USER MANUAL

+ ULTRA TOUCH SMART DIGITAL ANALYSER

Model: ULTRA-TOUCH-DSS
Software version: 1.3.0

Manual Version 1.5 - 12/12/2023

Table of Contents

Essential Information

Turtle Tough designs, manufactures and tests all its products to meet many national and international standards. As these devices are sophisticated and complex technical products, they must be appropriately installed, used and maintained to ensure that they continue to operate within their normal specifications. The following instructions must therefore be adhered to and integrated into your safety program while installing, using, and maintaining Turtle Tough analysers. Failure to follow these instructions may lead to personal injury, damage to this instrument and warranty invalidation.

Safety Precautions and Warnings

- Qualification and Training of Personnel ⚠
  - The individuals responsible for tasks such as installation, operation, inspection, and maintenance must possess the necessary qualifications and skills for these specific duties.
  - The owner must clearly outline the areas of responsibility, competence, and supervision for the personnel involved. It is essential to provide training and instructions to individuals who lack the required expertise to ensure they acquire the necessary knowledge and skills.

- Incorrect Use of Device and Unauthorised Modifications
  - Impermissible modes of operation usage other than as described in this manual, and any modifications made to the device will lead to the immediate cancellation of the warranty and any other manufacturer's liability.

- Chemicals ⚠
  - Use extreme caution when handling chemicals and ensure that the accident prevention regulations applicable on site must be observed and the specified personal protective equipment worn.
  - Additionally, ensure that the electronic components of the device are not in contact with chemicals at any time during usage, storage, or maintenance.

- Environmental Considerations
  Kindly utilize this product in an environmentally conscious manner, being mindful of its impact on the surroundings. When the product reaches the end of its lifespan, please dispose of, or recycle it appropriately in compliance with local regulations.

- Operational Safety ⚠
  - Before making or breaking any electrical or signal connections, ensure that the instrument is isolated from the electrical supply.
  - Under no circumstances should you operate damaged products. It is crucial to safeguard them against inadvertent operation. If a product is found to be damaged, promptly label it as defective and take the necessary steps to prevent its use or further damage.

- Electrostatic Discharge (ESD) Sensitivity and Protection ⚠
  - Our product is sensitive to Electrostatic Discharge (ESD), which can pose dangers to its functionality and reliability.
  - To protect the device from potential ESD-related issues, it is highly recommended to observe proper ESD precautions and use appropriate ESD protection measures when handling, installing, or servicing the product.

- Electrostatic discharge can result from activities such as handling electronic components, connecting, or disconnecting cables, or working in environments with static electricity. Failure to address ESD risks can lead to damage to the device's internal components and affect its performance.
- To minimize the risk of ESD-related damage, personnel should use ESD-safe equipment, such as antistatic wrist straps and mats, and follow established ESD control procedures during all phases of the product's lifecycle. Training in ESD safety practices is essential for individuals involved in handling the device.

Notice:

This manual is a crucial guide for end users, providing essential information for understanding and using the associated product. Users should note that the manual's contents may change without notice, underscoring the importance of consulting the latest version. Reproduction or copying, in whole or part, is strictly prohibited without permission. While the manual explains product functions, it doesn't guarantee suitability for specific purposes. Deviating from specified usage may compromise product safety. For more details on sensors and Turtle Tough devices, consult the product pages on the Turtle Tough website.

1. Introduction and General Description

The ULTRA TOUCH Smart Digital Analyser is a machine designed for industrial process monitoring, measurement, and control applications. This instruction manual contains the information needed to install, set up, operate, and maintain the unit correctly. This manual also includes a basic troubleshooting guide to handle typical user questions.

Figure 1 - Analyser overview

1.1. Features and Applications

The main features of the ULTRA Touch Smart Digital analyser are:

- Next Generation Software Intelligence: The integrated software empowers users to interact effortlessly with the device, requiring minimal prior training. The software enriches the user experience with valuable functionalities, including trend graphs, enhanced security through password protection, and an error log to aid in understanding and resolving any issues encountered during operation.

- Plug 'n Play Connectivity: The analyser incorporates quick-connect plugs, facilitating seamless hot swapping of sensors. This feature enables easy and efficient attachment and detachment of sensors to the analyser, made possible by the software's auto-recognition capability.

- Intuitive 7" Touch Screen: The device features a user-friendly 7-inch touch screen, offering effortless interaction with the analyser. The LED screen provides a wide viewing angle, ensuring clear visibility from indirect positions. Additionally, an optional dark mode feature is available for use in high-brightness environments, enhancing user comfort and readability.

- Compatibility Range: The Ultra Touch analyser is designed to seamlessly interface with all Turtle Tough Digital Smart Sensors. Upon connection, the analyser automatically identifies each sensor type, enabling the software to customize relevant screens accordingly.

- Analogue Output Control: For each connected sensor, the device offers a 4-20mA output, which

can be customized as per the user's requirements.

- **Digital Output Control:** There is a dedicated Modbus (RTU) RS485 output channel which can be used to poll sensors connected to the analyser. The output configuration can be customized as per the user's requirements.

- **Data Logging:** This feature allows the user to log all readings from any connected sensors at user selected time intervals. This data is stored in an easily accessible internally located USB drive in the form of a CSV file.

- **Sensor Diagnostics:** The analyser incorporates sensor diagnostics capabilities, enabling users to monitor the health status of connected sensors. This includes information on the date of the last calibration and the current sensor accuracy. *(This feature is only available for pH sensors)*

These features collectively contribute to the Ultra Touch analyser's advanced functionality and are described in more detail in **section 3**.

1.2. General Specifications

Specification	Description
Input Voltage	100-240VAC (DC option available)
Analogue Outputs	4-20mA (customisable)
Digital Outputs	Modbus (RTU) RS485 (customisable)
Digital Sensor Input channels	1 to 4 (as requested by user)
Dimensions	254mm x 204mm x 152mm (10"x 8" x 6")
Weight	3.5kg
Enclosure Material	Polycarbonate
IP Rating	IP68
NEMA Rating	NEMA 4X
Operating Temperature	-25°C to 55°C (-13°F to 131°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)

2. Installation

2.1. Instrument Check

Upon delivery, unpack the instrument carefully and inspect it to ensure that it has not been damaged during shipment. If any damage is found, retain the original packing materials, and immediately notify the carrier and the relevant Turtle Tough sales office.

Make sure the device description label affixed to the side of the analyser agrees with the model number in your order. An example of a product label is shown below.

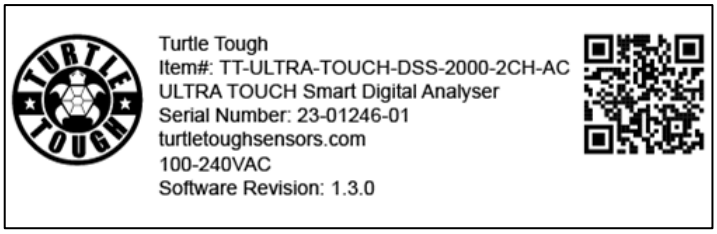


Figure 2 - Product Label of a 2-channel analyser

2.2. Site Selection

When selecting the optimal mounting location for the ULTRA TOUCH analyser, several factors should be carefully considered, as outlined below (Please note that this list is not intended as a definitive checklist, nor does it cover all possible considerations):

- Ensure that the mounting location allows access to all serviceable parts and unobstructed visibility of the QLED panel. The base mount of the analyser allows for panel or surface mounting.
- While the analyser is suitable for outdoor use, do not install in direct sunlight or in areas of extreme temperatures.
- Install the analyser in an area where vibration, electromagnetic interference and radio frequency interference are minimised or absent.
- It is recommended to position the electronics in a manner that minimizes exposure to frequent hosing during cleaning processes.
- Consider requirements for calibration and maintenance processes and ease of access to necessary equipment.

NOTE: The choice of installation site involves certain compromises, and it is advisable to seek the assistance of an experienced installation engineer to determine the most suitable location for installation on any given site.

2.3. Mounting Methods and Dimensions

The ULTRA TOUCH analyser has universal mounting capabilities and as such can be mounted in the following methods:

- Panel mounting using fixed brackets.
- Surface mounting on a plate (using bolts from the back).
- Wall mounting on a bracket.
- Pipe mounting using a bracket on a horizontal or vertical pipe of suitable strength.

The dimensions of the analyser play a pivotal role in the identification of mounting method and location. (Refer to Appendix B – Dimensions)

2.4. Wiring ⚠

2.4.1. General Information

All wiring connections of the analyser are self-contained and located inside the NEMA enclosure. The front panel is hinged and would need to be opened to access the wiring locations.

2.4.2. Power Supply Wiring

NOTE: Make sure the power supply is switched off and that the power supply is of the correct type and agrees with the voltage specified on the product label sticker.

Please replicate the wiring at the "INPUT" end of the power supply according to the image provided in Figure 03. To ensure proper installation, pass the cable through the M20 cable gland into the enclosure and securely fasten it after completing the connections.

Figure 3 - Power Supply Unit Wiring to be done before use.

2.4.3. Wiring the Analogue and Digital Output Signals

The designated wiring terminal for the Analogue and Digital output of each channel is labelled on the DIN rail mounted terminal block. The terminal blocks are equipped with a spring-loaded mechanism and are clearly labelled for each individual channel and can be accessed via the method shown in the figure 4 below. To ensure proper functionality and safety of the device, it is essential that the connected wires be routed through the M16 cable gland and firmly secured before utilizing the equipment.

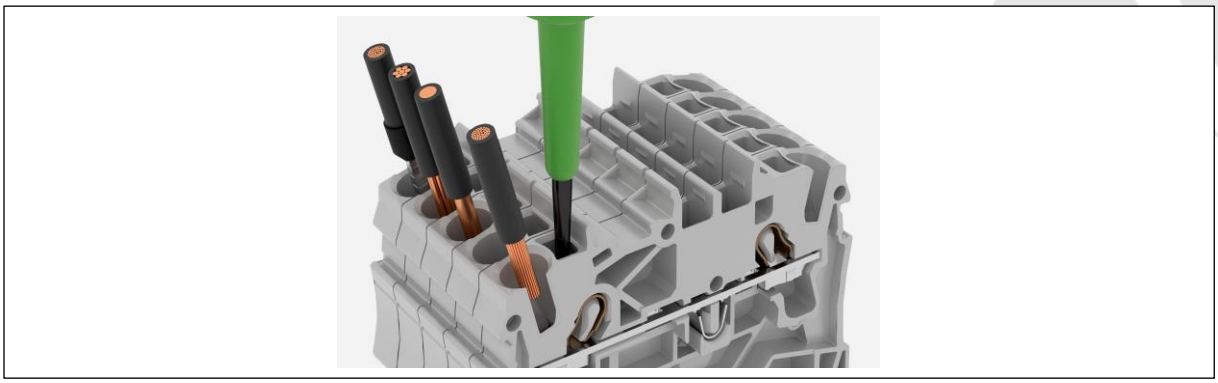


Figure 4 – Inserting wires into the DIN rail mounted terminal blocks.

2.4.4. Sensor Connections

The sensors do not require any separate wiring. They are simply connected to the externally located 4-pin female plugs sockets using the quick connect plug on the sensor cable. Each 4-pin socket will be labelled with its channel number and the specified sensor type (if applicable).

Figure 5 – 4-Pin female quick connect sockets for the sensors outlined by the red box.

3. Display and Operation

3.1. Basic Setup

Before initiating any operations on the analyser, it is crucial to ensure that the device is appropriately configured. Follow the step-by-step instructions below to set up the device:

1. Power up the device.
2. Once the **Home screen** is displayed, press the **Settings** tab.
3. Proceed to configure the **Date** and **Time** (The device will retain this information even in the event of a power loss for a period of up to 24hrs).
4. The **Administrator Password** and **Dark Theme** options are optional and dependant on user preferences. Additional details on these features can be found in **section 4.2** below.
5. By default, the **Data Logging** feature will be enabled. If required, you have the option to deactivate this feature or adjust the interval that the sensor data is logged to the USB drive by selecting any of the various options available.

   NOTE: If no sensor is connected to the analyser, the Data Logging feature will appear greyed out. However, once the logging interval is set, the configuration will be saved for future operations on the analyser.

Upon completion of the device setup, the analyser will save the configurations and apply the stored settings for any connected sensor going forward.

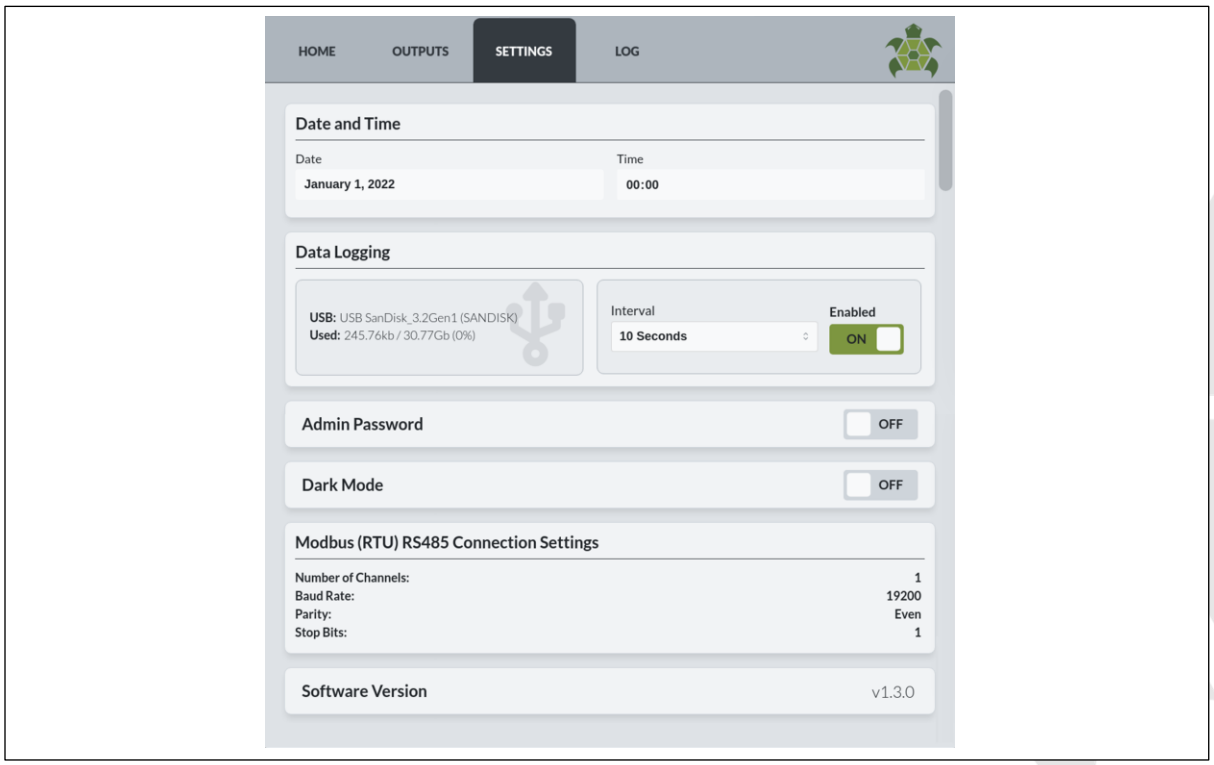


Figure 6 - Settings screen

3.2. Home Screen

The main display, also known as the Home Screen, shows the measurements of each connected sensor along with other information such as the type of sensor, the measurement temperature, the reading of the sensor in terms of mV values and the output current for that measurement (in mA) in the format shown below.

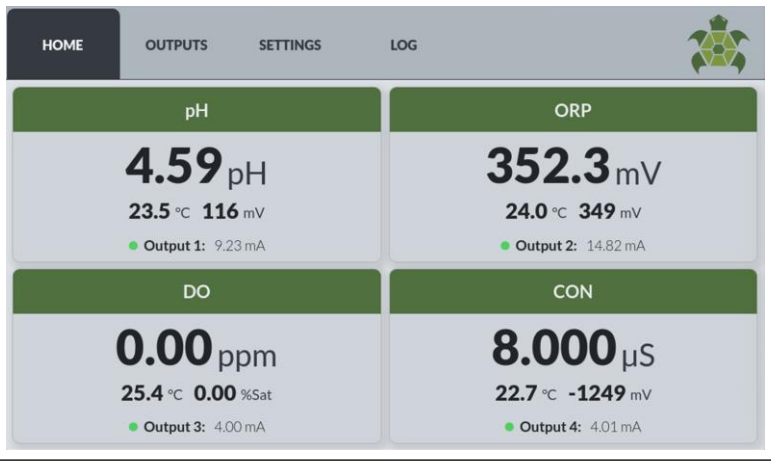


Figure 7 - Home screen with 4 sensors connected.

In the event where a sensor is disconnected from a channel, that channel will appear faded and display a symbol indicating that the channel has no device connected.

3.3. Trend Screen

Pressing the sensor reading or the green square on the bottom right of each sensor display changes the display into a graphical mode in which the average measured value is shown on an adjustable time scale. The "live" reading of the sensor is also digitally displayed on the left of the screen. By changing the Trend Period, you can scale the x–axis (timeline) to observe the sensor readings from 60 seconds up to 7 days (granted that the sensor was not disconnected from the analyser at any point during this period). The y-axis is automatically scaled depending on the sensor reading.

Figure 8 - Trend screen for the connected pH Sensor

3.4. Calibration Screen

This interface enables users to perform the essential calibration process on the sensor. For comprehensive details and step-by-step instructions regarding the calibration procedure, please refer Appendix A - Calibrations.

3.5. Diagnostics

The diagnostics screen provides comprehensive details pertaining to the sensor's health and current condition. Each type of sensor gives out different segments of information regarding its current condition and therefore this page will be automatically modified depending on the connected sensor.

The general information found on the diagnostics screen are slopes/offsets, sensor details (node addresses, sensor type, sensor number and labels etc.) and days since last calibration. (Figure 9)

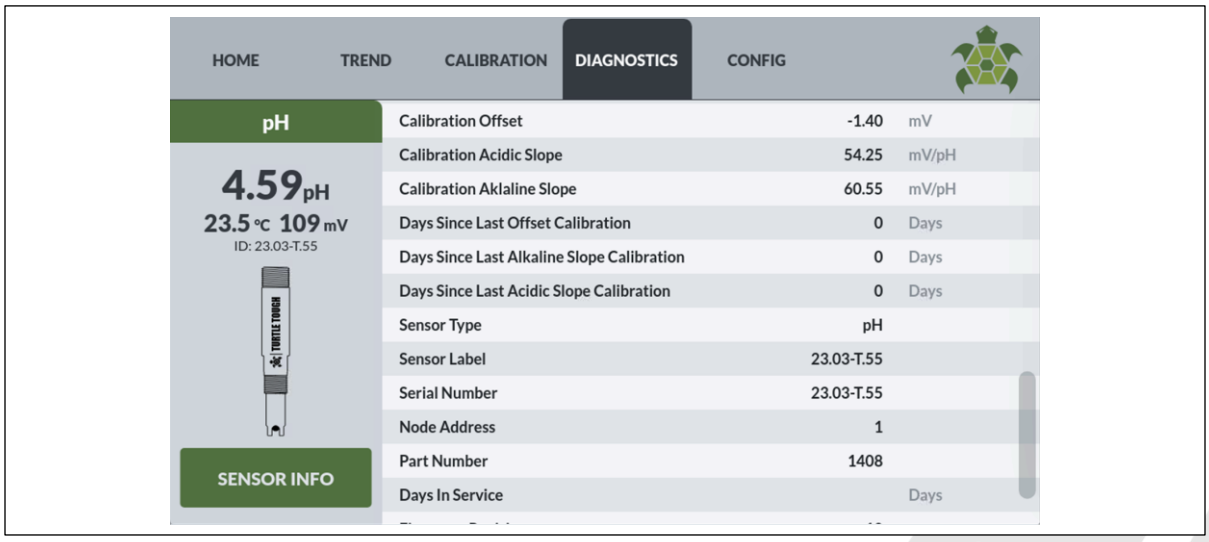


Figure 9 - General information on the diagnostics screen for a pH sensor.

The pH sensor allows the software to display a unique feature known as the "Health Score", which is a percentage value determining the sensor accuracy and performance. (Figure 9)

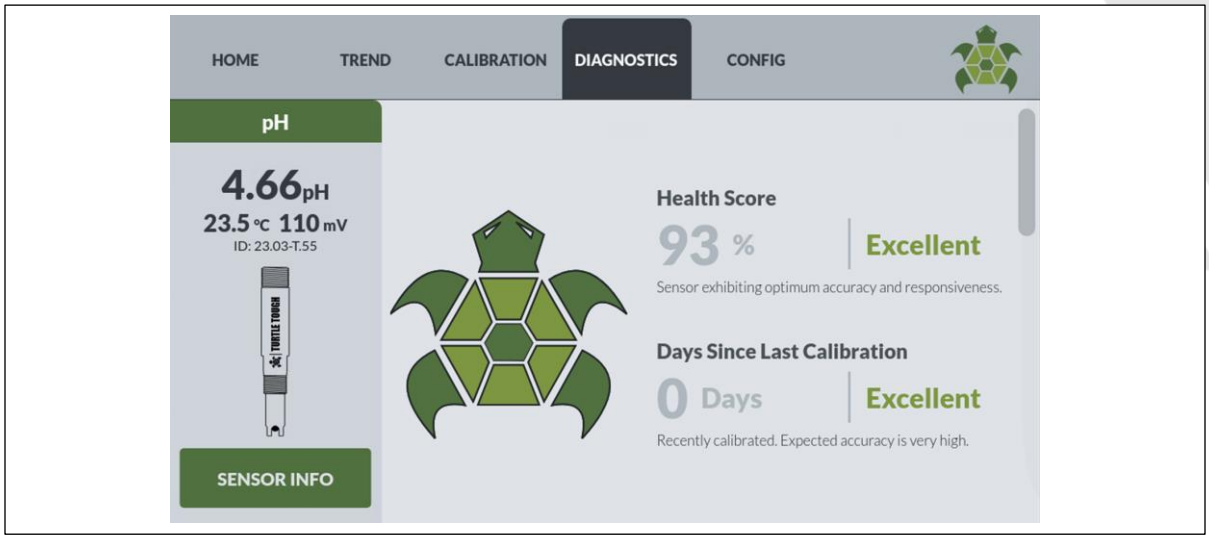


Figure 10 – Health score of the pH Sensor indicating current sensor status.

3.6. Configuration

The configuration screen is a sensor dependant screen which provides the user the option of changing the sensor settings. Although this screen is sensor oriented, every sensor gives the user the option to change the Node Address of the sensor, to aid in identifying the sensor uniquely.

Other settings that may be changed (not available for all sensor types) are:

- Sensor Dampener: The time which is considered when calculating the average sensor reading to be displayed.
- Sensor Output Delay: The time which the sensor takes before displaying its measurement after the device is booted up.
- Temperature Compensation Coefficient: The numerical factor used to compensate for variations in sensor readings caused by changes in temperature. This very rarely would require alteration from the default value.

Upon making any modifications, it is essential that the "SAVE" button is pressed to store and activate the updated configurations on the analyser.

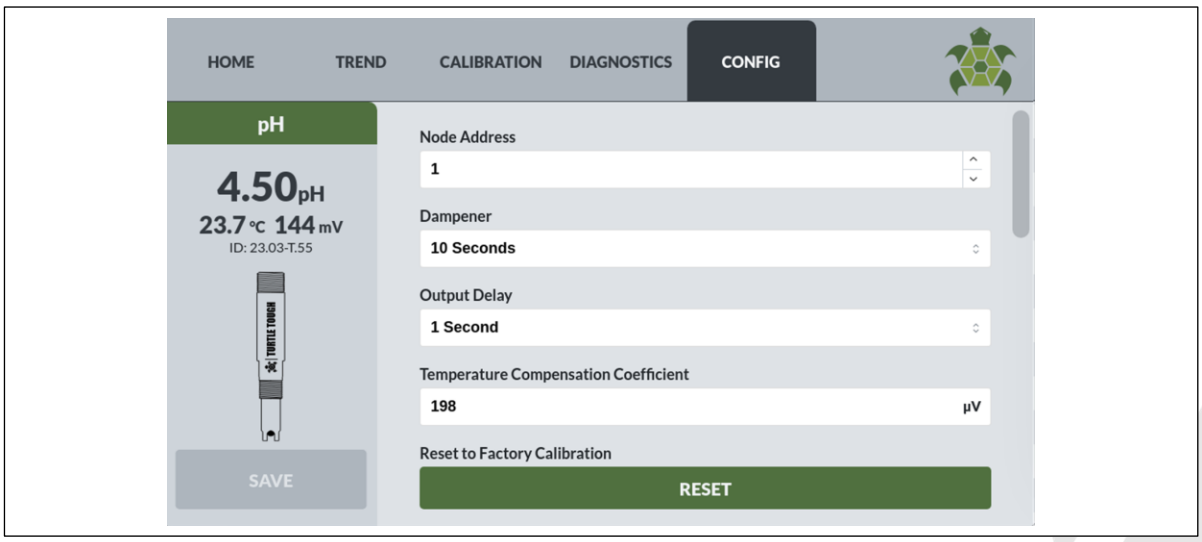


Figure 11 - Sensor configurations of a pH probe.

Within the configuration screen, users can access the "RESET" options situated at the lower section of the screen. These options provide the capability to reset specific sensor calibrations individually or perform a comprehensive reset of all sensor settings (excluding calibrations), reverting them to the original factory defaults.

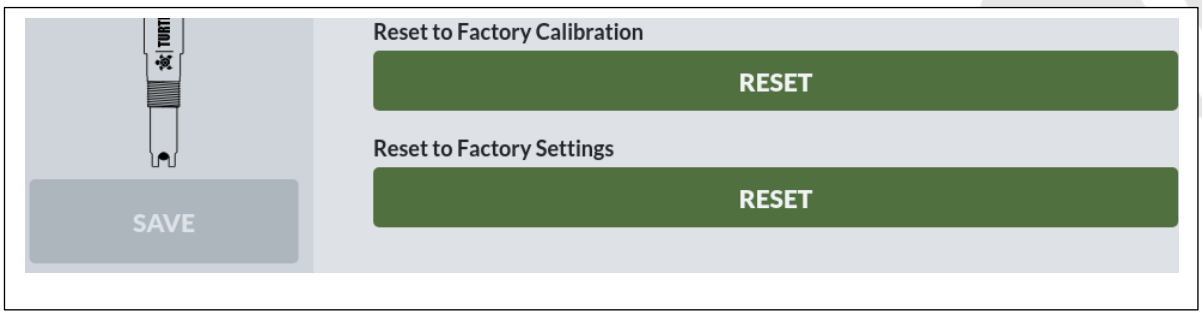


Figure 12 - Reset features.

4. Analogue and Digital Output

4.1. Analogue Outputs

The Ultra Touch analyser generates an Analogue output (with a default configuration of 4-20mA) corresponding to each sensor measurement. For details regarding the connections for these outputs, please refer to section 2.4.2.

In the Analogue tab, the system allows the user to:

- Check the status of the sensor.
- Hold the output of a sensor or all sensors.
- Change the Input Measurement type.
- Set the scaling range
- Customise the range of the output current.

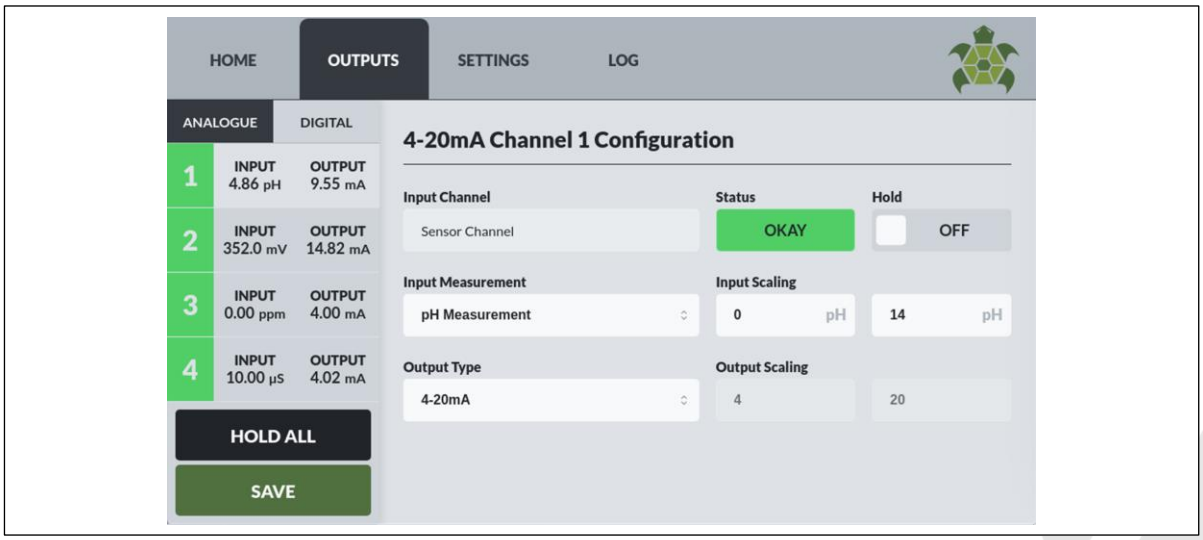


Figure 13 - Analogue outputs screen.

NOTE: For a 1-channel input device, there will be 2 Analogue outputs available where in the second output channel can be set to output a secondary parameter from the single sensor connected to the device.

4.1.1. Status Check

Within the Analog tab of the Outputs screen, the status of each channel can assume 1 of 4 distinct states, each serving as an indicator of its operational status:

- OKAY – This state confirms a successful sensor connection, signifying that the associated channel generates the expected output as intended.
- OFFLINE – This state shows that the channel has encountered an error when trying to produce an output.
- ON HOLD – In this state, the analogue output value will persist at the last value read from the sensor when this state was triggered.
- DISCONNECTED – This is displayed when the sensor has been disconnected and consequently, the associated channel cannot produce an output.

4.1.2. Setting the Output to Hold

The hold function is a useful feature utilised during hot-swapping and calibration processes of the sensor. There are two distinct methods at which the Analogue outputs are configured to hold:

- Manual Hold – This mode empowers the user to manually activate the hold feature for a specific channel by toggling the "ON" switch in that channel. Additionally, the user can press "Hold All" to enable the hold function for all channels simultaneously. This ensures a stable analogue output during sensor calibration or swapping operations, preventing output fluctuations caused by temporary changes in sensor readings.

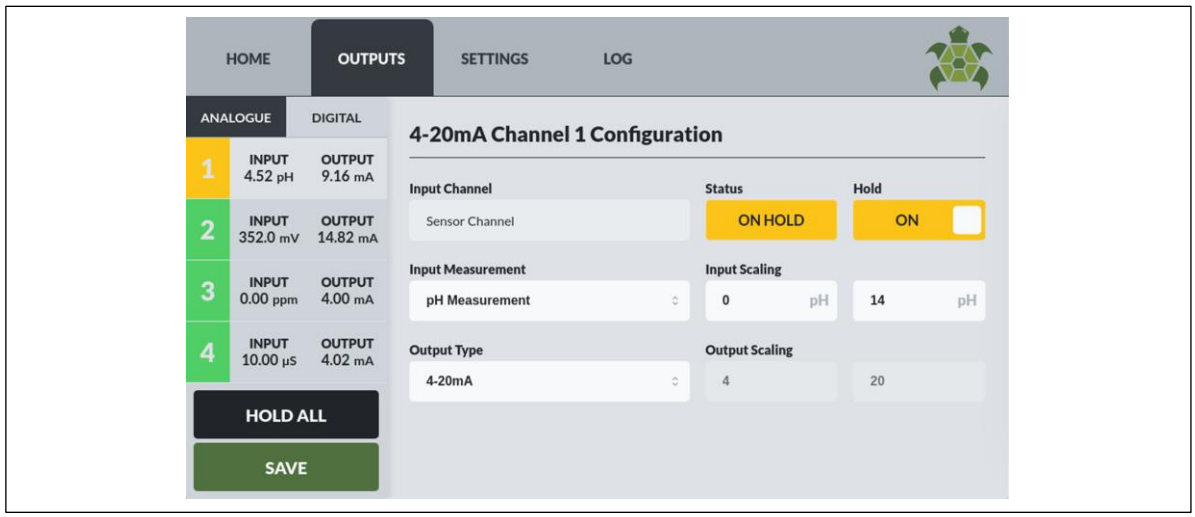


Figure 14 - Channel 1 set to hold manually.

- Automatic Hold – When starting a sensor calibration, the analogue and digital outputs are automatically set to hold for that sensor. The channel will remain on hold even after leaving the calibration page. This convenient feature allows the user to confidently perform calibrations without concern for fluctuating output signals. The automatic hold functionality ensures a steady and reliable analogue output throughout the calibration process.

4.1.3. Input Measurement Type

Given that various sensor types offer multiple input measurements (such as pH and temperature readings for a pH Sensor), this feature allows the user to designate the specific type of input measurement upon which the outputs are dependent upon.

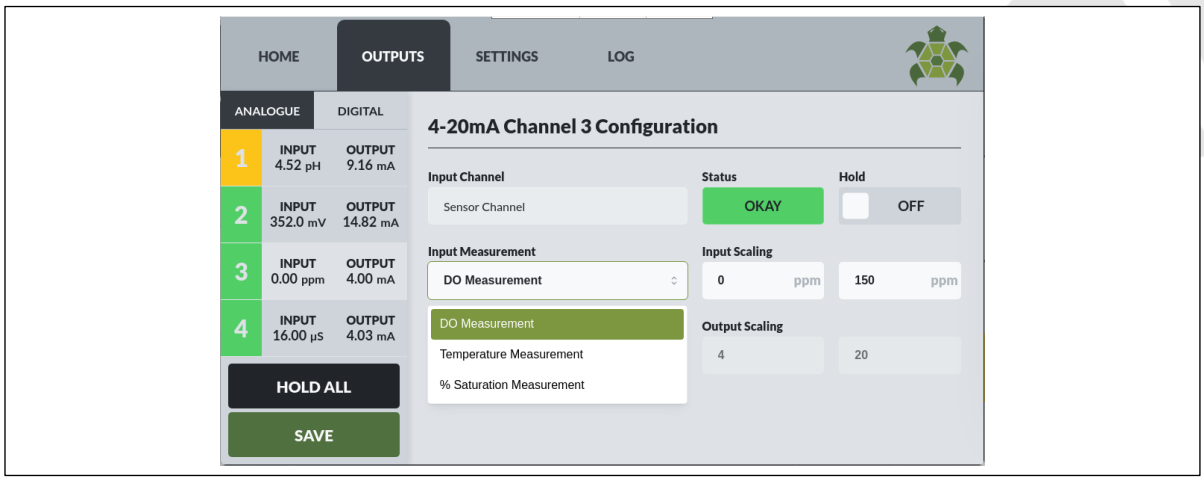


Figure 15 - Input measurement selection for a DO sensor connected to channel 3.

4.1.4. Input and Output Scaling

Through the adjustments of the channel's input scaling, users can optimize the analogue output's scale for maximum efficiency. This is achieved by setting the input scaling's minimum and maximum values to closely align with the sensor's measured minimum and maximum values, thereby maximizing the output scaling. Once the scaling values are entered, remember to save the range by pressing the "SAVE" button located at the left corner of the screen.

NOTE: The safest scaling values to set at any point are the extreme measurements of the connected sensor (smallest and largest possible readings).

4.2. Digital Outputs

The Ultra Touch analyser is equipped to deliver Modbus (RTU) RS485 output. Like the Analogue output, each sensor input channel corresponds to a dedicated digital output channel. Sensor data can be polled from the Analyser by a separate master device. In this use case, the Ultra Touch analyser acts as a slave. Note that this feature is only meant to read registers from the sensors. For details regarding the connections for these outputs, please refer to section 2.4.2.

In the Digital tab, the system allows the user to:

- View the primary measurement of the sensor.
- Check the status of the sensor.
- Hold the output of a sensor or all sensors.
- Change the incoming and outgoing messages.
- Customize the node address of the sensors.
- View the Modbus messages.

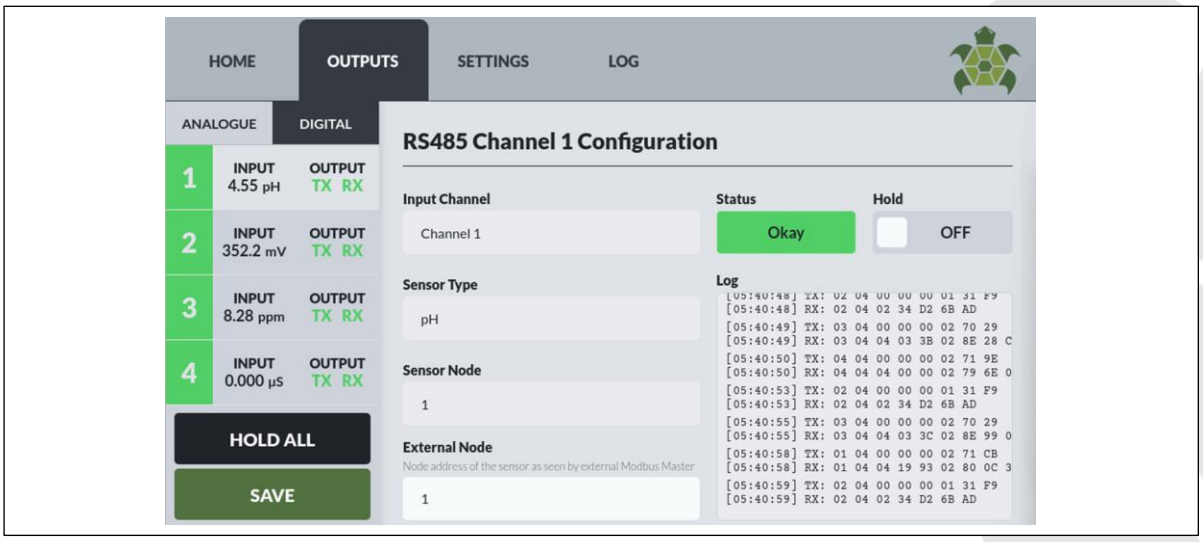


Figure 16 - Analogue outputs screen.

NOTE: For a 1-channel input device, there will be 2 Analogue outputs available wherein the second output channel can be set to output a secondary parameter from the single sensor connected to the device.

4.2.1. Sidebar Information

The sidebar shows information for each channel for quick viewing. It contains the Input parameter where the primary measurement value of the sensor is shown. It also shows the TX and RX statuses of the

Modbus message related to each specific channel. TX represents the data transmitted by an external master device while RX represents the data that the master is going to receive.

4.2.2. External Node Address

This represents the sensor's node address as identified by an external master device. By default, the values are set to 1, 2, 3, and 4, corresponding to the channel each sensor is connected to. It's important to note that this external node address differs from the sensor's actual node address. The external node address can be set to any valid Modbus node address.

4.2.3. Status Check

Within the **Digital** tab of the Outputs screen, the status of each channel can assume one of five distinct states, each serving as an indicator of its operational status. The channel number, TX/RX labels, and log messages will reflect the status of the channel by changing to the colours of the matching status.

- **INITIALISING** – This is the default state upon power-up when no valid Modbus message has been recognized by the analyser. Figure 17 shows the default screen during startup. No information is shown until a valid message has been received.

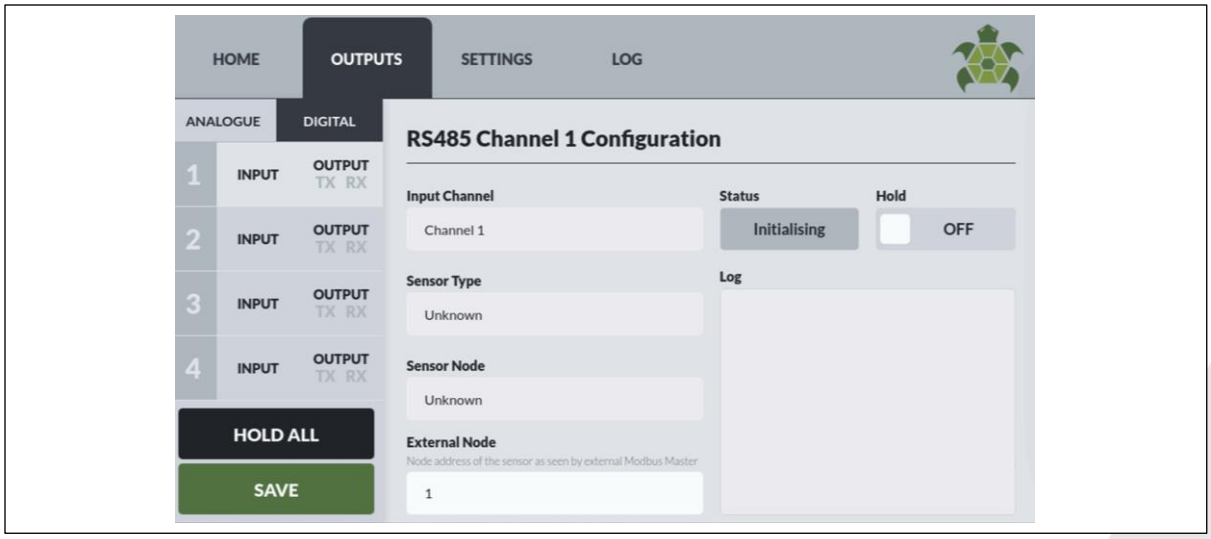


Figure 17 – Initialisation screen for the Digital tab.

- **OKAY** – This state confirms a successful poll to the sensor connected on a specific channel. In

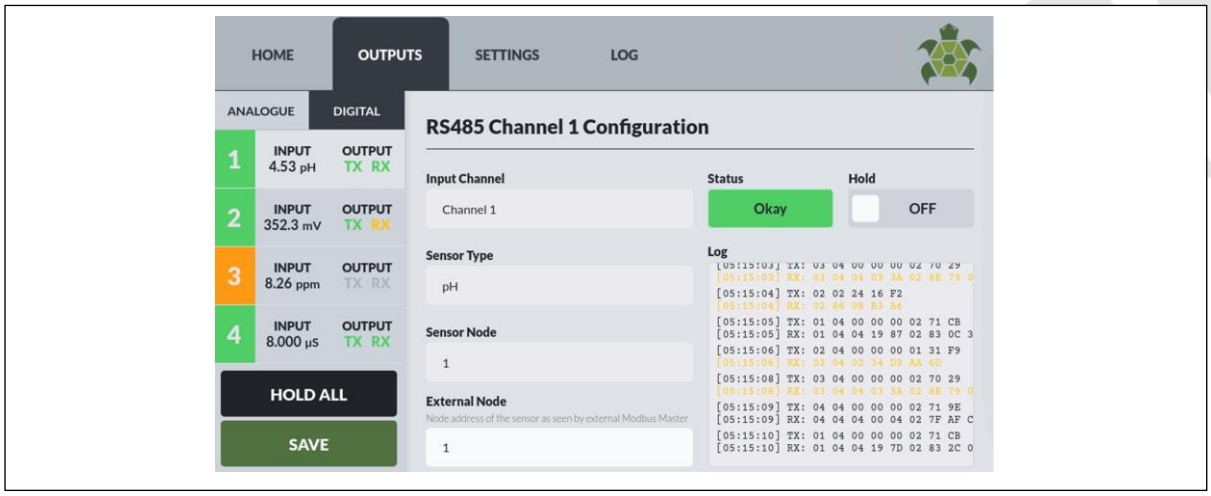


Figure 18 – Different statuses in the Digital tab.

figure 18, channels 1, 2, and 4 were all polled successfully and there were no errors in the message detected.

- ERROR – This state shows that the channel has encountered an error when trying to process a message. Attempting to write to a sensor's register will result in a failed message.

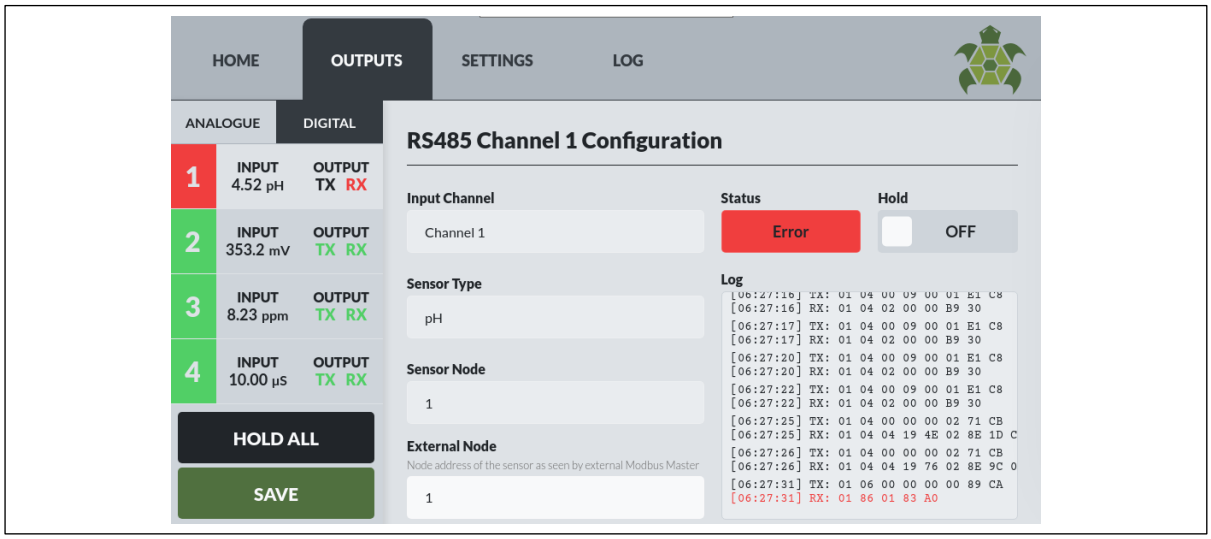


Figure 19 – Digital tab with an error message in Channel 1.

- ON HOLD – In this state, the analyser will save the last recorded data read from the sensor and will persistently output them when polled until the channel is removed from Hold. In figure 18 channel 2 is on hold. Note that the status can still be either OKAY or ERROR while the channel is on hold if the sensor is still being polled.
- DISCONNECTED – This is displayed when the sensor has been disconnected but unlike the Analgoue output, the digital output will act as if the channel is on hold and continue to output the last recorded valid data by the analyser. Figure 18 shows channel 3 is on hold and the TX and RX are grayed out. It is recommended to poll register 100 to determine the sensor's connection status. The value will either be 0 if a sensor is disconnected, or 1 if it is connected.

4.2.4. Output Hold

The hold function is a useful feature utilised during hot-swapping and calibration processes of the sensor. There are two distinct methods at which the Digital outputs are configured to hold:

Manual Hold – This mode empowers the user to manually activate the hold feature for a specific channel by toggling the "ON" switch in that channel. Additionally, the user can press "Hold All" to enable the hold function for all channels simultaneously. This ensures a stable Digital output during sensor calibration or swapping operations, preventing output fluctuations caused by temporary changes in sensor readings.

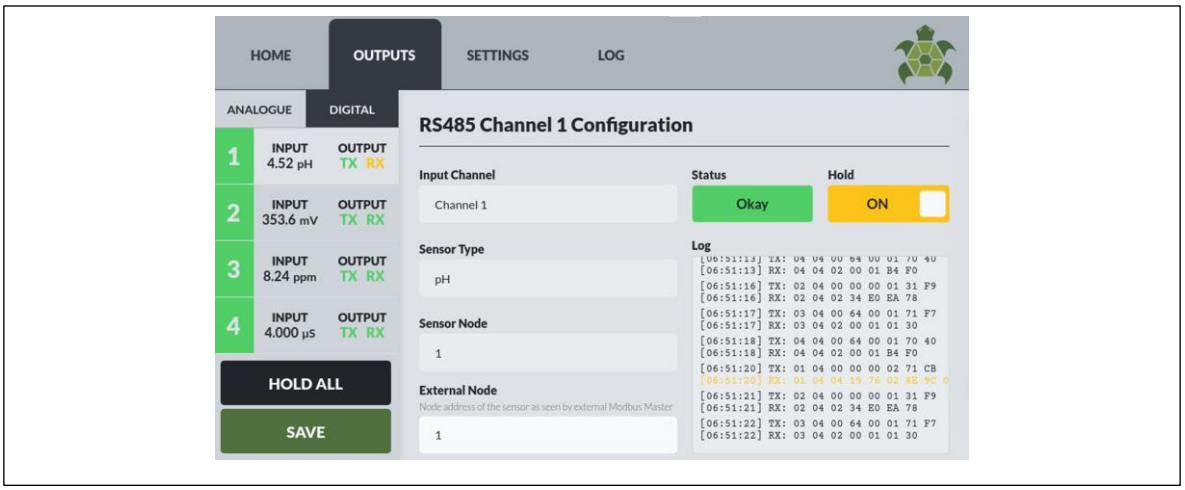


Figure 20 - Channel 1 set to hold manually.

- Automatic Hold – When starting a sensor calibration or when disconnecting a sensor, the digital outputs are automatically set to hold for that sensor. The channel will remain on hold even after leaving the calibration page. This convenient feature allows the user to confidently perform calibrations without concern for fluctuating output signals. The automatic hold functionality ensures a steady and reliable analogue output throughout the calibration process.

5. Settings

The settings screen of the analyser allows the user to:

- Adjust the date and time settings.
- Enable/disable the password feature for enhanced security.
- Configure data logging settings to meet data recording requirements.
- Activate/deactivate dark mode for optimised visual experience.
- View Modbus (RTU) RS485 output settings.
- View the current software version of the analyser.

5.1. Data Logging

The Ultra Touch smart analyser incorporates a robust data logging capability, enabling the recording of measurements from connected sensors onto an installed USB drive in the form of text files. To initiate this feature, users must first set the date and time, as outlined in the set-up guide (refer to section 4.1).

By default, the data logging function is activated when a sensor is connected to the system, and it operates at intervals of 10 seconds. The logging interval can be set to a larger interval by choosing any of the other available options on the drop-down list. When no sensor is connected, the data logging option will be disabled and appear greyed out.

For each unique sensor, an individual data file is generated. These files contain all the sensor readings captured at the specified intervals, alongside the exact timestamp obtained from the device's internal clock. This internal clock maintains accurate date and time settings even during a power-down period of up to 24 hours, ensuring correct time references in the data logs when the system is powered up again.

The analyser's user interface provides information on the USB drive, including connection status, name of the connected drive, as well as the current storage capacity available. To access the USB drive, simply open the front panel of the enclosure and retrieve the drive from the mounted USB port.

NOTE: If there is no USB drive connected to the analyser, data logging will not occur and sensor readings during that period will NOT be recorded.

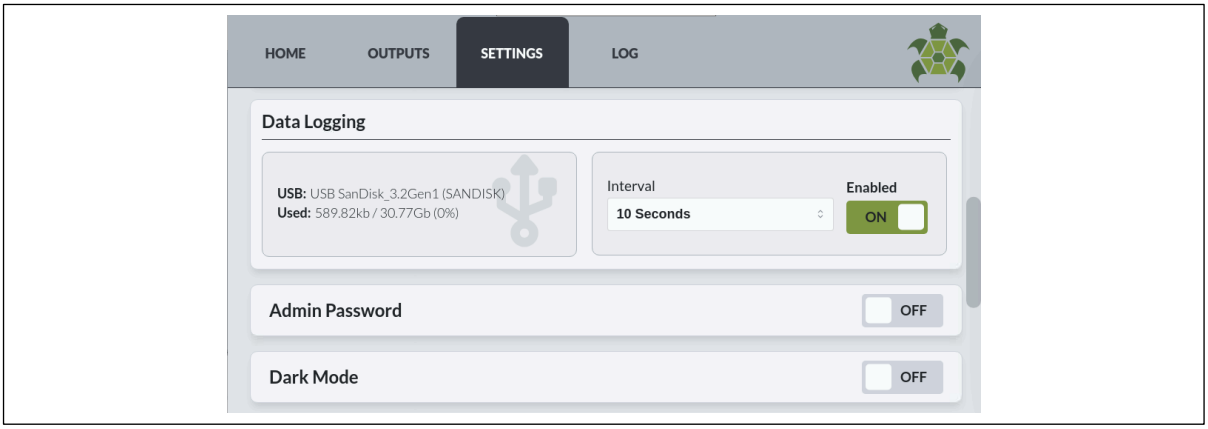


Figure 21 - Data logging configuration

5.2. Administrator Password

This functionality provides users with the ability to impose restrictions on specific aspects of the interface. Enabling the password toggle and inputting the designated password "1234" grants access control to the Outputs, Settings, Calibration, and Config screens, limiting their accessibility only to authorized individuals. When this feature is active, the device operates in an observation-only mode, permitting users to view measurements from connected sensors while preventing any modifications to device or sensor configurations.

5.3. Dark Theme

This functionality enables users to comfortably view the screen even in high light intensity environments. To activate or deactivate this feature, simply toggle the switch adjacent to the dark theme option.

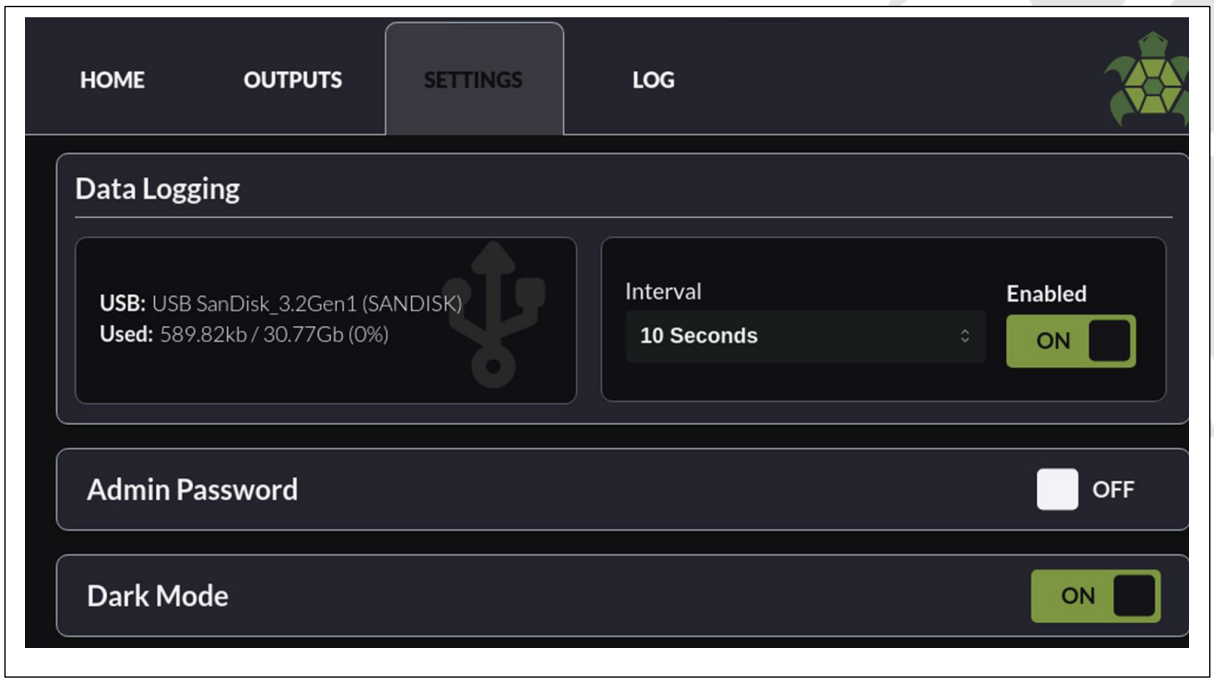


Figure 3 - Interface in Dark Mode

6. System Log

The system log serves as a comprehensive electronic record of events, connections, disconnections, and errors encountered during system operation. These logs are categorized into three types:

1. Errors – This category displays critical errors that require immediate attention and resolution.
2. Warnings – Notifications in this category pertain to issues or changes in the system that might impact specific features but will not disrupt the overall system operation.
3. Messages – General updates on system connections are grouped under this category, informing the user of various activities.

Users can utilize the interface to filter the desired type of logs by selecting the desired category from the left side of the screen.

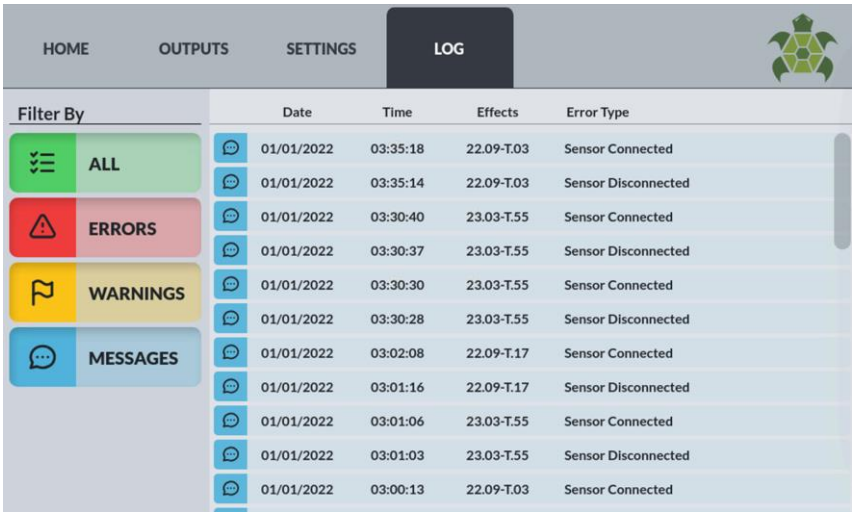


Figure 23 - System log of warnings, errors, and messages

7. Calibrations

Regular sensor calibrations are essential to maintain accurate and reliable measurements. The frequency of calibrations may vary based on environmental conditions and exposure to different circumstances.

Each sensor type requires a distinct calibration process. Therefore, it is recommended that the guidelines provided in Appendix A – Calibrations are strictly followed to ensure accurate results. It is also recommended that the sensor is tested with a known standard solution after calibration to ensure sensor accuracy.

Not all available calibration types need to be performed during each sensor calibration. Some calibration types are designed for specific process-oriented purposes. Therefore, it is at the user's discretion to choose and perform the appropriate calibrations based on the specific requirements.

E.g. For a pH sensor, carrying out both a three-point *and* a two-point calibration is unnecessary as it does not contribute to sensor accuracy improvement.

8. Maintenance

8.1. Periodic Maintenance

The Ultra Touch Digital Smart Analyser requires very little periodic maintenance. When performing cleaning procedures, it is crucial to address specific components as follows:

- Enclosure Lid – Make sure this window is kept clean to permit a clear view of the display. If the lid becomes soiled, clean it using a soft damp cloth or soft tissue. To deal with more persistent stains, a neutral detergent may be used. (Note: Never use harsh chemicals or solvents to remove tough stains or scratches).

- Touchscreen – Remove any stains on the screen using a soft tissue to preserve high sensitivity on the touch screen and prevent any unintended touches. Please DO NOT use any solvents when cleaning the screen as this will damage the display.

- Front Panel – Verify that the hinges of the panel are securely fastened, and the screws are fully tightened. This is essential to prevent any debris ingress, thereby maintaining the device's NEMA and IP ratings.

- Cable Glands – Inspect cable glands during periodic maintenance to ensure they remain properly tightened. Wipe the glands and the surrounding enclosure walls with a damp cloth to mitigate the risk of dust and particle infiltration.

NOTE: This manual does not cover the periodic maintenance of the sensors connected to the analyser. For further information on sensor maintenance and care, please refer the documents found on our website www.turtletoughsensors.com.

8.2. Return & Warranty

8.2.1. Product Warranty

Every Turtle Tough product is thoroughly inspected and tested before leaving the factory and prior to shipping.

In addition to any statutory rights and remedies you may have, Turtle Tough warrants all its products against defective workmanship and faulty materials for 12 months from the date of purchase and undertakes, at its option, to repair or replace, free of charge, each product or part thereof on condition that:

- The complete product is returned to Turtle Tough or one of its authorised service agents, in person or freight prepaid by you, and found, on examination, to be suffering from a manufacturing defect.
- The product or relevant part has not been subject to misuse, neglect, or been involved in an accident; and
- The repairs are not required because of normal wear and tear.
- Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical processes is excluded from this warranty coverage.

NOTE: The above warranty excludes sensors.

8.2.2. Warranty Exclusions

The following are not covered by the warranty:

1. Any component that has been altered or on which the serial number has been defaced, modified, or removed.
2. Damage, deterioration or malfunction resulting from:

- Accident, misuse, abuse, or neglect.
- Failure to follow instructions supplied with the product.
- Any shipment of the product (claims must be presented to the carrier).
- Repair or attempted repair by anyone not authorised by Turtle Tough to repair this product.
- Causes other than product defects, including lack of technical skill, competence, or experience of the user.

8.2.3. Return Goods

For all return goods the following information must be included in the letter accompanying the returned goods:

- Model Code and Serial Number.
- Original Purchase Order and Date.
- Length of time in service and description of the process.
- Description of the fault and circumstances of the failure.
- Process/environmental conditions that may be related to the failure of the sensor.
- Statement as to whether warranty or non-warranty service is requested.
- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person that can be reached for further information.
- Statement of cleanliness: returned goods that have been in contact with process fluids must be decontaminated and disinfected prior to shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material Safety Data sheets must be included for all components of the process to which the sensor(s) have been exposed.

8.3. Storage and Disposal

For proper storage procedure, ensure that all power sources are completely disconnected, and the enclosure is tightly sealed. It is recommended to shield the device from physical damage by placing it in a padded box or protective covering.

Find a suitable location for device storage, away from the reach of pests and magnetic fields and periodically inspect stored devices for any signs of corrosion, dust buildup or damage.

⚠ The device contains electronic components and must therefore be disposed of in a safe manner. Always dispose of batteries and power supply units in accordance with local regulations on battery disposal.

8.4. Support

For technical support, please contact your support staff or visit our website www.turtletoughsensors.com for information on sensor care, calibration, wiring and installation related issues.

9. Troubleshooting

The analyser features continuous self-monitoring of its functions, ensuring that the majority of encountered issues can be resolved with the assistance of interface warnings and errors available in the system log. Found below is a list of specific errors pertaining to the device along with corresponding troubleshooting steps for their resolution.

Problem	Possible Causes	Test/Solution
Device not booting up	Faulty wiring or incorrect power supply	Make sure that the provided power input to the device aligns with the specified power requirements as outlined in this user manual. Additionally, verify that the wiring adheres precisely to the guidelines specified in section 2.4
Screen not loading but the device receives power	Loose screen connections	Identify the HDMI connector cable and the 200mm USB cable. Detach and reattach the cables into their respective ports, ensuring a secure and firm connection.
Sensor readings not displayed on screen	Incompatible or damaged sensor, incomplete connection from sensor to the analyser	Disconnect the sensor from its current channel on the analyser and reconnect it to an alternate channel to verify if the issue is specific to that channel. If the problem continues to persist, verify the compatibility of the sensor type and confirm its ability to produce measurements with a different device, such as an HFC, to further diagnose the root cause.
Laggy screen performance	Device overheating due to warm surroundings	In the event of device overheating, it is imperative to power off the device promptly and allow it to cool down. For further assistance and resolution, please contact our dedicated support staff immediately.
Sensor measurements are offset or off scale	Possible ground looping error or incorrect calibration	In the event of slight deviations between the measurements and the anticipated values, we recommend resetting the sensor to its factory calibrations (refer to section 4.6) and subsequently recalibrating the sensor. If the measurements shown are extreme values and are significantly incorrect, it is more likely to be a ground loop problem. In such instances, we advise reaching out to our dedicated support staff, who will assist in identifying the appropriate troubleshooting steps to resolve this matter effectively.

For any additional support or inquiries, kindly reach out to our dedicated support team, and provide them with both the serial number and software revision of your device. This information will enable our support staff to provide you with more expedient and effective assistance.

10. Appendix A - Calibrations

Temperature Calibration ⚠

For optimal measurement accuracy, it is important to have a precise temperature measurement. However, performing temperature calibrations should be done with extreme caution and is not recommended unless there is a significant inaccuracy in the temperature measurement of the sensor, since minor temperature variations generally do not have substantial effects on sensor readings for those conditions.

To make precise adjustments to the temperature offset of the sensor, it is essential to carefully follow the prescribed instructions outlined below:

1. Before proceeding with calibration, ensure the system is properly set up with the sensor tip placed near a reliable reference thermometer (liquid in glass or an Infra-red thermometer is recommended). Confirm that the environmental conditions surrounding the setup closely match the actual process conditions. Allow sufficient time for the reference thermometer's measurement to stabilize before commencing the calibration process.
2. Navigate to the calibration screen and set the **Calibration Type** to "Temperature Offset".
3. Enter the temperature value of the reference thermometer and press **Start** to initiate calibration.
4. Once the temperature graph displays a stable reading, press **Next**. By doing so, you will be calibrating the sensor to the newly provided temperature value.
5. Upon successful calibration, the temperature reading of the sensor should now align closely or ideally match the reference thermometer value.

Calibration of a pH Sensor

The frequency of the calibration intervals can vary based on process conditions and installation methods. However, the ULTRA TOUCH Digital Smart analyser provides users with the ability to assess the current condition of the sensor through the **Health Status** feature (refer section 4.5). This feature serves as a reference to determine the appropriate calibration timing. It is important to note that the Health Status feature is simply a guide and calibrations should still be conducted at regular intervals determined by the user's judgement and the performance of the sensor.

The pH sensor offers three distinct calibration methods, namely:

1. **Three-point calibration**: This calibration involves the utilization of three distinct buffer solutions, providing comprehensive coverage across the entire pH scale range.
2. **Two-point calibration (Acid slope)**: For processes that exclusively operate within acidic conditions, a two-point calibration can be conducted using two buffer solutions, including a neutral buffer and an acidic buffer.
3. **Two-point calibration (Alkaline slope)**: Similarly, for processes primarily operating under alkaline conditions, a two-point calibration can be performed utilizing a neutral buffer and an alkaline buffer.

These calibration methods enable users to tailor the sensor's performance to the specific pH range requirements of their applications, ensuring accurate and reliable pH measurements as needed.

To perform the calibration, adhere to the instructions provided below:

1. Connect the pH to the analyser via the quick connect plug.
2. Navigate to the **Calibration** screen and select the required type of calibration. Enter the pH values of the available buffer solutions as shown below and press **Start.** (Provide the corresponding values of the buffer solutions used for your calibration)

Figure 4 - Calibration settings for a 3-point calibration of a pH sensor

3. Immerse the tip of the uncapped sensor in the neutral buffer (pH 7.0) and press "NEXT". Once the measurement stabilises, press "SAVE" to move onto the next buffer.
4. During the transition from one buffer to another, rinse and dry the tip of the sensor to prevent potential inaccuracies and contaminations.
5. Place the sensor in the next buffer as instructed on the screen of the analyser. Then repeat step 3 for each buffer.
6. Upon calibration with all the designated buffers, pressing "SAVE" after the final buffer will display the calibration results.

NOTE

- If you suspect the calibration process was not performed accurately, the system provides the option to restart calibrations once the procedure has concluded.
- During any step of the calibration process, you can cancel the procedure. However, please note that if you decide to cancel, you will be required to initiate the calibration again from the first buffer solution in the subsequent attempt.
- If the sensor readings exhibit significant inaccuracies, the calibration process may not be feasible. In such a scenario, it may require a Calibration Reset (refer section 4.6)

Calibration of an ORP Sensor

An Oxidation Reduction Potential Sensor (ORP) or a Wide-ORP sensor (an ORP sensor with an extended range) can be calibrated using a solution of known conductivity. It is essential to consider the temperature influence on conductivity solutions during calibration. To ensure accurate calibration, use the temperature-adjusted conductivity value (refer to the temperature-compensated conductivity scale generally provided on the solution bottle).

To perform the ORP sensor calibration, adhere to the following steps:

1. Navigate to the Calibration screen and set the calibration type to "ORP Standardisation". Enter the value of the available solution (temperature compensated) in the standard solution tab.
2. Submerge the uncapped sensor tip into the solution and press "START" to begin calibration.

3. Once the analyser displays a stable reading, press “NEXT” for the analyser to register the measurement and “SAVE” to finish calibration. Ensure that the sensor tip is rinsed and dried after the completion of the calibration.

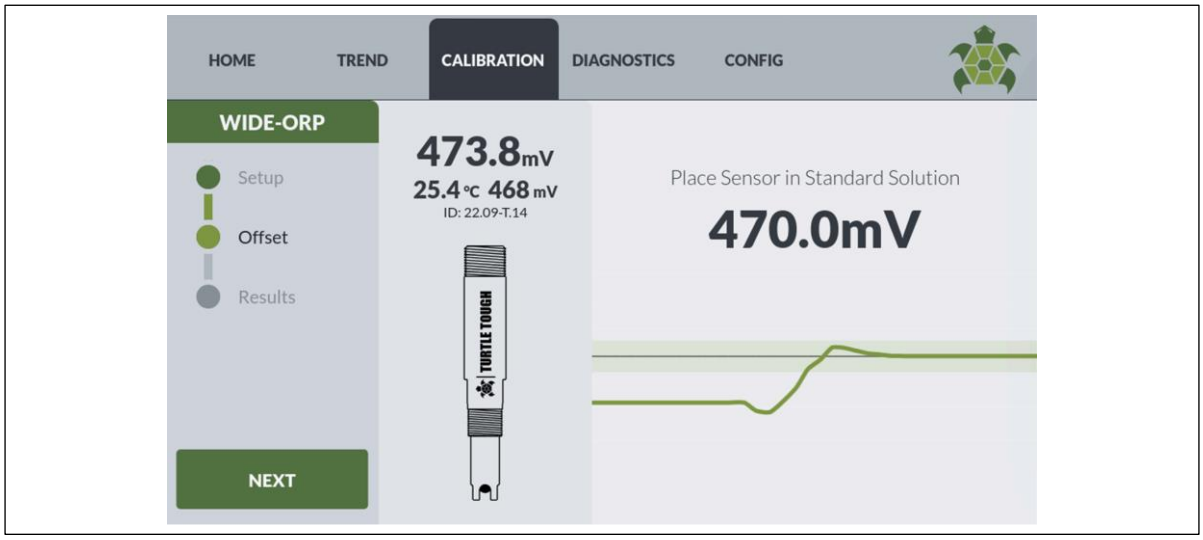


Figure 5 - Stabilisation screen during calibration

Calibration of a DO Sensor

Calibration of the Dissolved Oxygen (DO) sensor is performed using a dry air calibration method, which is quite simple as it does not require specific solutions.

The steps to perform this calibration are as follows:

1. Position the uncapped DO sensor above a container of water. Ensure the sensor remains vertically suspended without making direct contact with the water surface.
2. Navigate to the Calibration screen and enter “Dissolved Oxygen” as the calibration type. Then press “START” to begin calibration.
3. Click on the “NEXT” button and allow the sensor reading to stabilise until it displays a constant reading, then press “SAVE”.
4. To confirm the successful calibration, inspect the calibration results and ensure the slope value is within the acceptable range of 1.0mV per ppm (parts per million) and 2.0mV per ppm.

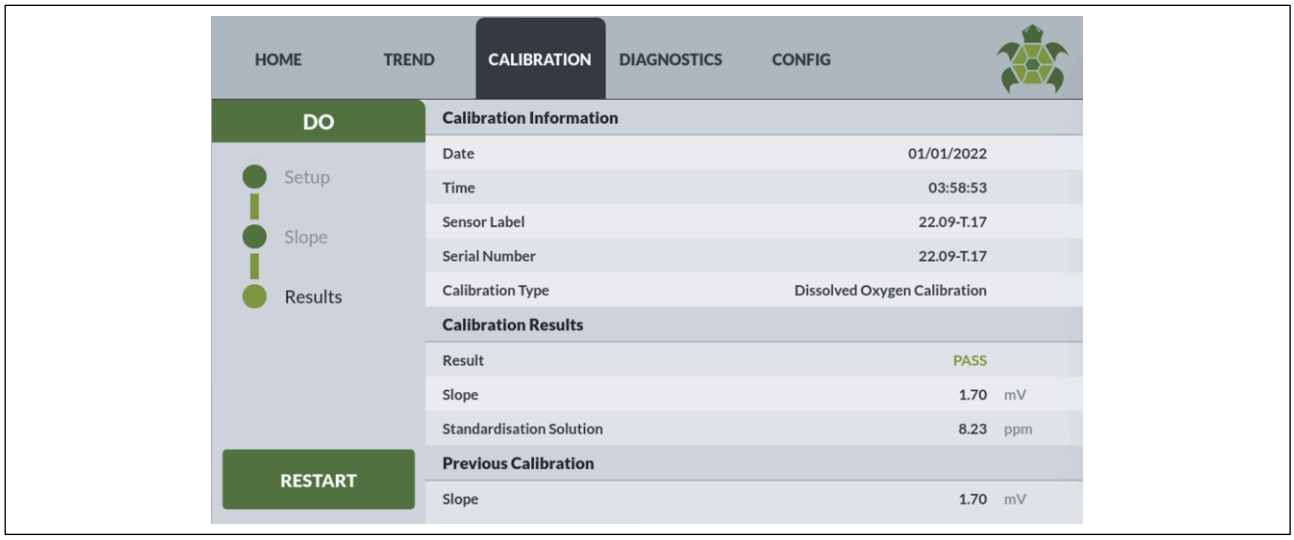


Figure 6 - Calibration results of a DO sensor

Calibration of a Conductivity Sensor

The calibration process for conductivity sensors is requires a single standard solution of known conductivity. Since conductivity sensors typically cover a wide range, it is crucial to pay attention to units and conversions when handling solutions.

To calibrate the conductivity sensors, follow these steps:

1. Navigate to the Calibration screen and select "Standardisation Calibration" as the calibration type. Then enter the value of the available solution (after temperature adjustment).
2. After pressing "START", the sensor would require a dry air calibration to be conducted. Once the reading stabilises, press "NEXT" to save the calibration and "NEXT" again to proceed.
3. Submerge the sensor tip into the calibration solution and press "NEXT to begin the calibration.
4. Wait for the measurement to stabilise. Then, press "SAVE" to complete the calibration procedure. Once completed, rinse and dry the tip of the sensor and dispose of the calibration solution in a safe manner.

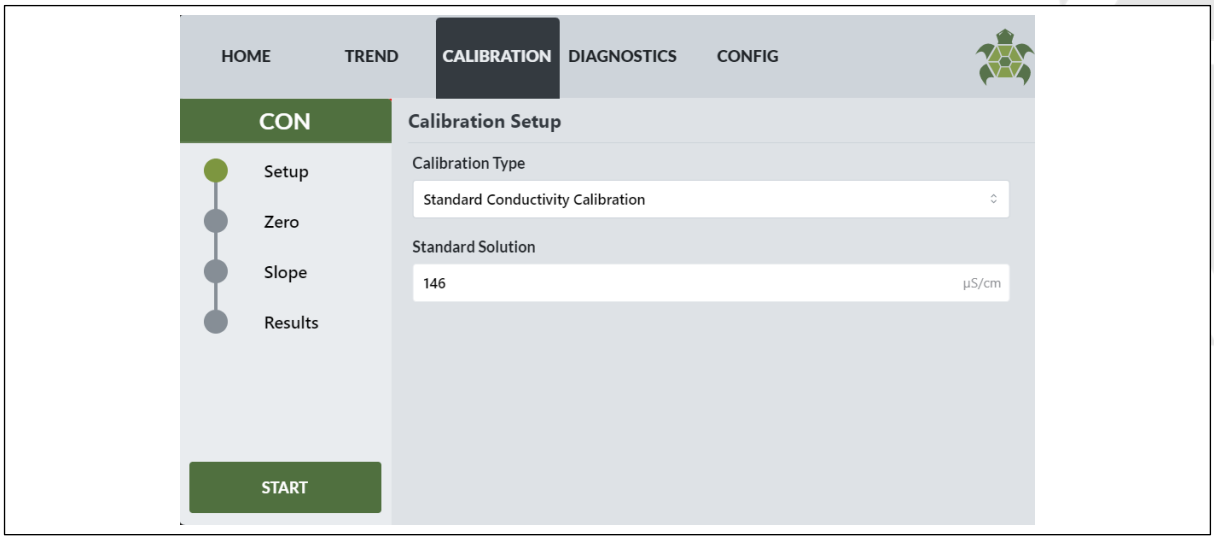
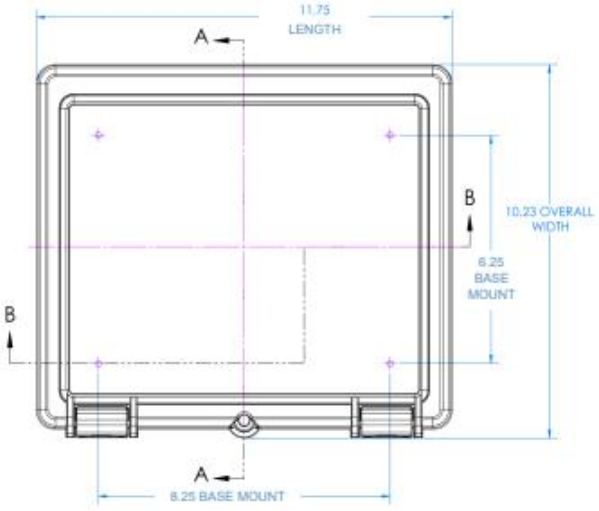
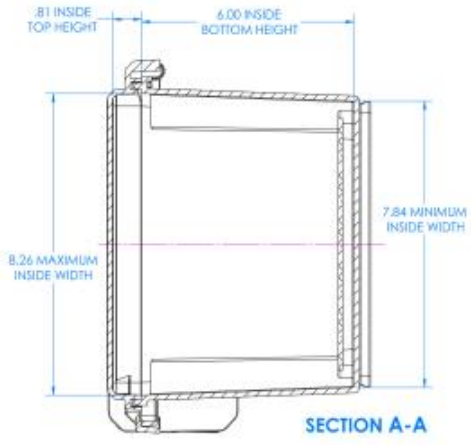


Figure 7 - Calibration configuration of a conductivity sensor

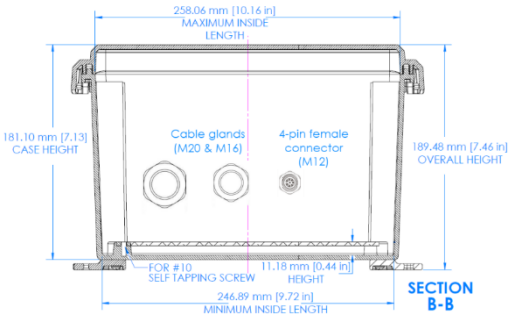
11. Appendix B – Dimensions

TOP VIEW

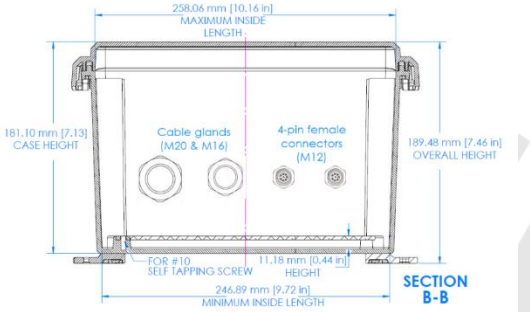




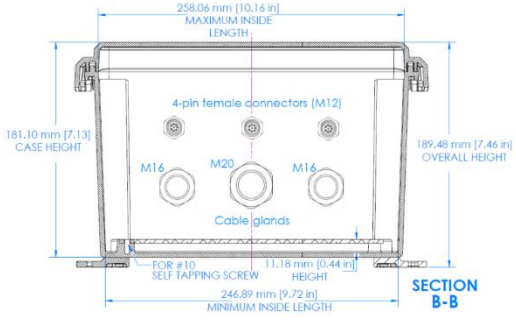
1 Channel Layout



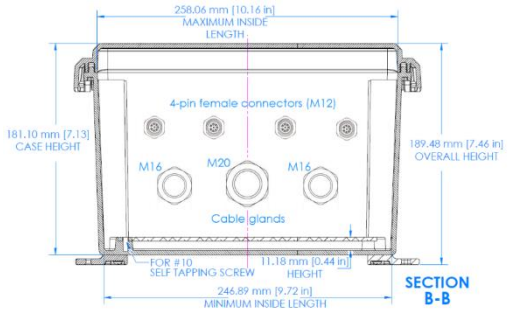
2 Channel Layout



3 Channel Layout



4 Channel Layout



* All analysers share identical dimensions, as the enclosure for each device remains consistent and independent of the number of channels in the analyser. However, please note that the layout of the cable glands and connection sockets will vary based on the number of channels in the analyser, as illustrated in the diagram above.