 1-Wire Configuration Flowchart*

8. Install the Sensor

Sensor on Hose

Below is an example of the hose sensor after installation, the sensor should be screw down until it is hand tight. For further instruction refer to OEM documentation.

Figure 8. Hose installation

Sensor on Spool

Below is an example of the spool sensor after installation, the sensor should be screw down until it is hand tight. For further instruction refer to OEM documentation.
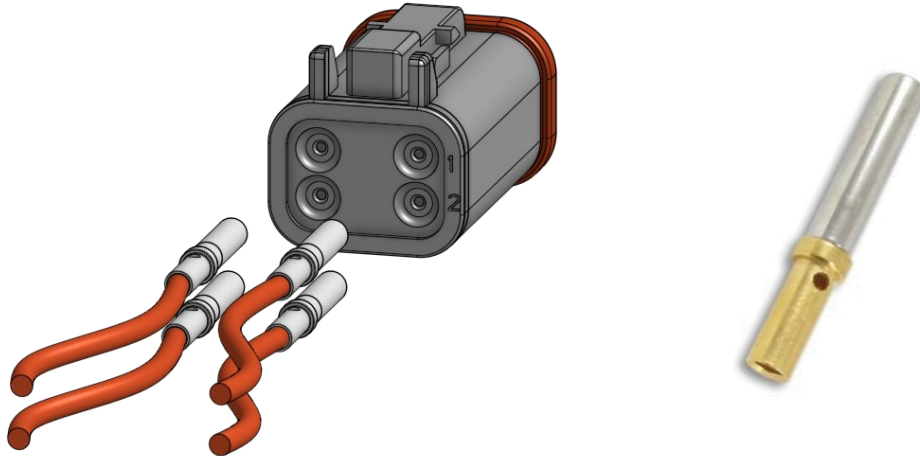

Figure 9. Spool installation

9. Wire terminal connection to hose/spool

Connecting the wear cable/wire from inside the hose/spool to the Sensor.

The supplied terminals and connector are shown below.

Use the correct crimp tool to crimp the terminal to the hose/spool wear indicator wire. Deutsch Tooling part number HDT-48-00

The hose/spool will have 4 wear indicator wires protruding from the sensor mount area.

These are paired as a coil 1 and coil 2 and are to indicate partially worn and fully worn.

The picture below shows the correct way to connect the wear indictor wires for the sensor to detect wear.
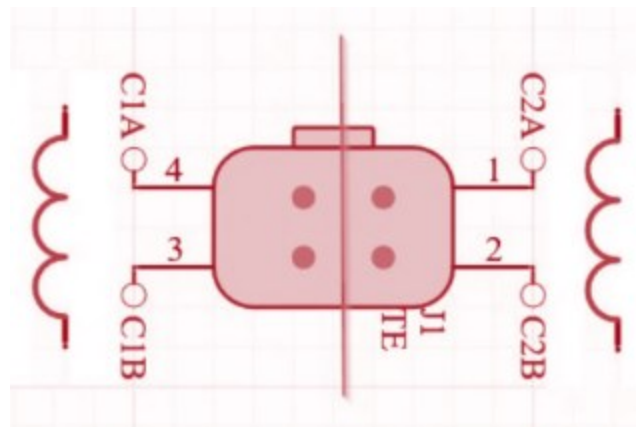
Connector locations 1 and 2 are to be connected to 1 of the wear indicator wires and locations 3 and 4 should be used for the remaining wear indicator wear.

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10. Install each Gateway

Now that the sensors have been installed, affix the gateways in a more permanent manner.

The gateway has two mounting options:
- Bolted/screwed
- DIN Rail
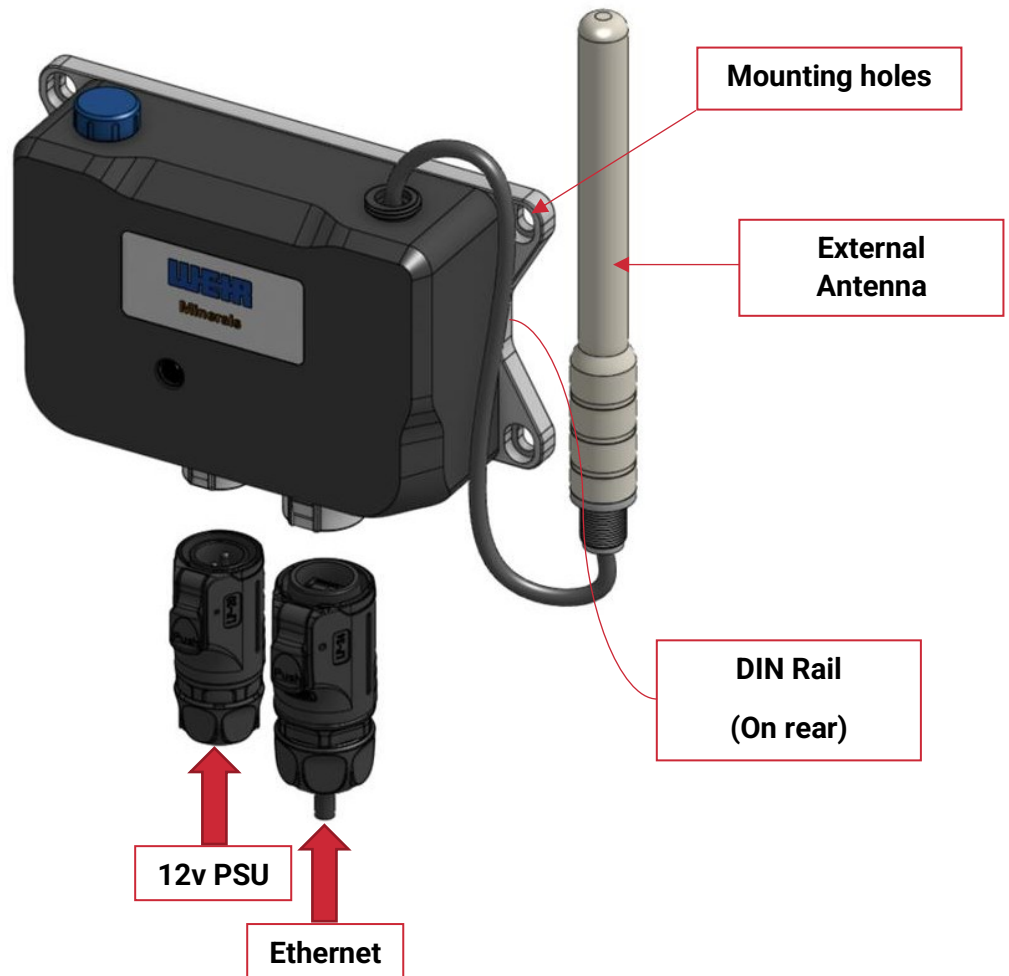
Figure 10. Gateway installation

The gateway is powered via a 12v connection. Please use the power supply connection cable provided.

If using an external power source, such as that within an enclosure or panel, ensure that it has capacity to provide 2A@12vdc.

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11. Troubleshooting

Please refer to the customer service email address below for additional support.

support@sensoteq.co.uk

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12   Regulatory Information

Note the label is located on the base of the sensor.

FCCID: 2ANL3SPR433TA   ICID: 23633-SPR433TA

Note : The approvals number label is located on the inside of the back cover

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.
WARNING: Changes or modifications not expressively approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with **Innovation, Science and Economic Development Canada**'s licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.
L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux **CNR d'Innovation, Sciences et Développement économique 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;
(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radiation Exposure Statement:
This equipment complies with FCC/ ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:
Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de 20 cm entre le radiateur et votre corps.