Axiom Product Manual

Axiom Fire (F7) and Axiom Water (H3)

Revision 1.0

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Engineering Control

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1 Introduction

Axiom Fire (F7) and Water (H3) Data Loggers are advanced environmental monitoring devices designed for reliable data collection in remote and harsh conditions. Built with rugged enclosures and intuitive touchscreen interfaces, they support seamless integration with various sensors and telemetry systems for reliable measurement recording and transmission.

1.1 Document Hierarchy

The following documents are available to Axiom Data Logger users. Both Axiom F7 and H3 Data Loggers use the same manuals. Any differences in operation are noted.

- Axiom Quick-start Guide is an easy, approachable installation guide for users that are familiar with Axiom F7 and H3 and have a standard system configuration.
- Axiom Product Manual offers detailed guidance on operation, configuration, and system functionality.
- Axiom Technical Guide provides detailed information on hardware, troubleshooting, and service procedures, including connectors, tech tools, disassembly instructions, and factory restore processes.
- Axiom Field Guide includes instructions and procedures for service of the data logger and sensors that are deployed in the field.

1.2 Document Structure

Most of this document is structured around the graphic user interface, including sections for the Home screen and each of the main menus on the home screen.

A bread crumb or navigation path in the title bar of most screens correlates to a section and subsection of this manual.

1.3 Document Styles

The action icons and their functions are shown in Table 1-1.

Button	Name	Function
	Home	Navigates to the Home screen
	Add	Adds a new sensor, telemetry, etc.
	Delete	Deletes the selected sensor, telemetry, file, etc.
	Settings	Opens the configuration screen for the current operation.
	Edit	Enables editing of the selected field.
	Move Right	Moves the selected data point to the right column.
	Move Left	Moves selected data point to the left column.
	Refresh	Reload the current screen to update the sensor list.
	Detect	Initiates the SDI-12 sensor mapping process.
	Transparent Mode	Opens the command interface to manually input the commands.
	Download	Downloads data, and logs from the data logger to flash drive.

Table 1-1 – Action Buttons

1.4 Document Style Convention

Menus: Primary navigation system to access the data logger's features and settings.

Field Labels: Helps users to provide accurate data or interpret displayed information.

Tabs: Screen sub-divisions for quick navigation between related features without leaving the main screen.

Buttons: Are actionable touch targets that execute specific actions or commands.

ELECTRICAL CONNECTIONS: Physical connectors for power supply or interfacing with external devices.

Screen Names: Identifies the current screen to help users understand their location within the interface.

Note: Provides additional information or tips about the system functionalities.

Important: Emphasizes key information that users must follow to ensure the correct operation of the device.

Warning: Highlights situations or conditions that could result in potential harm to the device or user if not addressed properly.

1.5 Support Information

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2 Product Overview

2.1 Product Description

Axiom Fire and Water Data Loggers are robust, waterproof environmental monitoring devices with integrated telemetry. They collect and transmit measurement data in support of hydrology and wildfire risk management. They feature outstanding power management, compatibility with a wide range of sensors and telemetry devices, an industrial-grade color display and touchscreen, and USB host port.

With military-grade connectors, IP67 ingress protection, and robust electrical protection, Axiom data loggers are built to withstand demanding applications.

Integrated GOES and Iridium satellite communications simplify site installation, improving service and reliability. The auxiliary communication port extends the options for telemetry devices, including the rugged, low-power AEM cell phone modem.

Two dedicated analog sensor ports and four independent SDI-12 sensor connections provide a wide range of sensor options.

Low power optimization, integrated solar charger, and temperature-compensated charging improve the reliability of solar-powered installations, even in demanding conditions.

These features combine to make Axiom data loggers ideal for a broad range of applications.

2.2 Electromagnetic Compliance

2.2.1 FCC Compliance Statement

FCC Part 15 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.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

2.2.2 Canadian Compliance Statement

ISED (Innovation, Science and Economic Development Canada) Compliance

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

2.3 General Theory of Operations

Axiom Fire (F7) and Axiom Water (H3) data loggers run FreeRTOS, a light-weight operating system that allows the device to perform several tasks at once (multi-threading), like reading sensors, transmitting data, and operating the graphic user interface. FreeRTOS (real-time operating system) is widely used for embedded devices such as medical devices, smart thermostats, and Ethernet routers.

2.3.1 Sensors

A combination of internal sensors and external sensors can collect operational and environmental data. Internal sensors provide voltage, current, and battery temperature for the native solar charge controller.

External sensors consist of two dedicated analog ports for temperature, humidity, and fuel stick (F7 only), rain gauge counter input, and four SDI-12 ports for all other sensors.

Pre-configured profiles are built into Axiom data loggers for sensors available from AEM. A generic SDI-12 sensor interface can be used to read other compliant devices.

2.3.2 Data Storage

Axiom data loggers employ a lightweight, embedded database optimized for real-time performance, reliability, and low power usage. It is used to store, manage, and retrieve large volumes of time-stamped measurement and event data saved in the non-volatile flash memory. The capacity of the datastore allows for more than 10 years of data collection at typical measurement intervals.

Once a sensor is configured with a measurement interval, all measurements are saved to the *full-spectrum datastore* (internal database).

2.3.3 Data Logging

Log configurations act as database queries, reading and converting measurements or processed data at the time of download. This dynamic logging approach allows "log" changes to be made at any time, even after data is collected. Deleting a log, merely deletes the log definition. A new log definition can be created to read the same data, different units of the data, or different time intervals (depending on the measurement interval). Refer to the Datalog menu section for further information.

2.3.4 Data Processes

The system supports real-time data processing, including statistical operations (e.g., min, max, average) and derived values. These are stored alongside raw measurements and are available for display, telemetry, and event triggers.

Conditional logic enables responsive behavior, such as initiating data transmission when predefined thresholds are met.

2.3.5 Telemetry

Optional internal GOES, Iridium SBD, and AirTalk (also known as RVT2) modules are tightly integrated for reliable, simple, and low-power operation.

The AuxCom (auxiliary communication) port operates as either a full-duplex RS-232 or half-duplex RS-485 serial interface. A single cable provides power and data to external devices, such as AEM's CTX-G1 cellular modem.

2.3.6 Power

The native solar charging of the connected battery ensures reliable and predictable operation in all conditions. The voltage and current controls are electrically quiet, unlike many PWM-type charge controllers.

2.3.7 USB

Finally, a USB-A device port is used for file transfer operations, including data logs, firmware, and device configuration file. This port and the touchscreen GUI eliminate the need for field service personnel to rely on additional equipment for installation and maintenance.

2.3.8 Power Management

Axiom utilizes several power modes that may generally be described as:

Run Mode – The normal data collection mode of the data logger. In this mode, the device automatically transitions from a low-power state to perform schedule operations. The display, backlight, USB, and other user interface features and systems are powered down. Sensor and telemetry interfaces are powered as needed to support the measurement, processing, data storage, and telemetry operations.

User Mode – User interface is active; display, backlight, USB port controller, and related support circuits are powered. This mode is activated whenever a touch screen action is detected.

Idle Mode – After 15 minutes without a touch input, the backlight turns off. The current screen position is held for another 45 minutes. After 60 minutes without a touch detection the device will transition to Run mode.

- If a Start Visit report has been created, an End Visit report is created with default or blank input fields.
- The display returns to Home, and the USB controller shuts down.
- If they have not been saved, edits to the currently active screen are lost.

Warning: Unresolved operating errors, such as improper or incomplete sensors or telemetry configuration may prevent desired data logger operation.

2.3.9 Solar Charge Controller

The built-in solar charge controller (SCC) regulates the charging of the connected sealed lead-acid battery. The charge state and voltage are determined by battery voltage, solar panel voltage, and the temperature of the battery.

SCC hardware incorporates safeguards to protect Axiom from damage when the battery or solar panel polarity is reversed or when an overvoltage condition exists.

An over-voltage condition triggers a hold-off, disconnecting the power inputs for 30 seconds, protecting internal circuits while the situation is corrected.

Charging Conditions

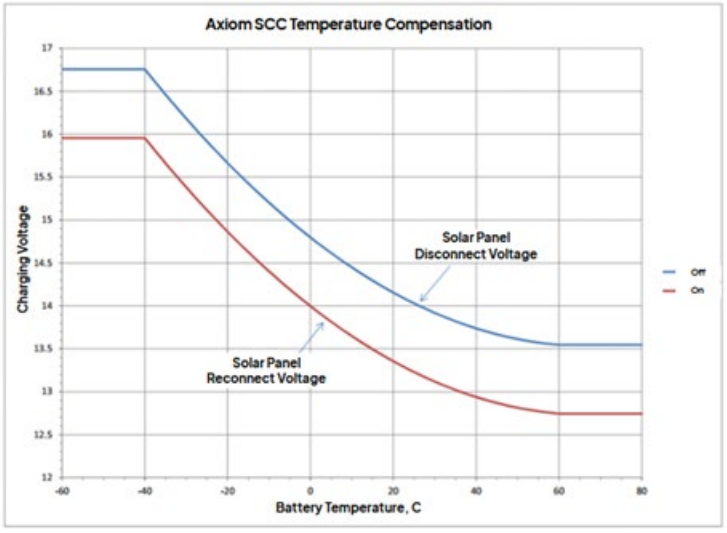
SCC starts charging when all the following conditions are met.

- Solar panel is present (Vsp >= 5 V).
- Battery is present (Vbatt >= 5 V).
- SCC is not under over-voltage 30 second hold-off.
- Solar panel voltage exceeds the battery voltage by two Volts (Vsp > Vbat + 2 V).
- Battery temperature within the allowed charging range.

Non-charging Conditions

SCC stops charging if any of the following conditions are met.

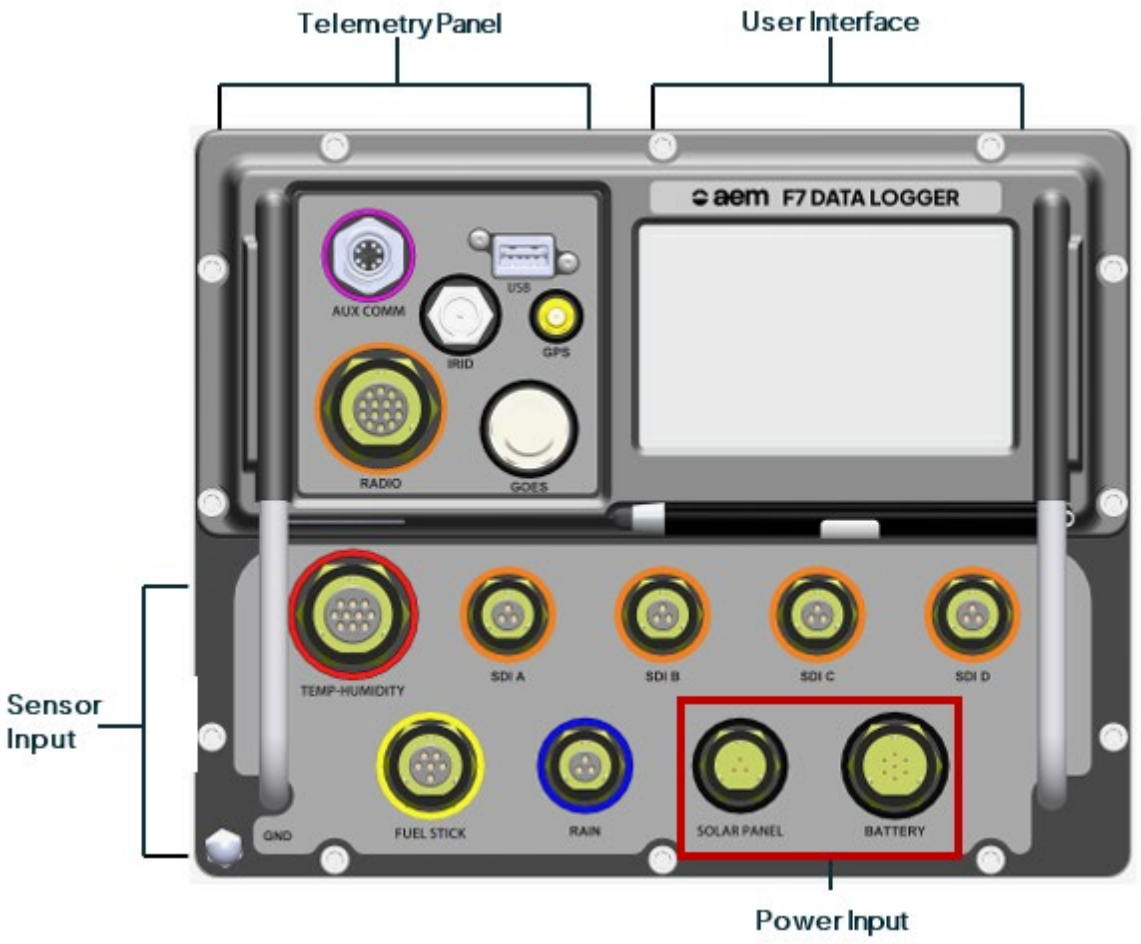
- Solar panel is not present (Vsp < 5V).
- Battery is not present (Vbat < 5V).
- Solar panel voltage (Vsp) is lower than Vbat + 2 V.
- Over-voltage condition detected. (Triggers 30 second hold-off.)
- Battery is not charging. (Battery current is zero or negative.)
- Battery temperature outside of the allowed charging range.



2.3.10 User Interface Conventions

While not always possible, the graphic environment was designed around the following general principles:

- Color-blindness accessibility
- Utilize a combination of distinct colors, icons, and text to differentiate menus and functions
- Where possible, implement verbose and descriptive text labels
- Space touch targets for finger action



Note: H3 is functionally identical to F7, except H3 does not include dedicated Temperature-Humidity or Fuel Stick sensor inputs.

2.4 Data Logger Connectors

2.4.1 Power Input

Power connections include the SOLAR PANEL and BATTERY inputs. Battery input is the primary power source; the internal power management system uses the SOLAR PANEL input to charge the external 12 V SLA battery.

Solar Panel

SOLAR PANEL input is designated with a black ring on the front panel and has a three-position bayonet-style military connector. AEM solar panels are pre-terminated with a compatible connector. Pig-tail cables are also available for users that wish to utilize their own solar panels.

Battery Connection

The BATTERY connection is a seven-position, bayonet-style military connector marked by a black ring. Axiom is compatible with 12 V sealed lead-acid batteries with capacities from 7 Ah to over 200 Ah. The battery cable includes voltage detection leads and a battery temperature sensor. (The charge circuit is not compatible with flooded-cell automotive batteries.)

2.4.2 Analog Sensor Connections (F7 only)

Fuel Stick Sensor (FS-3)

FUEL STICK sensor measures forest fuel moisture and temperature to match 10-hour fuel moisture standards for fire behavior analysis. It features a wooden dowel, a precision thermistor, and a capacitive humidity sensor for accurate data. The 6-position connector is indicated with a yellow ring, matching the THS cable over-molding.

Temp Humidity Sensor (THS-3)

TEMP-HUMIDITY sensor measures ambient temperature and relative humidity with an encapsulated thermistor and a capacitive humidity sensor. Its solar radiation shield reduces environmental interference for reliable data. The 10-position connector is indicated by a red ring, matching the sensor over-molding.

2.4.3 SDI-12 Connections

The Axiom Data Logger includes four discrete SDI-12 ports (SDI A through SDI D). Each port can supply up to 500 mA and 2 A combined switched power. These discrete ports support SDI-12 v1.3 compliant sensors and enable integration of up to 62 digital sensors via external expansion modules. Each SDI port is labeled and identified with orange rings.

2.4.4 Antenna Connectors

GOES Antenna Connection

The GOES antenna connection is compatible with the EON2 GOES antenna. This antenna connects through a Type-N (female) connector and offers robust durability for reliable data transmission in harsh conditions.

GPS Antenna Connection

GPS antenna SMA connection is designed for active GNSS antennas. Some versions of EON2 GOES antennas include GPS but the standard configuration uses separate antennas. The GPS/GNSS receiver provides precise positioning and timing information essential for accurate time base for data collection and transmission scheduling.

Iridium Antenna Connection

IRIDIUM SBD satellite transceiver connects to an omni-directional antenna with the TNC connector.

2.4.5 Auxiliary Communication Connection

The AUX COM connection is software selectable as a full-duplex RS-232 or half-duplex RS-485 serial port. The M-12 connections also supply switched power to external devices, such as AEM CTX-G1 cellular modem.

2.4.6 Radio (AirTalk) Connection (F7 only)

The RADIO connection is used for AirTalk, an interface to handheld radios like BK Technologies BKR 5000. AirTalk transmits user-configured voice reports based on received DTMF codes or changing weather conditions

2.4.7 USB Host Port

USB 2.0 Type-A port is compatible with mass storage devices such as flash memory drives. Flash drives may be used for on-site data retrieval, visit reports, and audit logs. A flash drive may also be used for loading system configuration files and firmware updates.

2.5 Display and Touchscreen

Axiom features an industrial-grade color display and capacitive touchscreen for easy configuration and monitoring, facilitating straightforward operation without an external device.

The graphical user interface (GUI) is designed for optimal usability in the field. Most actions, press and swipe, may be performed with a finger touch. The tethered stylus may be used for cold conditions or more intricate operations.

The touchscreen backlight activates when the screen is touched and automatically turns off after a period of activity. The active time depends on the operational mode of the data logger.

2.5.1 Care and Cleaning

The touch screen can be cleaned with a damp cloth. While the data logger is IP rated against water spray and submersion, it may be best practice to avoid spraying soapy water directly on the screen as a routine practice.

Warning: Do NOT clean the touch screen with Windex® or other glass cleaners that contain ammonia. The ammonia may react with the indium tin oxide (ITO), permanently degrading or damaging the electrical properties.

2.6 Mounting

Axiom data loggers are designed to mount to AEM keyhole backplates that are included in AEM field enclosures. The incremental horizontal center-to-center hole spacing is 1.6" (4.06 cm). Axiom spans five (5) slots and is described as a 5U device. (This is an AEM convention and is different from the EIA rack system standard which uses U or RU to define equipment height.)

3 General Operating Information

Axiom data loggers do not require programming. All operating characteristics can be set through the intuitive touchscreen and graphic display. The system supports password protection to control access and safeguard configurations.

The Axiom supports several internal and external telemetry options, providing solutions for a range of cost and data collection needs. Multiple telemetry devices can be installed on a single unit.

3.1 Menu and User Interface

Axiom users will encounter typical graphic user interface (GUI) elements including text boxes, spin boxes, list builders, radio buttons, and similar intuitive design elements.

The Home screen contains eight main menu categories. Refer to the *Home* screen section of this document and the following sections for more information on each menu.

Users can perform all routine operations through these menus. No external PC, program, or development environment is needed to operate Axiom data loggers. In some cases, such as when adding a new sensor, shortcuts or quick links are provided to bridge across main menu operations.

Except for keyboard and alert screens, a Home button is shown on all screens. This will immediately return the user to the home screen without saving any changes or settings.

A Back button is provided on most screens. It returns the user to the prior screen without saving any configuration changes.

3.2 Configuration Management

Device configuration includes specifying the site information, setting up sensor inputs, declaring measurement names and calculations, configuring telemetry transmitters, defining telemetry messages, setting log structure, and various other tasks.

3.2.1 Configuration Files

An Axiom data logger configuration can be captured as a file that includes operational details such as site, telemetry parameters, general data collection, sensors, data log, processing algorithms, and all user-configurable information.

Configuration files can be used to restore or duplicate the data logger setup. A data logger can store several system configurations but only one can be loaded (or active) at a time.

If a configuration file saved from one device is installed on a new device, the new device will mirror the original, including the GOES NESID and other site-specific parameters.

3.2.2 Configuration Methods

Methods to configure a data logger:

- Configure a new data logger from factory default settings.
- Load an existing configuration file from a USB flash drive.
  Refer to the Axiom Quick-Start Guide and the Station Menu section of this document for more information.
- Restore (load) a configuration file that is saved on the data logger.

- Modify a current, active system configuration.
- Use the Configuration Wizard to quickly install default settings for a particular application, such as US Fire Weather.

In some cases, Axiom data loggers may be pre-configured at the factory with basic settings for the sensors and telemetry included with the order. The user will need to validate these settings, set site-specific information, and configure other required features.

Configuring a data logger from factory default is done by accessing each main menu. Understanding this process will provide the background required for validating and editing installed configurations.

3.2.3 Configuration File Strategy

Users may find it helpful to preserve a standard template, a basic configuration that can be used for new data loggers. The template configuration would include standard sensors, telemetry, and logging common to a users' network.

A bench service configuration could standardize system checkout of devices retrieved from the field. Simply loading the service configuration would enable the sensors and processes used for bench testing.

A default or backup configuration can be saved on a deployed site, providing a fallback to a know-good state.

3.3 Understanding Interval and Offset Timing

3.3.1 Timing Framework Overview

Axiom uses a consistent timing framework across multiple functions, including sensor measurements, data processing, and telemetry operations. This framework is based on two key parameters: *Interval* and *Offset*.

Interval

The *Interval* specifies how frequently an operation repeats (e.g., every 5 minutes, hourly, or daily). This creates a regular cycle of operations throughout the logger's operation.

For SDI-12 sensors, *Interval* is labeled *Measurement Interval*.

For Processes, *Interval* is labeled *Process Interval*.

Offset

The *Offset* determines the specific time when an operation begins relative to a reference point (typically midnight or the start of each interval cycle). This creates a precise schedule for when operations occur within each cycle.

For SDI-12 sensors, *Offset* is the same as *Measurement Allowance (ttt)*, an inherent characteristic of SDI-12 sensors.

For Processes, *Offset* is labeled *Process Offset*.

3.3.2 How Interval and Offset Work Together

With an Interval of 01:00:00 (one hour) and an Offset of 00:15:00 (15 minutes):

- Operations will occur every hour
- Instead of at 00:00:00, 01:00:00, 02:00:00, etc.
- They will occur at 00:15:00, 01:15:00, 02:15:00, etc.

```
── Timeline (hours) ──────────────────────────────────
    00:00   01:00   02:00   03:00   04:00   05:00
      |       |       |       |       |       |
With 01:00:00 interval, 00:15:00 offset:
        X       X       X       X       X
```

Example: Run Process 5 min Before Every Hour

For example, with a Process Interval of 01:00:00 (1 Hour) and a Process Offset of 00:55:00 (55 minutes):

- The process will execute every 60 minutes
- Instead of running at 00:00:00, 01:00:00, 02:00:00, etc.
- It will run at 23:55:00, 00:55:00, 01:55:00, etc.

```
── Timeline (hours) ──────────────────────────────────────────────
    00:00   01:00   02:00   03:00   04:00   05:00   06:00   07:00
      |       |       |       |       |       |       |       |
Process executions (P) with 01:00:00 interval and 00:55:00 offset:
    P       P       P       P       P       P       P       P
    ↑       ↑       ↑       ↑       ↑       ↑       ↑       ↑
  55min   55min   55min   55min   55min   55min   55min   55min
```

Example: Read Sensor 5 min Before Every 30 min

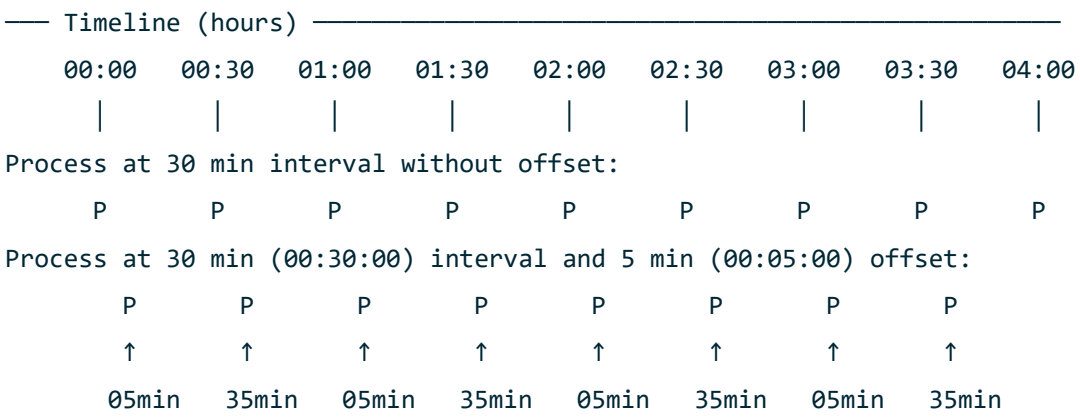
For example, read SDI-12 sensor every 30 min (00:30:00) and allow five minutes (00:05:00) for measurement time of sensor and follow-on processes:

- *Measurement Interval* is set for a read every 30 minutes

Measurement Allowance (ttt) is set for 5 minutes

- Instead of running at 00:00:00, 00:30:00, 01:00:00, etc.
- It will run at 00:05:00, 00:35:00, 01:05:00, etc.

Visualizing Process Timing



3.3.3 Applications

This timing framework applies to:

1. SDI-12 Sensor Measurements: Controls when measurement commands are sent to sensors
2. Process Execution: Determines when calculations and data processing occur
3. Data Logging: Sets where data points are recorded to memory
4. Telemetry Operations: Controls when data is prepared for transmission

Each section of this manual will reference these timing principles, adding specific guidance where necessary.

3.3.4 Timing Considerations

When configuring timing parameters:

1. Consider Dependencies: Ensure measurements complete before processes that need their data
2. Account for Transmission Schedules: For telemetry operations, data must be ready before transmission times
3. Stagger Operations: Avoid resource conflicts by distributing high-demand operations
4. Allow Processing Time: Include buffer time for calculations to complete before results are needed

3.4 Battery

Axiom Data Loggers do not contain any internal batteries or user-serviceable components.

The internal solar charge controller is compatible with 12 V valve-regulated sealed lead-acid (VRSLA or VRLA) batteries. Capacities between 20 Ah to 105 Ah are used for most systems.

To ensure consistent operation, replace the battery every 5 years.

Automotive batteries are NOT compatible with Axiom Data Loggers. These flooded cell batteries use a different charge profile and can produce hydrogen gas, which is hazardous in an enclosed space with electrical circuits.

> ***Note:*** Do not use lithium rechargeable batteries. These are not compatible with the charging algorithm and discharge requirements. Lithium cells also have limited temperature range, making them unsuitable for continuous outdoor use in many solar charging applications where special protection cannot be provided.

3.5 USB Host Port

The data logger includes a USB-A host port (USB 2.0) for connecting to mass storage devices such as USB flash memory drives, also known as thumb drives, memory sticks, or flash drives. “Flash drive” will be used in this document.

3.5.1 USB Flash Drive Specifications

For optimal performance, use a USB flash drive with at least 2 GB of storage. While individual files are small, this capacity ensures sufficient storage for multiple station visits. The USB Host port supports standard USB flash drives, enabling efficient data retrieval and system updates during field operations.

Station Folder

When the Station name is not provided, the Axiom Data Logger stores data in the Station folder by default. The data logger will save data to this generic Station folder if the Station field on the Site tab of the Station Setup screen is left blank. However, when a Station name is assigned to the data logger, the system creates a dedicated folder on the USB flash drive with the same name. This ensures that data for each specific site is nicely structured, with each named data logger site having its own distinct folder under the main Axiom data logger directory.

3.6 Display and Touchscreen Characteristics

The data logger's touchscreen and graphic display are the primary user interface for managing and interacting with the system. Consider the following issues when using the interface.

3.6.1 Temperature

At temperatures below -20°C, the display may respond slowly, appear pale, or lose contrast. This is normal for LCD screens in cold environments. While the display is rated for operation down to -20°C, it may remain visible at temperatures as low as -30°C.

Despite the cold, the data logger will record data even if the screen is hard to read. The display will return to normal once temperatures rise.

3.6.2 Touch

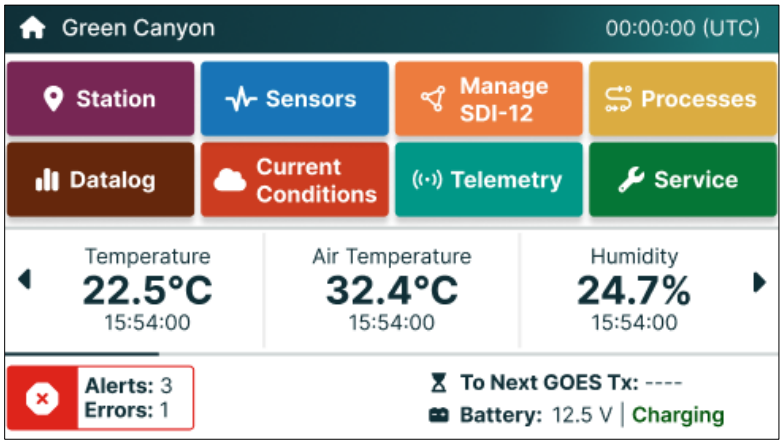
The Axiom capacitive touchscreen requires interaction with a bare finger or the attached stylus. Metallic or pointed objects will not activate the touch interface and could lead to permanent damage.

3.6.3 Backlight

The screen backlight automatically turns on when the screen is touched. It will remain on for approximately 5 minutes after the last touch detection.

4 Home Screen

The *Home* screen is the main interface of the Axiom data logger's graphical user interface (GUI), and the first screen after the data logger boots. Designed for both functionality and ease of use, it is the entry point into all system operations and provides key operational information so that users may quickly assess and correct system anomalies.



4.1 Header Bar

The header bar provides essential contextual information for quick reference.

For the home screen, the header contains the station name. In other cases, the header shows a breadcrumb representing the menu path to the screen, such as *Sensors > Add New*

- Station Name: The left side shows an icon for the current menu (or home). This is followed by the station or site name to let users easily identify the station or deployment location.
- Time: Local time with UTC offset (e.g., 12:34:24 UTC+1) is displayed on the right. This ensures accurate time tracking for data logging and system operations.

4.2 Main Menus

The Home screen includes the following menus:

- Station: This menu contains device and site-specific information, including software version, serial number, and production date. Station name, location, power management, and configuration management are accessed through each of the tabs.
- Sensors: All sensor management, including editing existing sensors and adding few sensors.
- Manage SDI-12: Unique tools for managing SDI-12 sensors, including address mapping and testing functions. Supports automatic sensor detection and manual command input.
- Datalog: Manages logging settings, including logging intervals and selected data points.

- Processes : Facilitates the creation of statistical calculations, user variables, and custom scripts. Process outputs are treated as data points that can be displayed, logged or transmitted.
- Current Conditions: Shows real-time values of selected data points. Data points automatically refresh to show the latest values.
- Telemetry: Configures internal telemetry options as well as Aux Com telemetry port settings for specific devices and displays status information.
- Service: Provides tools for setting the date and time, managing audit logs, rain gauge calibration, and site visit reports.

4.3 Home Carousel

The Home Carousel displays real time data from user-selected sensors to provide immediate insights into site status. Each reading is accompanied by a timestamp to show currency.

Users can swipe left or right to view up to 9 continuously updated data points for real-time system insights. See Current Conditions Menu section for information on selecting these values.

4.4 Status Bar

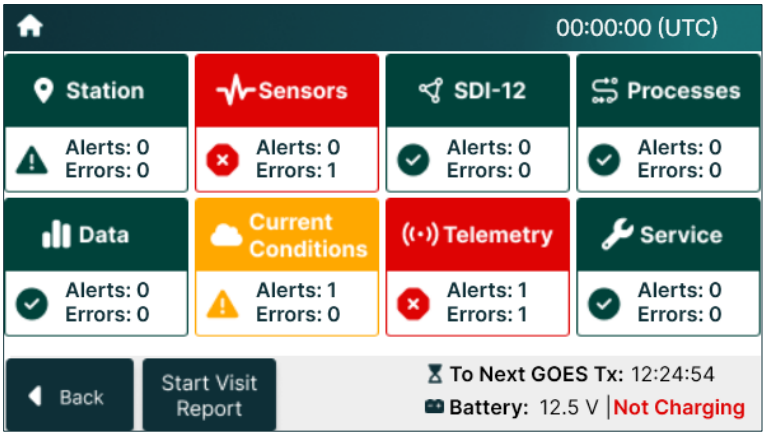
The Status Indicators provide critical information about the system's operational health and power status.

- *GOES Transmission Status*: Indicates the time remaining until the next scheduled GOES transmission.
- *Battery Status*: Displays the current battery voltage and its charging status. This helps users monitor the power supply and ensure the data logger is operating within expected voltage levels.

4.5 Alerts and Errors – Future Feature

The *Status* screen provides an overview of the system's general health along with the status of individual components. It highlights any alerts or errors detected, allowing users to identify potential issues.

1. Press the **Alerts and Errors** button on the *Home* screen.
   The *Status* screen is displayed.



2. Press **Back** button to go back to the *Home* screen.
   Or
   Press the **Start Visit Report** button to start creating the report.

Start Visit Report

The Start Visit Report allows users to generate a visit report, which records the current system status, and any issues observed during the system check.

Refer to the Start Visit Report section under Service menu for more information.

5 Station Menu

The Station menu provides high-level data logger and site information, the main power management settings, and configuration file management.

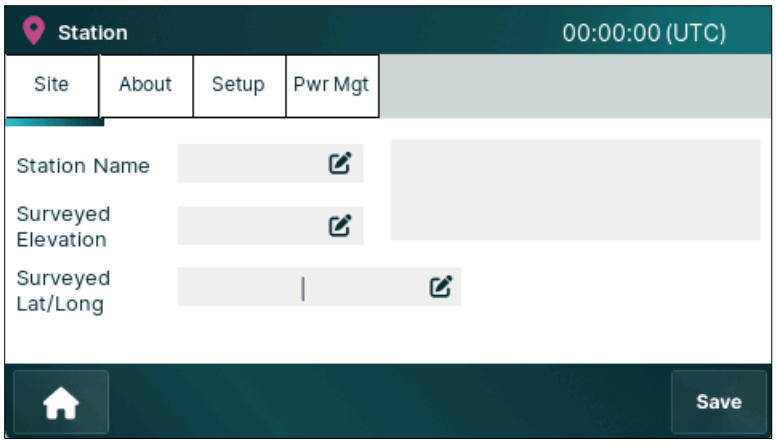
5.1 Site Tab

The Site tab is used to view and modify site-specific details for the data logger, including location data and site description.

The GPS/GNSS receiver provides automatic time, lat-lon, and elevation values (See *Telemetry > GPS > Settings*). Since these values can float from reading to reading, manually entered "Surveyed" data is used for stable location values.

The surveyed elevation is used for barometric pressure calculations.

1. Press the Station menu on the *Home* screen.
   The Site tab is displayed.



2. Enter the desired ***Station Name*** using any alphanumeric text string. The data logger displays the name as a single line with a character limit of 25 characters.
3. Provide a brief ***Description*** of the station. The data logger displays three lines of text in a textbox.
4. Press the **Save** button to save and apply the changes.

5.2 About Tab

The About tab provides basic information about the data logger such as its model, serial number, firmware version, and manufacturing date. These details are automatically generated and displayed by the data logger.

1. The *Model* is assigned to the data logger during the manufacturing process.
2. Each data logger is allocated a unique *Serial Number*.
3. The *Date of Manufacture* specifies when the data logger was manufactured at and is presented in the format YYYY-MM-DD.

The *Firmware Version* identifies the software used by the data logger. It does not include the data logger's configuration details.

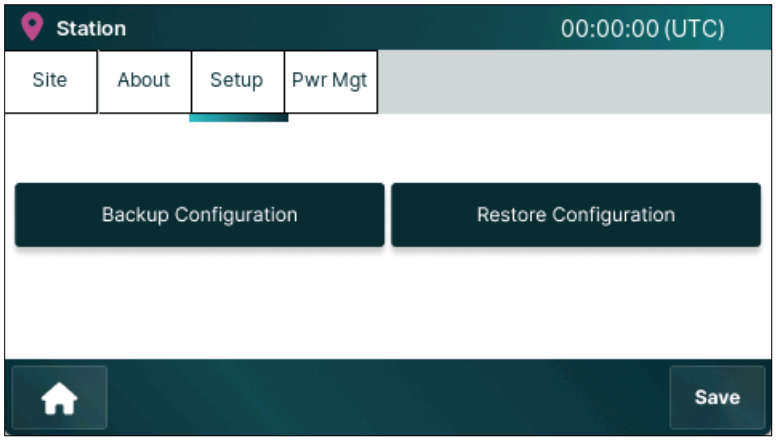
> *Note*: See the Technical Support Portal>software updates at http://www.ftsenvironmental.com/support/Software_updates/ for instructions and access to latest update.

5.3 Setup Tab

The Setup tab allows users to save and install system configuration files.

Configuration files include *all* operational settings. Refer to the General Operating Information section for more information.

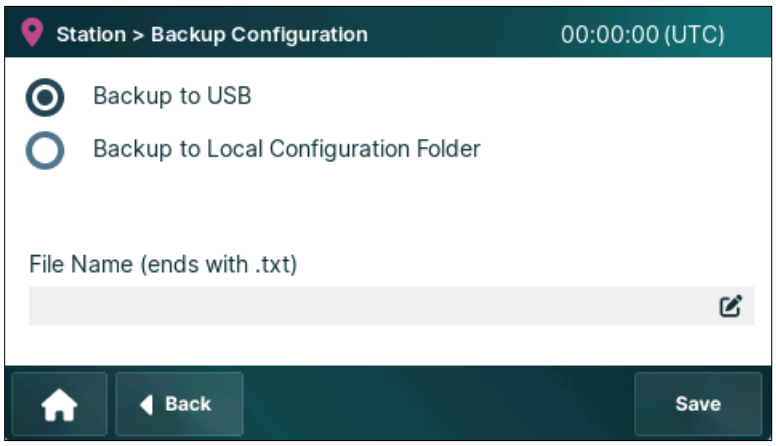
> ***Note***: Once a template is created, it is recommended that this be used for configuring new units.



5.3.1 Save Configuration

The *Backup Configuration* screen allows saving the file to a USB drive or to the local file system.

1. Press the **Save Configuration** button on the Setup tab.
   The *Station > Save Configuration* screen is displayed.



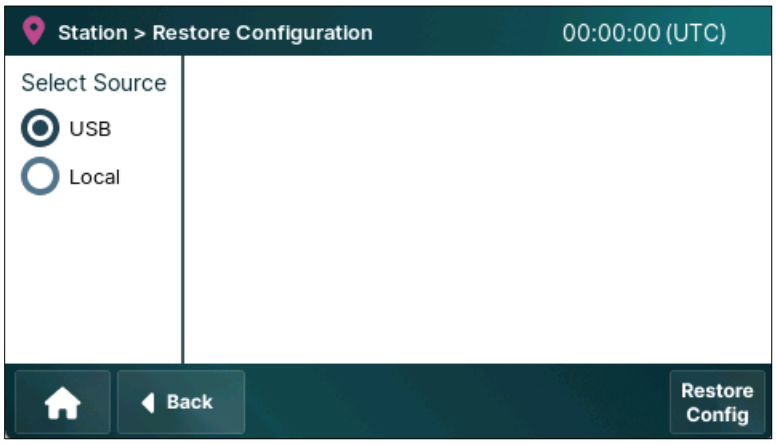
2. Select one of the options given:
   - ***Save to USB*** – The configuration file is to the written USB flash drive using the specified ***File Name***, which is user editable.
   - ***Save to Local Configuration Folder*** – Local files are saved using an automatically generated unique ID. Multiple files may be saved and restored.

3. The *File Name* field displays the current file name and allows users to modify it as required.
    - Press the **Edit** button to access the keypad and enter the desired file name.
4. Press the **Save** button to save and apply the changes.

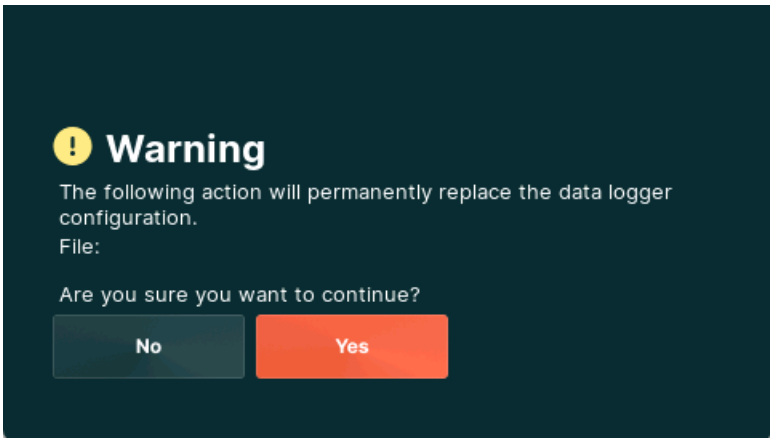
5.3.2 Load Configuration

Load Configuration is used to load a configuration file from a USB flash drive or local file.

1. Press the **Load Configuration** button in the **Setup** tab.
   The *Restore Configuration* screen is displayed.

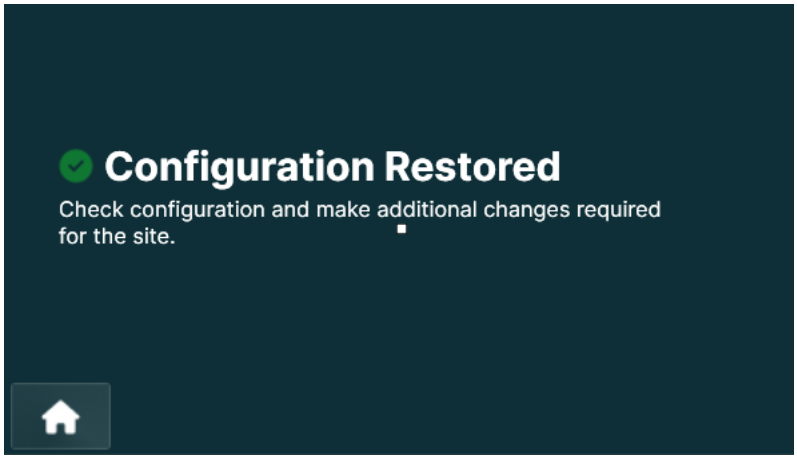


2. Select *Source*:
    - *USB*: Loads configuration files from the USB drive to the data logger.
    - *Local*: Loads a configuration file from the data logger's internal storage.
3. The right-hand pane displays available configuration files based on the selected source. Select the desired file to restore.
    - If files are not visible, toggle the radio button to refresh the list.
4. Press the **Load Config** button.
   The *Warning* screen is displayed.



5. Press the **No** button to decline and go back to the previous screen.
   Or

   Press the **Yes** button to confirm and replace the configuration.
   The *Confirmation* message is displayed.

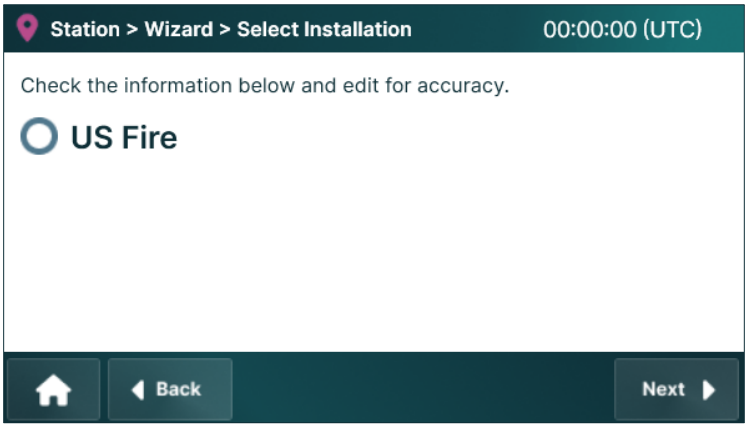


6. Press the **Home** button to go back to the *Home* screen.

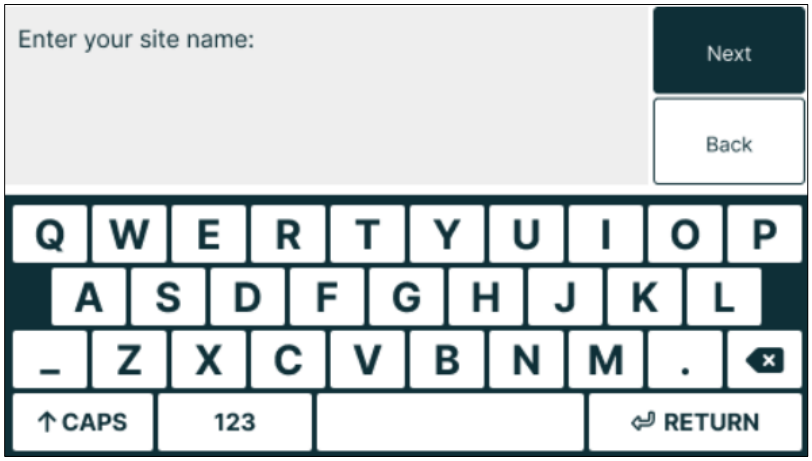
5.3.3 Configuration Wizard – Future Release

The Configuration Wizard allows users to replace the existing (or Factory Reset) configuration with a pre-built configuration. These built-in templates are created by AEM for large customers or common configurations. These may be used to jumpstart new device setup or restore a corrupted configuration.

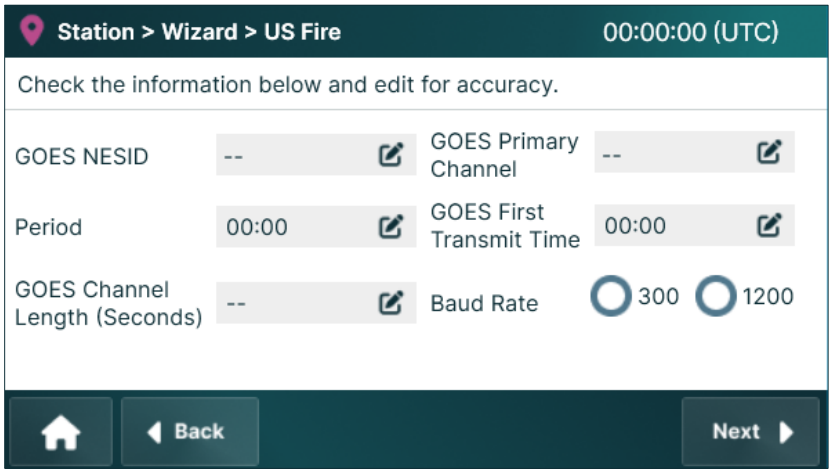
1. Press the **Configuration Wizard** button in the **Set Up** tab.
   The *Select Installation* screen is displayed, listing all the available configurations.



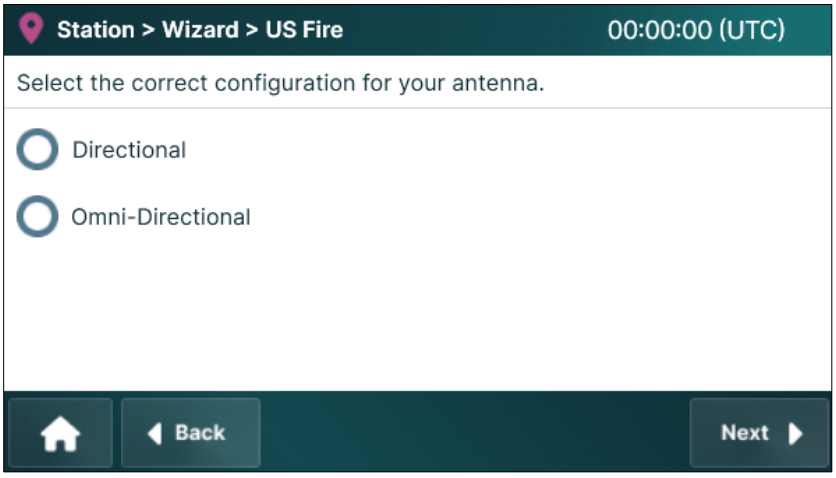
2. Select the desired configuration to install. (US Fire wizard is used for these instructions.)
3. Press the **Next** button and enter the site name.



4. Press the **Next** button.
   A screen with station specific information is displayed. Review the information displayed on the screen and adjust as required.

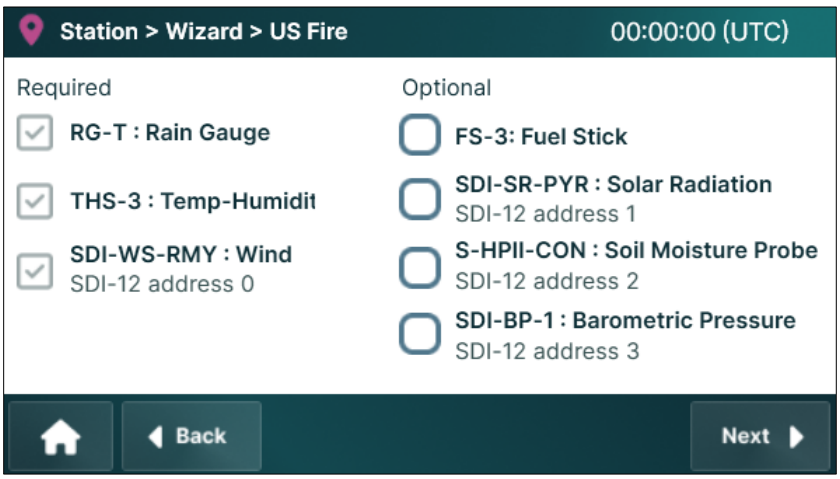


5. Set the GOES NESID assigned by NESDIS.
6. Enter the GOES Primary Channel provided with the NESID.
7. Set the Period for the NESID.
8. Set the GOES First Transmit Time associated with the NESID.
9. Configure the GOES Channel Length.
10. Select the appropriate Baud Rate (300 or 1200) to match the NESID assignment.
11. Press the **Next** button and select the correct configuration for antenna.
    Select the appropriate configuration for the antenna from the options provided.



- *Directional* - Directional antennas focus the signal in one direction for better transmission over longer distances, but they require exact alignment.
- *Omni-Directional* - Omni-directional antennas broadcast in all directions, ideal when precise alignment isn't possible, or the satellite position varies.

12. Press the **Next** button again.
The *Select Sensor* screen is displayed.



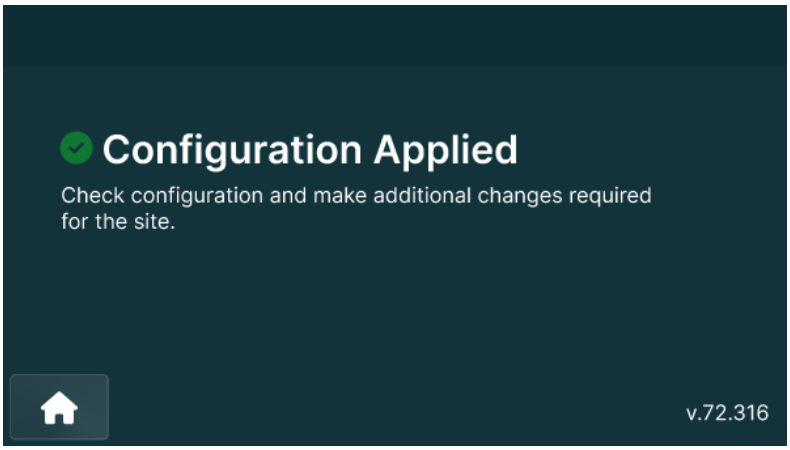
a. The ***Required*** sensor column displays the list of all the essential sensors that cannot be moved.

b. Select sensors from the ***Optional*** sensor list as required.

13. Press the **Next** button and review the information displayed.

The screen summarizes the new settings. Review all details for accuracy before selecting Confirm to proceed.
Or
Press the **Back** button to make changes.

14. Press the **Confirm** button to proceed.
The *Confirmation message* is displayed.



15. Press the **Home** button to go back to the *Home* screen.

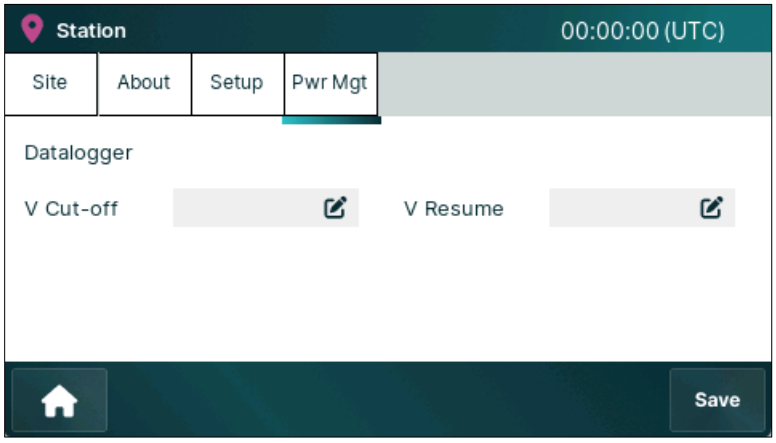
5.4 Power Management Tab

The Pwr Mgt (Power Management) tab lets users configure power settings to optimize battery usage and maintain system operation. When the battery voltage falls below the cut-off level, the data logger enters low-power standby mode, shutting down SDI bus power, telemetry, data logging, and the touchscreen. Normal operation resumes when the voltage recovers.

VRSLA batteries are considered fully depleted at 10.5 V. Discharge below this level can result in a reduced life span. Maximum cycle life would limit discharge to about 50%, or about 12.0 V. Users may prioritize battery life versus data collection differently for their application, such as operating as low as 9.6 V.

***Important*:** Cut-off values for integrated devices, such as GOES, Iridium, and AirTalk (RVT2 module) include their own internal operating voltages. Setting the cut-off below these values does not guarantee operation of all devices.

When in cut-off mode, briefly touching the screen will temporarily show the home screen.



1. Set the *V Cut-off* level to define the battery voltage at which the data logger reduces power consumption or shuts down to prevent battery depletion.
2. Set the *V Resume* level to specify the battery voltage required for the data logger to automatically resume normal operation after recharging.
3. Press the **Save** button to save and apply the changes.

6 Sensors Menu

The Sensors menu provides functions to configure and manage sensor settings for the Axiom data logger.

6.1 Sensor Classification

Axiom uses internal and external sensors. There are two types of external sensors, dedicated analog and SDI-12.

- **Internal Sensors:** Factory-installed on the data logger, these include the Battery Sensor, Case Temperature Sensor, and Solar Power Sensor. They are used for system the solar charge control algorithm and are also available for data logging, telemetry, and system monitoring.
- **Dedicated Analog Sensors (F7 only):** Two analog ports are dedicated to specific AEM sensors, one for a combination temperature and humidity (THS-1) and the other to fuel moisture (fuel stick, FS-3).
- **SDI-12 Sensors:** Four independent SDI-12 port are compatible with a broad range of sensors. Pre-configured profiles are available for AEM sensors. A "generic" interface is used for all other sensors.

Measurements from all inputs can be logged on a scheduled or conditional basis.

6.2 Sensor Operating Theory

Each sensor has a *Sensor Name* field. (See Data Point Names section below.)

A sensor may provide more than one measurement.

Each measurement has a measurement name field (data point name).

All external sensors have a Measurement Interval. This is the rate that the sensor will be read or polled.

Internal sensors are read periodically, as determined by internal processes.

The value from each sensor reading is stored in the Axiom datastore, *regardless of log settings*.

6.3 Data Point Names

Sensors, measurements, variables, functions, processes, and calculations all require a name to be logged, displayed, or transmitted. These names are collectively referred to as *data points* or *data point names*.

Internal sensors have default sensors and measurement names.

External sensors (analog and SDI-12) do not have default names. When a new sensor is added, the profile fields will be blank or show a null value "-".

Like declaring in a computer program, each sensor and measurement must be assigned a name before it is available for use.

6.3.1 Native Data Points – Future Release

Axiom Data Loggers contains several types of built-in or native data points that provide essential system information. These native data points include time, date, geographic information, system meta data, and internal telemetry information.

Native data points may be used for processes, logging, telemetry, and scripting.

Data Point Name	Description
t_dd	Day of month
t_doy	Day of year
t_HH	Hours (24 hour clock)
t_mm	Minutes
T_MM	Months
t_ss	Seconds
t_TZ	UTC time offset (eg. Pacific = -8)
t_yyyy	Year
Lat	Latitude
Long	Longitude
Elev	Elevation

If the data logger is operating with a G6 transmitter, the following additional built-in data points will be available:

Data Point Name	Description
Serial Number	G6 serial number
YB	Power Supply during transmission
YF	Forward Power
YR	Reflected Power
SWR	Standing Wave Ratio
VLoad	

6.4 Data Point Name Rules

To avoid conflicts, user-defined data point names, including those for sensor data points, must meet the following rules.

- Names must be unique.
- Names are case sensitive.
- Names must begin with a letter.
- Names can only contain uppercase letters (A-Z), lowercase letters (a-z), numerals (0-9), or hyphen character ("-").
- Spaces are not allowed.
- Name must start with a letter.
- Names must not match any reserved terms.
- Names must be 1 to 25 characters.

6.4.1 Reserved Terms

o ABS	o IF	o SteinhC	o t_dd
o ACOS	o INT	o SWR	o t_doy
o ASIN	o LN	o t_DySince	o t_HH
o AT	o Lat Long	o t_DySYr	o t_mm
o ATAN	o MAX	o t_HrSince	o t_MM
o CMD	o MIN	o t_HrSYr	o t_ss
o COS	o MOD	o t_IsLeap	o t_TZ
o Elev	o PI	o t_MnSince	o t_yyyy
o ELSE	o POW	o t_MnSYr	o YB
o ERR	o SIN	o t_SeSince	o YF
o EXP	o SQRT	o TAN	o YR
o FRAC			

How are the rules enforced? Error message, field highlight, blocking of "save"?

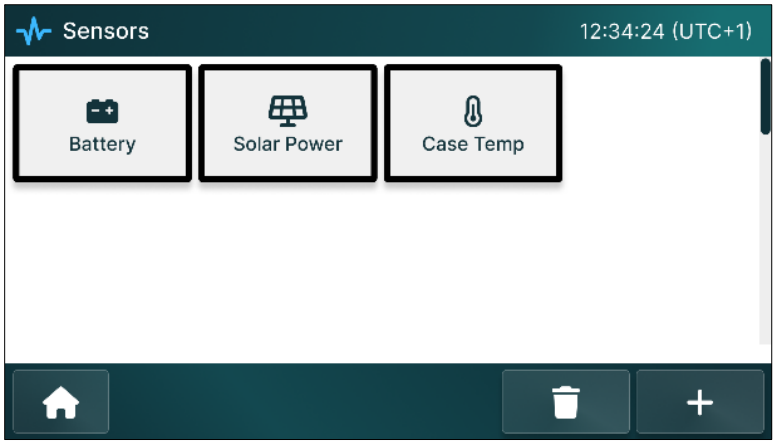
When a data point name is changed, how is the data store affected?

If a data point name is changed, are all implementations updated, such as telemetry and logging or do these each need to be edited?

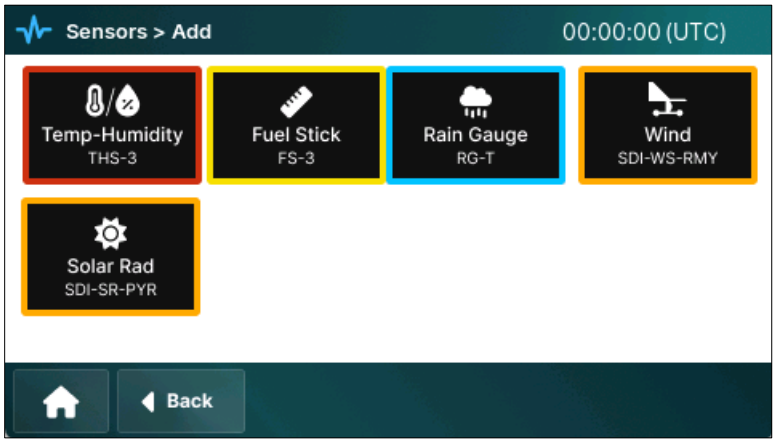
6.5 Adding New Sensors – General Process

Adding new sensors follows a standard process. Since internal are installed be default, these differ slightly. The process includes:

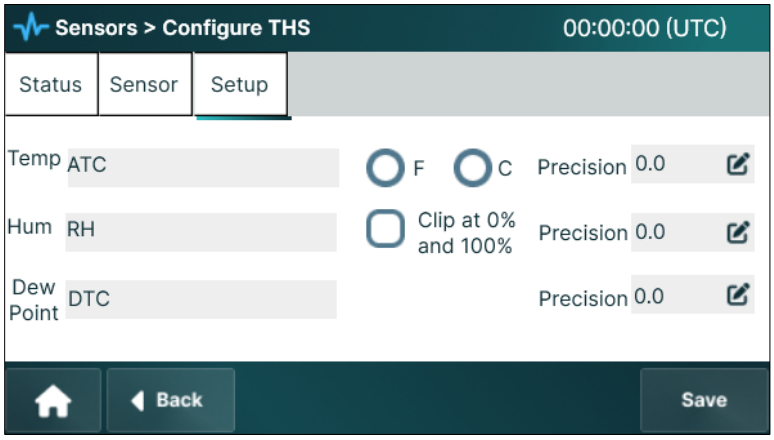
1. Press Sensors main menu.
2. Press the **Add** button on the bottom right.

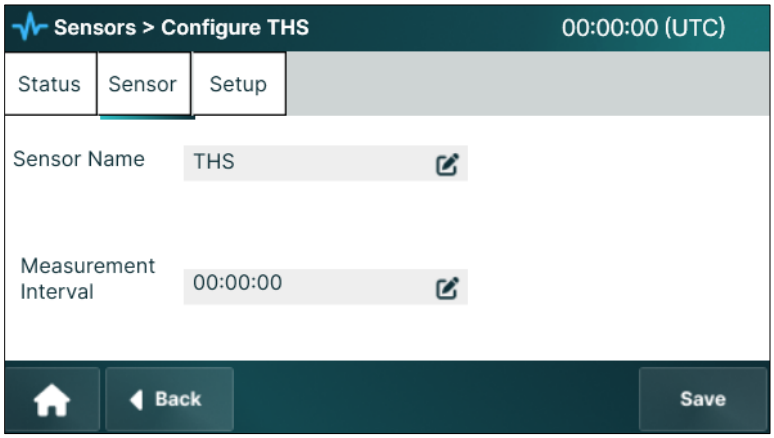


3. Select the tile representing the desired sensor profile.



4. Configure sensor using a series of tabbed screen. These set the sensor name, data point names, measurement interval, SDI-12 address, and other sensor-specific operating characteristics.





> ***Note***: At this point, a sensor is "defined" and a new tile will appear on the *Sensors* screen. Measurement data points will be available for data logging, processes, and monitoring.
>
> Processes, data logging, and current condition settings are not required to define a sensor; those can be configured later.

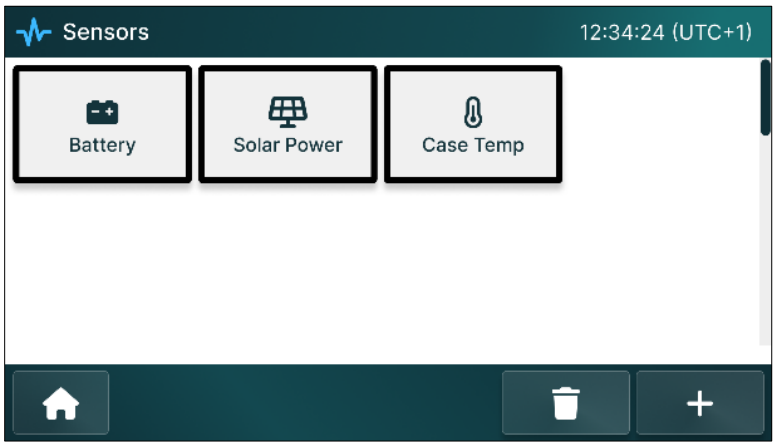
- After saving the above, the Additional Setup screen provides quick links to calculation processes, data logging, and current condition menus.
- Once a sensor is configured a new tile will appear on the Sensors screen. The Processes screen will show a similar tile. Data logging and Current Conditions screens will similarly show new settings that were added using Additional Setup features.

6.6 Internal Sensors

Axiom includes three preinstalled internal sensors: Battery, Case Temp, and Solar Power. These default sensors provide essential system operating input. They can also be accessed by the user for system monitoring, logging, and telemetry.

In the factory default condition, the *Sensors* screen shows tiles for only the internal sensors. All other sensors must be added manually or with a configuration file.

Select the desired sensor tile to view the status and edit the configuration.



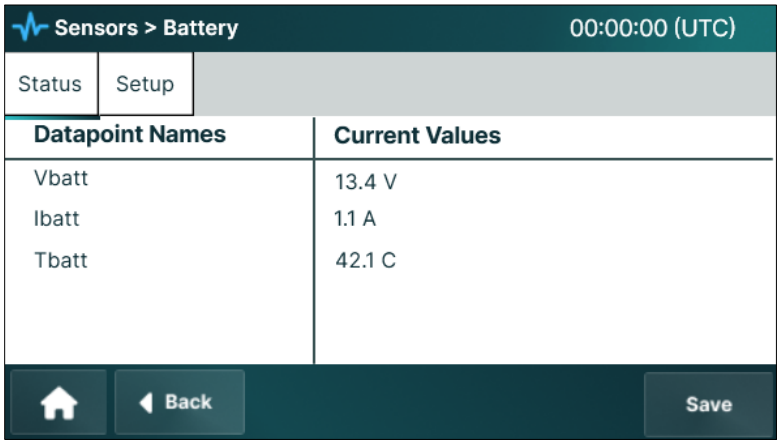
6.7 Battery Sensor

The Battery sensor monitors the logger's battery voltage, current, and temperature. Battery current may be positive or negative, corresponding to charging and discharging. The AEM battery cable includes a thermistor that must be secured to the battery for proper operation.

6.7.1 Battery Sensor Configuration

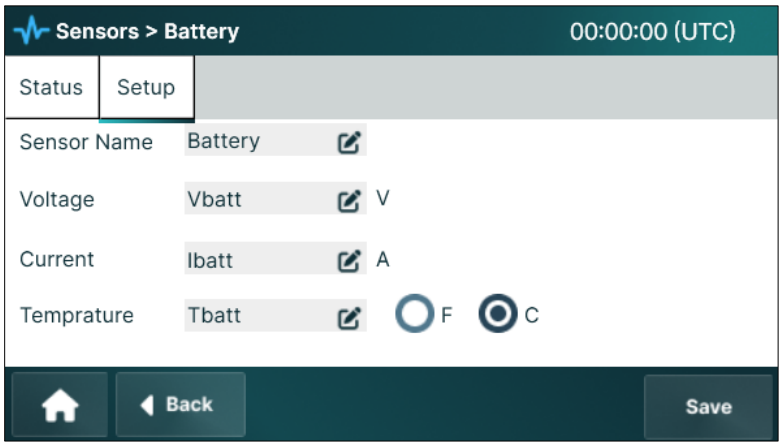
Status

The Status tab displays the user-defined *Datapoint Names* alongside *Current Values*.



Setup

The Setup tab enables editing of data point names and other settings.



1. *Sensor Name* is pre-set to 'Battery' and can be modified as required. The user-defined name appears on the sensor tile in the *Sensors* screen for quick reference.
2. Assign custom names to *Voltage* (default: Vbatt), *Current* (default: Ibatt), and *Temperature* (default: Tbatt).
3. Select temperature units: *F* (Fahrenheit) or *C* (Celsius).
4. Select the *Active* checkbox to enable the sensor. It allows the data logger to read the sensor data and enables calculations and processes to operate correctly without errors.
    - If the checkbox is cleared, the sensor remains active for internal process but it will not be read by the data logger. Any calculations or processes that rely on the sensor's readings will report an error.
5. Press the Save button to save and apply the changes and apply the changes.

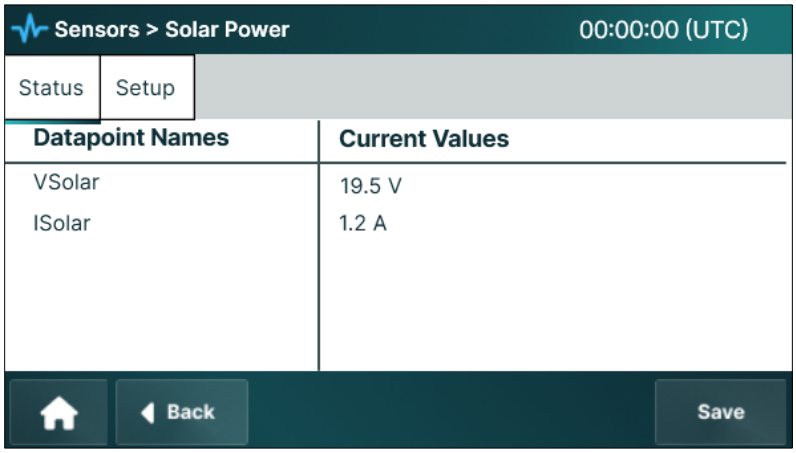
6.8 Solar Power Sensor

The Solar Power sensor measures the voltage and current of the solar panel input. Depending on the battery's level of charge, insolation on the panel, and the charge controller state, these values may closely match the battery or may differ significantly.

6.8.1 Solar Power Sensor Configuration

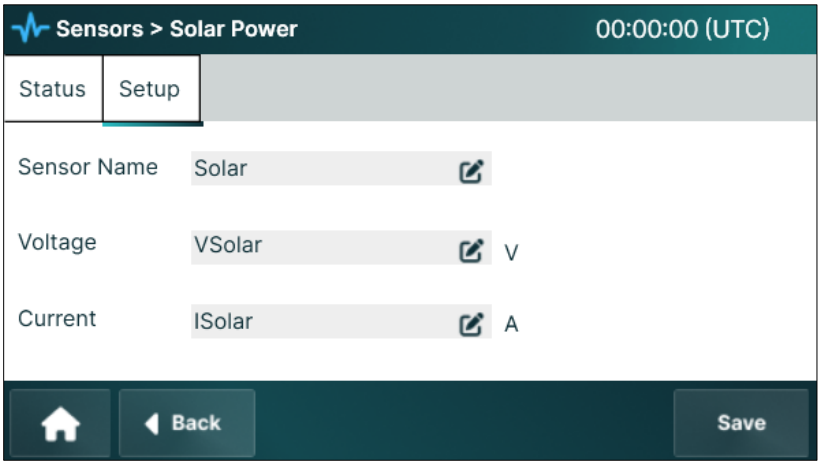
Status

The Status tab displays user-defined data points under *Datapoint Names* with real-time values for solar input.



Setup

The Setup tab provides a simple interface for configuring and monitoring essential solar power system properties. Users can configure the sensor's details and control its operation.



1. *Sensor Name* is pre-set to 'Solar' and can be modified as required. The user-defined name also appears on the sensor button in the Sensors screen for quick reference.
2. Specify custom names for *Voltage* (default: VSolar) and *Current* (default: ISolar).
3. Select the *Active* checkbox to enable the sensor. It allows the data logger to read the sensor data and enables calculations and processes to operate correctly without errors.
    - If the checkbox is left unselected, the sensor remains active for internal process but it will not be read by the data logger, and any calculations or processes that rely on the sensor's readings will report an error.
4. Press the Save button to save and apply the changes and apply the changes.

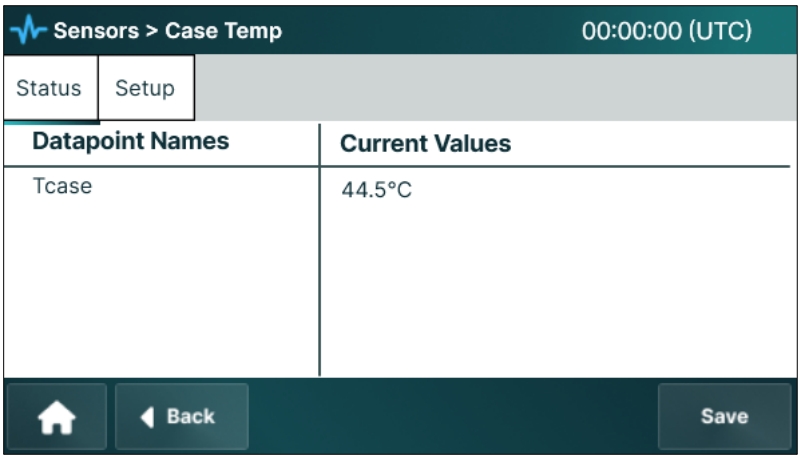
6.9 Case Temp Sensor

The internal Case Temp sensor measures inside the logger's housing. This sensor helps ensure that internal components operate within their safe thermal range.

6.9.1 Case Temp Sensor Configuration

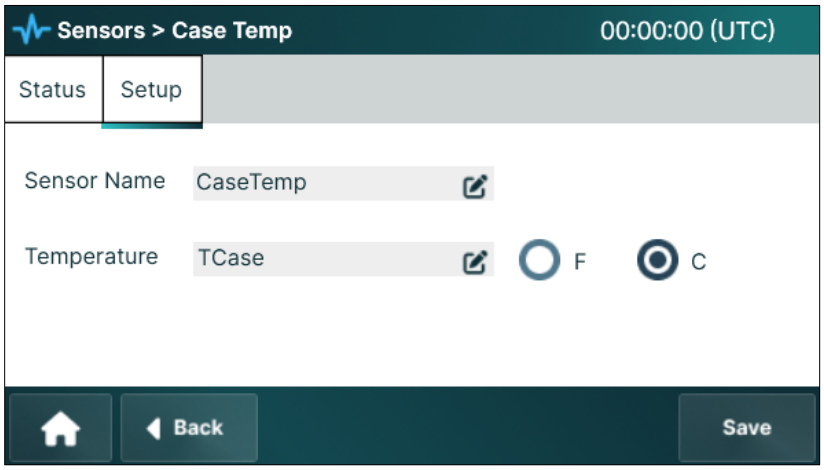
Status

The Status tab displays the real-time internal temperature of the data logger. The value refreshes automatically.



Setup

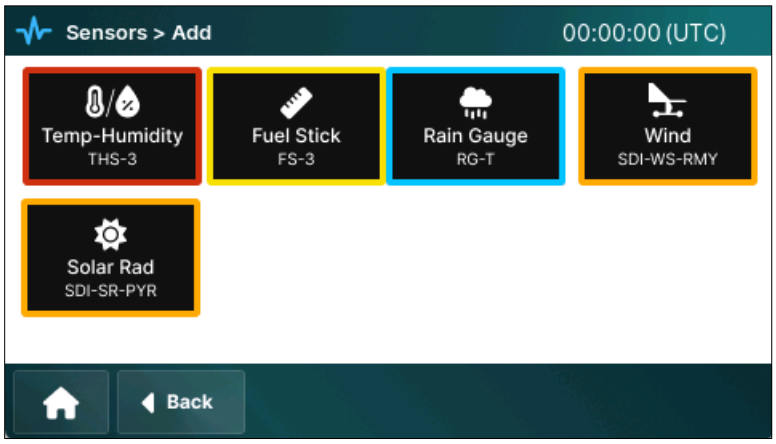
The Setup tab helps to configure and monitor the key parameters of the Case Temp sensor, including the sensor name and temperature units.



1. *Sensor Name* is pre-set to 'TCase' and can be modified as required. The user-defined name also appears on the sensor tile on the Sensors screen.
2. Select the desired temperature units.
   - *C* (Celsius)
   - *F* (Fahrenheit)
3. Select the *Active* checkbox to enable the sensor. It allows the data logger to read the sensor data and enables calculations and processes that include the data point.
   - If the checkbox is left unselected, the sensor will not be read by the data logger, and any calculations or processes that rely on the sensor's readings will report an error.
4. Press the **Save** button to save and apply the changes and apply the changes.

6.10 External Sensors

The *Sensors > Add* screen shows tiles for a range of sensors available from AEM. These tiles initiate a sensor configuration UI flow that presents the screens required to fully configure the features.



Once a sensor is configured, a new on the active sensor screen with the sensor name. Users can press the sensor's button to view and edit the associated parameters.

6.11 Temp-Humidity (THS-3) Sensor Configuration

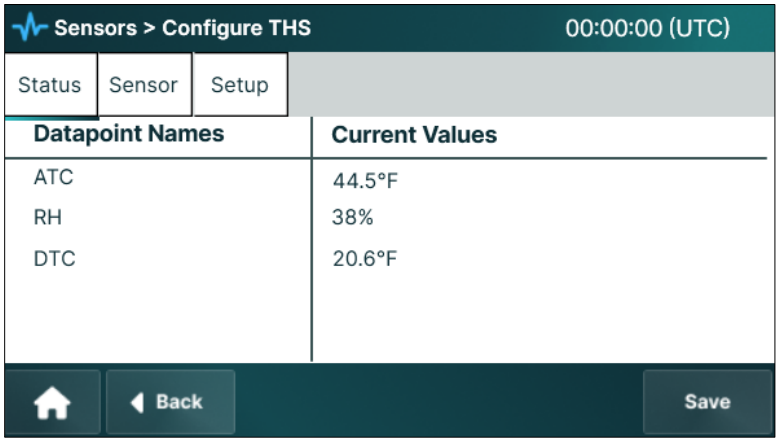
The Temp-Humidity (THS-3) sensor measures both temperature and relative humidity. It uses an enclosed thermistor to measure temperature and a capacitive humidity transducer to calculate relative humidity. The sensor produces a voltage corresponding to relative humidity (0-1 VDC for 0-100% RH).

> ***Note:*** The following instructions presume that the user is setting up a new THS-3.
>
> For existing sensors, the sequence does not include the *Additional Setup* screen. These features would be accessed through the respective main menu, Processes, Datalog, and Current Condition.

6.11.1 Temp-Humidity Sensor Setup

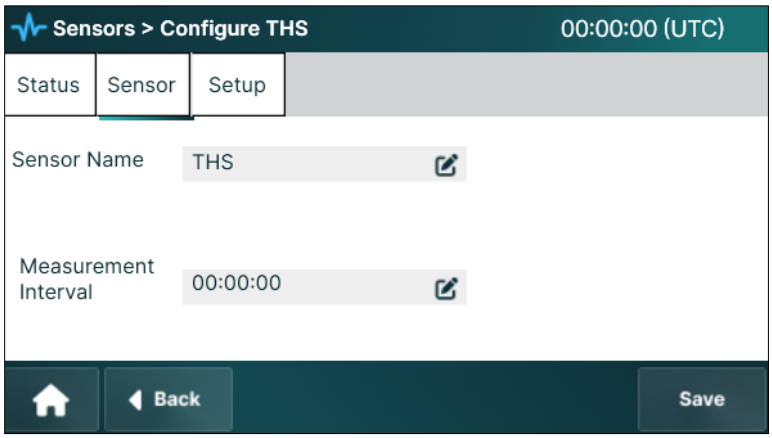
Status Tab

The Status tab provides real-time temperature (°C/°F) and humidity (%). These values will be initial blank when configuring a new sensor.



Sensor Tab

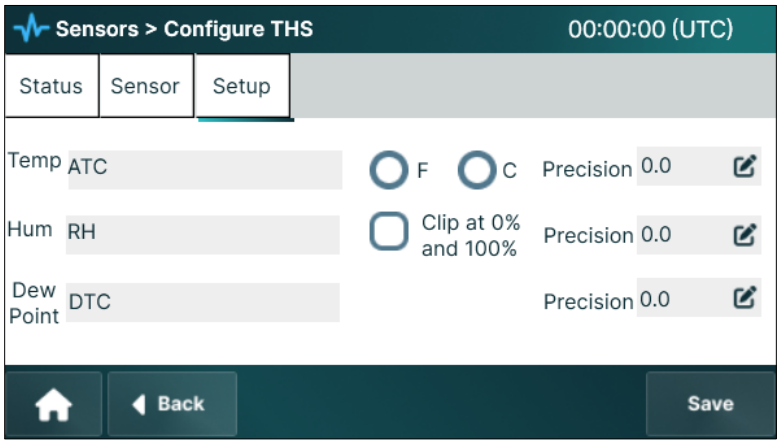
Use the Sensor tab to set the sensor name, measurement interval, and activity status.



1. *Sensor Name* appears on the tile in the Sensors screen.
2. *Measurement Interval* specifies the frequency at which the temperature and humidity measurements will be saved to the datastore.
3. Press the **Save** button to save and apply the changes.

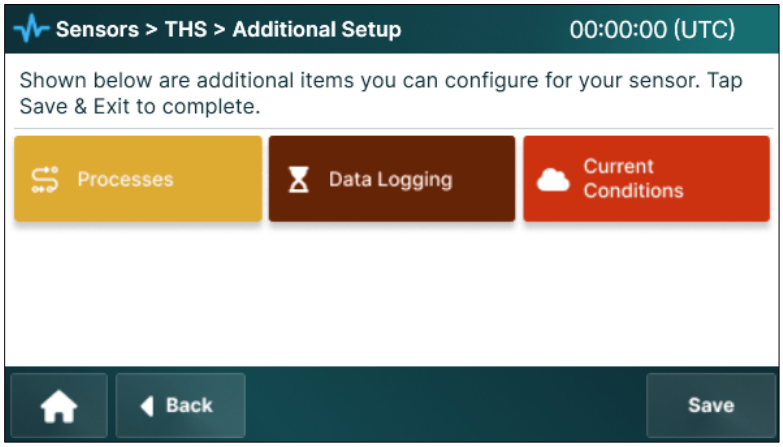
Setup Tab

The Setup tab configures data point names, precision, and units for temperature, humidity, and dew point.



1. *Temp* is data point name field for the temperature measurement value.
   - Select the unit for temperature measurement in the **Unit** field.
     - *F* (Fahrenheit)
     - *C* (Celsius)
2. *Hum* is the data point name for the relative humidity, RH.
   - Due to the nature of the capacitive sensing element, it can sometimes show values below 0% (negative) and above 100%. In some cases, this can be useful information. Otherwise, select *Clip at 0% & 100%* to restrict humidity to the normal range.
3. *Dew Point* is calculated automatically from temperature and relative humidity. The data point name is assigned in this field.
4. Specify the *Precision* for temperature, humidity, and dew point.
5. Press the **Save** button to save and apply the changes.

   When configuring new sensors, the **Save** button presents the *Additional Setup* screen. This page helps guide users to **Process**, **Data logging**, and **Current Conditions** menus.

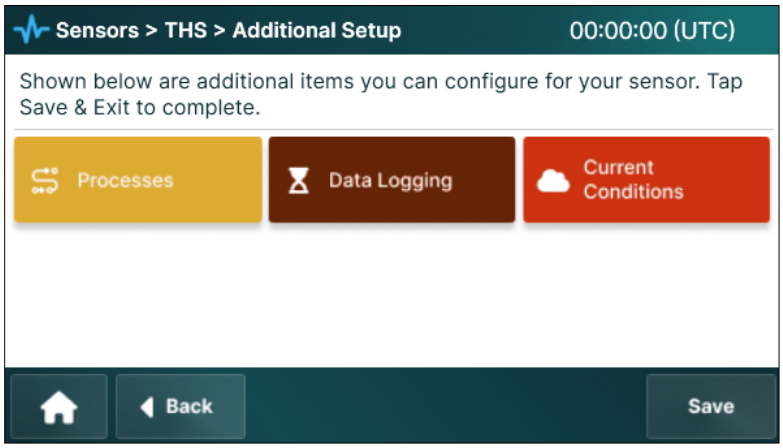


When editing an existing sensor, **Back** and **Save** will return to the *Sensors* screen.

6.11.2 Temp-Humidity Processes – Statistical Calculations

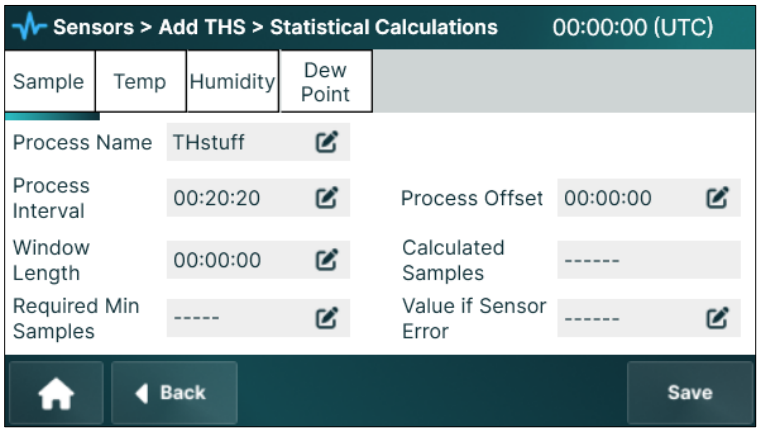
From the Additional Setup screen, press the **Processes** button.

> ***Note:*** When editing existing sensors, users will access **Processes** directly from the main menu.



Sample Tab

The Sample tab configures the data set and measurement characteristics of the statistical calculations.

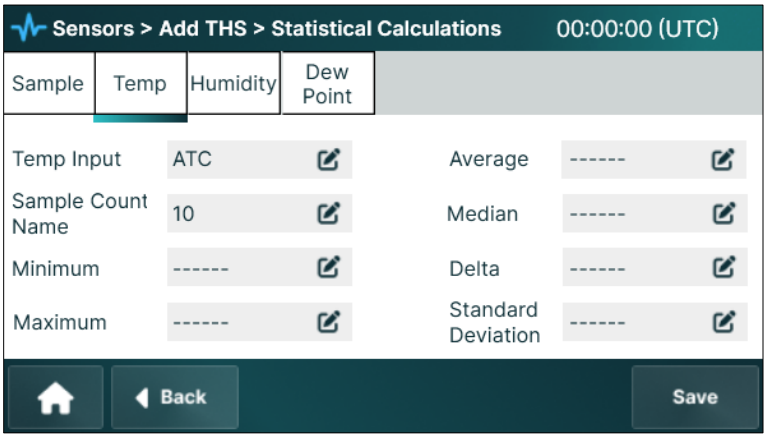


1. *Process Name* is the process name that will show on the active processes tile that is accessed from the main Process menu.
2. Set the *Process Interval* to specify how often the calculations occur.
3. *Process Offset* is used to execute the calculations prior to the clock time.
    - Example: An interval of 00:01:00 and an offset of 00:00:55 means readings will be taken every minute at the 55 second mark (eg: at 00:10:55, 00:11:55, 00:12:55, etc.). In this example, the specified offset ensures a measurement has been made and is available for logging on the minute mark.
    - Refer to Process Interval and Offset in the Processes Menu section for more information.
4. *Window Length* establishes the duration over which data is gathered for averaging calculations.
5. *Estimated Samples* dynamically updates and displays the calculated samples based on the *Measurement Interval* for the sensor.
    - Example: If Tem-Humidity sensor is configured for 1 minute *Measurement Interval* and *Window Length* is 10 minutes, *Estimated Samples* will show 10.
6. *Required Min Samples* defines the minumum number of samples that are required for accurate calculations.
    - Communication errors, sensor failures, or other disruptions may cause some seansor readings to be missed. An average that is calculated from only 2 samples may be considered unreliable. Setting *Required Min Samples* to 3 would block the process.
7. Specify a default value in the *Value if Sensor Error* field to be recorded in case of sensor error.
    - A value of 999 or some other would populate the fields if a error occurs.

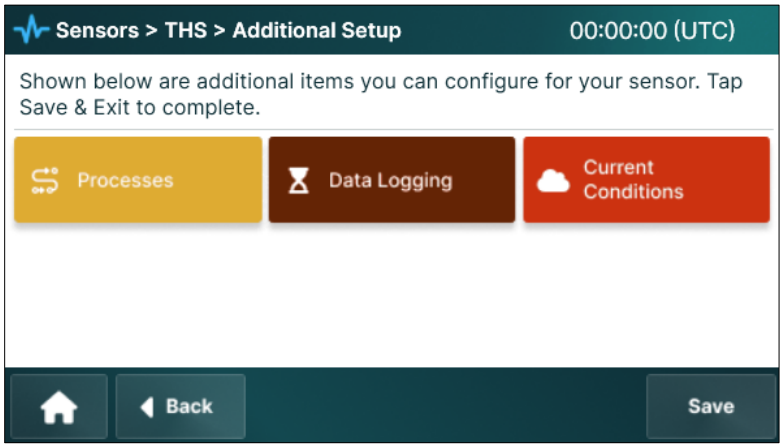
Temperature Tab

Temp consolidates all statistical calculations on a single tab.

A data point name is required for the calculation to occur; blank or "-" (null) data point names will not store a value.



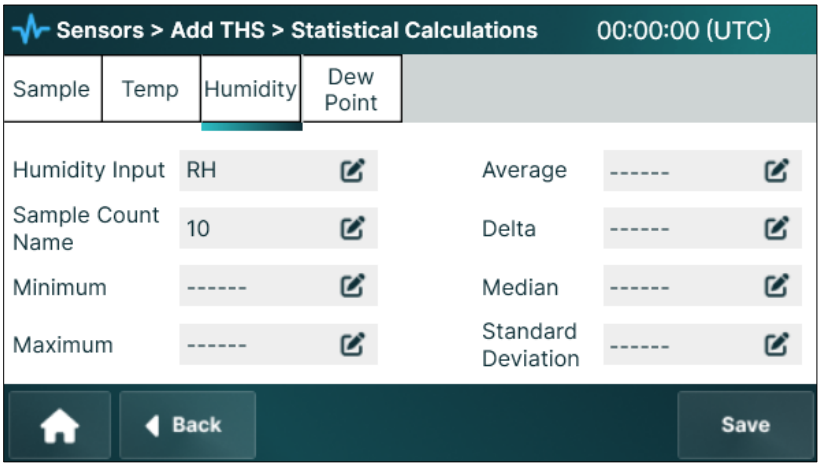
1. *Temp Input* is the sensor name to be used for the calculations.
2. *Sample Count Name* specifies the name field for the sample count.
   - In some cases, it may be important to log the number of measurements used for the calculation processes. This field is the data point name that will identify the value.
3. M*inimum/Maximum/Average/Median/Delta/Standard Deviation* are the data point name fields for the respective calculations. If a field is left blank, no calculation is performed on that parameter. The generated data points function similarly to any other in the data logger and can be used for logging, telemetry, additional process computations, or other operational purposes.
4. Save will record the changes to all tabs.
5. For new sensors, Back will return to the *Additional Setup* screen.
   If Save was not executed, all changes will be lost.

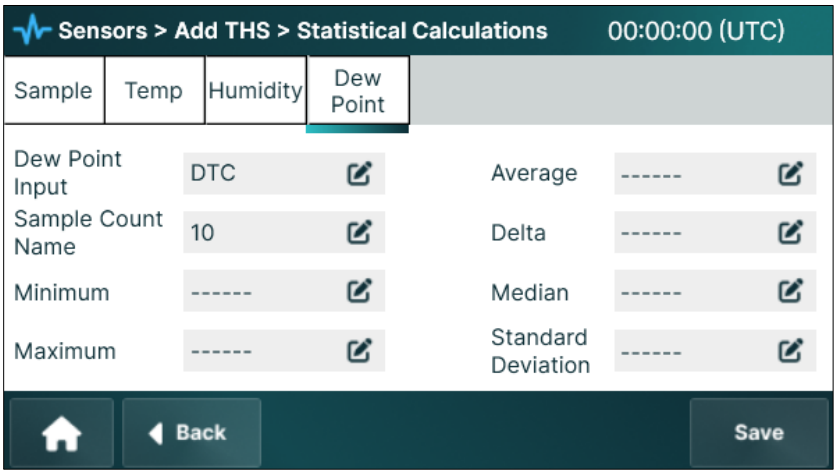


Humidity and Dew Point Tabs

The Humidity and Dew Point tabs operate in the same manner as Temp.

Utilize the previous instructions to configure statistical computations for humidity and dew point and press **Save** to record the changes on all tabs.





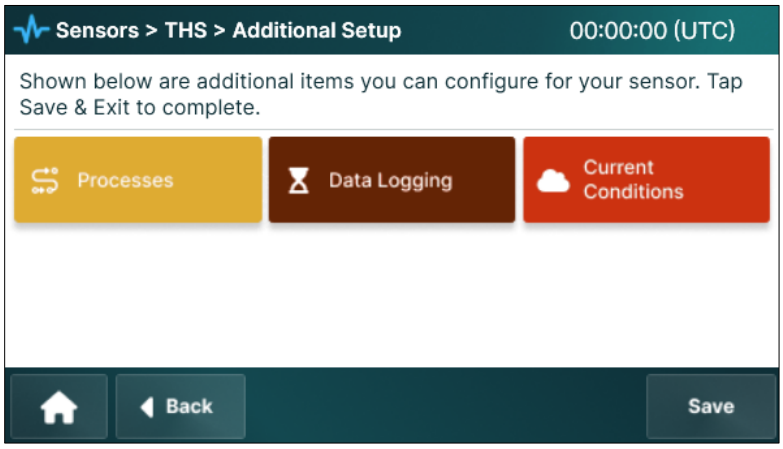
When adding a new sensor, pressing **Back** from the above *Sensors > Add THS >Statistical Calculations* screen will return to the *Additional Setup* menu screen.

When editing an existing sensor, **Back** will return to the Sensors screen.

6.11.3 Temp-Humidity Data Logging

From the Additional Setup screen, press the **Data Logging** button.

> *Note*: When editing existing sensors, users will access **Processes** directly from the main menu.

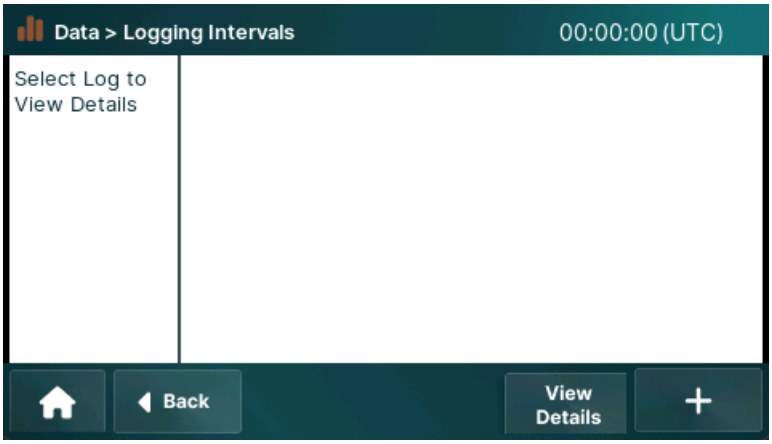


> *Note*: Depending on the application and intent, users may find it more convenient to create data log definitions automatically during the telemetry configuration process.

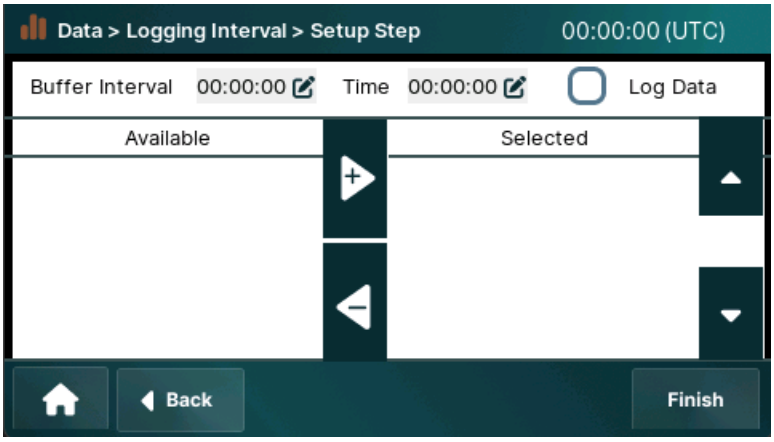
To log data from each sensor:

1. Press the **Data Logging** *Additional Setup* screen.
2. Press '**Add** button to create a new data log interval.

   O
   Press **View Details** to open an existing log definition.



3. Create or edit the log definition.



a. Select an *Available* data point name from the left column add (+) this to the *Selected* list on the right-hand side.

b. Continue adding to or removing names from the list until all the variables users want to log into display on the right-hand side.

   Re-order the *Selected* list using the up and down arrows.

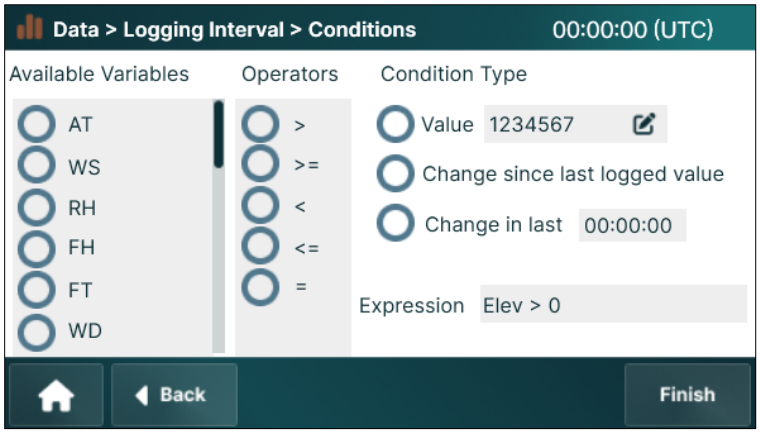
c. Enter the log *Interval* that will be used to extract measurements from the data store.

d. *Offset* may be set to match a sensor *Measurement Allowance*. Otherwise, the dynamic log will identify the entry with the time stamp closest to the Interval.

For more information on *Measurement Interval* and *Measurement Allowance*, refer to the Understanding Interval and Offset Timing section under General Operating information.

e. Select *Conditional* if the log is based on specific conditions that will trigger a log entry.

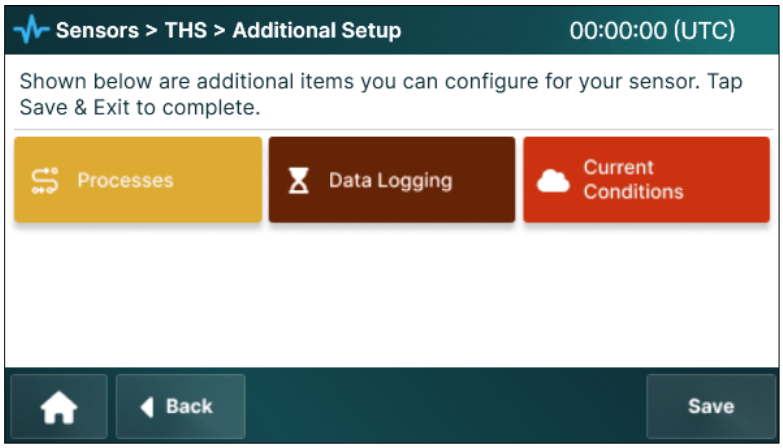
f. Press the **Next** button to save the changes. If conditional logging is enabled, the screen will advance to the Conditions screen.



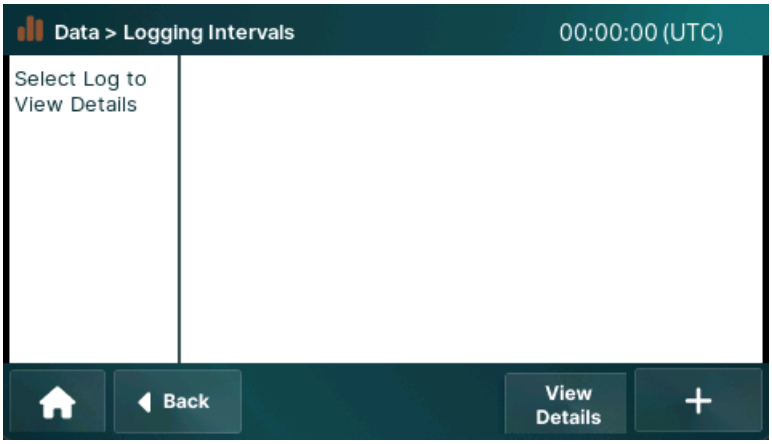
g. For conditional logging, select the variable, operator, and value that define the condition.

   Expression will show the Boolean expression to be used for the conditional trigger.

h. Press the **Finish** button to save the changes.

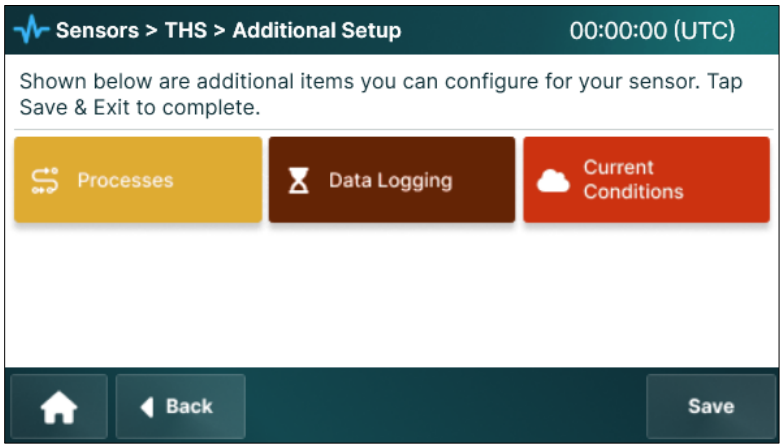


When editing an existing log, **Finish** will return to the *Datalog* screen.



6.11.4 Temp-Humidity Current Conditions

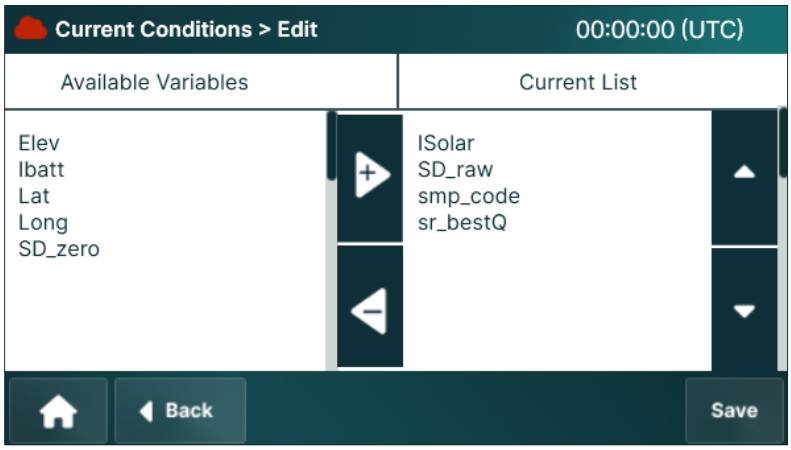
From the Additional Setup screen, press the **Current Conditions** button.



Use the list builder to select items from ***Available*** and add them to the ***Selected*** list.

> ***Note***: The Current Conditions page is limited to 25 data points.

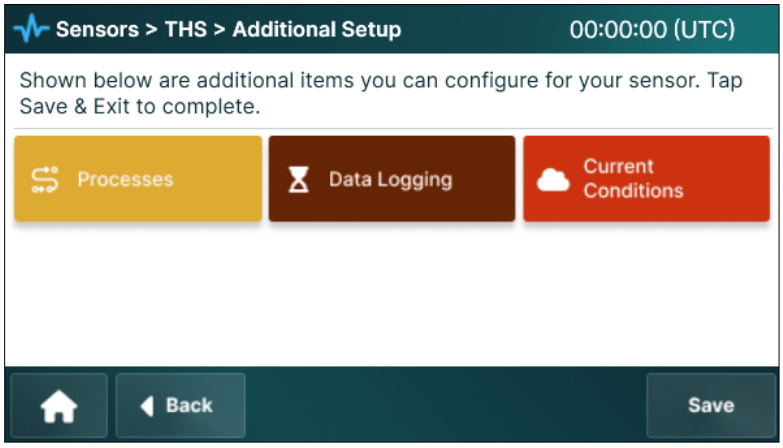
> ***Note***: The *Home* screen carousel displays up to nine data points simultaneously. Future updates will expand this limit and allow users to customize the displayed data points according to their preferences.



1. Use the **Move Right** and **Move Left Arrow** buttons to transfer data points between the ***Available*** and ***Selected*** columns.

   The **Up** and **Down Arrow** buttons allow users to adjust the order of selected data points. The configured data points will be displayed on the *Current Conditions* and *Home* screens.

   For new sensor configuration, **Save** will confirm the recording of the settings. **Back** will return to *Additional Setup* screen. Pressing **Back** before **Save** will cause all changes to be lost.



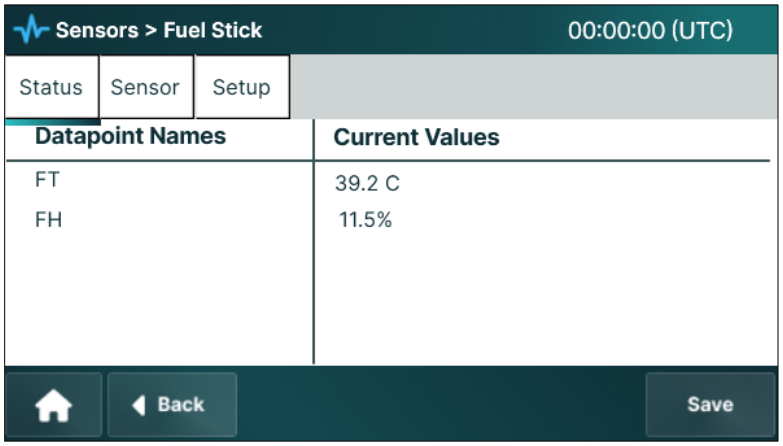
6.12 Fuel Stick (FS-3) Sensor Configuration

The Fuel Stick (FS-3) sensor is an analog to moisture content of natural fuels. This sensor simulates 10-hour fuel moisture by measuring temperature and humidity within a wooden dowel, a useful indicator of risk and potential fire behavior.

6.12.1 Fuel Stick Sensor Setup

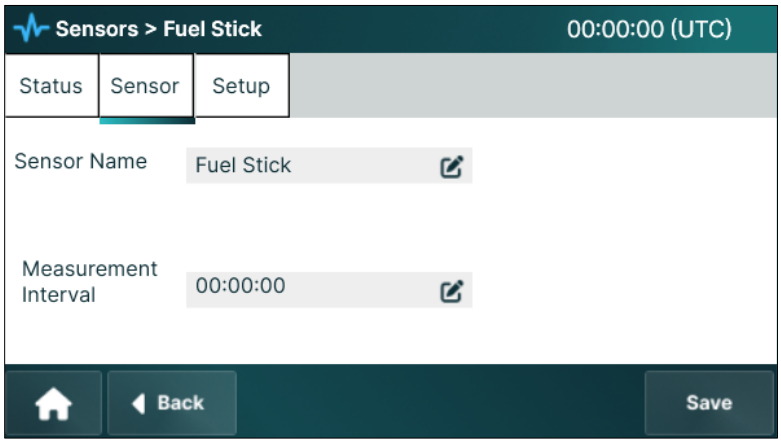
Status Tab

The Status tab provides real-time visibility into fuel-related metrics, reflecting configurations defined in the Setup tab for immediate monitoring.



Sensor Tab

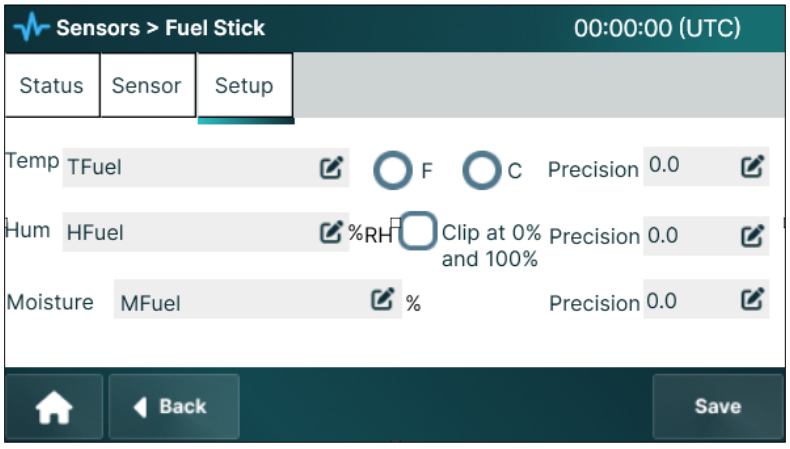
The Sensor tab enables configuration of operational settings for the Fuel Stick sensor, including activation and sampling frequency.



1. *Sensor Name* is pre-set to 'Fuel Stick' and can be modified as required. The user-defined name also appears on the sensor button in the Sensors screen for quick reference.
2. *Measurement Interval* specifies the frequency at which the rain gauge sensor records data.
3. Select the *Active* checkbox to enable the sensor. It allows the data logger to read the sensor data and enables calculations and processes to operate correctly without errors.
    - If the checkbox is left unselected, the sensor will not be read by the data logger, and any calculations or processes that rely on the sensor's readings will report an error.

Setup Tab

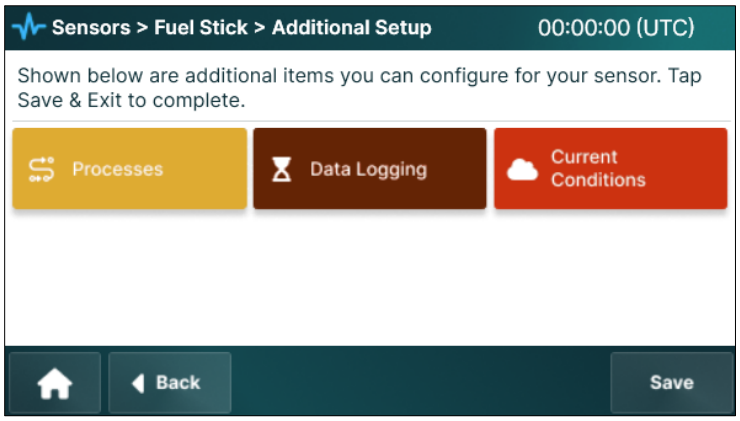
The Setup tab configures data points for fuel monitoring, allowing customization of parameter names and measurement settings for precise environmental tracking.



1. *Temp* displays the default name for temperature, set to TFuel by default. This name can be changed as required.
   - Select the unit for temperature measurement in the **Unit** field.
     - *F* (Fahrenheit)
     - *C* (Celsius)
2. *Hum* displays the default name for humidity, set to HFuel by default. This name can be changed as required.
   - Select the *Clip at 0% & 100%* to restrict sensor readings to 0%-100%. Values above 100% (1V) are recorded as 100%, while those below 0% (0V) are reported as 0%.

     If not selected, an error (ERR) will be reported if the sensor reads outside of its range (higher than 117%).
3. *Moisture* displays the default name for moisture, set to MFuel by default. This name can be changed as required.
4. Set the precision for temperature, humidity, and moisture readings in the *Precision* field. This helps ensure accurate measurement of atmospheric moisture.
5. Press the **Save** button to save and apply the changes.

   When configuring new sensors, the **Save** button presents the *Additional Setup* screen. This page helps guide users to **Process**, **Data logging**, and **Current Conditions** menus.



When editing an existing sensor, **Back** and **Save** will return to the *Sensors* screen.

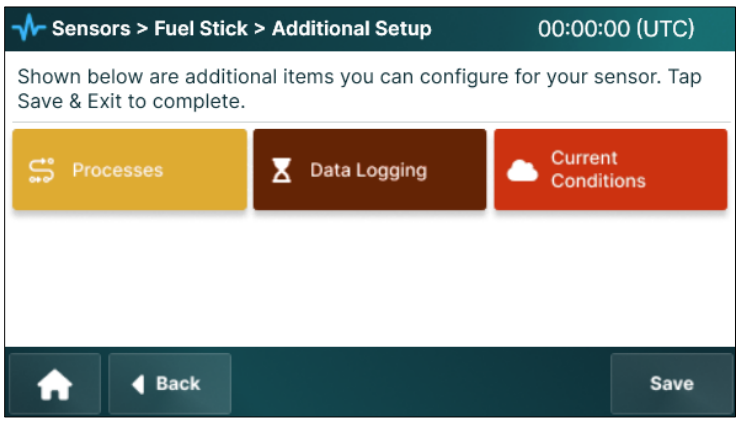
6.12.2 Fuel Stick Processes – Statistical Calculations

From the Additional Setup screen, press the **Processes** button.

> *Note*: When editing existing sensors, users will access **Processes** directly from the main menu.

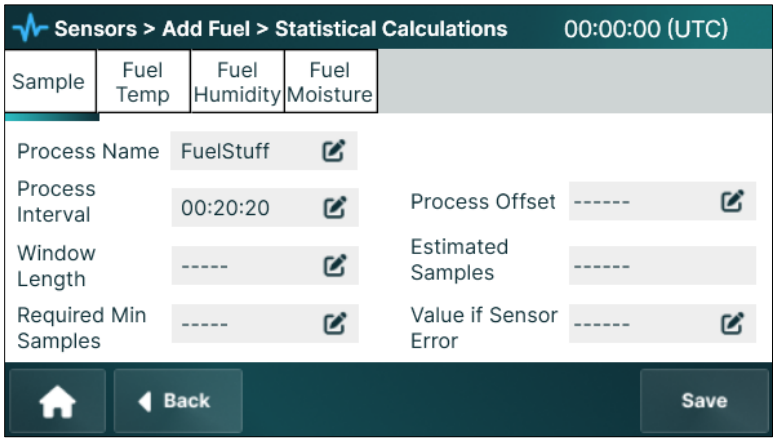
The *Processes* screen manages automated data analysis for the Fuel Stick sensor, configuring sampling parameters and statistical calculations to support fire behavior monitoring.

1. Press the **Processes** button on the Additional Setup screen.
   The *Processes* screen is displayed.



Sample Tab

The Sample tab defines how the Fuel Stick sensor manages data and enhances the sensor's ability to monitor fuel conditions.

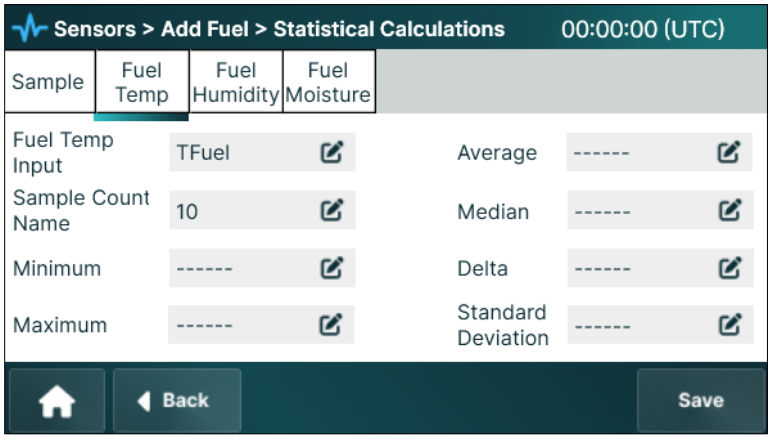


1. ***Process Name*** displays a default name, which can be modified as needed. The user-defined name helps identify the process when managing multiple statistical calculations.
2. Define the ***Process Interval*** to determine how frequently the input value is sampled to calculate temperature, humidity, and moisture. Shorter intervals provide more precise data.
3. Configure the ***Process Offset*** to set the specific time for sensor readings, ensuring measurements are completed and available before scheduled transmissions.
    - Refer to Process Interval and Offset in the Processes Menu section for more information.
4. Specify the ***Window Length*** to establish the duration over which data is gathered for averaging calculations.
5. ***Estimated Samples*** dynamically updates and displays the calculated samples based on the sampling parameters provided.
6. Set the ***Required Minimum Samples*** to ensure the process only executes when the defined number of samples is available for accurate calculations.

7. Specify a default value in the *Value if Sensor Error* field to be recorded in case of sensor error.

Fuel Temperature Tab

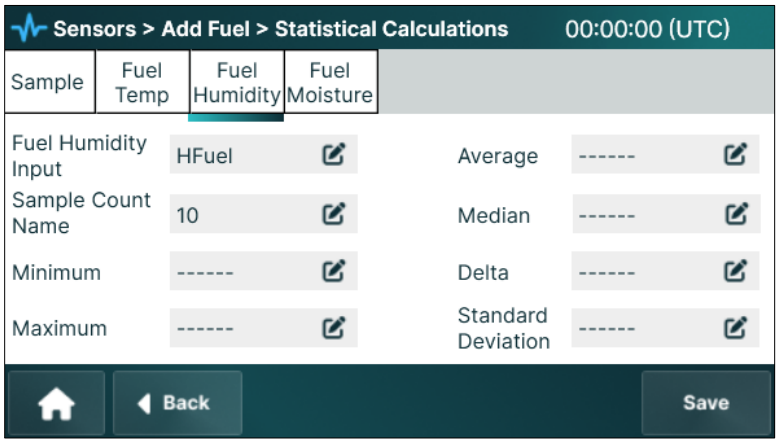
The Fuel Temp tab configures statistical analysis for temperature data, enabling detailed tracking of thermal conditions in fuel.



1. *Fuel Temp Input* displays the default name for fuel temperature input, set to TFuel by default. This name can be changed as required.
2. *Sample Count Name* specifies the number of samples taken during the sample period.
3. *Minimum/Maximum/Average/Median/Delta/Standard Deviation* specify the names of the data points created in the data logger to store the most recent calculations. If a field is left blank, no calculation is performed on that parameter. The generated data points function similarly to any other in the data logger and can be used for logging, telemetry, additional process computations, or other operational purposes.

Fuel Humidity Tab

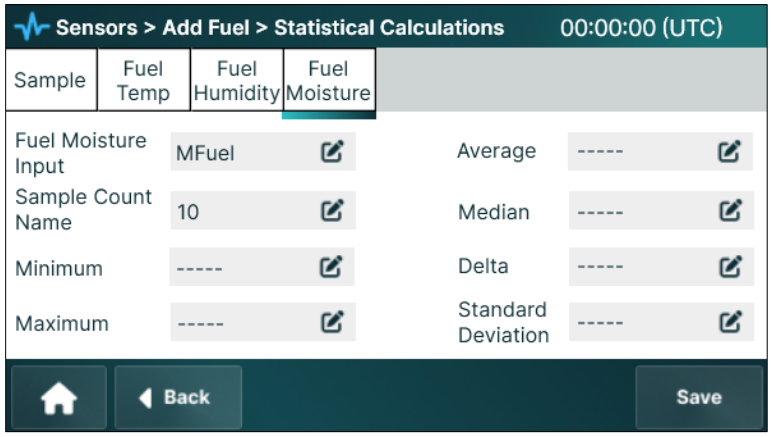
The Fuel Humidity tab configures statistical analysis for humidity data, supporting precise monitoring for fire risk assessment.



1. *Fuel Humidity Input* displays the default name for humidity input, set to HFuel by default. This name can be changed as required.
2. *Sample Count Name* specifies the number of samples taken during the sample period.
3. *Minimum/Maximum/Average/Median/Delta/Standard Deviation* specify the names of the data points created in the data logger to store the most recent calculations. If a field is left blank, no calculation is performed on that parameter. The generated data points function similarly to any other in the data logger and can be used for logging, telemetry, additional process computations, or other operational purposes.

Fuel Moisture Tab

The Fuel Moisture tab configures statistical analysis for moisture data, critical for assessing fuel flammability.



1. *Fuel Moisture Input* displays the default name for moisture input, set to MFuel by default. This name can be changed as required.
2. *Sample Count Name* specifies the number of samples taken during the sample period.
3. *Minimum/Maximum/Average/Median/Delta/Standard Deviation* specify the names of the data points created in the data logger to store the most recent calculations. If a field is left blank, no calculation is performed on that parameter. The generated data points function similarly to any other in the data logger and can be used for logging, telemetry, additional process computations, or other operational purposes.
4. Press the Save button to save and apply the changes.

6.12.3 Fuel Stick Data Logging

FS-3 operates identically to the Temp-Humidity sensor.

Refer to the Temp-Humidity Data Logging section of this manual.

6.12.4 Fuel Stick Current Conditions

FS-3 operates identically to the Temp-Humidity sensor.

Refer to the Temp-Humidity Current Conditions section or the Current Condition menu section of this manual for information on Current Conditions.

6.13 Rain Gauge (RG-T) Sensor Configuration

The Rain Gauge input is compatible with tipping bucket rain gauges, such as AEM RG-T. Tips are counted and associated with the increment that the user has configured, typically 0.01 inch or 02 mm. Note that precision should be set to the tip increment of the rain gauge.

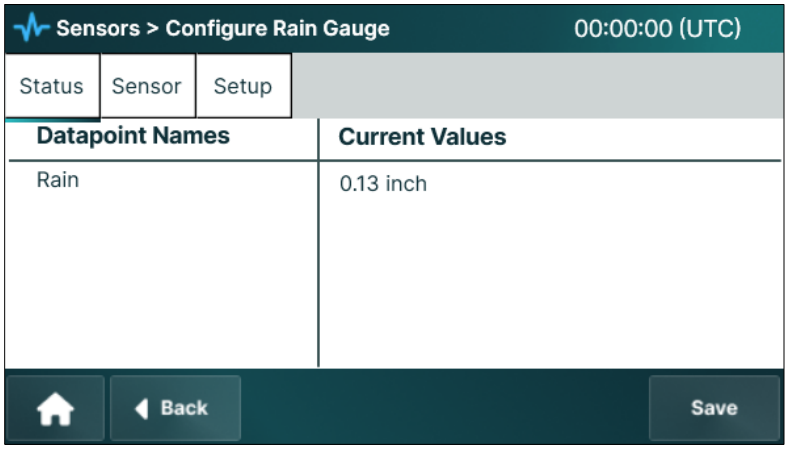
Tips are recorded in two different methods:

1. The number of new tips is recorded at the Measurement Interval.
2. Each tip is stored with a time stamp corresponding to the moment that it was detected. – New functionality which will be available in the future

6.13.1 Rain Gauge Sensor Setup

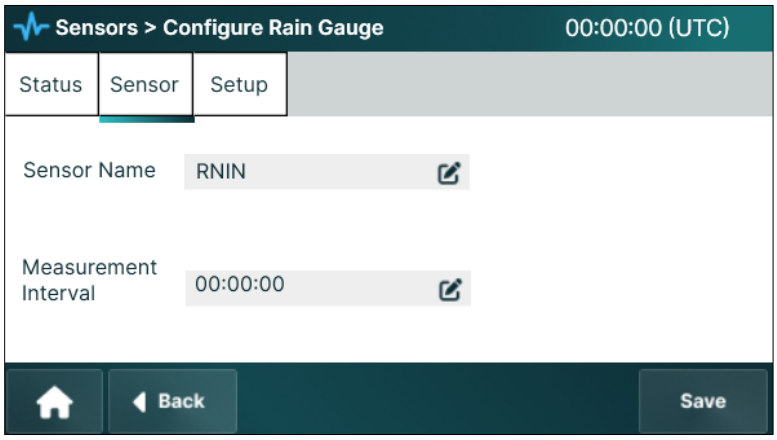
Status Tab

Once the sensor is configured, the Status tab will show current measurements. The current values refresh automatically.



Sensor Tab

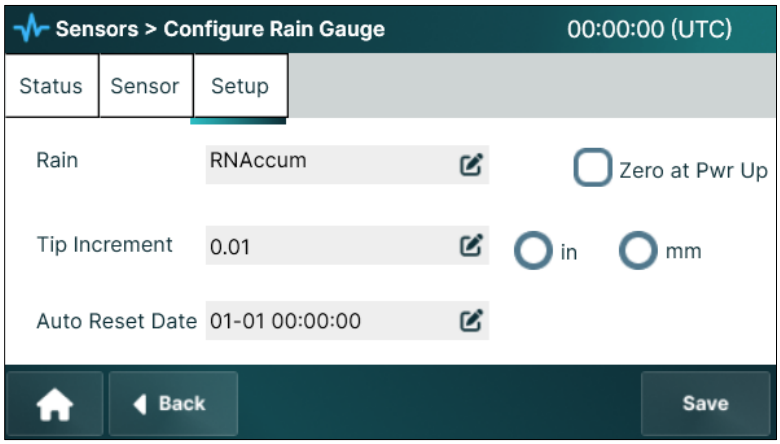
The Sensor tab sets *Sensor Name* and *Measurement Interval*. The checkbox may be selected to activate or deactivate the sensor.



1. *Sensor Name* appears on the sensor tile on the *Sensors* screen.
2. *Measurement Interval* specifies the period at which the rain gauge sensor saves any new detected tips to the datastore since the last record.
3. Select the *Active* checkbox to enable the sensor. It allows the data logger to read the sensor data and enables calculations and processes to operate correctly without errors.
    - If the checkbox is left unselected, the sensor will not be read by the data logger, and any calculations or processes that rely on the sensor's readings will report an error.

Setup Tab

The Setup tab calibrates the sensor for accurate rainfall measurement, allowing users to adjust settings to operational needs.



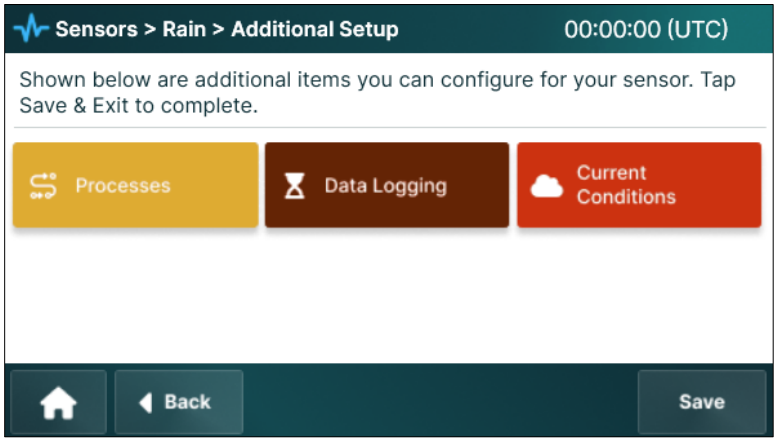
1. *Rain* specifies the name for accumulated rainfall. Users can edit this label by pressing the Edit icon.
2. *Zero at Pwr Up* checkbox, when enabled, resets the rain accumulation total to zero each time the sensor is powered on.
3. Define the *Tip Increment* (default: 0.01 inches) to calibrate rainfall per tip. The options include:

Units	Tip Increment
inches	0.01
cm	0.0254
mm	0.254
count	1

Important: Ensure the tip increment is converted to match the units selected for accurate measurements.

4. Select the measurement *Unit* as per preference. By default, inches are selected but it can be changed. The commonly used units are inches, millimeters (mm), or measurement counts.
5. Set a specific date and time for *Auto Reset Date* to automatically reset the rain accumulation count to zero. This helps in scheduling routine resets.
6. Press the **Save** button to save and apply the changes.

   When configuring new sensors, the **Save** button presents the *Additional Setup* screen. This page helps guide users to **Process**, **Data logging**, and **Current Conditions** menus.

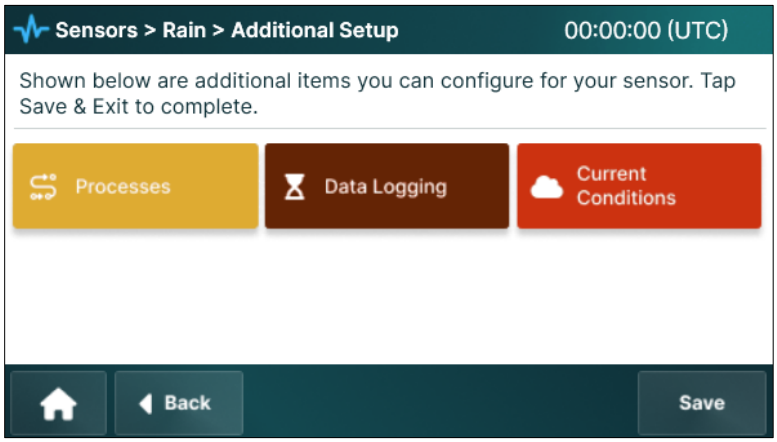


When editing an existing sensor, **Back** and **Save** will return to the *Sensors* screen.

6.13.2 Rain Gauge Processes – Statistical Calculations

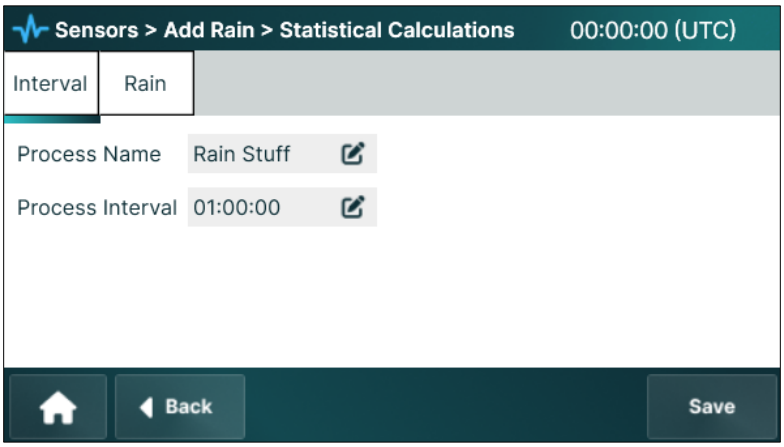
The **Processes** automate rainfall data analysis, enabling users to define sampling intervals and statistical calculations.

1. Press the **Processes** button on the Additional Setup screen.
   The *Processes* screen is displayed.



Interval Tab

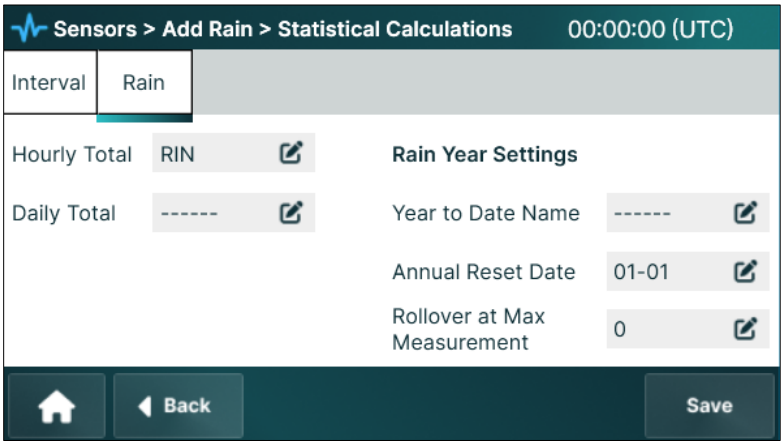
The Interval tab sets the process name, interval, and other parameters.



1. *Process Name* is displayed on the tile on the active *Processes* screen.
2. *Process Interval*, in the format hh:mm:ss, is the period that the calculation results are saved to the datastore. Process interval should be longer than Measurement Interval set on the Sensor tab during initial sensor setup.

Rain Tab

The Rain tab defines data point names and other characteristics for rainfall behavior.



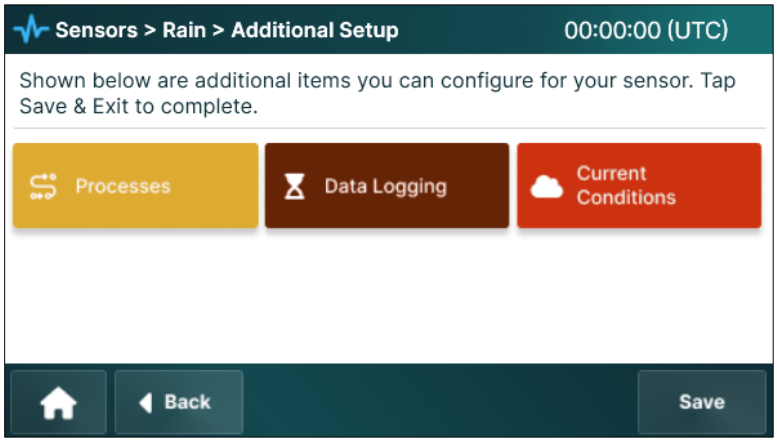
1. *Hourly Total* calculates and displays total rainfall recorded over the last hour.
2. *Rain/hr* indicates the measured rainfall rate per hour.
3. *Year to Date Name* is the name applied to cumulative annual rainfall.
4. *Annual Reset Date* automatically zeros the accumulated rain counter for the beginning of the next water year.

5. *Rollover at Max Measurement* resets the counter for systems that have limitations on the maximum count that can be recorded. For all other applications, leave this value set at zero.
6. Press the **Save** button to save and apply the changes.
   The *Additional Setup* screen is displayed.

6.13.3 Rain Gauge Data Logging

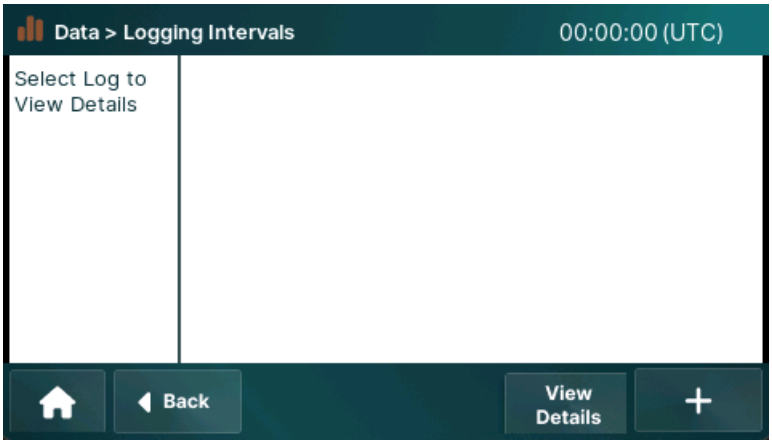
From the Additional Setup screen, press the **Data Logging** button.

> *Note*: When editing existing sensors, users will access **Processes** directly from the main menu.



> *Note*: Depending on the application and intent, users may find it more convenient to create data log definitions automatically during the telemetry configuration process.

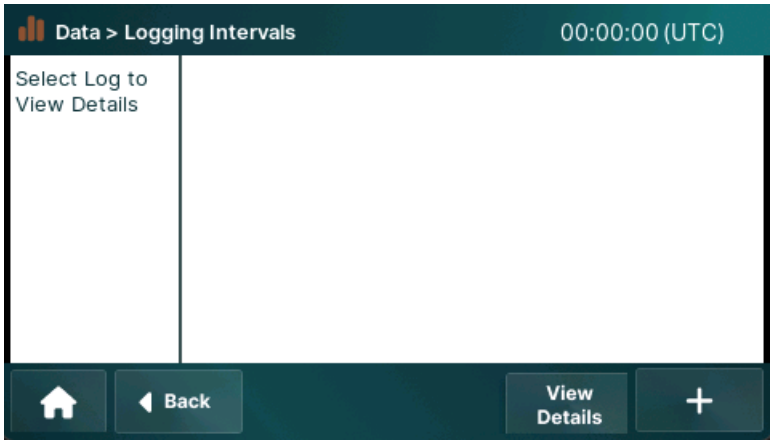
Data Logging defines frequency and data points included in the log.



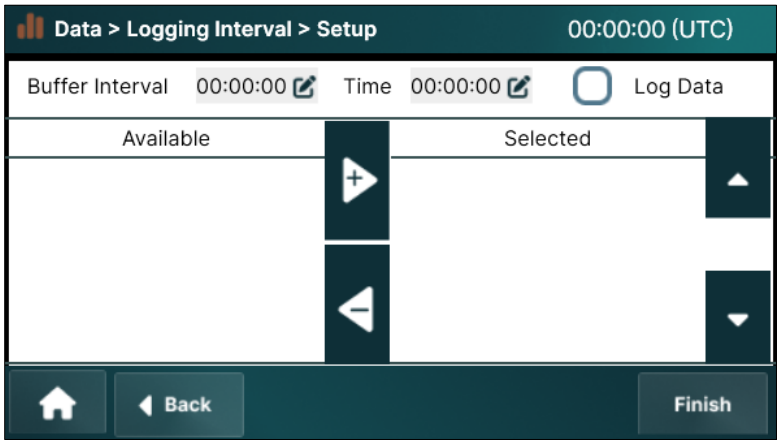
Setting up a logging interval requires selecting the frequency and identifying the specific data points to be included.

1. Press the **Data Logging** *Additional Setup* screen.
2. Press '**+**' (add) button to create a new data log interval.

Or
press **View Details** to open an existing log definition.



3. Create or edit the log definition.



a. Select an ***Available*** data point name from the left column add (**+**) this to the ***Selected*** list on the right-hand side.

b. Continue adding to or removing names from the list until all the variables users want to log into display on the right-hand side.

   Re-order the ***Selected*** list using the up and down arrows.

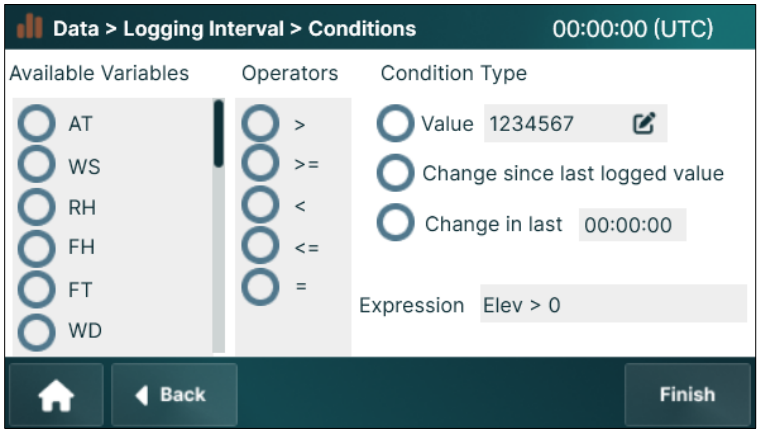
c. Enter the ***Interval.*** This is the logging interval that will be extracted from the data store.

d. ***Offset*** is the clock time used for the log.

> ***Note***: For more information regarding Interval and Offset, refer to the General Operating Information section Understanding Interval and Offset.

e. Select ***Conditional*** if the log is based on specific conditions that will trigger a log entry.

f. Press the **Next** button to save the changes. If conditional logging is enabled, the screen will advance to the Conditions screen.

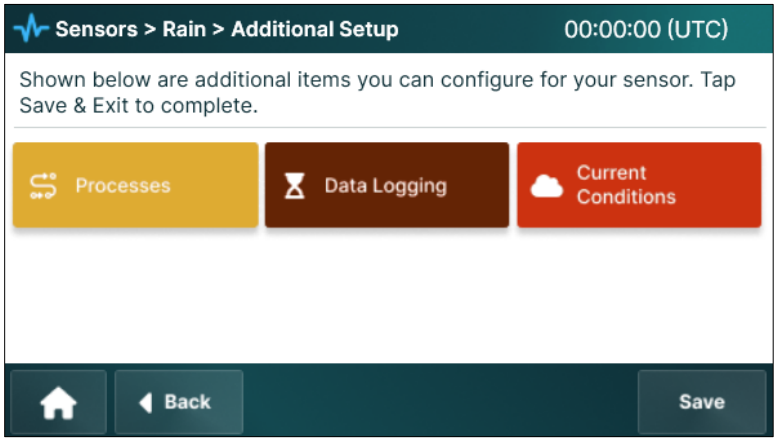


g. For conditional logging, select the variable, operator, and value that define the condition.

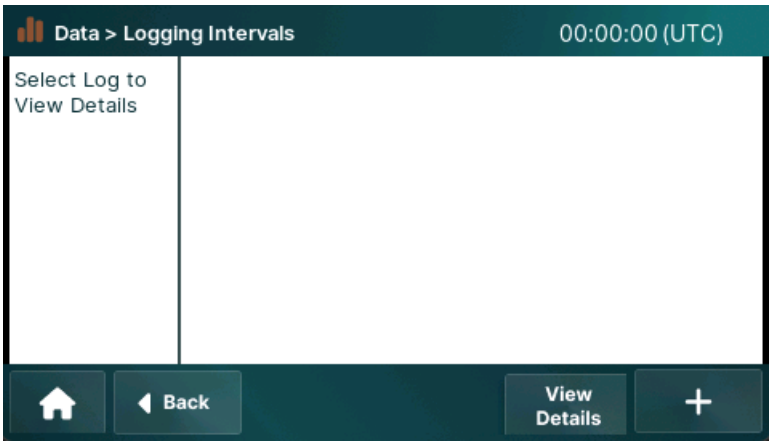
   Expression will show the Boolean expression to be used for the conditional trigger.

h. Press the **Finish** button to save the changes.

When adding a new sensor, **Finish** will return to the Additional Setup screen.

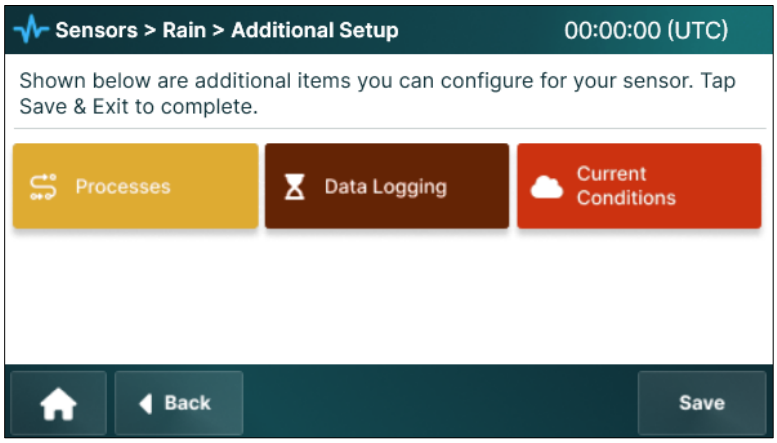


When editing an existing log, **Finish** will return to the *Datalog* screen.



6.13.4 Rain Gauge Current Conditions

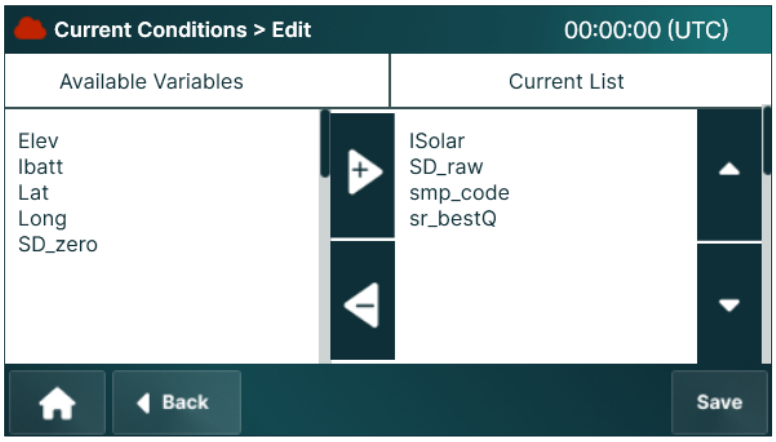
From the Additional Setup screen, press the **Current Conditions** button.



Use the list builder to select items from ***Available*** and add them to the ***Selected*** list.

> ***Note:*** The Current Conditions page is limited to 25 data points.

> ***Note:*** The *Home* screen carousel displays up to nine data points simultaneously. Future updates will expand this limit and allow users to customize the displayed data points according to their preferences.



1. Use the **Move Right** and **Move Left Arrow** buttons to transfer data points between the ***Available*** and ***Selected*** columns.

   The **Up** and **Down Arrow** buttons allow users to adjust the order of selected data points. The configured data points will be displayed on the *Current Conditions* and *Home* screens.

2. For new sensor configuration, **Save** will confirm the recording of the settings. **Back** will return to *Additional Setup* screen. Pressing **Back** before **Save** will cause all changes to be lost.

6.14 Wind Sensor (SDI-WS-RMY) Configuration

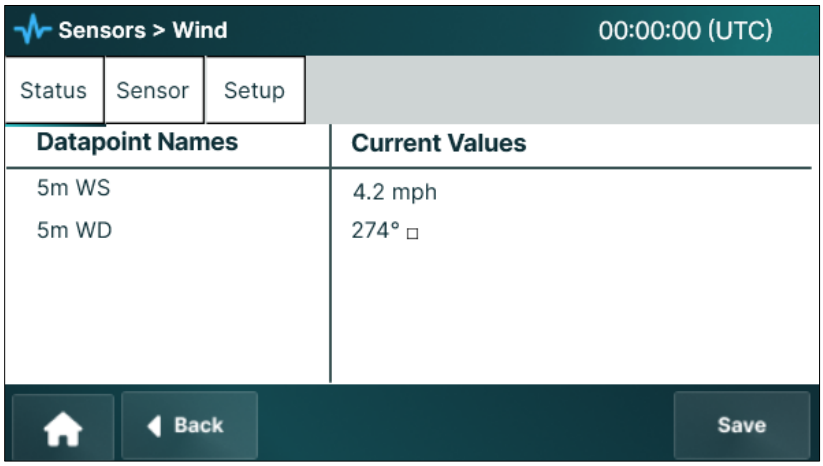
The Wind Sensor (SDI-WS-RMY) employs SDI-12 protocol to measure speed and direction.

Axiom leverages the AEM SDI interface installed in RM Young 0531 to provide higher sample rates and extended measurement functions for peak and average values that would otherwise not be possible with the standard 0531 device.

6.14.1 Wind Sensor Setup

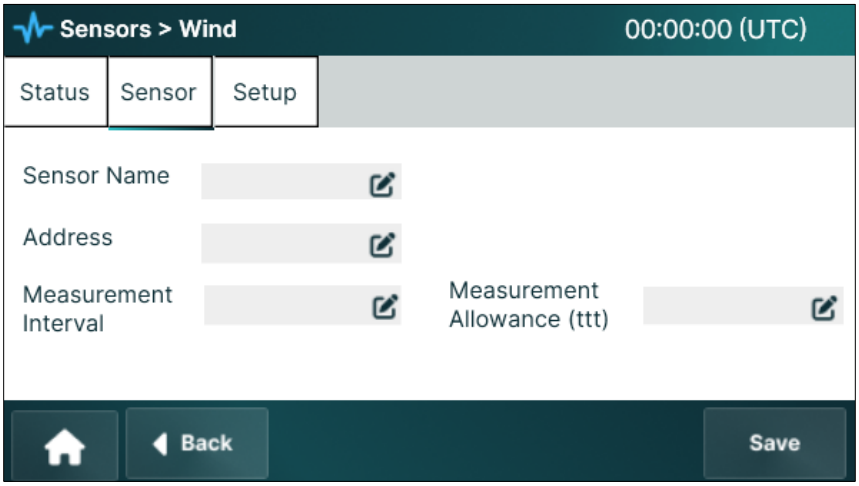
Status Tab

The Status tab for the Wind Sensor displays real-time wind measurements based on the configured data points. Measurement values are automatically refreshed to show current readings.



Sensor Tab

The Sensor tab configures operational settings for the Wind Sensor.



1. *Sensor Name* is shown on the sensor tile in the *Sensors* screen.
2. *Address* for the sensor. This should match the address set in sensor.

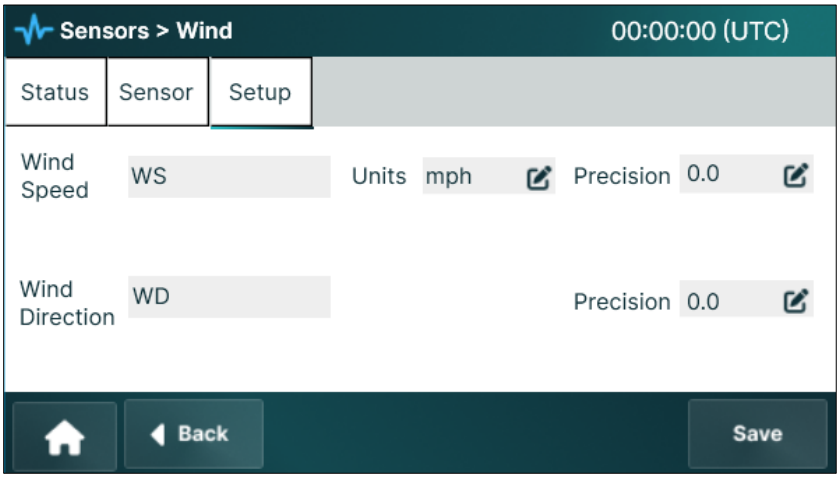
> *Note*: The sensor address can be changed using tools in the Axiom SDI-12 main menu.

3. Select the *Active* checkbox to enable the sensor. It allows the data logger to read the sensor data and enables calculations and processes to operate correctly without errors.
   - If the checkbox is left unselected, the sensor will not be read by the data logger, and any calculations or processes that rely on the sensor's readings will report an error.
4. Specify the *Measurement Interval* at which the sensor collects wind data and saves it to the datastore. (10 second interval is recommended.)
5. Set the *Measurement Allowance (ttt)* to the set the timing tolerance or measurement allowance of the sensor. A longer value may be used.

> *Note*: For more information on *Measurement Interval* and *Measurement Allowance*, refer to the Understanding Interval and Offset Timing section under General Operating information.

Setup Tab

The Setup tab configures wind speed and direction parameters, ensuring precise measurement and data representation.



1. *Wind Speed* is data point name for the wind speed measurement.
   - Select the *Unit* for wind speed measurement. By default, it shows mph, which can be changed as required. Press the **Edit** button to view the list of available units.
2. *Wind Direction* is the data point name for the wind direction measurement.
3. *Precision* specifies the precision value for wind speed and wind direction readings in the field.
4. Press the **Save** button to save and apply the changes.

   When configuring new sensors, the **Save** button presents the *Additional Setup* screen. This page helps guide users to **Process**, **Data logging**, and **Current Conditions** menus.

When editing an existing sensor, **Back** and **Save** will return to the *Sensors* screen.

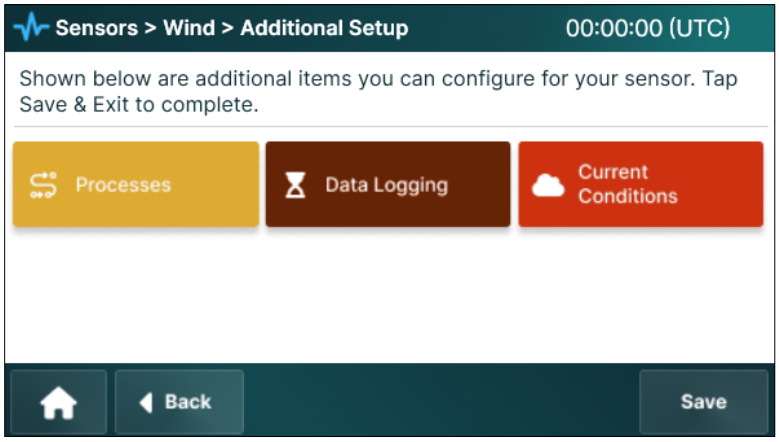
6.14.2 Wind Sensor Processes – Statistical Calculations

When configuring a new sensor, the *Additional Setup* screen provides quick links to processes, data logging, and current conditions monitoring menus.

The *Processes* screen customizes data analysis for the Wind Sensor, configuring sampling and statistical calculations to provide insights into wind dynamics.

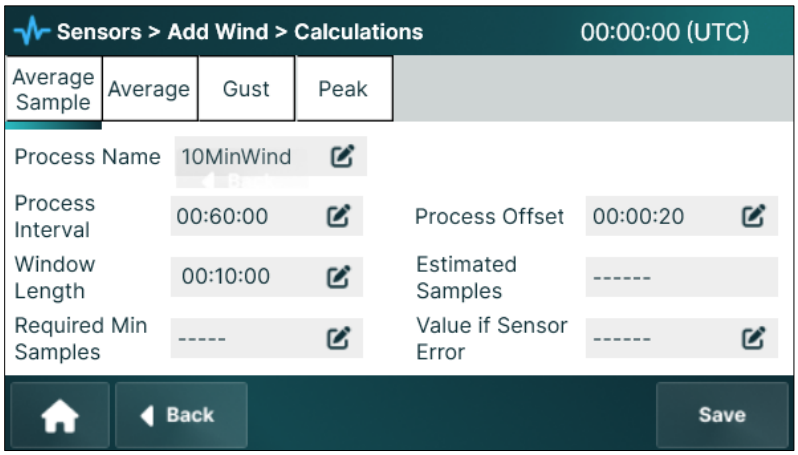
> ***Note***: More information on the operation and interaction of the data logger with SDI-WS-RMY can be found in the *Processes > SDI-RMY Process* section of this manual.

1. Press the **Processes** button on the *Additional Setup* screen.
   The *Processes* screen is displayed.



Average Sample Tab

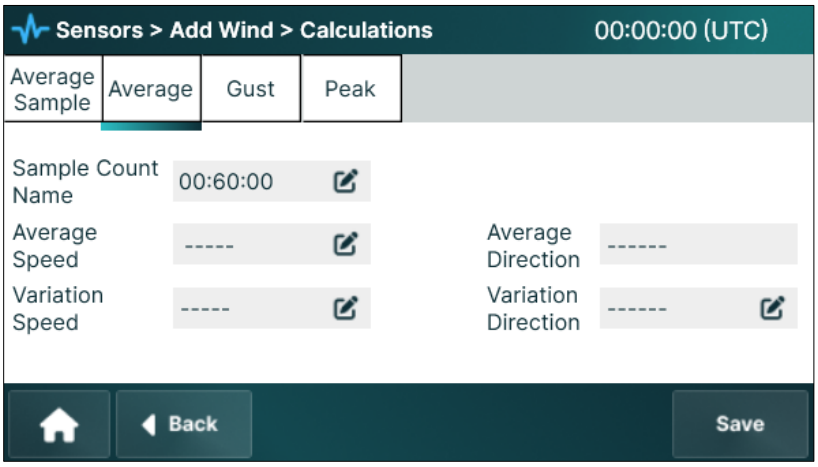
The Average Sample tab defines sample period to be used for calculating average and gust.



1. *Process Name* displays the name that will be shown on the new process tile that will appear on the active *Processes* screen.
2. *Process Interval* is the interval for the calculation to be executed.
3. Use *Process Offset* to specify the time difference for the process execution.
    - Example: A process interval of 00:60:00 and an offset of 00:55:00 means the process will run every hour, commencing at 55 after the hour.
    - Refer to Process Interval and Offset in the Processes Menu section for more information.
4. Set *Window Length* to the desired sample period.
5. *Estimated Samples* are dynamically calculated using the sensor Measurement Interval to determine the samples included in specified window length.
6. Set the *Required Minimum Samples* to ensure the process only executes when the defined number of samples is available for accurate calculations.
    - A sensor that is configured for a Measurement Interval of 10 seconds and a Window Length of 60 minutes, would show an Estimated Samples of 360. Required Min Samples might be set to 300, to ensure that there are a reasonable number of samples for the calculations.
7. Specify a default value in the *Value if Sensor Error* field to be recorded in case of sensor or process error.

Average Tab

The Average tab configures calculations for average and variation of wind speed and direction over the sample period.

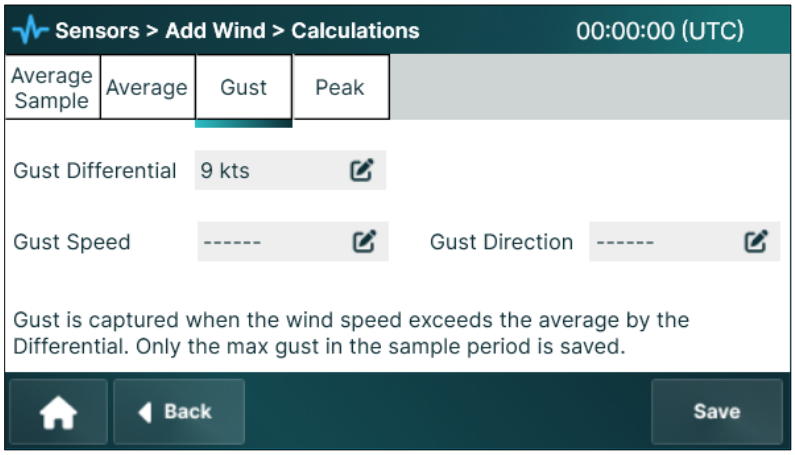


1. *Sample Count Name* is the name of the data point for the number of samples used for the calculations.
2. *Average Speed* sets the data point name for the average wind speed.
3. *Average Direction* sets the data point name for vector average wind direction.
4. *Variation Speed* is the data point name for fluctuation or variation in wind speed over the sample period.
5. *Variation Direction* is the data point name for wind direction variation over the sample period.
6. Press the **Save** button to save and apply the changes.

Gust Tab

The Gust tab configures the settings to identify and quantify, rapid increases in wind speed.

Unlike other wind parameters, Gust configuration does not include an interval or window length; it is inherently associated to the average period configured on the previous tab.



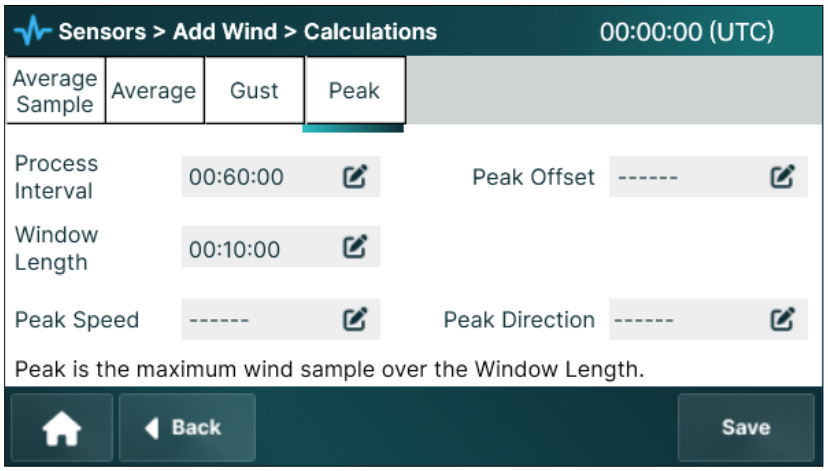
1. Set *Gust Differential* to the wind speed threshold above the average that will trigger a gust measurement.
   - Example: Consider a uniformly variable wind with a rolling 10-minute average speed of 5.5 knots and a *Gust Differential* set to 9 kts.

     A sudden change in wind causes a current wind measurement of 18.2 kts. This exceeds the average by 12.7 kts, surpassing the 9 kts threshold. 18.2 kts would be captured as a gust value.

     The gust, (like the maximum and peak values) is recorded in the data log with a timestamp indicating when it occurred. Alternatively, the gust value can be saved until the end of the Process Interval and recorded with other measurements. If a higher gust value is detected during the Process Interval, it will replace the previously recorded gust value.
2. Assign a data point name for *Gust Speed*.
3. *Gust Dir. (Direction)* is the data point name for the direction of a detected gust.
4. Press the **Save** button to save and apply the changes.

Peak Tab

The Peak tab configures settings to detect and record the highest (or maximum) wind over the sample period.



1. Set *Process Interval* to specify how often the process is executed.
2. Enter a *Process Offset* to execute calculations in advance of interval.
   - Refer to Process Interval and Offset in the Processes Menu section for more information.
3. Specify the *Window Length* to determine the duration over which data is collected for averaging.
4. *Peak Speed* calculates and displays the peak wind speed during the defined window length.
5. *Peak Dir. (Direction)* identifies the peak wind direction during the same time frame.
6. Press the Save button to save and apply the changes.
   The *Additional Setup* screen is displayed.

6.14.3 Wind Sensor Data Logging

Data Logging operates in the same manner as other sensors. Refer to Temp-Humidity Data Logging section for more information.

6.14.4 Wind Sensor Current Conditions

Current Conditions operate in the same manner as other sensors. Refer to Temp-Humidity Current Conditions for more information.

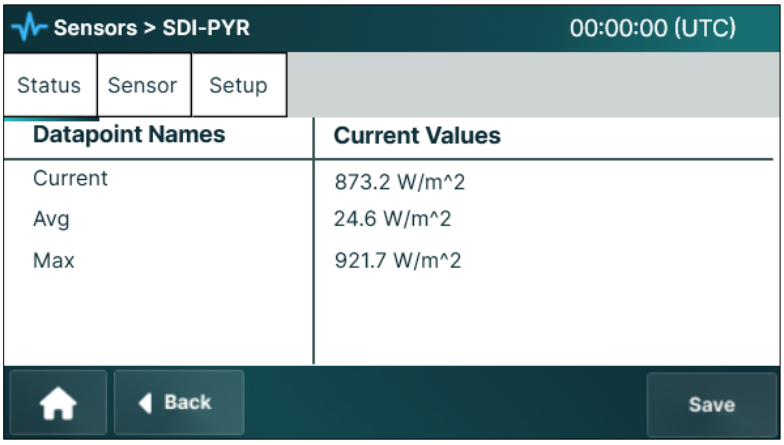
6.15 Solar Radiation (SDI-SR-PYR) Sensor Configuration

The solar radiation sensor is a silicon pyranometer that measures broadband solar irradiance across the 400 to 1100 nanometer range. Data are transmitted to the data logger using the SDI-12 protocol, which controls the measurement process and provides real-time irradiance values in W/m².

6.15.1 Solar Radiation Sensor Setup

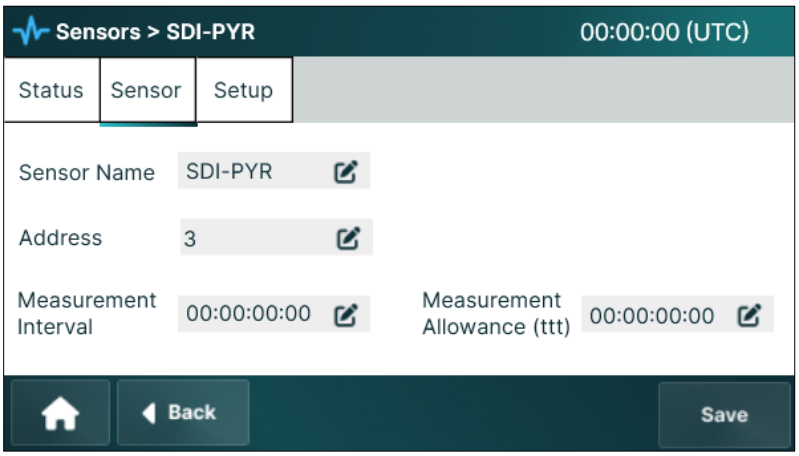
Status Tab

The Status tab provides solar irradiance measurements.



Sensor Tab

The Sensor tab configures core operational settings for the Solar Rad sensor.



1. *Sensor Name* will appear on the sensor tile on the *Sensors* screen.
2. Enter the *Address* of the sensor. This should be a unique address relative to other installed sensors.
3. Select the *Active* checkbox to enable the sensor.

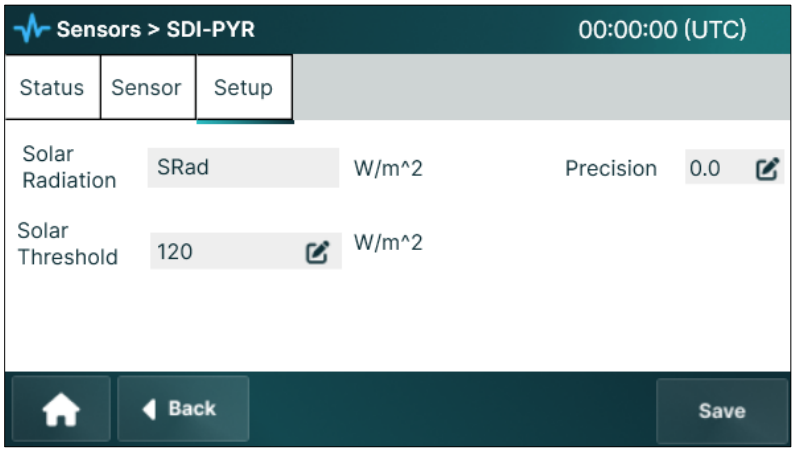
If the checkbox is left unselected, the sensor will not be read by the data logger, and any calculations or processes that rely on the sensor's readings will report an error.

4. *Measurement Interval* is the period at which the sensor is polled. All measurements are automatically saved to the data store.
5. Set the *Measurement Allowance (ttt)* to set the timing tolerance of the sensor.

> For more information on *Measurement Interval* and *Measurement Allowance*, refer to the Understanding Interval and Offset Timing section under General Operating information.

Setup

The Setup tab configures essential parameters for solar radiation measurement.



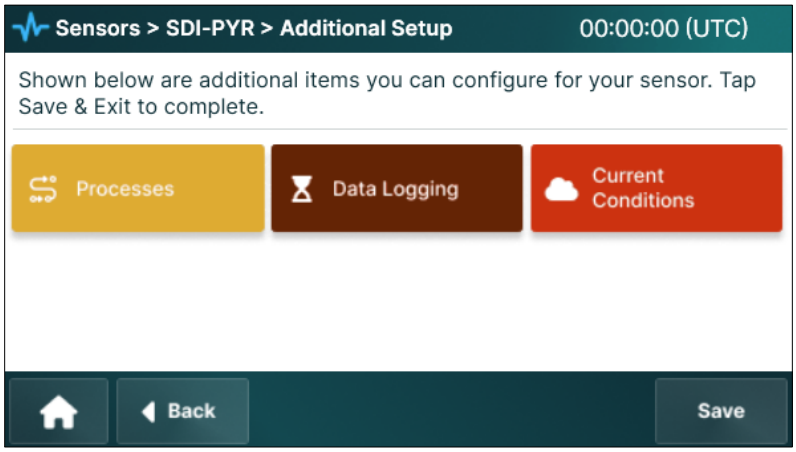
1. Enter the data point name to be used for *Solar Radiation* measurements.
2. Specify the precision value for solar radiation readings in the *Precision* field. This determines the number of decimal places displayed.
3. Enter the desired value in the *Solar Threshold* field, measured in W/m². Due to ambient light and measurement error, the detected value may not reach 0 (zero). This value defines the threshold for the calculation of duration statistics, which indicates when solar radiation exceeds the specified level.
4. Press the **Save** button to save and apply the changes.

   When configuring new sensors, the **Save** button presents the *Additional Setup* screen. This page helps guide users to **Process**, **Data logging**, and **Current Conditions** menus.

When editing an existing sensor, **Back** and **Save** will return to the *Sensors* screen

6.15.2 Solar Radiation Sensor Processes – Statistical Calculations

When configuring a new sensor, the *Additional Setup* screen provides quick links to processes, data logging, and current conditions monitoring menus.

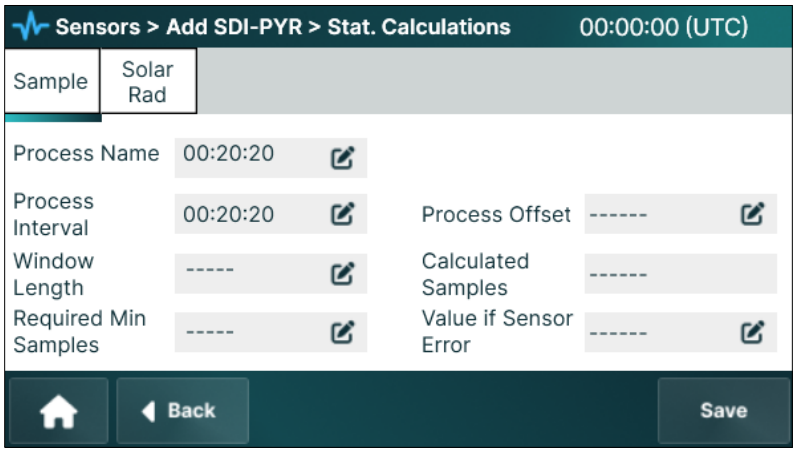


The Processes interface customizes data analysis for the Solar Radiation Sensor, configuring sampling and statistical calculations to provide insights into solar irradiance.

1. Press the **Processes** button on the Additional Setup screen.
   The *Stat. Calculations* screen is displayed.

Sample Tab

The Sample tab configures the frequency of data sampling for the Solar Radiation Sensor. It allows users to define the sampling interval, the number of samples collected, and the parameters for data collection.

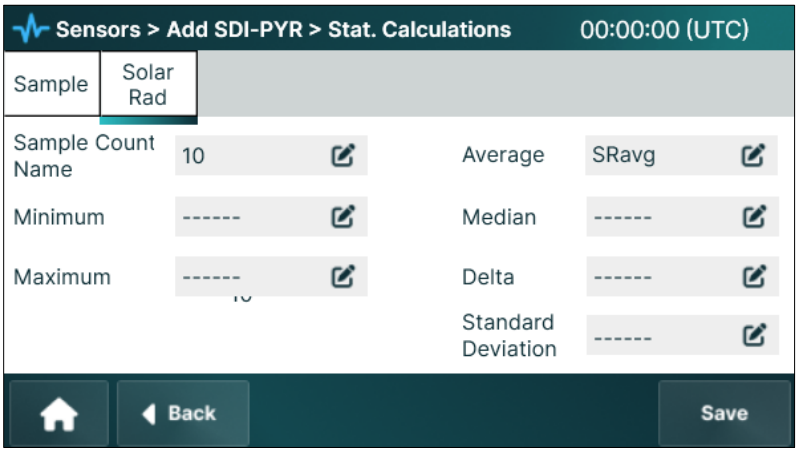


1. *Process Name* is used on the tile that appears on the *Processes* screen.
2. Set *Process Interval* to specify how often the calculations are executed.
3. Use *Process Offset* to define the timing of sensor readings, typically configured to ensure measurements are completed and data is available before the scheduled transmission time.

4. Specify the *Window Length* to establish the duration over which data is gathered for averaging calculations.
5. *Estimated Samples* dynamically updates and displays the calculated samples based on the sampling parameters provided.
6. Set the *Required Min Samples* to specify the minimum number of samples required for the solar radiation calculation to proceed. The process will only run if this threshold is satisfied.
7. Specify a default value in the *Value if Sensor Error* field to be recorded in case of sensor error.

Solar Rad Tab – Statistical Calculation

The Solar Rad tab configures statistical analysis for solar irradiance data, enabling detailed tracking of sunlight intensity.



1. *Sample Count Name* specifies the number of samples taken during the sample period.
2. *Minimum/Maximum/Average/Median/Delta/Standard Deviation* specify the names of the data points created in the data logger to store the most recent calculations. If a field is left blank, no calculation is performed on that parameter. The generated data points function similarly to any other in the data logger and can be used for logging, telemetry, additional process computations, or other operational purposes.
3. Press the Save button to save and apply the changes.

6.15.3 Solar Radiation Data Logging Configuration

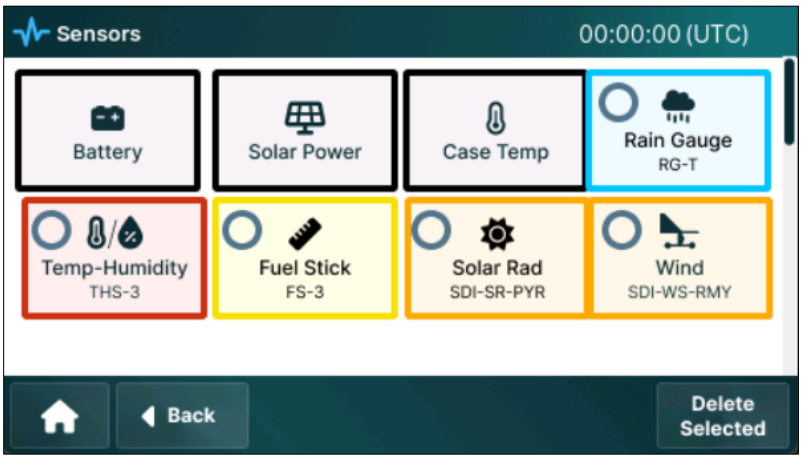
Data Logging operates in the same manner as other sensors. Refer to Temp-Humidity Data Logging section for more information.

6.15.4 Solar Radiation Current Conditions

Current Conditions operates in the same manner as other sensors. Refer to Temp-Humidity Current Conditions for more information.

6.16 Deleting Sensors

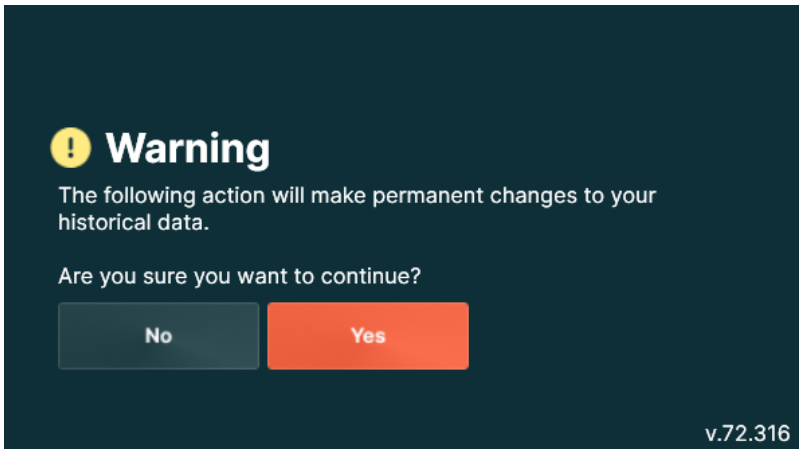
From the *Sensors* screen, users may edit sensors by selecting a sensor tile, add a sensor with the **Add** button, or delete using the **Delete** button.



1. On the delete screen, select the check box on the sensor tile.

> ***Note***: Internal sensors cannot be deleted.

2. Press the **Delete Selected** button.
   A *Warning* screen is displayed.



   a. Press the Yes button to confirm.
      Or
      Press the **No** button to cancel.

7 Manage SDI-12 Menu

Axiom includes four SDI-12 ports (SDI A, B, C, D), each with an independent UART (serial data) interface. While data communication is electrically isolated between ports, all four share a common power supply, with a maximum combined current of 2 A and up to 500 mA per port.

Axiom is SDI-12 v1.3 compliant and compatible with v1.4.

7.1 Address Requirements

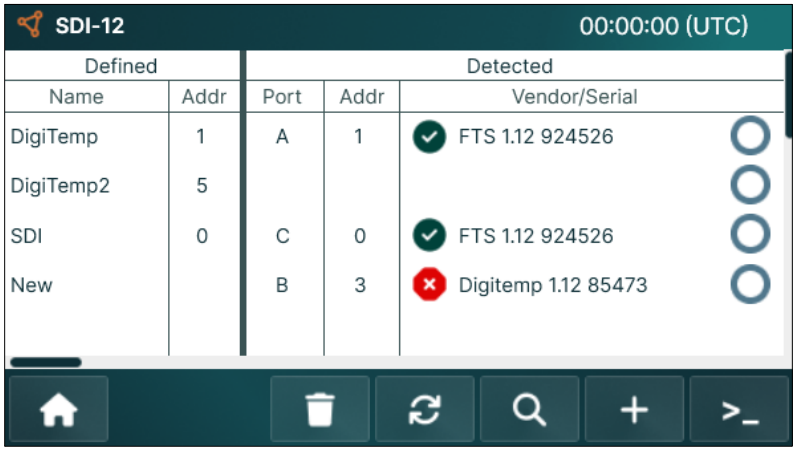
Due to the data port isolation, Axiom can read sensors with the same address, if they are on separate ports. This can be helpful during device installation and management. However, for the data collection to work correctly, sensor addresses must be unique and correctly mapped (matched) to the configuration in the data logger. The following sections outline this process.

Important: Each SDI sensor connected to the Data Logger MUST have a unique SDI address.

7.2 SDI-12 Sensor Mapping

Since sensors may be defined and fully configured without physically connecting them to the datalogger, sensor mapping is an essential step that finalizes the configuration. This mapping process matches the sensor ID (serial number) that is saved in the sensor definition to the ID of the connected device.

Selecting Manage SDI-12 menu on the *Home* screen will open the mapping screen, displaying currently configured SDI-12 sensors and previously detected devices.



1. The ***Defined*** column lists sensors configured in the data logger.
2. The ***Detected*** column shows sensors that are connected to the data logger's SDI-12 ports.
3. Sensors that are detected but do not match a defined sensor are identified by a red icon.
4. A green icon is displayed when a sensor is fully mapped.

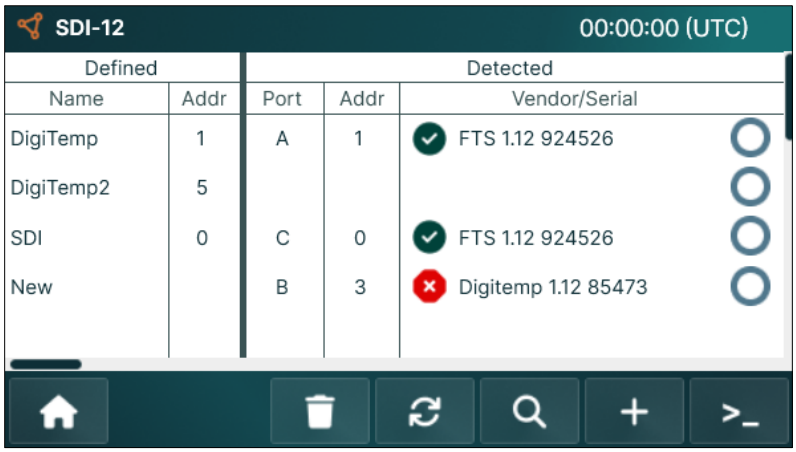
Action Bar Buttons

- ☐ **Refresh** : Updates connected SDI-12 sensors to update their status and configuration.
- ☐ **Detect** : Scans for connected sensors and automatically retrieves their addresses.
- ☐ **Transparent Mode** : Allows users to add or configure new sensor.

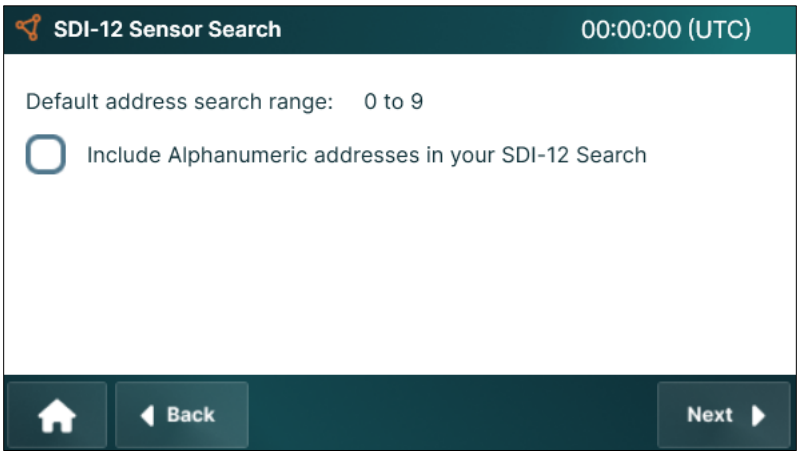
Important: Each time a sensor is installed or swapped; it MUST be mapped. The Data Logger will not be able to communicate with the sensors until they are mapped. Skip mapping only if the new sensor matches the logger's predefined configuration.

7.2.1 Detecting New SDI-12 Sensors

1. Connect one or more SDI-12 sensors to one of the SDI-12 ports.



2. Press the **Search** button on the *SDI-12* screen.
   The *Sensor Search* screen is displayed.



3. Select *Include letter addresses in the SDI-12 search* checkbox if an SDI sensor may have a non-numeric address (a-z, A-Z).

Warning: Enabling the checkbox will extend the detection process as the data logger must search for each of these addresses and await a response from a sensor.

4. Press the **Start** button to begin the search. Once complete, the screen will return to the mapping table.
5. Select the **Refresh** button to add detected sensors to the table.

7.3 Mapping Requirements

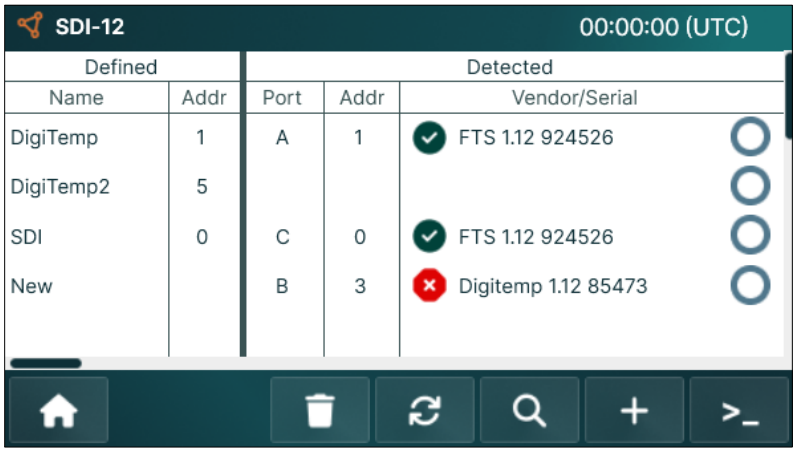
Each sensor address must be unique.

The sensor address must match the defined, or configuration, address.

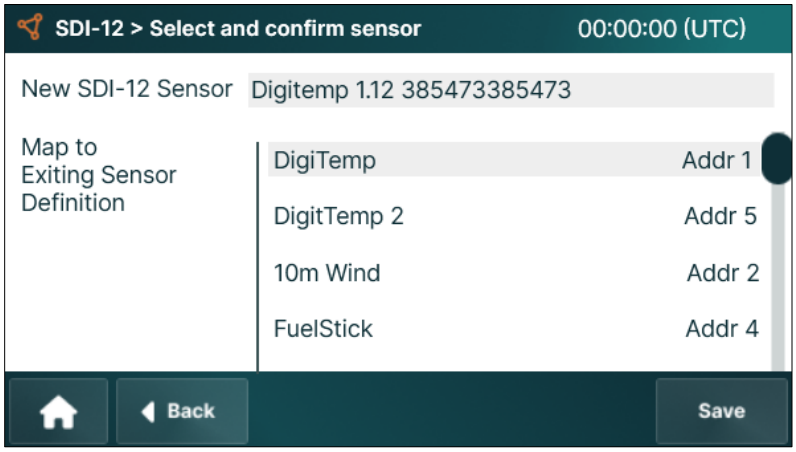
If addresses disagree, either the sensor configuration or the actual sensor address must be changed. Skip to Change Sensor Address under the >_ (Transparent Mode) section and return to Mapping Sensor once this is complete.

7.4 Mapping Sensor

Mapping includes associating a detected device ID with a defined device ID. When mapping a new sensor to an existing definition, the detected ID overwrites the defined value.



1. Select the radio button to the right of the New, unmapped, or incorrectly mapped sensor. This action will open the map editing window.



2. From the list, select the defined sensor that matches the address of the new sensor shown at the top of the screen.
3. Select **Save** to record the new map assignment.
4. Return to the *SDI-12* screen and validate that the new sensor has been mapped to the intended configuration.
5. Repeat the process until a green checkmark appears next to all SDI-12 sensors.

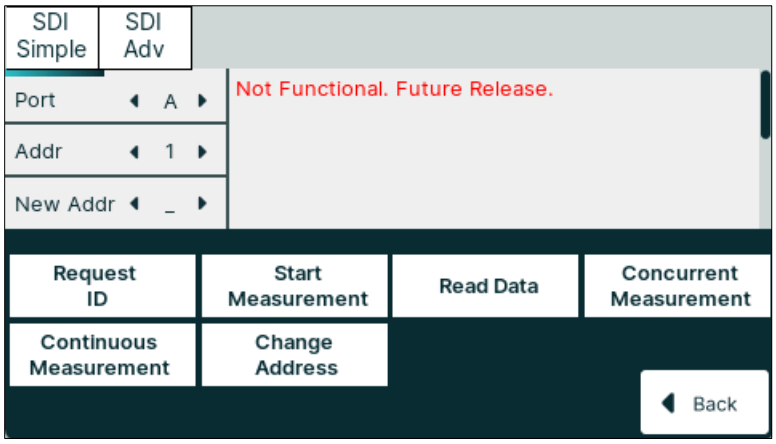
7.5 >_ (Transparent Mode)

Transparent Mode is a terminal screen that connects directly to SDI-12 sensor ports.

Simplified keyboards are used to send ASCII commands to SDI-12.

SDI Simple – Future Release

The SDI Simple terminal automates common commands.



Using the search results for the target sensor, use the arrow keys to:

1. Set the SDI *Port* (SDI A, B, C, D) to which the target sensor is connected.
2. Set the current *Addr* (address) of the sensor.

3. *New Addr* is used when changing the address of the sensor.

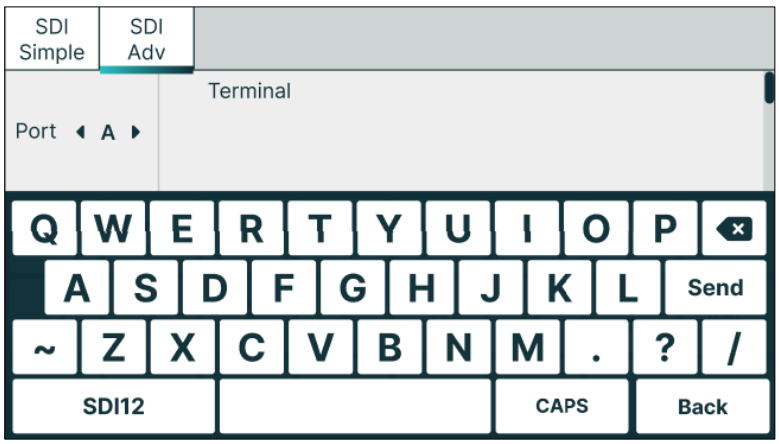
The following buttons will send common commands to the sensor. The command and response are shown in the terminal window.

- **Request ID** (aI!) – Retrieves the sensor's identification string (manufacturer, model, version, and serial number).
- **Start Measurement** (aM!) – Initiates a measurement and tells the logger how long to wait before retrieving data.
- **Read Data** (aD0!, aD1!, etc.) – Requests the results of the most recent measurement from the sensor, with optional index for multiple datasets.
- **Continuous Measurement** (aR0!, aR1!, etc.) – Commands the sensor to start sending data at fixed intervals without further prompting (vendor-specific, not always implemented).
- **Change Address** (aA<new_address>!) – Updates the sensor's SDI-12 address to a new, user-defined value for communication on shared lines.

SDI-12 Adv Tab

SDI Adv (Advanced) tab provides a direct connection to the data logger's SDI ports. This tab is ideal for users who are familiar with SDI command syntax and need flexibility in managing and testing sensor operations.

The terminal screen has two different keyboards (ABC/QWERTY and SDI12).



1. Use the arrow buttons to select the SDI ***Port*** (SDI A, B, C, D) of the connected sensor.
2. The **ABC** and **NUM** buttons open secondary keypads which allow users to enter command characters.
3. For the **SDI-12** keyboard, the '**!**' (exclamation) character sends commands to the designated port.

   The **Send** key on the QWERTY keyboard requires the user to enter the terminating '!' (exclamation) manually.
4. ***Terminal*** displays the command construction and returns sensor messages.
5. Press **Back** to go back to the *SDI-12* screen.

Warning: When users send an SDI command to configure a device, the Data Logger's user interface does not reflect any changes, and it continues operation using the old configuration. SDI transparent mode is only intended for diagnostics—specifically, to verify device functionality and obtain data.

Any sensor changes done in transparent mode, such as sensor address changes, may need to be made separately in the Axiom screens.

7.5.1 Change SDI-12 Sensor Address

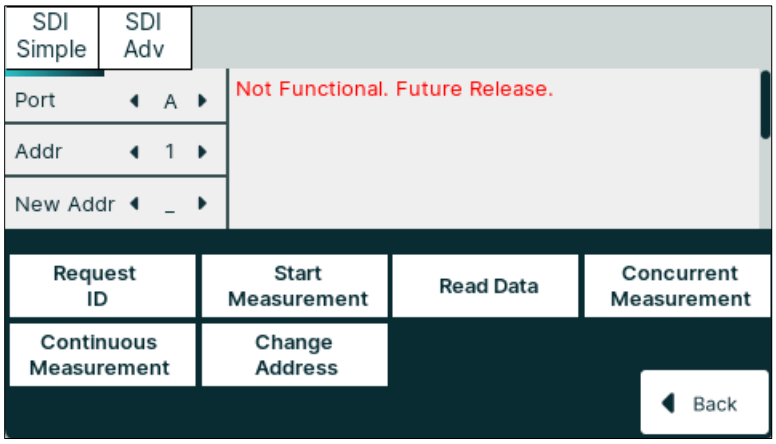
Even though SDI-12 ports are separate data connections, each sensor must have a unique address before it can be mapped to a sensor definition.

For example, an SDI pyranometer is address 3 may be on SDI A and an SDI wind sensor connected to SDI B with address 3. The sensor search will correctly identify each, without a data conflict. Transparent mode may be used to connect to either sensor without conflict. However, the data logger will not map the sensors correctly until one of them is changed and both sensor addresses match the sensor configurations.

Either Transparent mode, SDI Simple or SDI Adv, can be used to change the sensor address.

SDI Simple Address Change

With the sensor connected



1. Select the sensor *Port*.
2. Select the current sensor address (*Addr*).
3. Select the *New Addr*.
4. Select the **Change Address** button.
   The terminal prompt will show the transmitted command and response.
5. To validate the new address, change *Addr* to match the new address.
6. Press the **Request ID** button.

The data logger employs the SDI change address command to assign a new address to the sensor. If the sensor's address cannot be changed the terminal window may display an error message from the sensor.

SDI Adv Address Change

The advanced terminal requires users to enter commands manually.

1. Select *Port*.
2. Test connection with information command. Example: Poll address 3.

   Command: 3I!

   Response: 313FTS-----DIGITEMP-v134567
3. Change address using the A command. Example: Change from address 3 to 5.

   Command: 3A5!

   Sensor Response: 5
4. Test new address with another information command.

   Command: 5I!

   Response: 513FTS-----DIGITEMP-v134567

8 Processes Menu

Processes enables users to define mathematical calculations using inputs from sensor data points and other sources.

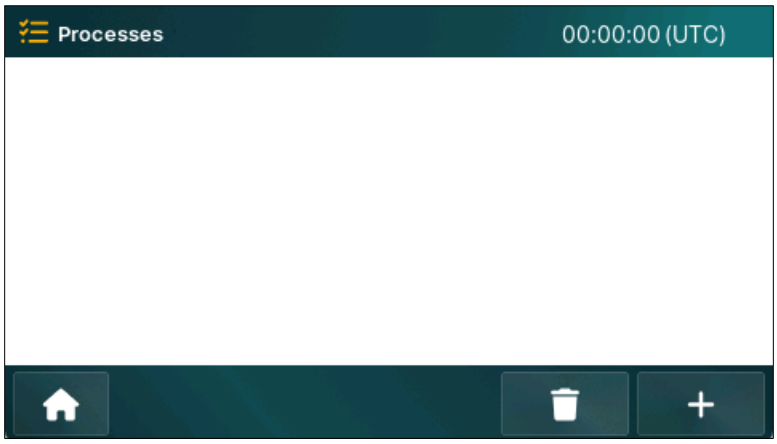
8.1 Processes

The *Processes* screen displays tiles for all sensor or data point processes currently defined and configured by the user.

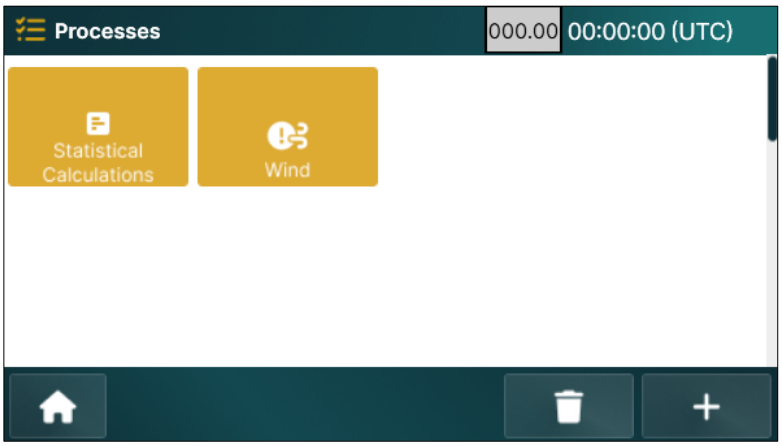
During new sensor configuration, the *Additional Setup* > *Processes* screen is one method to create new processes. These tiles will appear on this initial screen and will only be a accessible through the Processes menu.

Processes may also be added independently of initial sensor configuration.

1. Press the Processes menu on the *Home* screen.
   The *Processes* screen is displayed. It will be blank until a new senor process is implemented.

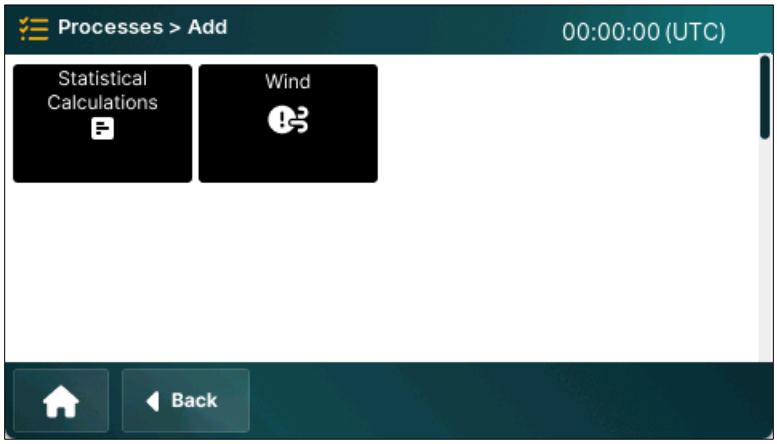


Active process tiles will appear as they are created.



8.2 Add Processes

The **Add** + button presents the *Processes > Add* screen. Each black tile represents available processes.



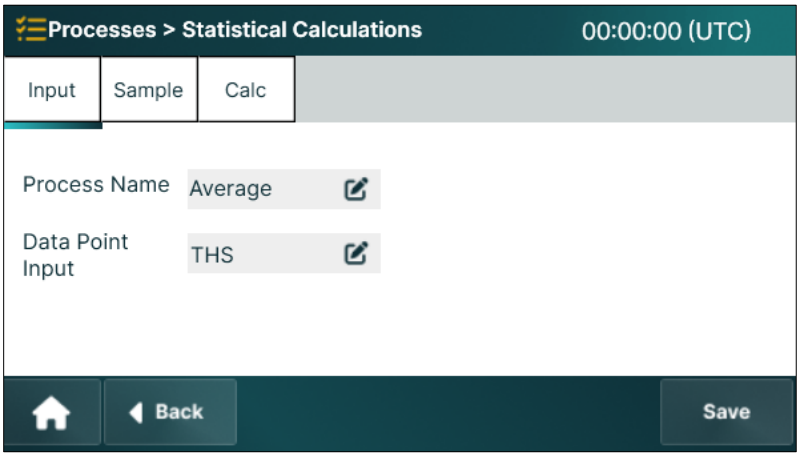
Select a process tile to configure a calculation process.

8.3 Statistical Calculations

The *Statistical Calculation* process performs common statistical operations, including average, minimum, maximum, mean, and standard deviation.

Input Tab

The Input tab sets the initial process parameters.

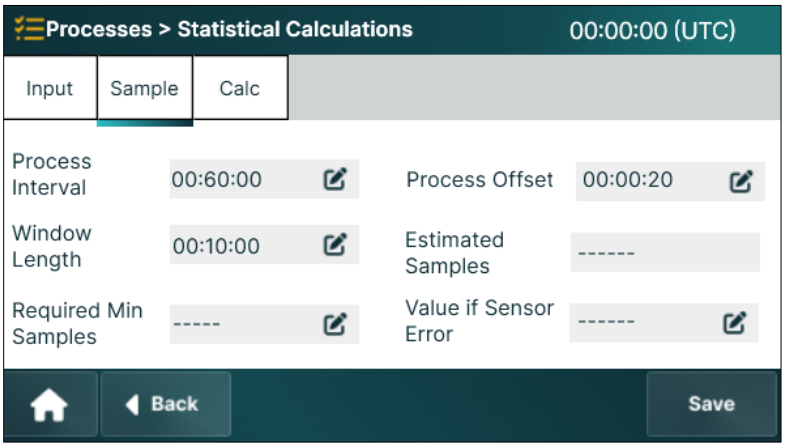


2. *Process Name* is the name that will appear on the active time that appears on the *Processes* screen.
3. *Data Point Input* requires a sensor or a user variable, also known as a data point name.
    - Press the **Edit** button in the *Process Input* field to select from available data point to be used for the process calculations.

4. Press the **Save** button to save and apply the changes.

Sample Tab

The Sample tab sets the sample characteristics.



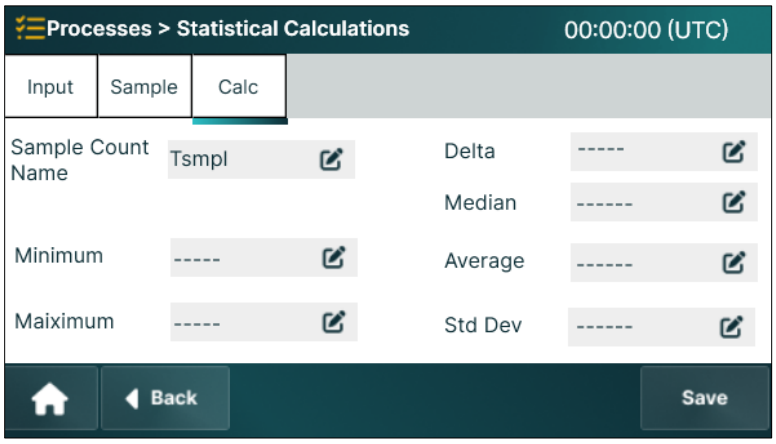
1. *Process Interval* is the frequency at which the calculations occur and be saved to the data store.
2. *Process Offset* specifies the time offset from 00:00:00.

> *Note*: For more information on *Process Interval* and *Process Offset*, refer to the Understanding Interval and Offset Timing section under General Operating information.

3. Set *Window Length* for the period over which data is collected for the calculations.
4. *Estimated Samples* uses *Measurement Interval* from the sensor configuration and the *Window Length* to determine the number of samples that will be included in the calculation.
5. Set the *Required Min Samples* to the minimum number of samples required for the statistical calculation. In case of missing or bad sensor readings, the process will be blocked to prevent a calculation using insufficient data.
6. *Value if Sensor Error* is the numeric value that will be used if a calculation cannot be completed.
7. Press the **Save** button to save and apply the changes.

Calc Tab

The Calc tab allows users to define which statistical outputs will be calculated and displayed.



1. *Sample Count Name* is the data point name for the number of samples used for the calculation.
2. *Minimum, Maximum, Average, Median, Delta, and Standard Deviation* each can be used to define the data point name of the respective calculations.
3. Press the **Save** button to save and apply the changes.

> *Note:* If a field is left blank or has a null character "----", no calculation is performed or saved to the data store.

8.4 SDI-RMY Wind Process

The wind process calculates key meteorological parameters including (vector) average, variation, peak, and wind gust data points.

8.4.1 How the Wind Processes Work

The SDI-RMY process is tightly integrated with AEM SDI-WS-RM, employing built-in functions. The process can also utilize other anemometers that only provide wind speed and direction but functionality may be limited.

Important: For best performance with the SDI-WS-RMY (RM Young) sensor, the Measurement Interval should be set to 10 seconds.

Sensor-Level Processing

The sensor itself performs initial calculations, producing three pairs of values every 10 seconds:

- Current speed and direction (instantaneous readings)
- Average speed and direction (10-second averages)
- Peak speed and direction (highest values during the 10-second period, measurement interval)

These six values are automatically saved to the data store every 10 seconds.

Statistical Processing

When the wind process runs, it performs hierarchical calculations:

- 10-minute averages use 60 ten-second samples
- 1-hour peak calculations examine 360 ten-second peak values

Process Creation

When setting up through *Additional Settings*, the system can create:

- A single wind process (if average and peak durations match)
- Separate wind processes (if different durations are specified)

When configured directly from the Processes screen, each wind process uses a single duration for all calculations.

A calculation only runs if it has a non-empty datapoint name assigned to it.

Compatibility

This system also works with basic anemometers that only provide current readings. In these cases:

- Leave the Average and Peak input fields blank
- The process will use the current speed/direction values for all calculations

8.4.2 SDI-WS-RMY Sensor Integration

The SDI-WS-RMY sensor employs high-frequency sampling with internal processing to provide:

- Current speed and direction readings
- 10-second vector-averaged values
- Peak readings

The sensor delivers these six data values to the data store every 10 seconds, current, average, and peak wind speed and direction. The sensor's internal electronics perform the initial averaging calculations, providing more accurate measurements than would be possible with standard SDI-12 polling alone.

8.4.3 SDI-WS-RMY Initialization

SDI-WS-RMY internal configuration is initialized when the data logger is reset or when sensor settings are changed. If a replacement sensor is installed, the sensor may be initialized to the current data logger settings by mapping the SDI sensor to the current configuration.

If the same sensor is removed and re-attached, reinitialization will occur when the data logger is reset or when the sensor settings are edited and saved.

SDI-WS-RMY Process Calculations

Average Values: Process averages are calculated using the 10-second average readings (10 min average uses 60 of the 10 s samples). This hierarchical averaging improves statistical validity while optimizing SDI-12 bus performance.

Peak Values: Maximum wind speeds are determined by comparing peak readings across the measurement window. For a 1-hour peak, 360 ten-second peak values are evaluated to find the highest value.

Gust Calculation: Wind gusts are identified when current wind speed exceeds the average by a configurable differential threshold.

> *Note*: A calculation is only enabled if it has a non-empty datapoint name defined for it.

SDI-WS-RMY Process Configuration

The process can be configured with different intervals for average and peak calculations:

- When configuring a new sensor through the *Additional Settings* screen, a single wind process is created if both average and peak duration values match.
- If different durations are specified, separate wind processes are automatically generated.
- When created directly from the Processes screen, each wind process uses a single duration for all enabled calculations.

8.4.4 Support for Standard Anemometers

For compatibility with simpler wind sensors that only report instantaneous speed and direction:

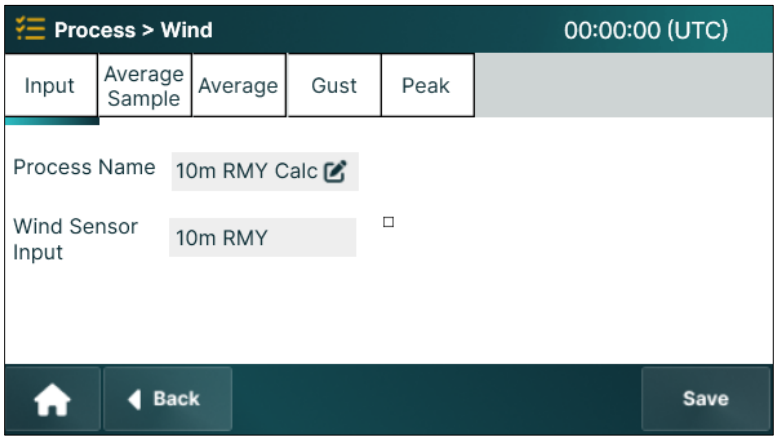
- The Average and Peak input fields are left blank
- The process will use the current speed and direction values to generate all statistical outputs
- Sample rates will be limited by the SDI-12 polling interval

8.4.5 SDI-RMY Process Configuration

1. Press the **SDI-RMY Wind** button on the *Processes* screen.
   The *Wind* screen is displayed.

Input Tab

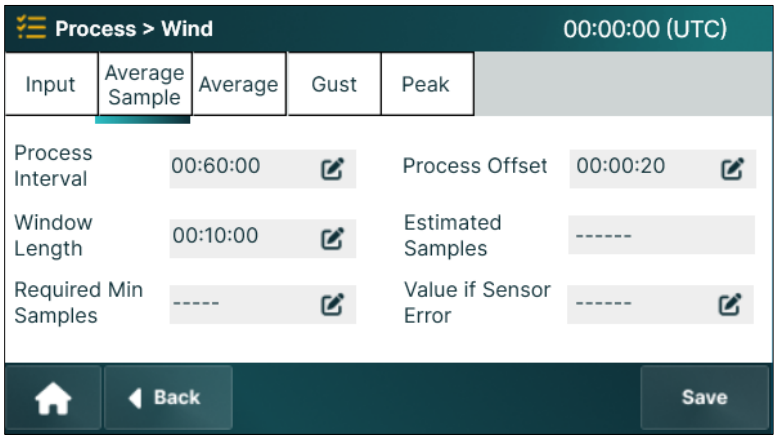
The Input tab defines the basic settings for the Wind Process, including the source sensor.



1. *Process Name* is pre-set to '10MinWind' and can be modified as required. The user-defined name also appears on the process button in the Processes screen for quick reference.
   - Press the **Edit** button next to the *Wind Sensor Input* to select the desired data point from the list.
2. Press the **Save** button to save and apply the changes.

Average Sample Tab

The Average Sample tab sets parameters for sample characteristics used for calculations on the Average tab.



1. Set the *Process Interval* to specify the frequency of the calculations. The calculated values are also saved to the data store at this same frequency.
2. Use the *Process Offset* to define the timing of sensor readings, typically configured to ensure measurements are completed and data is available before the scheduled transmission time.

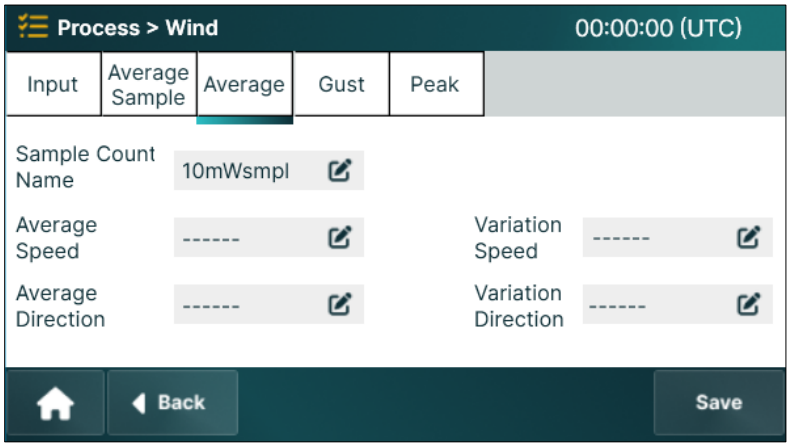
> *Note*: For more information on *Process Interval* and *Process Offset*, refer to the Understanding Interval and Offset Timing section under General Operating information.

3. Set *Window Length* to specify the time duration over which data is collected for calculations.
4. *Required Min Samples* uses *Measurement Interval* from the sensor configuration and the *Window Length* to determine the number of samples that will be included in the calculation.
5. *Value if Sensor Error* is the numeric value that will be used if a calculation cannot be completed.
6. Press the **Save** button to save and apply the changes.

Average Tab

The Average tab defines parameters for average wind speed, wind direction, and their variances, providing insights into overall wind dynamics.

Scalar average is sued for wind speed. Vector average is used for wind direction.



1. *Sample Count Name* specifies the data point name used for the number of samples included in the calculation.

> *Note*: It is not necessary to define names for all fields. Any field that is un-named, blank, or "----" (null) is not saved or available for other activities.

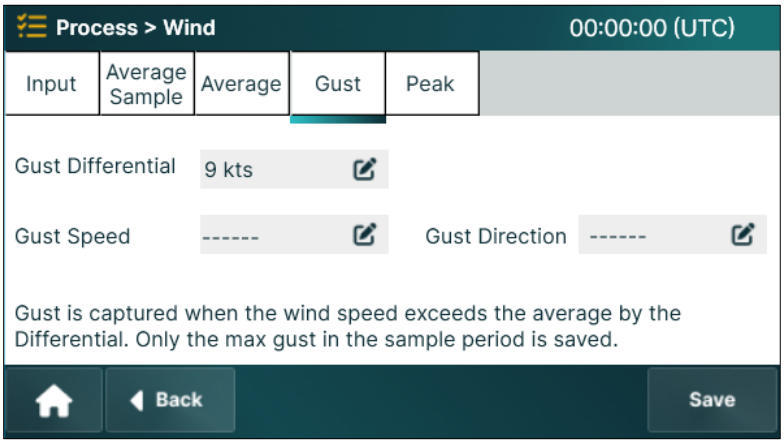
2. *Average Speed* is the data point name for average wind speed.
3. *Variation Speed* is the data point name for the delta wind speed (maximum – minimum) over the calculation window.
4. *Average Direction* is the data point name for vector average wind direction.
5. *Variation Direction* is the data point name for the delta wind direction (vector range) over the calculation window.

Gust Tab

The Gust tab configures parameters to detect and record wind gusts. Wind gusts are rapid increases in wind speed that occur over a short duration.

In conjunction with AEM SDI-WD-RMY wind sensor, Axiom continuously compares the wind speed average to the currently measured speed.

When the wind speed exceeds the average by the Gust Differential, a gust is recorded.

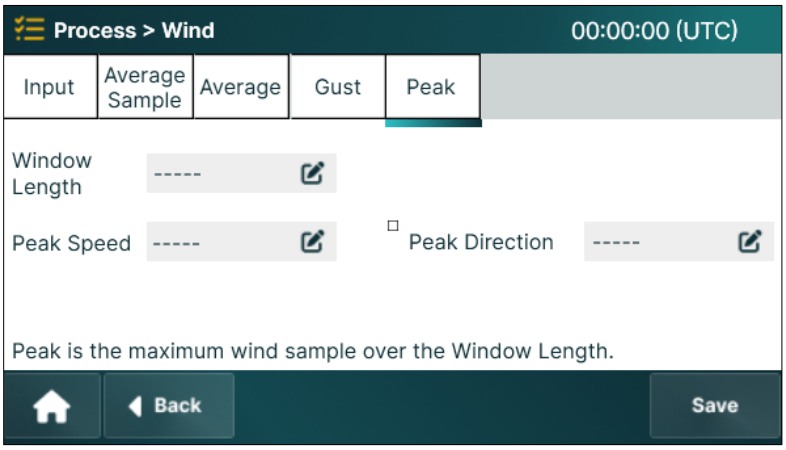


1. Enter the *Gust Differential* value. A wind event qualifies as a gust if its speed exceeds the average wind speed by this differential.
   - Example: Consider a uniformly variable wind with a 10-minute average speed of 5.5 knots. A sudden change in wind causes a current wind measurement of 18.2 knots, often known as a Wind Gust of 18.2 knots.

     Gust, like the maximum and peak values, is recorded in the data log with a timestamp indicating when it occurred. Alternatively, the gust value can be saved until the end of the Process Interval and recorded with other measurements. If a higher gust value is detected during the Process Interval, it will replace the previously recorded gust value.
2. *Gust Speed* is the name of the data point for wind gust speed records.
3. *Gust Dir. (Direction)* is the name for wind gust direction.
4. Press the **Save** button to save and apply the changes.

Peak Tab

The Peak tab configures parameters to detect and record the highest wind speed and direction over a specified period and stored at the *Process Interval*.



1. Set *Window Length* to specify the time duration for peak detection.
2. Peak Speed specifies the name of data point for peak wind.
3. *Peak Dir. (Direction)* specifies the name of data point for peak wind direction.
4. Press the Save button to save and apply the changes.

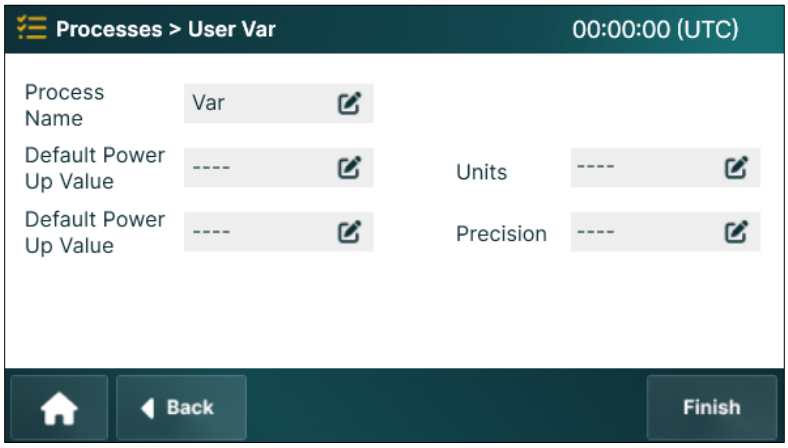
> *Note*: Data is only stored for data point name fields when a name value entered.

8.5 User Var (Variable) Process – Future Feature

User Variable declares a data point name that can be used in functions and scripts. The variable can be initialized with a specific value, such as a constant for calculations.

The variable must be defined before it can be referenced in scripts or functions or used as an output.

1. Press the **User Var** button on the *Process* screen.
   The *User Var* screen is displayed.



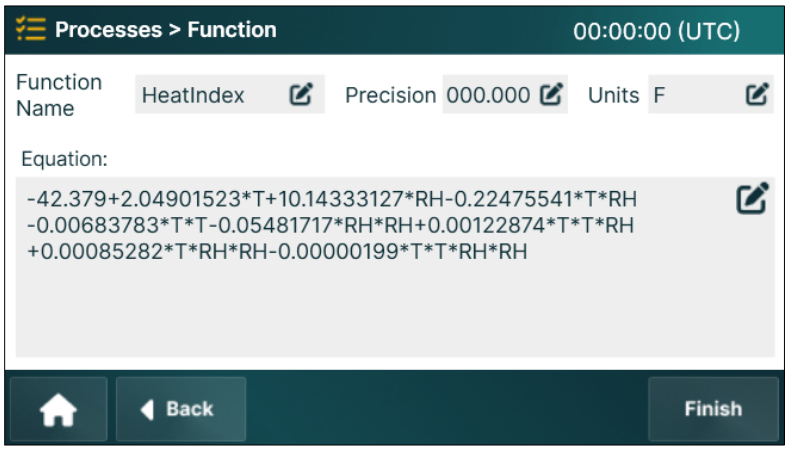
2. Enter the desired name for the process in the ***Process Name*** field.
3. Specify the variable's name in the ***User Variable Name*** field.
4. Define the measurement ***Units*** for the variable.
5. Set the ***Default Power-Up Value***. This value is assigned when the data logger restarts after a reset or power cycle.
6. Enter the number of decimal places for the function's output in the **Precision** field.
7. Press the **Finish** button save and apply the changes.
   The variable will now show as a data point name for telemetry, logging, and current conditions as well as being available for other processes.

8.6 Function Process – Future Feature

The Function Process evaluates a single-valued mathematical expression, producing a floating-point output. The function name is also the output data point name, Users must define the equation, units, and precision. The process supports various mathematical operators, including nested operations, which are listed below.

Important: All data points used in a function script must already exist in the Data Logger.

1. Press the **Function** button on the *Process* screen.
   The *Function* screen is displayed.



2. Enter the ***Function Name***. This will show on a new tile on the Processes screen ***Function Name*** is also the name of the output value.
3. Define the number of decimal places for the function's output in the ***Precision*** field.
4. Specify the measurement ***Units*** for the function's output in the Units field.
5. Input the mathematical expression in the ***Equation*** field using available operators and variables.
6. Press the **Finish** button save and apply the changes.

8.6.1 *Function Operators*

The following operators are available for the *Function* process.

Operator	Meaning
+	addition
-	subtraction
*	multiplication
/	division
=	equal to
MAX(A,B)	maximum of A or B
MIN(A,B)	minimum of A or B
SQRT(x)	square root
LN(x)	natural logarithm
EXP(x)	natural antilog
POW(A,B)	A raised to power of B, AB
PI	pi
ABS(x)	absolute value
FRAC(x)	fractional part of x
INT(x)	integer part of x
MOD(A,B)	modulus of A / B
SIN(x)	sine (in radians)
COS(x)	cosine (in radians)
TAN(x)	tangent (in radians)
ASIN(x)	arcsine (in radians)
ACOS(x)	arcos (in radians)
ATAN(x)	arctan (in radians)
ATAN2(y,x)	arctan (in radians), preserving the quadrant of the result.
SteinhC(x)	Calculates the Celsius temperature of a thermistor using the simplified Steinhart-Hart equation (see below).

Simplified Steinhart-Hart Equation

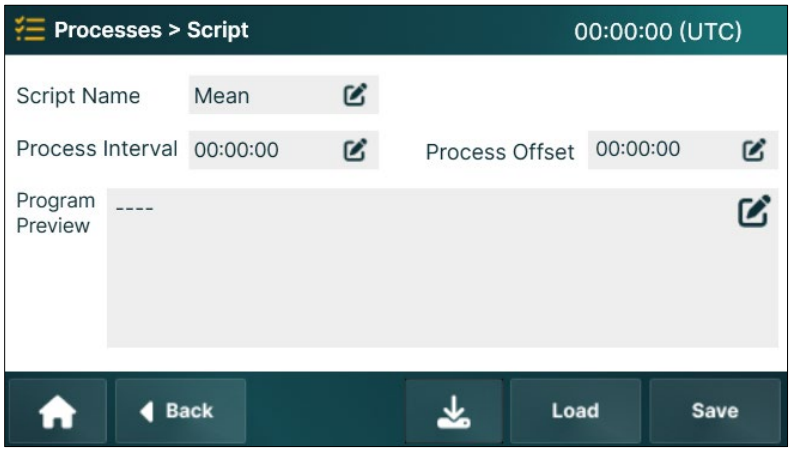
$$T = \frac{1}{A + B \ln R + C(\ln R)^3} - 273.15$$

Symbol	Meaning/Value	Note
T	temperature (C)	
R	thermistor resistance (Ω)	
A	1.0295 x 10 -3	coefficient for YSI 44006 thermistor
B	2.3910 x 10 -4	coefficient for YSI 44006 thermistor
C	1.5680 x 10 -7	coefficient for YSI 44006 thermistor

8.7 Script Process – Future Feature

The Script process executes a user-defined Micro-Python program. The program executes based on specified interval and offset parameters, with a minimum interval of one minute.

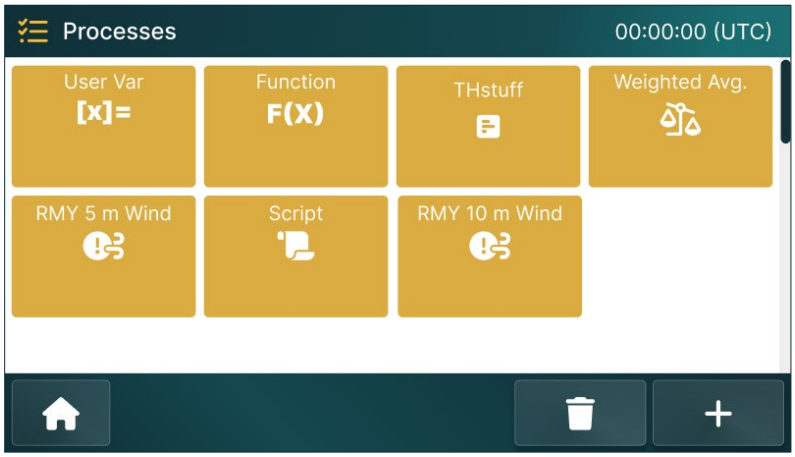
The program is time-boxed, meaning it must be completed within 10s or it will be blocked. This may limit programs that require sensor communication. Multiple programs can be used to ensure programs completely, one script for reading the sensors and a second for performing any calculations or tasks.



1. The *Script Name* defines the name of the process. Like other processes, this name appears on the associated tile on the *Processes* screen.
2. Set the *Process Interval* to specify how often the script is run. The minimum interval is one minute (00:01:00).
3. The *Process Offset* specifies the time delay from midnight at which the script starts running.
4. Enter the script program using logical operators in the *Program Preview* field.
5. Press the **Load** button to load a script from the data logger's internal memory or from USB flash drive.
6. Press the **Save** button to save and apply the changes.

8.8 Weighted Avg. (Average) Process – Future Feature

Press the **Weighted Avg** button on the *Process* screen.
The *Weighted Avg* screen is displayed.



The weighted average function in the data logger is used to smooth out data readings over time, giving more importance (or "weight") to newer readings while still retaining the influence of past data. This helps to filter out sudden spikes or drops in sensor readings, providing a steadier output.

8.8.1 How it Works

Mathematically:

Running Average	**Weighted Average**
$Y_n = (y_n + y_{n-1} + \ldots + y_m) / N$ Where, - Y_n is the next average, - y_n is the new sample, - y_{n-1} to y_m are previous samples, - N is the number of samples.	$Y_n = [1 - \exp(-3t / T)] \times (y_n - Y_m) + Y_m$ Where, - Y_n is the next average, - Y_m is the current average, - t is the sample interval, sensor *Measurement Interval,* - T is the average interval, *Window Length,* - y_n is the new sample value.

New Data Gets More Weight:

- When a new reading comes in (y_n), the logger doesn't just take a simple average. Instead, it uses a mathematical factor based on how often readings are taken (t) and how long the average should represent (T).
- New readings closer together (small t) or shorter averaging periods (small T) will give more weight to the latest reading.

Older Data Slowly Fades:

- Older readings are still considered (via Y_m), but their influence decreases over time.

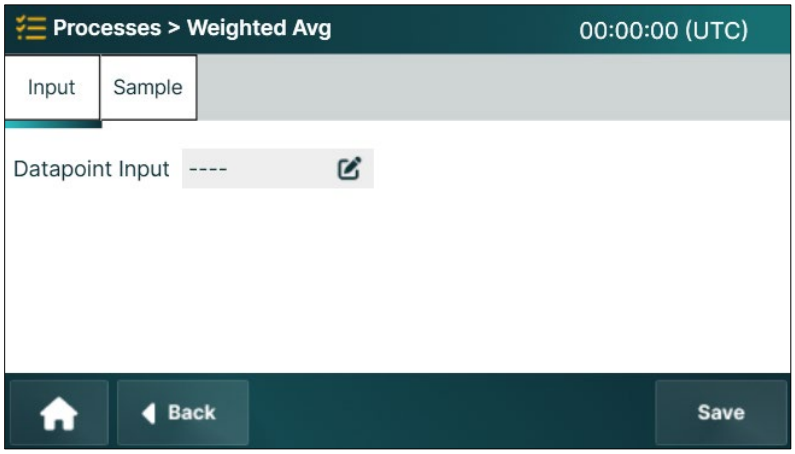
The Exponential Factor:

- The term *[1 – exp (-3t / T)]* controls how much of the new reading gets blended with the existing average.
- If *t* is small compared to *T*, the logger updates the average slowly (smoothing).
- If *t* is large or *T* is small, the logger reacts faster to new data.

8.8.2 Weighted Avg Configuration

Input Tab

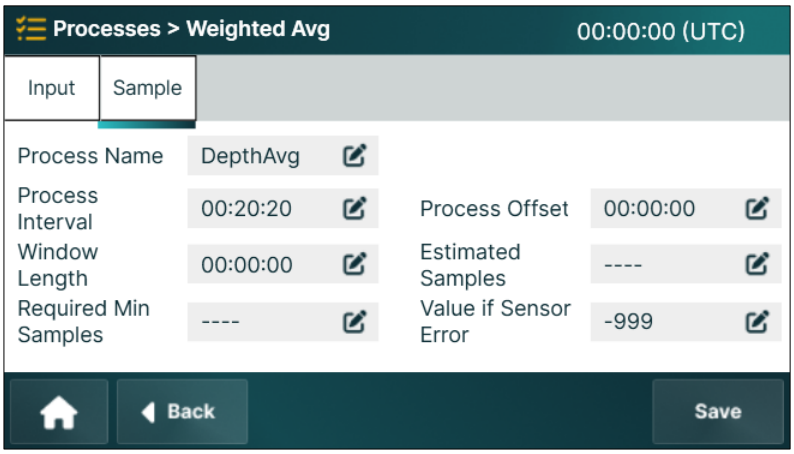
The Input tab allows customization of input sources and labels for the weighted average calculation.



1. Press the Edit button to select a data point as an input parameter.
2. Select Variable.
3. Press the Save button to save and apply the changes.

Sample Tab

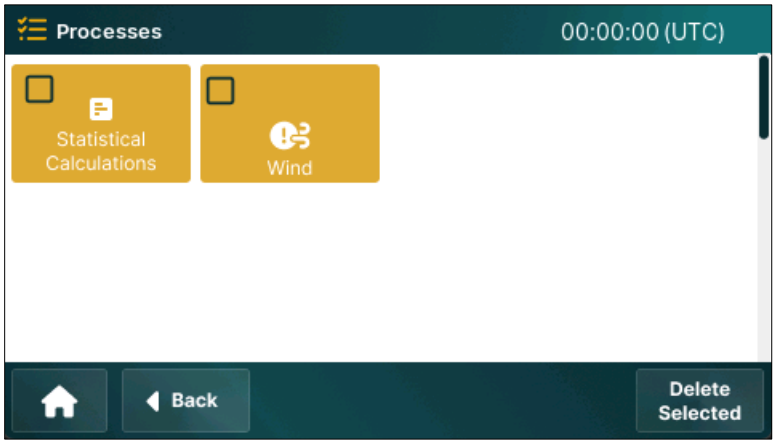
The Sample tab sets parameters for determining the weighted average over a specified period.



1. The *Process Name* defines the name of the process.
2. *Process Interval* sets the frequency that the process is executed.
3. Use *Process Offset* to set a delay before the process begins.
4. *Window Length* is the period over which samples are included in the calculation.
5. *Estimated Samples* is automatically generated based on the sensor *Measurement Interval* and the *Window Length*.
6. Sensor communication errors can result in missed readings. Set the *Required Min Samples* to the minimum number of samples for a confident calculation.
7. In case of a sensor failure, the *Value if Sensor Error* displays the value substituted in log and telemetry data.
8. Press the **Save** button to save and apply the changes.

8.9 Delete Processes – Future Feature

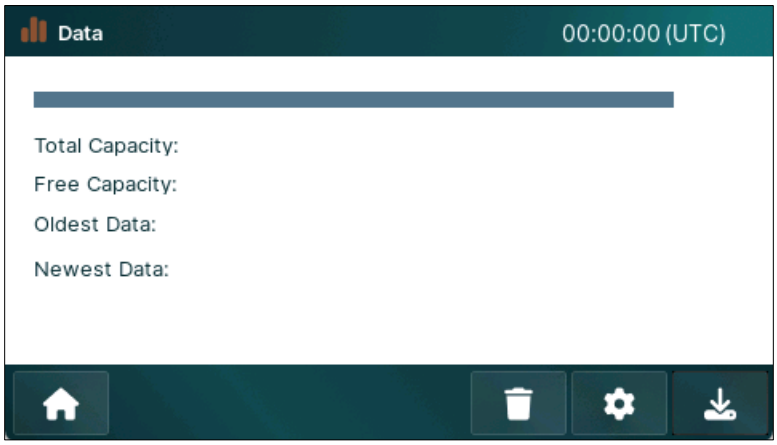
The *Delete Processes* screen provides a straightforward way to manage active processes. It allows users to identify, evaluate, and delete any processes that are no longer required.



1. Select the checkbox for the desired process/processes users wish to delete.
2. Press the **Delete Selected** button to remove the selected processes.

9 Datalog Menu

The Datalog displays complete information on data storage and management. It is used to create or edit data log definitions, download stored data, and remove unneeded log definitions.



The *Datalog* screen displays the following key aspects related to data storage:

- *Progress Bar* represents the current data storage. The filled area indicates the amount of storage used while the empty part indicates the capacity available.
- *Total Capacity* displays the total data storage, shown here as 120 days.
- *Free Capacity* displays the remaining storage available, shown here as 31 days.
- *Oldest Data* indicates the timestamp of oldest previously recorded data in the data logger.
- *Newest Data* indicates the timestamp of most recently recorded data in the data logger.

Action Bar Buttons

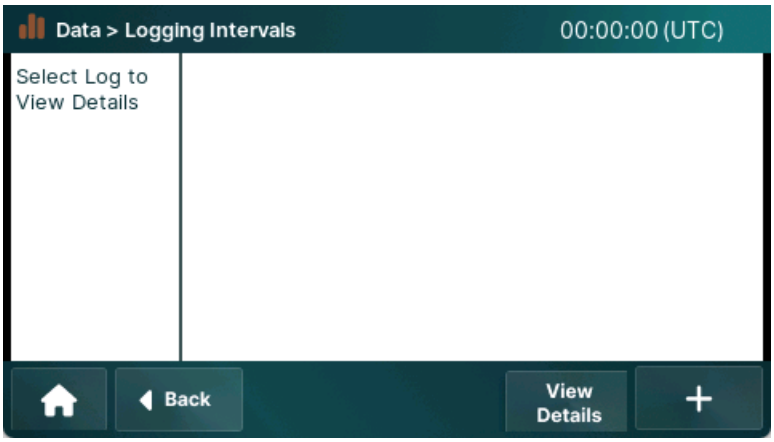
- ☐ Delete : Jumps to the log list to delete log definitions.
- ☐ Settings : Accesses the log list for viewing or editing log definition.
- ☐ Download : Presents the log list to selection and download to USB.

9.1 Configure Datalogging

As explained in General Theory of Operations, all sensor data is saved to the data store at the specified *Measurement Interval*. Similarly, processes and calculations are saved to the data store at their respective processing intervals.

Logging Intervals are, effectively, database queries of the data store. These may be created, edited, and deleted without affecting any stored data. For practical purposes, the "data log" can be envisioned as a static file.

1. Press the **Settings** button on the *Datalog* screen.
   The *Logging Intervals* screen is displayed.



The *Logging Intervals* screen displays a list of data log definitions.

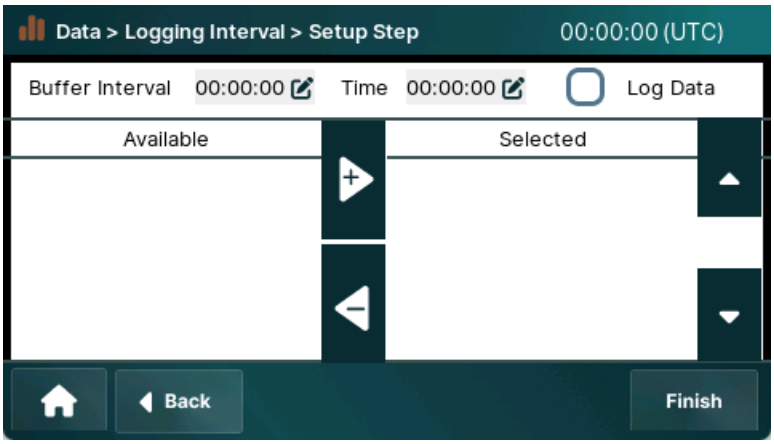
Action Bar Buttons

- **Add** +: Adds new or modifies existing logging intervals.
- **View Details:** Displays information for the selected datalog entry.

9.1.1 View Details

The **View Details** button opens the log definition to viewing and editing.

1. Highlight a specific log definition.
2. Press **View Details** to open *Setup*.



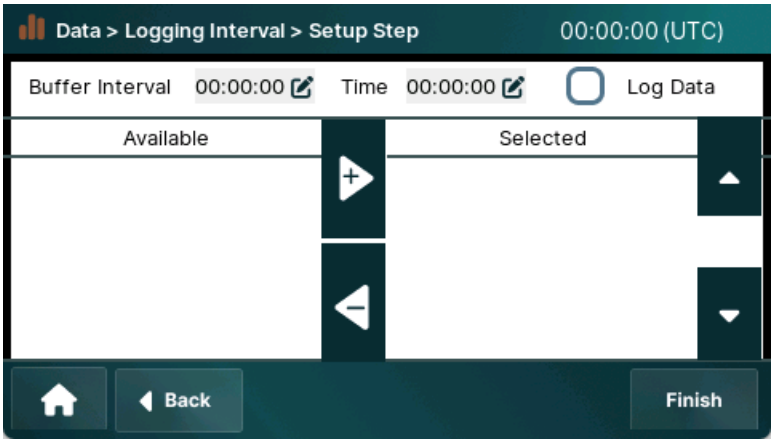
3. The log configuration can be viewed and changed.
4. If the *Conditional* box is checked, **Next** will advance to the *Conditions* screen.
5. Otherwise, **Next** will return to the Logging Intervals screen.

Refer to the next section, Add Log Interval, for more information on configuring and editing a log interval definition.

9.1.2 Add Log Interval

Log setup utilizes a list-builder to select and order data points to be provided in the downloaded log file.

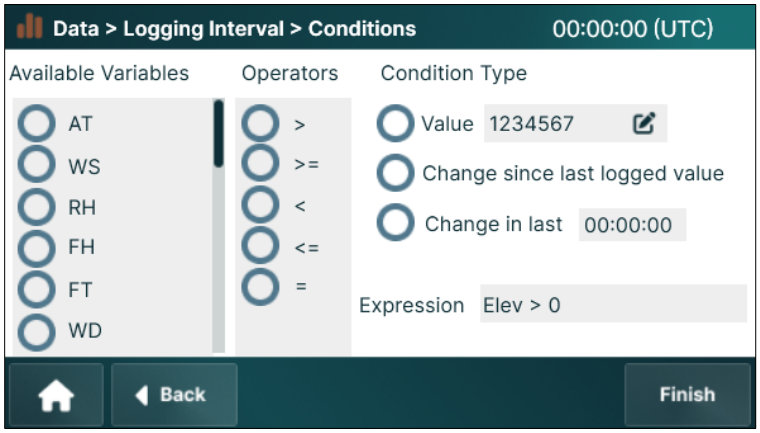
1. Press the **Add** + button of the *Logging Intervals* screen.
   The *Setup* screen is displayed.



2. Specify the time ***Interval*** between data points.
3. Set the specific start ***Offset*** for data logging clock time.
4. Using the list builder, select from **Available** data points to add to the ***Selected*** list. The order of the selected data points may be rearranged by selecting the name and using the up and down arrows.

> ***Note***: If this differs from the ***Measurement Interval*** and ***Offset*** for the respective data point, the nearest time value will automatically be selected for the log file.
>
> For more information on ***Interval*** and ***Offset***, refer to *Understanding Interval and Offset Timing* in the *General Operating Information* section.

5. If conditional logging is required, select the ***Conditional*** checkbox to enable the conditional logging. Otherwise, press ***Next*** to complete the log definition.



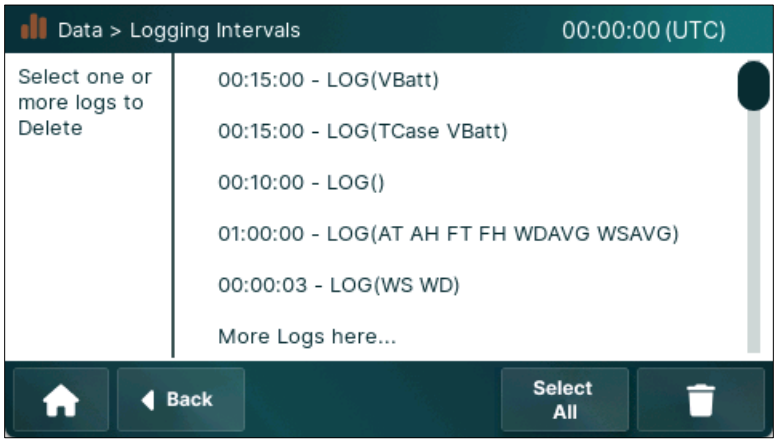
6. *Input Data Points* column displays a list of variables that can be for the conditional trigger. This value is used to modify the log definition, including log data based on the conditional expression.
7. *Operator* is the comparison operator used for the conditional expression.
8. Condition type specifies the right-hand side of the expression:
   - **Value** can be set to an interger or decimal numeric value.
   - **Change since last logged value** dynamically evaluates the condition based on the prior measured value, triggering a log entry from the condition.
   - **Change in last** to log data if the variable's change during the specified interval satisfies the conditions.
9. The *Expression* field displays the complete expression based on the selected variable, operator, and condition type.
10. Press the **Finish** button to save and apply the changes.
    The *Logging Intervals* screen is displayed.

9.1.3 Delete Log Definition

Logs definitions can be automatically created when configuring new sensors and when building telemetry messages. This can create unwanted or duplicate log definitions.

> ***Note***: Log Intervals may be created, edited, and deleted at anytime without affecting the actual data storage.

1. Press **Delete** button on the *Datalog* screen.
   The *Logging Intervals* screen is displayed.

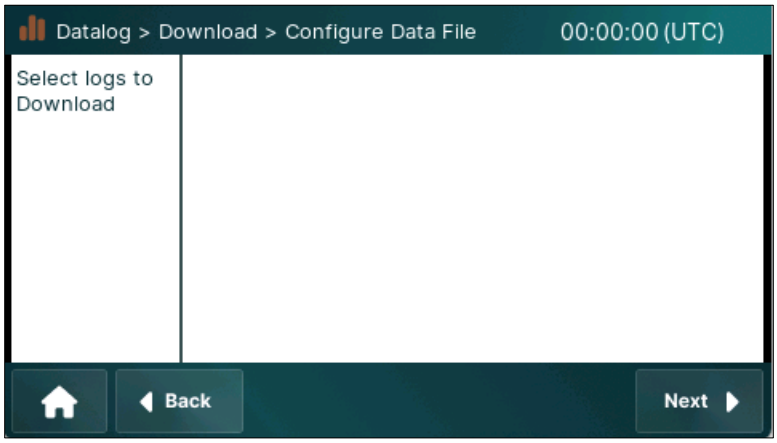


2. Select the line of the unwanted log definition, or **Select All** button.
3. Press the **Delete** button to remove the log definitions.

Download Data Log

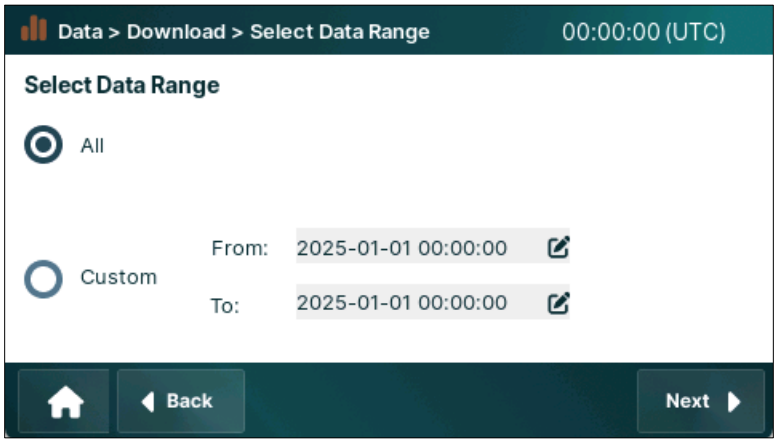
The **Download** function allows users to export data from the data logger to a USB flash drive.

1. Press the **Download** button of the *Datalog* screen.
   The *Download Data* screen is displayed.

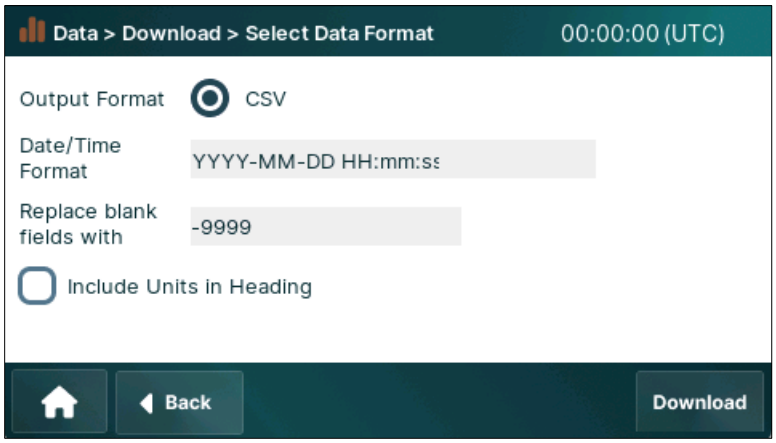


2. Select log definition to be downloaded.

3. Press the **Next** button to proceed.
   The *Configure Data File* screen is displayed to select the data range.

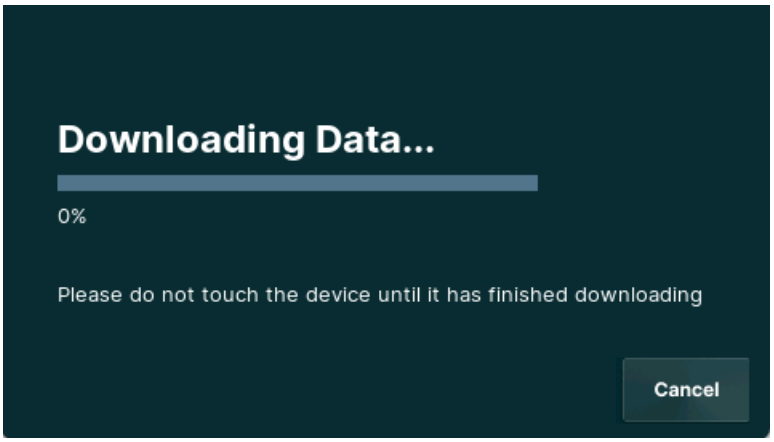


4. Select one of the following options:
   - *All* to download all available data logs.
   - *Since Last Download* – Future Release
   - *Custom* and set the *From* (start) and *To* (end) date.
5. Press the **Next** button to proceed.
   The *Configure Data File* screen is displayed.



   a. *Output Format* is set to CSV, enabling data export in a standard ASCII text format compatible with most analysis tools.
   b. *Date/Time Format* defines how timestamps appear in the exported file, ensuring consistency in data logging.
   c. *Replace Blank Fields* is preset to -9999, representing missing data with a defined placeholder.
   d. *Include Units in Heading* adds a second heading row that shows the units for the data values.

e. Press the **Download** button to start extracting and downloading the file to an attached USB flash drive.
The *Download Data* screen is displayed.

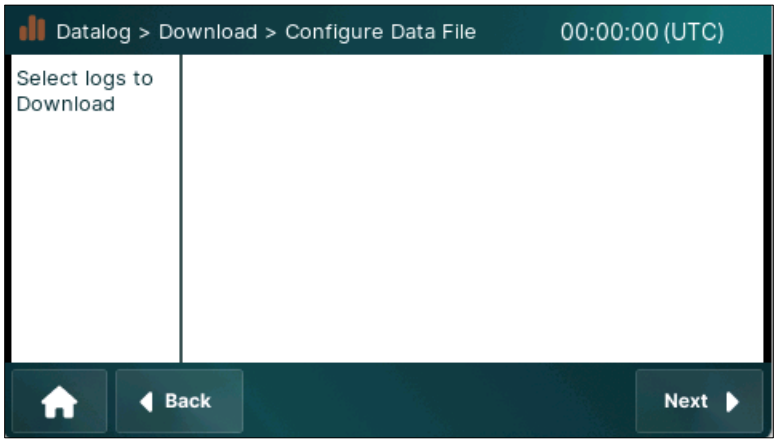


Note: Insert a USB flash drive BEFORE selecting Download.
Log data extraction and download will not proceed if a USB flash drive is not inserted before starting the download. If this occurs, simply Cancel and reset the format and date range.

9.1.4 Export Data to USB

To export data to USB flash drive:

1. Plug a flash drive into one of the data logger's USB HOST ports.
2. Press the **Datalog** menu on the *Home* screen.
3. Press the **Download** button.



4. Select the desired log(s) to download.
5. Press the **Next** button.
6. Select the desired date range.
7. Press the **Next** button.

8. Select the desired *Output Format* and enter the other details.
9. Press the **Download** button to download the data.
   This process may take several minutes to complete.

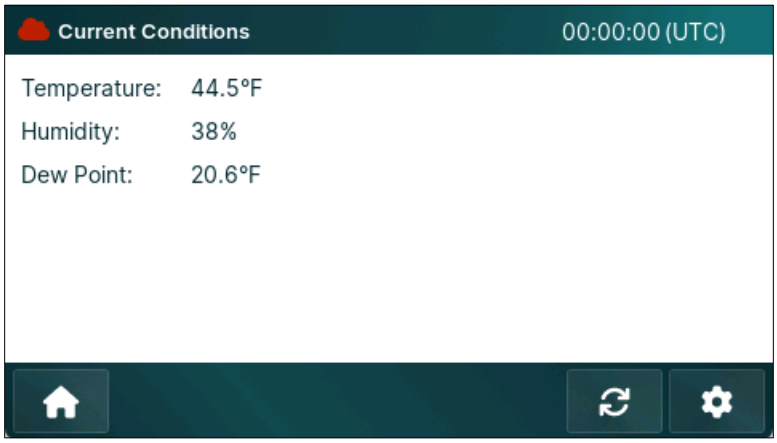
10 Current Conditions Menu – Future Feature

There are three locations users can find current sensor readings:

- *Home* screen carousel – Limited to 9 values.
- Sensor *Status* tab – Requires opening each sensor.
- *Current Conditions* screen – Consolidates up to 25, user-selectable data points on a scrollable window.

Current Conditions values are automatically or manually refreshed.

1. Press the Current Conditions menu on the *Home* screen.
   The *Current Condition* screen is displayed.



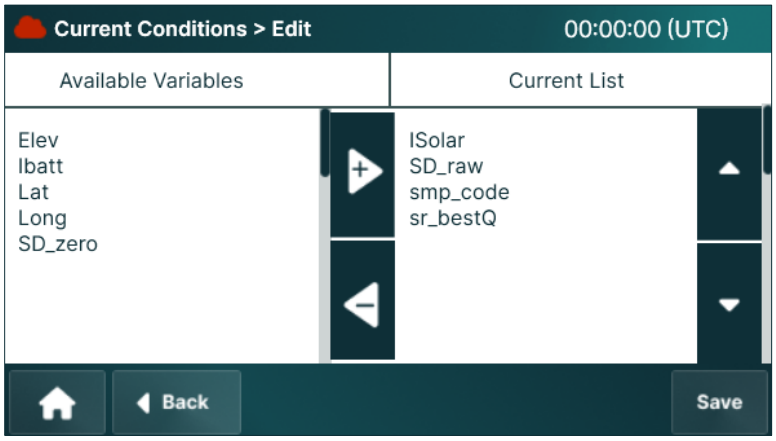
Action Bar Buttons

- ☐ Refresh : Manually updates the current condition values by retrieving the latest sensor data from the data logger.
- ☐ Settings : Configures which current condition data points are displayed.

10.1 Current Condition List

To select data points to display:

1. Press the Current Conditions menu on the *Home* screen.
2. Press the **Settings** button.



3. Select and move variables from the ***Available*** to the ***Selected*** for monitoring.

   Change the order by selecting the data point and using up and down arrows.

Important: The first 9 (nine) values that are selected for the *Current Condition* screen will appear on the sliding carousel on the *Home* screen.

4. Press the **Save** button to save and apply the changes.
5. Press the **Refresh** button on the *Current Conditions* screen to update the display with the latest sensor readings.
6. Press the **Home** button to go to the *Home* screen.

***Important*: Manual refresh does not initiate a new set of readings from SDI sensors or process outputs. Instead, SDI sensors continue to display the last recorded value based on their defined reading interval, which could be several minutes or hours old.

11 Telemetry Menu

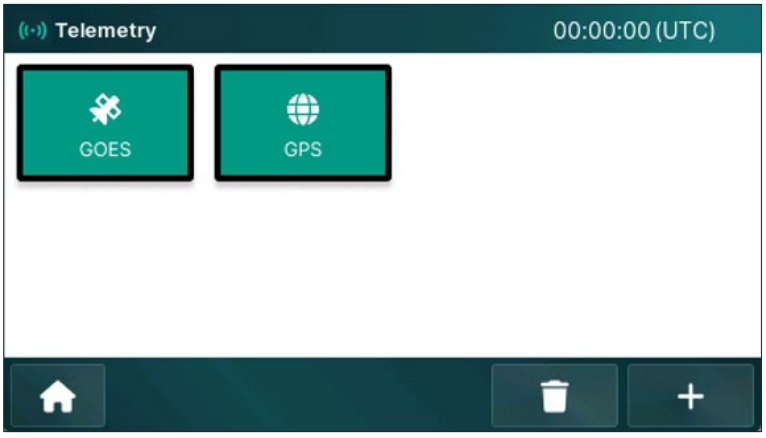
The Telemetry menu configures and manages radio receivers, transmitters, and transceivers of Axiom data logger. These include:

- AEM G6 GOES transmitter – An internal option
- Iridium SBD transceiver – An internal option
- GPS-GNSS receiver – An internal option when G6 is not installed
- AirTalk transceiver controller (also known as RVT2) – An internal option
- Cellular data transceiver – An external option

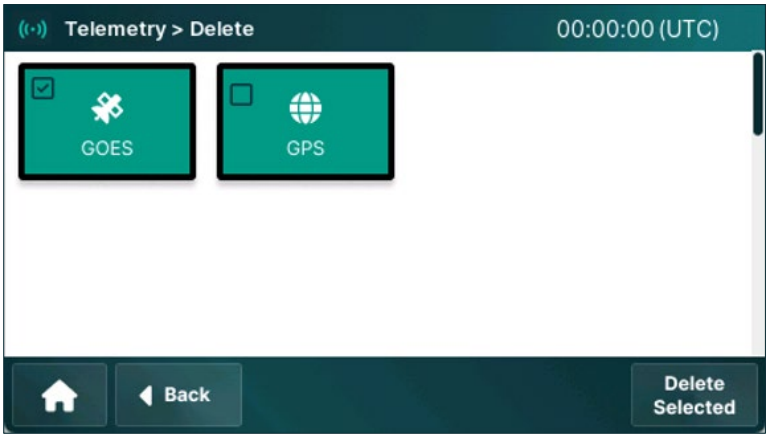
11.1 Telemetry General Information

To configure the telemetry settings:

1. Press the Telemetry menu on the *Home* screen.
   Tiles represent configured telemetry modes. Typically, internal telemetry options installed or sold with the data logger will be configured.



2. Press **Add** + button to view telemetry profiles.
3. **Delete** presents a new screen where telemetry devices can be removed from the data logger.



Note: This may only be needed if a telemetry mode has been deleted from the configuration by a user or **Factory Reset** (see Service menu).

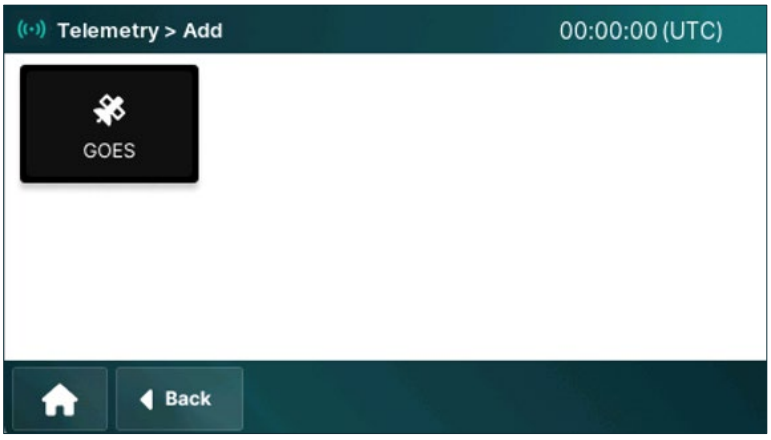
11.2 Status Indicator Overview

The *To Next GOES Tx* field of the *Home* screen indicates the time remains until the next scheduled data transfer through the GOES telemetry system. This countdown specifies when the data logger will send its next data packet to the satellite. If no time is displayed, it means that the telemetry system is not currently scheduled for transmission or must be configured.

11.3 Add Telemetry Device

The Add option simplifies the process of expanding the data logger's telemetry capabilities. Users can integrate new telemetry devices and customize them further to enhance the system's functionality.

1. Press the **Add** + button of the *Telemetry* screen.
   The *Add* screen is displayed.

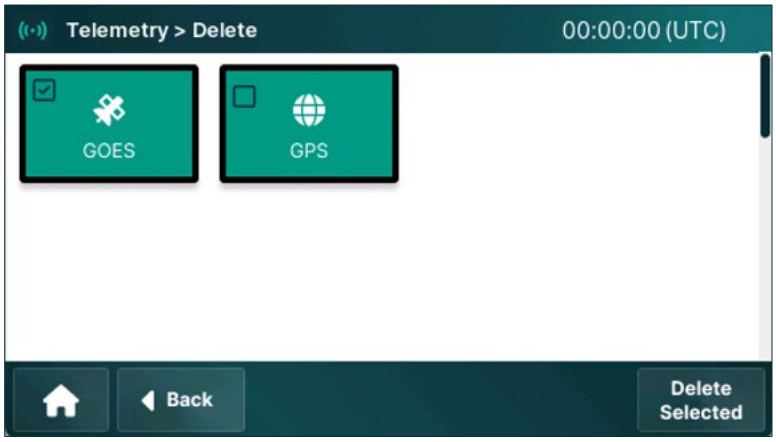


2. Select the telemetry device users wish to add to the data logger by pressing on it. This will navigate users to the configuration screen specific to the selected device to customize its settings.

11.4 Delete Telemetry Device

The Telemetry Delete provides a user-friendly interface for managing and removing telemetry devices that are no longer required.

1. Press the **Delete** button on the *Telemetry* screen.
   The *Delete screen* is displayed.



2. Select the device/devices that users wish to remove or delete from the data logger.
3. Press the **Delete Selected** button to delete the devices.

11.5 GOES

The GOES (Geostationary Operational Environmental Satellite) system is a network of satellites operated by the National Oceanic and Atmospheric Administration (NOAA). Environmental monitoring stations, including those focused on wildfire risk management and water resources, can use GOES satellite communication to transmit data to central collection points.

Axiom Data Loggers, for example, includes integrated GOES satellite transmitter options that allow periodic uploads.

These systems use a specific transmission protocol with assigned channels, timing windows, and identification codes (NESIDs) to ensure reliable data delivery through the satellite network. This capability is particularly valuable for stations deployed in extreme environments that require consistent transmission of critical environmental data.

AEM (FTS) G6 may be installed internally to Axiom Data Loggers. The option provides GOES telemetry for Axiom data loggers.

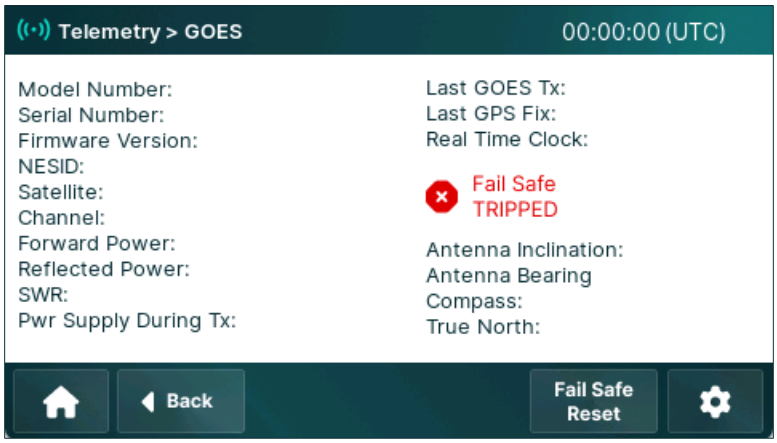
11.5.1 Compliance

AEM (FTS) G6 meets NOAA communication standards known as CS2. The following table shows the key characteristics of CS2.

	Operating Characteristics
Channel numbers	1-266, 301-566
Bit rates (bps)	300 bps - Channels 1-266 and 301-566 1200 bps - Every third channel from 3-264 (i.e., 3,6,9...264) and from 301-565 (i.e., 301, 304...565)
RF power level	26–38.5 dBm, variable

11.5.2 GOES Status

1. Press the **GOES** button on the Telemetry screen.
   The *GOES Status* screen provides essential information about the device.



- G6 transmitter information - model number, serial number, firmware version
- G6 transmitter configuration - NESID, satellite, channel, transmit power
- Transmitter status – reflected power, SWR, power supply, last transmit time, GPS fix, and clock status, fail-safe trip warning
- Calculated antenna orientation - inclination, bearing for assigned satellite

Action Bar Buttons

- ☐ **Fail-Safe Reset** Fail Safe Reset : Restores G6 transmitter function.
- ☐ **Settings** : Opens the G6 GOES transmitter settings screen.

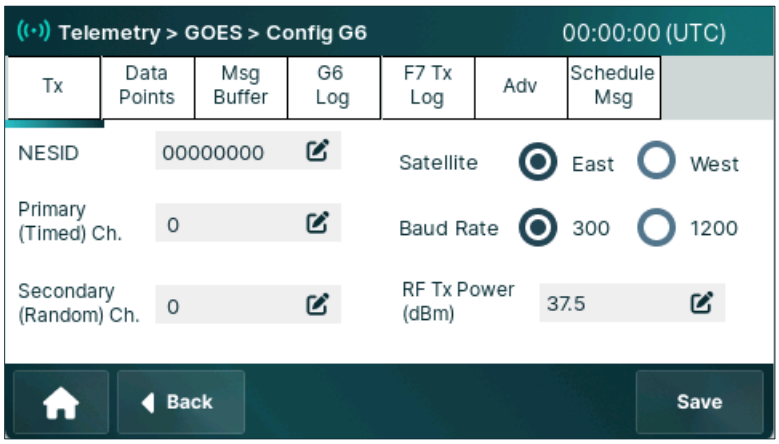
11.5.3 G6 GOES Transmitter Configuration

The Config G6 provides access to the configuration settings of G6 transmitter. Users can adjust the parameters and settings of G6 for optimal performance of the transmitter.

1. Press **Settings** button on the *Telemetry* screen.
   The *Configure G6* screen is displayed.

TX Tab

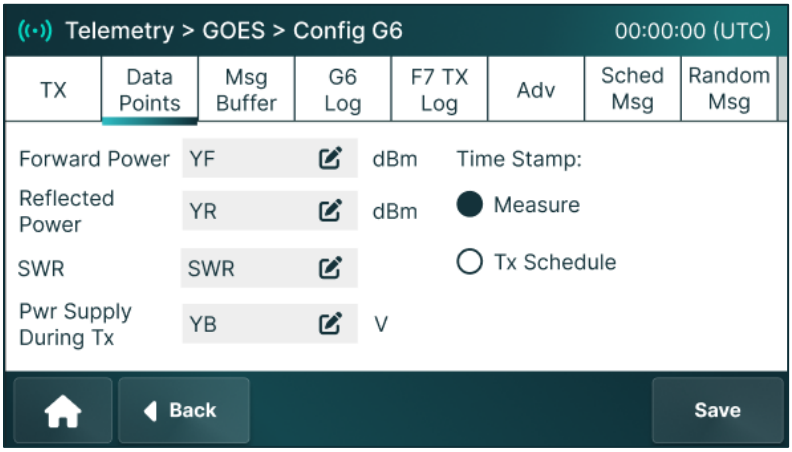
The TX (transmitter) tab configures the G6 transmission settings.



1. *NESID* is a unique assigned by National Environmental Satellite, Data, and Information Service (NESDIS), which is part of the National Oceanic and Atmospheric Administration (NOAA).
2. *Satellite* is based on the device's location to optimize communication.
   - *GOES-East* – Automatically selected for odd channel numbers.
   - *GOES-West* – Automatically selected for even channel numbers.
3. *Primary (Timed) Channel* is used for scheduled transmissions at the time slot indicated for the NESID.
4. Select the *Baud Rate* provided with the NESID.
   - *300*
   - *1200*
5. *Secondary (Random) Channel* acts as a backup to handle unscheduled (random) transmissions and automatically activates if the primary channel fails, maintaining continuous data transfer.
6. *RF Tx Power (dBm)* is typically set to 26-38.5 dBm. Use 32dBm when an AEM EON antenna is installed.
7. Press the **Save** button to save and apply the changes on all tabs.

Data Points Tab

Several data points are available by which critical operating metrics of G6 can be monitored. When assigned names, these can be viewed in *Current Conditions*, transmitted, and logged.

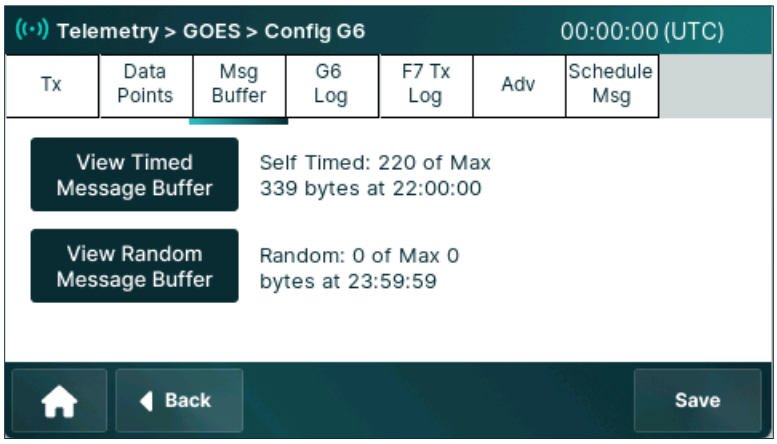


1. ***Forward Power*** displays the RF output power (measured in dBm) of the G6 transmitter during the most recent transmission.
2. Select the ***Time Stamp*** option to specify when data points are recorded.
   - ***Measure*** - Records data immediately.
   - ***Tx Schedule*** - Aligns recordings with the transmission schedule.
3. ***Reflected Power*** displays the RF power (measured in dBm) reflected to the G6 transmitter from the antenna connection during the most recent transmission.
4. ***SWR (Standing Wave Ratio)*** measures signal efficiency.

   SWR is a measure of the impedance mismatch between the transmission line and the antenna. It is determined by comparing forward and reflected power. An SWR of 1:1 indicates a perfect match and maximum power transfer. Values below 1.5 are generally considered acceptable, with an SWR of 1.5 corresponding to about 4% of the power being reflected.
5. **Power Supply During Tx (V)** reflects the power supply voltage during transmission when the battery is under load. A low voltage will reduce transmitted power and may indicate insufficient charge on the battery, cold battery, or an aging battery.
6. Press the **Save** button to save and apply the changes made to all tabs.

Message Buffer Tab – Future Release

The Message Buffer tab is used to view expected messages.

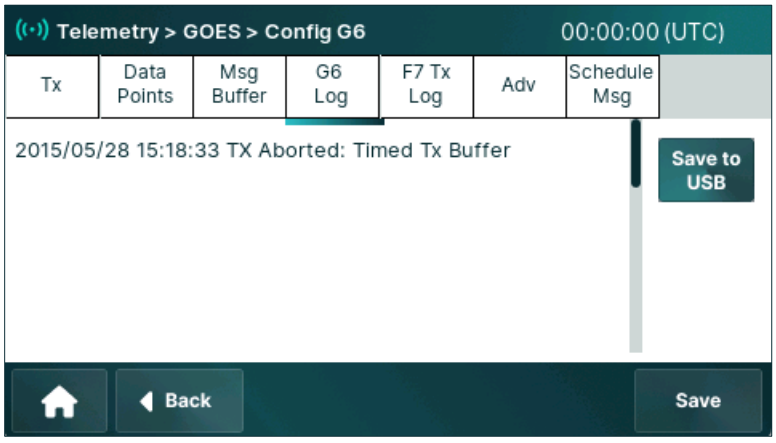


- Preview Scheduled Message uses the data point names and message settings to show the fields to be transmitted.
- Preview Random Message Buffer same as above.

G6 Log Tab – Future Release

The G6 Log tab displays a comprehensive log of transmission events in the format YYYY/MM/DD HH:MM:SS. It provides details about the status of time and random transmissions, including any errors or aborted transmissions.

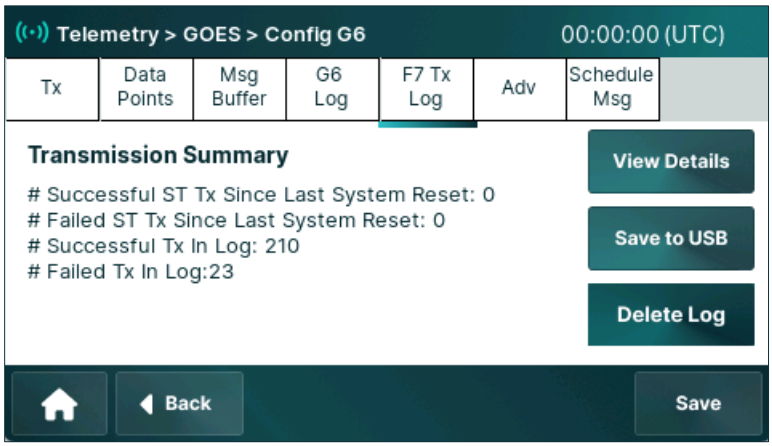
The log is captured by the G6 itself.



1. Insert a USB flash drive into the data logger.
2. Press the Save to USB  button at the top right corner.

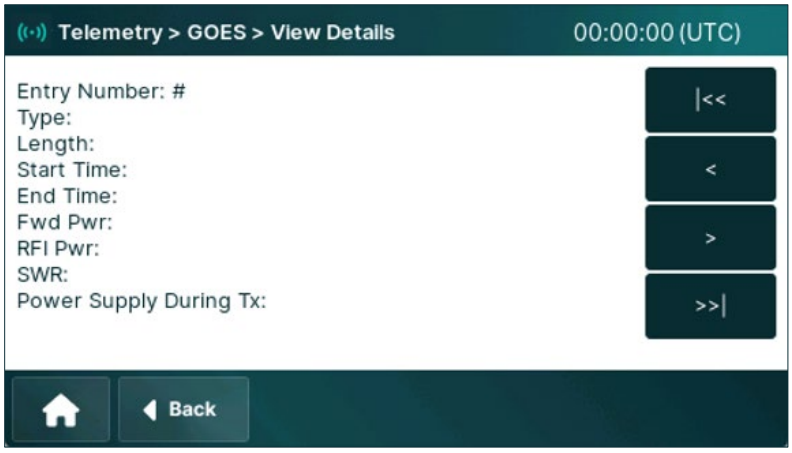
F7 TX (Transmission) Log Tab – Future Release

The F7 TX Log tab shows the transmissions and events of Axiom.



1. The **View Details** button provides access to individual transmission reports. The circular telemetry log file can store approximately 500 reports and will automatically overwrite the oldest entries when the file reaches its capacity.

   a. Press the **View Details** button.
   The *View Details* screen is displayed.



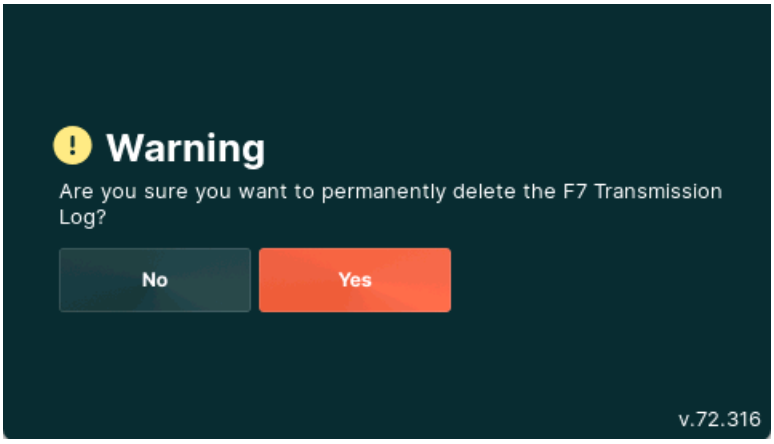
- Entry Number – Serialized message ID.
- Message Status – Date, time, and results of transmission.
- Transmitter – Enabled/Disabled at scheduled time of transmission.
- RTC – Valid/Invalid real-time clock value at time of transmission
- GPS – Last date of successful GPS fix and time synchronization.
- Failsafe – OK/Tripped status at time of transmission
- Supply Voltage – Power input during transmission, when battery is under load.

- Freq F-OCX0 – Represents the frequency value associated with the Oven-Controlled Crystal Oscillator (OCX0) at the time of transmission.
- Freq F-TCXO – Indicates the frequency value associated with the Temperature-Compensated Crystal Oscillator (TCXO) at the time of transmission.

Warning: Even if the GPS is synchronized, both oscillators must be calibrated for optimal transmission. Calibration must be done at the factory.

b. Use the **First** |<<, **Last** >>|, **Previous** <, and **Next** > buttons to navigate through the log entries.

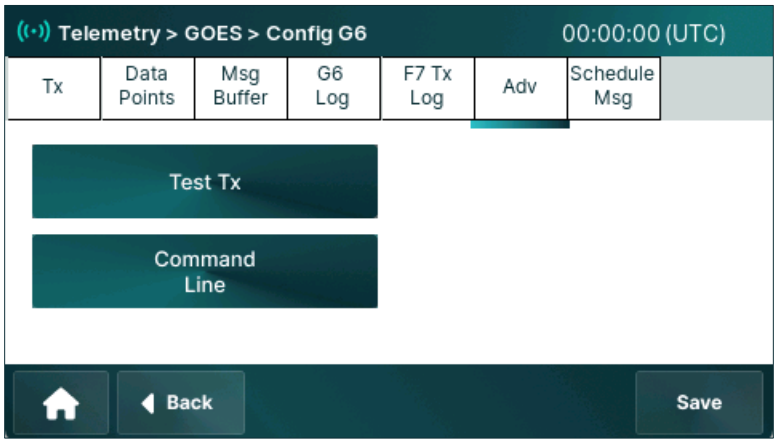
2. The **Save to USB** button on the F7TX Log tab writes the full GOES telemetry log file to the inserted USB flash drive.
3. The **Delete Log** button permanently removes all stored transmission GOES log data.
   a. Press the **Delete Log** button.
   A *Warning message* is displayed.



   i. Press the Yes button to confirm and delete the transmission logs.
   Or
   Press the **No** button to cancel and return to the *F7 Tx Log* screen.

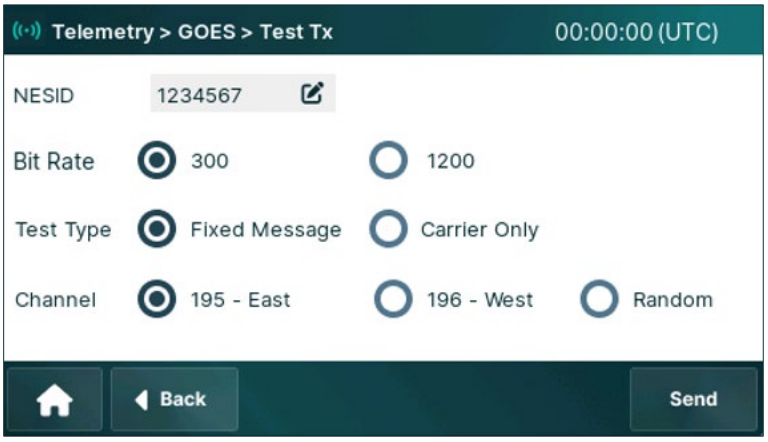
Adv (Advanced) Tab – Future Release

The Adv (Advanced) tab provides advanced tools for managing and testing the G6 GOES transmitter.



Test Tx (Transmission) button configures transmission settings such as NESID, channel, and schedule.

1. Press the **Test Tx** button.
   The *Test Tx (Transmission)* screen is displayed.



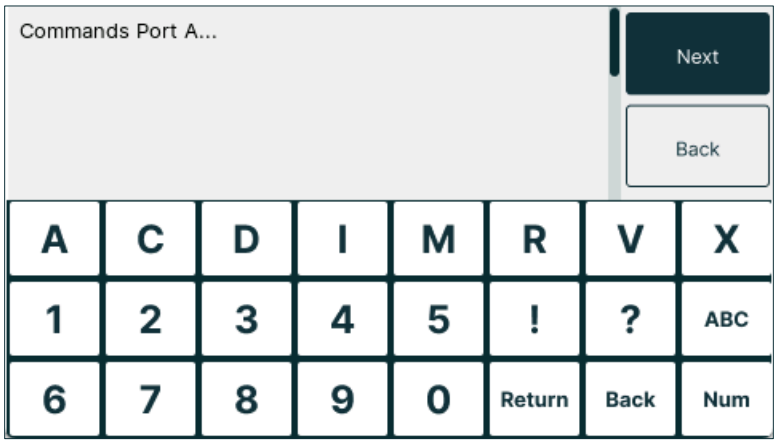
2. Enter ***NESID*** for the test transmission.
3. Select the desired ***Bit Rate*** for the test transmission.
   - ***300*** – Ensures reliable transmission in low-signal conditions.
   - ***1200*** - Ensures faster data transmission in strong signal conditions.
4. Specify the ***Test Type*** for test transmission.
   - ***Fixed Message*** – Sends a predefined test message to verify transmitter functionality and communication.
   - ***Carrier Only*** - Sends only the carrier signal to assess the transmission carrier's quality.
5. Select the **Channel** for the test transmission.

- *195 - East*: Transmits to the GOES-East satellite on channel 195.
- *196 - West*: Transmits to the GOES-West satellite on channel 196.
- *Random:* Enables the system to select a random channel for the test transmission.

6. Press the **Send** button to transmit a test message according to the parameters specified on the *Test Tx* screen.

Command Line button provides an interface to manually enter commands directly to the G6 transmitter. Commands are found in the G6 product manual.

1. Press the **Command Line** button.
   The *Command* screen is displayed with a keyboard.



2. Enter the desired command in the *Command Input* field using the keyboard.
3. Press the **Enter** button to submit the entered command to the transmitter.
   Or
   Press the **Back** button to the previous screen.

11.5.4 GOES Messages

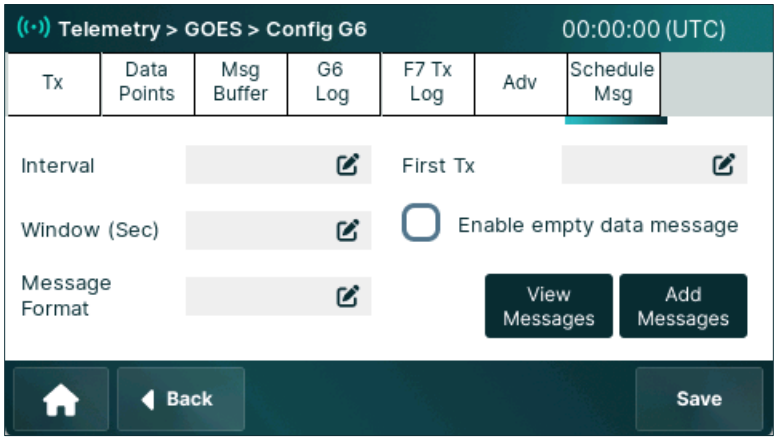
Axiom data loggers can transmit several GOES message types and data formats.

Message Types

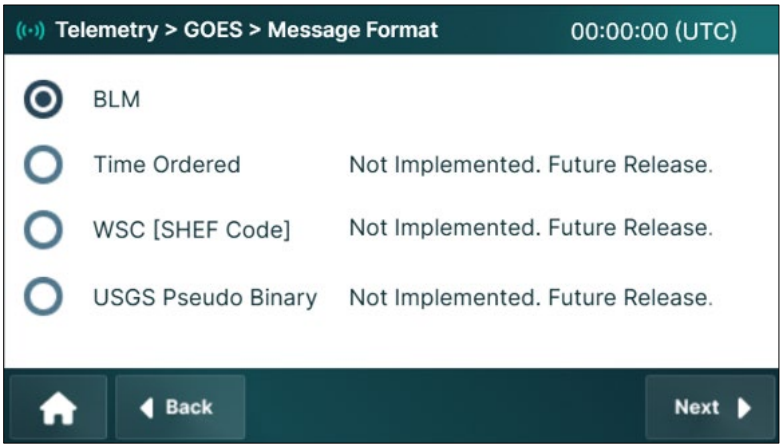
There are two general types of messages, Scheduled and Random.

- *Scheduled messages* - Sent at the interval (typically hourly) and offset from the hour that is assigned to the specific NESID.
- *Random messages* - Smaller and may be sent at any time but typically no less than 15 minutes apart. Since any device may transmit a random message, there is greater possibility of a collision and failure to deliver.

The allowed message types are enabled based on the selected *Message Format* shown on the Schedule Message tab. For example, BLM message format does not allow *Random* messages.



Selecting the **Edit** button on the ***Message Format*** field will open the selection screen.



- ***BLM***(Bureau of Land Management) - The BLM Message Format is an ASCII-based standardized format widely used in fire weather applications. It converts critical weather data, including temperature, humidity, wind speed, and direction, into a readable text format for easy transmission, analysis, and integration with fire control systems. The format allows for customizable data point selection and precision settings to optimize message content.
- ***Time-ordered*** – Time-ordered messages use a time-stamped, recurring transmission of ASCII (plain text) measurement data. This format also supports Random messages, or a combination of both. Random messages may be transmitted based on measurement conditions.
- ***WSC***(Water Survey Canada) - The WSC format uses the Standard Hydrologic Exchange Format (SHEF) coding system to efficiently transmit hydrological data. This format is specifically designed for water resource monitoring applications and supports conditional transmission triggers based on threshold events.

  WSC format allows for multiple message types including scheduled (self-timed) transmissions, random event-based transmissions, conditional transmissions based on preset thresholds, alarm hold-off features to prevent message flooding during rapidly changing conditions, and redundant messaging for critical data assurance. The format's

structured approach enables efficient data processing by Canadian water monitoring systems.

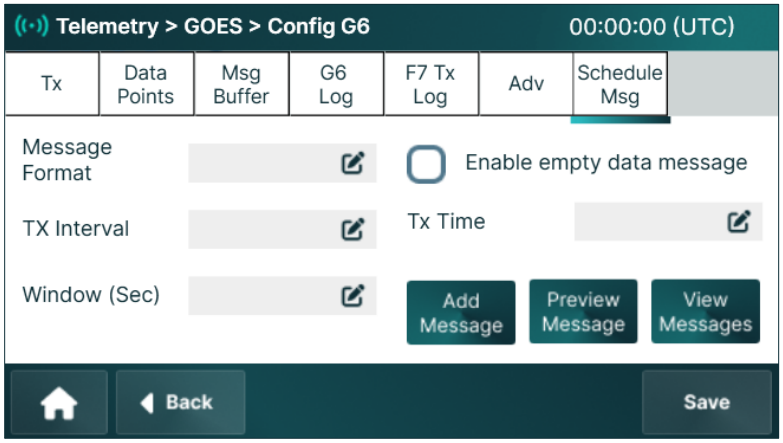
- *USGS Pseudo Binary* - The USGS Pseudo Binary format is a specialized transmission protocol developed for the United States Geological Survey that encodes numeric data in a compact binary-like format while still using ASCII characters. This approach significantly reduces message size compared to plain text formats, allowing more data to be transmitted within bandwidth constraints.

  The format supports both scheduled and random transmissions with conditional triggering options based on measurement thresholds. It includes features like alarm hold-off periods to prevent excessive messaging during rapidly changing conditions and redundant transmission capabilities for critical monitoring stations. USGS-PB is particularly valuable for water resource monitoring applications where data transmission efficiency is essential.

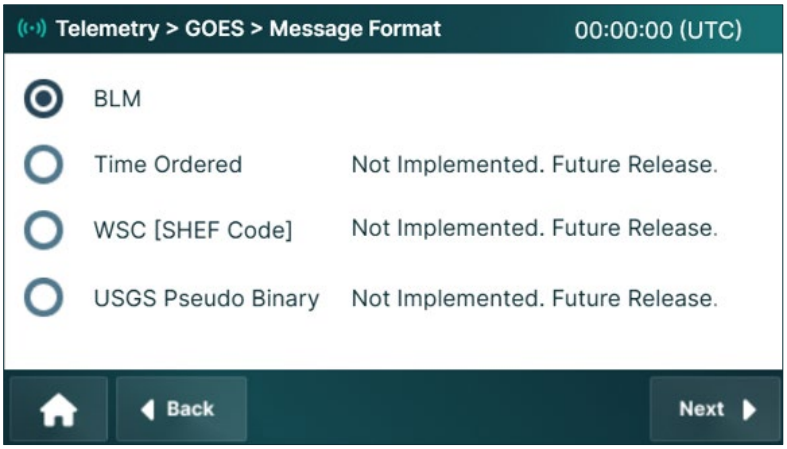
The configuration of each message format is covered in the following sections.

11.5.5 BLM Format

1. Go to the Sched Msg tab on the *Config G6* screen.



2. Touch the *Message Format* field and select BLM from the radio buttons.



3. Selecting **Next** will return to the **Sched Msg** tab.
4. Set *TX Interval* to the transmission period in HH:MM:SS format, with a valid range of 5 minutes (00:05:00) to 1 day (24:00:00).
5. Enter the **TX Time** offset to the assigned by National Environmental Satellite, Data, and Information Service (NESDIS).

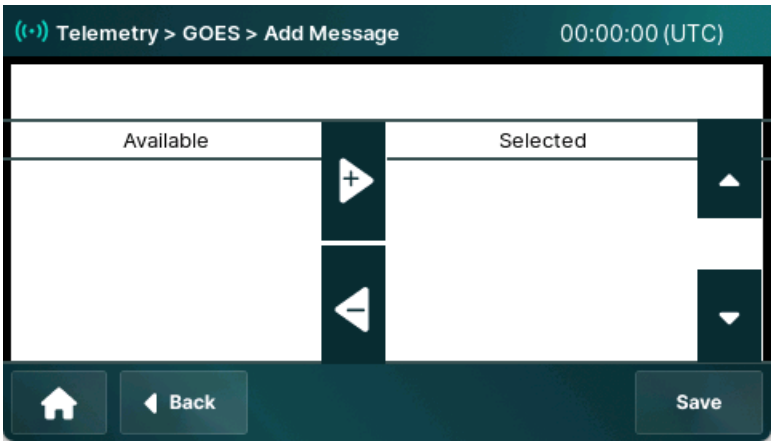
> ***Note***: For more information on *Interval* and *Offset*, refer to *Understanding Interval and Offset Timing* in the *General Operating Information* section.

6. Set *Window* to the seconds (typically 10) provided with the NESID.
7. Check the *Enable empty data message* box to send the message "NO DATA AVAILABLE FOR TRANSMISSION" when there is no data. This confirms that transmission would have succeeded if data had been available. Enabling this option is recommended but ensure compatibility with the reception software before use.

Add Message Button

The **Add Message** is used to create new message content. It provides options to select variables for inclusion, set the transmission interval, and configure the offset time for message scheduling.

1. Press the **Add Messages** button on the Transmit Setup screen.
   The *Add Msg* screen is displayed.



2. *Data Interval* defines the frequency of data measurements that will be pulled from the data store when preparing a GOES message.
   - A buffer interval of 00:00:00 will only pull one measurement value per transmission for the listed data points.
   - A buffer interval of less than the *TX Interval* will pull multiple measurements per transmission.

     Example: *TX Interval* is set to 01:00:00. *Data Interval* is set to 00:05:00. Each data point in the set will include 12 comma-separated values of measurements stored over the last hour.
3. *Offset* is the time of the data values.

Example: If the TX Time 00:20:00 (20 minutes past the hour), a Data Interval of 1:00:00 and an Offset of 00:18:00 means data that is two minutes prior to the transmission time will be sent.

Note: For more information on ***Interval*** and ***Offset***, refer to *Understanding Interval and Offset Timing* in the *General Operating Information* section.

4. Select the ***Log Data*** checkbox to automatically create a data log definition that matches the GOES message data points, interval, and offset. This log definition may then be edited, expanded, or deleted in the **Datalog** menu.

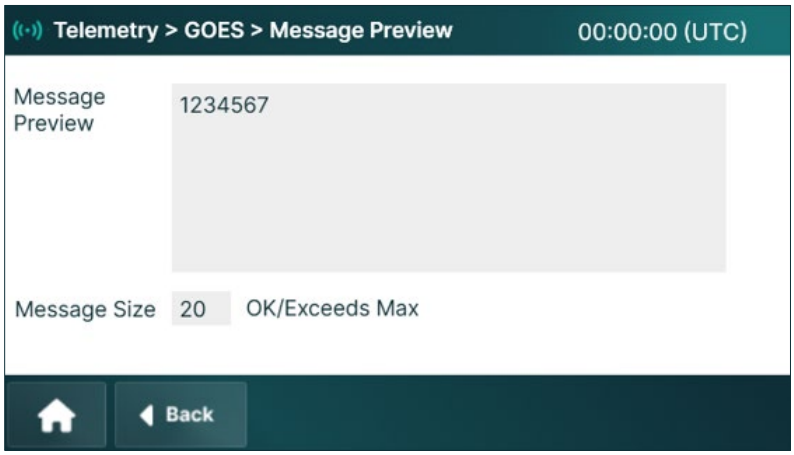
Note: Log Data checkbox creates a normal measurement data log. The TX Log and G6 Log are different logs.

   - Select from the ***Available*** data points and press the **Right Arrow** button to move them to the ***Selected*** list. Similarly, ***Selected*** data points can be removed with the **Left Arrow** button.
   - Selected items may be ordered using the **Up** and **Down** arrows.
5. Highlight (touch) each data point in the ***Selected*** column and press **Format** button to define the number of decimal places.
6. Press the **Save** button to record the precision for the selected data point.
7. ***Message Parameters*** are not applicable to BLM messages.
8. Press the **Save** button to save and apply the changes.

Message Preview Button

The Preview Message presents a structured view of the fields used for message.

The same process is used for all ***Scheduled Messages***. Refer to the *Add Message* section and Preview Message section under ***BLM Format***.



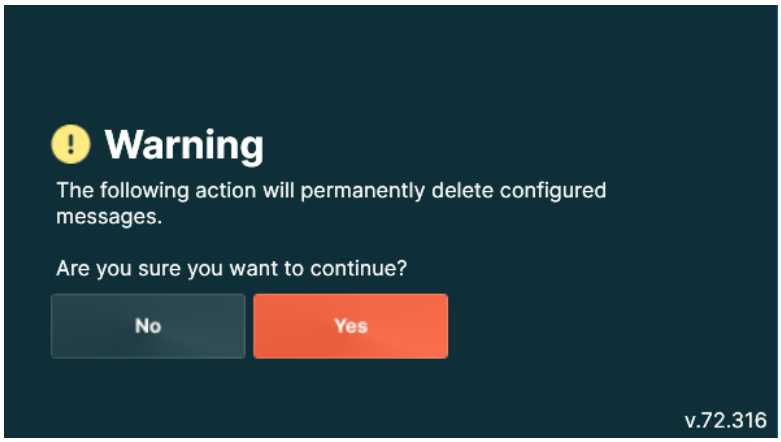
View Messages

The *preview Messages* screen displays a list of all configured GOES messages currently stored in the data logger that are scheduled for transmission.

1. Press the **View Messages** button on the *Transmitter Setup* screen.
   The *View Msg* screen is displayed. The screen displays a list of currently stored messages that are scheduled for transmission.

   Select the desired message from the list and press the **View Details** button to view details of the message.

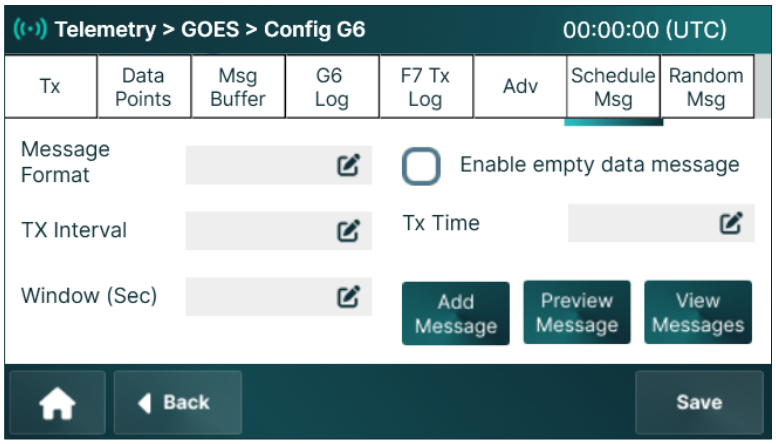
2. **Delete** allows users to delete the desired messages.
   a. Press the **Delete** button and select the message or messages.
   b. Press the **Delete** button. Deleting the message is irreversible. Ensure that necessary data is backed up before proceeding.
   A *Warning* screen is displayed.



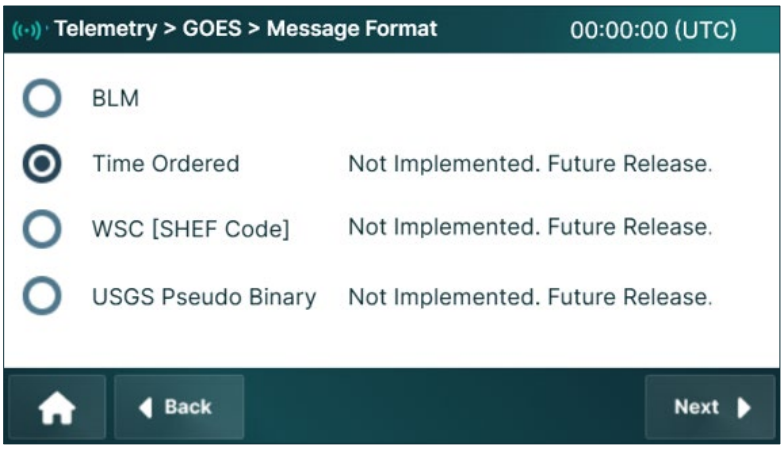
      i. Press the **Yes** button to confirm.
      Or
      Press the **No** button to cancel and go back to the previous screen.

11.5.6 Time Ordered Format – Future Release

1. Go to the Sched Msg tab on the *Config G6* screen.



2. Touch the *Message Format* field and select Time Ordered from the radio buttons.



3. Selecting **Next** will return to the Sched Msg tab.
4. Set *TX Interval* to the transmission period in HH:MM:SS format, with a valid range of 5 minutes (00:05:00) to 1 day (24:00:00).
5. Enter the **TX Time** offset to the assigned by National Environmental Satellite, Data, and Information Service (NESDIS).

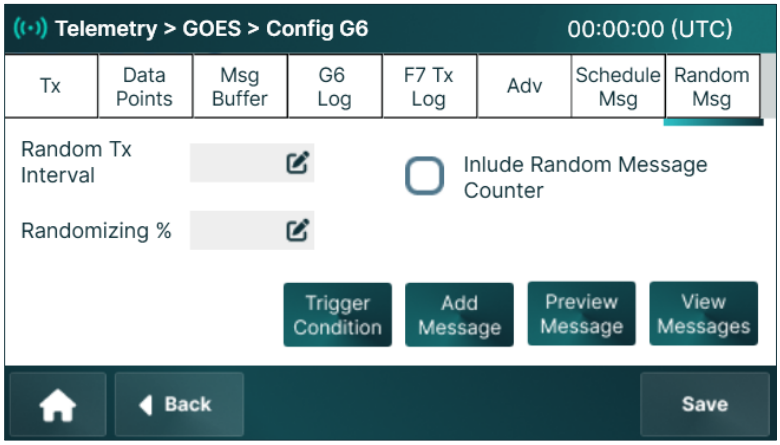
> *Note*: For more information on *Interval* and *Offset*, refer to *Understanding Interval and Offset Timing* in the *General Operating Information* section.

6. Set *Window* to the seconds (typically 10) provided with the NESID.
7. Check the *Enable empty data message* box to send the message "NO DATA AVAILABLE FOR TRANSMISSION" when there is no data. This confirms that transmission would have succeeded if data had been available. Enabling this option is recommended but ensure compatibility with the reception software before use.

Random Message Tab

The Random Msg tab provides options for configuring conditional message transmission. To enable random transmissions, the necessary random channel parameters must be provided by NESDIS and specified on the TX tab.

> *Note*: Random transmissions have a maximum message size of 78 bytes. Any data exceeding this limit will be truncated.



1. Set the *Randomizing TX Interval* for repeated messages that are sent outside of the normal scheduled message. The actual transmission time will be random, but on average it will occur at this rate. Valid range is 5 to 99 minutes.

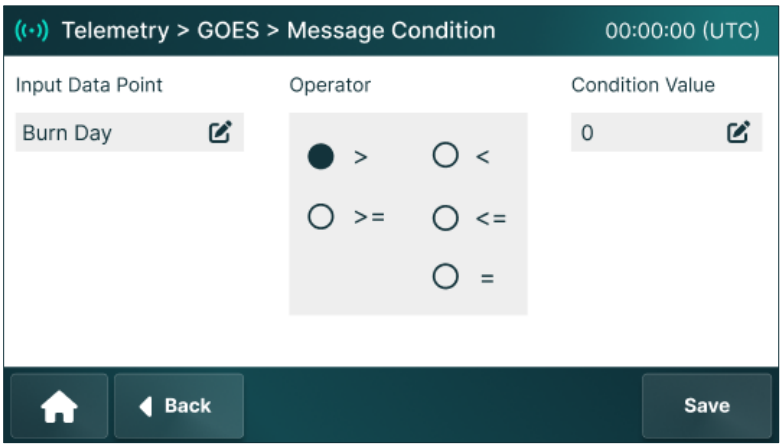
   Randomizing % determines the range of randomization of the *Random TX Interval*. Random transmissions will occur at a uniformly distributed time within this range. Valid range is 10 to 50%.

   For example, with a *Random TX Interval* of 15 minutes and a *Randomizing %* of 20%, the transmissions will be within 12 to 18 minutes (15 ± 3 minutes).

2. Check the *Include Random Message Counter* checkbox to include a two-digit sequence number that resets at 99.

Trigger Condition Button

The results of a data points comparison is used to trigger random messages.



Add Message Button

The same process is used for all message builders. Refer to the *Add Message* section under ***BLM Format***.

Preview Message Button

The same process is used for message preview. Refer to the Preview Message section under ***BLM Format***.

View Messages Button

The same process is used for viewing all messages. Refer to the View Message section under ***BLM Format***.

11.5.7 WSC Format – Future Release

Defined by Water Surveys Canada, this self-contained ASCII format embeds parameter names and timing within the message, supporting GOES random transmissions.

11.5.8 USGS Pseudo-binary Format – Future Release

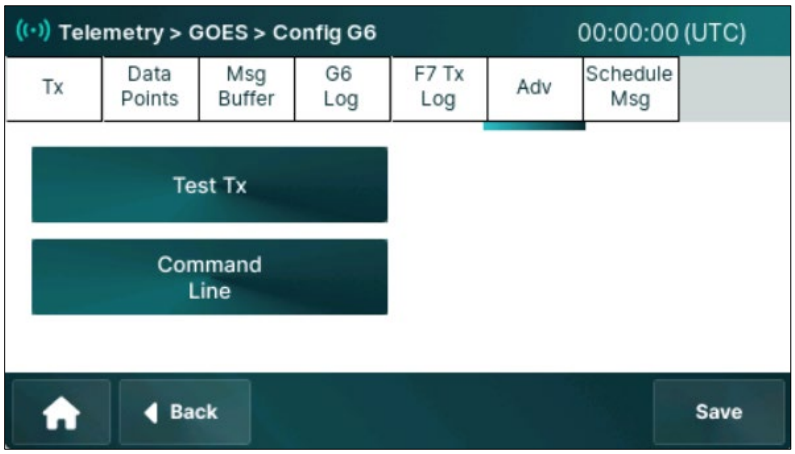
Developed by the United States Geological Survey, this bit-packed, modified ASCII transmission format facilitates flexible GOES random transmissions with efficient data encoding.

11.5.9 GOES Test Transmission

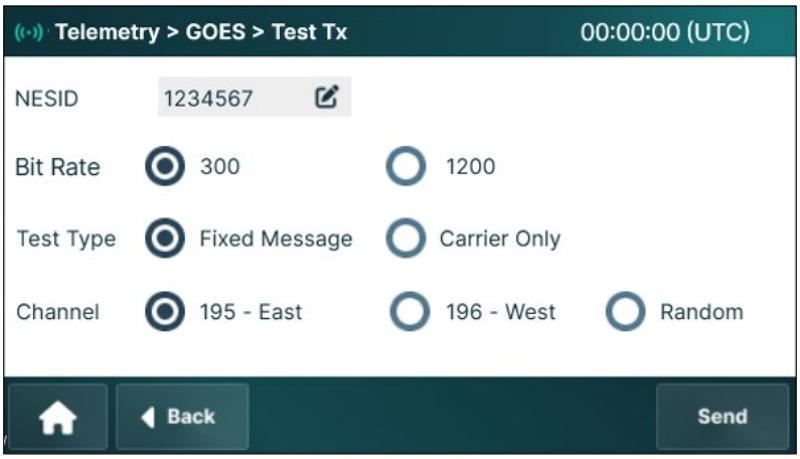
The **Test Tx** button on the Config G6 screen provides access to the Test Transmission functionality. Selecting this option displays the Test Tx screen, where users can send a test transmission for diagnostics or configuration verification.

1. Press the **GOES** button on the *Telemetry* screen.
   The *GOES Status* screen is displayed.

2. Press the **Config G6** button on the *GOES Status* screen.
   The *Config G6* screen is displayed.
3. Go to **Adv** tab.



4. Press the **Test Tx** button on the *Config G6* screen.
   The *Test Tx* screen is displayed.



   a. Enter ***NESID*** for the test transmission.
   b. Select the desired ***Bit Rate*** for the test transmission.
      - *300* – Ensures reliable transmission in low-signal conditions.
      - *1200* - Ensures faster data transmission in strong signal conditions.
   c. Specify the ***Test Type*** for test transmission.
      - *Fixed Message* – Sends a predefined test message to verify transmitter functionality and communication.
      - *Carrier Only* - Sends only the carrier signal to assess the transmission carrier's quality.
   d. Select the ***Channel*** for the test transmission.

- *195 - East*: Transmits to the GOES-East satellite on channel 195.
- *196 - West*: Transmits to the GOES-West satellite on channel 196.
- *Random*: Enables the system to select a random channel for the test transmission.

e. Press the **Send** button to transmit a test message according to the parameters specified on the *Test Tx* screen.
A test transmission report is displayed once the test transmission is completed.

Test Transmission Example

The following is a sample of a fixed message test transmission. The message includes a header, added by the GOES Data Collection System, along with the test transmission data.

001014E809124191542G47-0NN195EFF00396□

Operator Initiated Test Transmission:

Operator Initiated Test Transmission:

Operator Initiated Test Transmission:

Operator Initiated Test Transmission:

Operator Initiated Test Transmission:

Operator Initiated Test Transmission:

DCS (Data Collection System) Header Breakdown

The table below breakdowns the header (*001014E809124191542G47-0NN195EFF00396□*) from the previous fixed message test transmission sample.

Code	Meaning
001014E8 09 124 19 15 42 G 47 -0 N N 195 E FF 00396□	Full header
001014E8	DCP Address (NESDIS ID)
09	Year
124	Day of Year
19	Hour
15	Minute
42	Second
G	Message Code (see table below)
47	Signal Strength, 33 to 57 dBm (normal is 44 to 49)
-0	Frequency Offset in Hz
N	Modulation Index (N = normal, L = low, H = high)

N	Data Quality (N = normal, F = fair, P = poor)
195	Channel Number
E	Satellite (West, East)
FF	Uplink Carrier Status
00396	Number of Data Characters
☐	Flag word, 8 bits (see table below)

Message Code Descriptions

Code	Description
G	Good message
?	Message received with parity errors
W	Message received on wrong channel
D	Message received on multiple channels (duplicate)
A	Message received on multiple channels (duplicate)
T	Message received early or late (time error)
U	Unexpected message received (>2 min early or late of assigned time)
M	Scheduled message is missing
N	PDT is incomplete

Flag Words Definition

	Code	Description
LSB	1	Undefined
	2	Clock update since last transmission (1 = update, 0 = not)
	3	Clock update since last transmission (1 = update, 0 = not)
	4	Reed Solomon (1 = on, 0 = off); future enhancement
	5	Undefined
	6 & 7	ASCII = 10, Pseudo binary = 11, Binary = 01 (bit 6 / bit 7)
MSB	8	Odd parity for ASCII formatted data

11.5.10 Fail-Safe Reset

The Fail-Safe status is displayed at the center of the screen, along with an indicator showing whether it is OK or TRIPPED. When the failsafe status is OK, the system functions normally. If the status is TRIPPED or unknown, it means there is an issue. The status can be reset by pressing the Fail-Safe Reset button.

11.6 GPS

The GPS-GNSS (GPS) receiver provides essential data logger UTC time as well as automatic latitude, longitude, and elevation.

The time is used for GOES transmissions (if installed) and data log time values.

For power efficiency, the GPS receiver is only enabled once a day for resynchronization.

11.6.1 Sources

Depending on the configuration, Axiom data loggers use one of two different GPS-GNSS receiver sources.

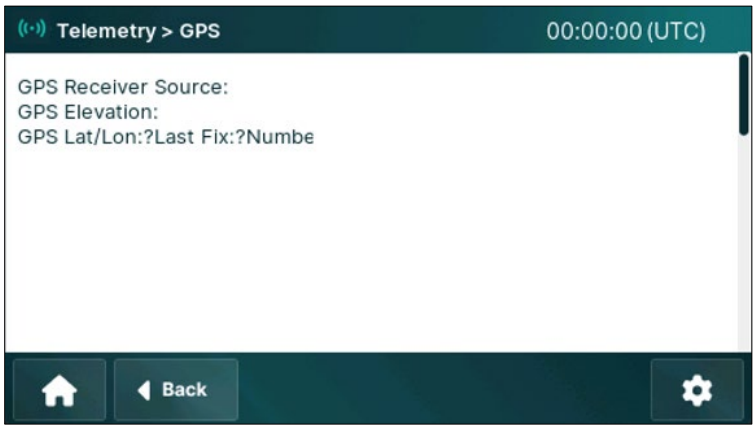
- *G6 GOES Transmitter* - A GPS receiver is built into G6 available in F7-**G6** and H3-**G6** product variants. The transmitter can run for up to 28 days without requiring GPS resynchronization.
- *GPS-GNSS receiver* - When a G6 is not installed, a separate GPS receiver may be installed in the same internal position. The receiver is installed in F7-**GN** and F7-IR-**GN** variants.

11.6.2 GPS Status

The GPS source is automatically selected.

Depending on the operational status of the receiver, the GPS/GNSS status information may take a few seconds or several minutes to update. The GPS remains active until the user departs the screen or the data logger times out.

1. Press the **GPS** button on the *Telemetry* screen.
   The *GPS* screen is displayed. This screen displays the detected receiver and its current values.



   - *GPS Receiver Source* displays the source of the GPS signal.
   - *GPS Elevation* provides the elevation data captured by the GPS receiver.

- *GPS Lat/Lon* displays the current latitude and longitude coordinates from the GPS receiver.
- *Last Fix* indicates the date and time when the last GPS was fixed.
- *Number Sat* shows the number of satellites currently connected to the GPS receiver.
- *Antenna Errors* lists any errors or issues detected with the GPS antenna.

11.6.3 GPS Time Synchronization

When in normal data collection mode, the GPS receiver periodically powers on and synchronizes with UTC time. The automatic latitude, longitude, and elevation are updated.

The GPS fix occurs within 5 minutes, while UTC sync may take up to 20 minutes.

GPS and GOES

Time synchronization is required for GOES transmissions. If synchronization fails, the G6 module disables the GPS receiver for one minute before retrying.

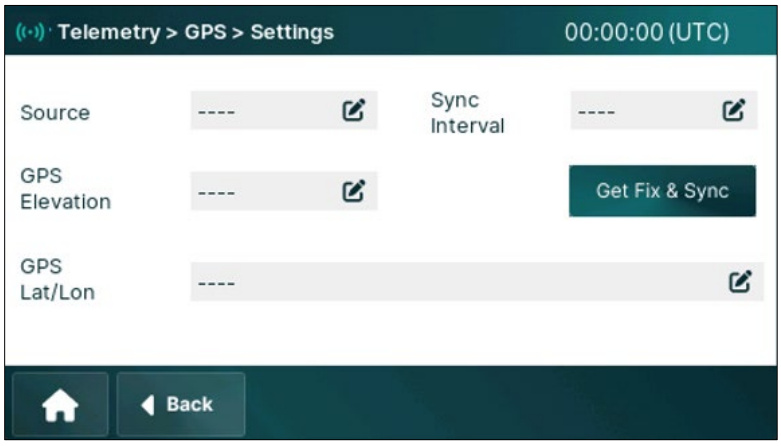
The transmitter resyncs every 24 hours and operates for 28 days without sync. If synchronization is lost, transmissions will pause but resume automatically once UTC synchronization is restored.

GPS and Other

While timing is less critical that for GOES, GPS time synchronization is also required for data logging, and system timing, including cell phone and Iridium transmission scheduling.

11.6.4 GPS Receiver Setup

The *GPS Settings* screen allows users to configure location and elevation.



1. *Source* is set to Automate by default to allow the system to select the GPS source automatically.
2. Set *Sync Interval* to configure the frequency of the GPS synchronization. By default, it is set to sync in every 24 hours, which can be changed as required.
3. *GPS Elevation* is set to Automate by default to let the system automatically select the elevation data from the GPS source.

4. *GPS Lat/Lon* displays the current latitude and longitude of the GPS transmitter.
5. Press the **Get Fix & Sync** button to manually initiate the synchronization. It also updates the GPS data including elevation and position coordinates.

11.7 AirTalk – Future Release

AirTalk is an option for Quick-deploy (-QD) systems. It delivers verbal weather reports directly to firefighter radios.

Two types of user-configurable weather reports are transmitted:

- *Messages* - A voice transmission initiated in response to a received DTMF code.

  Current temperature seventy-two degrees Fahrenheit, wind speed four miles per hour, humidity thirty-two percent.

- *Alerts* – An automatic voice announcement is triggered by weather conditions, such as low humidity or high wind.

  Alert, alert, alert. Humidity is below twenty percent.

> *Note*: Messages and Alerts transmissions are delayed if other radio activity is detected.

11.7.1 How Does It Work?

Axiom data loggers with the optional AirTalk module (models F7-xx-AX-**AT**-QD) can connect to external radios.

AirTalk requires a radio interface kit. This includes a cradle for a handheld radio, interface cable, coaxial feedline, and antenna. (Users provide the radio.)

Specific kits are available for:

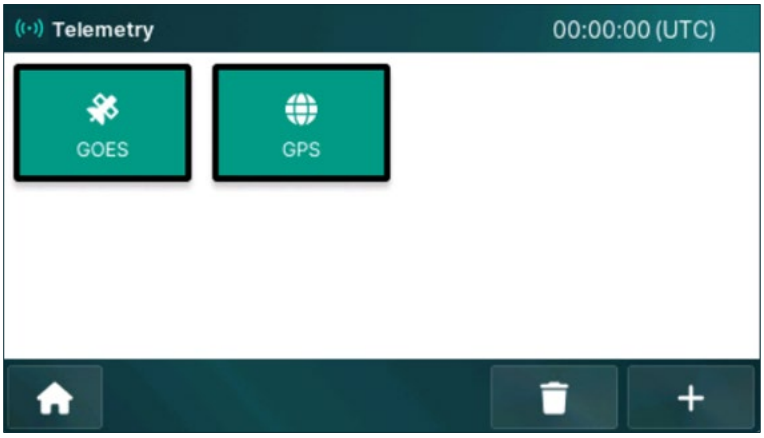
- BK Technologies BKR5000
- BK Technologies KNG-P150

The interface cable provides power and control signals (carrier detect, audio, and PTT) from the **RADIO** connector on the data logger to the accessory connector on the radio.

The AirTalk module contains a pre-recorded vocabulary of English words and phrases. Messages are responses to DTMF codes transmitted from handheld or mobile radios. Alerts are automatically transmitted by the weather station when triggered by a weather condition. Users can construct both Messages and Alerts from the available vocabulary and data points. The full vocabulary list is provided in the last subsection under AirTalk.

When a voice transmission is called for, AirTalk waits for a clear channel and then keys the transmitter on the connected radio and transmits the audio.

When an AirTalk module is installed at the factory, the AirTalk tile is displayed on the *Telemetry* screen.



DTMF Timing and Messages

DTMF tones are often transmitted by holding the PTT button on a radio and pressing a numeral key.

The beginning of each tone in a sequence must be less than one second apart.

This timing may be used to create combinations of 2-, 3-, and 4-digit messages. For example:

- DTMF 22 – Basic weather information, such as wind, temperature, humidity.
- DTMF 222 – Adds dew point and fuel moisture.
- DTMF 2222 – Adds solar radiation, peak wind.

Warning: After matching a code to an existing message, AirTalk will continue to receive codes before it begins transmitting the first message. These will be evaluated as separate message requests. This may occur when a four-digit code is entered two slowly or when multiple users request a message in close succession.

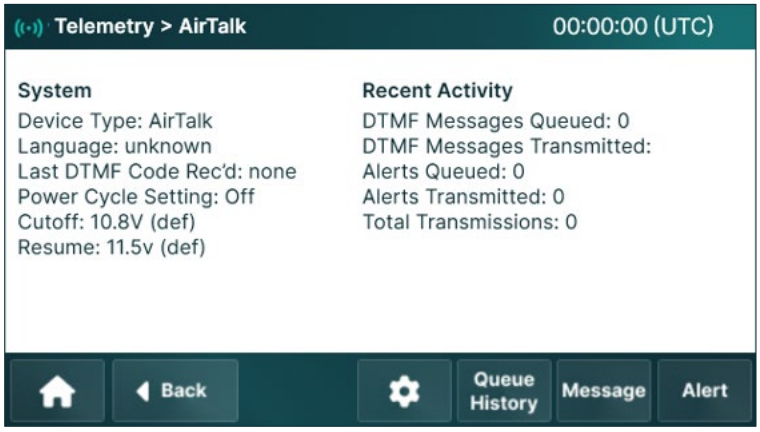
Since the second sequence may be cut off, this can lead to incomplete codes and unpredictable operation.

Best practice is to key only one DTMF code at a time, waiting for the response before keying in another code.

11.7.2 AirTalk Status

The initial AirTalk page provides information related to the AirTalk module, internal to the Data Logger. It does not provide any information related to the radio itself.

1. Press the **Air Talk Radio** button on the *Telemetry* screen.
   The *Air Talk Radio* screen is displayed.



Status Fields

- *Device Type* indicates the type of device in use. In this case, it is AirTalk (or RVT2).
- *Last DTMF code Rec'd* displays the last DTMF (Dual-Tone Multi-Frequency) code received by the device.
- *Enabled* setting as Yes or No.
- *Disable on Power Up* indicates current setting as On of Off.
- *Cutoff* indicates the voltage cutoff value for the device. In this case, by default it is set to 10.8V.
- *Resume* indicates the voltage value at which the device will resume. In this case, by default it is set to 11.5V. Once the voltage reaches this point, the device will resume operation.
- The *Recent Activity* column reports queued and transmitted messages.

> *Note*: In normal conditions, the queued count may only momentarily show a value before returning to zero and incrementing the "Transmitted" counters.

Action Bar Buttons

- ☐ **Configuration**: User this feature for changing the operational characteristics of the AirTalk module.
- ☐ **Queue History**: Displays queued and previously sent DTMF messages with timestamps for review.
- ☐ **Message**: Opens the interface to create and send manual DTMF messages.
- ☐ **Alert**: Opens the alert configuration screen for setting up and managing AirTalk alert triggers.

11.7.3 AirTalk Configuration

Through the Air Talk Configuration, users can configure the primary settings of the Air Talk system, which facilitates communication with the data logger.

1. Press the **Settings** button on the *AirTalk Radio* screen.
   The *Air Talk Configuration* screen is displayed.

2. If multiple stations might be in the same area, enter a one- or two-digit ***Station Number*** to identify the source of transmissions.

   When the field contains a numeric value, messages and alerts will begin with "Station number <xx>…".

   If no value is entered "Station number…" will not be transmitted.

3. ***Suspend AirTalk*** can be manually checked or cleared. Or…

   If ***Suspend on Power Up*** is checked, ***Suspend AirTalk*** is automatically set when the data logger restarts after a power loss. This prevents unintended transmission when a Quick-deploy station is moved from one location to another.

Note: Suspending and resuming AirTalk does not affect the Enable/Disable status of individual Alerts or Messages. All Alerts and Messages are blocked when in suspend.

Important: When ***Suspend on Power Up*** is checked, users must manually resume AirTalk after each power interruption if they want to use the feature.

4. All Numbers Spoken As selects two different verbal renderings of numeric values:
   - ***Compound*** – "Seventy-two"
   - ***Digit-by-Digit*** – "Seven Two"
5. Press the **Save** button to save and apply the changes.

11.7.4 AirTalk Message Queue and History

Press the **Queue History** button to review messages awaiting transmission and past messages and transmissions.

Queue Tab

Messages or alerts that are awaiting transmission are listed in the Queue tab. These may be awaiting a clear channel, or a technical problem has interrupted the transfer of the messages to the AirTalk module.

In most cases, messages will appear only momentarily in the Queue, if at all.

The **Delete** button will delete un-transmitted messages.

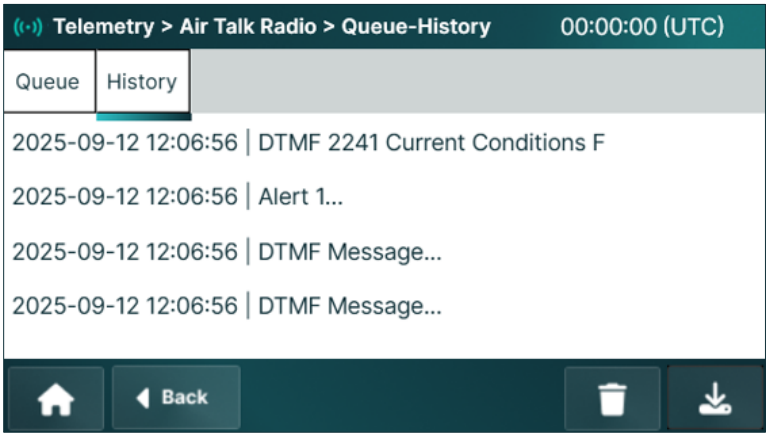
The counters and data shown on the status screen will similarly be cleared.

Since the queue is transitory, **Download** only applies to the message history.

History Tab

Successfully transmitted messages and alerts are logged.

Important: A disconnected, defective, or unpowered radio cannot be detected by AirTalk. Messages are considered "successful" if loaded to the AirTalk module and it completes the "transmission" process.



Action Bar Buttons

- ☐ **Delete** : Erases the message log. The counters and data shown on the status screen will similarly be cleared.
- ☐ **Download** : Saves the message log to a USB flash drive.

11.7.5 AirTalk Message Configuration

The AirTalk Message Configuration allows users to define and manage weather reports that are transmitted in response to DTMF (Dual-Tone Multi-Frequency) codes.

Each verbal message is composed of an optional station ID and one or more phrases.

Each phrase includes:

- *Descriptor* – A combination of one or more words from the vocabulary library that describe the requested information.
- *Data Point* – A measured value from one of the available data points.
- *Units* – Measurement units for the data point.

```
|Message--------------------------------------|
|[station ID] <Phrase 1> <Phrase 2> <Phrase 3>…|
                  |
   |Phrase----------------------------|
   |<Descriptor> <Data Point> < Units> |
```

For example, a firefighter may transmit DTMF code 2241 from their handheld radio.

AirTalk will wait for any current radio activity to stop and then respond with the verbal message:

> *Station ID 32, Current Temperature Seven Two Degrees Fahrenheit, Wind Speed Four Miles Per Hour, Humidity Three Two Percent.*

Multiple messages may be configured for different DTMF codes.

> *Note*: DTMF codes 9999 (Disable All Alerts) and 8888 (Enable All Alerts) are default codes and reserved for these functions.

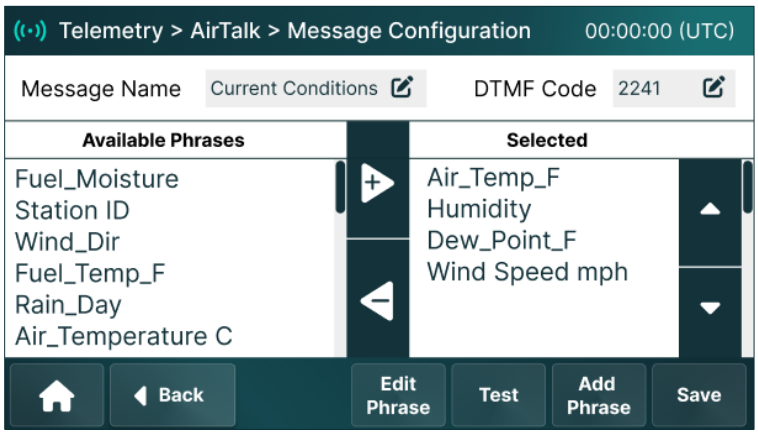
Action Bar Buttons

- **Enable/Disable All**: Toggles the status of all listed DTMF messages. If any message is disabled, pressing this button enables all; if all are already enabled, it disables them in a single action.
- **Edit**: Opens the Message Configuration screen for editing DTMF code or description.
- **Delete**: Removes the selected DTMF message from the list.
- **Add**: Adds a new DTMF message entry to the list.

11.7.6 Add New Message

Message Editor allows users to create and modify AirTalk messages by assigning phrases to a specific DTMF (Dual-Tone Multi-Frequency) code.

The screen also provides buttons to edit existing phrases and add new phrases which can then be used for new messages.



1. *Message Name* is the name of the message. Users can edit this field to rename the message. Each message name must be unique.
2. *DTMF Code* displays the assigned 2-4 digit DTMF code.

> *Note:* On new data loggers, no phrases will be displayed. The user must define each phrase. Jump to the Add Phrase section then return here to complete *Message Configuration*.

3. The *Available Phrases* column contains user-defined phrases that can be added to the message.
    - Use the **Right Arrow** to add a phrase from the *Available* list to the *Selected* list and the **Left Arrow** to remove it.
4. The *Selected* column lists the phrases assigned to the message, which will be spoken in the specified order when the DTMF code is triggered.

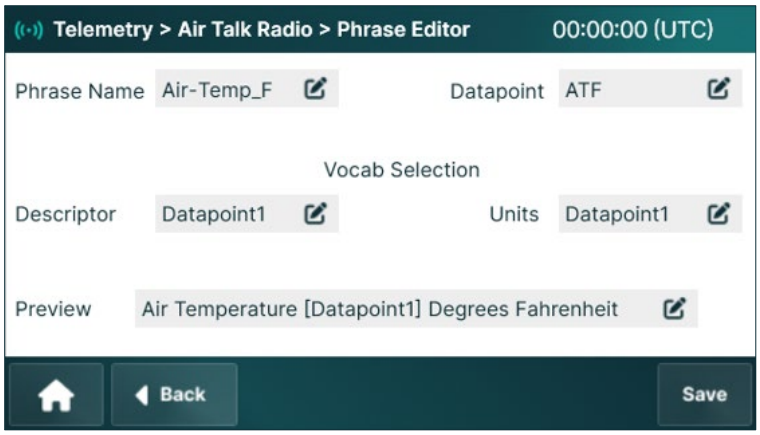
- Adjust the speaking order by touching the desired phrase and move it using the **Up Arrow** and **Down Arrow** buttons.

Action Bar Buttons

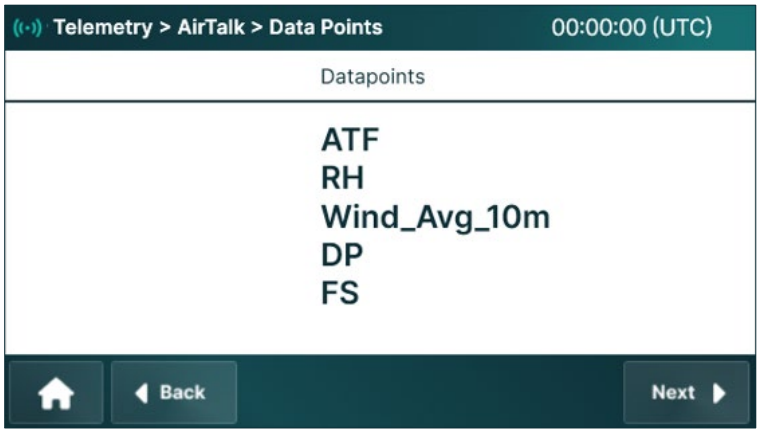
- ☐ **Edit Phrase:** Opens Phrase Editor screen to edit phrase.
- ☐ **Test:** Sends the current DTMF message configuration as a test transmission.
- ☐ **Add Phrase**: Adds a new phrase to the list of available message components.

11.7.7 Add Phrase

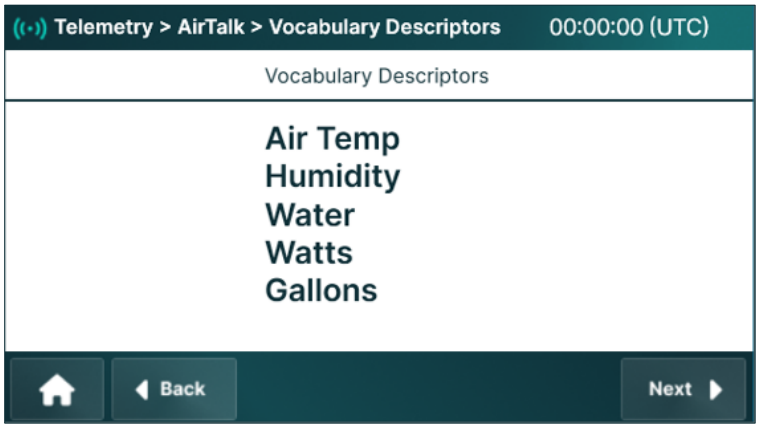
Edit Phrase and **Add Phrase** buttons open the *Phrase Editor* screen. Phrases are the verbal components that make up Messages and Alerts.



1. *Phrase Name* assigns the name that will appear in the *Message Configuration* screen for *Available Phrases*.
2. *Datapoint* is the measurement or calculated numeric value to be spoken by AirTalk. Select from the list of available data points then press **Next**.
   Pressing **Back** will return to the previous screen without applying (or changing) a data point selection.



3. Vocabulary ***Descriptor*** defines the verbal phrase, selected from those available in the vocabulary library.



4. Select vocabulary ***Units*** for the measured value. If left blank, no units will be spoken.
5. The ***Preview*** field shows the constructed phrase.

Test Button

Once a phrase is constructed, **Test** may be used to transmit the phrase on an attached radio.

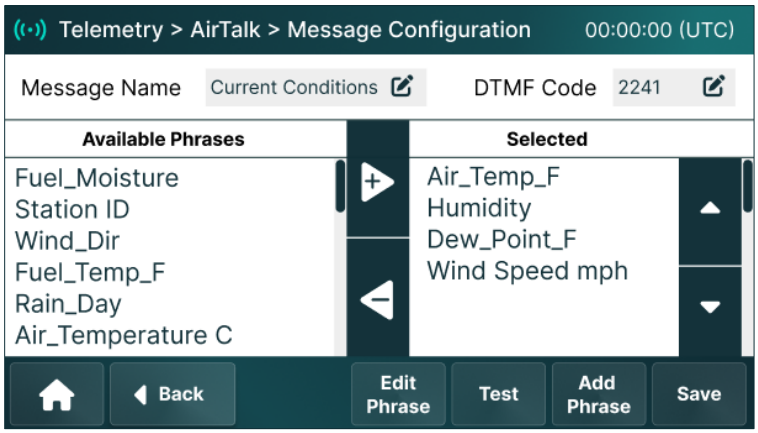
Delete Button

When editing or creating a new phrase, **Delete** will remove the phrase from the data logger, even if the phrase is included in a current message.

Pressing **Delete** button will present a confirmation screen. If confirmed, the user is returned to the *Message Configuration* screen.

Save Button

After all fields are complete, **Save** will write the phrase to memory and return the user to the *Message Configuration* screen.



11.7.8 AirTalk Alert Configuration

Automatic AirTalk notifications are broadcast based on custom thresholds.

Each verbal Alert is composed of:

- *Preamble* – An announcement of the broadcast
- *Station Identifier* – The ID or name of weather station broadcasting the alert.
- *Descriptor* – A combination of one or more words from the vocabulary library that describe the information.
- *Relation* – A comparison condition, such as “is above”, “is below”, “is equal to.”
- *Data Point Value* – The numeric value of the configured trigger threshold.

```
|Alert----------------------------------------------------|
|[Preamble] [station ID] <Descriptor> <Relation> <Phrase 1>|
```

For example, an alert may be set to transmit when humidity drops below 20%.

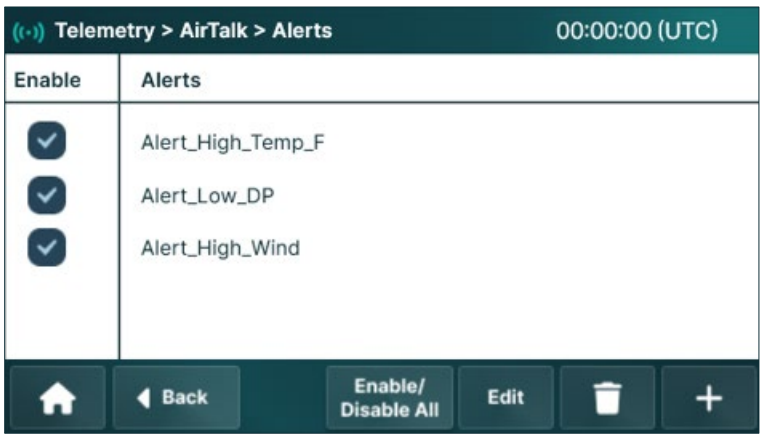
When this condition is met, AirTalk will wait for the channel to clean and then transmit:

Alert. Station zero one. Humidity is below two zero percent.

Multiple alerts may be configured for different conditions, such as wind speed, humidity, fuel moisture, and other parameters.

Users can manage AirTalk alerts in the data logger by enabling, disabling, adding, or deleting alerts.

1. Press the **Alerts** button on the *Air Talk Radio* screen.
   The *Air Talk Alerts screen* displays all configured alerts with checkboxes to enable or disable individual alerts.



Action Bar Buttons

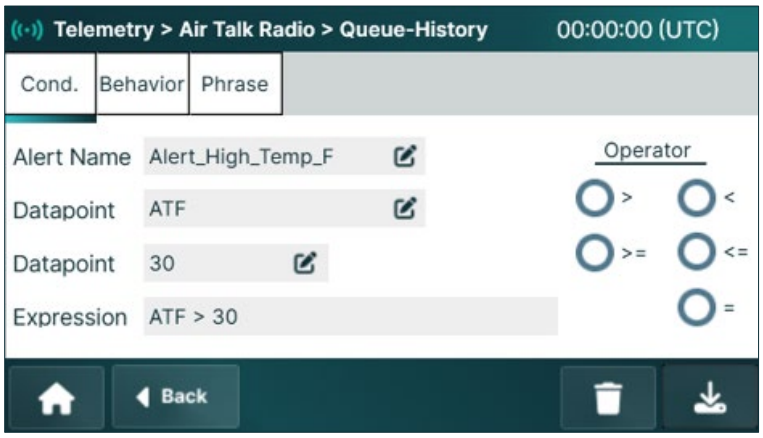
- **Enable/Disable All**: Toggles the status of all listed DTMF messages. If any message is disabled, pressing this button enables all; if all are already enabled, it disables them in a single action.
- **Edit**: Opens the Message Configuration screen for editing DTMF code or description.
- **Delete**: Removes the selected DTMF message from the list.
- **Add**: Adds a new DTMF message entry to the list.

11.7.9 Add New Alert

Press the **Add** button to add a new Alert. The same screens are used for editing existing Alerts.

Condition Tab

The Condition tab determines the threshold at which the alert activates based on sensor data.



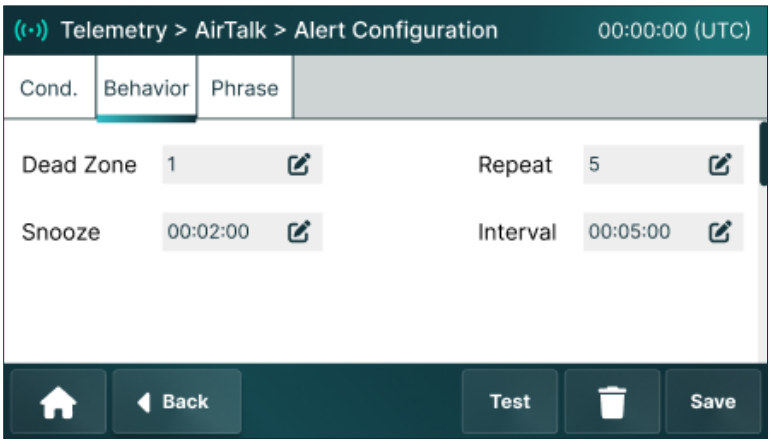
1. Enter the desired name for the Alert in the *Alert Name* field.
2. Select a *Datapoint* that triggers the alert.
3. The *Threshold* specifies the numeric value that is evaluated to trigger the Alert.
4. Comparison *Operator* defines the condition for activation (e.g., > triggers when the value is above the threshold).

Action Bar Buttons

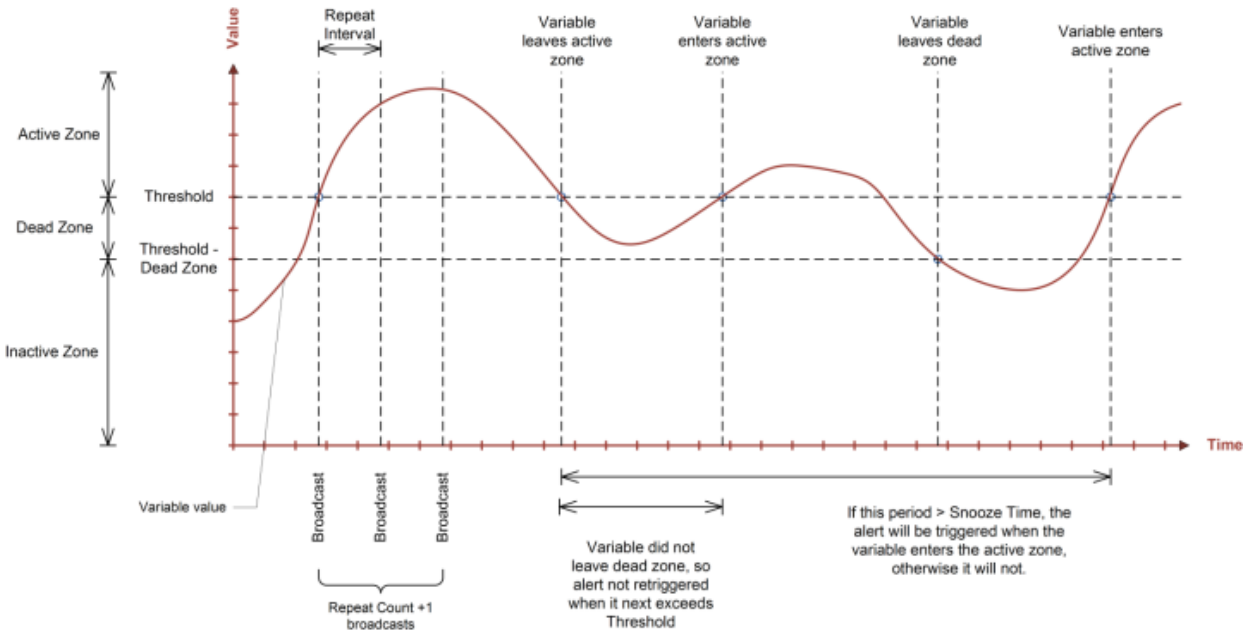
- **Test**: Broadcasts on the connected radio the message shown on the Phrase tab.
- **Delete**: Removes the current Alert and returns the user to the Alerts list screen.

Behavior Tab

The Behavior tab determines how often and how frequently an alert is repeated once activated.



1. *Dead Zone*, also called deadband, neutral zone, or hysteresis, prevents redundant alerts caused by minor data fluctuations.
2. *Snooze* prevents multiple alerts with the specified period.
3. *Repeat* sets the number of times the alert is rebroadcast. A Repeat value of 3 will transmit the alert four (4) times.
4. Specify the *Interval* between each Alert repetition.

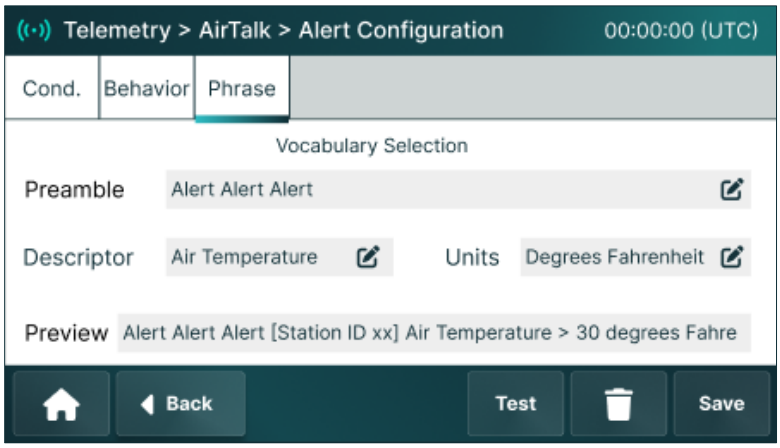


Action Bar Buttons

- ☐ **Test**: Broadcasts on the connected radio the message shown on the Phrase tab.
- ☐ **Delete** : Removes the current Alert and returns the user to the Alerts list screen.

Phrase Tab

The Phrase tab customizes the spoken alert message when the condition is met.



1. *Preamble* can be used to differentiate automatic Alerts from a requested Message, calling attention to a critical condition.
2. *Descriptor* defines the datapoint type.
3. *Units* may be appended if the condition is a measurement.
4. *Preview* displays structure of the verbal alert.

Action Bar Buttons

- ☐ Test: Broadcasts on the connected radio the message shown on the Phrase tab.
- ☐ Delete : Removes the current Alert and returns the user to the Alerts list screen.

11.7.10 AirTalk Vocabulary

The device vocabulary contains pre-recorded words that may be combined to build a voice Alert or Message.

NATO Phonetic Alphabet

Also known as the International Radiotelephony Spelling Alphabet—is a standardized set of code words used to represent the 26 letters of the English alphabet. It is widely used in military, aviation, maritime, and emergency services to ensure clarity and avoid miscommunication, especially over radio or telephone, where poor signal quality or language barriers can cause confusion.

Any word, units, initials, or abbreviations not contained in the vocabulary library may be spelled out with the phonetic alphabet.

A — Alfa	F — Foxtrot	K — Kilo	P — Papa	U — Uniform	Z — Zulu
B — Bravo	G — Golf	L — Lima	Q — Quebec	V — Victor	
C — Charlie	H — Hotel	M — Mike	R — Romeo	W — Whiskey	
D — Delta	I — India	N — November	S — Sierra	X — X-ray	
E — Echo	J — Juliett	O — Oscar	T — Tango	Y — Yankee	

Measurement Units

Amps	Gallons Per Second	Meters Per Second	One Kilometer Per Hour
Bottle	Inch	Microsiemen	One Knot
Bottles	Inch Of Mercury	Microsiemens	One Mile Per Hour
Celsius	Inches	Mile Per Hour	One Millimeter
Centimeter	Inches Of Mercury	Miles	One Volt
Centimeters	Kilometer	Millibar	Pint
Cubic Meter	Kilometers	Millibars	Pints
Cubic Meters	Kilometers Per Hour	Milligram	Quart
Degree	Kilopascal	Milligrams	Quarts
Degrees	Kilopascals	Millilitre	Volt
Degrees Celsius	Knot	Millilitres	Volts
Degrees Fahrenheit	Knots	Millimeter	Watt
Fahrenheit	Litre	Millimeters	Watt Per Square Meter
Fluid Ounce	Litre Per Second	Ntu	Watts
Fluid Ounces	Litres	One Degree	Watts Per Square Meter
Gallon	Litres Per Second	One Degree Celsius	
Gallon Per Second	Meter	One Degree Fahrenheit	
Gallons	Meters	One Inch	

Measurement Descriptors

Air Temperature	Peak Speed	Rain Gauge Bucket	Solar Panel Voltage
Barometric Pressure	Peak Wind	Rain Gauge Buckets	Solar Radiation
Battery Current	Peak Wind Speed	Rain Gauge Tips	Solar Voltage
Direction	Percent	Rain Limit	Speed
Fuel Moisture	Percent Full	Rain Limit Over	Turbidity
Fuel Temperature	Plus	Soil Moisture	Water Level
Humidity	Point	Soil Temperature	Water Temperature
Main Battery	Points	Solar Current	Wind Direction
Peak Direction	Rain	Solar Panel Current	Wind Speed

Preamble for Alerts

Alert	Alert Alert	Alert Alert Alert	

Comparison

Above	Is Above	Is Greater Than Or	Over
Below	Is Below	Is Less Than	Under
Equals	Is Equal To	Is Less Than Or Equal To	
Is	Is Greater Than	Is Not Equal To	

All Other Words

Equals	Off	Sensor Error	Station Number
Logger Not Responding	On	Station	
Minus	Relay	Station ID	

11.8 Aux Comm Configuration – Future Release

The data logger is equipped with an auxiliary communication port with software selectable RS-232 or RS-485 signals. RS-232 operates using full-duplex RXD and TXD signals and no handshaking signals. RS-485 is half-duplex, with pins for A (Data+) and B (Data-). Refer to Axiom Technical Guide for pin signals.

Switchable 12 V nominal battery power is provided through the Aux Comm connector.

Aux Comm supports select cellular modems, including AEM's 4G LTE Cat-M1/NB2 cellular modem (CTX-G1), which is compatible with major carriers like AT&T, Verizon, and other major carriers throughout the world.

The serial port may also be connected to a PC for low-level technical tools. See Service menu for more information.

This flexibility ensures that the data logger can adapt to various communication requirements, providing reliable data access across diverse monitoring environments.

11.8.1 Aux Comm Status

1. Press the Aux Comm button on the *Telemetry* screen.
   The *Aux Comm* screen is displayed. The screen provides an overview of the connected communication devices and the current port configuration.

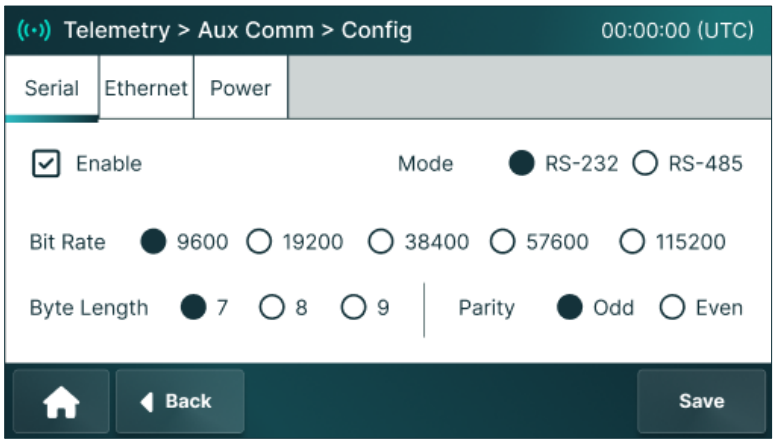
- *Connected Device* - Lists the connected device, if a standard AEM device is connected.
- *Serial* - Define the serial data transmission parameters.
- *Mode* - Indicates the communication protocol.
- *Ethernet* - Displays whether Ethernet connectivity is Enabled or Disabled. – Future Release.
- *Power State* - Shows whether the power output is currently On or Off.

11.8.2 Aux Comm Setup

The Aux Comm Configuration allows users to customize auxiliary communication settings for the data logger.

Serial Tab

This Serial tab allows users to configure the serial communication mode and parameters for connected devices.



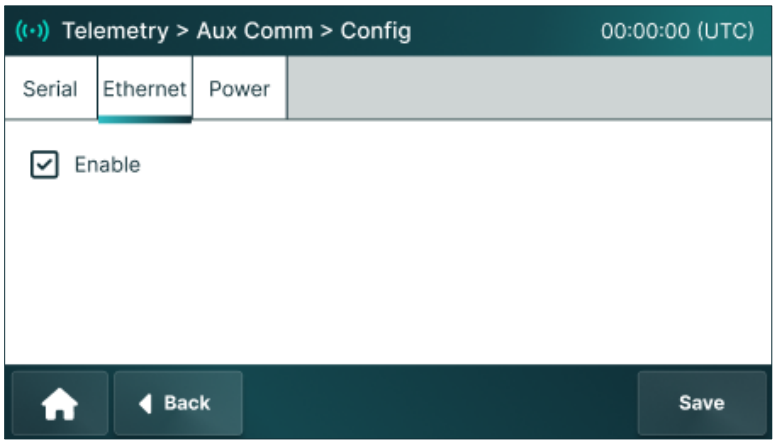
1. Select the *Enable* checkbox to activate serial communication.
2. Select *Mode* to specify the communication protocol:
   - *RS-232* for standard serial data exchange

- *RS-485* for multi-device networks.

3. Adjust *Bit Rate* to set the data transfer speed.
4. Use *Byte Length* to specify the bits per character (7, 8, or 9).
5. Set *Parity* to select the error-checking method—Odd or Even parity.

Ethernet Tab – Future Release

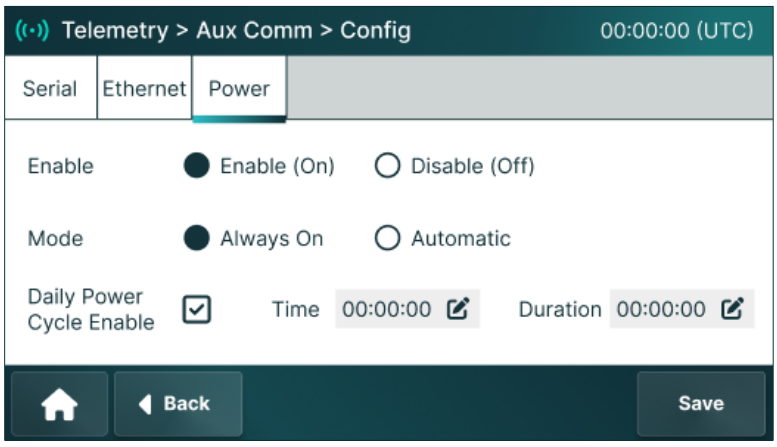
The Ethernet tab enables or disables Ethernet communication for the auxiliary module.



1. Select the *Enable* checkbox to activate Ethernet communication, enabling data transmission over a network.

Power Tab – Future Release

The Power tab allows users to configure how power is supplied to the auxiliary communication module.

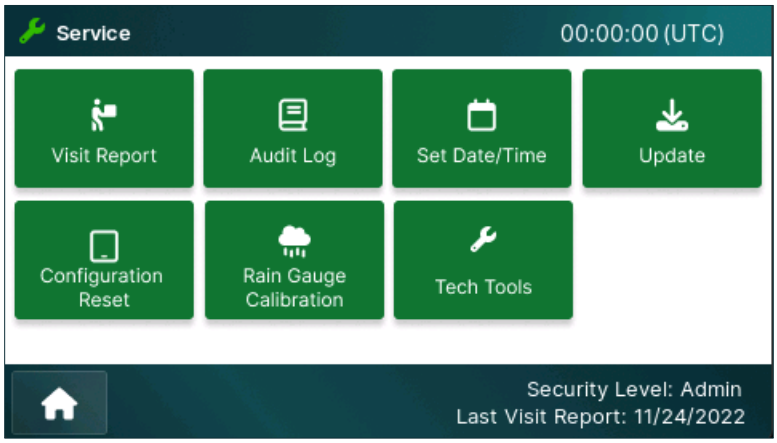


1. Select *Enable* to turn power On or Off for the Aux Comm module.
2. Select *Mode*:
   - *Always On*: Keeps the module powered continuously.
   - *Automatic*: Allows the system to manage power based on usage and efficiency.
3. Press the **Save** button to save and apply the changes.

12 Service Menu

The Service menu consolidates maintenance and service functions. It offers tools to access logs, manage configurations, and generate service reports.

1. Press the Service menu on the *Home* screen.
   The *Service* screen is displayed.



12.1 Visit Report

Visit Report is used to capture system status during site service activities. The process includes both a start and end report, both of which can be useful for troubleshooting and maintenance activities.

Normal service operations store the report to a USB flash drive. Each of the following files is included in both Start and End Files:

- Visit reports, including site information, report ID, technician, and notes.
- Full system configuration
- Audit log
- G6 and any other telemetry logs

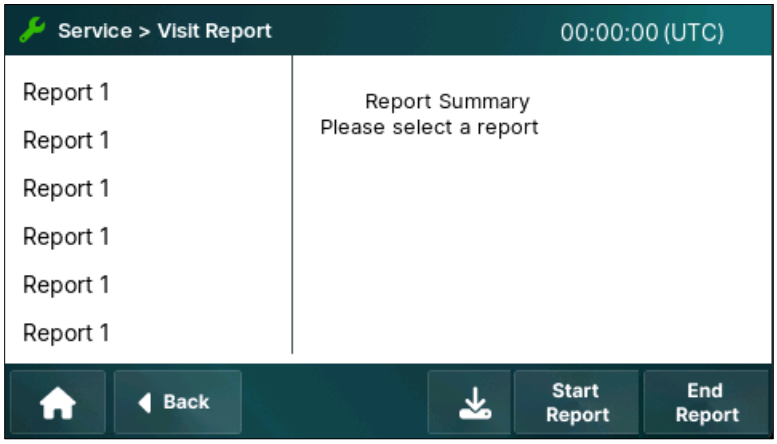
The *Start* and *End* copies help to capture the *as-found* and *as-left* system status.

Service reports are also preserved on the data logger.

Important: It is highly recommended to save a ***Visit Report*** for each site visit. The report captures the precise state of the Data Logger upon arrival and departure, documents any changes, and tracks configurations. This information is critical for troubleshooting and site service.

12.1.1 Report List

1. Press the **Visit Report** button on the Service screen.
   The *Visit Report* screen is displayed.



Action Bar Buttons

- **Download** : Downloads visit report from the data logger to a USB stick.
- **Start Report:** Starts visit report.
- **End Report:** Ends visit report.

The left panel displays a list of previous visit reports, each with the date and time it was generated. The right panel displays details of the selected visit report, such as the name of the person who generated it, the date and time, and any notes or data logged during the visit.

12.1.2 Report Download

Start and End Visit Reports are stored on the local data logger and can be downloaded to an inserted USB flash drive.

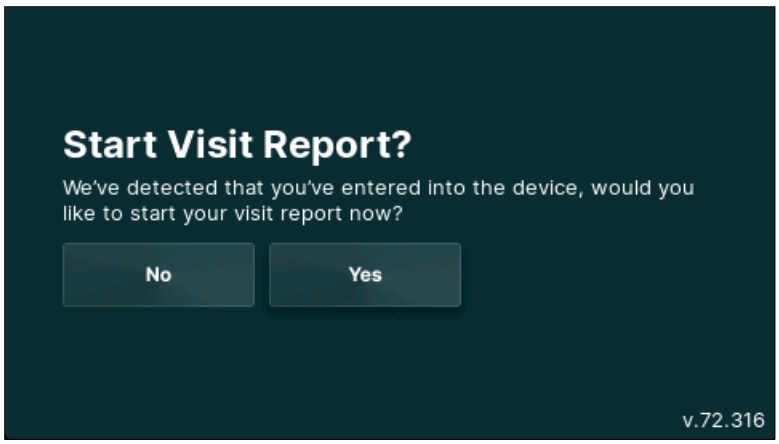
To download:

1. Insert a USB flash drive into the data logger.
2. Select the desired report from the left column.
3. Press the **Download** button.

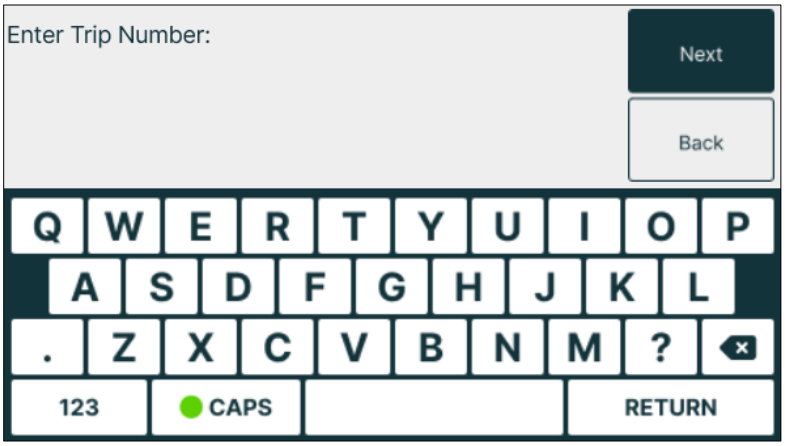
12.1.3 Start Visit Report

The **Start Report** initiates a new visit report and captures the data logger's *as-found* state.

1. Press the **Start Report** button on the *Visit Report* screen.
   The *Start Visit Report* message is displayed.



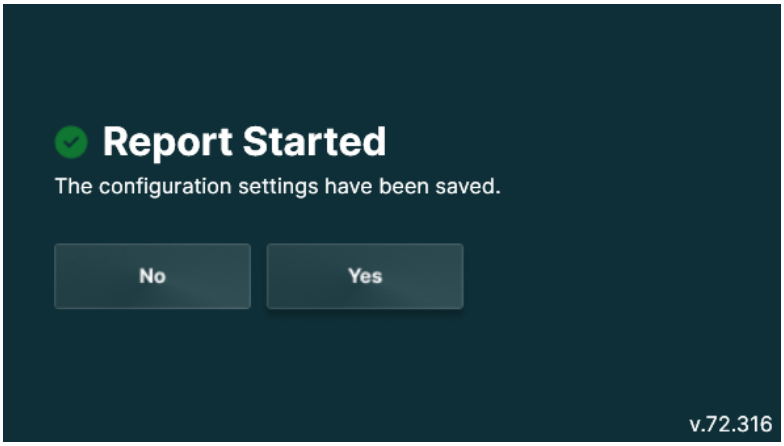
2. Press the **No** button to decline and go back to the Visit Report screen.
   Or
   Press the **Yes** button to start creating a visit report.
   The *Enter Trip Number* screen is diaplayed.



3. Enter users *Trip Number*. The trip number automatically increments from the last visit; alternatively, users can manually enter a trip number using the keypad.
4. Press the **Back** button to go back to the Visit Report screen.
   Or
   Press the **Next** button to continue.
   The *Enter Technician Name* screen is diaplayed.

5. Enter users name in the ***Enter technician name*** field using the keypad.
6. Press the **Back** button to go back to the Visit Report screen.
   Or
   Press the **Next** button to continue.
   The *Enter report* screen is diaplayed.

7. Enter users observations in the ***Enter Report*** field.
8. Press the **Next** button to navigate to the screen.



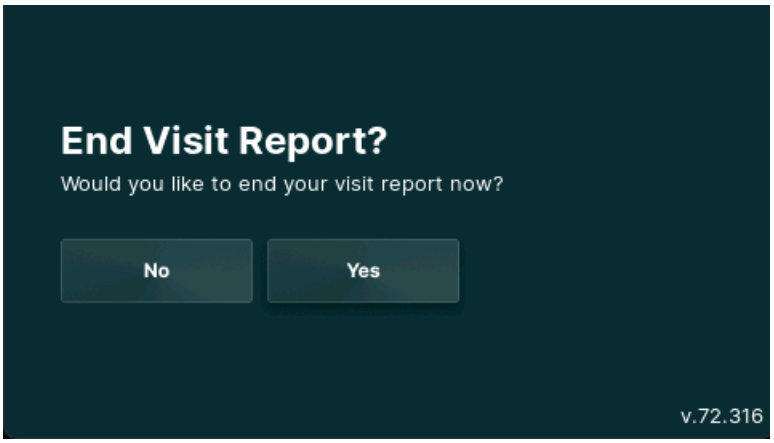
9. Press the **Home** button to go back to the *Home* screen.

12.1.4 End Visit Report

At the end of the site service, an End Visit Report will capture the *as-left* system state.

The End Visit Report prompts confirmation to finalize and save the visit report. When the report is completed, it is stored to the installed USB drive (if available) and the data logger's onboard non-volatile memory.

1. Press the **End Report** button on the *Visit Report* screen.
   The *End Visit Report* message is displayed.



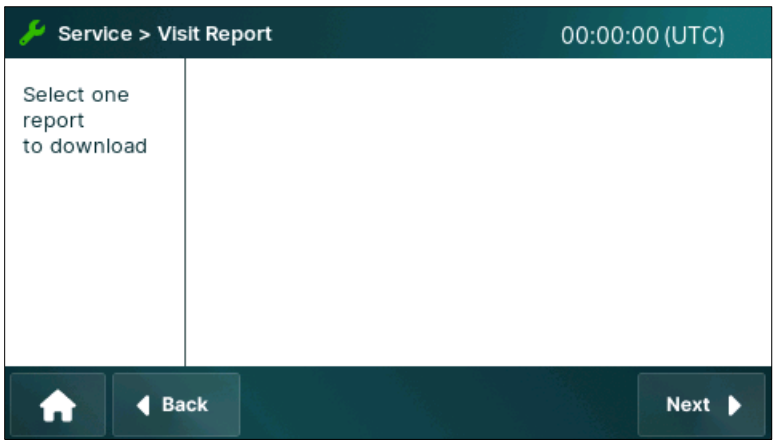
   a. Press the **No** button to decline.
      Or
      Press the **Yes** button to save the report.

> ***Note***: If a Start Visit Report has been created, an End Visit Report is automatically created when the data logger has been idle for about 60 minutes. For more information, see Power Management under the General Theory of Operations section.

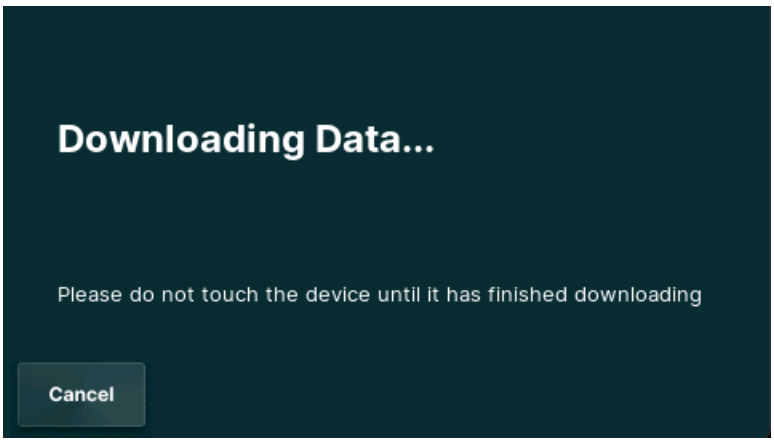
12.1.5 Visit Report Download

The Download Visit Report allows users to download the visit report to the flash drive.

1. Press the **Download** button on the *Visit Report* screen.
   The *Visit Report* screen is displayed.



2. Select the desired report from the list that users wish to download.
3. Press the **Next** button to confirm downloading.
   The *Downloading Data* message is displayed.

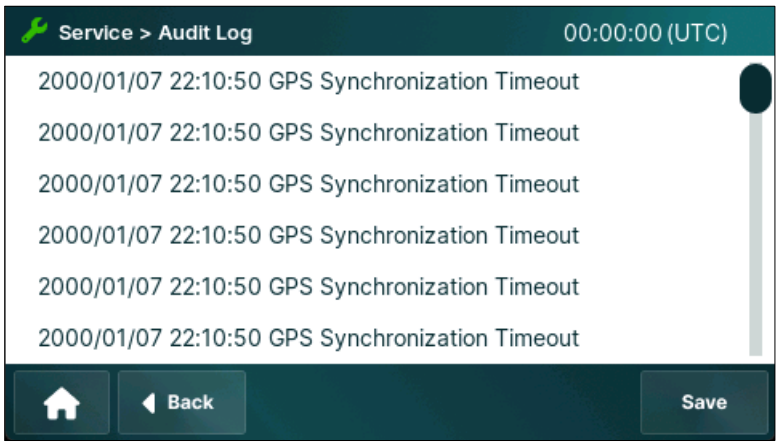


12.2 Audit Log

Audit log records messages from the underlying system and processes. These can be helpful for deep debugging activities.

The **Audit Log** screen displays the data logger's Audit Log which includes time-stamped events. Users can navigate through the log entries, clear the log, or save the Audit Log to a USB flash drive.

1. Press the **Audit Log** button on the Service screen.
   The *Audit Log* screen is displayed.



2. Select the desired audit log to download.
3. Press the **Save** button at the bottom right corner to write the data logger's Audit Log file to the USB flash drive.
   The *Downloading Data* message is displayed.

The Audit Log is automatically saved to the USB flash drive visit report created. on the flash drive.

12.3 Set Date/Time

Time is automatically synchronized to UTC using the primary GPS-GNSS source once per day. Local time is set manually as an offset to UTC.

Once set, the desired time zone is always shown in the upper right corner of the screen.

All entries in the datastore are time stamped using UTC.

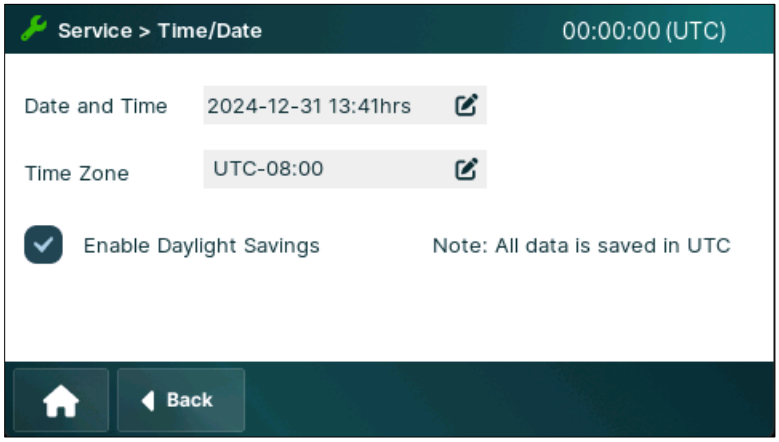
Local operations, such as daily accumulated rain, annual rain reset, daily min-max, are reset according to local time.

This scheme allows users to work from many locations while maintaining precise time tracking and data integrity across operations.

12.3.1 Date and Time Configuration

The Set Date/Time allows users to configure the date, time, and time zone settings for the data logger.

1. Press the **Set Date/Time** button on the *Service* screen.
   The *Set Date/Time* screen is displayed.



2. Set the data logger's date, time, and time zone.
3. Select the ***Enable Daylight Savings*** checkbox for time zone selection to be converted to Daylight Savings time.
   Or
   Leave it unchecked to stay in standard time.

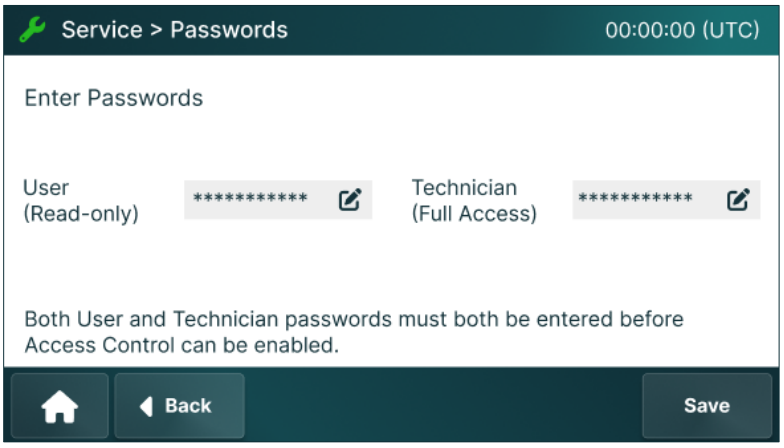
12.4 Passwords – Future Release

Users can enable password-protected access controls. There are two access privilege levels:

- **User Level**: A User Level password provides the operator read-only access to the data logger. The operator can monitor data logger status, such as data, sensor readings, and telemetry configuration, but cannot make any changes if a Tech Level password is set.
- **Tech Level**: The Tech Level password allows complete control over the data logger, there are no restrictions for Tech Level users. If no Tech Level password is specified, the User Level can use Tech Level parameters.

Change Password

1. Press the **Passwords** button on the *Service* screen.
   The *Passwords* screen is displayed.



2. Press the **Edit** button for each field to enter the password.
3. Press **Save** to apply the changes and enable access-control mode.
   A password will be required once the unit enters idle mode.

> *Note*: For easy enabling-disabling of the password mode, leave the User password in place and enter or delete the Technician password.

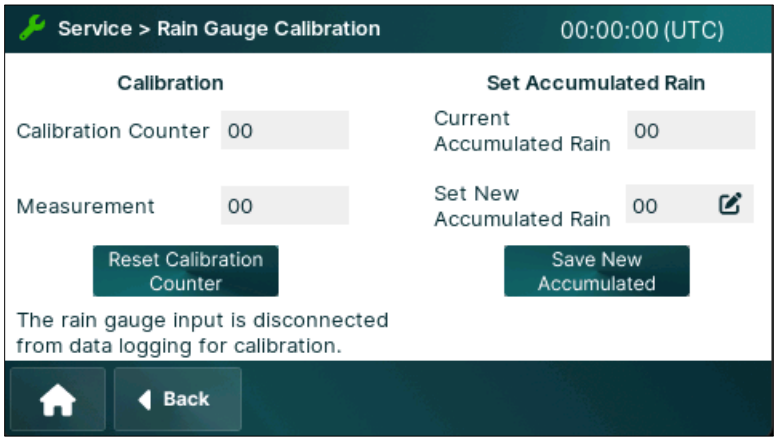
12.4.1 Recover Lost Password

Every data logger has a master or super-user password which allows the Technician password to be reset. Contact AEM support for lost password assistance.

12.5 Rain Gauge Calibration

The Rain Gauge Calibration allows users to perform a calibration test on the rain gauge and manage accumulated rain settings.

1. Press the **Rain Gauge Calibration** button on the *Service* screen.
   The *Rain Gauge Calibration* screen is displayed.



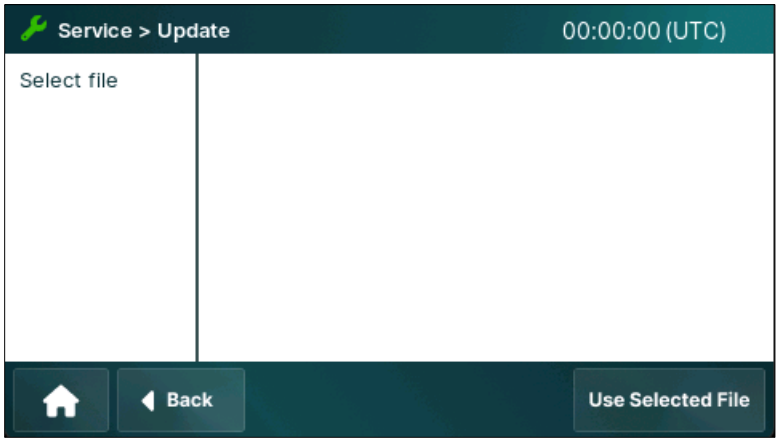
2. ***Calibration Counter*** displays the number of recorded rain gauge tips during a calibration test, such as when using a rain gauge calibrator.
3. ***Measurement*** shows the measured value corresponding to the recorded tips.
4. Press the **Reset Calibration Counter** button to clear the tip count and measurement values to restart a calibration test.
5. ***Current Accumulated Rain*** displays the total recorded rainfall for the water year.
6. Set the ***New Accumulated Rain*** to adjust the total recorded rainfall. This only updates the current total, it does not change any past recorded rainfall data.
7. Press the **Save New Accumulated** button to save the updated accumulated rain value.

> ***Note***: Data logs from before this change will still show the original totals and will not include the new adjusted value.

12.6 Update

The Update screen allows users to update the data logger's software (firmware) using a USB flash drive.

1. Insert a USB flash drive with the new firmware file into the data logger USB port.
2. Press the **Update** button on the *Service* screen.
   The *Update* screen is displayed.



3. Select a file from the list and press the **Use Selected File** button .

   The update process will take approximately 5 minutes to complete.

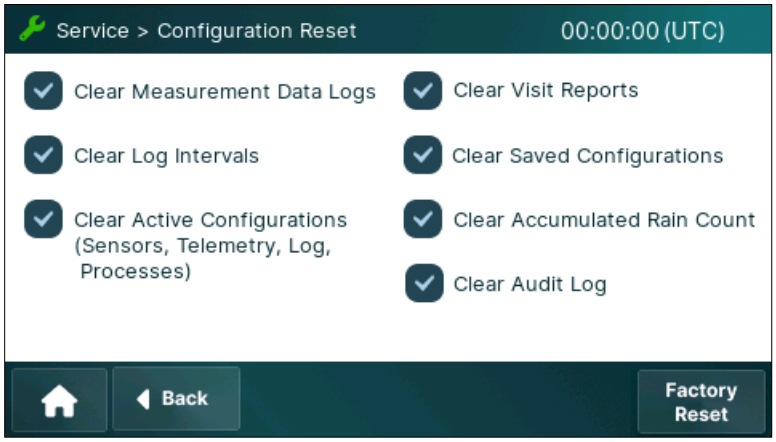
Warning: The update process will reset the G6 transmitter. This will require the transmitter to resynchronize the GPS time, which may take as long as 20 minutes.

Fimware update on Axiom data loggers with G6 should be done at least 30 prior to the next GOES transmission.

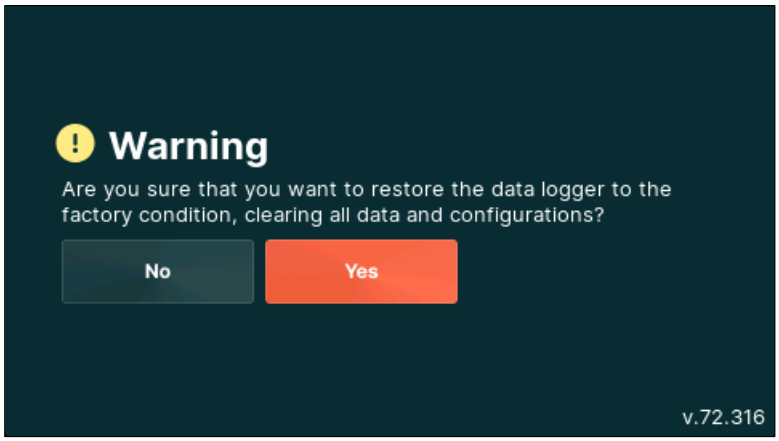
12.7 Configuration Reset

The Configuration Reset restores the system's settings to their default or factory configuration. This process eliminates any custom settings, modifications, or configurations and restores the system to its original condition when it was first installed or deployed.

1. Press the **Configuration Reset** on the *Service* screen.
   The *Configuration Reset* screen is displayed.



2. Select the desired options that users wish to reset.
    - *Clear Measurement Data Logs*: Deletes all recorded measurements while keeping sensor settings, processes, telemetry, and log configurations. Recommended when relocating the data logger to a new site.
    - *Clear Log Intervals*: Removes log interval configurations but retains measurement data. Useful for clearing redundant or duplicate log definitions.
    - *Clear Active Configurations*: Deletes all sensor, telemetry, log, and process configurations, including data point names. Data remains but becomes inaccessible without names.
    - *Clear Visit Reports*: Erases all stored visit reports, helpful when redeploying the logger.
    - *Clear Saved Configurations*: Deletes locally saved system configurations to prevent issues with outdated settings.
    - *Clear Accumulated Rain Count*: Resets the rainfall counter to zero.
    - *Clear Audit Log*: Removes the audit log, which tracks system events. Useful before redeploying to avoid old event records.
3. Press the **Next** button to proceed.
   A *Warning* screen is displayed.

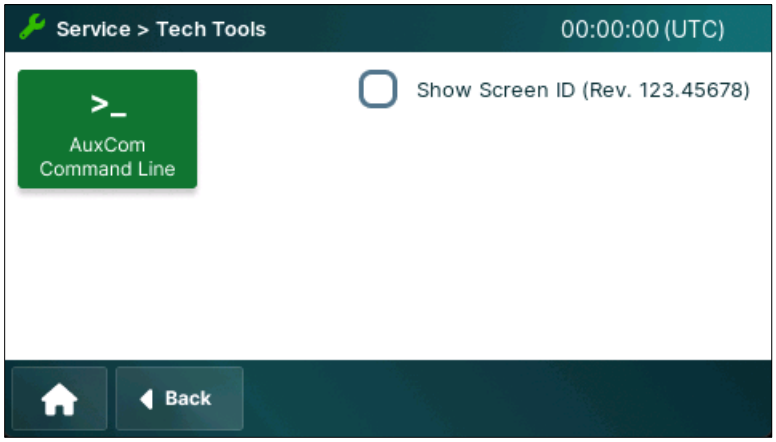


a. Press the **Yes** button to confirm reset.
Or
Press the **No** button to decline.

12.8 Tech Tools – Future Release

The Tech Tools function assists users with advanced maintenance and troubleshooting tasks on the data logger. It provides a centralized interface to access essential diagnostic tools and configurations. This option simplifies the tasks like verifying data logging, troubleshooting hardware or software issues, and adjusting configurations to improve the system's efficiency and reliability during field operations.

1. Press the **Tech Tools** button on the *Service* screen.
The *Tech Tools* screen is displayed.



12.8.1 AuxCom Command Line – Future Release

The AuxCom Command Line is a diagnostic tool that provides users with direct access to the core functionalities of the F7 data logger. This tool may be used by experienced maintenance technicians for low-level service and diagnostic tasks.

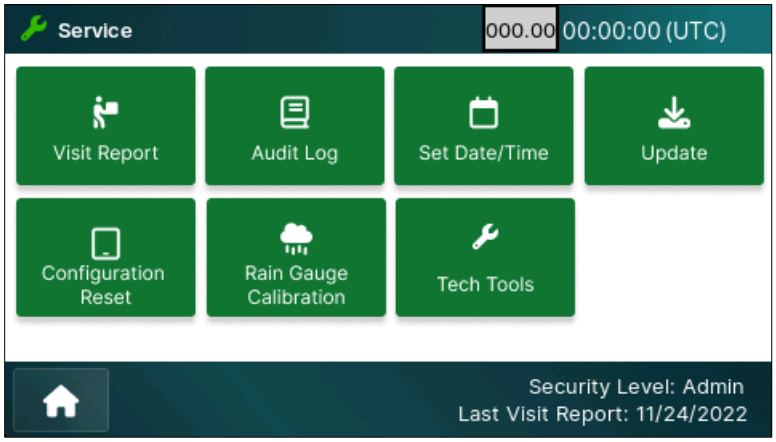
To input the required command, press the **AuxCom Command Line** button and enter the desired instructions.

Refer to Axiom Technical Guide for more information regarding the Command Line Interface (CLI)

12.8.2 Show Screen IDs – Future Release

The ***Show Screen IDs*** checkbox assists with troubleshooting system issues or user interface errors. When the checkbox is selected, the corresponding screen IDs will be displayed at the top of each screen, as highlighted.

Providing a screen reference to AEM support will help identify any errors or questions.



12.9 Logout – Future Release

When passwords are enabled, Axiom will automatically close the session after one hour.

Pressing **Logout** will manually terminate the session and return the user to the home screen. A password will be required to regain read or write access.

If password access control is not enabled, the Logout button will return the user to the home screen but will not block access.

> *Note*: If a Start Visit Report has been created, Logout will automatically create an End Visit Report. If installed, the report will also be saved to the USB flash drive.

Refer to the Passwords section for more information on user access control.

13 Service and Support

13.1 Warranty

13.1.1 Product Warranty

AEM provides a 24-month warranty on all products, guaranteeing:

- Compliance with AEM specifications at the time of purchase
- Freedom from material and workmanship defects

Warranty Terms

- Customers must notify AEM of any warranty claim within 24 months of purchase and ship the product to an AEM service center at their own expense.
- AEM will repair or replace the product free of charge for valid claims. Repaired or replaced items will retain the original warranty period.
- Repairs may include new or reconditioned parts. Replaced parts become the property of AEM.

Exclusions

The warranty does not cover:

- Normal wear and tear.
- Damage caused by extreme environments, fire, water, or improper installation.
- Alterations or repairs by unauthorized personnel.
- Failures due to misuse, neglect, or acts of God.

Limitations

The warranty is non-transferable and applies only to the original purchaser. AEM does not warrant results obtained from the product's use or design implementation.

13.1.2 Service Warranty

AEM warrants service work, repairs, and replacement parts for 6 months after the service date.

Terms

- Customers must return the equipment to AEM for repairs or evaluation.
- AEM will repair or replace defective parts free of charge for valid claims.
- Non-valid claims are subject to standard evaluation fees. Repairs can be carried out at the customer's expense.

Exclusions

The warranty applies only to replaced parts and associated repairs, not to other components.

14 Revision History

Revision	Date	Description
1.0	June 2025	Original release – Engineering Control