PRODUCT MANUAL

Software

Campbell Aero™

Automated Surface Observing System (ASOS) Support Software

Revision: 02/2026

RELIABLE MONITORING SINCE 1974

Campbell SCIENTIFIC®

Table of contents

1. Introduction to Campbell Aero™

> NOTE:
> Acronyms used in this document are defined in the Glossary (p. 167).

Campbell Aero™ is a real-time data collection software application for ASOS and AWOS systems. It measures one or more meteorological sensors, retrieves weather data, and produces weather reports, such as METAR/SPECI & OMO. Sensors connect to Campbell Aero using direct links such as TCP/IP through data loggers or Field Data Collection Units (FDCU). Weather information can also be obtained from inputs such as the FAA Runway Visual Range (RVR) system. In ASOS, Campbell Aero normally runs on two servers (Embedded Controllers) simultaneously. When running on two servers, the second server acts as a backup.

Campbell Aero is capable of performing the following functions:

- Collects and displays the latest data from the configured data acquisition systems
- Monitors data quality in real-time
- Performs algorithmic processing on the input data and produces data for reports
- Creates METAR/SPECI/OMO reports
- Creates SYNOP reports at specified intervals
- Allows editing of the METAR and SYNOP
- Broadcasts meteorological voice messages to radios using analog or VoIP
- Issues alert messages for user-configured conditions
- Archives data to database and/or disk files
- Allows multiple users to view data on their computers using the web-based user interface
- Provides a data feed in various real-time data formats which can be collected for analysis or display on other systems
- Displays historical graphs of weather data
- Allows the monitoring of device diagnostic information logging events in the maintenance log

Campbell Aero can run on Windows or Linux systems (server or desktop).

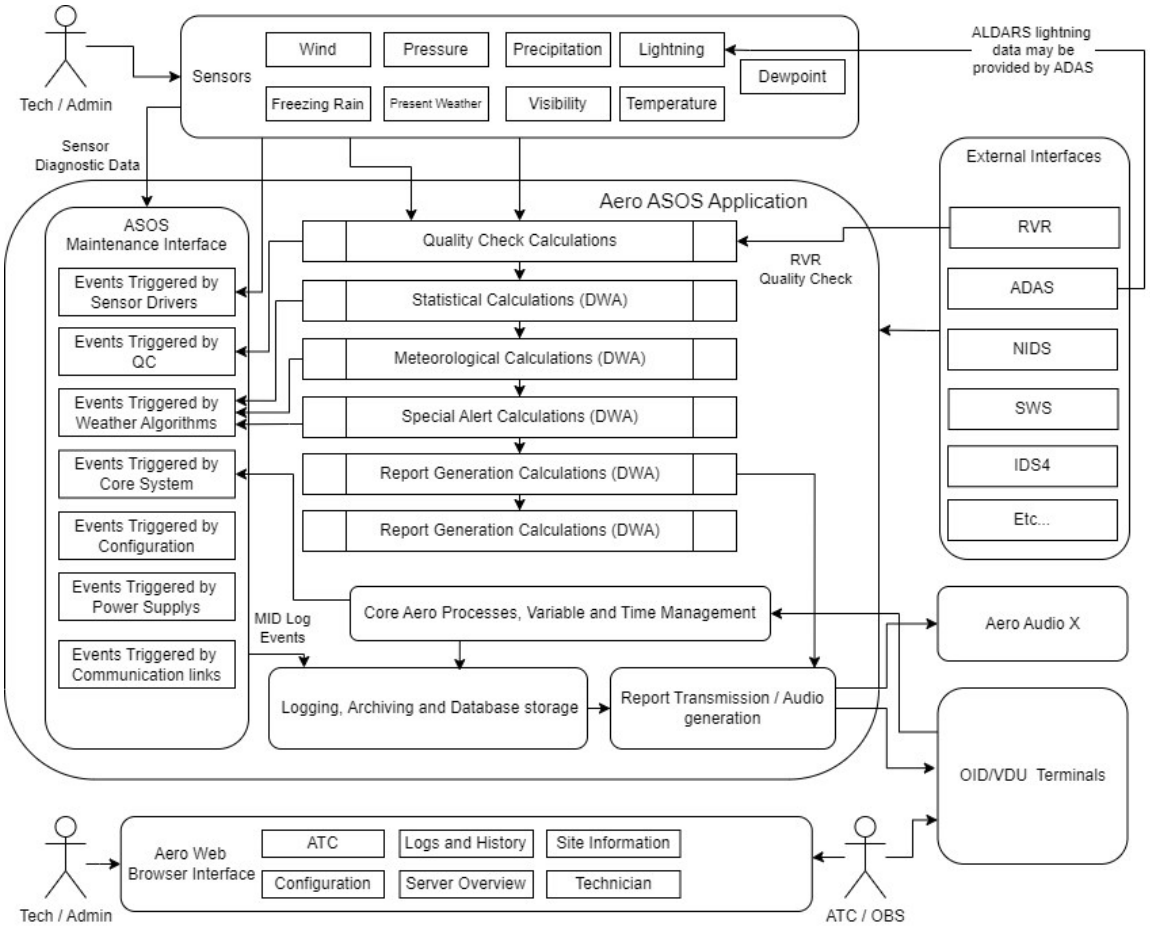


Figure 1-1. Overview of the Campbell Aero application infrastructure

2. Document conventions

This section describes some of the conventions used in this document.

Alarm – status information generated by a sensor, external system, data logger or the Campbell Aero application.

Alert – an alarm generated on the user interface when an alert condition is met. The user sets conditions for triggering an alert. Alarms can be conditioned on variables, time, or system events. An alert also can indicate that a meteorological report is being processed.

Algorithms – equations used by the application. Campbell Aero uses simple algorithms such as averages and more in-depth algorithms such as RVR calculations.

Log files – standard data files generated for raw data and protocols that run in the application. The Campbell Aero system configuration and connected stations determine which log files are generated.

Perspective – content available to a specific user role, which includes the content accessed through tabs or buttons on the screen.

Role – the way the user can interact with Campbell Aero. Air traffic controllers mainly view data. One user can be assigned to multiple roles although only one role perspective is active at a time.

Theme – set of colors and styles applied to the screen. Changing the theme modifies the aesthetics of the screen without changing the content or position of any elements.

View – display seen from a specific user perspective. For the Observer and Maintenance perspective, the view does not contain all the content available to the user since the content is contained on different screens, each presenting a subset of the entire content available in that perspective.

Warning – notification from a sensor or other hardware that has a lower importance than an alarm.

3. Weather stations and protocol handlers

3.1 Campbell Aero weather station configuration

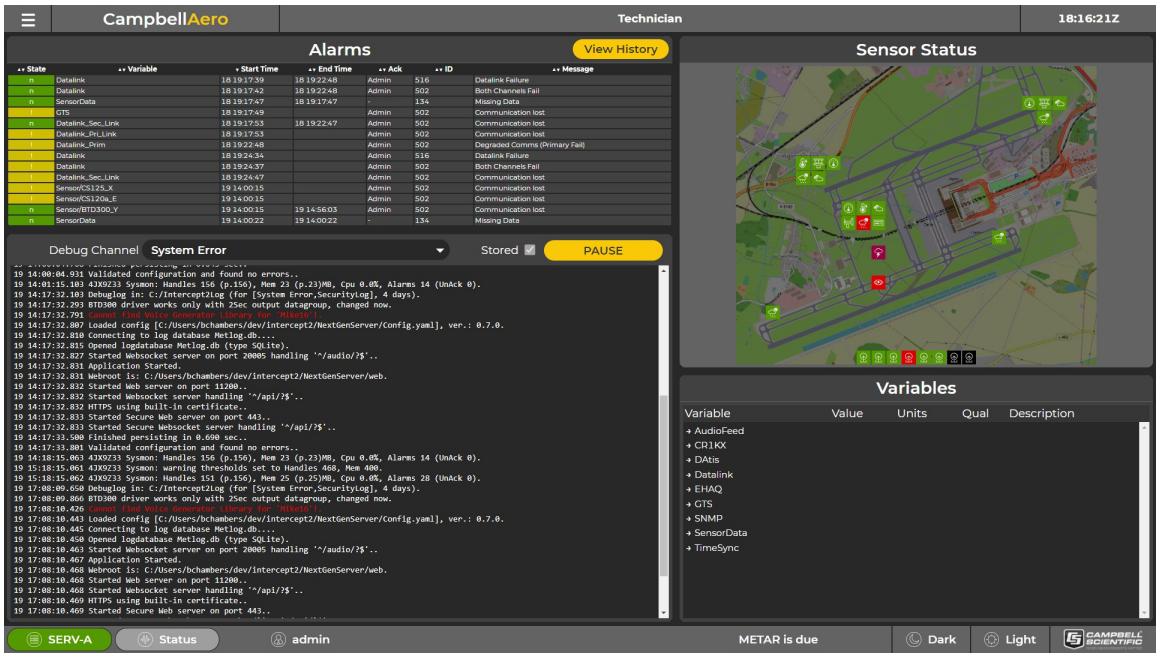
Although Campbell Scientific configures the systems, settings such as communications may need to be adjusted. After installing Campbell Aero, you can configure protocols, sensors, and weather stations.

You need the following information to configure a station:

- The method the sensors and data loggers connect to the computers running Campbell Aero — Serial port, TCP/IP, or modem
- Configuration information for the external connections
- Whether or not the sensors are being polled, and, if so, the polling interval

Campbell Scientific recommends using the **Station** tab of the Configuration tool (p. 42) to configure one weather station and confirm that it is communicating correctly with Campbell Aero

before configuring the display. Once the station is configured and enabled, Campbell Aero will begin receiving data from the station immediately. Verify that the data is coming in by switching to the **Technician** perspective. There you can verify the data flow for the station in the **Debug Channel** and review the data in the **Variables** section. If all is correct, you will see a green icon for each sensor and station in the **Sensor Status** section.



3.2 Protocol handlers

Campbell Aero can send data to external interfaces over various protocols. These protocols are configured by Campbell Scientific before the systems are shipped.

The following connection methods are available for most protocols:

- **TCP/IP server type** listens on a specific TCP port.
- **TCP/IP connector type** connects to one or more external systems on specific TCP port(s).
- **WebSocket server type** listens on a specific TCP port.
- **UDP Multicast server** broadcasts data on a specific multicast address and port.
- **Serial port** sends and receives data using a serial port.

Common protocols:

- **AFTN** – Aeronautical Fixed Telecommunications Network. When connected to the AFTN, Campbell Aero delivers reports such as METAR/SPECI/SYNOP.

  AFTN traditionally connects to the server using a serial port but can also use a TCP/IP link.

- **AMHS** – Aeronautical Message Handling System (AMHS) connections normally use X400 software. That software is installed separately on the system. When connected to the AMHS, Campbell Aero delivers reports such as METAR/SPECI/SYNOP.
- **GTS** – Global Telecommunication System (GTS) is the WMO system of exchanging meteo data, normally over a TCP/IP link. When connected to the GTS, Campbell Aero delivers reports such as METAR/SPECI/SYNOP.
- **FTP** – File Transfer protocol is a standard protocol for exchanging files. For WMO the variant is called GTSFTP and when used, Campbell Aero delivers reports such as METAR/SPECI/SYNOP.
- **MQTTS** – Message Queuing Telemetry Transport Secured is a secure method for transferring data mostly to cloud-based systems . This is a bi-directional protocol.
- **SNMP** – Simple Network Management Protocol can serve status information and variables. It can send out traps on alarms. Status information from SNMP devices can be ingested by Campbell Aero.
- **NTP** – Time synchronization protocol can synchronize the server using NTP3 or NTP4.
- **LiveStream** – a Campbell Aero defined protocol to distribute real-time data to external systems in various formats (for example, plain text, xml, json, yaml).

When interfaces are configured, the **Technician** screen displays their status. See Technician screen (p. 6) for more information.

4. User interface

The JavaScript-based Campbell Aero user interface is HTML, CSS3 (Cascading Style Sheet level 3), and is supported by all modern browsers. Except for the initial HTML page, all data distributed to and from the user interface uses the WebSocket, which is a permanent connection between the client and the server. The user interface will stop displaying data when the client link is disconnected or if no new data is transmitted for more than 60 seconds.

All client connections are over secured WebSocket (WSS) and HTTPS or over non-secure versions of them (WS and HTTP).

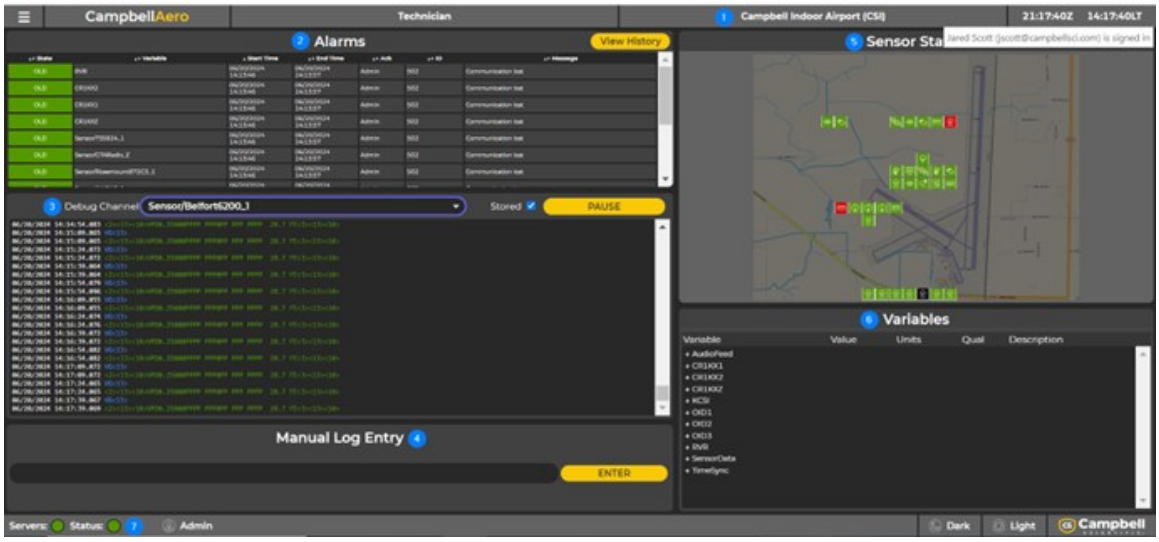
Users can resize screens.

Users can open multiple sessions to the server.

5. Technician screen

The starting screen for the Technician provides an overview of debug information, sensor states, system variables list, and an alarm list.

Each of the numbered items in the following image are described in the following sections.



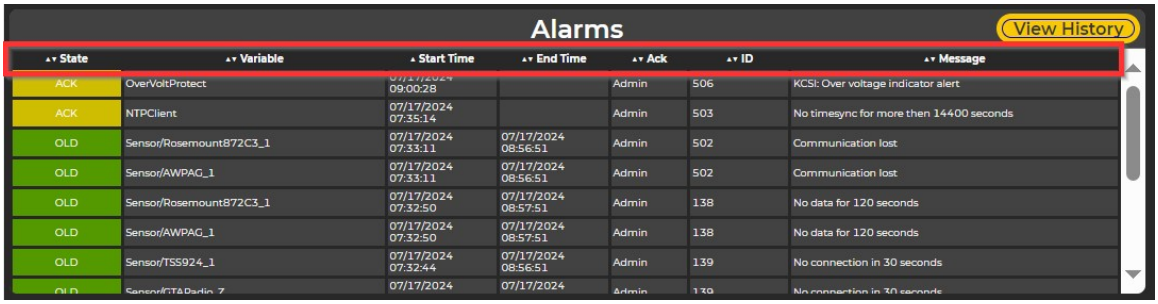
1. Site identifier
2. Alarms list
3. Debug Channel selection
4. Manual Log Entry
5. Sensor Status window
6. Variables table
7. System Status indicators

5.1 Site identifier

At the top of the screen is a display of the airport name and ID; the ID is usually 4 letters and may contain a number. (Note at the top of the screen, the first letter, indicating country or region, is in some cases omitted.)

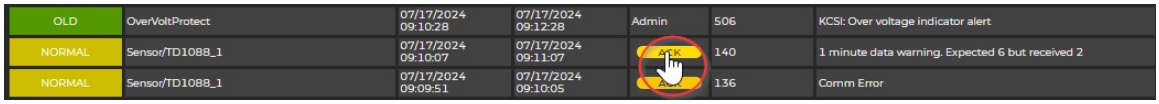
The ID will appear within any transmitted reports.

5.2 Alarms list

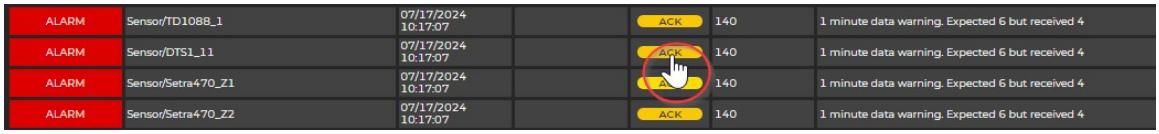


The **Alarms** list will display details around events related to sensors, data loggers, power supplies, and other connected equipment. Alarms are raised by the individual drivers and protocols. Alarms have an indicated state. Green means the alarm has been acknowledged or has been resolved.

Yellow is a warning and can indicate that communication is degraded yet operational, NTP (Network Time Protocol) warnings, or data warnings. A warning can be acknowledged by pressing **ACK**.



Red is an active alarm which may indicate physical action is needed to address the issue. Alarms can mean a disconnected sensor, a failing power supply, or a measurement (temperature, wind) has crossed a designated threshold.



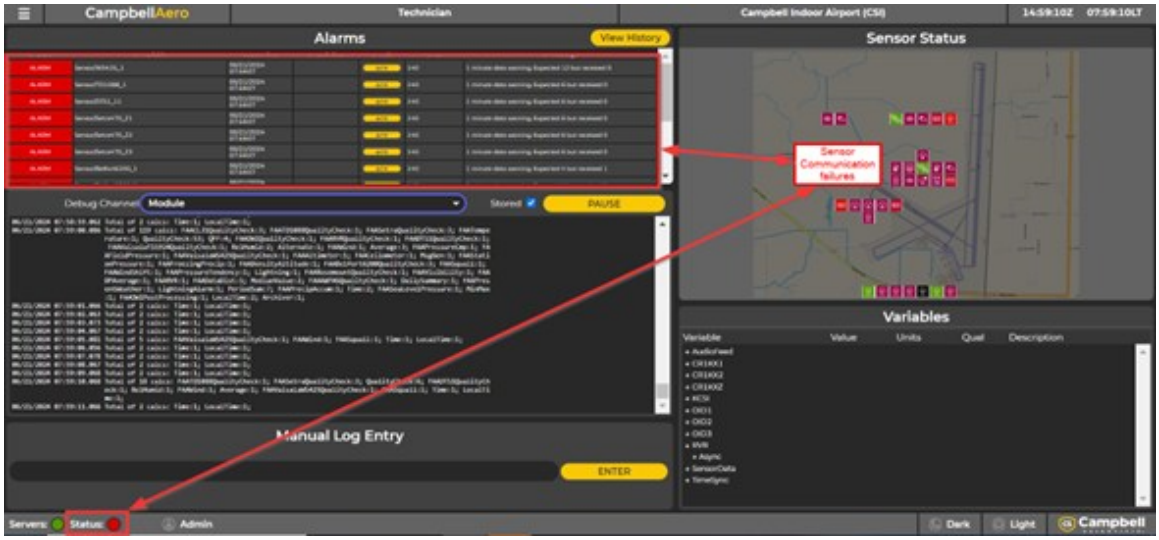
Acknowledged alarms will be yellow until the conditions which triggered it have been resolved.

When the underlying conditions behind an alarm have been resolved the alarm will move into the green **OLD** status.

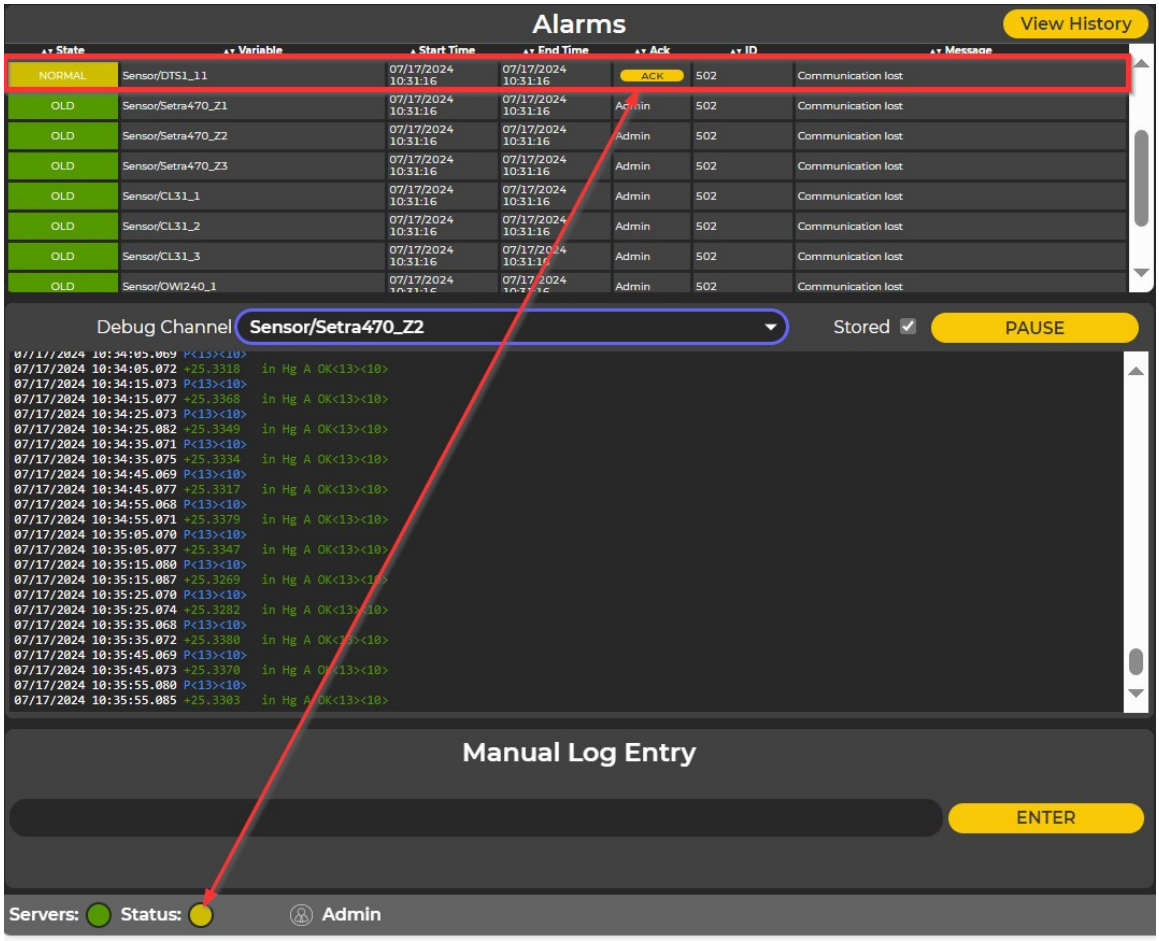
Alarms which resolve on their own (Communication degraded) will enter the yellow **NORMAL** state and indicate the time when the conditions resolved. These warnings will remain unacknowledged until a technician presses **ACK**.

OLD	Sensor/Belfort6200_2	07/17/2024 10:18:07	07/17/2024 10:21:07	Admin	140	1 minute data warning. Expected 4 but received 0
NORMAL	Sensor/Belfort6200_3	07/17/2024 10:18:07	07/17/2024 10:21:07	ACK	140	1 minute data warning. Expected 4 but received 0

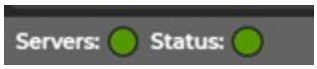
While there are active alarms, the system **Status** indicator at the bottom of the screen will be red.



When active alarms have been resolved yet there are remaining warnings which have not been acknowledged, the system **Status** indicator will be yellow.

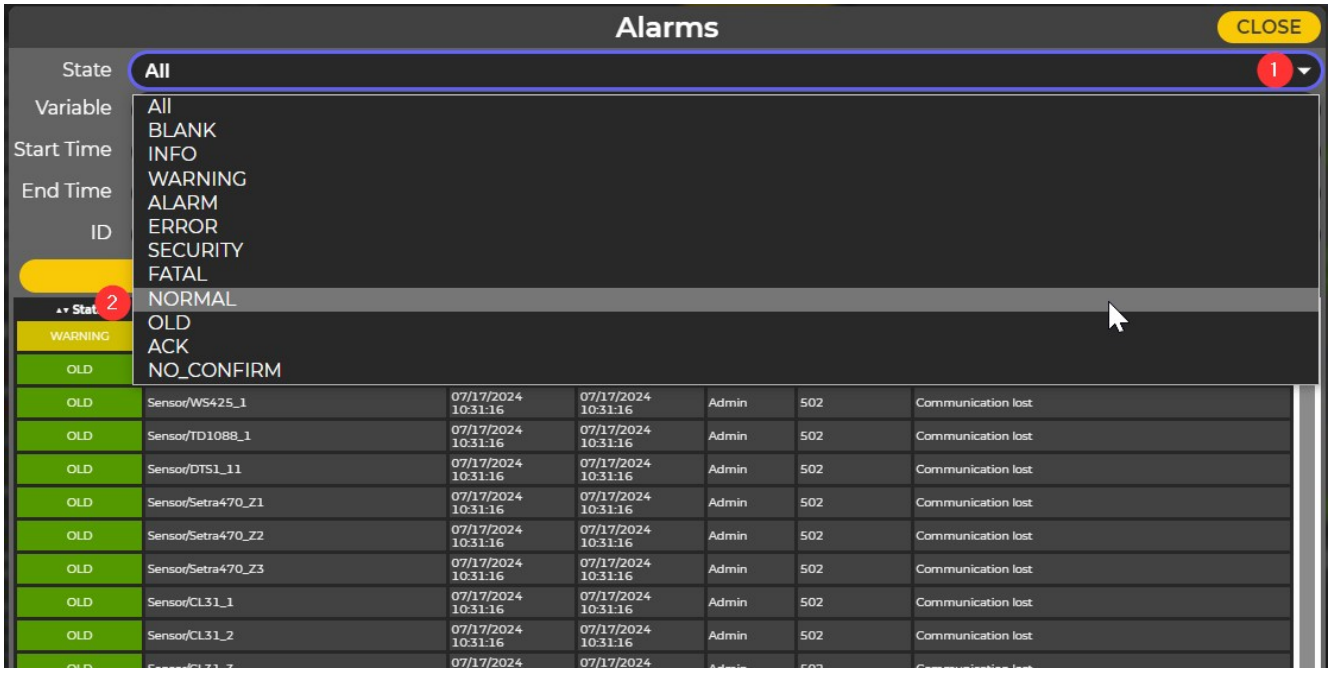


Resolving any physical issues with the system and acknowledging all warnings will cause the system **Status** indicator to become green.

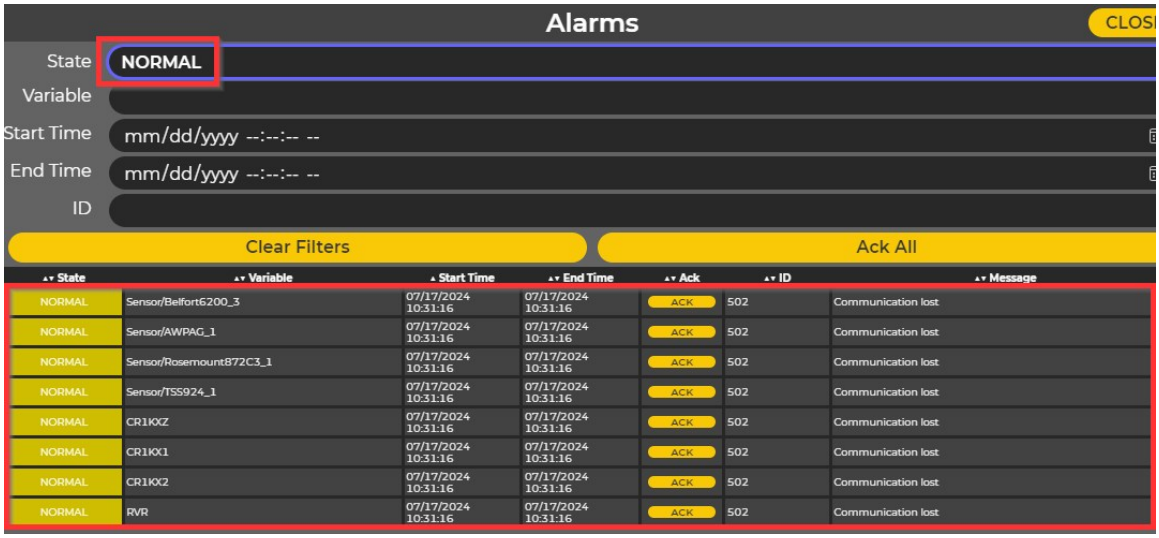


When a system has been in operation for a long period of time, it is possible for an unacknowledged alarm to exist far in the past. By pressing **View History**, you can access a search and filter feature.

Through this window, you can filter events by state.



Filtering by **NORMAL** shows all unacknowledged warnings.



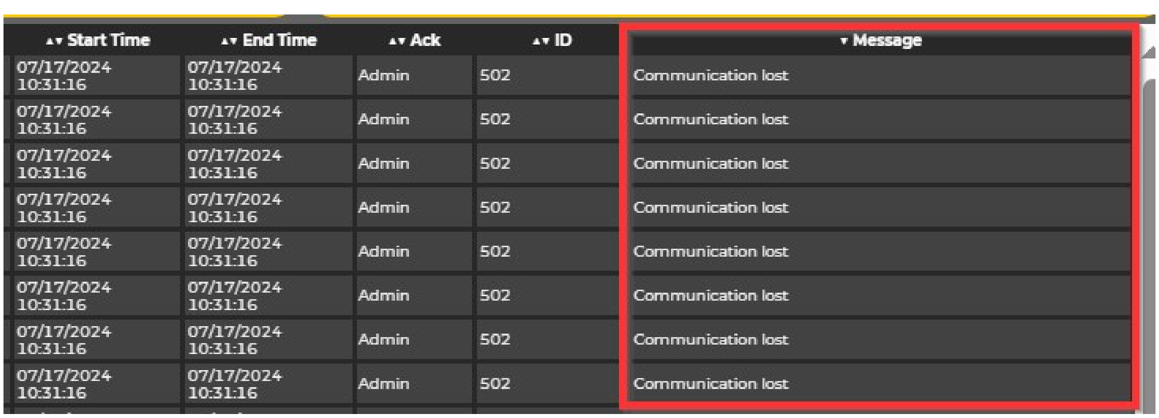
Press **Ack All** to acknowledge all alarms and warnings within the **Alarms** list.

Press **Clear Filters** to remove any applied filters from the list

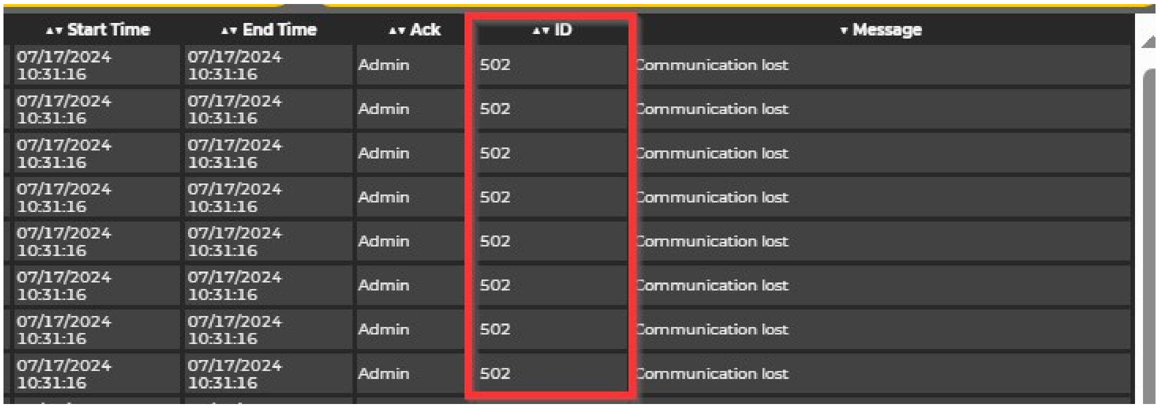
Table 5-1 (p. 12) is a table describing all possible Alarm States:

Table 5-1: Alarm States	
State	**Description**
BLANK	Event description is blank.
INFO	An informational event has been posted to the **Alarms** list.
WARNING	A warning can indicate an alarm occurred and the conditions have resolved themselves or a variables value has increased or decreased past a warning threshold. Warnings can indicate communications are active yet degrading. Warnings cause the system **Status** indicator to be yellow.
ALARM	An alarm generally indicates a failure with a sensor, communication link, a critical threshold was crossed by a measurement value, or system errors which may impede operations. Alarms cause the system **Status** indicator to be red.
ERROR	A system error event has occurred.
SECURITY	A security related event has occurred.
FATAL	The event which has occurred will interrupt system operations.
NORMAL	The event has been normalized and no longer poses a threat to system operations.
OLD	Designated events which have been acknowledged by a technician.
ACK	Event has been acknowledged
NO_CONFIRM	More time or data needed to confirm event details.

Alarms can be sorted by the columns by clicking on the column.



Alarm IDs are generated by Aero and are unique for each event. Events have descriptions which are found in the **Message** column.



Start Time	End Time	Ack	ID	Message
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost
07/17/2024 10:31:16	07/17/2024 10:31:16	Admin	502	Communication lost

5.3 Debug Channel selection

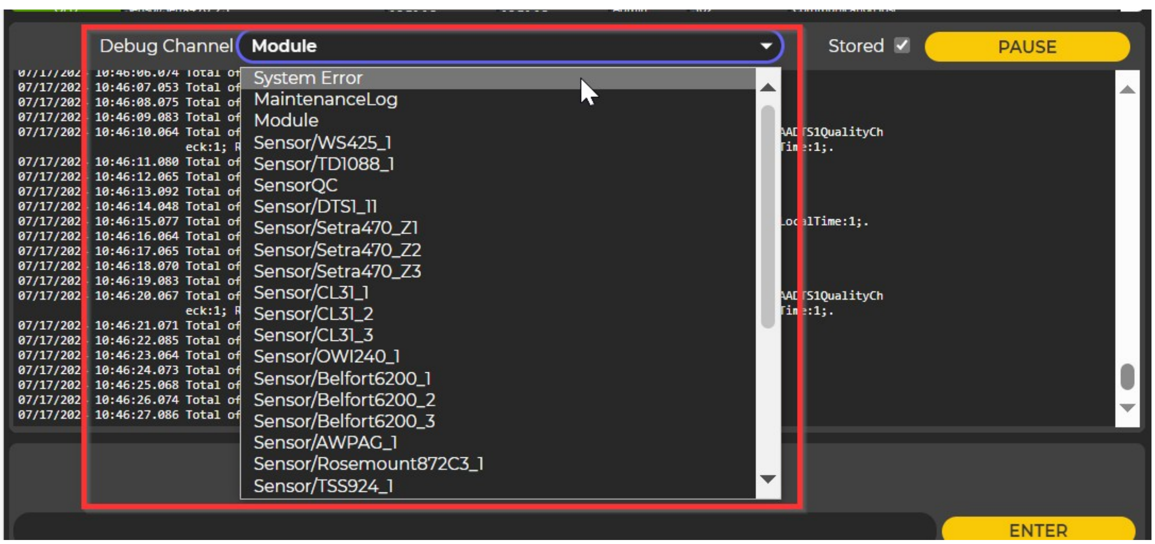
The **Debug Channel** selection widget provides a user with access to a wide range of information.

Each sensor will have a dedicated debug channel which displays that sensor's serial communications. Messages are color coded:

- Green - incoming data
- Blue - sent data
- Red - error

Protocols also have a debug channel where communication history is logged. During initialization, Aero will read the configuration file and initialize all defined sensors, interfaces, data logger drivers, algorithms, modules, protocols, and communication links.

Click the drop-down menu to select which debug channel you would like to see.



Within the configuration yaml, there is a constant (**DEBUGLOG**) which defines which debug channels are stored by default. The constant allows you to define how many days the logs will be stored.

```
Constants: {
    STANDARD: FAA,
    AERODROME: { icao: KCSI, wmo: '12345', name: "Campbell Indoor Airport", hmsl: 1358.49
    #DEBUGLOG has options: path, days and store (comma sep. list of channels or ALL, or S
    DEBUGLOG: { days: 31, store: [System Error,Module,MaintenanceLog,'Sensor/*',SensorQC,
    #DECLINATION has 2 options: sensor: either magnetic or true, and declination in degre
```

For the logs defined in the yaml file, the **Stored** checkbox will be automatically checked.

In order to store other log files temporarily, select the **Stored** checkbox; Aero will produce log files in the "/var/AeroLog/" folder on Linux or "C:\AeroLog" on Windows.

Press **PAUSE** to pause the data feed. This is useful for reviewing events without being interrupted by new data.

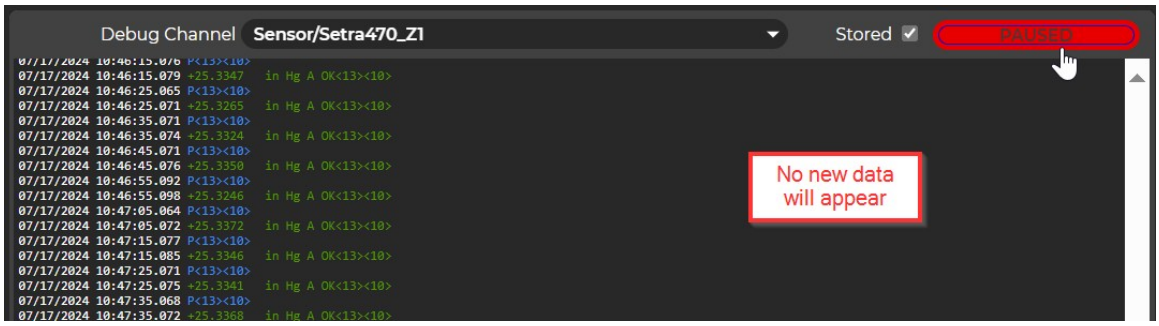


Table 5-2 (p. 14) provides some useful debug channels and descriptions.

Table 5-2: Debug Channels

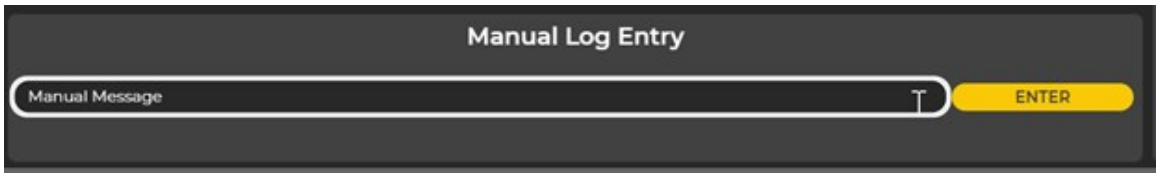
Channel name	Description
System Error Log	Records system events such as initialization, report errors, hourly resource usage readings, errors, and any warnings from system modules.
Maintenance Log (ASOS)	This channel will record maintenance events reported from sensors, interfaces, algorithms, power supplies and other ASOS modules along with a designated event code. Manually entered messages via the entry field at the bottom of the window will appear in this log. This log is dedicated to the ASOS configurations of Aero.

Table 5-2: Debug Channels	
Channel name	Description
Sensor/******	These channels will display individual sensors' serial communication feeds. Raw sensor data can be evaluated and the polling behavior monitored.
SensorQC (ASOS)	Records log messages output by the ASOS sensor Quality Check Algorithms. All messages in this log appear in the **Maintenance Log**.
Module	This log will provide insight into Aero's internal functioning. Aero operates on a tick system, where at each tick in time, certain events happen within Aero. This feed will show which modules are running at each tick and will have one entry per second. This is one way to evaluate the execution of calculations.
Report Log	The **Report Log** is the most concise location to find all reports generated by Aero. One-Minute, Five-Minute, SHEF (15 and 60 Min), AMR, Hourly METARs, condition-triggered SPECIs, and user-generated SPECIs. When a SPECI is triggered, the **Report Log** will contain what condition caused the SPECI to be transmitted and any user activity related to the generation of reports.
Logger	This records information related to logging information into the database.
Security Log	The **Security Log** will display any events related to the security of the system. User log-in and log-out actions, page navigation, user activity on the report edit screens, failed authentication attempts, and other system security related events will be recorded in this log.
AudioFeed	Logs communications with peripheral audio devices (Aero Audio 105 X).
NTP Client	Logs communications between Aero and the Network Time Protocol Server when Aero is using NTP for time management.
CR1KX*	For each data logger configured within the system's yaml file. There will be a dedicated debug channel where the serial communication feed can be monitored. The CR1KX indicates these are CR1000X data loggers.
RVR	Runway Visual Range is an external interface which involves sensors and external data processing. Aero communicates with RVR systems via a data link. This log is the transcript of the communication with any RVR systems.
OID# (ASOS)	When OID thin clients are connected to an ASOS system, the transcript of the communication between Aero and the OID terminal will appear in this log.

Table 5-2: Debug Channels	
Channel name	Description
WebServer	Activity which occurs between the Aero server and connected clients will be logged here.
WSAPI	Activity between Aero and end users which involve Aero's web APIs will be logged here.

5.4 Manual log entry

Below the **Debug Channel** window is the **Manual Log Entry** widget. This field will allow a user to insert a manual message into the **Security Log** and **Maintenance Log**.



Enter the message into the text field and press the **ENTER** button to insert a message. Messages will appear in the **Security Log**.

It will also appear in the ASOS **Maintenance Log**.

5.5 Sensor Status window

The **Sensor Status** window provides insight into the status of all sensors and devices connected to Aero. Devices are grouped by their host locations. In the example case, Aero has 4 locations defined with devices. The row of icons on the bottom indicate protocols and various communication links. In this example we have ADAS, AudioFeed, 3 CR1000X data loggers, a lightning alarm, a status indicator for the primary server hosting Aero, and an RVR interface connection. Aero will monitor the diagnostic information received from each device routinely to determine the individual statuses of devices. When a device experiences a flag or failure, the ASOS Maintenance Interface will log the event in the **Maintenance Log** with a code and additional details about the event. ASOS and non-ASOS Aero installations will see events occur within the **Alarms** list.

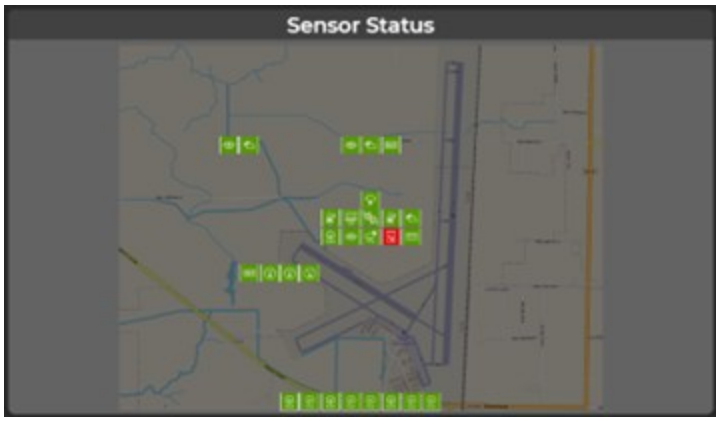


Table 5-3 (p. 17) shows the possible statuses for a sensor.

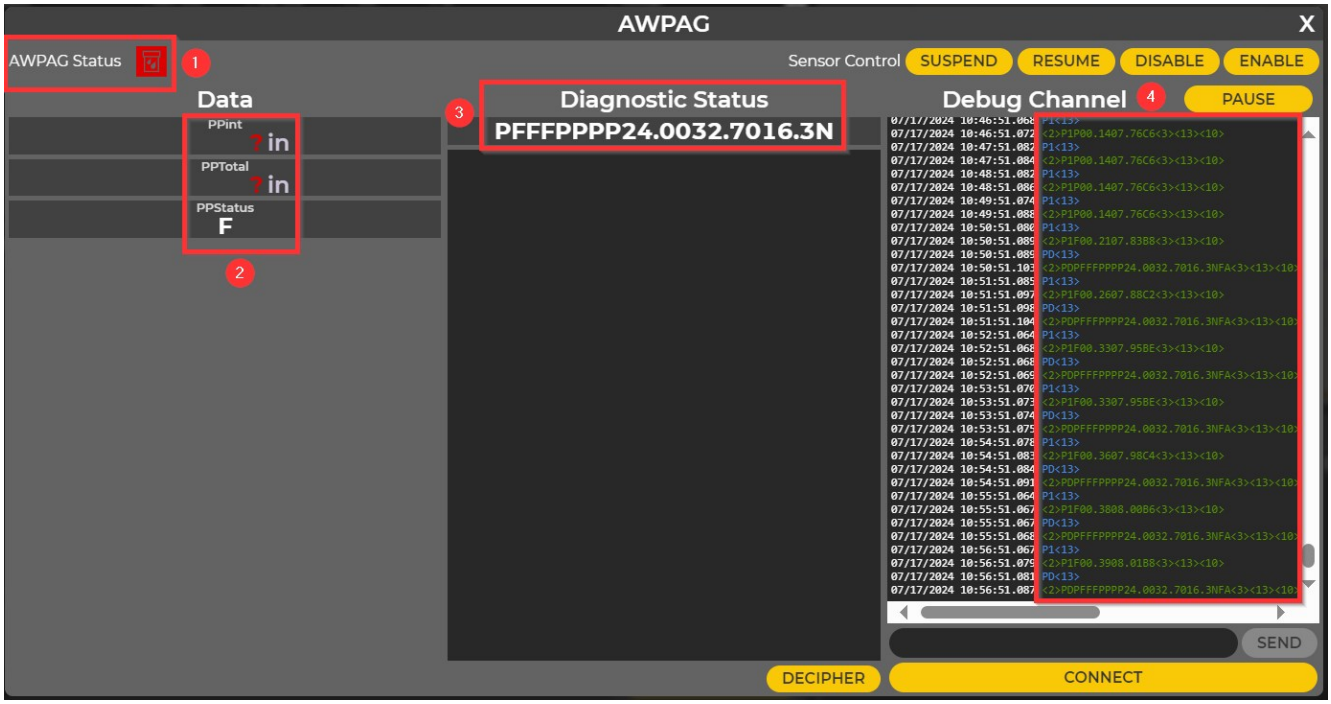
Table 5-3: Sensor Statuses

Color	State	Description
Green	Operational	The sensor is responding to polls and providing data.
Yellow	Warning	The sensor is experiencing communication issues or has failed a quality check.
Blue	Disabled	Report processing has been disabled. The sensor will continue to poll; data received form the sensor will not be processed into a reportable value.
Gray	Suspended	Polling has been suspended. Power may still be on; in some cases a sensor is suspended and power is shut off.
Red	Non-Operational, Error	The device has experienced a critical error. Communication may be disconnected. The device may be unresponsive. Power loss. See the **Alarms** list and **Maintenance Log** for more information.
Black	Unavailable, Status Not Applicable	No status information is available for this device.

In the following image, the precipitation gauge is in the red state.

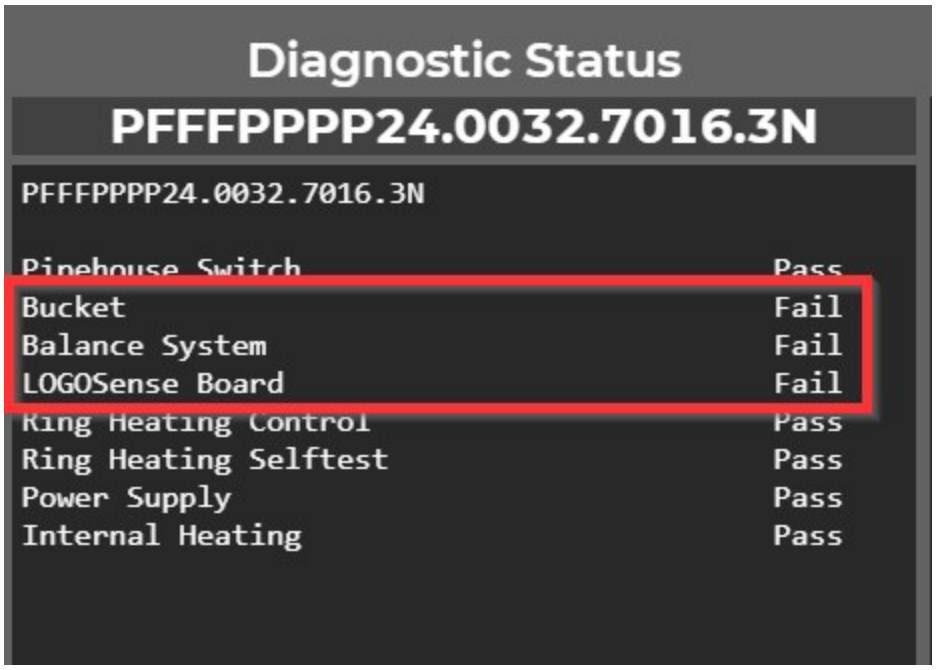
Clicking on the icon pops up a box that contains more information about the device. In this example there are a number of important details.

1. The sensor status is red (Non-operational).
2. The sensor data is missing with a failing status flag.
3. The **Diagnostic** string has "F" characters meaning failures (see AWPAG example below).
4. The sensor is still communicating and data is flowing.

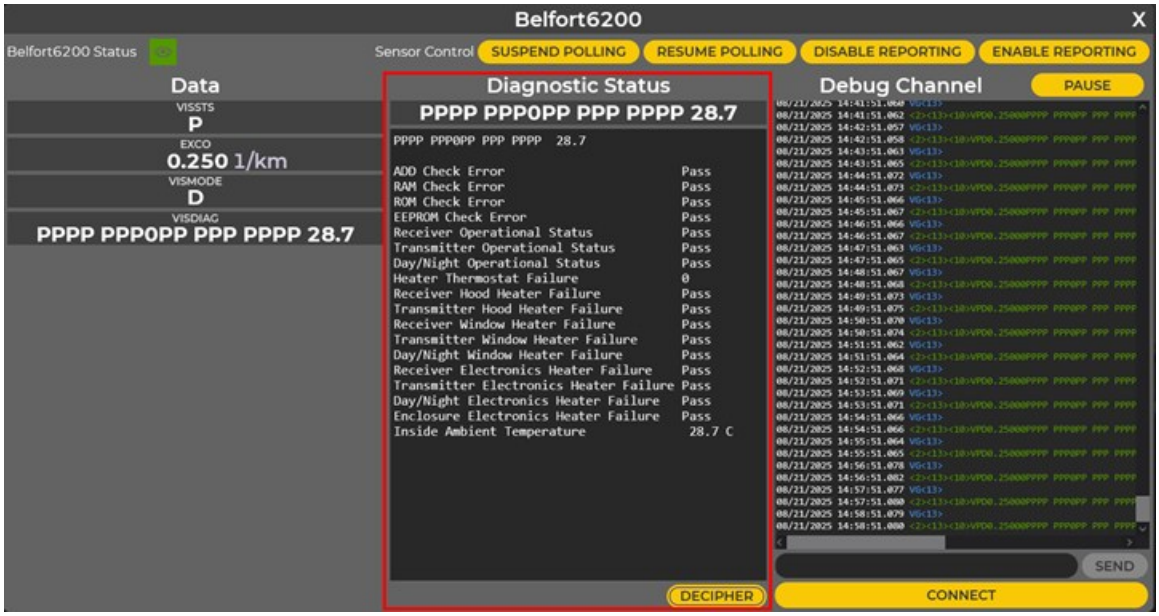


Press **Decipher** to decode the **Diagnostic** string and display more details.

Within this example the AWPAG sensor is reporting a Bucket failure, a Balance System, and a LOGOSense Board. The various flags have been decoded in order for a technician to diagnose the issue.

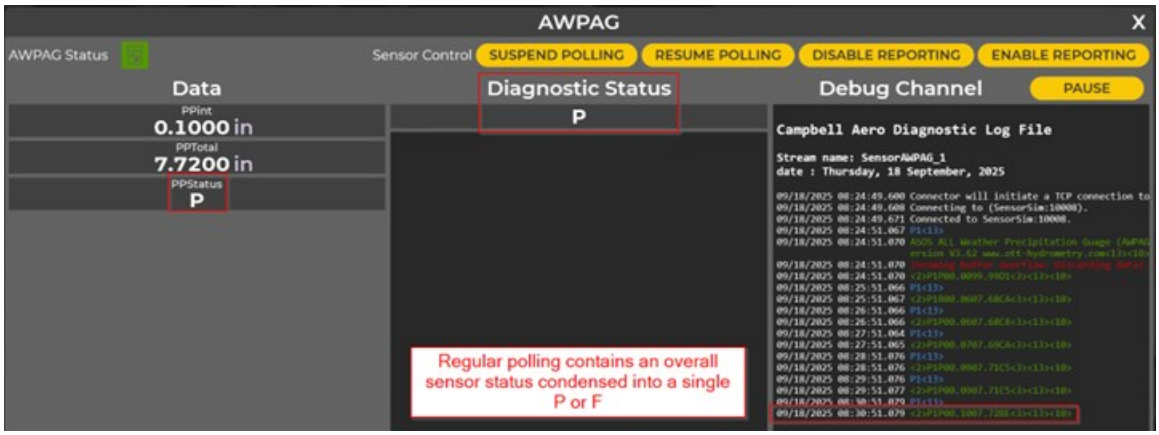


Each sensor capable of providing diagnostic data will have a section dedicated to the diagnostic status on the Sensor Status window.

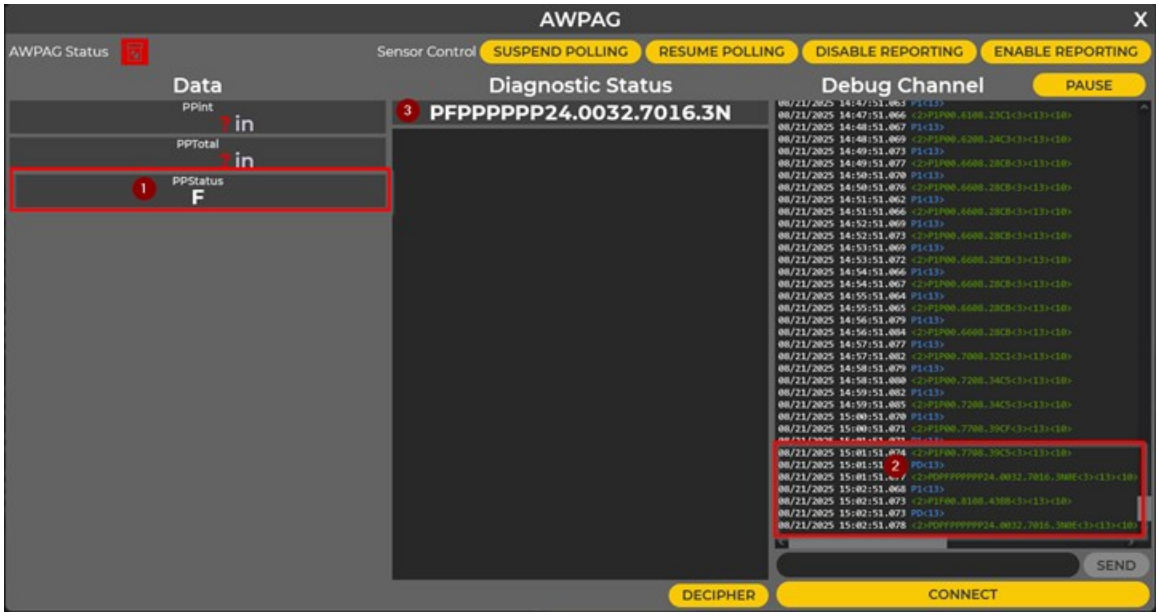


Most sensors (Belfort, CL31, TD1088, WS425, OWI240, TSS924, TSS928) routinely perform a diagnostic poll meaning that the full diagnostic status is available during when the reported status is both Passing and Failing.

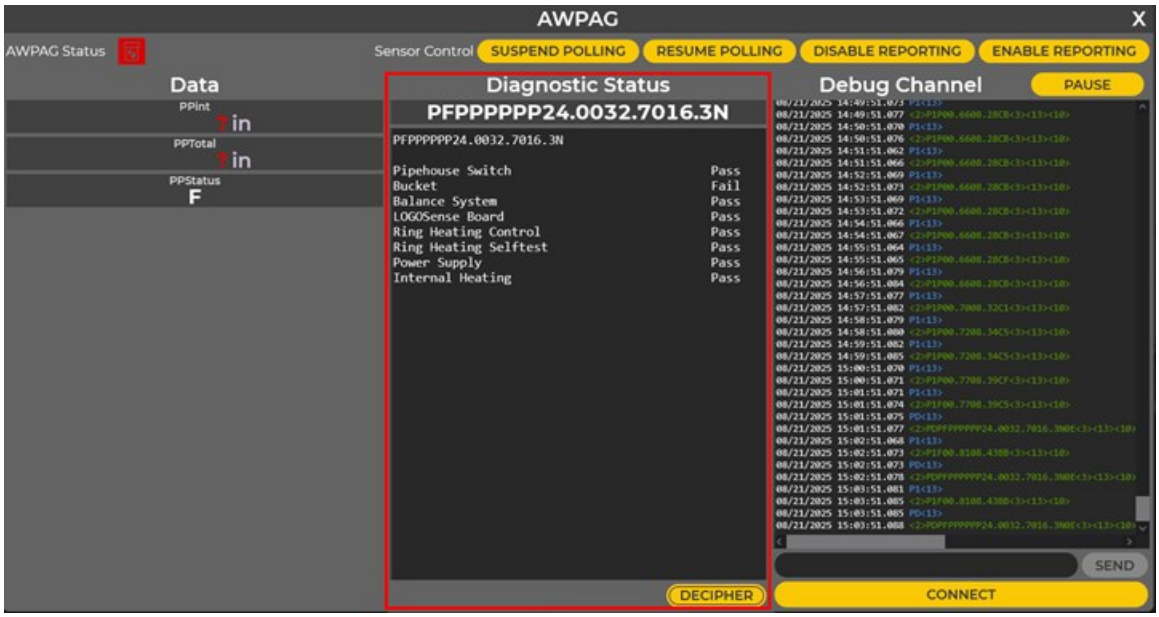
There are sensors (AWPAG, DTS1, HO83R) which have triggered diagnostic polls. This means that when the sensor is operational and reporting a passing status a simple 'P' will be displayed within the Diagnostic Status window.



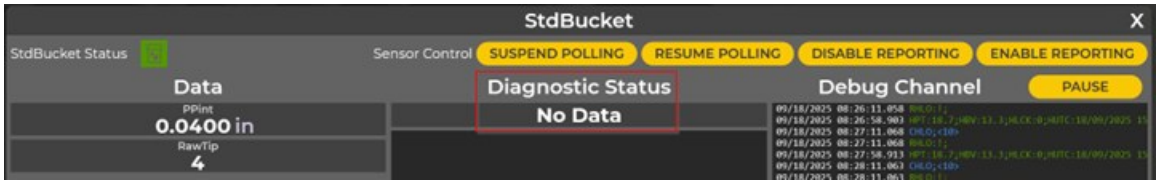
When the sensor reports a high-level failure (1 within the image below) this will cause Aero to issue a diagnostic poll (2 within the image below) and collect more verbose diagnostic data (3 within the image below).



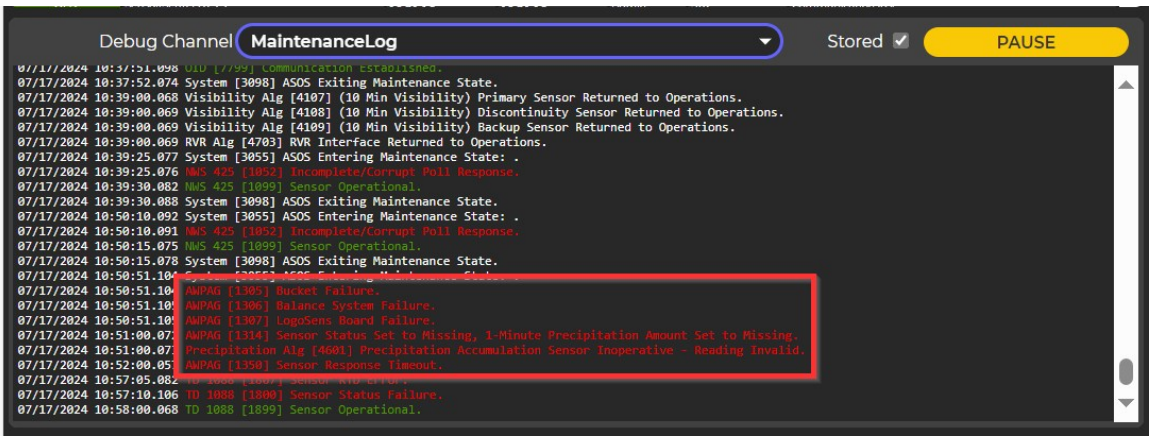
When the verbose diagnostic information has been collected, it will be displayed within the Diagnostic Status window. When **DECIPHER** is pressed, the verbose diagnostic status will be broken out into the individual flags for review.



Some sensors do not provide a direct diagnostic status (Setra 470, Tipping Bucket). For these sensors the operational status will be algorithmically determined by analyzing the data received from the sensor.

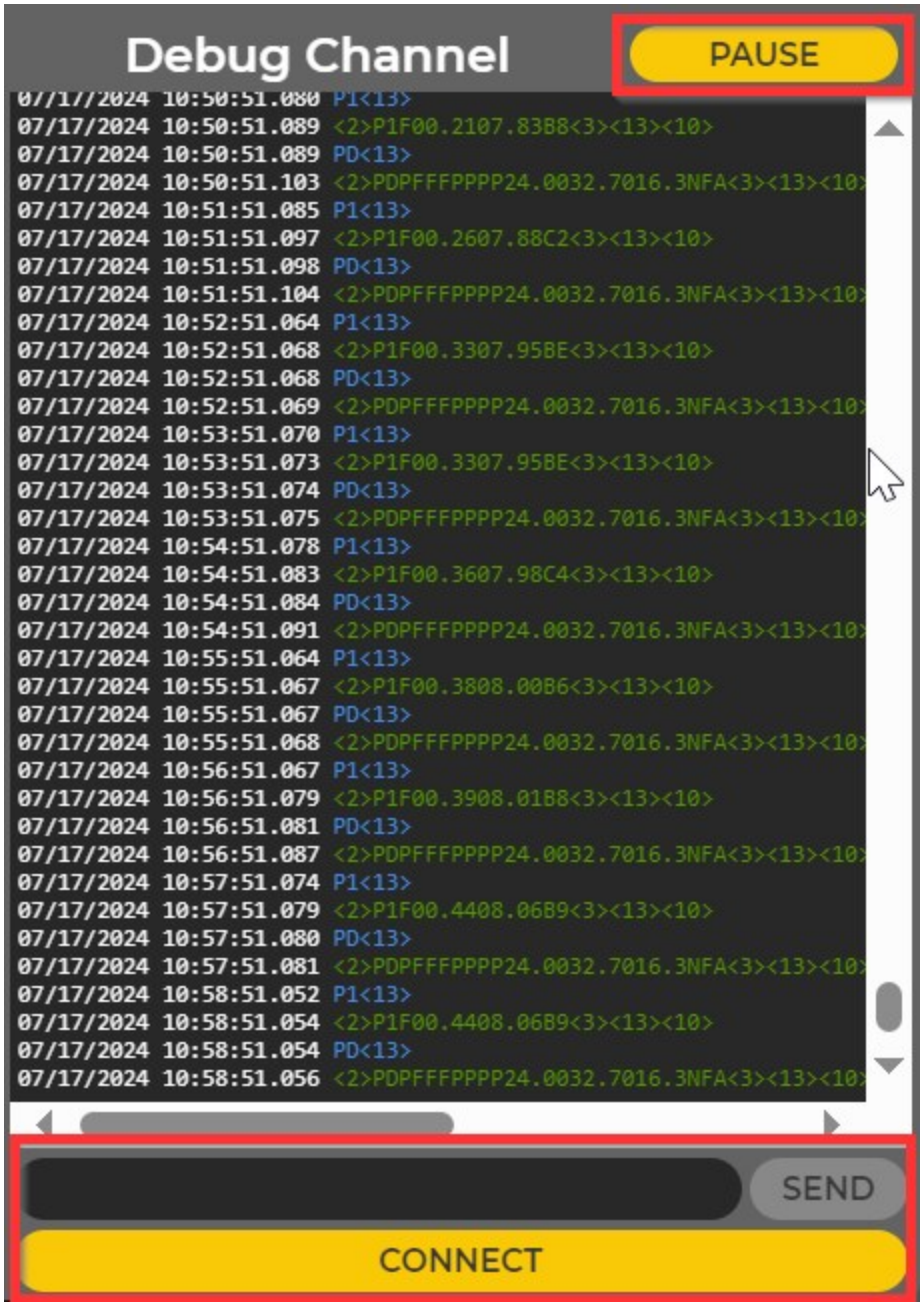


Within the ASOS system, the **Maintenance Interface** is scanning the available diagnostic data from connected devices and failures or warnings will be reported within the system **Maintenance Log**:



The **Sensor Status** windows also provide technicians with a serial terminal and debug channel feed. The debug channel feed can be paused and scrolled to review sensor communications and

by pressing the **Connect** button a serial connection is established where a user can send commands to the sensor.



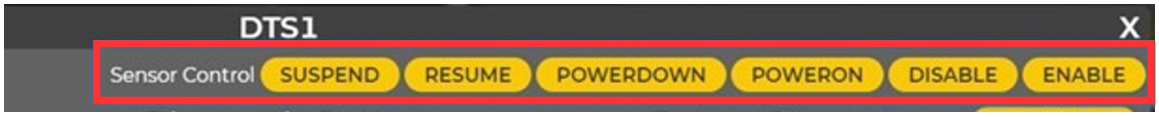
After pressing **Connect** the **Debug Channel** view has now become a sensor terminal. Pressing **Disconnect** will close the session.

Type a command into the text field and press **Send**. This is useful for technicians while diagnosing issues with sensors and equipment. Each device will have a unique set of commands and

diagnostic capabilities. Refer to the sensors ICD for more details regarding sensor message capabilities.

Responses will appear in the terminal window.

The **Sensor Status** window also provides the technician the ability to toggle the operational state of the sensor driver. These options come in pairs. **SUSPEND** and **RESUME** are paired together. Suspending a sensor suspends polling; resuming a sensor will resume regular polling at the period configured for that sensor. **POWERDOWN** and **POWERON** correspond to the power supply to the sensor; these are serviced by the SIO2 modules within the ASOS cabinet and will be unavailable if the associated hardware is not installed. **DISABLE** and **ENABLE** are for report processing. When a sensor is disabled, the sensor will continue to poll, yet the data will be ignored and not used for report generation. Adjusting these settings will change the color of the icon of the sensor and may interrupt system operation if essential sensors are suspended or disabled.



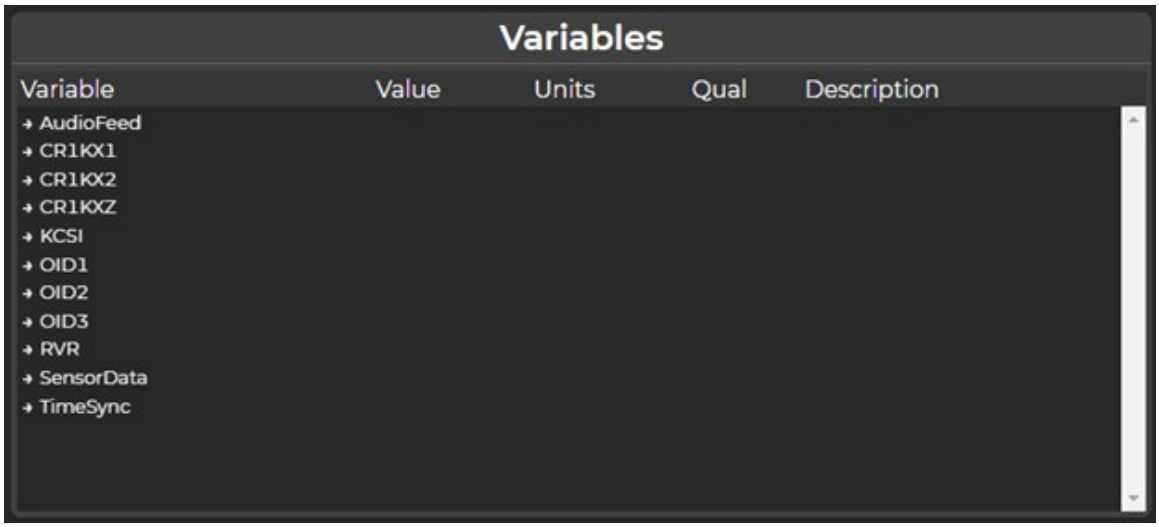
Toggling these settings will adjust values within the **Variables** table; these values can be found in the **SensorData/Manual** variable set. Adjusting these settings will also cause log messages to appear within the **Debug** log for that sensor.

Enabling or disabling a sensor will cause an event in the system **Maintenance Log**.

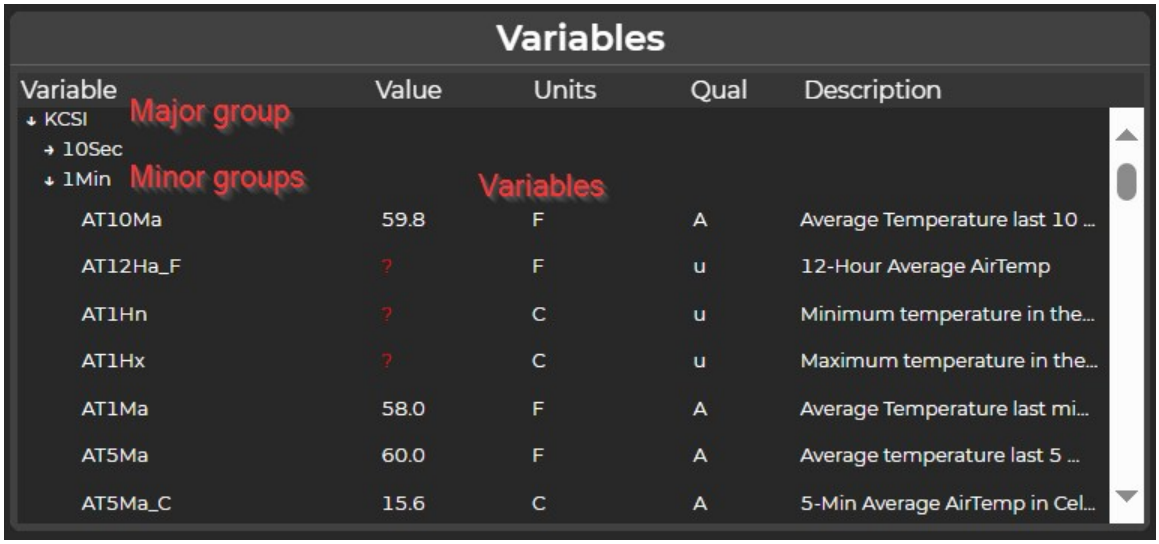
5.6 Variables table

In the bottom right section of the **Technician** screen resides the **Variables** table. For the most part the **Variables** table rests silently in the corner of the **Technician** screen unnoticed and unneeded. There are occasions where the **Variables** table becomes an indispensable tool for testing or diagnosing issues with algorithmic processing. A variable within the **Variables** table is a special software object created and used by the Aero application. These variables are dynamic objects

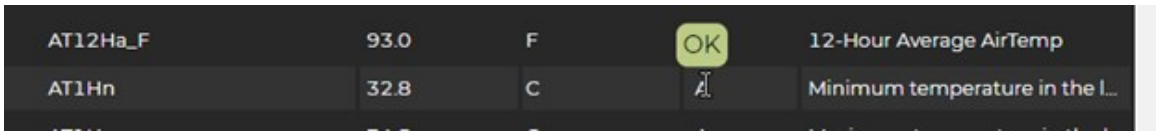
and retain their own histories which can be viewed in the AeroArchive file. Variables may have a designated unit, if the variable stores a numeric type. Some examples of units are knots, meters, feet, degrees (Celsius, Fahrenheit or Kelvin), inches, etc. A variable is updated on a regular interval. For the most part the interval at which a variable is updated is the minor group to which the variable is assigned. Exceptions will be addressed further on in this section.



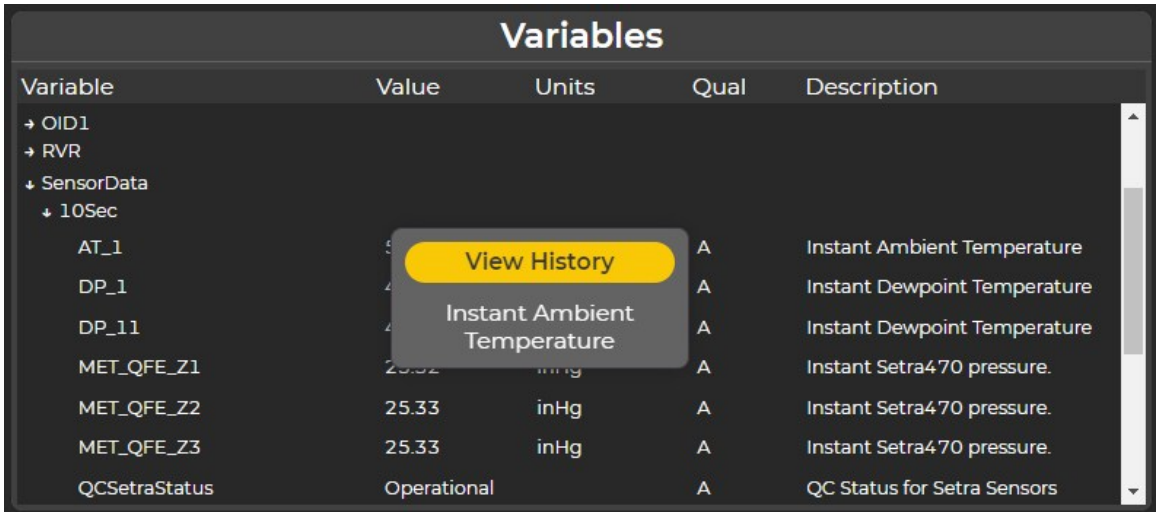
The **Variables** table provides technicians a view into the inner workings of Aero and the algorithmic processing of sensor data. The **Variables** table is divided into major groups, each with their own minor groups of variables. The table can be collapsed and expanded by pressing the arrows.



The **Variables** table shows the most recently assigned value for variables, along with their unit, quality designation and description. Hovering over a value in the **Variables** table will show a tool tip which provides clarifying information.



Right click on the value of a variable entry to display a context menu allowing you to **View History**.



Variable names include the measurement type in an optional suffix:

- time the measurements are averaged
- x - maximum
- n - minimum
- a - average
- g - gust
- l - lull

For example, the variable for the 1-minute average of the air temperature (AT) measurements is named AT1Ma, where 1Ma is the abbreviation for a 1-minute average.

Some variable names end with an underscore and one or two letters that indicate a specific sensor. For example, WD2MA_A is a variable name for Wind Direction 2-Minute average for sensor A, and ICAO/10Sec/WS10Mg_C is a variable for the 10-Minute Wind Gust Speed for sensor at location C.

The Report groups have another naming convention. Temporary variables start with an _ underscore.

Table 5-4 (p. 26) shows the most common major groups for variables.

Table 5-4: Common major groups for variables	
Name	Description
AudioFeed	This group contains variables related to the peripheral audio device. Variables associated with status and caller lists can be found here.
Data Logger Groups (CR1KX*)	Holds variables associated with specific data loggers and their status.
Airport Identification Code	This group holds the most diverse set of variables ranging from quality checked sensor measurements, intermediate processing variables, reported values, and flags. See further details in section Airport identifier code major group (p. 28).
Terminal connections (OID* & VDU*)	These variables relate to end user terminals within the ASOS system. Each OID/VDU terminal defined in the configuration yaml will have its own group in the **Variables** table.
RVR	This groups holds the status variables for the Runway Visual Range interface connections.
SensorData	This group is where variables associated with sensor drivers are stored. Raw sensor data and status flags can be found within this group. See further details in SensorData major group (p. 27).
TimeSync	Variables related to the system's management of time and syncing between servers will be stored here.
DAtis /Atis	Stores variables related to Digital / Automated Terminal Information Service.
RunwayInUse	Stores variables related to any Runway In Use systems connected to Aero.
SNMP	Stores variables related to any Simple Network Management Protocol connections.
GTS / AFTN / AMHS	Stores variables related to telecommunication networks.
DataLink	Stores variables related to any external data links which are connected to Aero.

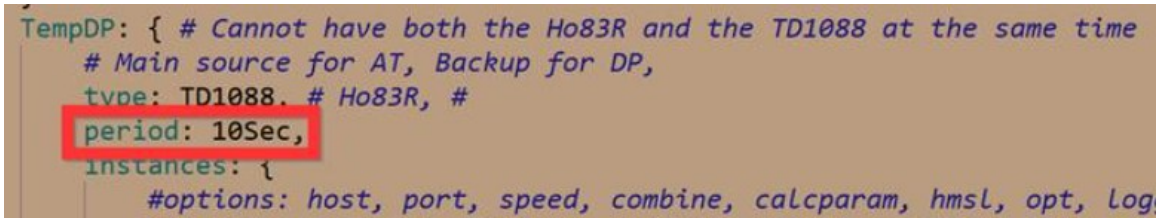
Minor groups are most often the time interval of the variable. Most minor groups will follow the naming convention indicating the number and unit of that group. 1Sec, 5Sec, 30Sec, 1Min, and 5Min are examples of such time-based groups. Async stands for asynchronous, and this minor group will hold variables which have no time-based update schedule. There are some minor groups which correspond to modules such as Climat, Metar, OID, and Manual.

Table 5-5 (p. 27) is a description of the various minor groups that one might find in the **Variables** table.

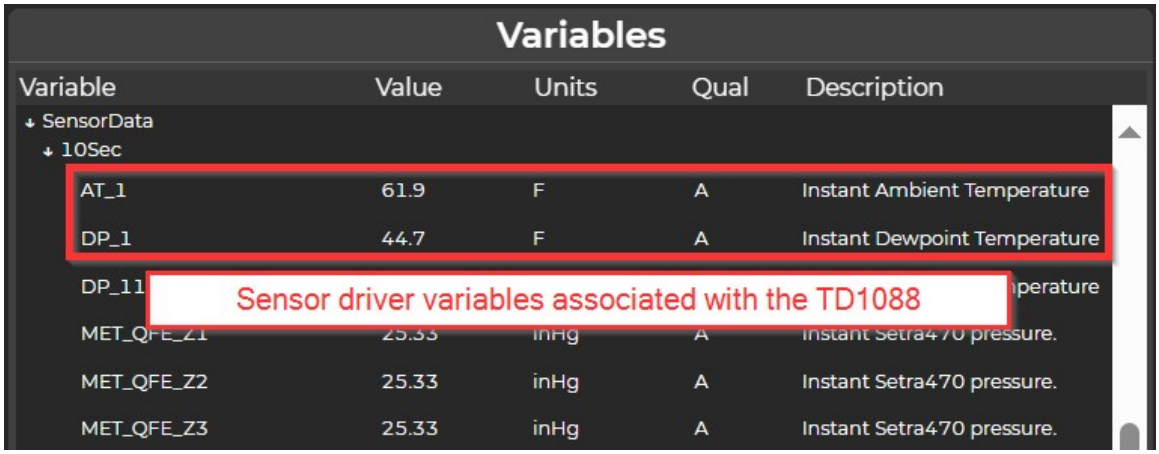
Table 5-5: Common minor groups for variables	
Name	**Description**
Climat	Variables used in the generation of Climat synoptic reports.
Metar	Variables used for the generation of routine scheduled METAR reports.
OID	Variables associated with the operation of OID terminals. Displayed/edited values and flags can be found here.
Manual	Stores variables which have been designated as Manual. Examples include calibration flags set by technicians and manually assigned notices.
Stats	Stores variables related to statistics.
Atis	Stores variables used in the Automated Terminal Information Service.
MetReport	Stores variables used in the generation of the MetReport.
Sigmet	Stores variables related to the generation of Significant Meteorological reports.
Taf	Stores variables related to the generation of Terminal Airport Forecasts.
Synop	Stores variables related to the generation of synoptic reports.

5.6.1 SensorData major group

Within the **SensorData** major group you will find the raw sensor data and status information broken out into minor groups based on polling period. Within the configuration yaml file, the technician can assign each sensor a polling period. This will govern where the variables for that sensor will be found.



If we run Aero with the above configuration, we will find the following variables in the **SensorData/10Sec** group:



5.6.2 Airport identifier code major group

Each ASOS system will be assigned a station identification code. This can be found in the configuration file within the Constants section.

```
Constants: {
    STANDARD: FAA,
    AERODROME: { icao: KCSI, wmo: '12345', name: "Campbell I
    #DEBUGLOG has options: path, days and store (comma sep.
    DEBUGLOG: { days: 31, store: [System Error,Module,'Senso
```

This Airport identification code can be seen at the top of the **Technician** screen in short form.

This identifier also appears in all transmitted reports:

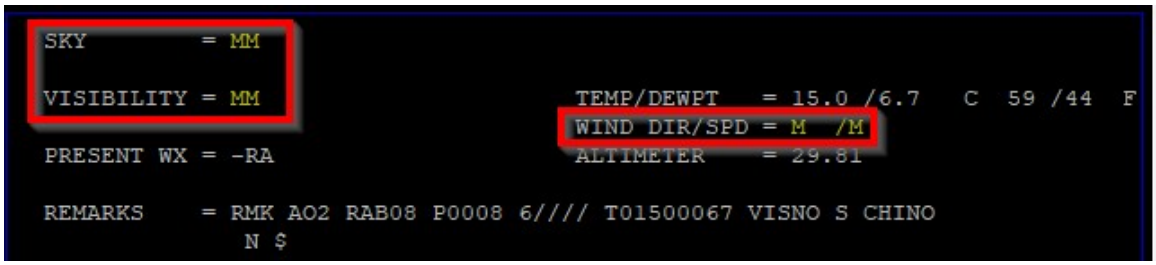
This identifier is 4 characters and is a combination of letters and/or numbers. Within the example above the Airport identifier code is KCSI. The **Variables** table will have a major group named after the station's identifier code.

The ID code major group within the **Variables** table will store most of the relevant variables for system diagnosis and algorithm analysis. The minor groups within the ID code major group follow the same naming as described above: 1Sec, 10Sec, 1Min, etc. The variables found in this group cover many core functionalities of the ASOS system. The outputs of the sensor quality check algorithms can be found in their sensor specific period groups. Algorithms are executed for the most part each minute. Due to the nature of the ASOS algorithms, many of the critical system variables will reside in the 1Min minor group. For help finding the location of a variable for a specific algorithm see AllVariables.txt (p. 31) and AllCalculations.txt (p. 32)

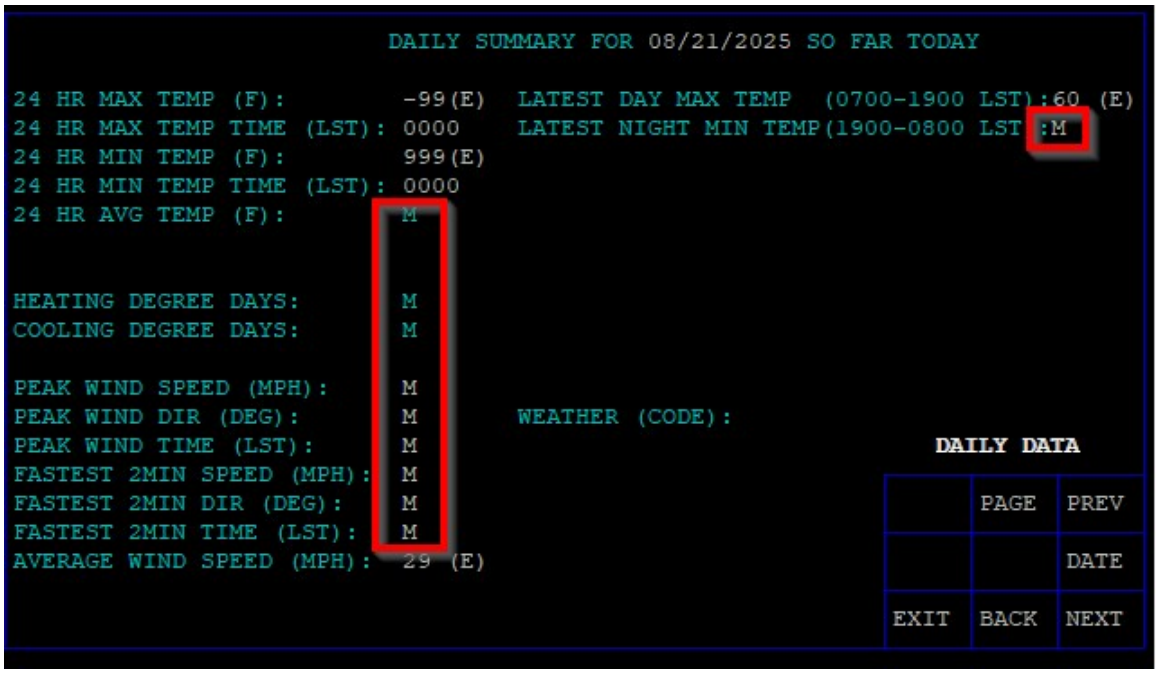
5.6.3 Explanation of missing

Within ASOS there are multiple representations of the concept of "Missing". When evaluating the algorithms or when checking data through the OID screens having a description of how ASOS represents "Missing" data will be useful.

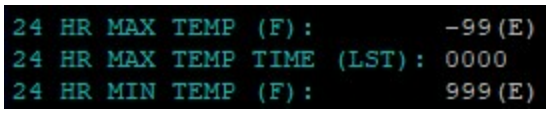
On the One-Minute Screen missing data will be represented with an 'M'.



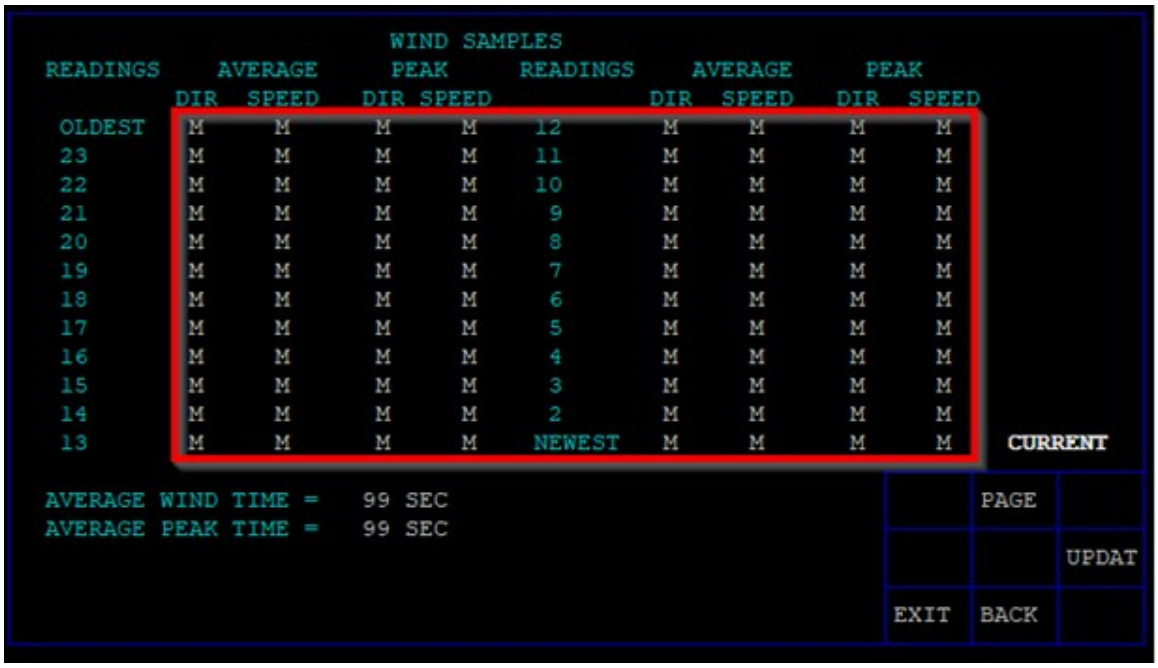
The 'M' may be yellow, blue, or white.



Within the OID screens there are a couple of alternative representations of "Missing". The preceding image contains a few such examples. Some fields will display the value '999' or '-99' or '0000' when the underlying variable value is missing. (A close-up of the lines with these representations is shown in the following image.)



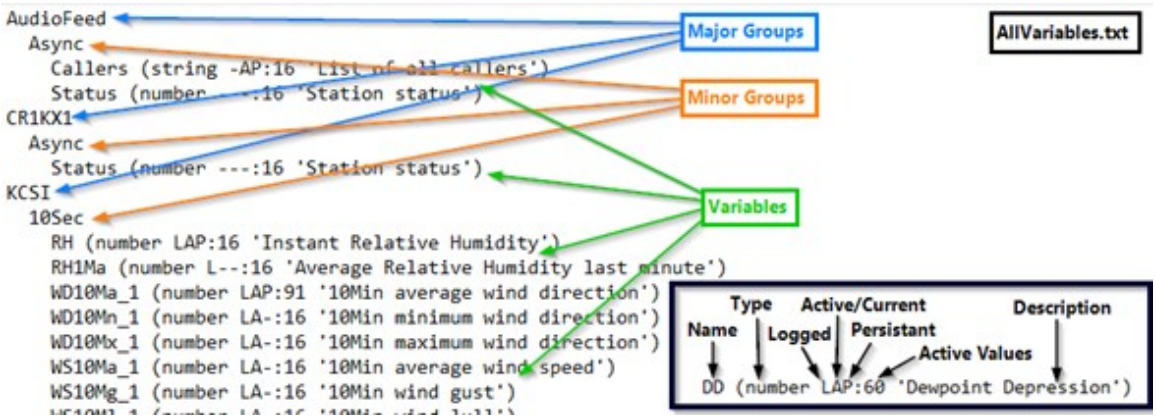
Here are additional examples of missing values represented by 'M' characters as well as the average times being displayed as '99' when missing.



WithinAero's browser interface, missing values will be represented with a '?' characters or with 'No Data'.

5.6.4 AllVariables.txt

Variables are context specific and where to find a certain variable in the **Variables** table depends heavily on the circumstances, which configuration is being used, how sensors are configured in a system, and protocols and interfaces the system is connected to. Many factors lead into determining the location of various variables within the table. During initialization, Aero will generate a text file within the working directory of the Aero process called AllVariables.txt. This file provides a list of all the tracked variables created during initialization along with a description.



Within AllVariables.txt, variables are grouped by major and minor groups and include some meta data about the variable. The presence of an L means this variable will be logged each time stamp in the AeroArchive file. The presence of an A means that the variable has an active or current value meaning the value of this variable has an impact on the live operation of Aero. Report generation or system monitoring are examples. The presence of a P means that the variable's value will be persistent. Persistence means the variables value will be stored in the database. The presence of an '-' symbol means the variable does not have that quality: logged, active, or persistent, respectively. If a technician is unsure where to find a specific variable, they may search the AllVariables.txt for keywords and will likely find the variable's location in the **Variables** table.

5.6.5 AllCalculations.txt

When evaluating the systems' operation, it may become useful to investigate specific algorithms or calculations. To make investigation into internal data processing accessible, Aero will generate the AllCalculations.txt file during system initialization. The AllCalculations.txt file is similar to the AllVariables.txt file in that it is generated during initialization and can be found in the working directory of Aero. The file lists calculations, in their assigned order of execution, the main variable for that calculation, and a list of the calculation's parameters.

During initialization, Aero creates calculations based on the connected sensors. For example, if pressure sensors are defined in the system's yaml file, quality check calculations are initialized:

```
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z1,          [AVGPRESSVAR=SensorData/1M
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z2,          [AVGPRESSVAR=SensorData/1M
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z3,          [AVGPRESSVAR=SensorData/1M
```

Quality check calculations will have a lower order number meaning they will execute before other calculations. Following the chain of pressure calculations, farther down the calculation ordering we find multiple pressure related calculations in a series. This mirrors the associated DWA (Documented Weather Algorithm) structure where one method's outputs are needed as inputs into the next method in the algorithm series. Generally, calculations follow this pattern. The sensor driver retrieves values from a sensor on a regular period defined in the yaml file. Sensor measurements are then processed through quality check calculations; after passing QC, measurements are generally averaged over varying time periods: 1 Min, 5 Min, 10 Min, etc. After averaging, there are derived values such as station pressure, density altitude, wind shift, visibility trends, etc. After data products have been generated, there are formatting and reporting algorithms which prepare and generate report content. Reports are transmitted at varying intervals such as 1-Min, 5-Min, Hourly, 6 Hourly, etc. Lastly, there are daily and monthly summary algorithms which are responsible for generating long term reports over time. The AllCalculations.txt file shows each calculation with its designated parameters, while also allowing technicians to see the overall structure and relationship between calculations.

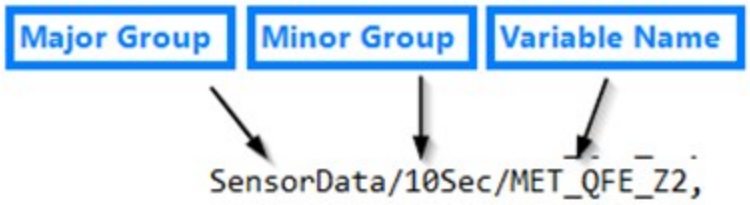
```
FAACL31QualityCheck(10),    KCSI/30Sec/QCCL31Sts_2,    [CL31SENSTS=SensorData/30Sec/Status_2,CL
FAACL31QualityCheck(10),    KCSI/30Sec/QCCL31Sts_3,    [CL31SENSTS=SensorData/30Sec/Status_3,CL
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z1,          [AVGPRESSVAR=SensorData/1M
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z2,          [AVGPRESSVAR=SensorData/1M
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z3,          [AVGPRESSVAR=SensorData/1M
QualityCheck(10),    SensorData/1M                    [LIMITS=strlen(Senso                  age
Q                    SensorData/1M                    TS=strlen(SensorData/                 1]
QualityCheck(10),    SensorData/10Sec/AT_1,     [LIMITS=SensorData/10Sec/AT_1 > -80 and SensorDa
QualityCheck(10),    SensorData/10Sec/DP_1,     [LIMITS=SensorData/10Sec/DP_1 > -80 and SensorDa
```

Calculation name

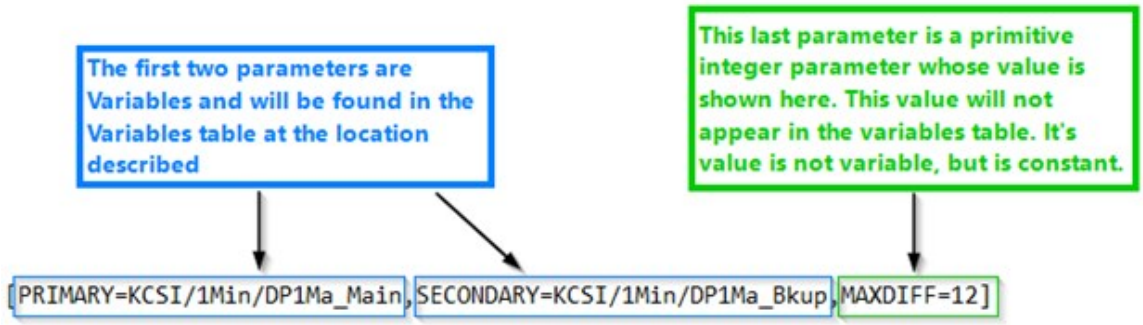
Main variable declaration

Parameter array

Each calculation has a designated main variable. This main variable is generally the primary output of a calculation or perhaps a status designation after evaluating system conditions. The main variable of the station pressure calculation is the variable holding the station pressure value. This station pressure variable is then used in other calculations as an input in order to generate reports and trigger special alerts. The main variable is declared to the reader in the format of its location within the variables table.



This is also how the parameters are declared. The parameters will be listed inside '[]' symbols with each parameter separated by a comma.



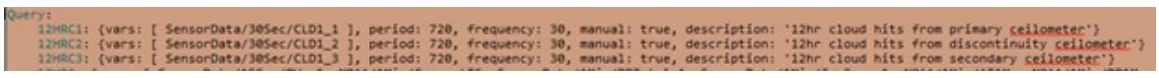
Using the AllCalculations.txt file, one can review which variables are associated with a calculation under investigation. The technician can then use the AllVariables.txt file to gain more insight into the variable, and the **Technician** screen and archive logs to analyze the variables value and behavior. Aero provides a useful screen, the **Logs and History** screen, which allows a technician to dig into a variable's history. See Logs and History screen (p. 34) for more information about additional tools for evaluating system data and variable history.

The ASOS system has a set of documents which outline the various methods for calculating data products. Refer to the DWA documents for more details relating to ASOS weather algorithms.

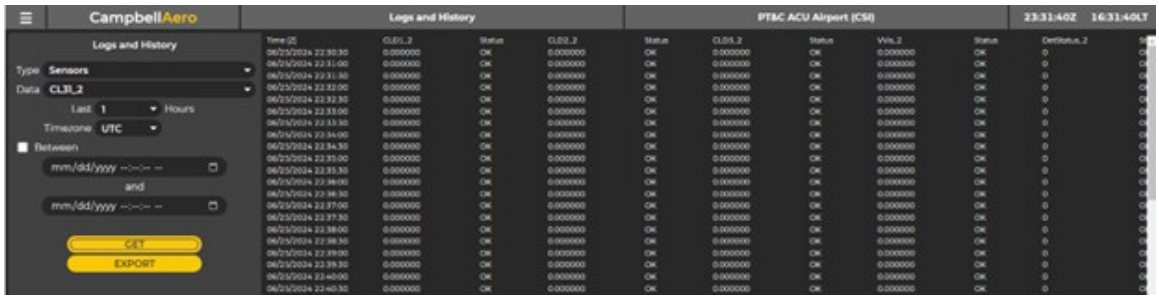
5.6.6 Logs and History screen

The Aero web interface provides users with a utility for retrieving historical logs and variable values. This is a separate screen from the **Technician** screen yet provides functionality which overlaps with the **Technician** screen and whose features are very useful when technicians are working on a system.

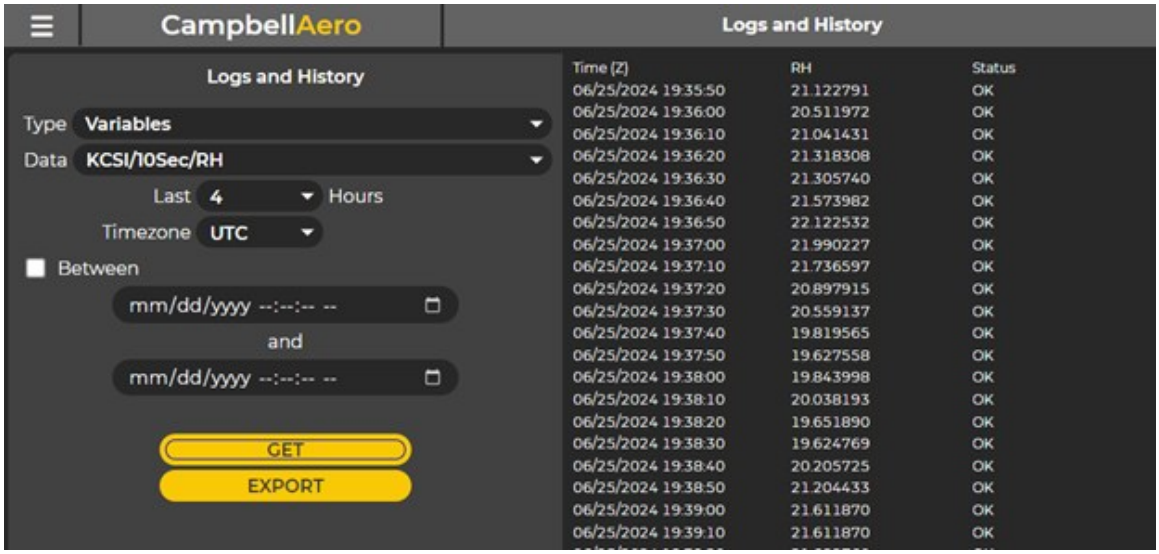
The **Logs and History** screen provides a user with the option of choosing **Sensors**, **Debug channels**, **Variables**, and predefined queries in order to retrieve data from the system. Queries can be defined in the system configuration yaml file. Queries target specific variables and time ranges which may be customized to a site's needs.



When selecting a sensor, all available sensors will be listed in the drop-down selection menu. Press **GET** to display the data on screen or **EXPORT** to return a comma separated value object filled with the data associated with that sensor.

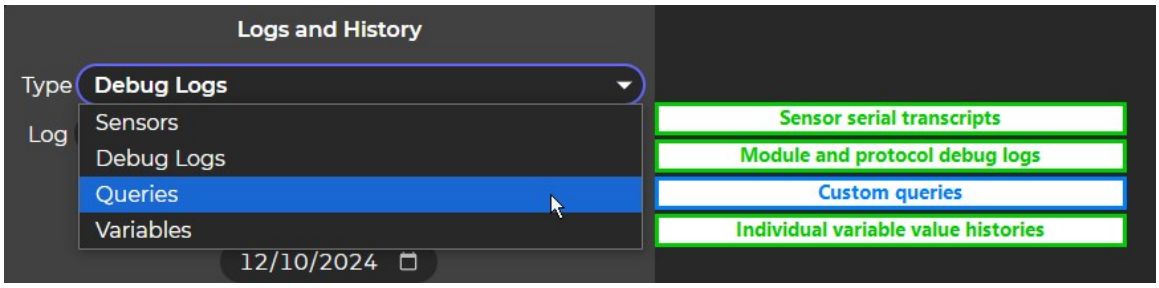


When selecting a debug channel, as discussed earlier, all communication between Aero and a device will be logged in that devices debug channel. The **Logs and History** screen allows a user to retrieve a range of logs for a device. The log files for the selected device will be packaged into a zip file which will download onto your local machine. When selecting a specific variable, the **Logs and History** screen will display or package the data occurring within the selected range. Use **GET** to view the data on screen and **EXPORT** to download data to your local machine in the form of a csv.



5.6.6.1 Logs and History queries

During operation, Aero will take input from sensors, peripheral devices, and protocol data sources. That data is processed into data products in the form of variables, reports, and transmitted audio recordings. Over time Aero stores the historical values assigned to these data products and at times it may be useful to retrieve this data for evaluation or troubleshooting. The **Logs and History** screen provides several default options such as sensor serial data transcripts, protocol communication logs, logs with a record of reports.



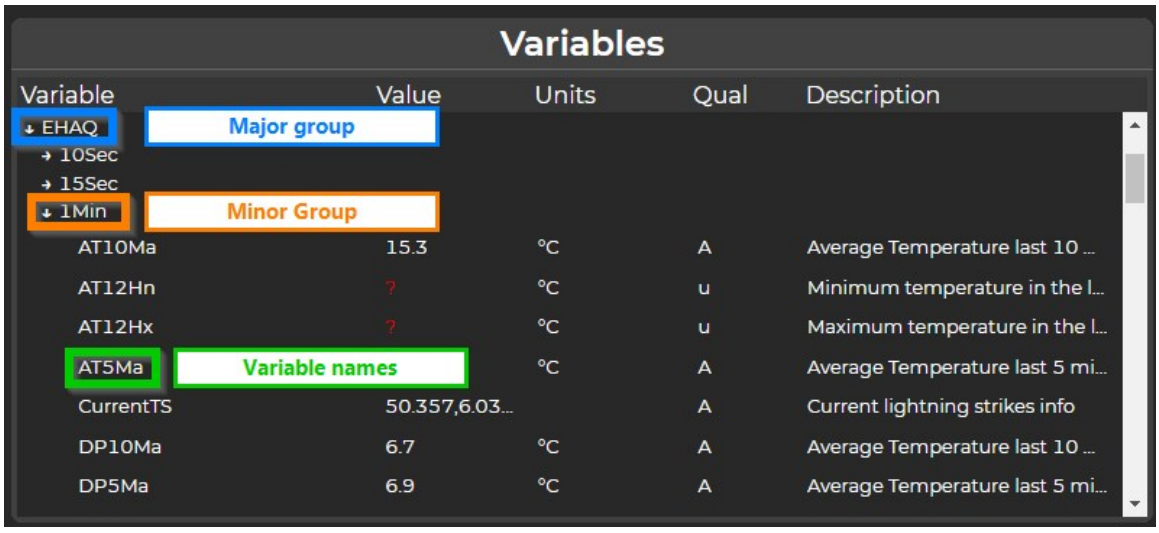
Among the default options are tools for retrieving individual variable value histories. There are situations where a station regularly retrieves a collection of variables for distribution to an external system or for archival purposes. This is possible through the construction of custom queries. The process for adding custom queries to a live Aero system will proceed as follows:

1. Identify the variables which the query will retrieve.
2. Sign into **Aero** as an Administrator or Technician user. (Must have configuration privileges.)
3. Use the **Configuration** editor tool to add the desired variables into a query definition.
4. Save and Apply the new query definition.
5. Restart Aero to have access to your new query.

This section will outline these steps for a general case.

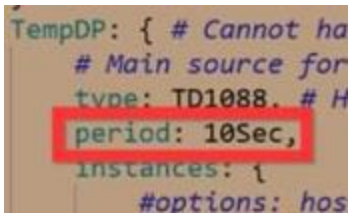
Variable name identification

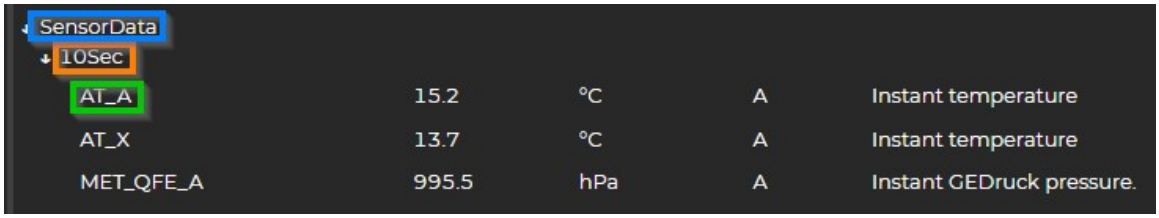
As a starting place, it is often best to gather a list of the full variable names for the desired data products as outlined in the **Variables** table on the **Technician** screen. Finding the exact variables of interest will require some context specific understanding of the variables major group, minor group, and name.



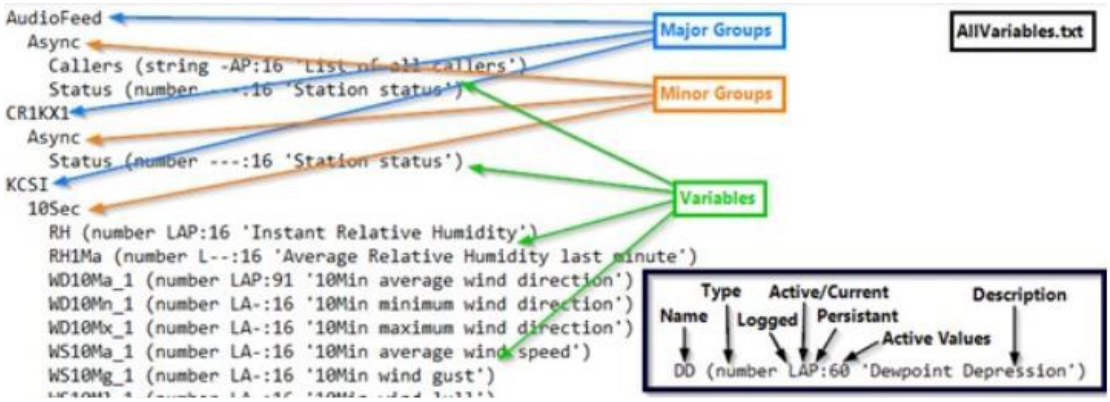
In the example above, the 5-Minute Average Air Temperature is being highlighted. The full variable name for this data product is EHAQ/1Min/AT5Ma.

For the most part, raw data is found within the **SensorData** major group, and final processed data is found in the **ICAO** major group. In the case of the example station the **ICAO** major group is **EHAQ**. This will vary from station to station. The minor group is related to the time interval of that data product. The **1Min** group holds many data products, a rule of thumb is that data products generally follow the time interval of 1) the sensor from which it is derived, and 2) the reporting interval. For example, a sensor with a 10Sec polling interval will have sensor data variables within the SensorData/10Sec/ group.





When Aero is first initialized, the application will produce a text file called AllVariables.txt within the working directory of Aero. Within AllVariables.txt, variables are grouped by the same major and minor groups and include some meta data about the variable.



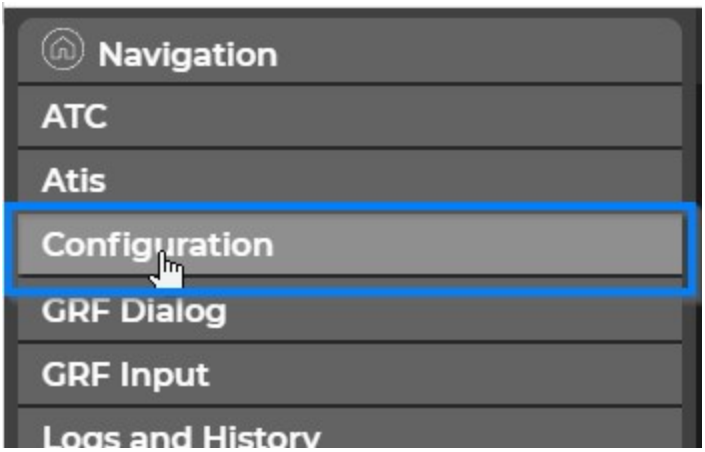
The presence of an L means this variable will be logged each time stamp in the AeroArchive file. The presence of an A means that the variable has an active or current value meaning the value of this variable has an impact on the live operation of Aero. Report generation or system monitoring are examples. The presence of a P means that the variable's value will be persistent. Persistence means the variables value will be stored in the database. The presence of an '–' symbol means the variable does not have that quality: logged, active, or persistent, respectively.

If a technician is unsure where to find a specific variable, they may search the AllVariables.txt for keywords and will likely find the variable's location in the **Variables** table.

For the first step of query creation, gather the desired full variable names and list them with this format: Major/Minor/Name.

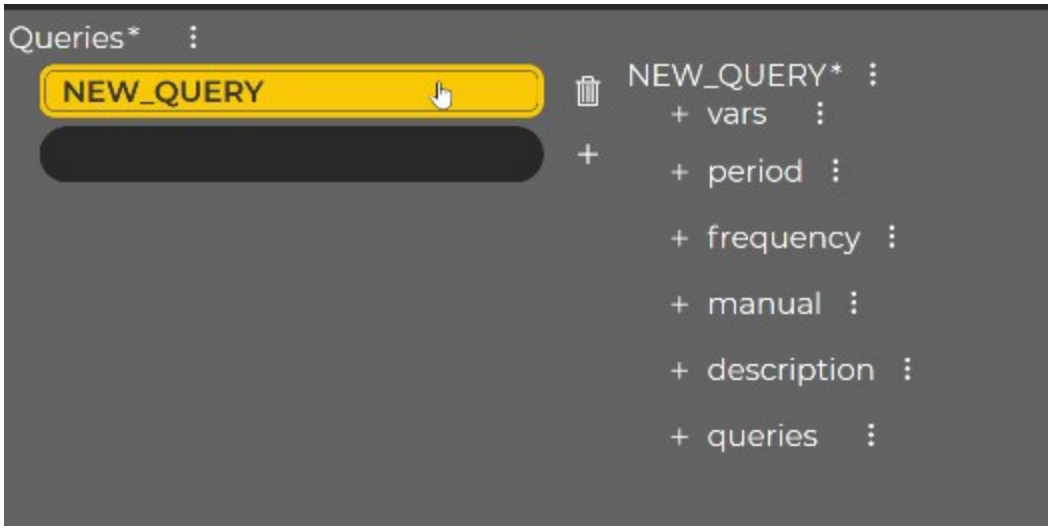
Using the Configuration editor tool to add a new query

Sign into an instance of Aero as an Administrator or Technician user and navigate to the **Configuration** screen. Select your active configuration and choose the **Queries** section form the menu on the left.



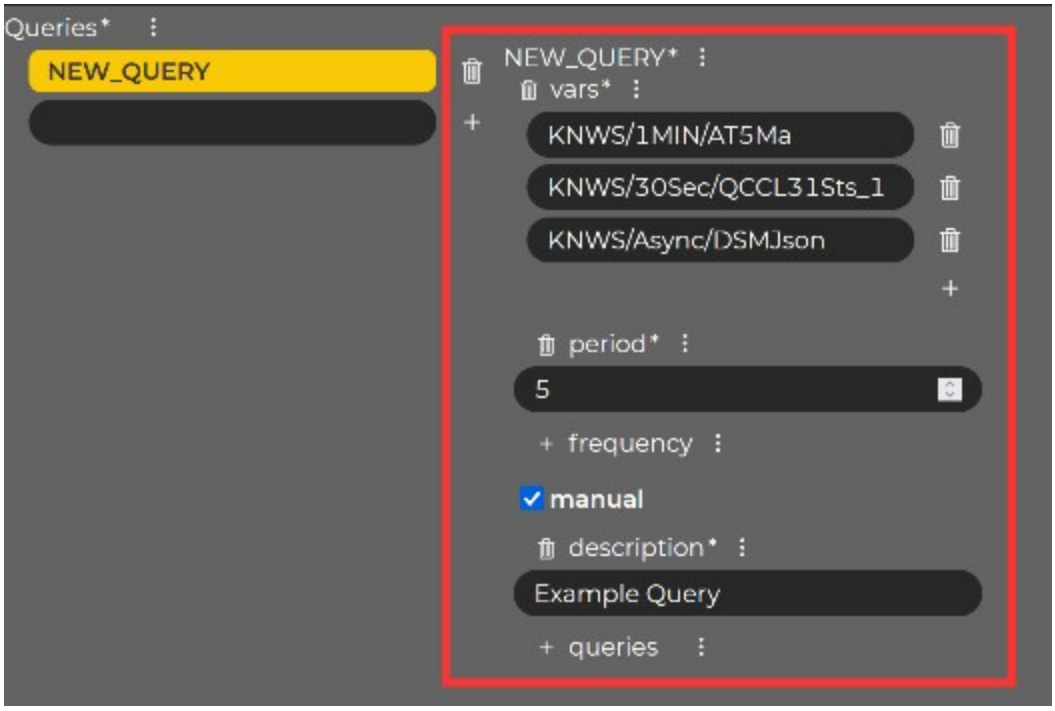
Add a name for your new query and click **+**.

Click the new definition to expand its properties.



For a Variable query, we must define at least one variable (**vars**) and a **period**. If the query is intended to run automatically, a **frequency** must be defined along with leaving the **manual** property as false. One can use the AllVariables.txt file found within the Aero working directory to find variable names. A technician can also use the **Technician** screen's **Variable** window to identify variable names.

For the sake of this demonstration, a **manual** query is defined for three variables. Setting a **period** of 5 means the query will retrieve 5 minutes of that value's data. Provide a **description** for clarity.

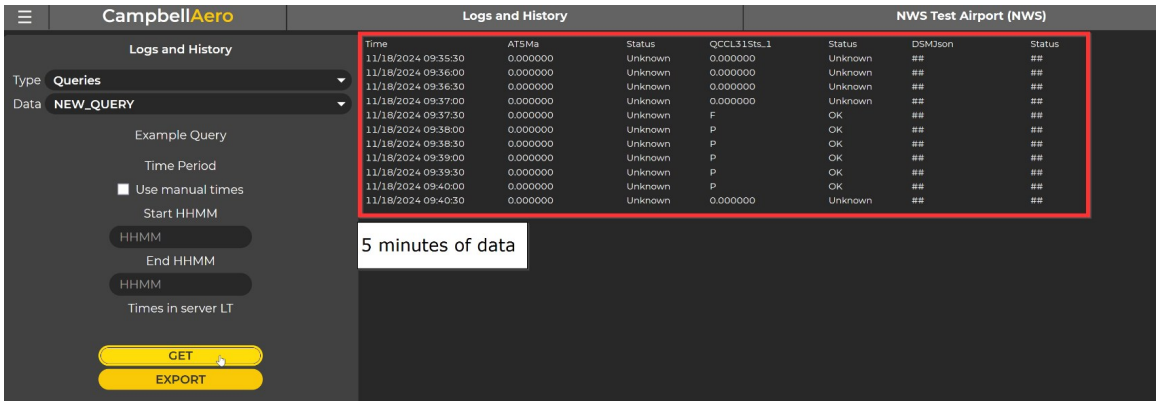


Click **Save**.

To apply these changes, select the top section of the side menu titled **Selected File** and click **Apply to Aero** on the top right.

Testing a new query

Run the query from the **Logs and History** screen.



5.7 System Status indicators

At the bottom left of the screen, Aero provides technicians with two status indicators.

The left indicator is associated with the operational capacity of the server(s) hosting the Aero process.

A single **Servers** icon means there is only one server running as the primary server, two **Servers** indicators will appear when the system has a primary and secondary server configured. The right indicator is an overall system **Status** indicator. This **Status** indicator will be green if all connected devices, protocols, and interfaces are connected and communicating properly and all system alarms have been acknowledged. If there is a quality error, a disconnected sensor, a malfunctioning power supply, or any issues with connected devices, the system **Status** indicator

will be red or yellow. The system **Status** indicator is also tied to the **Alarms** list. Even if all devices are connected and communicating, but there are unacknowledged alarms, the system **Status** indicator will appear yellow. In other words, unacknowledged alarms will cause the system **Status** indicator to be yellow. Table 5-6 (p. 41) shows the system statuses and their related color.

Table 5-6: System Status

Status	Color
Unknown	Grey
Operational	Green
Warning	Yellow
Error State	Solid Red
New Error	Flashing Red
Potential Warning	Blue

5.8 Auto and SemiAuto mode

CampbellAero's reporting module (METAR, One Minute Observation) can operate in two different modes. While in Auto mode, Aero will operate as if there are no physical observers present to monitor the systems activity from hour to hour. Aero will collect sensor data, algorithmically process that data into report elements, and transmit report which contain the AUTO element.

While in Auto mode, Aero meets the operational requirements contained within section 3.1.1 of the ASOS SSD:

3.1.1 Automated Mode

[ASOS-1] ASOS must operate in 'Automated Mode' when neither an Observer nor an Air Traffic Controller is logged on to the system

[ASOS-2] ASOS must include the word AUTO as the report modifier in transmitted report when operating in 'Automated Mode'

When an observer or ATC user signs into the system, the system will enter SemiAuto mode which is synonymous with the ASOS term of Augmented mode. When Aero is operating in SemiAuto mode it meets the operational requirements contained within section 3.1.2 of the ASOS SSD:

3.1.2 Augmented Mode

[ASOS-3] ASOS must operate in 'Augmented Mode' when either an Observer or an Air Traffic Controller is logged on to the system.

[ASOS-4] When operating in 'Augmented Mode', ASOS must provide logged on Observers or Air Traffic Controllers the capability to add operationally significant weather information to observations and reports.

[ASOS-5] ASOS must omit the word AUTO as the report modifier in transmitted report when operating in 'Augmented Mode'.

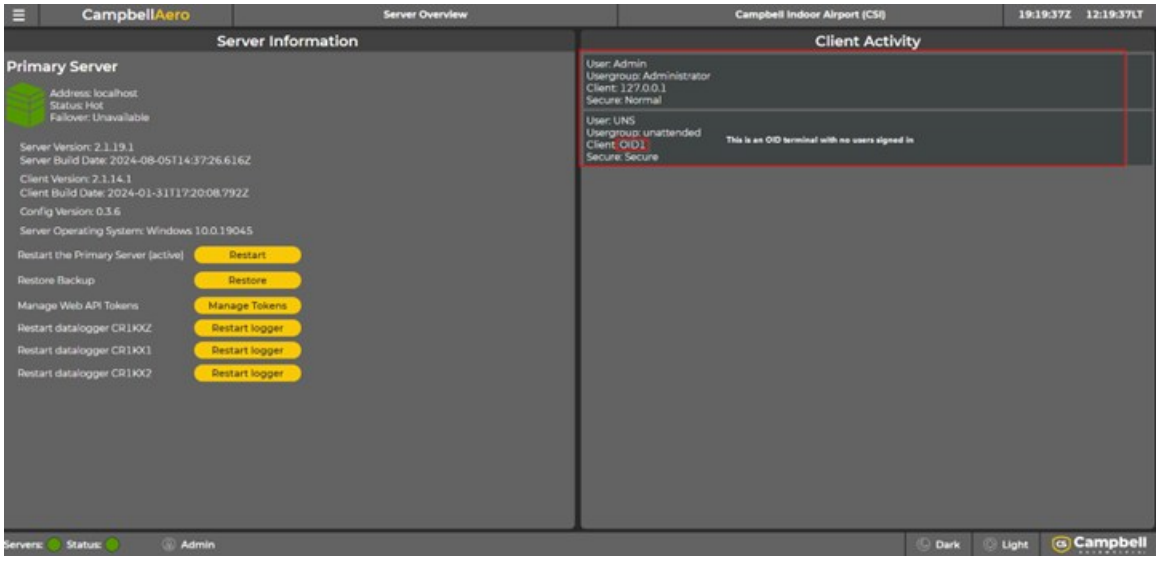
ASOS-4 refers to being able to add operationally significant weather information to observations. This is possible through the OID One-Minute Screen's EDIT functionality. In addition to the ingestion of the augmented data, Aero will also provide an edit window along with a timer at the top of the OID screen indicating the remaining time before report transmission.

6. Configuration tool

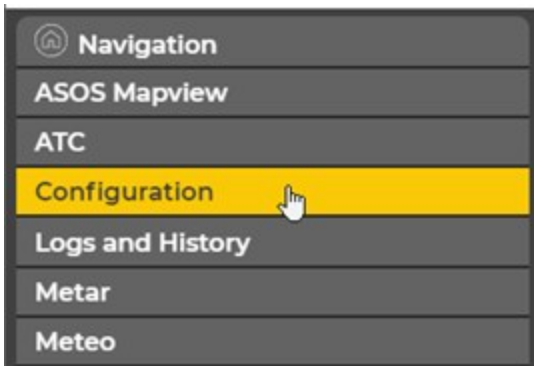
6.1 Accessing a live system's configuration

In order to access a live system's configuration, all Observer and Air Traffic Controller users must log off the system. Only Administrator and Technician accounts are able to log in during system configuration. Once all Observer and Air Traffic Controller users have logged off, we confirm this by signing in as an Administrator user and reviewing the Server Overview screen.

Ensure only Admin, Tech and Unsigned connections are active.



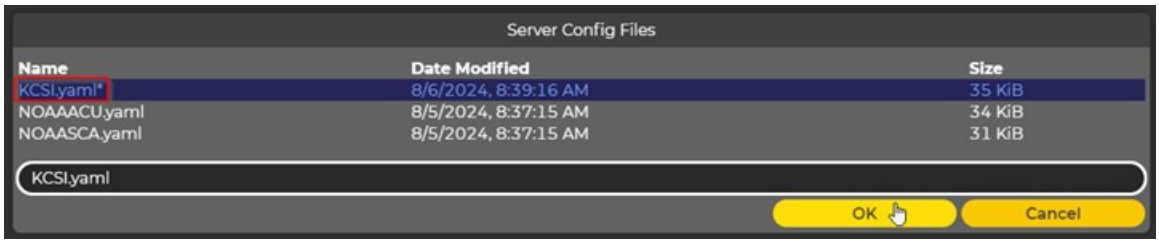
Once you are sure that only Admin and Technician users are signed in, use the navigation menu to view the **Configuration** screen.



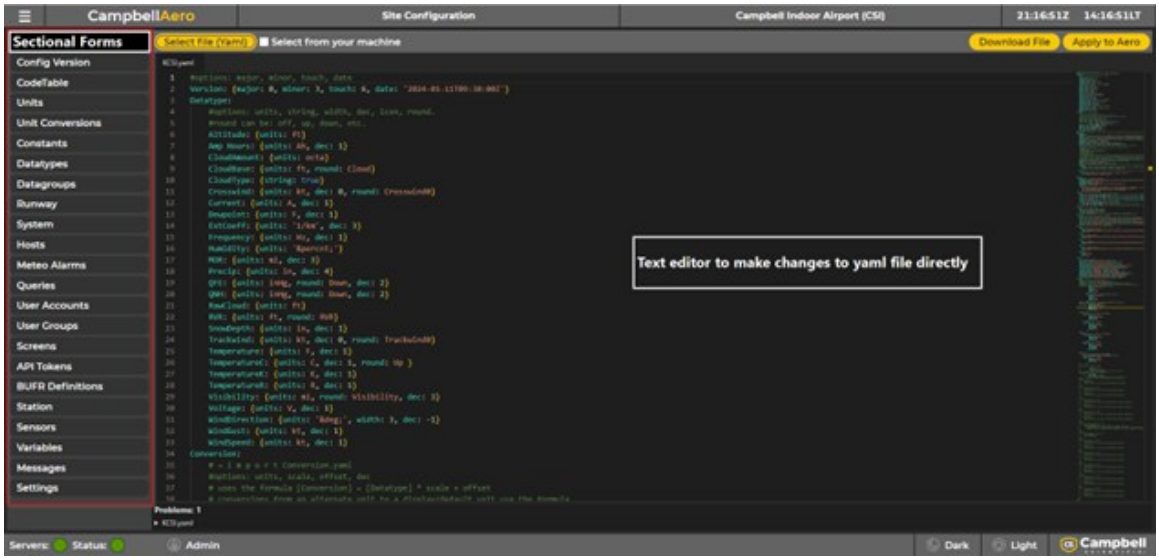
Click **Select file** to choose the active yaml file.

> **NOTE:**
> Note: If you are wanting to apply a configuration file which is local to the machine being used to access the ASOS, technicians can select **Select from your machine**.

The active yaml file will be marked with a '*' symbol. Select the desired configuration file and click **OK**.

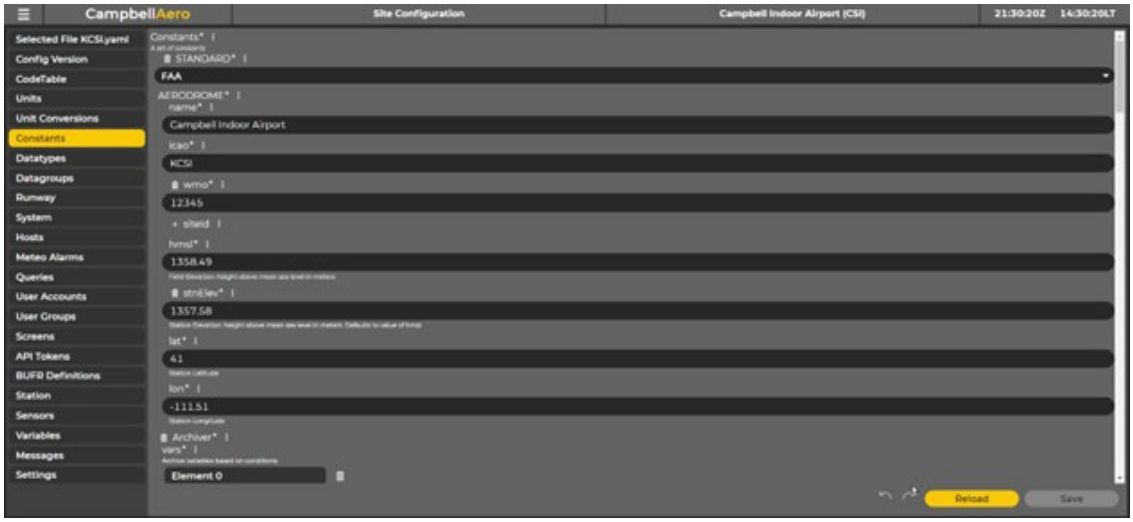


You will see a text editor with a sectional menu on the left:

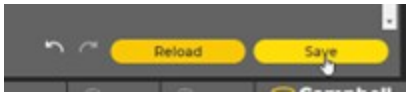


A technician can make edits to the yaml configuration file directly by using the text editor. Alternatively, a technician or administrator can use various forms dedicated to the sections of the yaml file.

By selecting a section from the menu on the left, a technician will be able to adjust the yaml configuration file by filling out a web form.



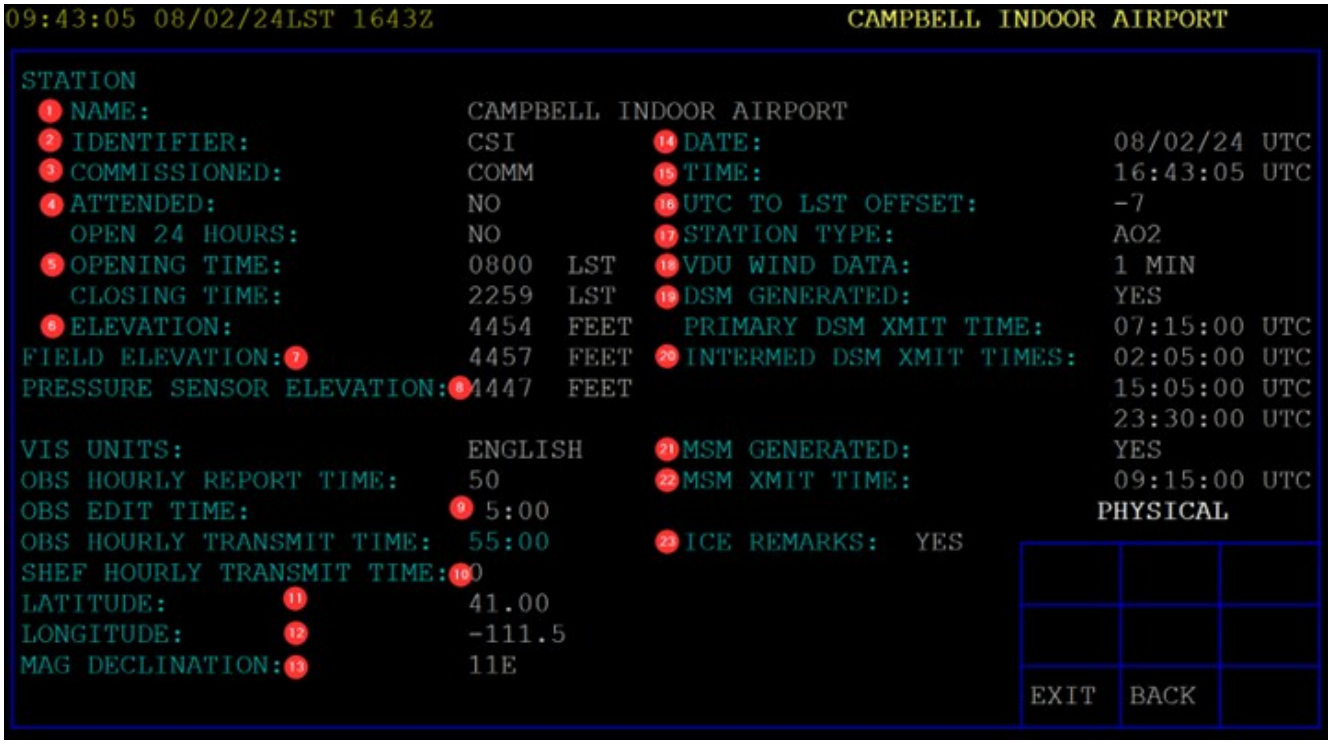
After a change is made through the web form, the technician must click **Save** at the bottom right corner of the screen.



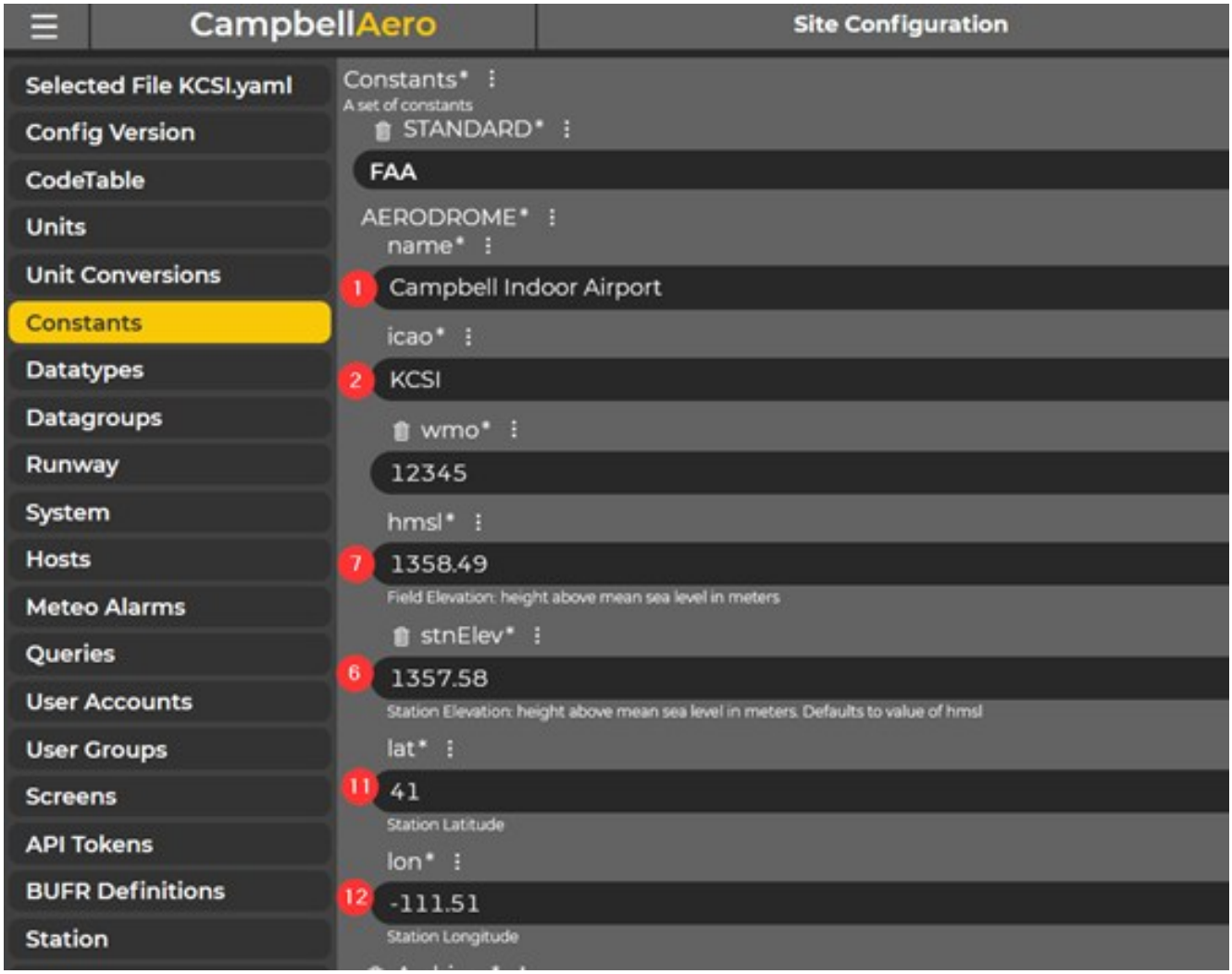
Then after returning to the yaml view (#1 in screenshot), a technician must click **Apply to Aero** (#2 in screenshot) to apply the saved changes to the system.

Applying the changes will restart the server:

6.2 Site physical configuration



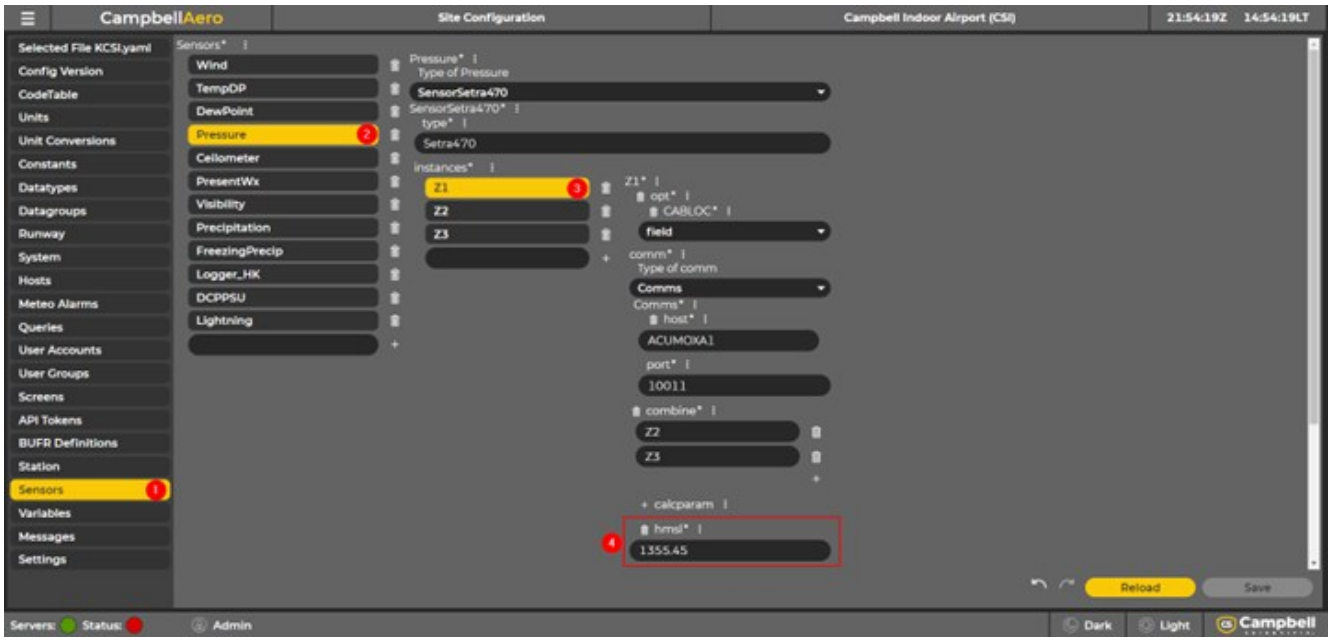
1: Airport Name, 2: Airport Identification Code, 6: Airport Elevation, 7: Field Elevation, 11: Latitude and 12: Longitude are found within the **Constants** section of the **Configuration** tool:



13: Magnetic Declination and 16: UTC Offset are also configurable within the **Constants** section. Aero will inherit the system time (14 and 15) from the host machine and apply the local time offset in order to generate timestamps seen in Aero.

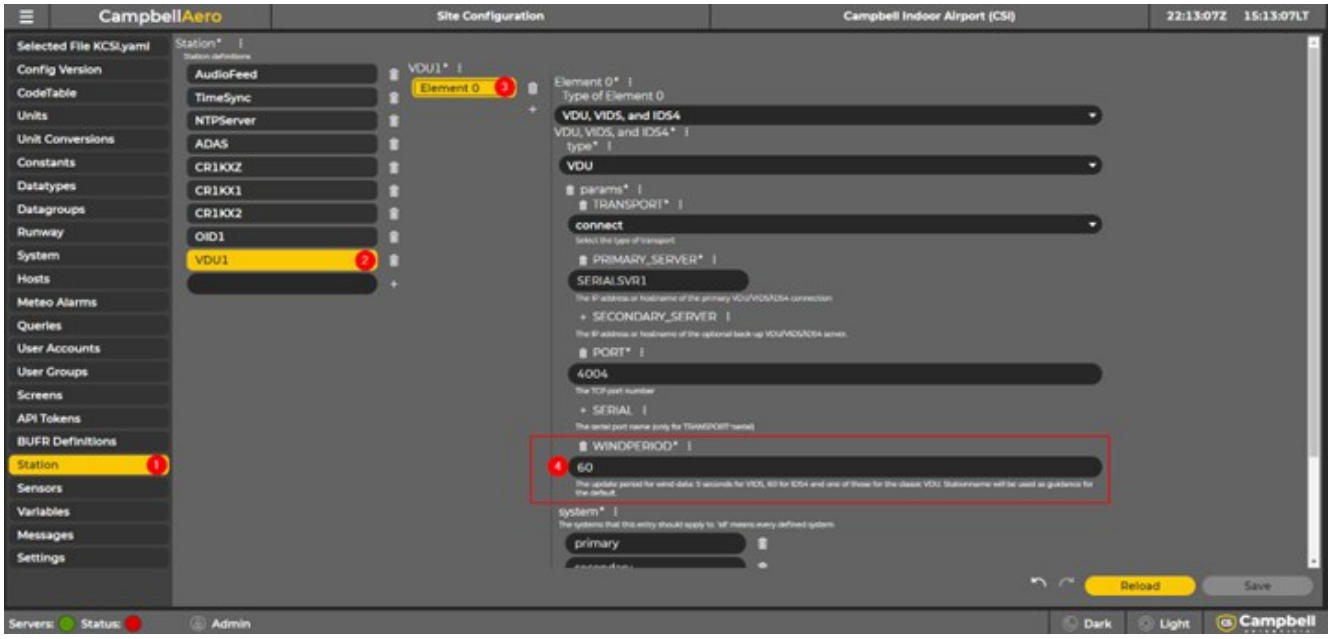
3: Commissioned Status, 4: Attended Status, 5: Opening/Closing Times, 10: SHEF Transmit Time, 17: Station Type, 19: Daily Summary Message Setting, 20: Daily Summary times, 21: Monthly Summary Setting, 22: Monthly Summary Transmit Time and 23: Ice Remarks can be configured within the **Settings** section.

8: Pressure Sensor Elevations can be configured through the **Sensors** section. Select **Pressure** then the instance which one is configuring. After selecting an instance, the technician will see an **hmsl** setting which is the height above mean sea level for that sensor.



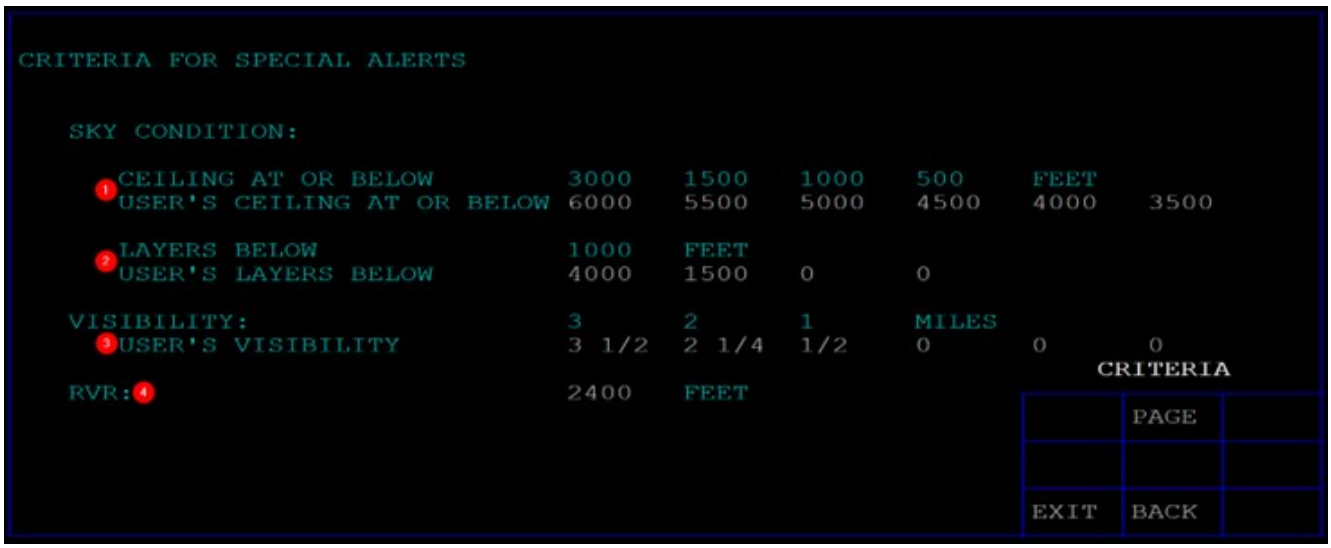
9: Observation Times are configured within the **Messages** section. Select the **METAR** report and find the **MetarTimer** parameters. The core parameters are **period**, **offset**, **editTime**, and **editTimeSpecial**. These parameters work together to determine the exact observation transmit time. See following image for more details.

18: VDU Wind Setting can be configured through the **Station** section. Select the VDU instance desired and adjust the **WINDPERIOD** parameter.



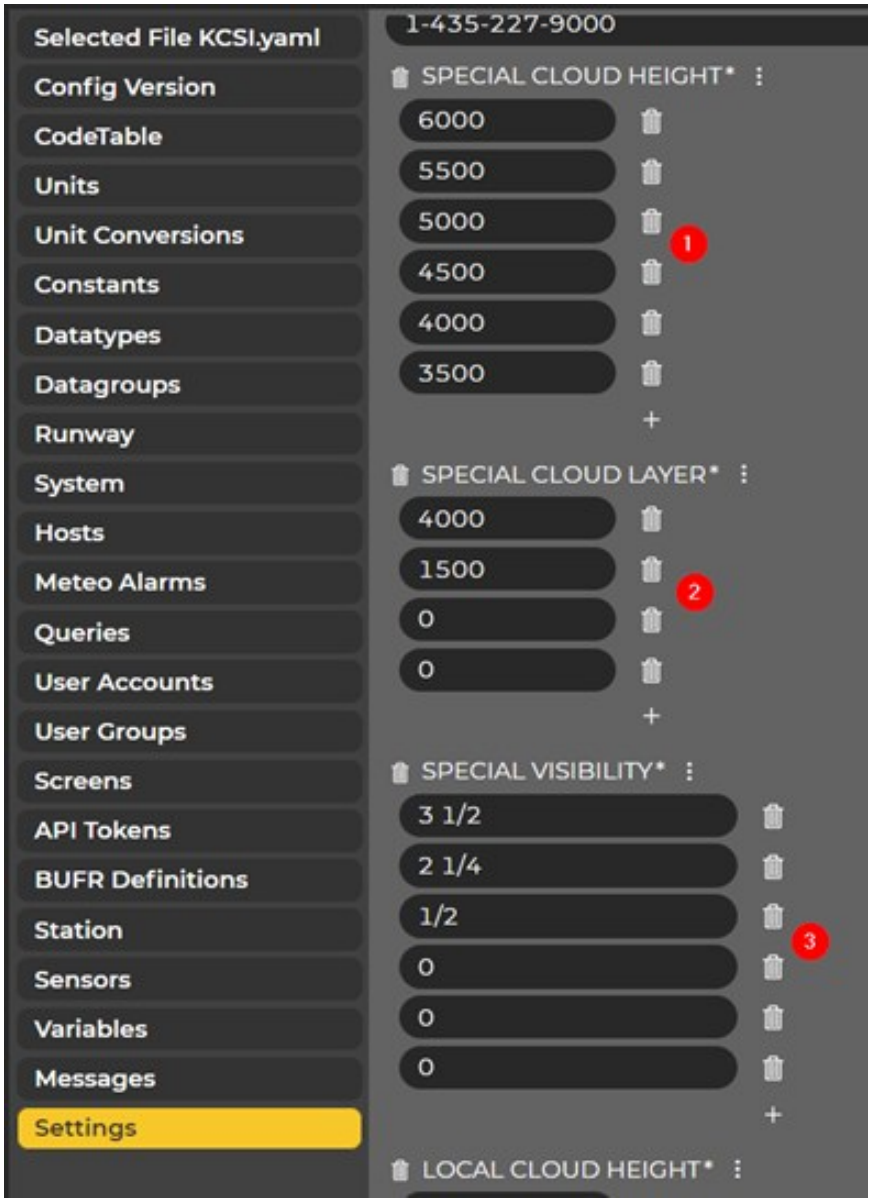
6.3 Special alert thresholds

The user's Sky Condition and Visibility Thresholds displayed on the REVUE/SITE/CRIT Page 1 OID screen can be configured through the **Settings** section of the **Configuration** tool.



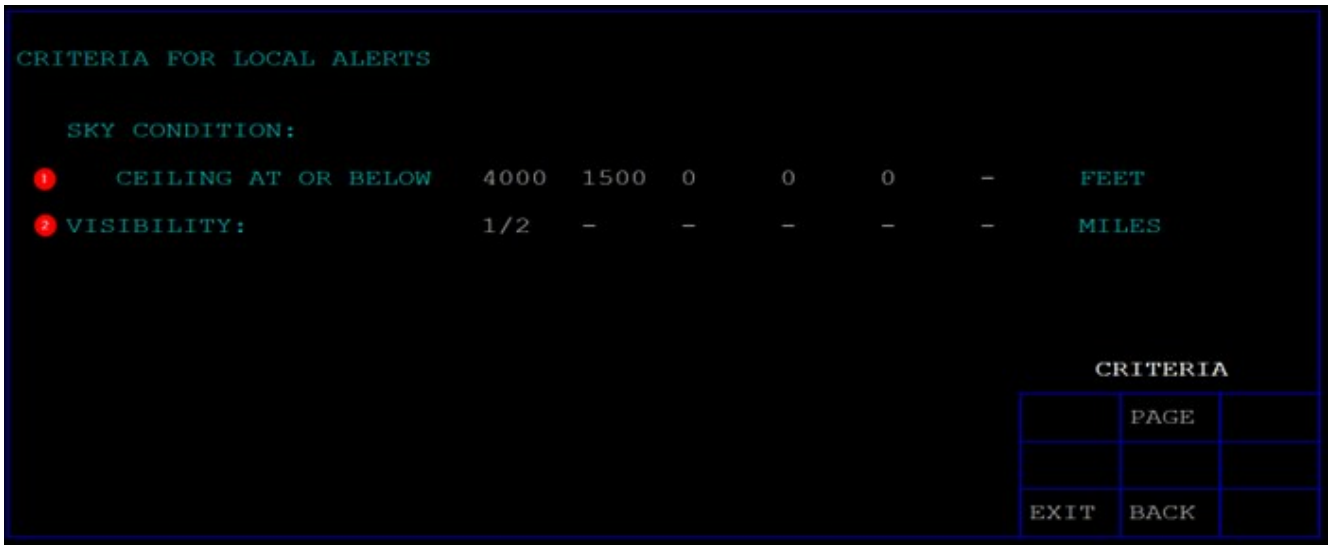
Thresholds must be entered from highest to lowest. The **Special Cloud Height** array will hold user configurable thresholds for the Cloud Height Special Alert method. The **Special Cloud Layer** array defines thresholds which will be used by the Cloud Layer Special Alert method. The **Special**

Visibility array defines the thresholds which will be used when determining Visibility Special Alerts. Finally, the **RVR** setting will define the threshold for triggering RVR Special Alerts.

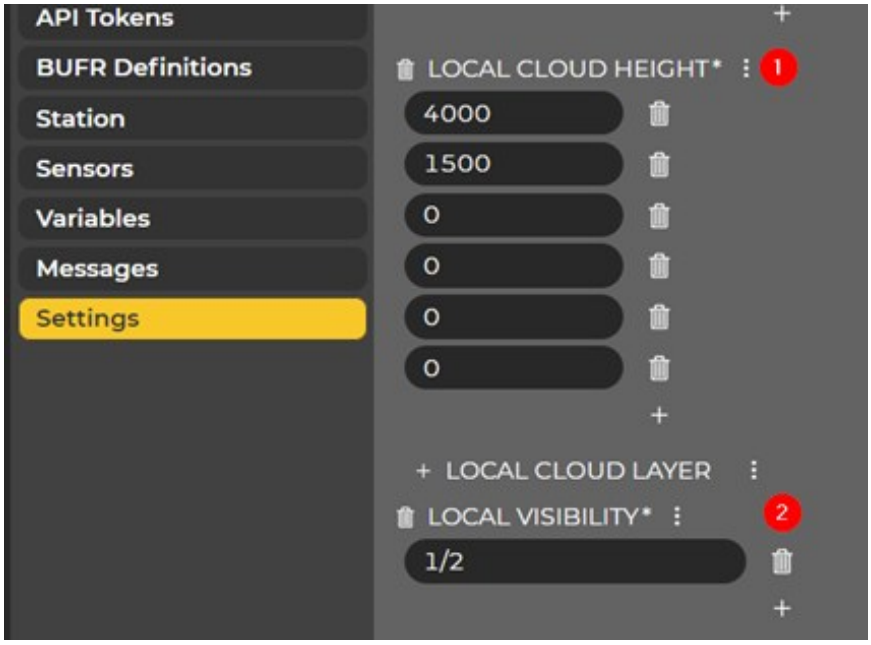


6.4 Local alert thresholds

Technicians can configure the Local Sky Condition and Visibility Alert thresholds found on REVUE/SITE/CRIT Page 2 OID screen within the **Settings** section of the **Configuration** tool.



Thresholds must be entered from highest to lowest. The **Local Cloud Height** array define the thresholds used when evaluating local Alert conditions. The **Local Visibility** array will define the thresholds which drive the generation of local alerts related to visibility conditions.



6.5 SHEF alert thresholds

Technicians can configure the SHEF alert thresholds found on REVUE/SITE/CRIT Page 3 OID screen from within the **Settings** section of the **Configuration** tool.

6.6 R-Values for pressure calculations

When producing pressure data products, Aero will take input from pressure sensors along with configured information such as station elevation, sensor elevation, and the associated pressure reduction ratios for various temperature values. The pressure reduction ratios are stored in an array which can be found within the Aero configuration file.

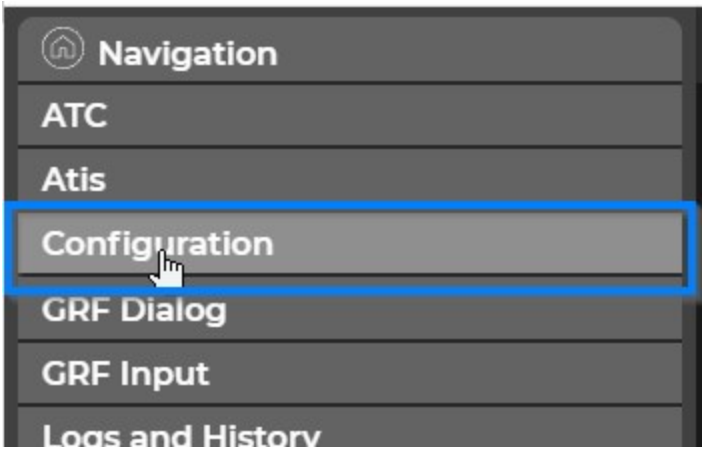
The process for adding this setting or adjusting ratio values is as follows:

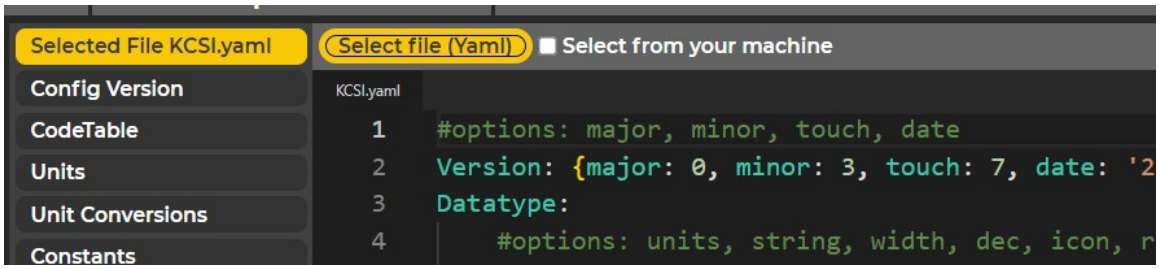
1. Identify the pressure reduction ratios relating to the temperatures from –70 to 129 degrees F.
2. Sign into Aero as an Administrator or Technician user. (Must have configuration privileges.)
3. Use the **Configuration** tool to add or modify the R-Values setting.
4. **Save and Apply** the configuration changes.
5. Restart Aero.

This section will outline these steps for a general case.

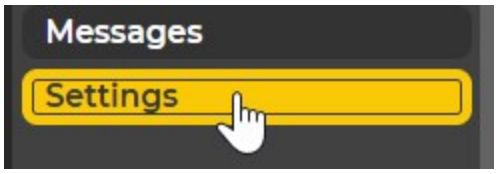
6.6.1 Using the Configuration tool to add or adjust R-values

1. Navigate to the **Configuration** editor and select your current configuration.



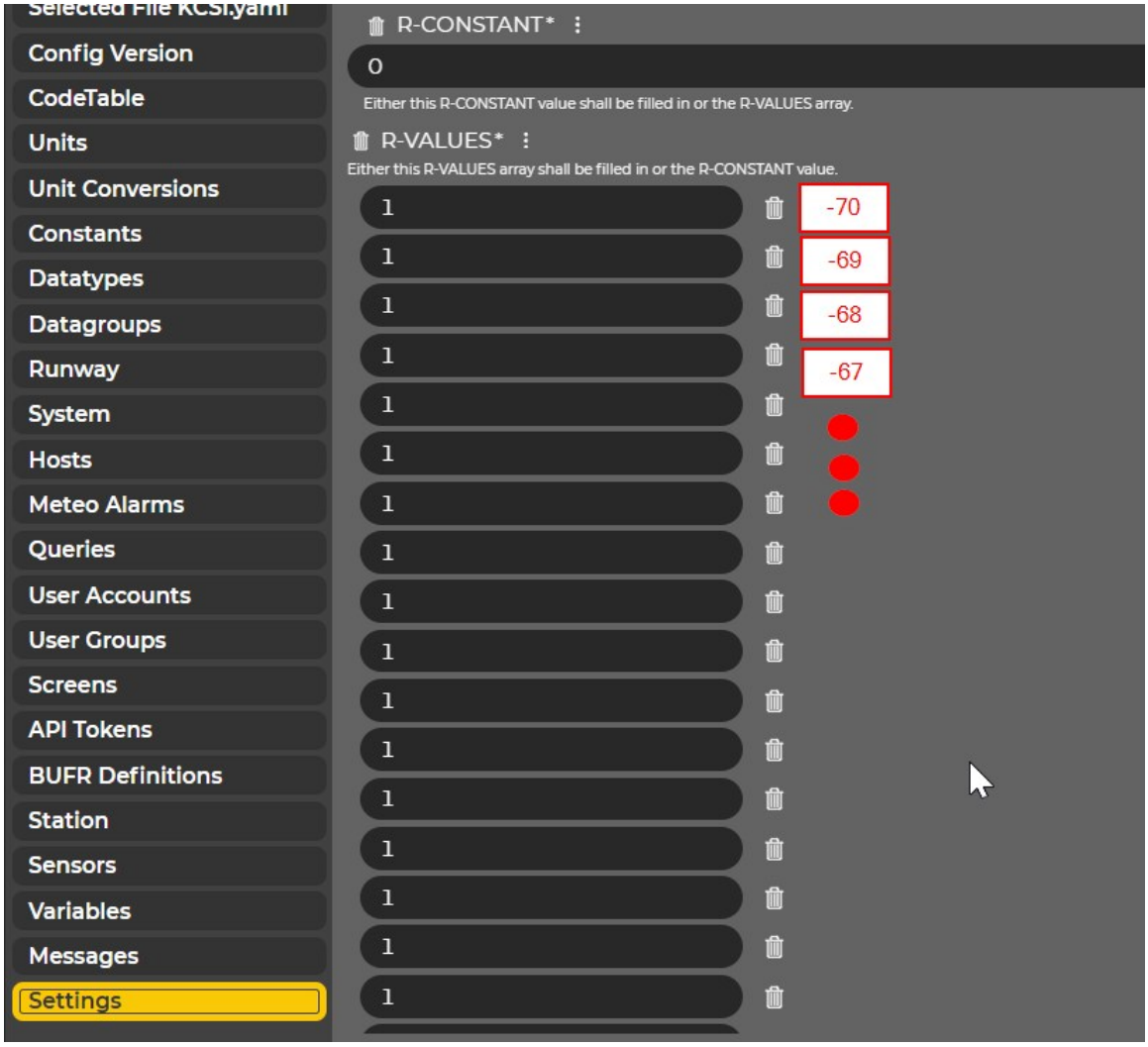


2. Choose the **Settings** section from the left-hand menu.

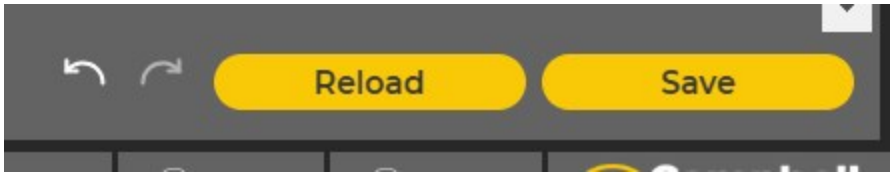


3. Find the **R-VALUES** setting within the list.

4. Fill in the associated ratio values. The array starts with –70 and as the fields descend on the screen, they represent numbers –70 to 129 F.



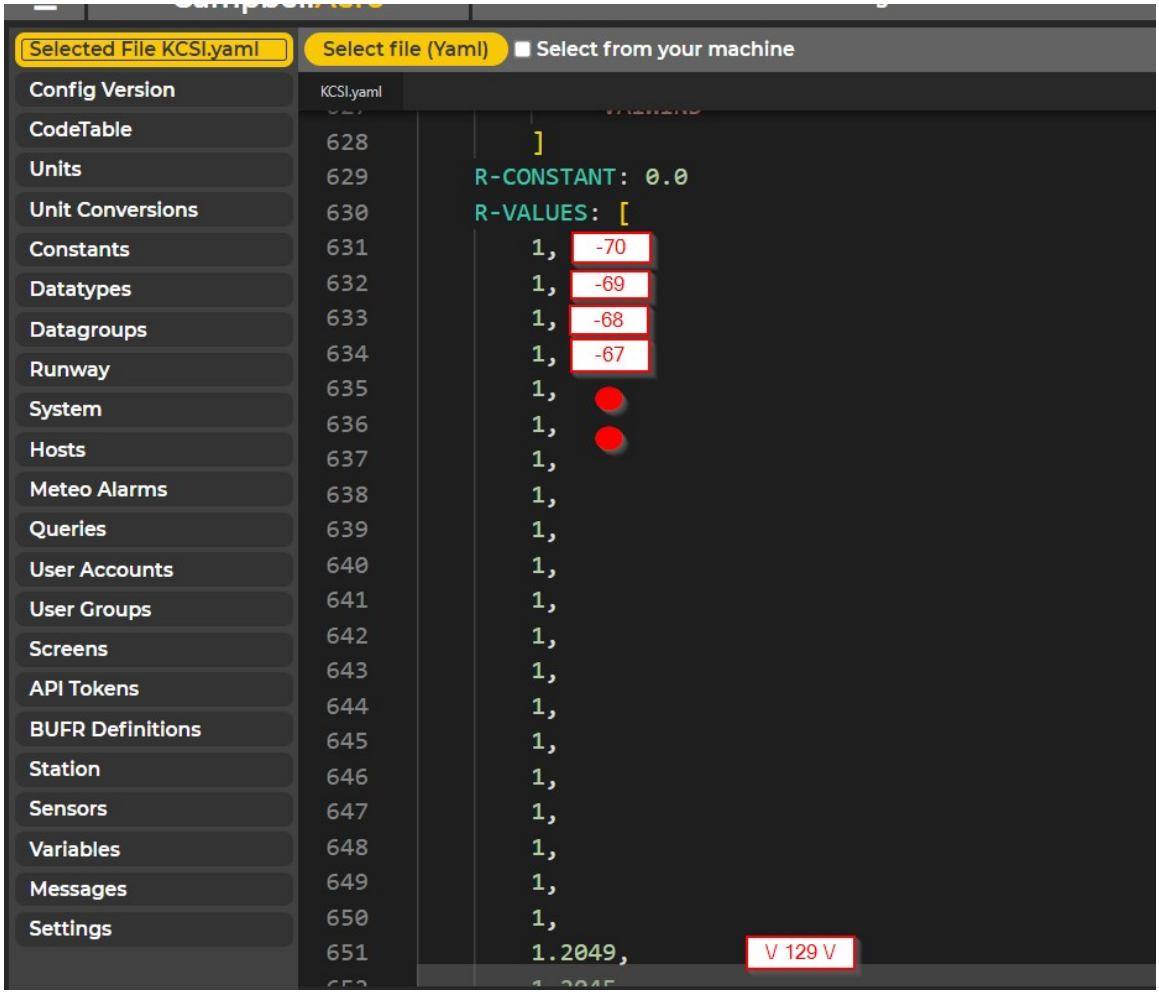
5. Once you have input the desired ratio values. Click **Save**.



6. Return to the selected file section and click **Apply**.

7. Aero will restart and the new values will be applied to the configuration.

8. Alternatively, the array of ratios can be input as a comma-separated list within the text editor section of the **Configuration** editor.



6.7 Permissions overview

Table 6-1 (p. 55) was adapted from Table 3 in the ASOS Software User's Manual.

Table 6-1: Permissions overview

Function	UNS	OBS	ATC	TECH	ADMIN	Access interface
SIGN Function	X	X	X			OID
Log In	X	X	X	X	X	Web Browser
Review	X	X	X			OID

Table 6-1: Permissions overview

Function	UNS	OBS	ATC	TECH	ADMIN	Access interface
Print (Except Remote Users)						No Longer Supported
Review METAR/SPECI Reports	X	X	X	X	X	OID/Web Browser
Review SHEF Reports	X	X		X	X	OID/Web Browser
Review 5-Min Reports	X	X	X	X	X	OID/Web Browser
Review Daily Summary Products and Messages	X	X		X	X	OID/Web Browser
Review Monthly Summary Products and Messages	X	X		X	X	OID/Web Browser
Review 1-Minute Sensor Data 12-Hr Archive	X	X		X	X	OID
Review Current 1-Minute Sensor Data	X	X		X	X	OID/Web Browser
Review Edit Log		X	X	X	X	OID
Review System Maintenance Log				X	X	Web Browser
Review Communications Log	X	X	X			OID
Print 1-Minute Screen with AUX Data						No Longer Supported
Activate/Deactivate Audible Alarms	X	X	X	X	X	OID
View Auxiliary Parameters	X	X	X	X	X	OID
Examine Manual Sensors (User Edited)	X	X	X	X	X	OID/Web Browser
Examine the Release Version and Install Date				X	X	Web Browser
Access Help Descriptions	X	X	X	X	X	OID

Table 6-1: Permissions overview

Function	UNS	OBS	ATC	TECH	ADMIN	Access interface
Generate SPECI Reports		X	X			OID
Generate Tornadic SPECI Reports		X	X			OID
Transmit SPECI Early/Correct a Transmitted Report		X				OID
Enter a Tower Visibility		X	X			OID
Cancel a Pending SPECI		X	X			OID
Edit/Augment 1 Minute Observation Data		X	X			OID
Turn Sensor Report Processing Off		X	X	X	X	OID/Web Browser
Add/Change Daily Summary Entries (EDIT)		X				OID
Request 2-Hr Archive of 5-Min Observations		X	X	X	X	OID
Select Voice Output			X			OID
Manually Record a 90-Second Message (NOTAM)			X			OID
Erase Manually Recorded 90-Second Messages			X			OID
Playback Manually Recorded 90-Second Message			X			OID
Change System Configuration				X	X	Web Browser
Review System Diagnostics				X	X	Web Browser
Change Site Physical Information				X	X	Web Browser
Change Selected Hardware Configuration				X	X	Web Browser
Change Selected External Interface Configuration				X	X	Web Browser

Table 6-1: Permissions overview

Function	UNS	OBS	ATC	TECH	ADMIN	Access interface
Change Selected Sensor Configuration				X	X	Web Browser
Change Selected ACU Serial Configuration				X	X	Web Browser
Make Entries in the System Maintenance Log				X	X	Web Browser
Reset System Hardware and Software				X	X	Web Browser
Reset DCPs				X	X	Web Browser
Assign/Change Remote Access					X	Web Browser
Change Selected Site Parameters Special Alert Thresholds SHEF criteria Site Pressure Data X Web Browser					X	Web Browser

6.8 Screens

Within the **Screens** section of the **Configuration** tool, administrators may provide access to various screens within the Aero web browser interface.

1. Select the screen you wish to edit or press + to add a new screen definition. The name of the screen must match an available html resource housed in the web folder inside the working directory of the Aero process.
2. Select User Groups which will have access to this screen. See the section of this document related to defining User Groups for more information.
3. Assign a nice name for the screen. The nice name is what will be displayed within the web interface navigation menu.
4. Determine whether navigating to this screen automatically signs in a user; this setting is either true or false.

6.9 User rights

An Administrator can assign the following rights to various user groups within the Aero **Configuration** Tool.

Table 6-2: User Rights

Right (Yaml)	Description
blocked_web	User cannot log in via the web interface.
can_alarm_ack	User can acknowledge alarms.
can_block_sensor	User can block the sensor data from being used in report generation.
can_cancel_scheduled	User can cancel a scheduled message (METAR).
can_change_opmode	User can change the operational mode of the system between Auto and Semi-Auto.
can_failover	User can manually trigger a failover from one server to the other.
can_qc_send	User can send a message which contains quality check errors.
can_send_aftn	User can manually send AFTN/GTS/AMHS messages.

Table 6-2: User Rights

Right (Yaml)	Description
can_view_aftn	User can view AFTN/GTS/AMHS message and settings.
can_view_blocked	User can view blocked sensors.
can_view_monitor	User can open Debug channels via the Technician screen.
can_auto_login	User can use the autologin client page/script.
can_change_config	User is able to access the **Configuration** tool and make changes to the active configuration.
get_alarm_hint	When an alarm is issued, users with this right will receive a notification.
get_alarm_popup	When an alarm is issued, users with this right will receive a popup dialog.
is_admin	User is an administrator and can use all features and capabilities.
is_supervisor	User is designated as a supervisor.
is_auto	System remains in Auto; user is in the Unattended user group with no interactive rights.
jump_all	User will get a popup to jump to newly activated messages.
generate_log_in_event	User log-in events will be logged in the security log.
view_log_in_event	User will get popups when other users log in or log out of the system.
user_cant_change_ password	These users are unable to change their own passwords.

6.10 Password policies

Within the Aero **Configuration** tool, a technician or administrator can define rules for the passwords allowed for each user group. The Password Policies are found within the **Constants** section of the configuration tool. Once the **Constants** tab has been selected. Find the **PWDPOLICY** constant. (1) Select which policy you would like to edit or press the + to add a new policy. The following table outlines the various configurable parameters for password policies.

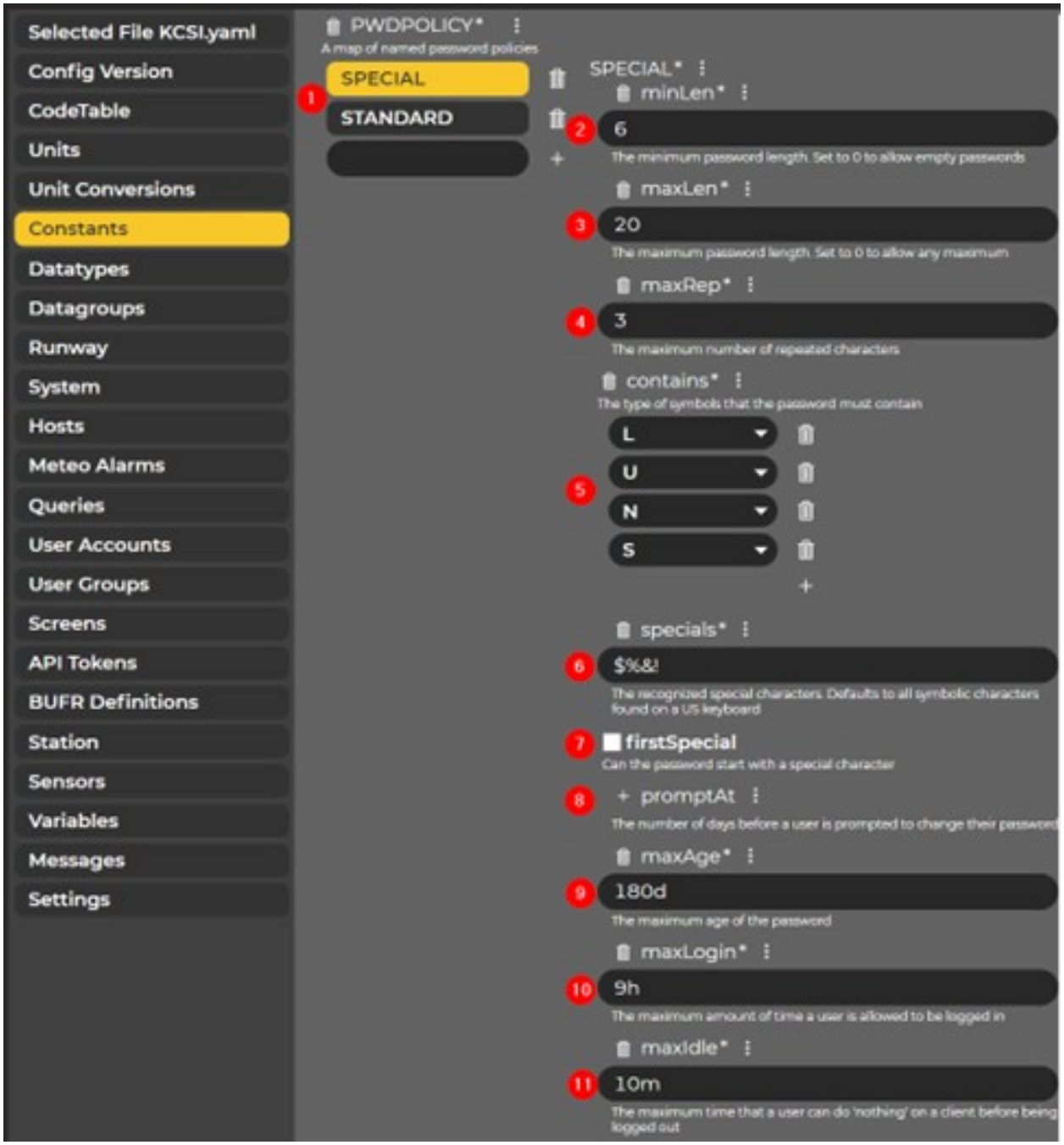


Table 6-3: Password policies

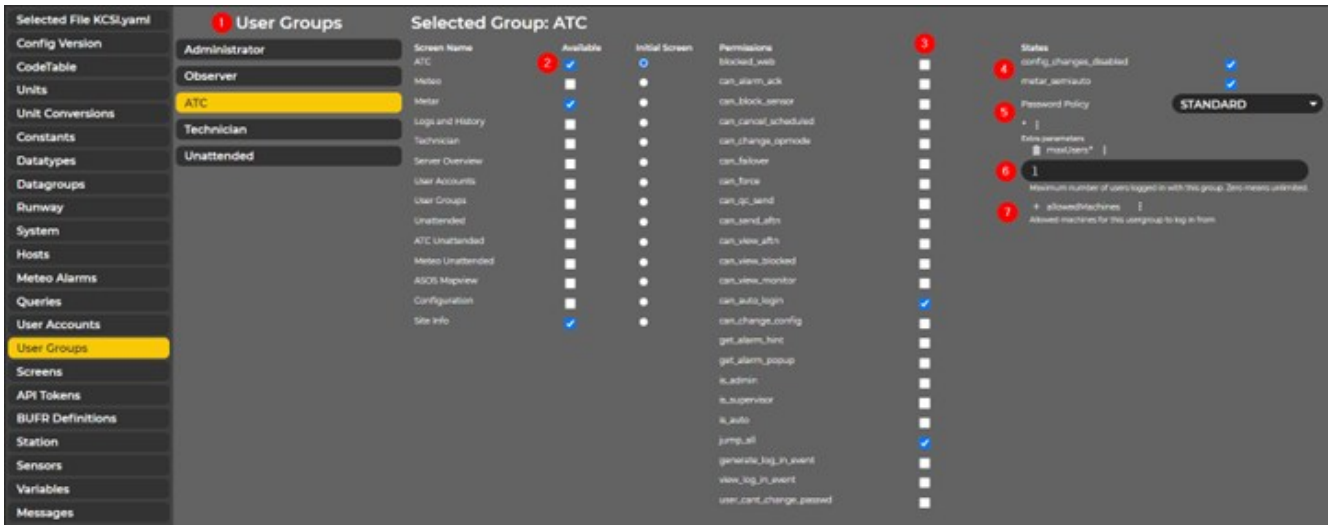
# from image	Parameter name	Description
2	MINLEN	Minimum length of a password, if 0 all lengths are ok. Default is 0.
3	MAXLEN	Maximum Length of a password, if 0 all lengths are ok. Default is 0.
4	MAXREP	Maximum number of repeated characters in a password. Default is 0 meaning no restriction is applied.
5	CONTAINS	Set up abbreviation for: LUNS = Lower, Upper, Numeric, Specials. Default is not set so no limitations.
6	SPECIALS	Set of characters that are marked to be 'special'.
7	FIRSTSPECIAL	Is the first character allowed to be a special character? TRUE or FALSE, default is TRUE.
8	PROMPTAT	The number of days before a user is prompted to change their password.
9	MAXAGE	Maximum time a password will be valid, using extension d for days. Default is 0 as no expiry time.
10	MAXLOGIN	The maximum allowable time that a user may remain logged in per session.
11	MAXIDLE	The maximum allowable time that a user may remain idle or 'do nothing' before the user is logged out. .

6.11 User group configuration

Pulling together the Screen, Permissions, Password Policies and additional parameters, the **User Groups** section of the **Configuration** tool allows administrators to define broad security and privilege access for groups of users.

1. First select the desired User Group for editing.
2. Assign screens which this user can access and designate one of the screens as the **Initial Screen** after sign in.
3. Select the appropriate permissions from the list of available user permissions.
4. Designate any system state effects such as disabling configuration changes when logged in or causing the system to enter the Semi Auto operation mode.

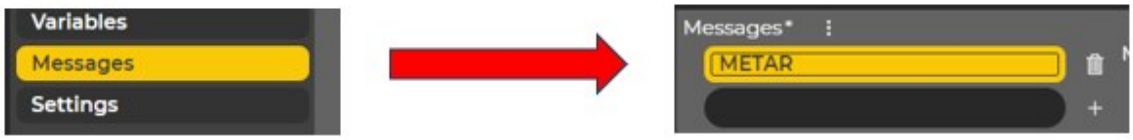
5. Assign a password policy for the user group selecting from the configured password policies. If no policies are available, see Password policies (p. 61).
6. Indicate how many users may be simultaneously logged in from this user group.
7. Indicate how many unique machines (terminals) may log into this user group.

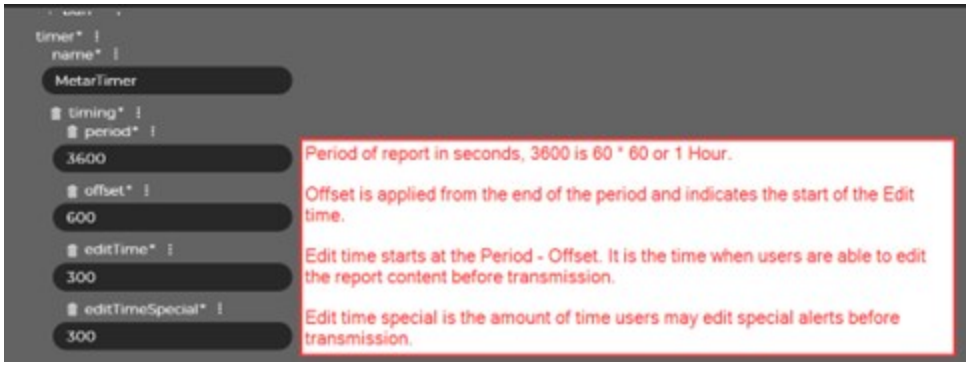


6.12 Message configuration

6.12.1 METAR

Within the **Messages** section of the **Configuration** tool, administrators and technicians can adjust report transmission times.





A period of 3600 (1 hour) with an offset of 600 (10 Min) means that at 50 minutes after each hour the edit time starts. With an edit time of 300 (5 Min) the METAR will transmit at 55 minutes after the hour.

6.12.2 OMO

To generate OMO reports, enable the **GENERATE OMO** setting. Enable the **OMO Magnetic Wind** to have OMO report wind with respect to magnetic north.

6.13 Declination

The site declination can be set within the **Constants** section of the **Configuration** tool.

A negative **declination** is east; positive is west. The **sensor** parameter determines whether the wind senor references True or Magnetic North.

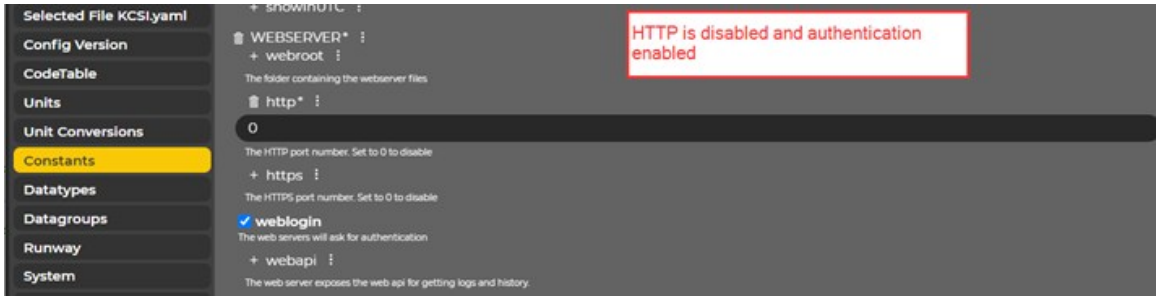
6.14 Time zone and UTC offset

Time settings are found within the **Constants** section of the **Configuration** tool. Look for the **TIMEZONE** constant.

The **stdOff** parameter is the UTC offset. The **tzFormat** option can be used to adjust from Universal Standard Time and Local Standard Time.

6.15 HTTP and HTTPS

To configure settings related to HTTP and HTTPS see the **Constants** section of the **Configuration** tool. Look for the **WEBSERVER** constant.



Setting **http** to 0 disables access through HTTP. Enabling the Web API provides remote access to the Logs and History API.

6.16 Sensor configuration

See Maintenance Interface (p. 68) for specific details regarding Visibility and Ceilometer sensor configuration. Sensor configuration is done within the **Sensors** section of the **Configuration** tool.

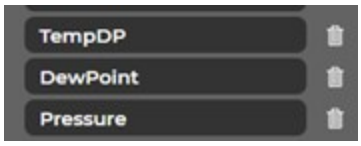
6.16.1 Sensor definition ordering

When Aero reads the configuration file, various calculations and variables will be initialized depending upon which sensors and interfaces are defined within the configuration. There are dependencies between sensors which require special ordering within the configuration file.

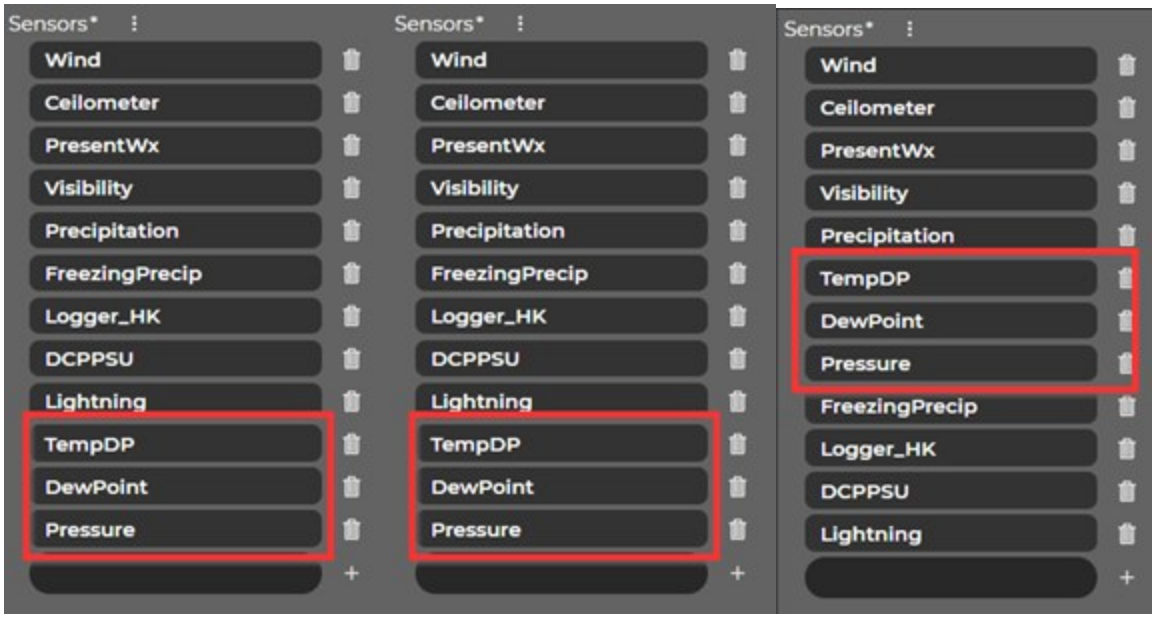
The inter-sensor dependencies are as follows:

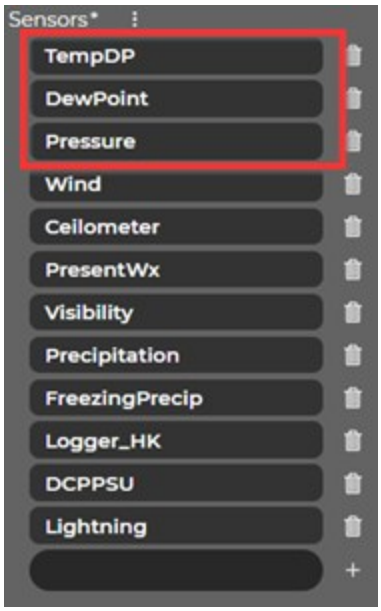
1. Pressure depends upon TempDP. in order to have pressure sensors configured, they must be after the TempDP sensor definition.

2. Dewpoint depends upon TempDP, in order to have dewpoint sensors configured, they must be after the TempDP sensor definition. It is generally best to group TempDP, Dewpoint, and Pressure together in this ordering.

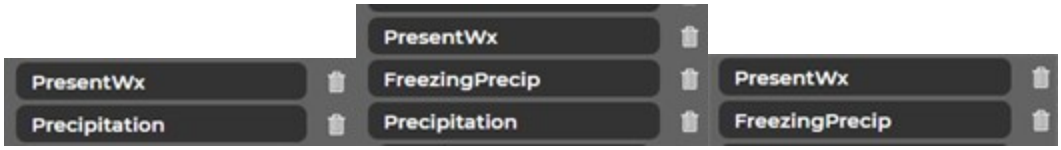


The TempDP, Dewpoin,t and Pressure grouping can appear in any location within the other sensor definitions. All of the following orderings are valid.





3. Precipitation and FreezingPrecip both depend upon PresentWx. In order to have either a Precipitation and/or FreezingPrecip sensor, they must be after the PresentWx sensor definition. Between Precipitation and FreezingPrecip there are no sensitivities. As long as they occur after PresentWx, both the FreezingPrecip and Precipitation sensors can be above and below the other. They are also exclusive in that you can have one, the other, or both with no difference. All three of the following are valid orderings.



All other sensors and devices can be configured in any order desired.

6.16.2 Default sensor configuration

Table 6-4: Default sensor configurations

Sensor name	Polling interval	IP port	Host device	SDM port	System
TD1088	10 Sec	3002	DCP 1/SCA Logger	SDM2 /SDM6	ACU/SCA
Ho83R	10 Sec	3002	DCP 1/SCA Logger	SDM2	ACU/SCA
DTS1	10 Sec	3003	DCP 1/SCA Logger	SDM3 / SDM7	ACU/SCA
Setra 470 1	10 Sec	4001	ACU/SCA Logger	SDM1	ACU/SCA
Setra 470 2	10 Sec	4002	ACU/SCA Logger	SDM2	ACU/SCA
Setra 470 3	10 Sec	4003	ACU/SCA Logger	SDM3	ACU/SCA
OWI 240	1 Min	3004	DCP 1/SCA Logger	SDM4	ACU/SCA
Rosemount 872C3	1 Min	3007	DCP 1/SCA Logger	SDM7	ACU/SCA
Belfort 6200 Primary	1 Min	3008	SCA Logger	SDM8	SCA
Belfort 6200 Primary	1 Min	3008	DCP 1 Logger	SDM8	ACU
Belfort 6200 Disc	1 Min	3008	DCP 3 Logger	SDM10	ACU
Belfort 6200 Backup	1 Min	3008	DCP 2 Logger	SDM10	ACU
CL 31 Primary	30 Sec	3006	SCA Logger	SDM6	SCA
CL 31 Primary	30 Sec	3006	DCP 1 Logger	SDM6	ACU
CL 31 Discontinuity	30 Sec	3006	DCP 3 Logger	SDM9	ACU
CL 31 Backup	30 Sec	3006	DCP 2 Logger	SDM9	ACU

Table 6-4: Default sensor configurations

Sensor name	Polling interval	IP port	Host device	SDM port	System
NWS 425	5 Sec	3005	DCP 1/SCA Logger	SDM5 / SDM8	ACU/SCA
WMT 700	5 Sec	3005	DCP 1/SCA Logger	SDM5 / SDM8	ACU/SCA
AWPAG	1 Min	3001	DCP 1/SCA Logger	SDM1 / SDM5	ACU/SCA
Frise 7405HA	1 Min	Logger	DCP 1 Logger	Pulse Port 1	ACU
Frise 7405HA	1 Min	Logger	SCA Logger	Pulse Port 1	SCA
TSS 924	1 Min	3011	DCP 1/SCA Logger	SDM11	ACU/SCA
TSS 928	1 Min	3011	DCP 1/SCA Logger	SDM11	ACU/SCA

6.17 Additional settings

ICEFREWD DS-AVG: Defines the NWS 425/WMT 700 wind averaging time.

ICFREEPKWD DS-AVG: Defines the NWS 425/WMT 700 peak wind averaging time.

FZ STATUS: Defines the period of the year when the Freezing Precip sensor is seasonally disabled.

R-CONSTANT: This value is used in the generation of Pressure Data Products

R-VALUES: These values correspond to temperature values and are used to generate Pressure Data Products

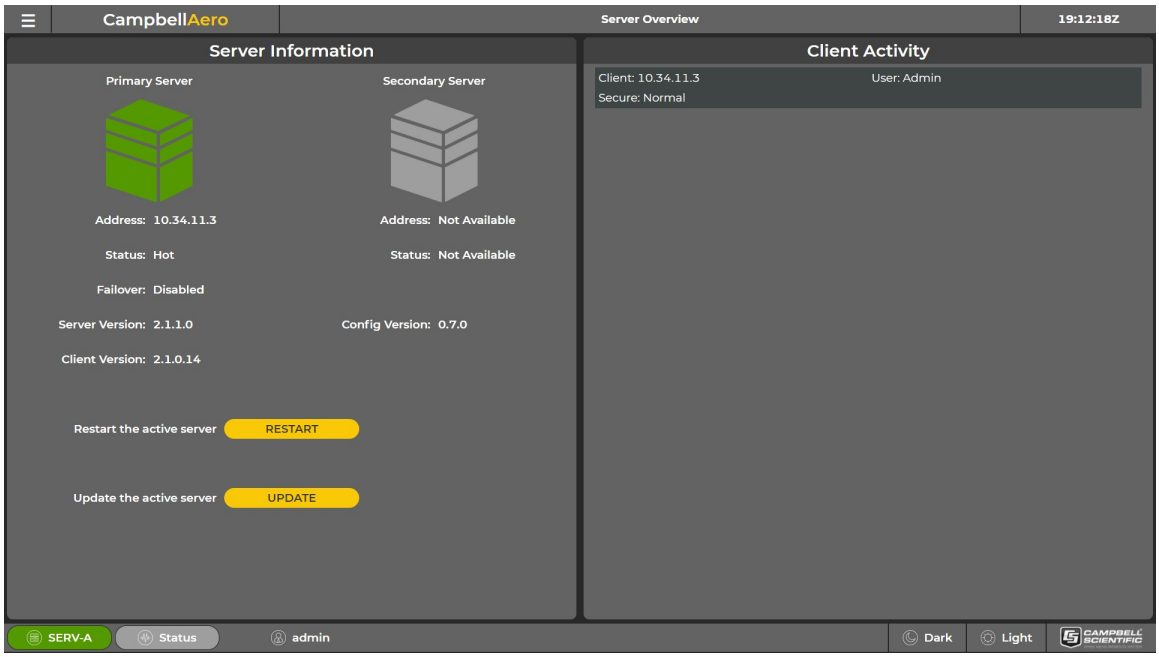
7. Maintenance Interface

The **Maintenance Interface (MI)** is a monitoring and event logging system. The ASOS will regularly poll devices for available diagnostic data. The **MI** monitors all components which are capable of reporting status/diagnostic information within the system. This includes power supplies, radios, serial bridges, loggers, embedded controllers, over voltage protection, etc. Components incapable of providing diagnostic or operational information to the ASOS are not monitored. This data is visible on the **Technician** screen within the **Sensor Status** window. The **MI** will produce various log messages each with unique numeric codes and a description of the reason for the log event. There are sensor configurations, sensor drivers, sensor quality checks, and post processing algorithms. The **MI** reports events produced by the weather and reporting algorithms otherwise known as the Documented Weather Algorithms or DWAs. The **MI** monitors the report processing of each sensor reacting to various events affecting report generation. The

MI monitors connected devices and protocols such as ADAS, OID, VDU, etc. For a comprehensive list refer to Aero MI maintenance codes (p. 123). The MI allows for the configuration and maintenance of ASOS sites through a Configuration Editor Tool. It also allows a user to retrieve logs, variable histories, algorithm outputs and execute configured queries for data analysis. The MI provides a Maintenance Log where events and their resolution can be seen. It allows a user to manually enter messages into the Maintenance Log. The MI allows a technician to enter commands to interact with the Maintenance Interface. Due to the distributed nature of the Maintenance Interface, there is no single location where all functionality within the MI can be accessed. Rather there are context specific screens and tools available to provide the monitoring, diagnostic, and maintenance capabilities. These different UIs will be detailed in this document along with instructions on how to access certain feature sets as well as perform maintenance operations on the ASOS.

The MI access points and their available functions include:

- Technician screen: Allows technicians to monitor sensor communications and protocol debug channels. Provides visibility into the system variables where live data is available for review. Displays system alarms with the ability to acknowledge or resolve them. Provides a number of debug channels which can be used to diagnose and monitor the ASOS. Debug channels relate to sensor communications, protocol activity, logger communications as well as internal Aero modules. Allows a user to review and make manual entries to the Maintenance Log.
- Logs and History screen: This screen allows the user to retrieve system logs, variable histories, and run configured queries to retrieve values from the ASOS database/archive.
- Server Overview screen: Displays the status of the embedded controllers hosting the Aero software with-in the ASOS. Provides a technician the ability to update the software, toggle which server is the hot server hosting the running Aero application as well as view information regarding the version of the software. This screen displays the active connections to the server and which users are signed into the ASOS.



- **Configuration Editor Tool**: Allows the creation of a new configuration file (or the modification of an existing configuration file) to the extent necessary to configure a new site.

7.1 ASOS configuration files

The Campbell Aero system has two configuration files. One configures the Aero application and is known as the Configuration Yaml. The Yaml defines many aspects of the Aero software including sensors, connections to protocols, interfaces and details related to the DCPs and sensor locations. The default configuration of Aero has configuration files configured for a basic 1, 2, and 3 DCP setups; there is a default configuration for SCA systems as well. The Configuration Editor Tool l is used to perform this initial configuration or any subsequent major configuration changes.

The second configuration file configures the Campbell CR1000X data logger and how it connects directly to the sensors. This is stored on the logger itself and is a group of values indicating which sensors are actively connected to that logger and details relating to the connections with that sensor.

7.2 Sensors, devices, and components monitored by the MI

Table 7-1: Sensors, devices, and components monitored by the MI

Sensor name	Sensor type	Sensor interval	MI code group
NWS 425	Wind	5 Seconds	1000
TSS 924	Lightning	1 Minute	1100
DTS1	Dewpoint	10 Seconds	1200
AWPAG	Precip. Weight	1 Minute	1300
OWI 240	Present Weather	1 Minute	1400
Belfort 6200 Primary	Visibility	1Minute	1500
Rosemount 872C3	Precip. Freezing	1 Minute	1600
Frise 740HA	Precip. Tipping	1 Minute	1700
TD 1088	Air Temp/Dewpoint	10 Seconds	1800
Ho83R	Air Temp/Dewpoint	10 Seconds	1900
Setra 470	Pressure	10 Seconds	2000
Setra 470	Pressure	10 Seconds	2100
Setra 470	Pressure	10 Seconds	2200
CL 31 Primary	Ceilometer	30 Seconds	2300
TSS 928	Lightning	1 Minute	2400
RVR	RVR	! Minute	2500
WMT 700	Wind	5 Seconds	2600
System	System Status	Async	3000
Belfort 6200 Backup	Visibility	1 Minute	3100
Belfort 6200 Disc.	Visibility	1 Minute	3200
CL 31 Backup	Ceilometer	30 Seconds	3300
CL 31 Disc.	Ceilometer	30 Seconds	3400
DCP 1	Data Logger	1 Minute	3500

Table 7-1: Sensors, devices, and components monitored by the MI

Sensor name	Sensor type	Sensor interval	MI code group
DCP 2	Data Logger	1 Minute	3600
DCP 3	Data Logger	1 Minute	3700
Sky Condition Algorithm	Algorithm	1 Minute	4000
Visibility Algorithm	Algorithm	1 Minute	4100
Temperature Algorithm	Algorithm	1 Minute	4200
Wind Algorithm	Algorithm	1 Minute	4300
Pressure Algorithm	Algorithm	1 Minute	4400
Present Weather Algorithm	Algorithm	1 Minute	4500
Precipitation Algorithm	Algorithm	1 Minute	4600
RVR Algorithm	Algorithm	1 Minute	4700
Data Distribution Algorithm	Algorithm	1 Minute	4800
Eaton	Uninterruptable Power Supply	1 Minute	5600
Alpha #1	Uninterruptable Power Supply	1 Minute	5700
Alpha #2	Uninterruptable Power Supply	1 Minute	5800
Alpha #3	Uninterruptable Power Supply	1 Minute	5900
MOXA 6500	Serial Bridge	1 Minute	6200
ACU PSU	Power Supply	1 Minute	6300
DCP PSU	Power Supply	1 Minute	6400
ACU	Embedded Controller	1 Minute	7400
VDU	Display	1 Minute	7600
OID (May have multiple end points)	Display	1 Minute	7700
EDS 408a	Serial Device	1 Minute	7800

Table 7-1: Sensors, devices, and components monitored by the MI

Sensor name	Sensor type	Sensor interval	MI code group
ACE-IDS	Protocol	1 Minute	8200
Navy-ATC	Protocol	1 Minute	8700
WSP	Protocol	1 Minute	8900
GTA Radio	Radio	1 Minute	9000
Phone	Phone	Async	9100

7.3 Alternate sensor configurations

For most of the sensor types within the ASOS system there are alternative configurations.

This section will outline the possible configurations and how to configure them within the Aero Configuration Yaml file.

> **NOTE:**
> The host and port assignments may need to be changed to meet the physical connections present within the ASOS system being configured.

Temperature:

TD1088 Alone:

The TD1088 can produce both Ambient Air Temperature as well as Dewpoint Temperature.

```
TempDP: {
  # Main source for AT, Backup for DP,
  type: TD1088,
  period: 10Sec,
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  '1': { comm: {host: DCPDL1, port: 3002} }
  }
}
```

TD1088 With DTS1:

Notice how the TD1088 definition now contains the combine calculation parameter. This instructs Aero to use the DTS1 as the source for Dewpoint and the TD1088 as the backup Dewpoint source.

```
TempDP: {
  # Main source for AT, Backup for DP,
  type: TD1088,
  period: 10Sec,
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  '1': { comm: {host: DCP1, port: 3002}, combine: ['11'] }
  }
}
DewPoint: {
  # Main source for DP
  type: DTS1,
  period: 10Sec,
  instances: {
  '11': { comm: {host: DCPDL1, port: 10051 } }
  }
}
```

Ho83R With DTS1:

The Ho83R can fill the place of the TD1088 and must include the combine calculation parameter. This instructs Aero to use the DTS1 as the source for Dewpoint and the Ho83R as the backup Dewpoint source.

```
TempDP: {
  # Main source for AT, Backup for DP,
  type: TD1088,
  period: 10Sec,
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  '1': { comm: {host: DCPDL1, port: 3002}, combine: ['11'] }
  }
}
DewPoint: {
  # Main source for DP
  type: DTS1,
  period: 10Sec,
  instances: {
  '11': { comm: {host: DCPDL1, port: 10051 } }
  }
}
```

Wind:

NWS 425:

```
Wind: {
  #options: type, period, poll, alarmlimit, geostatus, icon, params.
  type: WS425,
  period: 5Sec,
  alarmlimit: 5,
  geostatus: { maxTimeout: 3h, defTimeout: 1h },
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  '1': { comm: {host: DCPDL1, port: 3001 }}
  }
}
```

WMT 700:

```
Wind: {
  #options: type, period, poll, alarmlimit, geostatus, icon, params.
  type: WMT700,
  period: 5Sec,
  alarmlimit: 5,
  geostatus: { maxTimeout: 3h, defTimeout: 1h },
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  '1': { comm: {host: DCPDL1, port: 3001 }}
  }
}
```

Lightning:

TSS 924:

```
Lightning: {
  # We do 1 sample per 60 seconds.
  type: TSS924,
  period: 1Min,
  instances: {
  '1': { comm: {host: DCPDL1, port: 3011 } }
  }
}
```

TSS 928:

```
Lightning: {
  # We do 1 sample per 60 seconds.
  type: TSS928,
  period: 1Min,
  instances: {
  '1': { comm: {host: DCPDL1, port: 3011 } }
  }
}
```

Precipitation :

AWPAG:

```
Precipitation: {
  # We do 1 sample per 1 minute.
  type: AWPAG,
  period: 1Min,
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  '1': { comm: {host: DCPDL1, port: 10008 } }
  }
}
```

Frise 740HA:

```
PrecipTip: {
  # We do 1 sample per 1 minute.
  type: StdBucket,
  period: '1Min',
  instances: {
  #options: host, port, speed, combine, calcparam, hmsl, opt, logger
  Z: { comm: {logger: CR1KXZ }}
  }
}
```

Ceilometer and Visibility Sensors:

The ceilometers and visibility sensors may have multiple instances of the same sensor with varying roles.

There are three roles: Primary, Backup and Discontinuity. In order forCampbell Aero to construct the ecosystem of, drivers, variables, sensor roles, quality check calculations, weather and reporting algorithms, we must have one of the defined sensors assigned to the Primary role. It is entirely possible to have a Primary sensor defined and assigned the role of Primary, as well as have that sensor inoperative or otherwise dysfunctional. The configuration involves two separate locations within the Yaml file. The Sensor definition where instances are outlined and the Location array in Settings. For the Sensor definitions, when there is only one sensor defined it

must be the Primary and the combine setting should be omitted. Within the Settings there are location arrays used by the OID screen. The letter indicates the cardinal direction where the sensor is located ['N','W','S','E','1','2','3'], a '-' indicates the designated sensor is not defined in this system. These must be adjusted whenever the sensor configurations are adjusted, and instances are added or removed. The order within this array is ['Primary', 'Backup, 'Discontinuity'].

Ceilometer Sensors:

Primary Only:

```
Sensor:
  Ceilometer: {
    # We do 1 sample per 30 seconds.
    type: CL31,
    period: 30Sec,
    instances: {
      #options: host, port, speed, combine, calcparam, hmsl, opt, logger
      '1': { comm: {host: DCPDL1, port: 10005, }, hmsl: 1388, opt: { PRIMARY: '1' } }
    }
  }
Settings:
  CEILO LOC: [ 'W', '-', '-' ] #Pri Bckup Disc
```

Primary and Backup:

```
Sensor:
  Ceilometer: {
    # We do 1 sample per 30 seconds.
    type: CL31,
    period: 30Sec,
    instances: {
      #options: host, port, speed, combine, calcparam, hmsl, opt, logger
      '1': { comm: {host: DCPDL1, port: 10005, }, hmsl: 1388, combine: [ '3' ], opt:
      { PRIMARY: '1', BACKUP: '3' } },
      '3': { comm: {host: DCPDL2, port: 10005, }, hmsl: 1382, opt: {} }
    }
  }
Settings:
  CEILO LOC: [ 'W', 'E', '-' ] #Pri Bckup Disc
```

Primary and Discontinuity:

```
Sensor:
  Ceilometer: {
    # We do 1 sample per 30 seconds.
    type: CL31,
    period: 30Sec,
    instances: {
      #options: host, port, speed, combine, calcparam, hmsl, opt, logger
      '1': { comm: {host: DCPDL1, port: 10005, }, hmsl: 1388, combine: [ '2' ], opt:
      { PRIMARY: '1', DISCONTINUITY: '2' } },
      '2': { comm: {host: DCPDL2, port: 10005, }, hmsl: 1382, opt: {} }
    }
  }
Settings:
  CEILO LOC: [ 'W', '-', 'N' ] #Pri Bckup Disc
```

Primary, Backup and Discontinuity:

```
Sensor:
  Ceilometer: {
    # We do 1 sample per 30 seconds.
    type: CL31,
    period: 30Sec,
    instances: {
      #options: host, port, speed, combine, calcparam, hmsl, opt, logger
      '1': { comm: {host: DCPDL1, port: 10005, }, hmsl: 1388, combine: [ '2','3' ],
      opt: { PRIMARY: '1', DISCONTINUITY: '2', BACKUP: '3' } },
      '2': { comm: {host: DCPDL2, port: 10005, }, hmsl: 1382, opt: {} },
      '3': { comm: {host: DCPDL3, port: 10005, }, hmsl: 1385, opt: {} }
    }
  }
Settings:
  CEILO LOC: [ 'W', 'E', 'N' ] #Pri Bckup Disc
```

Visibility Sensors:

Primary Only:

```
Sensor:
  Visibility: {
    # We do 1 sample per 15 seconds.
    type: Belfort6200,
    period: 15Sec,
    instances: {
    #options: host, port, speed, combine, calcparam, hmsl, opt, logger
    '1': {comm: { host: DCPDL1, port: 10007, }, opt: { PRIMARY: '1' } }
    }
  }
Settings:
  VIS LOC: [ 'E', '-', '-' ] #Pri Bckup Disc
```

Primary and Backup:

```
Sensor:
  Visibility: {
    # We do 1 sample per 15 seconds.
    type: Belfort6200,
    period: 15Sec,
    instances: {
    #options: host, port, speed, combine, calcparam, hmsl, opt, logger
    '1': {comm: { host: DCPDL1, port: 10007, }, combine: ['3'], opt: { PRIMARY: '1',
    BACKUP: '3'} },
    '3': {comm: { host: DCPDL2, port: 10007, }, opt: {}}
    }
  }
Settings:
  VIS LOC: [ 'E', 'N', '-' ] #Pri Bckup Disc
```

Primary and Discontinuity:

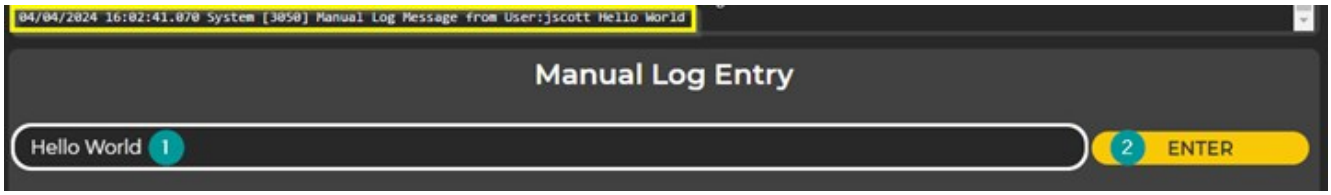
```
Sensor:
  Visibility: {
    # We do 1 sample per 15 seconds.
    type: Belfort6200,
    period: 15Sec,
    instances: {
    #options: host, port, speed, combine, calcparam, hmsl, opt, logger
    '1': {comm: { host: DCPDL1, port: 10007, }, combine: ['2'], opt: { PRIMARY: '1',
    DISCONTINUITY: '2'} },
    '2': {comm: { host: DCPDL2, port: 10007, }, opt: {}}
    }
  }
Settings:
  VIS LOC: [ 'E', '-', 'S' ] #Pri Bckup Disc
```

Primary, Backup and Discontinuity:

```
Sensor:
  Visibility: {
    # We do 1 sample per 15 seconds.
    type: Belfort6200,
    period: 15Sec,
    instances: {
    #options: host, port, speed, combine, calcparam, hmsl, opt, logger
    '1': {comm: { host: DCPDL1, port: 10007, }, combine: ['2','3'], opt: { PRIMARY:
    '1', DISCONTINUITY: '2', BACKUP: '3', } },
    '2': {comm: { host: DCPDL2, port: 10007, }, opt: {}},
    '3': {comm: { host: DCPDL3, port: 10007, }, opt: {} },
    }
  }
Settings:
  VIS LOC: [ 'E', 'N', 'S' ] #Pri Bckup Disc
```

7.4 Entering MI commands via the Manual Log Entry feature

On the **Technician** screen at the bottom left of the screen near the **Debug Channel** is a field where the user can enter a manual **Maintenance Log** message.



This feature can be used to interact with the Maintenance Interface with a series of commands as shown in Table 7-2 (p. 80).

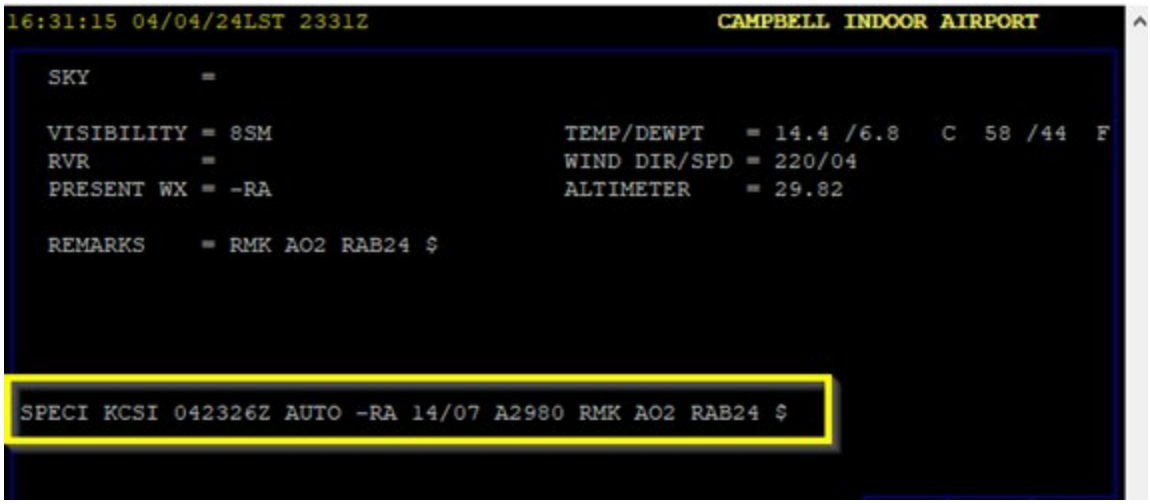
Table 7-2: Maintenance Interface manual commands

Command format	Description	Result example
[3091]	This command causes the MI to produce a message containing the devices with active events by name. This message will appear in the **Maintenance Log**.	Sensors in Maintenance State: 'WMT 700', 'TSS 928'.
[3092]	This command causes the MI to produce a message containing all active events in the Maintenance Code List. This list of active maintenance events will appear in the **Maintenance Log**.	System [3051] Printing Active Maintenance Events. System [3051] ACU [2652]: Incomplete/Corrupt Poll Response. System [3051] Alpha 2 [5802] COMM FAILURE System [3051] Events Found: 2.
[3093][####]	This command will insert the entered event code into the MI List. Any value < [##90] will trigger the Maintenance state for that group. (MI codes are grouped by device, such as Setra 470T or TD1088.) Sending a [3093] [##99] will clear out all MI events for that group.	System [3050] Manual Log Message from User:jscott [3093][7499] ACU [7499] Manual MI Event

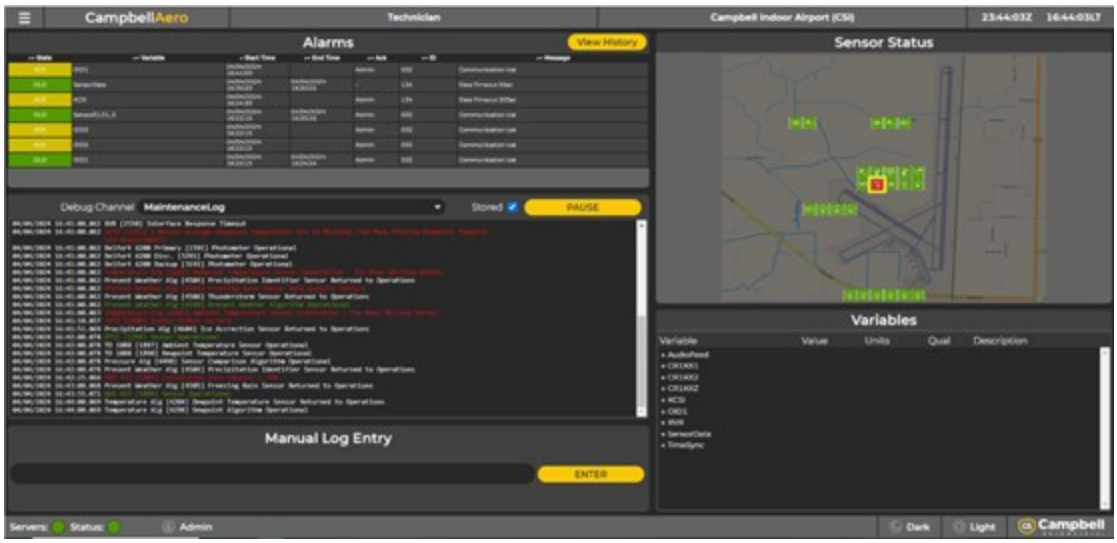
In order to enter a MI command, the string must match the exact format with no extra characters before or after the command. Once the command is typed, press **ENTER** to initiate the process.

Following is an example of how these tools can be used.

I have a system which is in the Maintenance State. I know this because transmitted reports contain the '$' symbol.



In order to determine the issue, I sign into the Aero browser UI as a Technician user and navigate to the **Technician** screen. Looking at my **Sensor Status**, I can see the AWPAG is having some sort of issue. Let's investigate further.



Within the **Manual Log Entry** field, I enter the command **[3091]**:

```
System [3050] Manual Log Message from User:Admin [3091]
Sensors in Maintenance State: 'AWPAG', 'OID'
OID [7799] Communication Established
```

Evaluating the results I can see that indeed the AWPAG is in the Maintenance State; in this case there is an unconnected OID terminal as well. I activated the missing OID terminal which causes the **OID [7799] Communications Established** log message to occur.

In order to know more specifically what the issue is with the AWPAG, I enter the **[3092]** command:

```
System [3050] Manual Log Message from User:Admin [3092]
System [3051] Printing Active Maintenance Events
System [3051] AWPAG [1350]: Sensor Response Timeout
System [3051] AWPAG [1314]: Sensor Status Set to Missing, 1-Minute Precipitation Amount Set to Missi
ng
System [3051] AWPAG [1305]: Bucket Failure
System [3051] Events Found: 3
```

The response to the command indicates that there is a Bucket Failure which is causing the sensor to fail and be in the Maintenance State. This might have been left over from a previous launch of Aero. To validate that this issue is still occurring, I clear out the AWPAG group [13##] using the **[3093][####]** command:

```
System [3050] Manual Log Message from User:Admin [3093][1399]
AWPAG [1399] Manual MID Event
System [3098] ASOS Exiting Maintenance State
```

Notice how the Manual MI Event removed all the AWPAG errors, and the system exited the Maintenance State.

I wait for a minute to allow the sensor to be polled and to respond, monitoring the AWPAG Debug channel to see the data format. I see there are failures in the diagnostic response from the AWPAG sensor.

```
P1<13>
<2>P[illegible]0.3507.97C2<3><13><10>
PD<13>
<2>PD[illegible]PPPP24.0032.7016.3N0E<3><13><10>
```

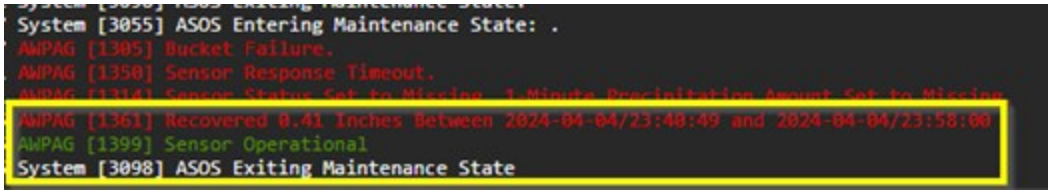
Checking the **Maintenance Log** once more I see that the errors have returned and thus are true errors:

```
System [3055] ASOS Entering Maintenance State: .
AWPAG [1305] Bucket Failure.
AWPAG [1350] Sensor Response Timeout.
AWPAG [1314] Sensor Status Set to Missing, 1-Minute Precipitation Amount Set to Missing.
```

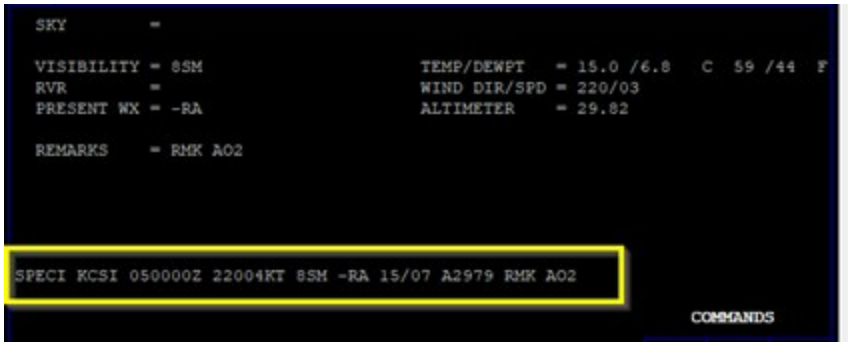
For the sake of this example, I am using a sensor simulator. Let's say I performed physical maintenance on the sensor and restored the bucket to regular operations.

After resolving the source of the issue, I allow the system to run for a few minutes with the operational sensor.

Within a few minutes I see the sensor return to regular operations and the system exits the Maintenance State.



Checking the OID screen, I can see that the system has in fact exited the Maintenance State and is transmitting reports without the `$`



Appendix A. Computer requirements

> NOTE:
> Campbell Aero generally comes preconfigured. This section is for IT personnel needing to update or reinstall the system.

Campbell Aero is browser-based software. See your browser requirements for minimum computer specifications. Generally, modern computers with a keyboard and mouse, trackpad, or trackball input provide a responsive experience.

Speakers are required for audio alerts.

A.1 Browser support

The Campbell Aero client is designed to work in modern browsers and does not require the use of any third party plug-ins or extensions. Google Chrome is the recommended browser, although Mozilla Firefox and Chromium based Microsoft Edge will work. When using Campbell Aero on a secure network, without internet access, is it recommended that you disable auto updates and keep a copy of a complete installer for your browser version.

A.2 Browser installation

For best results, have your IT department use one of the enterprise installers available from:

https://chromeenterprise.google/browser/download/#download

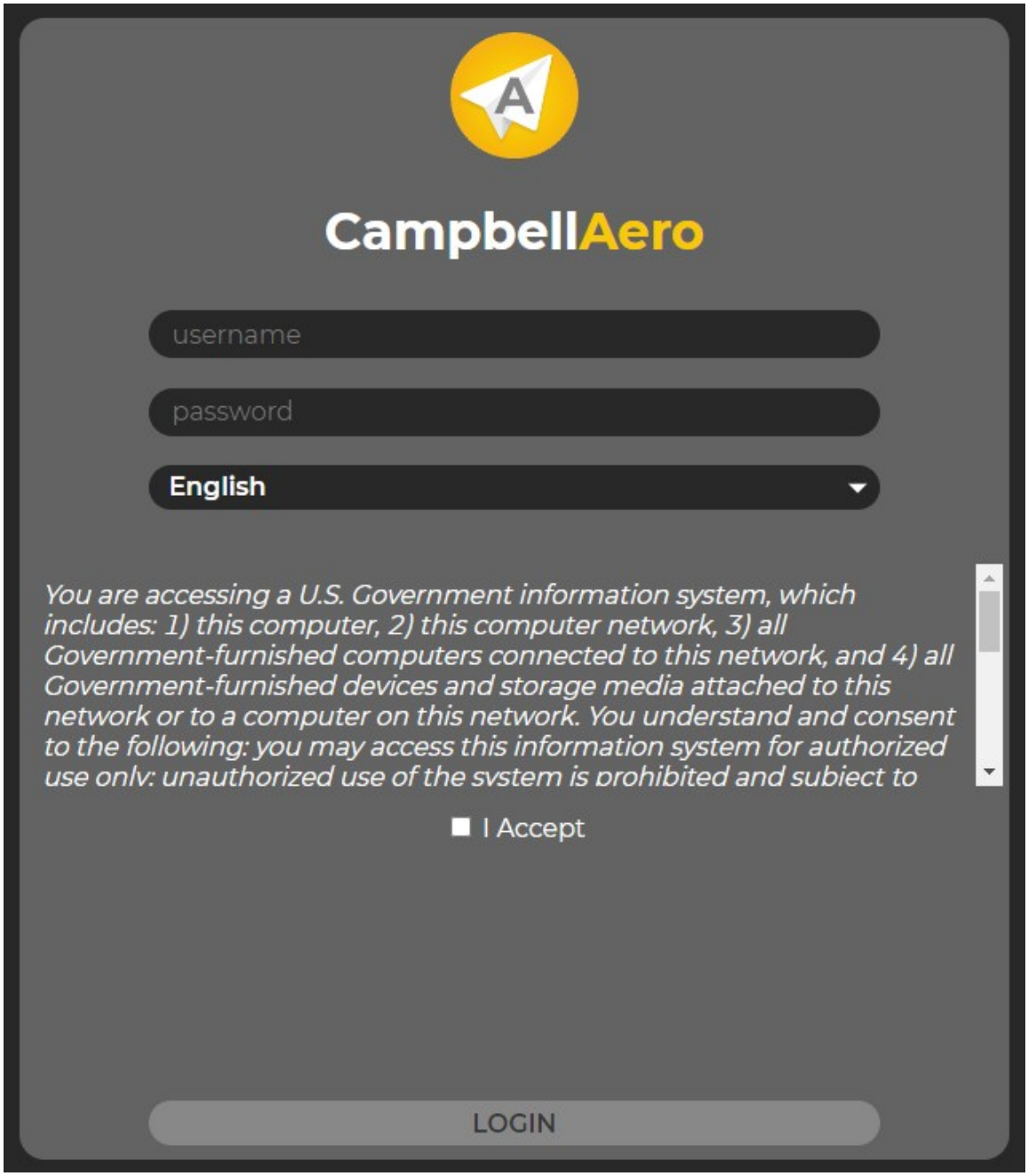
Extract the files, then run the Google Chrome Standalone installation. Open Google Chrome and make settings changes described in the following sections.

A.3 Startup and shortcuts

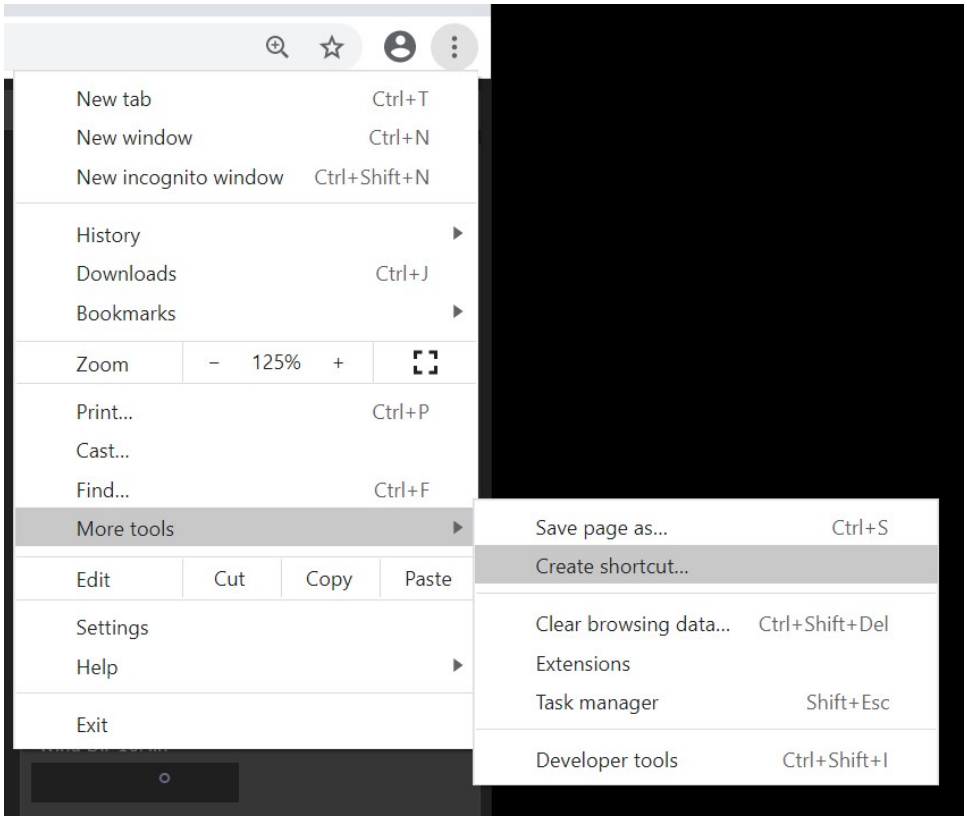
For single-server installations, a shortcut on the desktop can be used to start the browser and load the initial page from the server.

Open Chrome with the server running and enter the server name and web server port number into the address bar. This should load the log-in page from the server.

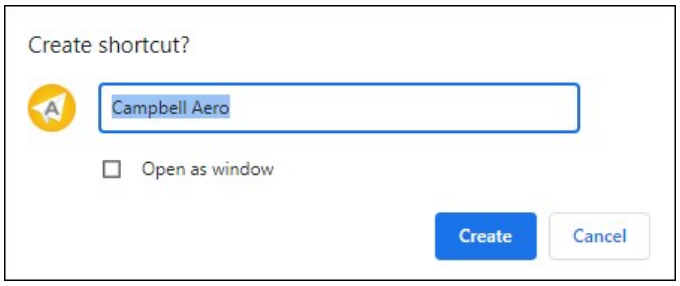
NOTE:
Usernames are used to select and grant access to user roles.



Open the Chrome options menu and select **More Tools** > **Create Shortcut**.



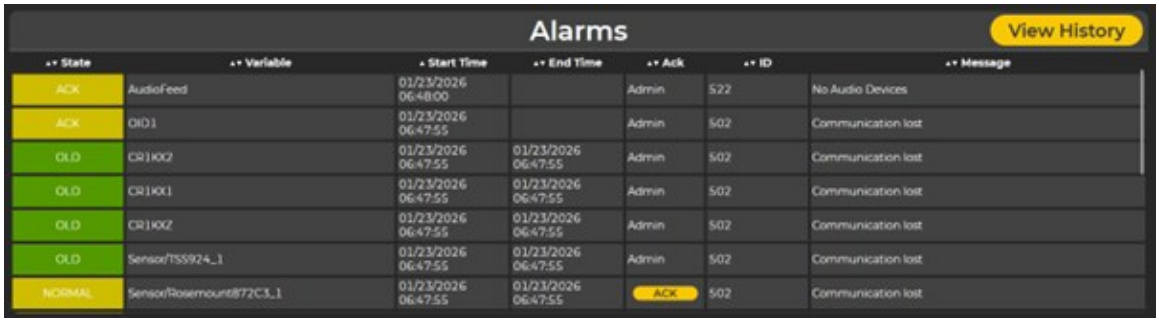
Enter the name for the shortcut and click **Create**. Do not select **Open as window**.



Appendix B. Meteo alarms

B.1 Overview and purpose

This section explains the logical flow of the Meteo Alarm system in Campbell Aero.



The Meteo Alarm system monitors meteorological variables and alerts operators when specific conditions are met. It provides three types of alarms:

1. BOOLEAN ALARMS - Simple True/False conditions

   Example: "CHI < 1500" triggers when ceiling height goes below 1500

2. MULTI-VALUE ALARMS - Multiple possible states with severity ordering

   Example: "BLU,GRN,RED|fVar1 < 1000 ? 'RED' : (fVar1 < 2000 ? 'GRN' : 'BLU')"

   This evaluates to RED, GRN, or BLU and triggers when degrading from better to worse state (e.g., BLU -> GRN or GRN -> RED).

3. SYSTEM-GENERATED ALARMS - Automatic alarms triggered by the system

   These are NOT user-configured expressions but are raised automatically by the Aero application when specific system events occur.

System-generated alarms:

These alarms are raised by sensor drivers and system components using routine methods. They:

- Use predefined Alarm IDs from the ALARM_ID enum
- Are typically created with CAlarmAction::Alarm() (requires ack)
- Auto-reset when the condition clears (e.g., sensor reconnects)
- Follow the same acknowledgment workflow as user-configured alarms

Common system-generated alarms include:

Sensor/Data Alarms (IDs 134-144):

- AL_MISSING_DATA (134) - Data missing from AWS station
- AL_CRC_ERROR (135) - CRC errors detected in data
- AL_DATA_ERROR (136) - Data errors detected
- AL_LIGHTNING_ALARM (137) - Lightning strike(s) detected
- AL_DATA_RECEPTION (138) - No data received for >120 seconds
- AL_SENSOR_CONNECT (139) - Sensor connection lost
- AL_1_MINUTE_DATA (140) - Missing/excessive samples in 1 minute
- AL_VARIABLE_FORCE (141) - User forced a variable value
- AL_VARIABLE_SUSPECT (142)- Suspicious variable jump detected
- AL_VARIABLE_JUMP (143) - Erroneous variable jump detected
- AL_VARIABLE_IDLE (144) - Variable unchanged too long

Technical/System Alarms (IDs 500+):

- AL_CONNECT (501) - Machine disconnected (informational)
- AL_COMMS_FAULT (502) - Communication/data source failure
- AL_SENSOR (506) - Sensor defect (value too low/high)
- AL_UPS_ON_BATTERY (517) - System running on battery power
- AL_POWER_ISSUE (518) - Power supply problem
- AL_CABINETRH (521) - Cabinet humidity above limit
- AL_DATABASE (524) - Database connection failure

Meteo Alarms:

- Are user-configurable using standard operators on variables
- Have per-alarm user group targeting
- Can include optional sound alerts
- Have configurable acknowledgment requirements

B.2 Configuration and creation

B.2.1 Where alarms are defined

Meteo Alarms are defined in the system configuration (typically in YAML files), hard coded into Campbell Aero's algorithm implementation, and loaded during application startup.

The configuration file (Yaml) allows for the following attributes:

- Name: Unique identifier for the alarm
- Code: Expression to evaluate (with optional order prefix)
- UserGroup: Which user groups receive notifications (e.g., "Obs|Tech")
- Enabled: Whether the alarm is active
- Description: Human-readable explanation
- Flags: Bitwise flags controlling behavior

```
MeteoAlarm:
    'Freezing Rain ':
        usrgrp: Administrator
        code: 'SensorData/15Sec/PWm_A == "FZRA" '
        description: 'Freezing Rain Event has occurred '
        flags: 4
    Hail:
        usrgrp: Administrator
        code: 'SensorData/15Sec/PWm_A == "GR" '
        description: Hail Event has occoured
        flags: 4
    High Temp Anomaly:
        usrgrp: Administrator
        code: 'EHAQ/1Min/AT5Ma > 25'
        description: '5-Min Air Temperature is Above 25 C'
        flags: 8
    Low Temp Anomaly:
        usrgrp: Administrator
        code: 'EHAQ/1Min/AT5Ma < 3'
        description: '5-Min Air Temperature is Below 3 C'
        flags: 8
    RWY 05L Low Visibility:
        usrgrp: Administrator
        code: 'EHAQ/15Sec/Vis1Ma_A < 1000' # Made this a 1Min var for ease of testing
        description: 'RWY 05L Visibility Less Than 1Km '
        flags: 8
    RWY 23R Low Visibility:
        usrgrp: Administrator
        code: 'EHAQ/1Min/Vis10Ma_C < 1000'
        description: 'RWY 23R Visibility Less Than 1Km '
        flags: 8
```

B.2.2 Alarm flags (control behavior)

Each alarm can have multiple flags set using bitwise OR:

Table B-1: Alarm flags

Flag Name	Value	Meaning
g_nPlaySound	0x01	Play an audible alert sound
g_nCreateVariable	0x02	Create a variable in station's Async group
g_nShowAsWarning	0x04	Display as WARNING (no acknowledgment)
g_nShowAsAlarm	0x08	Display as ALARM (requires acknowledgment)
g_nMetarTrigger	0x10	Trigger METAR SPECI message generation
g_nMetreportTrigger	0x20	Trigger METREPORT SPECI message generation

Example Flag Combinations:

0x09 = 0x01 | 0x08 = Play sound + Show as alarm (needs ack)

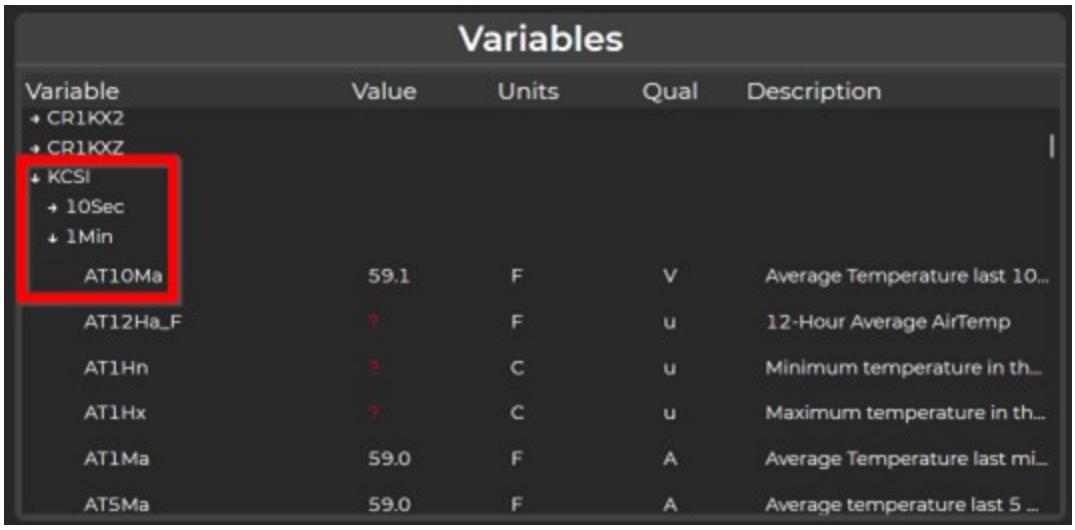
0x12 = 0x02 | 0x10 = Create variable + Trigger METAR SPECI

0x0C = 0x04 | 0x08 = Show as warning AND alarm (alarm takes precedence)

B.2.3 Variable resolution

When an alarm references variables, the system searches in this order:

1. station/group/varname - Fully qualified (most specific)
2. group/varname - Within main ICAO station
3. varname - Searches all periodic groups (3Sec, 10Sec, etc.)



Example: If alarm uses "CHI", system looks for:

ICAO/3Sec/CHI, ICAO/10Sec/CHI, ICAO/1Min/CHI, etc.

If variable not found -> ERROR logged and alarm cannot evaluate

B.2.4 Expression parsing

The alarm code is parsed by the Expression Parser which supports:

- Basic operators: +, -, *, /, %, ^
- Comparison: <, <=, >, >=, ==, !=
- Logical: &&, ||, !
- Ternary: condition ? true_value : false_value
- Functions: min(), max(), abs(), etc.
- String comparisons and concatenation

Multi-value alarms use the format:

ORDER_LIST|EXPRESSION

Where ORDER_LIST is comma-separated from BEST to WORST

Example: "BLU,GRN,AMB,RED|..." means BLU is best, RED is worst

B.3 Evaluation logic

The evaluation logic runs every second.

B.3.1 Boolean alarm evaluation

Boolean alarms (TRUE/FALSE expressions) follow these steps:

1. Evaluate expression

   Result = m_pExpression->Evaluate()

   Example: "CHl < 1500" -> TRUE or FALSE
2. Get current boolean value

   CurrValue = Result.AsBool()
3. Compare with last value

   If CurrValue != m_LastValue:

   -> Value has changed
4. Trigger condition

   If CurrValue == TRUE:

   -> TRIGGER ALARM (value degraded to fault condition)

   Else:

   -> Do not trigger (value improved or stayed good)
5. Update last value

   m_LastValue = CurrValue

Logic Summary:

- Only triggers when expression changes from FALSE to TRUE
- Does NOT trigger when TRUE -> FALSE (that's a return to normal)
- Does NOT trigger repeatedly while TRUE (only on transition)

B.3.2 Multi-value evaluation

Multi-value alarms (multiple states with ordering) follow these steps:

1. STEP 1: Evaluate expression

   Result = m_pExpression->Evaluate()

   Example: "fVar1 < 1000 ? 'RED' : 'GRN'" -> "RED" or "GRN"
2. Get current value as string

   CurrValueStr = Result.AsString()
3. Look up order index

   CurrOrder = m_OrderMap[CurrValueStr]

   Example with order "BLU,GRN,RED":

   "BLU" -> 0 (best)

   "GRN" -> 1 (middle)

   "RED" -> 2 (worst)

   Unknown -> 9999 (invalid)
4. Compare with last order

   If CurrOrder < m_nLastOrder:

   -> Condition DEGRADED (got worse)

   -> TRIGGER ALARM

   Else:

   -> Condition same or improved

   -> Do not trigger
5. Update last order

   m_nLastOrder = CurrOrder

   m_LastValue = CurrValueStr

Logic Summary:

- Only triggers when state degrades (moves toward worse in order list)
- Example: BLU->GRN triggers, GRN->BLU does not trigger

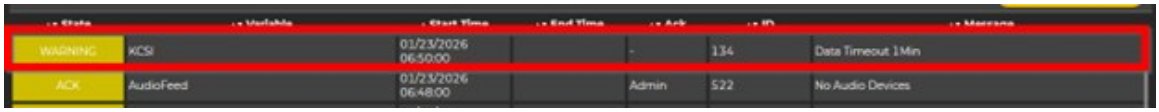
- Must have valid current and previous values (not 9999)
- Unknown values (not in order list) don't trigger alarms

B.4 Alarm system integration

B.4.1 Alarm action types

When creating system alarms, the CAlarmAction determines behavior:

- CAlarmAction::Alarm() -> Requires acknowledgment
- CAlarmAction::Info() -> Informational only, no ack
- CAlarmAction::Warning() -> Warning level



- CAlarmAction::Fault() -> Fault condition

The flag determines which action is used:

- g_nShowAsAlarm -> Uses Alarm() action (needs ack)
- g_nShowAsWarning -> Uses Warning() action (info only)

B.4.2 Duplicate and intermittent fault protection

The global alarm system (CAlarmList) has protection:

Duplicate Check:

If same alarm name + ID already active -> Skip, don't add duplicate

Intermittent Fault Check:

If 10+ similar unacknowledged alarms exist:

-> Create AL_TOO_MANY_FAULTS alarm instead

-> Prevents alarm flooding

-> User must acknowledge to reset counter

> **NOTE:**
> This applies to system alarms (CAlarm), not direct Meteo Alarms.

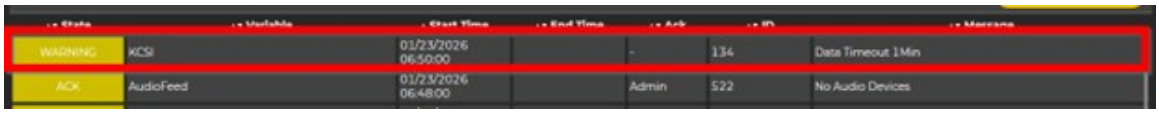
B.5 Acknowledgment workflow

B.5.1 When acknowledgment is required

Meteo Alarms themselves don't require acknowledgment ; they are monitoring systems that send notifications. However, if they create system alarms with the g_nShowAsAlarm flag, those system alarms require acknowledgment.

For System Alarms (CAlarm objects):

- Requires Ack: g_nShowAsAlarm flag set (0x08)
- No Ack: g_nShowAsWarning flag only (0x04) or no flags



B.5.2 Acknowledgment process for system alarms

When a user acknowledges an alarm, the following steps are involved:

1. User Initiates Acknowledgment

   Via: Web interface, GUI, or command

   Function: CAlarmList::Ack(alarmName, username)

2. System Finds Matching Alarm
   - Alarm name matches
   - m_sAck is empty (not yet acknowledged)
   - Severity is not OLD

3. Update Alarm State

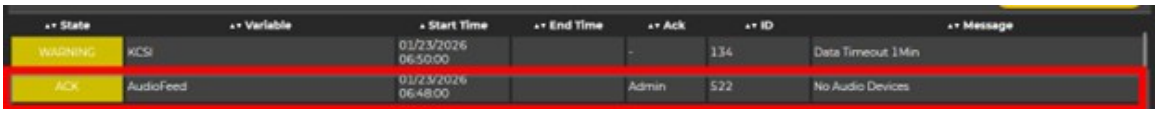
   IF alarm is still active (EndTime is NULL):

   -> m_sAck field will hold the username

   -> Set severity = ACK (acknowledged but still active)

   -> Decrement active alarm count

   -> Update station status



State	Variable	Start Time	End Time	Ack	ID	Message
WARNING	KCSI	01/23/2026 06:50:00		-	134	Data Timeout 1Min
ACK	AudioFeed	01/23/2026 06:48:00		Admin	522	No Audio Devices

   IF alarm has ended (EndTime is set):

   -> m_sAck field will hold the username

   -> Set severity = OLD (acknowledged and ended)

   -> Remove from station alarm list

OLD	CR1KK2	01/23/2026 06:47:55	01/23/2026 06:47:55	Admin	502	Communication lost

4. Update Timestamp

   Set m_UpdateTime = current time

> **NOTE:**
> This is a logging of when a user acknowledged an Alarm.

   This value is stored in the database with each event which triggers a meteo alarm.

5. Notify Observers

   For each IAlarmListObserver:

   -> Notify of alarm

6. Log to Database

   Create: CDBQueueItemAckAlarm(alarm)

   Queue to database thread

   Updates AlarmList table:

   Sets m_sUserName = username

   Sets m_iState = ACK or OLD

   Sets m_tUpdateTime

   > **NOTE:**
   > This is the time the user acknowledged the alarm IF it is acknowledged.

   If the Alarm is simply resolved without an acknowledgment needed the State will be "Old" and the Update time will reflect the time the event resolved itself.

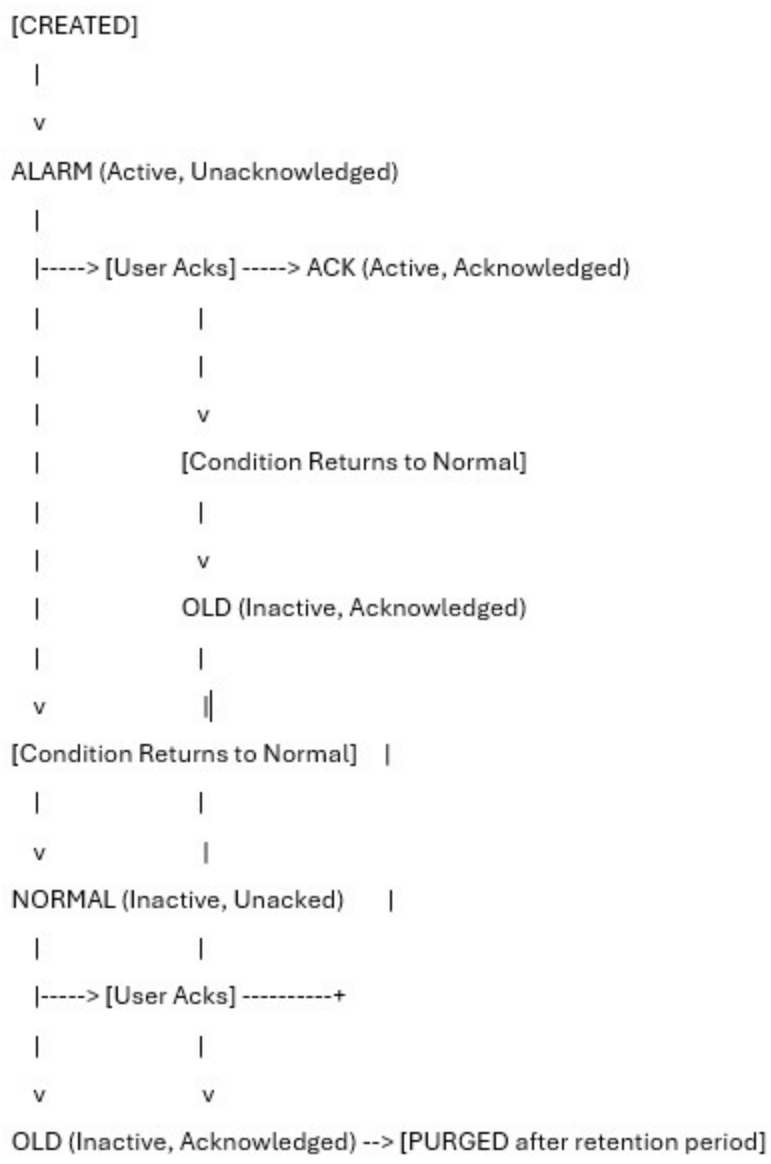
7. Replicate to Mirror

   If mirror server configured:

   Send acknowledgment to cold/backup server

   Keeps redundant systems in sync

B.5.3 Alarm states through lifecycle



B.6 Database logging

B.6.1 When logging occurs

Meteo Alarms are logged to the database when:

- Application is Server or Standalone (not client-only)
- Database logging is enabled in configuration
- The alarm action has IsLog() = true

For Meteo Alarm-created system alarms:

Default: All alarms are logged (m_log bit set in CAlarmAction)

B.6.2 Database operations

OPERATION: AddAlarm

When: New alarm created

Table: AlarmList

Action: INSERT new record

Fields:

m_tStartTime = Alarm occurrence time

m_sVariableName = Alarm name/identifier

m_iID = Alarm ID (e.g., 134-144 for meteo)

m_sMessage = Description/message

m_tEndTime = NULL (still active)

m_sUserName = Empty (not yet acknowledged)

m_iState = ALARM (severity level)

m_tUpdateTime = Same as start time

OPERATION: UpdateAlarm

When: Alarm returns to normal (condition cleared)

Table: AlarmList

Action: UPDATE existing record

Fields:

m_tEndTime = Time condition returned to normal

m_iState = NORMAL or OLD

m_tUpdateTime = Current time

OPERATION: AckAlarm

When: User acknowledges alarm

Table: AlarmList

Action: UPDATE existing record

Fields:

m_sUserName = Username who acknowledged

m_iState = ACK or OLD

m_tUpdateTime = Current time

OPERATION: PurgeAlarm

When: Old alarms removed (retention policy)

Table: AlarmList

Action: DELETE record

Criteria:

Alarm is acknowledged AND ended AND older than 24 hours

OR any alarm older than MAXALARMS period (regardless of state)

B.6.3 Retention period configuration

The alarm retention period is configured in the station YAML configuration file under the System -> Parameters section:

```
System:
    #options: role, backup, params
    #role can be: standalone, primary, secondary
    Primary: {role: primary, backup: ASOS-B}
    Secondary: {role: secondary, backup: ASOS-A}
    Test: {role: standalone,
        params: { PORT_BASE_NUMBER: 0, IPV6: false,MAXLOG: 7d,MAXALARMS: 14d,FILETRANSFER: false }}
```

System:

Parameters:

MAXALARMS: '28d' # How long to keep alarms in database

Parameter Details:

Name: MAXALARMS

Type: TimeSpan (e.g., '7d', '14d', '28d', '30d')

Default: 28 days

Location: System -> Parameters in station YAML config

Example Configurations:

MAXALARMS: '7d' # Keep alarms for 1 week

MAXALARMS: '14d' # Keep alarms for 2 weeks

MAXALARMS: '28d' # Keep alarms for 4 weeks (default)

MAXALARMS: '30d' # Keep alarms for 30 days (regulatory)

Purge Logic:

The system runs periodic purge checks and removes alarms when:

1. QUICK CLEANUP (after 24 hours):

Alarm is acknowledged (m_sAck not empty)

AND alarm has ended (m_EndTime set)

AND alarm is older than 24 hours

-> DELETE from database and memory

2. FORCE CLEANUP (after MAXALARMS period):

Alarm is older than MAXALARMS value

-> DELETE regardless of acknowledgment state

-> Prevents indefinite alarm accumulation

This two-tiered approach ensures:

- Resolved alarms are cleaned up quickly (24 hours)
- Unresolved/unacknowledged alarms are retained for investigation
- No alarm persists beyond the configured retention period

B.6.4 Database queue

All database operations are queued to prevent blocking:

Thread Model:

Main Thread: Creates CDBQueueItem* objects

Adds to queue

Database Thread: Processes queue

Executes SQL commands

Items:

CDBQueueItemAddAlarm

CDBQueueItemUpdateAlarm

CDBQueueItemAckAlarm

CDBQueueItemPurgeAlarm

Benefits:

- Non-blocking alarm processing
- Batch operations for efficiency
- Automatic retry on failure

B.6.5 Mirror server replication

If a mirror/backup server is configured:

All alarm operations are sent to mirror:

AddAlarm -> Mirror receives full alarm details

UpdateAlarm -> Mirror updates its copy

AckAlarm -> Mirror marks as acknowledged

(PurgeAlarm NOT sent to mirror - local cleanup only)

This ensures:

- Hot and cold servers have identical alarm states.
- Failover can occur without losing alarm history.
- Both servers can respond to client queries.

B.7 Example scenarios

B.7.1 Example 1: Simple Boolean alarm with sound

Configuration:

Name: "LowCeiling"

Code: "CHI < 1500"

UserGroup: "Obs"

Flags: 0x09 (0x01 | 0x08 = Sound + Show as Alarm)

Enabled: true

Description: "Ceiling height below 1500 feet"

Timeline:

T+0s: System starts, CHI = 2000

-> Expression evaluates to FALSE

-> m_LastValue = FALSE

-> No alarm

T+30s: CHI changes to 2000

-> Expression still FALSE

-> No change from last value

-> No alarm

T+60s: CHI changes to 1400

-> Expression evaluates to TRUE

-> Change from FALSE to TRUE detected

-> ALARM TRIGGERED

-> Sound plays (flag 0x01)

-> WebSocket message sent to "Obs" group

-> Security log entry created

-> System alarm created (flag 0x08)

T+90s: CHI still at 1400

-> Expression still TRUE

-> No change from last value

-> No new alarm (doesn't retrigger)

T+120s: CHI improves to 1600

-> Expression evaluates to FALSE

-> Change from TRUE to FALSE

-> Alarm does NOT trigger

-> System alarm marked as NORMAL

-> Station status updated (alarm cleared)

T+150s: Observer acknowledges alarm via web interface

-> Alarm state changed to OLD

-> Username recorded

-> Database updated

B.7.2 Example 2: Multi-value alarm with METAR SPECI

Configuration:

Name: "VisibilityStatus"

Code: "GRN,YEL,RED|fVis >= 5000 ? 'GRN' : (fVis >= 3000 ? 'YEL' : 'RED')"

UserGroup: "Obs|Tech"

Flags: 0x1A (0x02 | 0x08 | 0x10 = Variable + Alarm + METAR)

Enabled: true

Description: "Visibility monitoring with color codes"

Order Mapping:

"GRN" -> 0 (best - vis >= 5000m)

"YEL" -> 1 (warning - 3000m <= vis < 5000m)

"RED" -> 2 (worst - vis < 3000m)

Timeline:

T+0s: System starts, fVis = 8000

-> Expression: "fVis >= 5000 ? 'GRN'" = TRUE -> 'GRN'

-> Order: 0 (best)

-> m_LastValue = "GRN", m_nLastOrder = 0

-> Variable ICAO/Async/VisibilityStatus set to "GRN"

-> No alarm (initial state)

T+60s: fVis = 7500 (still good)

-> Expression = 'GRN'

-> Order: 0

-> No change (0 == 0)

-> Variable updated to "GRN"

-> No alarm

T+120s: fVis = 4000 (degraded)

-> Expression: "fVis >= 5000 ? 'GRN'" = FALSE

-> "fVis >= 3000 ? 'YEL'" = TRUE -> 'YEL'

-> Order: 1

-> Change detected (1 > 0) - DEGRADED

-> ALARM TRIGGERED

-> Variable set to "YEL"

-> WebSocket sent to "Obs" and "Tech" groups

-> Security log entry

-> System alarm created

-> METAR SPECI triggered (flag 0x10)

-> Message "ICAO_METAR" generates SPECI with reason

T+180s: fVis = 4200 (slight improvement but still YEL)

-> Expression = 'YEL'

-> Order: 1

-> No change (1 == 1)

-> Variable updated to "YEL"

-> No new alarm

T+240s: fVis = 2500 (severe degradation)

-> Expression: Both conditions FALSE -> 'RED'

-> Order: 2

-> Change detected (2 > 1) - DEGRADED

-> ALARM TRIGGERED AGAIN

-> Variable set to "RED"

-> WebSocket notifications sent

-> Security log entry

-> System alarm created

-> METAR SPECI triggered again

-> Message generated with updated reason

T+300s: Observer acknowledges both alarms

-> First alarm (YEL): marked OLD

-> Second alarm (RED): still active, marked ACK

-> Database updated for both

-> Station status updated

T+360s: fVis = 3500 (improved to YEL)

-> Expression = 'YEL'

-> Order: 1

-> Change detected (1 < 2) - IMPROVED

-> NO ALARM (improvement doesn't trigger)

-> Variable set to "YEL"

-> Second alarm (RED) automatically reset to NORMAL

T+420s: fVis = 6000 (back to good)

-> Expression = 'GRN'

-> Order: 0

-> Change detected (0 < 1) - IMPROVED

-> NO ALARM (improvement doesn't trigger)

-> Variable set to "GRN"

-> All alarms now ended

B.7.3 Example 3: Intermittent fault protection

Configuration:

Name: "TempSensorFault"

Code: "fTemp < -50 || fTemp > 60"

UserGroup: "Tech"

Flags: 0x08 (Show as Alarm)

Enabled: true

Description: "Temperature sensor out of range"

Timeline:

T+0s: fTemp = 25, Expression = FALSE, No alarm

T+10s: fTemp spikes to 65 (fault)

-> Expression = TRUE, Alarm #1 triggered

-> System alarm created

T+20s: fTemp returns to 25

-> Expression = FALSE

-> Alarm #1 resets to NORMAL (unacknowledged)

T+30s: fTemp spikes to 62 (fault)

-> Expression = TRUE, Alarm #2 triggered

-> Similar alarm count = 1 (Alarm #1 unacked)

T+40s: Returns to normal, Alarm #2 resets

... Pattern repeats 8 more times ...

T+300s: fTemp spikes to 70 (10th occurrence)

-> Expression = TRUE

-> Similar alarm count = 9 (9 previous unacked)

-> Alarm #10 triggered

T+310s: Returns to normal, Alarm #10 resets

T+320s: fTemp spikes to 68 (11th occurrence)

-> Similar alarm count >= 10 (THRESHOLD)

-> INTERMITTENT FAULT DETECTED

-> Instead of Alarm #11, creates:

AL_TOO_MANY_FAULTS alarm

Message: "Intermittent fault (>10 times)"

-> No more individual alarms until acknowledged

T+330s-600s: Additional faults occur but are suppressed

-> System logs the issue once

-> Prevents alarm flooding

T+610s: Technician acknowledges AL_TOO_MANY_FAULTS

-> Counter resets

-> Normal alarm behavior resumes

B.7.4 Example 4: User acknowledges an active alarm

This example walks through the complete acknowledgment workflow when an operator responds to an active alarm.

Configuration:

Name: "WindShear"

Code: "fWindShear > 15"

UserGroup: "Obs|Tech"

Flags: 0x09 (0x01 | 0x08 = Sound + Show as Alarm)

Enabled: true

Description: "Wind shear exceeds 15 knots"

Timeline:

T+0s: ALARM TRIGGERED

---

fWindShear = 18 (exceeds threshold)

-> Expression evaluates to TRUE

-> Alarm "WindShear" created with:

m_sName = "WindShear"

m_sMessage = "Wind shear exceeds 15 knots"

m_StartTime = 14:30:00 UTC

m_EndTime = NULL (still active)

m_sAck = "" (empty - not acknowledged)

m_AlarmAction = ALARM (severity)

-> Sound alert plays

-> WebSocket notification sent to Obs and Tech groups

-> Security log entry created

-> Database INSERT queued

-> m_nActiveAlarms incremented

-> m_nUnAcknowledged incremented

-> Station status shows alarm indicator

T+45s: OPERATOR VIEWS ALARM

Observer "obs" sees alarm in web interface:

- Alarm list shows "WindShear" with red indicator

- Status shows: Active, Unacknowledged

- Message: "Wind shear exceeds 15 knots"

- Time: 14:30:00 UTC (45 seconds ago)

T+60s: OPERATOR ACKNOWLEDGES ALARM

Observer "obs" clicks "Acknowledge" button

System processes acknowledgment:

STEP 1: Validate Request

-> User "obs" authenticated

-> User has permission to acknowledge alarms

-> Alarm "WindShear" found in alarm list

-> Alarm is not already acknowledged (m_sAck empty)

STEP 2: Update Alarm State

-> Alarm is still ACTIVE (m_EndTime is NULL)

-> Set m_sAck = "obs"

-> Set m_AlarmAction.severity = ACK

-> Set m_UpdateTime = 14:31:00 UTC

STEP 3: Update Counters

-> m_nActiveAlarms decremented (still tracked but ack'd)

-> m_nUnAcknowledged decremented

STEP 4: Update Station Status

-> Station alarm indicator changes (ack'd state)

STEP 5: Notify Observers

-> All IAlarmListObserver objects notified

-> Web clients receive update via WebSocket

-> Alarm list refreshes to show "Acknowledged by obs"

STEP 6: Queue Database Update

-> CDBQueueItemAckAlarm created

-> UPDATE AlarmList SET

m_sUserName = 'obs',

m_iState = ACK,

m_tUpdateTime = '14:31:00'

WHERE m_sVariableName = 'WindShear'

AND m_tStartTime = '14:30:00'

STEP 7: Mirror Replication

-> If mirror configured, send ack to backup server

Alarm now shows:

Status: Active (Acknowledged)

Acknowledged: obs at 14:31:00 UTC

Color: Yellow (ack'd but still active)

T+90s: CONDITION RETURNS TO NORMAL

---

fWindShear = 12 (below threshold)

-> Expression evaluates to FALSE

System processes reset:

STEP 1: Find Active Alarm

-> Search for "WindShear" with EndTime = NULL

-> Found alarm from 14:30:00

STEP 2: Check Acknowledgment Status

-> m_sAck = "obs" (already acknowledged)

-> Since acknowledged: Set severity = OLD

STEP 3: Update Alarm Record

-> Set m_EndTime = 14:31:30 UTC

-> Set m_UpdateTime = 14:31:30 UTC

-> Set m_AlarmAction.severity = OLD

STEP 4: Update Station Status

-> Remove alarm from station alarm list

-> Station status indicator clears

STEP 5: Notify Observers

-> OnAlarmReset called for all observers

-> Web clients see alarm move to "Resolved" section

STEP 6: Queue Database Update

```
-> UPDATE AlarmList SET
    m_tEndTime = '14:31:30',
    m_iState = OLD,
    m_tUpdateTime = '14:31:30'
  WHERE m_sVariableName = 'WindShear'
    AND m_tStartTime = '14:30:00'
```

Final Alarm State:

Status: Resolved (OLD)

Started: 14:30:00 UTC

Ended: 14:31:30 UTC

Acknowledged: obs at 14:31:00 UTC

Duration: 90 seconds

T+2592000s (30 days later): ALARM PURGED

-> Retention policy runs

-> Alarm is OLD and older than 30 days

-> DELETE from AlarmList table

-> Alarm removed from memory

ALTERNATE SCENARIO: Condition Clears BEFORE Acknowledgment

If the operator had not acknowledged the alarm before it cleared:

T+60s: CONDITION RETURNS TO NORMAL (no ack yet)

---

fWindShear = 12 (below threshold)

System processes reset:

-> m_sAck is empty (not acknowledged)

-> Since NOT acknowledged: Set severity = NORMAL

-> Set m_EndTime = 14:31:00 UTC

-> m_nActiveAlarms decremented

-> m_nUnAcknowledged stays same (still needs ack)

Alarm shows:

Status: Inactive (NORMAL) - Awaiting Acknowledgment

Color: Orange (cleared but needs ack)

T+90s: OPERATOR ACKNOWLEDGES INACTIVE ALARM

Observer "obs" acknowledges the now-inactive alarm

System processes:

-> Alarm has EndTime set (not active)

-> Set m_sAck = "obs"

-> Set severity = OLD (inactive + ack'd)

-> m_nUnAcknowledged decremented

-> Remove from station alarm list

Final Alarm State:

Status: Resolved (OLD)

Started: 14:30:00 UTC

Ended: 14:31:00 UTC

Acknowledged: obs at 14:31:30 UTC

B.8 Auditing

User acknowledgments can be audited by accessing the MetLog database directly.

Database Record:

- Who acknowledged (m_sUserName)
- When acknowledged (m_tUpdateTime)
- Which alarm (m_sVariableName, m_iID)

B.9 Meteo Alarm IDs

Table B-2: Meteo Alarm IDs

ID	Name	Description	Requires acknowledgment	Notes
0	AL_UNKNOWN	Is not known yet	No	Unknown alarm type
1	AL_TRAP_ISALIVE	Identifies SNMP IsAlive trap	No	Informational SNMP heartbeat
64	AL_TOO_MANY_ FAULTS	CQuality::REASON::TO O_MANY_FAULTS	Yes	Intermittent fault threshold reached (10+ similar unacked alarms)
133	AL_FIRST_METEO	This is only for internal testing - below are the meteo alarms	N/A	Marker only - not a real alarm
134	AL_MISSING_DATA	Some data is missing from AWS type station	Configurable	
135	AL_CRC_ERROR	CRC error(s) in data seen	Configurable	
136	AL_DATA_ERROR	Data error(s) seen	Configurable	
137	AL_LIGHTNING_ ALARM	A (or some) Lightning strike(s) have occured	Configurable	
138	AL_DATA_RECEPTION	No data received for long time (> 120 sec)	Configurable	
139	AL_SENSOR_ CONNECT	No connection to sensor established	Configurable	
140	AL_1_MINUTE_DATA	Missing or excessive data samples in 1 minute based on poll period	Configurable	

Table B-2: Meteo Alarm IDs

ID	Name	Description	Requires acknowledgment	Notes
141	AL_VARIABLE_FORCE	A User forced a value	Configurable	
142	AL_VARIABLE_ SUSPECT	A variable has a suspicious jump over a short period of time	Configurable	
143	AL_VARIABLE_JUMP	A variable has an erroneous jump over a short period of time	Configurable	
144	AL_VARIABLE_IDLE	A variable has not been changed enough over a long period of time	Configurable	
145	AL_LASTALARM_ METEO	This is only for internal testing - all meteo data related alarms are above	N/A	Marker only - not a real alarm
500	AL_FIRST_TECH	This is only for internal testing - below are the technical alarms	N/A	Marker only - not a real alarm
501	AL_CONNECT	A machine has disconnected (informational)	No	Informational only - excluded from standard alarm processing
502	AL_COMMS_FAULT	A data source has failed	Yes	Uses CAlarmAction::Alarm() or Fault(), If this is set to Alarm then it will require acknowledgment
503	AL_ADJUST_TIMEOUT	Adjust time-out time synchronisation	Yes	System alarm requiring acknowledgment

Table B-2: Meteo Alarm IDs

ID	Name	Description	Requires acknowledgment	Notes
504	AL_SMSMODEM	SMS-modem not found	Yes	System alarm requiring acknowledgment
505	AL_SMSNOSIGNAL	SMS-Modem has no signal	Yes	System alarm requiring acknowledgment
506	AL_SENSOR	Sensor defect reported (too low or too high)	Yes	Uses CAlarmAction::Alarm() which will require acknowledgment
507	AL_MSG_SENT	A message has been sent (informational)	No	Uses CAlarmAction::Info() - informational only
508	AL_AFTN_ALARM	An AFTN/GTS channel has bad connection	Yes	Uses CAlarmAction::Alarm() which will require acknowledgment
509	AL_FAILOVER	A Failover has occured	Yes	System alarm requiring acknowledgment
510	AL_COLDSERVER_ DOWN	Cold server gone down	Yes	System alarm requiring acknowledgment
511	AL_TIMEGAPTOOBIG	Time between servers too big	Yes	System alarm requiring acknowledgment
512	AL_STATIONCONNECT	Mirror client could not connect to server	Yes	System alarm requiring acknowledgment

Table B-2: Meteo Alarm IDs

ID	Name	Description	Requires acknowledgment	Notes
513	AL_SYSTEMMON	A System Monitor alarm	Yes	System alarm requiring acknowledgment
514	AL_SYSTEMMON_ WARNING	A System Monitor warning	Yes	Warning level but still requires acknowledgment
515	AL_ BATAPUNDELIVERABL E	A Datalink BATAP message could not be sent	Yes	System alarm requiring acknowledgment
516	AL_DATALINKFAIL	The Datalink service is failing	Yes	System alarm requiring acknowledgment
517	AL_UPS_ON_BATTERY	System is running on battery	Yes	Uses CAlarmAction::Alar m() which will require acknowledgment
518	AL_POWER_ISSUE	One or more power supplies not OK	Yes	System alarm requiring acknowledgment
519	AL_COLDSERVER_TIME	A cold server has time sync issues	Yes	System alarm requiring acknowledgment
520	AL_BACKUPLOGGER	A backup logger connection is failing	Yes	System alarm requiring acknowledgment
521	AL_CABINETRH	Logger cabinet relative humidity above high limit	Yes	Uses CAlarmAction::Alar m() which will require acknowledgment

Table B-2: Meteo Alarm IDs

ID	Name	Description	Requires acknowledgment	Notes
522	AL_AUDIOFEED	The Audiofeed protocol has too few listeners	Yes	System alarm requiring acknowledgment
523	AL_EMAILSEND	The EMailSend protocol has met a poblem	Yes	System alarm requiring acknowledgment
524	AL_DATABASE	Failure connecting to the database	Yes	Uses CAlarmAction::Alarm() which will require acknowledgment

Appendix C. Aero MI maintenance codes

The following PDF pages contain the maintenance codes for the Aero MI.

Maintenance Code	Condition:	Triggers Maintenance State?	Message	Implemented in:	Remarks
1000	Sensor Status Failure	Yes	NWS 425 [1000]: Sensor Status Failure	qc	
1001	Encountered Five Consecutive Communication Errors	Yes	NWS 425 [1001]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
1002	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	NWS 425 [1002]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	qc	
1003	**Heater Voltage Status** = *Fail*	Yes	NWS 425 [1003]: Sensor Heater Voltage Failure	dr	
1004	**Array Heater Resistance Status** = *Fail*	Yes	NWS 425 [1004]: Sensor Array Heater Resistance Failure	dr	
1005	**Heater Off Voltage Status** = *Fail*	Yes	NWS 425 [1005]: Sensor Heater Off Voltage Failure	dr	
1006	**Thermistor Temperature Status** = *Fail*	Yes	NWS 425 [1006]: Sensor Thermistor Failure	dr	
1007	**Incoming Supply Status** = *Fail*	Yes	NWS 425 [1007]: Sensor Incoming Supply Voltage Failure	dr	
1008	**Five-volt Supply Status** = *Fail*	Yes	NWS 425 [1008]: Sensor +5 Volt Supply Failure	dr	
1009	**Ten-volt Supply Status** = *Fail*	Yes	NWS 425 [1009]: Sensor +10 Volt Supply Failure	dr	
1010	**Path 0 Signal Quality Index Status** = *Fail*	Yes	NWS 425 [1010]: Sensor Path 0 Error	dr	
1011	**Path 1 Signal Quality Index Status** = *Fail*	Yes	NWS 425 [1011]: Sensor Path 1 Error	dr	
1012	**Path 2 Signal Quality Index Status** = *Fail*	Yes	NWS 425 [1012]: Sensor Path 2 Error	dr	
1013	**Path 3 Signal Quality Index Status** = *Fail*	Yes	NWS 425 [1013]: Sensor Path 3 Error	dr	
1014	**Path 4 Signal Quality Index Status** = *Fail*	Yes	NWS 425 [1014]: Sensor Path 4 Error	dr	
1015	**Path 5 Signal Quality Index Status** = *Fail*	Yes	NWS 425 [1015]: Sensor Path 5 Error	dr	
1051	QC Algorithm Related Failure	Yes	NWS 425 [1051]: Multiple Incorrect Averaging Time Detected, Resetting Averaging Times to Stored System Values	qc	
1052	QC Algorithm Related Failure	Yes	NWS 425 [1052]: Incomplete/Corrupt Poll Response	qc	
1053	QC Algorithm Related Failure	Yes	NWS 425 [1053]: Heater Failure	qc	
1054	QC Algorithm Related Failure	Yes	NWS 425 [1054]: Wind Speed Out of Acceptable Range	qc	
1055	QC Algorithm Related Failure	Yes	NWS 425 [1055]: Wind Direction Out of Acceptable Range	qc	
1056	QC Algorithm Related Failure	Yes	NWS 425 [1056]: Incorrect Averaging Times	qc	
1058	QC Algorithm Related Failure	Yes	NWS 425 [1058]: Peak Speed Less Than Average Speed	qc	
1059	QC Algorithm Related Failure	Yes	NWS 425 [1059]: Peak Speed > 30 Knots, Average Speed < 12 Knots	qc	
1060	QC Algorithm Related Failure	Yes	NWS 425 [1060]: Average Direction - Peak Direction Difference > 30 Degrees, Average Speed ≥ 12 Knots	qc	
1061	QC Algorithm Related Failure	Yes	NWS 425 [1061]: Signal Quality Too Low	qc	
1062	QC Algorithm Related Failure	Yes	NWS 425 [1062]: Peak Speed > Check Speed, Average Speed ≥ 12 Knots	qc	
1063	QC Algorithm Related Failure	Yes	NWS 425 [1063]: Peak Speed > 13 Knots & Check Speed, Average Speed < 6 Knots	qc	
1064	QC Algorithm Related Failure	Yes	NWS 425 [1064]: Too Many Failed QC Samples in Previous 2 Minutes	qc	
1065	QC Algorithm Related Failure	Yes	NWS 425 [1065]: Consecutive Pass Counter < 75%	qc	
1066	QC Algorithm Related Failure	No	NWS 425 [1066]: Total Samples Failed Today: [Sample Flagged Counter]	qc	
1067	QC Algorithm Related Failure	Yes	NWS 425 [1067]: Multiple Incorrect Averaging Times Errors Detected, Resetting NWS425 Averaging Times to Stored Values	dr	
1069	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for NWS 425)	NWS 425 [1069]: Report Processing Turned On	ui	
1070	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	NWS 425 [1070]: Report Processing Turned Off	ui	
1097	A NWS 425 Wind Sensor is added or removed from the system.	No	NWS 425 [1097]: Configured - (Configuration Key) set to (Configuration Value)		
1098	A NWS 425 Wind Sensor is added or removed from the system.	No	NWS 425 [1098]: No Errors Detected	qc	
1099	QC Algorithm Related Message	No (Resolves Maintenance State Condition for NWS 425)	NWS 425 [1099]: Sensor Operational	qc	
1100	Sensor Status Failure	Yes	TSS 924 [1100]: Sensor Status Failure	qc	
1101	Encountered Five Consecutive Communication Errors	Yes	TSS 924 [1101]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
1102	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	TSS 924 [1102]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
1103	**Self-test results Bytes 32-33** not equal to **0xc6**	Yes	TSS 924 [1103]: Sensor Self Test Failed	dr	
1104	**Self-test results B1** = 0	Yes	TSS 924 [1104]: Input Voltage Too Low	dr	
1105	**Self-test results B0** = 1	Yes	TSS 924 [1105]: Input Voltage Too High	dr	
1106	**Self-test results B5** = 1	Yes	TSS 924 [1106]: Internal 5 Volts Too Low	dr	
1107	**Self-test results B4** = 1	Yes	TSS 924 [1107]: Internal 10 Volts Too Low	dr	
1151	**QC Algorithm Related Failure**	Yes	TSS 924 [1151]: Self-Test Status Failed	qc	
1152	QC Algorithm Related Failure	Yes	TSS 924 [1152]: Self-Test Status Not Available	qc	
1153	QC Algorithm Related Failure	Yes	TSS 924 [1153]: Lightning Counts Below Acceptable Range	qc	
1154	QC Algorithm Related Failure	Yes	TSS 924 [1154]: Lightning Counts Above Acceptable Range	qc	
1155	QC Algorithm Related Failure	Yes	TSS 924 [1155]: Total Lightning Counts Not Equal to Component Lightning Counts	qc	
1157	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for TSS 924)	TSS 924 [1157]: Report Processing Turned On	ui	
1158	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	TSS 924 [1158]: Report Processing Turned Off	ui	
1197	A TSS 924 Lightning Sensor is added or removed from the system.	No	TSS 924 [1197]: Configured - (Configuration Key) set to (Configuration Value)		
1199	QC Algorithm Related Message	No (Resolves Maintenance State Condition for TSS 924)	TSS 924 [1199]: Sensor Operational	qc	
1200	Sensor Status Failure	Yes	DTS1 [1200]: Sensor Status Failure	qc	
1201	Five Consecutive Communication Errors	Yes	DTS1 [1201]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
1202	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	DTS1 [1202]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
1203	**Dew Point Transmitter Status** = *Fail*	Yes	DTS1 [1203]: Transmitter Error	dr	
1204	**Transmitter Operating Voltage Status** = *Fail*	Yes	DTS1 [1204]: Transmitter Operating Voltage Error	dr	
1205	**Enclosure Heating Status** = *Fail*	Yes	DTS1 [1205]: Enclosure Heater Error	dr	
1206	**Enclosure Temperature Status** = *Fail*	Yes	DTS1 [1206]: Enclosure Temperature Error	dr	
1250	Sensor Response Timeout	Yes	DTS1 [1250]: Sensor Response Timeout	qc	
1253	QC Algorithm Related Failure	Yes	DTS1 [1253]: Dewpoint Temperature Measurement Below Acceptable Range	qc	
1254	QC Algorithm Related Failure	Yes	DTS1 [1254]: Dewpoint Temperature Measurement Above Acceptable Range	qc	
1255	QC Algorithm Related Failure	Yes	DTS1 [1255]: 1-Minute Average Ambient Temperature Set to Missing, Too Many Missing Dewpoint Temperature Measurements	qc	
1257	QC Algorithm Related Failure	Yes	DTS1 [1257]: 1-Minute Average Dewpoint Temperature Difference of ± 10 Degrees Detected Over 1 Minute, 1-Minute Average Dewpoint Temperature Set to Missing	qc	

1258	QC Algorithm Related Failure	Yes	DTS1 [1258]: 1-Minute Average Dewpoint Temperature Failed to Vary More Than 0.1 Degrees Over 2 Hours, 1-Minute Average Dewpoint Temperature Set to Missing	qc	
1259	QC Algorithm Related Failure	Yes	DTS1 [1259]: 1-Minute Average Dewpoint Temperature - 1-Minute Average Ambient Temperature > 2 Degrees, 1-Minute Average Dewpoint Temperature Set to Missing	qc	
1260	QC Algorithm Related Failure	Yes	DTS1 [1260]: 1-Minute Average Dewpoint Temperature - 1-Minute Average Ambient Temperature ≤ 2 Degrees, 1-Minute Average Dewpoint Temperature Set to 1-Minute Average Temperature	qc	
1264	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for DTS1)	DTS1 [1264]: Report Processing Turned On	ui	
1265	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	DTS1 [1265]: Report Processing Turned Off	ui	
1297	A DTS1Dewpoint Sensor is added or removed from the system.	No	DTS1 [1297]: Configured - (Configuration Key) set to (Configuration Value)		
1299	QC Algorithm Related Message	No (Resolves Maintenance State Condition for DTS1)	DTS1 [1299]: Sensor Operational	qc	
1301	Encountered Five Consecutive Communication Errors	Yes	AWPAG [1301]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	qc	
1302	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	AWPAG [1302]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	qc	
1304	**Pipehouse switch Status** = *Fail* from PD	Yes	AWPAG [1304]: Pipehouse Failure	dr	
1305	**Bucket Status** = *Fail from PD*	Yes	AWPAG [1305]: Bucket Failure	dr	
1306	**Balance system Status** = *Fail from PD*	Yes	AWPAG [1306]: Balance System Failure	dr	
1307	**LOGOSense board Status** = *Fail from PD*	Yes	AWPAG [1307]: LogoSens Board Failure	dr	
1308	**Ring heating control Status** = *Fail from PD*	Yes	AWPAG [1308]: Ring Heating Control Failure	dr	
1309	**Power supply Status** = *Fail from PD*	Yes	AWPAG [1309]: Power Supply Failure	dr	
1310	**Internal heating Status** = *Fail from PD*	Yes	AWPAG [1310]: Internal Heating Failure	dr	
1314		Yes	AWPAG [1314]: Sensor Status Set to Missing, 1-Minute Precipitation Amount Set to Missing	qc	
1350	**Sensor not responding prior to the configurable timeout period**	Yes	AWPAG [1350]: Sensor Response Timeout	qc	
1351	QC Algorithm Related Failure	Yes	AWPAG [1351]: Bucket Total Exceeds 80% Capacity	qc	
1352	QC Algorithm Related Failure	Yes	AWPAG [1352]: Sensor Status Set to Reset, 1-Minute Precipitation Set to Missing	qc	
1353	QC Algorithm Related Failure	Yes	AWPAG [1353]: Sensor Status Set to Fail, Ring Heater Only Failure, Verification Temperature < 35, 1-Minute Precipitation Set to Missing	qc	
1354	QC Algorithm Related Failure	Yes	AWPAG [1354]: Sensor Status Set to Fail, Not Only Ring Heater Failure, 1-Minute Precipitation Set to Missing	qc	
1355	QC Algorithm Related Failure	Yes	AWPAG [1355]: Previous Sensor Status Set to Fail, 1-Minute Precipitation Set to Missing	qc	
1357	QC Algorithm Related Failure	Yes	AWPAG [1357]: 1-Minute Precipitation Amount Below Acceptable Range, 1-Minute Precipitation Set to Missing	qc	
1358	QC Algorithm Related Failure	Yes	AWPAG [1358]: 1-Minute Precipitation Amount Above Acceptable Range, 1-Minute Precipitation Set to Missing	qc	
1359	QC Algorithm Related Failure	Yes	AWPAG [1359]: 1-Minte Precipitation Set to Zero with Consistent Moderate or Heavy Precipitation Detected, 1-Minute Precipitation Set to Missing	qc	
1361	QC Algorithm Related Failure	Yes	AWPAG [1361]: Recovered (Precipitation Amount) Inches Between (Last Good Date/Time) and (Current Date/Time)	qc	
1363	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for AWPAG)	AWPAG [1363]: Report Processing Turned On	ui	
1364	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	AWPAG [1364]: Report Processing Turned Off	ui	
1397	An AWPAG Precipitation Sensor is added or removed from the system.	No	AWPAG [1397]: Configured - (Configuration Key) set to (Configuration Value)		
1399	QC Algorithm Related Message	No (Resolves Maintenance State Condition for AWPAG)	AWPAG [1399]: Sensor Operational	qc	
1400	Sensor Status Failure	Yes	OWI 240 [1400]: Sensor Status Failure	qc	
1401	Encountered Five Consecutive Communication Errors	Yes	OWI 240 [1401]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
1402	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	OWI 240 [1402]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
1405	**Table 5 Checksum** error	Yes	OWI 240 [1405]: Checksum Error	dr	
1406	**FRU #8 Status Bit** = *"1"* or **FRU #6 Status Bit** = *"1"*	Yes	OWI 240 [1406]: Digital Power Supply or Microprocessor Error	dr	
1407	**FRU #7 Status Bit** = *"1"*	Yes	OWI 240 [1407]: Analog Power Supply Error	dr	
1408	**FRU #2 Status Bit** = *"1"*	Yes	OWI 240 [1408]: Transmitter Card Error	dr	
1409	**FRU #3 Status Bit** = *"1"*	Yes	OWI 240 [1409]: Receiver AGC Card Error	dr	
1410	**FRU #4 Status Bit** = *"1"*	Yes	OWI 240 [1410]: Signal Processing Card 1 Error	dr	
1411	**FRU #5 Status Bit** = *"1"*	Yes	OWI 240 [1411]: Signal Processing Card 2 Error	dr	
1412	**FRU #9 Status Bit** = *"1"*	Yes	OWI 240 [1412]: Heater Power Supply Error	dr	
1413	**FRU #1 Status Bit** = *"1"*	Yes	OWI 240 [1413]: Frame Assembly Error	dr	
1414	**Table 5 Checksum** error	Yes	OWI 240 [1414]: Diagnostic Data Checksum Error	dr	
1452	QC Algorithm Related Failure	Yes	OWI 240 [1452]: Precipitation Identifier Reading Not Valid	qc	
1453	QC Algorithm Related Failure	Yes	OWI 240 [1453]: Precipitation Identifier Precipitation Amount Below Acceptable Range	qc	
1454	QC Algorithm Related Failure	Yes	OWI 240 [1454]: Precipitation Identifier Precipitation Amount Above Acceptable Range	qc	
1456	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for OWI 240)	OWI 240 [1456]: Report Processing Turned On	ui	
1457	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	OWI 240 [1457]: Report Processing Turned Off	ui	
1497	An OWI 240 PW Sensor is added or removed from the system.	No	OWI 240 [1497]: Configured - (Configuration Key) set to (Configuration Value)		
1498	QC was failing, then starts Passing	No	OWI 240 [1498]: Sensor Returned to Regular Operations	qc	
1499	QC Algorithm Related Message	No (Resolves Maintenance State Condition for OWI 240)	OWI 240 [1499]: Sensor Operational	qc	
1500	Sensor Status Failure	Yes	Belfort 6200 Primary [1500]: Sensor Status Failure	qc	
1501	Encountered Five Consecutive Communication Errors	Yes	Belfort 6200 Primary [1501]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
1502	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	Belfort 6200 Primary [1502]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
1513	**Inside Ambient Temperature value (five digits) out of range**	Yes	Belfort 6200 Primary [1513]: Inside Ambient Temperature Failure	dr	What are these limits ? 0 - 150 Fahr?
1516	**Day/night Window Heater Status = Fail**	Yes	Belfort 6200 Primary [1516]: Day/Night window heater Failure	dr	
1518	**Transmitter Hood Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1518]: Transmitter hood heater Failure	dr	
1519	**Receiver Hood Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1519]: Receiver hood heater Failure	dr	
1521	T**ransmitter Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1521]: Transmitter Electronics heater Failure	dr	
1522	**Receiver Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1522]: Receiver Electronics heater Failure	dr	
1523	**Day/night Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1523]: Day/Night Electronics heater Failure	dr	
1524	**Transmitter Window Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1524]: Transmitter window heater Failure	dr	
1525	**Receiver Window Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1525]: Receiver window heater Failure	dr	
1541	**RAM Check Status** = *Fail*	Yes	Belfort 6200 Primary [1541]: RAM Check Error (Replace the Controller FRU)	dr	
1542	**ROM Check Status** = *Fail*	Yes	Belfort 6200 Primary [1542]: ROM Check Error (Replace the Controller FRU)	dr	
1543	**ADD Check Status** = *Fail*	Yes	Belfort 6200 Primary [1543]: Address Check Error (Replace the Controller FRU)	dr	

1544	**EPROM Check Status** = *Fail*	Yes	Belfort 6200 Primary [1544]: EEPROM Check Error (Replace the Controller FRU)	dr
1545	**Table 5 Checksum** error	Yes	Belfort 6200 Primary [1545]: Diagnostic Data Checksum Error (Check the Fiber Optic Module FRU)	dr
1546	**Enclosure Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Primary [1546]: Enclosure Electronics heater Failure	dr
1547	**Receiver Operational Status** = *Fail*	Yes	Belfort 6200 Primary [1547]: Receiver Operational Status Failure	dr
1548	**Transmitter Operational Status** = *Fail*	Yes	Belfort 6200 Primary [1548]: Transmitter Operational Status Failure	dr
1549	**Day/Night Operational Status** = *Fail*	Yes	Belfort 6200 Primary [1549]: Day/Night Operational Status Failure	dr
1552	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1552]: Heater Thermostat Failure	qc
1553	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1553]: Extinction Coefficient Below Acceptable Range	qc
1554	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1554]: Extinction Coefficient Above Acceptable Range	qc
1555	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1555]: Extinction Coefficient Missing	qc
1556	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1556]: Night Photometer Reading at Noon, Readings Reset to Day	qc
1557	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1557]: Day Photometer Reading at Midnight, Readings Reset to Day	qc
1558	QC Algorithm Related Failure	Yes	Belfort 6200 Primary [1558]: Photometer Reading Not Set to Day or Night, Readings Reset to Day	qc
1561	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for Belfort 6200 Primary)	Belfort 6200 Primary [1561]: Report Processing Turned On	ui
1562	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	Belfort 6200 Primary [1562]: Report Processing Turned Off	ui
1591	Photometer Operational	No	Belfort 6200 Primary [1591]: Photometer Operational	qc
1597	A Belfort 6200 Visibility Sensor is added or removed from the system.	No	Belfort 6200 Primary [1597]: Configured - (Configuration Key) set to (Configuration Value)	
1599	QC Algorithm Related Message	No (Resolves Maintenance State Condition for Belfort 6200 Primary)	Belfort 6200 Primary [1599]: Sensor Operational	qc
1600	Sensor Status Failure	Yes	Rosemount 872C3 [1600]: Sensor Status Failure	qc
1601	Encountered Five Consecutive Communication Errors	Yes	Rosemount 872C3 [1601]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
1602	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	Rosemount 872C3 [1602]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr
1603	**Pass/Fail/Deice Status** = *Failure* & **Code** =*1 from Z4*	Yes	Rosemount 872C3 [1603]: Probe Failure	dr
1604	**Pass/Fail/Deice Status** = *Failure* & **Code** =*2 from Z4*	Yes	Rosemount 872C3 [1604]: Probe Deicing Heater Failure	dr
1605	**Pass/Fail/Deice Status** = *Failure* & **Code** =*3 from Z4*	Yes	Rosemount 872C3 [1605]: Electronics Failure	dr
1606	Driver Related Failure	Yes	Rosemount 872C3 [1606]: 30-Second Deice Failure, Sensor Inoperative	qc
1607	Driver Related Failure	Yes	Rosemount 872C3 [1607]: 45-Second Deice Failure, Sensor Inoperative	qc
1625	QC Algorithm Related Failure	No	Rosemount 872C3 [1625]: Field Calibration Requested	qc
1626	QC Algorithm Related Failure	No	Rosemount 872C3 [1626]: Field Calibration Cancelled	dr
1627	QC Algorithm Related Failure	No	Rosemount 872C3 [1627]: Field Calibration Set to Not Authorized by Operator	qc
1628	QC Algorithm Related Failure	No	Rosemount 872C3 [1628]: Field Calibration Set to Authorized by Operator	qc
1629	QC Algorithm Related Failure	No	Rosemount 872C3 [1629]: Seasonally Enabled for Operational	qc
1630	QC Algorithm Related Failure	No	Rosemount 872C3 [1630]: Seasonally Disabled for Operational	qc
1631	Driver Related Failure	No	Rosemount 872C3 [1631]: 30-Second Deice Requested	dr
1632	Driver Related Failure	No	Rosemount 872C3 [1632]: 45-Second Deice Requested	dr
1652	QC Algorithm Related Failure	Yes	Rosemount 872C3 [1652]: Sensor Frequency Below Acceptable Range, Sensor Frequency Set to Missing	qc
1653	QC Algorithm Related Failure	Yes	Rosemount 872C3 [1653]: Sensor Frequency Above Acceptable Range, Sensor Frequency Set to Missing	qc
1655	QC Algorithm Related Failure	Yes	Rosemount 872C3 [1655]: ABF Value is (ABF Value) Hz, ABF Value Out of Acceptable Range, Report Processing Set to OFF	qc
1656	QC Algorithm Related Failure	No	Rosemount 872C3 [1656]: ABF Value is (ABF Value) Hz, ABF Value in Calibration Range, Sensor Requires Field Calibration	qc
1657	QC Algorithm Related Failure	No	Rosemount 872C3 [1657]: ABF Value is (ABF Value), ABF is in Acceptable Range, Sensor Does Not Require Field Calibration	qc
1658	**Frequency =** *True Idle Frequency from F5*	No	Rosemount 872C3 [1658]: Field Calibration Successful, True Idle Frequency is (True Idle Frequency) Hz	dr
1659	**Pass/Fail Status** = *Failure* from F5	Yes	Rosemount 872C3 [1659]: Field Calibration Failure	dr
1660	Sensor is Enabled Via OID or Tech screen.	No	Rosemount 872C3 [1660]: Report Processing Turned On	ui
1661	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	Rosemount 872C3 [1661]: Report Processing Turned Off	ui
1697	A Rosemount 872C3 Ice Accretion Sensor is added or removed from the system.	No	Rosemount 872C3 [1697]: Configured - (Configuration Key) set to (Configuration Value)	
1700	Sensor Status Failure	Yes	Frise 7405HA [1700]: Sensor Status Failure	qc
1752	QC Algorithm Related Failure	Yes	Frise 7405HA [1752]: Tip Count Set to Zero with Consistent Moderate or Heavy Precipitation Detected, 1-Minute Precipitation Set to Missing	qc
1754	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for Frise 7405HA)	Frise 7405HA [1754]: Report Processing Turned On	ui
1755	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	Frise 7405HA [1755]: Report Processing Turned Off	ui
1791	Tip Count Missing	No	Frise 7405HA [1791]: Tip Count Missing	qc
1792	Tip Count Below Acceptable Range	No	Frise 7405HA [1792]: Tip Count Below Acceptable Range	qc
1793	Tip Count Above Acceptable Range	No	Frise 7405HA [1793]: Tip Count Above Acceptable Range	qc
1797	A Frise 7405HA Precipitation Sensor is added or removed from the system.	No	Frise 7405HA [1797]: Configured - (Configuration Key) set to (Configuration Value)	qc
1799	QC Algorithm Related Message	No (Resolves Maintenance State Condition for Frise 7405HA)	Frise 7405HA [1797]: Sensor Operational	qc
1800	Sensor Status Failure	Yes	TD 1088 [1800]: Sensor Status Failure	qc
1801	5 Consecutive Failed sensor responses.	Yes	TD 1088 [1801]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
1802	20% in 24 Hours Failed sensor responses	Yes	TD 1088 [1802]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr
1804	QC Algorithm Related Failure	Yes	TD 1088 [1804]: Sensor Aspirator Fan Failure	dr
1805	QC Algorithm Related Failure	Yes	TD 1088 [1805]: Sensor 0 Degree C Calibration Error	dr
1806	QC Algorithm Related Failure	Yes	TD 1088 [1806]: Sensor 50 Degree C Calibration Error	dr
1807	QC Algorithm Related Failure	Yes	TD 1088 [1807]: Sensor RTD Error	dr
1808	QC Algorithm Related Failure	Yes	TD 1088 [1808]: Sensor Mirror Servo Error	dr
1809	QC Algorithm Related Failure	Yes	TD 1088 [1809]: Sensor Critical Voltage Error	dr
1810	QC Algorithm Related Failure	Yes	TD 1088 [1810]: Sensor Dirty Mirror Flag	dr
1852	QC Algorithm Related Failure	Yes	TD 1088 [1852]: Ambient Temperature Measurement Missing	qc
1853	QC Algorithm Related Failure	Yes	TD 1088 [1853]: Ambient Temperature Measurement Below Acceptable Range	qc
1854	QC Algorithm Related Failure	Yes	TD 1088 [1854]: Ambient Temperature Measurement Above Acceptable Range	qc
1855	QC Algorithm Related Failure	Yes	TD 1088 [1855]: Dewpoint Temperature Measurement Missing	qc

1856	QC Algorithm Related Failure	Yes	TD 1088 [1856]: Dewpoint Temperature Measurement Below Acceptable Range	qc
1857	QC Algorithm Related Failure	Yes	TD 1088 [1857]: Dewpoint Temperature Measurement Above Acceptable Range	qc
1858	QC Algorithm Related Failure	No	TD 1088 [1858]: Sensor Heat Cycle Detected, Measurements Replace with Last Good Measurements	qc
1859	QC Algorithm Related Failure	Yes	TD 1088 [1859]: 1-Minute Average Ambient Temperature Set to Missing, Too Many Missing Ambient Temperature Measurements	qc
1860	QC Algorithm Related Failure	Yes	TD 1088 [1860]: 1-Minute Average Ambient Temperature Set to Missing, Too Many Missing Dewpoint Temperature Measurements	qc
1861	QC Algorithm Related Failure	Yes	TD 1088 [1861]: 1-Minute Average Ambient Temperature Difference of ± 10 Degrees Detected Over 1 Minute, 1-Minute Average Ambient and Dewpoint Temperatures Set to Missing	qc
1862	QC Algorithm Related Failure	Yes	TD 1088 [1862]: 1-Minute Average Ambient Temperature Failed to Vary More Than 0.1 Degrees Over 2 Hours, 1-Minute Average Ambient and Dewpoint Temperatures Set to Missing	qc
1863	QC Algorithm Related Failure	Yes	TD 1088 [1863]: 1-Minute Average Dewpoint Temperature Difference of ± 10 Degrees Detected Over 1 Minute, 1-Minute Average Dewpoint Temperature Set to Missing	qc
1864	QC Algorithm Related Failure	Yes	TD 1088 [1864]: 1-Minute Average Dewpoint Temperature Failed to Vary More Than 0.1 Degrees Over 2 Hours, 1-Minute Average Dewpoint Temperature Set to Missing	qc
1865	QC Algorithm Related Failure	Yes	TD 1088 [1865]: 1-Minute Average Dewpoint Temperature - 1-Minute Average Ambient Temperature > 2 Degrees, 1-Minute Average Dewpoint Temperature Set to Missing	qc
1866	QC Algorithm Related Failure	Yes	TD 1088 [1866]: 1-Minute Average Dewpoint Temperature - 1-Minute Average Ambient Temperature ≤ 2 Degrees, 1-Minute Average Dewpoint Temperature Set to 1-Minute Average Temperature	qc
1870	QC Algorithm Related Failure	No	TD 1088 [1870]: Heat Cycle Occurred Twice in 11 Hours	qc
1871	QC Algorithm Related Failure	No	TD 1088 [1871]: Heat Cycle Duration Greater Than 15 Minutes	qc
1872	QC Algorithm Related Failure	No	TD 1088 [1872]: No Heat Cycle in 25 Hours	qc
1873	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for TD 1088)	TD 1088 [1873]: Report Processing Turned On	ui
1874	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	TD 1088 [1874]: Report Processing Turned Off	ui
1897	A TD1088 Temp RH Sensor is added or removed from the system.	No	TD 1088 [1897]: Configured - (Configuration Key) set to (Configuration Value)	
1899	QC Algorithm Related Message	No (Resolves Maintenance State Condition for TD 1088)	TD 1088 [1899]: Sensor Operational	qc
1900	Ho83R Sensor Status Failure	Yes	HO83R [1900]: Sensor Status Failure	qc
1901	5 Consecutive Failed sensor responses.	Yes	HO83R [1901]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
1902	20% in 24 Hours Failed sensor responses	Yes	HO83R [1902]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr
1950	QC Algorithm Related Failure	Yes	HO83R [1950]: Sensor Thermal Runaway Error	qc
1952	QC Algorithm Related Failure	Yes	HO83R [1952]: Ambient Temperature Measurement Missing	qc
1953	QC Algorithm Related Failure	Yes	HO83R [1953]: Ambient Temperature Measurement Below Acceptable Range	qc
1954	QC Algorithm Related Failure	Yes	HO83R [1954]: Ambient Temperature Measurement Above Acceptable Range	qc
1955	QC Algorithm Related Failure	Yes	HO83R [1955]: Dewpoint Temperature Measurement Missing	qc
1956	QC Algorithm Related Failure	Yes	HO83R [1956]: Dewpoint Temperature Measurement Below Acceptable Range	qc
1957	QC Algorithm Related Failure	Yes	HO83R [1957]: Dewpoint Temperature Measurement Above Acceptable Range	qc
1958	QC Algorithm Related Failure	Yes	HO83R [1958]: Sensor Heat Cycle Detected, Measurements Replace with Last Good Measurements	qc
1959	QC Algorithm Related Failure	Yes	HO83R [1959]: 1-Minute Average Ambient Temperature Set to Missing, Too Many Missing Ambient Temperature Measurements	qc
1960	QC Algorithm Related Failure	Yes	HO83R [1960]: 1-Minute Average Dewpoint Temperature Set to Missing, Too Many Missing Ambient Temperature Measurements	qc
1961	QC Algorithm Related Failure	Yes	HO83R [1961]: 1-Minute Average Ambient Temperature Difference of ± 10 Degrees Detected Over 1 Minute, 1-Minute Average Ambient and Dewpoint Temperatures Set to Missing	qc
1962	QC Algorithm Related Failure	Yes	HO83R [1962]: 1-Minute Average Ambient Temperature Failed to Vary More Than 0.1 Degrees Over 2 Hours, 1-Minute Average Ambient and Dewpoint Temperatures Set to Missing	qc
1963	QC Algorithm Related Failure	Yes	HO83R [1963]: 1-Minute Average Dewpoint Temperature Difference of ± 10 Degrees Detected Over 1 Minute, 1-Minute Average Dewpoint Temperature Set to Missing	qc
1964	QC Algorithm Related Failure	Yes	HO83R [1964]: 1-Minute Average Dewpoint Temperature Failed to Vary More Than 0.1 Degrees Over 2 Hours, 1-Minute Average Dewpoint Temperature Set to Missing	qc
1965	QC Algorithm Related Failure	Yes	HO83R [1965]: 1-Minute Average Dewpoint Temperature - 1-Minute Average Ambient Temperature > 2 Degrees, 1-Minute Average Dewpoint Temperature Set to Missing	qc
1966	QC Algorithm Related Failure	Yes	HO83R [1966]: 1-Minute Average Dewpoint Temperature - 1-Minute Average Ambient Temperature ≤ 2 Degrees, 1-Minute Average Dewpoint Temperature Set to 1-Minute Average Temperature	qc
1970	QC Algorithm Related Failure	No	HO83R [1970]: Heat Cycle Occurred Twice in 11 Hours	qc
1971	QC Algorithm Related Failure	No	HO83R [1971]: Heat Cycle Duration Greater Than 15 Minutes	qc
1972	QC Algorithm Related Failure	No	HO83R [1972]: No Heat Cycle in 25 Hours	qc
1973	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for HO83R)	HO83R [1973]: Report Processing Turned On	ui
1974	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	HO83R [1974]: Report Processing Turned Off	ui
1997	A Ho83R Temp RH Sensor is added or removed from the system.	No	HO83R [1997]: Configured - (Configuration Key) set to (Configuration Value)	
1998	QC Algorithm Related message	No	HO83R [1998]: Dewpoint Temperature Sensor Operational	qc
1999	QC Algorithm Related message	No (Resolves Maintenance State Condition for HO83R)	HO83R [1999]: Sensor Operational	qc
2051	Pressure Measurement is missing from sensor	Yes	Setra 470T 1 [2051]: Pressure Measurement Missing	qc
2052	QC Algorithm Related Failure	Yes	Setra 470T 1 [2052]: Pressure Measurement Below Acceptable Range	qc
2053	QC Algorithm Related Failure	Yes	Setra 470T 1 [2053]: Pressure Measurement Above Acceptable Range	qc
2054	QC Algorithm Related Failure	Yes	Setra 470T 1 [2054]: Pressure Measurements Increased/Decreased Greater Than or Equal to 0.1 Inches of Mercury Over 1 Minute	qc
2056	QC Algorithm Related Failure	Yes	Setra 470T 1 [2056]: (Enclosure) Cabinet Temperature Below Acceptable Range - Pressure Measurement Set to Missing	qc
2057	QC Algorithm Related Failure	Yes	Setra 470T 1 [2057]: (Enclosure) Cabinet Temperature Above Acceptable Range - Pressure Measurement Set to Missing	qc
2058	QC Algorithm Related Failure	Yes	Setra 470T 1 [2058]: (Enclosure) Cabinet Temperature Not Available - Pressure Measurement Set to Missing	qc
2059	QC Algorithm Related Failure	No	Setra 470T 1 [2059]: (Enclosure) Pressure Cabinet Temperature is Available and In the Acceptable Range	qc
2060	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition)	Setra 470T 1 [2060]: Report Processing Turned On	ui
2061	Sensor is Disabled Via OID or Tech screen. Or a quality Error turns report processing off.	Yes	Setra 470T 1 [2061]: Report Processing Turned Off	ui
2097	A Setra 470T Pressure Sensor is added or removed from the system.	No	Setra 470T 1 [2097]: Configured - (Configuration Key) set to (Configuration Value)	
2099	A Setra 470T Pressure Sensor is added or removed from the system.	No (Resolves Maintenance State for Setra 470T	Setra 470T 1 [2099]: Pressure Sensor Operational	qc
2151	Pressure Measurement is missing from sensor	Yes	Setra 470T 2 [2151]: Pressure Measurement Missing	qc
2152	QC Algorithm Related Failure	Yes	Setra 470T 2 [2152]: Pressure Measurement Below Acceptable Range	qc
2153	QC Algorithm Related Failure	Yes	Setra 470T 2 [2153]: Pressure Measurement Above Acceptable Range	qc
2154	QC Algorithm Related Failure	Yes	Setra 470T 2 [2154]: Pressure Measurements Increased/Decreased Greater Than or Equal to 0.1 Inches of Mercury Over 1 Minute	qc
2156	QC Algorithm Related Failure	Yes	Setra 470T 2 [2156]: (Enclosure) Cabinet Temperature Below Acceptable Range - Pressure Measurement Set to Missing	qc
2157	QC Algorithm Related Failure	Yes	Setra 470T 2 [2157]: (Enclosure) Cabinet Temperature Above Acceptable Range - Pressure Measurement Set to Missing	qc
2158	QC Algorithm Related Failure	Yes	Setra 470T 2 [2158]: (Enclosure) Cabinet Temperature Not Available - Pressure Measurement Set to Missing	qc
2159	QC Algorithm Related Failure	No	Setra 470T 2 [2159]: (Enclosure) Pressure Cabinet Temperature is Available and In the Acceptable Range	qc
2160	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition)	Setra 470T 2 [2160]: Report Processing Turned On	ui
2161	Sensor is Disabled Via OID or Tech screen. Or a quality Error turns report processing off.	Yes	Setra 470T 2 [2161]: Report Processing Turned Off	ui

2197	A Setra 470T Pressure Sensor is added or removed from the system.	No	Setra 470T 2 [2197]: Configured - (Configuration Key) set to (Configuration Value)	
2199	A Setra 470T Pressure Sensor is operational	No (Resolves Maintenance State for Setra 470T	Setra 470T 2 [2199]: Pressure Sensor Operational	qc
2251	Pressure Measurement is missing from sensor	Yes	Setra 470T 3 [2251]: Pressure Measurement Missing	qc
2252	QC Algorithm Related Failure	Yes	Setra 470T 3 [2252]: Pressure Measurement Below Acceptable Range	qc
2253	QC Algorithm Related Failure	Yes	Setra 470T 3 [2253]: Pressure Measurement Above Acceptable Range	qc
2254	QC Algorithm Related Failure	Yes	Setra 470T 3 [2254]: Pressure Measurements Increased/Decreased Greater Than or Equal to 0.1 Inches of Mercury Over 1 Minute	qc
2256	QC Algorithm Related Failure	Yes	Setra 470T 3 [2256]: (Enclosure) Cabinet Temperature Below Acceptable Range - Pressure Measurement Set to Missing	qc
2257	QC Algorithm Related Failure	Yes	Setra 470T 3 [2257]: (Enclosure) Cabinet Temperature Above Acceptable Range - Pressure Measurement Set to Missing	qc
2258	QC Algorithm Related Failure	Yes	Setra 470T 3 [2258]: (Enclosure) Cabinet Temperature Not Available - Pressure Measurement Set to Missing	qc
2259	QC Algorithm Related Failure	No	Setra 470T 3 [2259]: (Enclosure) Pressure Cabinet Temperature is Available and In the Acceptable Range	qc
2260	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition)	Setra 470T 3 [2260]: Report Processing Turned On	ui
2261	Sensor is Disabled Via OID or Tech screen. Or a quality Error turns report processing off.	Yes	Setra 470T 3 [2261]: Report Processing Turned Off	ui
2297	A Setra 470T Pressure Sensor is added or removed from the system.	No	Setra 470T 3 [2297]: Configured - (Configuration Key) set to (Configuration Value)	
2299	A Setra 470T Pressure Sensor is operational	No (Resolves Maintenance State for Setra 470T	Setra 470T 3 [2299]: Pressure Sensor Operational	qc
2300	Sensor Status Failure	Yes	CL31 Primary [2300]: Sensor Status Failure	qc
2301	Encountered Five Consecutive Communication Errors	Yes	CL31 Primary [2301]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
2302	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	CL31 Primary [2302]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr
2303	**P/W/F Flag of Transmitter Inlaser** = *F*	Yes	CL31 Primary [2303]: Transmitter Inlaser Failure	dr
2304	**P/W/F Flag of Receiver Gain** = *F*	Yes	CL31 Primary [2304]: Receiver Gain Failure	dr
2305	**P/W/F Flag of Window Condition** = *F*	Yes	CL31 Primary [2305]: Window Conditioner Failure	dr
2306	**P/W/F Flag of Outlaser** = *F*	Yes	CL31 Primary [2306]: Outlaser Failure	dr
2307	**P/W/F Flag of Relative Outlaser** = *F*	Yes	CL31 Primary [2307]: Relative Outlaser Failure	dr
2308	**P/W Flag of Background Radiance** = *F*	Yes	CL31 Primary [2308]: Background Radiance Failure	dr
2309	**P/W Flag of Tilt Angle** = *F*	Yes	CL31 Primary [2309]: Tilt Angle Failure	dr
2310	**P/W Flag of Internal Temperature** = *F*	Yes	CL31 Primary [2310]: Internal Temperature Failure	dr
2311	**P/W Flag of External Temperature** = *F*	Yes	CL31 Primary [2311]: External Temperature Failure	dr
2312	**P/W Flag of DC Power Temperature** = *F*	Yes	CL31 Primary [2312]: DC Power Temperature Failure	dr
2313	**P/W Flag of Inclinometer Temperature** = *F*	Yes	CL31 Primary [2313]: Inclinometer Temperature Failure	dr
2314	**P/W Flag of Laser Temperature** = *F*	Yes	CL31 Primary [2314]: Laser Temperature Failure	dr
2315	**P/W Flag of Blower Temperature** = *F*	Yes	CL31 Primary [2315]: Blower Temperature Failure	dr
2316	**P/W/F Flag of Suspect Module (Primary)** = *F*	Yes	CL31 Primary [2316]: Suspect Module (Primary) Failure	dr
2317	**P/W/F Flag of Suspect Module (Secondary)** = *F*	Yes	CL31 Primary [2317]: Suspect Module (Secondary) Failure	dr
2318	**P/W/F Flag of Transmitter Inlaser** = *W*	Yes	CL31 Primary [2318]: Transmitter Inlaser Warning	dr
2319	**P/W/F Flag of Receiver Gain** = *W*	Yes	CL31 Primary [2319]: Receiver Gain Warning	dr
2320	**P/W/F Flag of Window Condition** = *W*	Yes	CL31 Primary [2320]: Window Conditioner Warning	dr
2321	**P/W/F Flag of Outlaser** = *W*	Yes	CL31 Primary [2321]: Outlaser Warning	dr
2322	**P/W/F Flag of Relative Outlaser** = *W*	Yes	CL31 Primary [2322]: Relative Outlaser Warning	dr
2323	**P/W Flag of Background Radiance** = *W*	Yes	CL31 Primary [2323]: Background Radiance Warning	dr
2324	**P/W Flag of Tilt Angle** = *W*	Yes	CL31 Primary [2324]: Tilt Angle Warning	dr
2325	**P/W Flag of Internal Temperature** = *W*	Yes	CL31 Primary [2325]: Internal Temperature Warning	dr
2326	**P/W Flag of External Temperature** = *W*	Yes	CL31 Primary [2326]: External Temperature Warning	dr
2327	**P/W Flag of DC Power Temperature** = *W*	Yes	CL31 Primary [2327]: DC Power Temperature Warning	dr
2328	**P/W Flag of Inclinometer Temperature** = *W*	Yes	CL31 Primary [2328]: Inclinometer Temperature Warning	dr
2329	**P/W Flag of Laser Temperature** = *W*	Yes	CL31 Primary [2329]: Laser Temperature Warning	dr
2330	**P/W Flag of Blower Temperature** = *W*	Yes	CL31 Primary [2330]: Blower Temperature Warning	dr
2331	**P/W/F Flag of Suspect Module (Primary)** = *W*	Yes	CL31 Primary [2331]: Suspect Module (Primary) Warning	dr
2332	**P/W/F Flag of Suspect Module (Secondary)** = *W*	Yes	CL31 Primary [2332]: Suspect Module (Secondary) Warning	dr
2352	QC Algorithm Related Failure	Yes	CL31 Primary [2352]: Unknown Detection Status	qc
2353	QC Algorithm Related Failure	Yes	CL31 Primary [2353]: Height Measurements Missing	qc
2354	QC Algorithm Related Failure	Yes	CL31 Primary [2354]: Height Measurements Below Measurement Range	qc
2355	QC Algorithm Related Failure	Yes	CL31 Primary [2355]: Height Measurements Above Measurement Range	qc
2356	Inconsistent Detection Status and Height Measurements	Yes	CL31 Primary [2356]: Inconsistent Detection Status and Height Measurements	qc
2358	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for CL 31)	CL31 Primary [2358]: Report Processing Turned On	ui
2359	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	CL31 Primary [2359]: Report Processing Turned Off	ui
2397	A CL31 ceilometer Sensor is added or removed from the system.	No	CL31 Primary [2397]: Configured - (Configuration Key) set to (Configuration Value)	
2399	QC Algorithm Related Message	No (Resolves Maintenance State Condition for CL 31)	CL31 Primary [2399]: Sensor Operational	qc
2400	Sensor Status Missing	Yes	TSS 928 [2400]: Sensor Data Set to Missing	qc
2401	Encountered Five Consecutive Communication Errors	Yes	TSS 928 [2401]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
2402	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	TSS 928 [2402]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr
2403	**Status =** *F* or **Status =** *?* or an unknown sensor response	Yes	TSS 928 [2403]: Self Test Failed	qc
2404	**Self-test results B0** = *1*	Yes	TSS 928 [2404]: Input Voltage Out of Range	dr
2405	**Self-test results B1** = *1*	Yes	TSS 928 [2405]: Reference Voltage Out of Range	dr
2406	**Self-test results B2** = *1*	Yes	TSS 928 [2406]: Optical 5 Volts Out of Range	dr
2407	**Self-test results B3** = *1*	Yes	TSS 928 [2407]: Digital 5 Volts Out of Range	dr
2408	**Self-test results B4** = *1*	Yes	TSS 928 [2408]: Analog 5 Volts Out of Range	dr
2409	**Self-test results B5** = *1*	Yes	TSS 928 [2409]: Internal Temperature Out of Range	dr
2410	**Self-test results B6** = *1*	Yes	TSS 928 [2410]: Self Test Signal Out of Range	dr

2411	**Self-test results B7** = *1*	Yes	TSS 928 [2411]: Stroke Rejection Value Too High	dr	
2451	QC Algorithm Related Failure	Yes	TSS 928 [2451]: Self Test Not Available	qc	
2452	QC Algorithm Related Failure	Yes	TSS 928 [2452]: Lightning Counts Below Acceptable Range	qc	
2453	QC Algorithm Related Failure	Yes	TSS 928 [2453]: Lightning Counts Above Acceptable Range	qc	
2454	QC Algorithm Related Failure	Yes	TSS 928 [2454]: Total Lightning Counts Not Equal to Component Lightning Counts	qc	
2456	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for TSS 928)	TSS 928 [2456]: Report Processing Turned On	ui	
2457	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	TSS 928 [2457]: Report Processing Turned Off	ui	
2497	A TSS 928 Lightning Sensor is added or removed from the system.	No	TSS 928 [2497]: Configured - (Configuration Key) set to (Configuration Value)		
2499	QC Algorithm Related Message	No (Resolves Maintenance State Condition for TSS 928)	TSS 928 [2499]: Sensor Operational	qc	
2500	Interface Status Failure	Yes	RVR [2500]: Interface Status Failure (Failure Message if Available)	CProtocolRvr	
2501	Encountered Five Consecutive Communication Errors	Yes	RVR [2501]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	FAARVRVQualityCheck	
2502	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	RVR [2502]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	FAARVRVQualityCheck	
2550	QC Algorithm Related Failure	No	RVR [2550]: Interface Response Timeout	FAARVRVQualityCheck	
2551	QC Algorithm Related Failure	No	RVR [2551]: Runway Number Not Valid	FAARVRVQualityCheck	
2552	QC Algorithm Related Failure	No	RVR [2552]: Runway Designator Not Valid	FAARVRVQualityCheck	
2553	QC Algorithm Related Failure	No	RVR [2553]: Interface Inoperative	FAARVRVQualityCheck	
2554	QC Algorithm Related Failure	No	RVR [2554]: Interface Offline	FAARVRVQualityCheck	
2555	QC Algorithm Related Failure	No	RVR [2555]: Measurement Value Out Of Range	FAARVRVQualityCheck	
2556	QC Algorithm Related Failure	No	RVR [2556]: Measurement Sign Not Valid	FAARVRVQualityCheck	
2557	QC Algorithm Related Failure	No	RVR [2557]: Measurement Value and Sign Pairing Not Valid	FAARVRVQualityCheck	
2559	RVR Report Processing is turned on	No (Resolves Maintenance State condition for RVR)	RVR [2559]: Report Processing Turned On	ui	
2560	RVR Report Processing is turned off	Yes	RVR [2560]: Report Processing Turned Off	ui	
2597	RVR is added or removed from the system.	No	RVR [2597]: Configured - (Configuration Key) set to (Configuration Value)		
2599	QC Algorithm Related Failure	No (Resolves Maintenance State condition for RVR)	RVR [2599]: Interface Operational	FAARVRVQualityCheck	
2600	Sensor Status Failure	Yes	WMT 700 [2600]: Sensor Status Failure	qc	
2601	Encountered Five Consecutive Communication Errors	Yes	WMT 700 [2601]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
2602	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	WMT 700 [2602]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	qc	
2651	QC Algorithm Related Failure	Yes	WMT 700 [2651]: Multiple Incorrect Averaging Time Detected, Resetting Averaging Times to Stored System Values	qc	
2652	QC Algorithm Related Failure	Yes	WMT 700 [2652]: Incomplete/Corrupt Poll Response	qc	
2653	QC Algorithm Related Failure	Yes	WMT 700 [2653]: Heater Failure	qc	
2654	QC Algorithm Related Failure	Yes	WMT 700 [2654]: Wind Speed Out of Acceptable Range	qc	
2655	QC Algorithm Related Failure	Yes	WMT 700 [2655]: Wind Direction Out of Acceptable Range	qc	
2656	QC Algorithm Related Failure	Yes	WMT 700 [2656]: Incorrect Averaging Times	qc	
2658	QC Algorithm Related Failure	Yes	WMT 700 [2658]: Peak Speed Less Than Average Speed	qc	
2659	QC Algorithm Related Failure	Yes	WMT 700 [2659]: Peak Speed > 30 Knots, Average Speed < 12 Knots	qc	
2660	QC Algorithm Related Failure	Yes	WMT 700 [2660]: Average Direction - Peak Direction Difference > 30 Degrees, Average Speed ≥ 12 Knots	qc	
2661	QC Algorithm Related Failure	Yes	WMT 700 [2661]: Signal Quality Too Low	qc	
2662	QC Algorithm Related Failure	Yes	WMT 700 [2662]: Peak Speed > Check Speed, Average Speed ≥ 12 Knots	qc	
2663	QC Algorithm Related Failure	Yes	WMT 700 [2663]: Peak Speed > 13 Knots & Check Speed, Average Speed < 6 Knots	qc	
2664	QC Algorithm Related Failure	Yes	WMT 700 [2664]: Too Many Failed QC Samples in Previous 2 Minutes	qc	
2665	QC Algorithm Related Failure	Yes	WMT 700 [2665]: Consecutive Pass Counter < 75%	qc	
2666	QC Algorithm Related Failure	No	WMT 700 [2666]: Total Samples Failed Today: [Sample Flagged Counter]	qc	
2667	QC Algorithm Related Failure	Yes	WMT 700 [2667]: Multiple Incorrect Averaging Times Errors Detected, Resetting NWS425 Averaging Times to Stored Values	dr	
2669	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for WMT 700)	WMT 700 [2669]: Report Processing Turned On	ui	
2670	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	WMT 700 [2670]: Report Processing Turned Off	ui	
2697	A WMT 700 Wind Sensor is added or removed from the system.	No	WMT 700 [2697]: Configured - (Configuration Key) set to (Configuration Value)		
2698	A WMT 700 No Errors Detected	No	WMT 700 [2698]: No Errors Detected	qc	
2699	QC Algorithm Related Message	No (Resolves Maintenance State Condition for WMT 700)	WMT 700 [2699]: Sensor Operational	qc	
3100	Sensor Status Failure	Yes	Belfort 6200 Backup [3100]: Sensor Status Failure	qc	
3101	Encountered Five Consecutive Communication Errors	Yes	Belfort 6200 Backup [3101]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
3102	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	Belfort 6200 Backup [3102]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
3113	**Inside Ambient Temperature value (five digits) out of range**	Yes	Belfort 6200 Backup [3113]: Inside Ambient Temperature Failure	dr	
3116	**Day/night Window Heater Status = Fail**	Yes	Belfort 6200 Backup [3116]: Day/Night window heater Failure	dr	
3118	**Transmitter Hood Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3118]: Transmitter hood heater Failure	dr	
3119	**Receiver Hood Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3119]: Receiver hood heater Failure	dr	
3121	T**ransmitter Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3121]: Transmitter Electronics heater Failure	dr	
3122	**Receiver Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3122]: Receiver Electronics heater Failure	dr	
3123	**Day/night Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3123]: Day/Night Electronics heater Failure	dr	
3124	**Transmitter Window Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3124]: Transmitter window heater Failure	dr	
3125	**Receiver Window Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3125]: Receiver window heater Failure	dr	
3141	**RAM Check Status** = *Fail*	Yes	Belfort 6200 Backup [3141]: RAM Check Error (Replace the Controller FRU)	dr	
3142	**ROM Check Status** = *Fail*	Yes	Belfort 6200 Backup [3142]: ROM Check Error (Replace the Controller FRU)	dr	
3143	**ADD Check Status** = *Fail*	Yes	Belfort 6200 Backup [3143]: Address Check Error (Replace the Controller FRU)	dr	
3144	**EPROM Check Status** = *Fail*	Yes	Belfort 6200 Backup [3144]: EEPROM Check Error (Replace the Controller FRU)	dr	What are these limits ? 0 - 310 Fahr?
3145	**Table 5 Checksum** error	Yes	Belfort 6200 Backup [3145]: Diagnostic Data Checksum Error (Check the Fiber Optic Module FRU)	dr	
3146	**Enclosure Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Backup [3146]: Enclosure Electronics heater Failure	dr	
3147	**Receiver Operational Status** = *Fail*	Yes	Belfort 6200 Backup [3147]: Receiver Operational Status Failure	dr	

3148	**Transmitter Operational Status** = *Fail*	Yes	Belfort 6200 Backup [3148]: Transmitter Operational Status Failure	dr	
3149	**Day/Night Operational Status** = *Fail*	Yes	Belfort 6200 Backup [3149]: Day/Night Operational Status Failure	dr	
3152	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3152]: Heater Thermostat Failure	qc	
3153	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3153]: Extinction Coefficient Below Acceptable Range	qc	
3154	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3154]: Extinction Coefficient Above Acceptable Range	qc	
3155	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3155]: Extinction Coefficient Missing	qc	
3156	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3156]: Night Photometer Reading at Noon, Readings Reset to Day	qc	
3157	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3157]: Day Photometer Reading at Midnight, Readings Reset to Day	qc	
3158	QC Algorithm Related Failure	Yes	Belfort 6200 Backup [3158]: Photometer Reading Not Set to Day or Night, Readings Reset to Day	qc	
3161	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for Belfort 6200 Backup)	Belfort 6200 Backup [3161]: Report Processing Turned On	ui	
3162	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	Belfort 6200 Backup [3162]: Report Processing Turned Off	ui	
3191	Photometer Operational	No	Belfort 6200 Backup [3191]: Photometer Operational	qc	
3197	A Belfort 6200 Visibility Sensor is added or removed from the system.	No	Belfort 6200 Backup [3197]: Configured - (Configuration Key) set to (Configuration Value)		
3199	QC Algorithm Related Message	No (Resolves Maintenance State Condition for Belfort 6200 Backup)	Belfort 6200 Backup [3199]: Sensor Operational	qc	
3200	Sensor Status Failure	Yes	Belfort 6200 Disc. [3200]: Sensor Status Failure	qc	
3201	Encountered Five Consecutive Communication Errors	Yes	Belfort 6200 Disc. [3201]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
3202	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	Belfort 6200 Disc. [3202]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
3213	**Inside Ambient Temperature value (five digits) out of range**	Yes	Belfort 6200 Disc. [3213]: Inside Ambient Temperature Failure	dr	
3216	**Day/night Window Heater Status = Fail**	Yes	Belfort 6200 Disc. [3216]: Day/Night window heater Failure	dr	
3218	**Transmitter Hood Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3218]: Transmitter hood heater Failure	dr	
3219	**Receiver Hood Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3219]: Receiver hood heater Failure	dr	
3221	**Transmitter Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3221]: Transmitter Electronics heater Failure	dr	
3222	**Receiver Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3222]: Receiver Electronics heater Failure	dr	
3223	**Day/night Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3223]: Day/Night Electronics heater Failure	dr	
3224	**Transmitter Window Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3224]: Transmitter window heater Failure	dr	
3225	**Receiver Window Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3225]: Receiver window heater Failure	dr	
3241	**RAM Check Status** = *Fail*	Yes	Belfort 6200 Disc. [3241]: RAM Check Error (Replace the Controller FRU)	dr	
3242	**ROM Check Status** = *Fail*	Yes	Belfort 6200 Disc. [3242]: ROM Check Error (Replace the Controller FRU)	dr	
3243	**ADD Check Status** = *Fail*	Yes	Belfort 6200 Disc. [3243]: Address Check Error (Replace the Controller FRU)	dr	
3244	**EPROM Check Status** = *Fail*	Yes	Belfort 6200 Disc. [3244]: EEPROM Check Error (Replace the Controller FRU)	dr	What are these limits ? 0 - 150 Fahr?
3245	**Table 5 Checksum** error	Yes	Belfort 6200 Disc. [3245]: Diagnostic Data Checksum Error (Check the Fiber Optic Module FRU)	dr	
3246	**Enclosure Electronics Heater Status** = *Fail*	Yes	Belfort 6200 Disc. [3246]: Enclosure Electronics heater Failure	dr	
3247	**Receiver Operational Status** = *Fail*	Yes	Belfort 6200 Disc. [3247]: Receiver Operational Status Failure	dr	
3248	**Transmitter Operational Status** = *Fail*	Yes	Belfort 6200 Disc. [3248]: Transmitter Operational Status Failure	dr	
3249	**Day/Night Operational Status** = *Fail*	Yes	Belfort 6200 Disc. [3249]: Day/Night Operational Status Failure	dr	
3252	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3252]: Heater Thermostat Failure	qc	
3253	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3253]: Extinction Coefficient Below Acceptable Range	qc	
3254	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3254]: Extinction Coefficient Above Acceptable Range	qc	
3255	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3255]: Extinction Coefficient Missing	qc	
3256	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3256]: Night Photometer Reading at Noon, Readings Reset to Day	qc	
3257	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3257]: Day Photometer Reading at Midnight, Readings Reset to Day	qc	
3258	QC Algorithm Related Failure	Yes	Belfort 6200 Disc. [3258]: Photometer Reading Not Set to Day or Night, Readings Reset to Day	qc	
3261	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for Belfort 6200 Disc.)	Belfort 6200 Disc. [3261]: Report Processing Turned On	ui	
3262	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	Belfort 6200 Disc. [3262]: Report Processing Turned Off	ui	
3291	Photometer Operational	No	Belfort 6200 Disc. [3291]: Photometer Operational	qc	
3297	A Belfort 6200 Visibility Sensor is added or removed from the system.	No	Belfort 6200 Disc. [3297]: Configured - (Configuration Key) set to (Configuration Value)		
3299	QC Algorithm Related Message	No (Resolves Maintenance State Condition for Belfort 6200 Disc.)	Belfort 6200 Disc. [3299]: Sensor Operational	qc	
3300	Sensor Status Failure	Yes	CL31 Backup [3300]: Sensor Status Failure	qc	
3301	Encountered Five Consecutive Communication Errors	Yes	CL31 Backup [3301]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr	
3302	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	CL31 Backup [3302]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr	
3303	**P/W/F Flag of Transmitter Inlaser** = *F*	Yes	CL31 Backup [3303]: Transmitter Inlaser Failure	dr	
3304	**P/W/F Flag of Receiver Gain** = *F*	Yes	CL31 Backup [3304]: Receiver Gain Failure	dr	
3305	**P/W/F Flag of Window Condition** = *F*	Yes	CL31 Backup [3305]: Window Conditioner Failure	dr	
3306	**P/W/F Flag of Outlaser** = *F*	Yes	CL31 Backup [3306]: Outlaser Failure	dr	
3307	**P/W/F Flag of Relative Outlaser** = *F*	Yes	CL31 Backup [3307]: Relative Outlaser Failure	dr	
3308	**P/W Flag of Background Radiance** = *F*	Yes	CL31 Backup [3308]: Background Radiance Failure	dr	
3309	**P/W Flag of Tilt Angle** = *F*	Yes	CL31 Backup [3309]: Tilt Angle Failure	dr	
3310	**P/W Flag of Internal Temperature** = *F*	Yes	CL31 Backup [3310]: Internal Temperature Failure	dr	
3311	**P/W Flag of External Temperature** = *F*	Yes	CL31 Backup [3311]: External Temperature Failure	dr	
3312	**P/W Flag of DC Power Temperature** = *F*	Yes	CL31 Backup [3312]: DC Power Temperature Failure	dr	
3313	**P/W Flag of Inclinometer Temperature** = *F*	Yes	CL31 Backup [3313]: Inclinometer Temperature Failure	dr	
3314	**P/W Flag of Laser Temperature** = *F*	Yes	CL31 Backup [3314]: Laser Temperature Failure	dr	
3315	**P/W Flag of Blower Temperature** = *F*	Yes	CL31 Backup [3315]: Blower Temperature Failure	dr	
3316	**P/W/F Flag of Suspect Module (Primary)** = *F*	Yes	CL31 Backup [3316]: Suspect Module (Primary) Failure	dr	
3317	**P/W/F Flag of Suspect Module (Secondary)** = *F*	Yes	CL31 Backup [3317]: Suspect Module (Secondary) Failure	dr	
3318	**P/W/F Flag of Transmitter Inlaser** = *W*	Yes	CL31 Backup [3318]: Transmitter Inlaser Warning	dr	
3319	**P/W/F Flag of Receiver Gain** = *W*	Yes	CL31 Backup [3319]: Receiver Gain Warning	dr	

3320	**P/W/F Flag of Window Condition** = *W*	Yes	CL31 Backup [3320]: Window Conditioner Warning	dr
3321	**P/W/F Flag of Outlaser** = *W*	Yes	CL31 Backup [3321]: Outlaser Warning	dr
3322	**P/W/F Flag of Relative Outlaser** = *W*	Yes	CL31 Backup [3322]: Relative Outlaser Warning	dr
3333	**P/W Flag of Background Radiance** = *W*	Yes	CL31 Backup [3323]: Background Radiance Warning	dr
3324	**P/W Flag of Tilt Angle** = *W*	Yes	CL31 Backup [3324]: Tilt Angle Warning	dr
3325	**P/W Flag of Internal Temperature** = *W*	Yes	CL31 Backup [3325]: Internal Temperature Warning	dr
3326	**P/W Flag of External Temperature** = *W*	Yes	CL31 Backup [3326]: External Temperature Warning	dr
3327	**P/W Flag of DC Power Temperature** = *W*	Yes	CL31 Backup [3327]: DC Power Temperature Warning	dr
3328	**P/W Flag of Inclinometer Temperature** = *W*	Yes	CL31 Backup [3328]: Inclinometer Temperature Warning	dr
3329	**P/W Flag of Laser Temperature** = *W*	Yes	CL31 Backup [3329]: Laser Temperature Warning	dr
3330	**P/W Flag of Blower Temperature** = *W*	Yes	CL31 Backup [3330]: Blower Temperature Warning	dr
3331	**P/W/F Flag of Suspect Module (Primary)** = *W*	Yes	CL31 Backup [3331]: Suspect Module (Primary) Warning	dr
3332	**P/W/F Flag of Suspect Module (Secondary)** = *W*	Yes	CL31 Backup [3332]: Suspect Module (Secondary) Warning	dr
3352	QC Algorithm Related Failure	Yes	CL31 Backup [3352]: Unknown Detection Status	qc
3353	QC Algorithm Related Failure	Yes	CL31 Backup [3353]: Height Measurements Missing	qc
3354	QC Algorithm Related Failure	Yes	CL31 Backup [3354]: Height Measurements Below Measurement Range	qc
3355	QC Algorithm Related Failure	Yes	CL31 Backup [3355]: Height Measurements Above Measurement Range	qc
3356	Inconsistent Detection Status and Height Measurements	Yes	CL31 Backup [3356]: Inconsistent Detection Status and Height Measurements	qc
3358	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for CL 31)	CL31 Backup [3358]: Report Processing Turned On	ui
3359	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	CL31 Backup [3359]: Report Processing Turned Off	ui
3397	A CL31 ceilometer Sensor is added or removed from the system.	No	CL31 Backup [3397]: Configured - (Configuration Key) set to (Configuration Value)	
3399	QC Algorithm Related Message	No (Resolves Maintenance State Condition for CL 31)	CL31 Backup [3399]: Sensor Operational	qc
	See CalcFAACL31QualityCheck.cpp			qc
3400	Sensor Status Failure	Yes	CL31 Disc. [3400]: Sensor Status Failure	qc
3401	Encountered Five Consecutive Communication Errors	Yes	CL31 Disc. [3401]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
3402	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	CL31 Disc. [3402]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	dr
3403	**P/W/F Flag of Transmitter Inlaser** = *F*	Yes	CL31 Disc. [3403]: Transmitter Inlaser Failure	dr
3404	**P/W/F Flag of Receiver Gain** = *F*	Yes	CL31 Disc. [3404]: Receiver Gain Failure	dr
3406	**P/W/F Flag of Window Condition** = *F*	Yes	CL31 Disc. [3405]: Window Conditioner Failure	dr
3406	**P/W/F Flag of Outlaser** = *F*	Yes	CL31 Disc. [3406]: Outlaser Failure	dr
3407	**P/W/F Flag of Relative Outlaser** = *F*	Yes	CL31 Disc. [3407]: Relative Outlaser Failure	dr
3408	**P/W Flag of Background Radiance** = *F*	Yes	CL31 Disc. [3408]: Background Radiance Failure	dr
3409	**P/W Flag of Tilt Angle** = *F*	Yes	CL31 Disc. [3409]: Tilt Angle Failure	dr
3410	**P/W Flag of Internal Temperature** = *F*	Yes	CL31 Disc. [3410]: Internal Temperature Failure	dr
3411	**P/W Flag of External Temperature** = *F*	Yes	CL31 Disc. [3411]: External Temperature Failure	dr
3412	**P/W Flag of DC Power Temperature** = *F*	Yes	CL31 Disc. [3412]: DC Power Temperature Failure	dr
3413	**P/W Flag of Inclinometer Temperature** = *F*	Yes	CL31 Disc. [3413]: Inclinometer Temperature Failure	dr
3414	**P/W Flag of Laser Temperature** = *F*	Yes	CL31 Disc. [3414]: Laser Temperature Failure	dr
3415	**P/W Flag of Blower Temperature** = *F*	Yes	CL31 Disc. [3415]: Blower Temperature Failure	dr
3416	**P/W/F Flag of Suspect Module (Primary)** = *F*	Yes	CL31 Disc. [3416]: Suspect Module (Primary) Failure	dr
3417	**P/W/F Flag of Suspect Module (Secondary)** = *F*	Yes	CL31 Disc. [3417]: Suspect Module (Secondary) Failure	dr
3418	**P/W/F Flag of Transmitter Inlaser** = *W*	Yes	CL31 Disc. [3418]: Transmitter Inlaser Warning	dr
3419	**P/W/F Flag of Receiver Gain** = *W*	Yes	CL31 Disc. [3419]: Receiver Gain Warning	dr
3420	**P/W/F Flag of Window Condition** = *W*	Yes	CL31 Disc. [3420]: Window Conditioner Warning	dr
3421	**P/W/F Flag of Outlaser** = *W*	Yes	CL31 Disc. [3421]: Outlaser Warning	dr
3422	**P/W/F Flag of Relative Outlaser** = *W*	Yes	CL31 Disc. [3422]: Relative Outlaser Warning	dr
3434	**P/W Flag of Background Radiance** = *W*	Yes	CL31 Disc. [3434]: Background Radiance Warning	dr
3424	**P/W Flag of Tilt Angle** = *W*	Yes	CL31 Disc. [3424]: Tiit Angle Warning	dr
3425	**P/W Flag of Internal Temperature** = *W*	Yes	CL31 Disc. [3425]: Internal Temperature Warning	dr
3426	**P/W Flag of External Temperature** = *W*	Yes	CL31 Disc. [3426]: External Temperature Warning	dr
3427	**P/W Flag of DC Power Temperature** = *W*	Yes	CL31 Disc. [3427]: DC Power Temperature Warning	dr
3428	**P/W Flag of Inclinometer Temperature** = *W*	Yes	CL31 Disc. [3428]: Inclinometer Temperature Warning	dr
3429	**P/W Flag of Laser Temperature** = *W*	Yes	CL31 Disc. [3429]: Laser Temperature Warning	dr
3430	**P/W Flag of Blower Temperature** = *W*	Yes	CL31 Disc. [3430]: Blower Temperature Warning	dr
3431	**P/W/F Flag of Suspect Module (Primary)** = *W*	Yes	CL31 Disc. [3431]: Suspect Module (Primary) Warning	dr
3432	**P/W/F Flag of Suspect Module (Secondary)** = *W*	Yes	CL31 Disc. [3432]: Suspect Module (Secondary) Warning	dr
3452	QC Algorithm Related Failure	Yes	CL31 Disc. [3452]: Unknown Detection Status	qc
3453	QC Algorithm Related Failure	Yes	CL31 Disc. [3453]: Height Measurements Missing	qc
3454	QC Algorithm Related Failure	Yes	CL31 Disc. [3454]: Height Measurements Below Measurement Range	qc
3455	QC Algorithm Related Failure	Yes	CL31 Disc. [3455]: Height Measurements Above Measurement Range	qc
3456	Inconsistent Detection Status and Height Measurements	Yes	CL31 Disc. [3456]: Inconsistent Detection Status and Height Measurements	qc
3458	Sensor is Enabled Via OID or Tech screen.	No (Resolves Maintenance State Condition for CL 31)	CL31 Disc. [3458]: Report Processing Turned On	ui
3459	Sensor is Disabled Via OID or Tech screen. Or a Quality Error turns report processing off.	Yes	CL31 Disc. [3459]: Report Processing Turned Off	ui
3497	A CL31 ceilometer Sensor is added or removed from the system.	No	CL31 Disc. [3497]: Configured - (Configuration Key) set to (Configuration Value)	
3499	QC Algorithm Related Message	No (Resolves Maintenance State Condition for CL 31)	CL31 Disc. [3499]: Sensor Operational	qc
	See CalcFAACL31QualityCheck.cpp			qc
3500	DCP 1 Communication	Yes	DCP1 [3500] Datalogger Communication Degraded	dr
3501	DCP 1 Communication	Yes	DCP1 [3501] All Datalogger Communication Degraded last minute	dr
3598	DCP 1 Communication	No (Resolves Maintenance State Condition for DCP1)	DCP1 [3598] Datalogger Communications Operational	dr
3600	DCP 2 Communication	Yes	DCP2 [3600] Datalogger Communication Degraded	dr
3698	DCP 2 Communication	No (Resolves Maintenance State Condition for DCP2)	DCP2 [3698] Datalogger Communications Operational	dr
3700	DCP 3 Communication	Yes	DCP3 [3700] Datalogger Communication Degraded	dr
3798	DCP 3 Communication	No (Resolves Maintenance State Condition for DCP3)	DCP3 [3798] Datalogger Communications Operational	dr
4000	Algorithm Initialization Failure	Yes	Sky Condition Alg [4000]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAACeilometer.cpp
4001	From Sky DWA 1.4.3	No (For Pri)	Sky Condition Alg [4001]: Primary Sensor Inoperative - Too Many Missing Values	CalcFAACeilometer.cpp
4002	From Sky DWA 1.4.3	No (For Disc)	Sky Condition Alg [4002]: Discontinuity Sensor Inoperative - Too Many Missing Values	CalcFAACeilometer.cpp
4003	From Sky DWA 1.4.3	No (For Bkup)	Sky Condition Alg [4003]: Backup Sensor Inoperative - Too Many Missing Values	CalcFAACeilometer.cpp
4004	From Sky DWA 1.4.3	No (for Pri)	Sky Condition Alg [4004]: Primary Sensor Returned to Operations	CalcFAACeilometer.cpp
4005	From Sky DWA 1.4.3	No (for Disc)	Sky Condition Alg [4005]: Discontinuity Sensor Returned to Operations	CalcFAACeilometer.cpp
4006	From Sky DWA 1.4.3	No (for Bkup)	Sky Condition Alg [4006]: Backup Sensor Returned to Operations	CalcFAACeilometer.cpp
4007	From Sky DWA 1.4.3	Yes	Sky Condition Alg [4007]: Both Primary and Backup Sensors Inoperative	CalcFAACeilometer.cpp
4098		No	Sky Condition Alg [4098]: Algorithm Initialization Success	CalcFAACeilometer.cpp
4099	From Sky DWA 1.4.3	No	Sky Condition Alg [4099]: Sky Condition Algorithm Operational	CalcFAACeilometer.cpp
4100	Algorithm Initialization Failure	Yes	Visibility Alg [4100]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAAVisibility.cpp
4101	From Vis DWA 2.4.5	No	Visibility Alg [4101]: Primary Sensor Inoperative - Too Many Missing Values	CalcFAAVisibility.cpp
4102	From Vis DWA 2.4.5	No	Visibility Alg [4102]: Discontinuity Sensor Inoperative - Too Many Missing Values	CalcFAAVisibility.cpp
4103	From Vis DWA 2.4.5	No	Visibility Alg [4103]: Backup Sensor Inoperative - Too Many Missing Values	CalcFAAVisibility.cpp
4104	From Vis DWA 2.4.5	Yes	Visibility Alg [4104]: Primary Sensor Inoperative - Rate of Change Check Failure	CalcFAAVisibility.cpp
4105	From Vis DWA 2.4.5	Yes	Visibility Alg [4105]: Backup Sensor Inoperative - Rate of Change Check Failure	CalcFAAVisibility.cpp
4106	From Vis DWA 2.4.5	Yes	Visibility Alg [4106]: Backup Sensor Inoperative - Rate of Change Check Failure	CalcFAAVisibility.cpp
4107		No	Visibility Alg [4107]: Primary Sensor Returned to Operations	CalcFAAVisibility.cpp
4108		No	Visibility Alg [4108]: Discontinuity Sensor Returned to Operations	CalcFAAVisibility.cpp
4109		No	Visibility Alg [4109]: Backup Sensor Returned to Operations	CalcFAAVisibility.cpp
4199		No (Resolves Maintenance State Condition)	Visibility Alg [4199]: Visibility Algorithm Operational	CalcFAAVisibility.cpp
4200	Algorithm Initialization Failure	Yes	Temp Dew Alg [4200]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAATemperature.cpp
4201	From Temp DWA 3.4.3	Yes	Temp Dew Alg [4201]: Ambient Temperature Sensor Inoperative - Too Many Missing Values	CalcFAATemperature.cpp
4202	From Temp DWA 3.4.3	Yes	Temp Dew Alg [4202]: Dewpoint Temperature Sensor Inoperative - Too Many Missing Values	CalcFAADPAverage.cpp
4203	From Temp DWA 3.4.3	No (Resolves Maintenance State Condition for Temp)	Temp Dew Alg [4203]: Ambient Temperature Sensor Returned to Operations	CalcFAATemperature.cpp
4204	From Temp DWA 3.4.3	No (Resolves Maintenance State Condition for Dewpoint)	Temp Dew Alg [4204]: Dewpoint Temperature Sensor Returned to Operations	CalcFAADPAverage.cpp
4298	From Temp DWA 3.4.3	No	Temp Dew Alg [4298]: Dewpoint Algorithm Operational	CalcFAADPAverage.cpp
4299	From Temp DWA 3.4.3	No (Resolves MS condition for Temp DP)	Temp Dew Alg [4299]: Temperature Algorithm Operational	CalcFAATemperature.cpp
4300	Algorithm Initialization Failure	Yes	Wind Alg [4300]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAAWind.cpp
4301	From Wind DWA 4.4.3	Yes	Wind Alg [4301]: Sensor Inoperative - Too Many Missing Values	CalcFAAWind.cpp
4399	From Wind DWA 4.4.3	No (Resolves Maintenance State Condition)	Wind Alg [4399]: Sensor Returned to Operations	CalcFAAWind.cpp
4400	Algorithm Initialization Failure	Yes	Pressure Alg [4400]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAAPressureCmp.cpp
4401	From Pressure DWA 5.4.4	Yes	Pressure Alg [4401]: Sensor #1 Inoperative - Absolute Differences Out of Range	CalcFAAPressureCmp.cpp
4402	From Pressure DWA 5.4.4	Yes	Pressure Alg [4402]: Sensor #2 Inoperative - Absolute Differences Out of Range	CalcFAAPressureCmp.cpp
4403	From Pressure DWA 5.4.4	Yes	Pressure Alg [4403]: Sensor #3 Inoperative - Absolute Differences Out of Range	CalcFAAPressureCmp.cpp
4404	From Pressure DWA 5.4.3	No	Pressure Alg [4404]: Sensor #1 Inoperative - Sensor QC Failure	QC
4405	From Pressure DWA 5.4.3	No	Pressure Alg [4405]: Sensor #2 Inoperative - Sensor QC Failure	QC
4406	From Pressure DWA 5.4.3	No	Pressure Alg [4406]: Sensor #3 Inoperative - Sensor QC Failure	QC

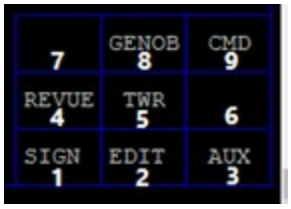
This is for all dataloggers, but we only report it on the first

4498		No	Pressure Alg [4498]: Sensor Comparison Algorithm Operational	QC
4499		No (Resolves Maintenance State)	Pressure Alg [4499] Pressure Sensors Returned to Regular Operations	QC
4500	Algorithm Initialization Failure	Yes	Present Weather Alg [4500]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAAPresentWeather.cpp
4501	From PW DWA 6.4.3	Yes	Present Weather Alg [4501]: Precipitation Identifier Sensor Inoperative - Too Many Missing Values	CalcFAAPresentWeather.cpp
4502	From PW DWA 6.4.7	Yes	Present Weather Alg [4502]: Freezing Rain Sensor Inoperative - Too Many Missing Values	CalcFAAPresentWeather.cpp
4503	From PW DWA 6.4.6	Yes	Present Weather Alg [4503]: Thunderstorm Sensor - Too Many Missing Values	CalcFAAPresentWeather.cpp
4504	From PW DWA 6.4.3	No	Present Weather Alg [4504]: Precipitation Identifier Sensor Returned to Operations	CalcFAAPresentWeather.cpp
4505	From PW DWA 6.4.7	No	Present Weather Alg [4505]: Freezing Rain Sensor Returned to Operations	CalcFAAPresentWeather.cpp
4506	From PW DWA 6.4.6	No	Present Weather Alg [4506]: Thunderstorm Sensor Returned to Operations	CalcFAAPresentWeather.cpp
4598		No	Present Weather Alg [4598]: Algorithm Initialization Success	CalcFAAPresentWeather.cpp
4506		No	Present Weather Alg [4599]: Present Weather Algorithm Operational	CalcFAAPresentWeather.cpp
4600	Algorithm Initialization Failure	Yes	Precip Accum Alg [4600]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAAPrecipAccum.cpp
4601	From Precip DWA 7.4.2	Yes	Precip Accum Alg [4601]: Precipitation Accumulation Sensor Inoperative - Reading Invalid	CalcFAAPrecipAccum.cpp
4602	From Precip DWA 7.4.2	Yes	Precip Accum Alg [4602]: Ice Accretion Sensor Inoperative - Too Many Missing Values	CalcFAAPrecipAccum.cpp
4603		No	Precip Accum Alg [4603]: Precipitation Accumulation Sensor Returned to Operations	CalcFAAPrecipAccum.cpp
4604		No	Precip Accum Alg [4604]: Ice Accretion Sensor Returned to Operations	FreezingPrecipSensors
4698		No	Precip Accum Alg [4698]: Algorithm Initialization Success	CalcFAAPrecipAccum.cpp
4699		No (Resolves Maintenance State Condition for Tipping Bkt and Weighing	Precip Accum Alg [4699]: Precipitation Accumulation Algorithm Operational	CalcFAAPrecipAccum.cpp
4700	Algorithm Initialization Failure	Yes	RVR Alg [4700]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAARVR.cpp
4701	From RVR DWA 8.4.3	Yes	RVR Alg [4701]: Too Many Missing Values	CalcFAARVR.cpp
4702	From RVR DWA 8.4.3	Yes	RVR Alg [4702]: Sensor Inoperative - Runway ID Change Detected	CalcFAARVR.cpp
4703	From RVR DWA 8.4.3	No (Resolves the Maintenance State Condition for RVR)	RVR Alg [4703]: Sensor Returned to Operations	CalcFAARVR.cpp
4799		No (Resolves the Maintenance State Condition for RVR)	RVR Alg [4799]: RVR Algorithm Operational	CalcFAARVR.cpp
4800	Algorithm Initialization Failure	Yes	Data Distribution Alg [4800]: Algorithm Initialization Failure (Failure Message if Available)	CalcFAADataDist.cpp
4899		No (Resolves Maintenance State)	Data Distribution Alg [4899]: Algorithm Initialization Success	CalcFAADataDist.cpp
5600	Eaton1500 Device Failure	Yes	Eaton1500 [5600]: (Failure Message if Available)	dr
5601	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.5", Temperature Bad	Yes	Eaton1500 [5601]: OVERTEMP	dr
5602	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.8", Output Overload	Yes	Eaton1500 [5602]: OVERLOAD	dr
5603	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.13", Charger Failed	Yes	Eaton1500 [5603]: CHARGER FAULT	dr
5604	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.20", Communications Lost	Yes	Eaton1500 [5604]: COMM FAILURE	dr
5605	Object ID (From Eaton UPS), ".1.3.6.1.2.1.33.1.6.3.2", On Battery	No	Eaton1500 [5605]: ON BATT	dr
5606	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.9", Battery on Bypass	No	Eaton1500 [5606]: ON BYPASS	dr
5607	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.3", Battery Low	Yes	Eaton1500 [5607]: BATT LOW	dr
5608	Object ID (From Eaton UPS): ".1.3.6.1.2.1.33.1.6.3.1" or ".1.3.6.1.2.1.33.1.6.3.7" or ".1.3.6.1.2.1.33.1.6.3.16" or ".1.3.6.1.2.1	Yes	Eaton1500 [5608]: BATT FAULT	dr
5609	Eaton is added or removed from system	No	Eaton1500 [5609]: CONFIG CHANGE (Change to configuration state)	
5699		No	Eaton1500 [5609]: Eaton UPS Operational	dr
5701	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.19", Internal Temp Fault is ON	Yes	Alpha 1 [5701]: OVERTEMP	dr
5702	Alpha FXM2000 Communications failure	Yes	Alpha 1 [5702]: COMM FAILURE	dr
5703	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.4.1.0" alpha-output-source 2 is OFF Line	No	Alpha 1 [5703]: ON BATT	dr
5704	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.4.1.0" alpha-output-source 11 is ON Bypass	No	Alpha 1 [5704]: ON BYPASS	dr
5705	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.20" Output Over voltage = ON or ".1.3.6.1.4.1.7309.6.1.8.2.1.3.2	No	Alpha 1 [5705]: AC OUTPUT OUT OF RANGE	dr
5706	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.17" = ON Overload	No	Alpha 1 [5706]: CAPACITY WARNING	dr
5707	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.22" = ON, Battery Over Voltage	No	Alpha 1 [5707]: BATT HIGH	dr
5708	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.23" = ON, Battery Volt Low	Yes	Alpha 1 [5708]: BATT LOW	dr
5709	Object ID (From Alpha UPS): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.25" = ON, Batt Fail	Yes	Alpha 1 [5709]: BATT FAULT	dr
5710	Alpha FXM2000 is added or removed from system	No	Alpha 1 [5710]: CONFIG CHANGE (Change to configuration state)	
5799		No	Alpha 1 [5799]: Alpha UPS Operational	dr
5801	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.19", Internal Temp Fault is ON	Yes	Alpha 2 [5801]: OVERTEMP	dr
5802	Alpha FXM2000 2, Communications failure	Yes	Alpha 2 [5802]: COMM FAILURE	dr
5803	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.4.1.0" alpha-output-source 2 is OFF Line	No	Alpha 2 [5803]: ON BATT	dr
5804	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.4.1.0" alpha-output-source 11 is ON Bypass	No	Alpha 2 [5804]: ON BYPASS	dr
5805	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.20" Output Over voltage = ON or ".1.3.6.1.4.1.7309.6.1.8.2.1.3.	No	Alpha 2 [5805]: AC OUTPUT OUT OF RANGE	dr
5806	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.17" = ON, Overload	No	Alpha 2 [5806]: CAPACITY WARNING	dr
5807	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.22" = ON, Battery Over Voltage	No	Alpha 2 [5807]: BATT HIGH	dr
5808	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.23" = ON, Battery Volt Low	Yes	Alpha 2 [5808]: BATT LOW	dr
5809	Object ID (From Alpha UPS 2): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.25" = ON, Batt Fail	Yes	Alpha 2 [5809]: BATT FAULT	dr
5810	Alpha FXM2000 2 is added or removed from system	No	Alpha 2 [5810]: CONFIG CHANGE (Change to configuration state)	
5899		No	Alpha 2 [5899]: Alpha UPS Operational	dr
5901	Object ID (From Alpha UPS 3), ".1.3.6.1.4.1.7309.6.1.8.2.1.3.19", Internal Temp Fault is ON	Yes	Alpha 3 [5901]: OVERTEMP	dr
5902	Alpha FXM2000 3, Communications failure	Yes	Alpha 3 [5902]: COMM FAILURE	dr
5903	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.4.1.0" alpha-output-source 2 is OFF Line	No	Alpha 3 [5903]: ON BATT	dr
5904	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.4.1.0" alpha-output-source 11 is ON Bypass	No	Alpha 3 [5904]: ON BYPASS	dr
5905	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.20" Output Over voltage = ON or ".1.3.6.1.4.1.7309.6.1.8.2.1.3.	No	Alpha 3 [5905]: AC OUTPUT OUT OF RANGE	dr
5906	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.17" = ON Overload	No	Alpha 3 [5906]: CAPACITY WARNING	dr
5907	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.22" = ON, Battery Over Voltage	No	Alpha 3 [5907]: BATT HIGH	dr
5908	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.23" = ON, Battery Volt Low	Yes	Alpha 3 [5908]: BATT LOW	dr
5909	Object ID (From Alpha UPS 3): ".1.3.6.1.4.1.7309.6.1.8.2.1.3.25" = ON, Batt Fail	Yes	Alpha 3 [5909]: BATT FAULT	dr
5910	Alpha FXM2000 is added or removed from system	No	Alpha 3 [5910]: CONFIG CHANGE (Change to configuration state)	
5999		No	Alpha 3 [5999]: Alpha UPS Operational	dr
6200	Serial Server Communication Failure	Yes	MOXA SRVR [6200]: Communications Failure	dr
6201	Serial Server Port 1 Down	Yes	MOXA SRVR [6201]: Port 1 Down	dr
6202	Serial Server Port 2 Down	Yes	MOXA SRVR [6202]: Port 2 Down	dr
6203	Serial Server Port 3 Down	Yes	MOXA SRVR [6203]: Port 3 Down	dr
6204	Serial Server Port 4 Down	Yes	MOXA SRVR [6204]: Port 4 Down	dr
6205	Serial Server Port 5 Down	Yes	MOXA SRVR [6205]: Port 5 Down	dr
6206	Serial Server Port 6 Down	Yes	MOXA SRVR [6206]: Port 6 Down	dr
6207	Serial Server Port 7 Down	Yes	MOXA SRVR [6207]: Port 7 Down	dr
6208	Serial Server Port 8 Down	Yes	MOXA SRVR [6208]: Port 8 Down	dr
6209	Serial Server is added or removed from system	No	MOXA SRVR [6209]: CONFIG CHANGE (Change to configuration state)	
6299		No (Resolves Maintenance State)	MOXA SRVR [6299] MOXA SRVR Operational	dr
6300	ACU-PSU Voltage Failure	Yes	ACU-PSU [6300]: Found PSU diagnostic string length %zu, expected %zu.\n	dr
6301	ACU-PSU Voltage Failure	Yes	ACU-PSU [6301]: Voltage Failure, (Voltage Value) Detected, Threshold (Failure Voltage Threshold)	dr
6399	ACU-PSU is added or removed from system	No	ACU-PSU [6399]: PSU Voltage OK	dr
6400		Yes	(DCP/SCA)-PSU [6400]: Found PSU diagnostic string length (Length), expected (Expected Length).\n	dr
6401	(DCP/SCA)-PSU Voltage Failure	Yes	(DCP/SCA)-PSU [6401]: PSU Voltage Failure (Voltage Value) Detected, Threshold (Failure Voltage Threshold)	dr
6499		No	(DCP/SCA)-PSU [6499]: PSU Voltage OK	dr
7420	Primary Embedded Controller Device Failure	Yes	Controller Primary [7420]: Primary Controller Disconnected. Servers offline:	dr
7430	Secondary Embedded Controller Device Failure	Yes	Controller Secondary [7430]: Secondary Controller Disconnected. Servers offline:	dr
7497		No	Controller Primary [7497]: Secondary Controller Operational	dr
7498		No	Controller Primary [7498]: Primary Controller Operational	dr
7499		No	Controller Primary [7499]: All Controllers Operational	dr
7600	VDU Device Communication Failure	Yes	VDU [7600]: Communication Failure	VduVidsIds4.cpp
7699	VDU communication is active	No	VDU [7699]: Communication Established	VduVidsIds4.cpp
7700	Interface Status Failure	Yes	OID [7700]: Communication Failure	VduVidsIds4.cpp
7799	OID Device communication active	Yes	OID [7799]: Communication Established	VduVidsIds4.cpp
7800	Eth Switch Hard Failure	Yes	ED5 408a [7800]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
7801	Eth Switch Degraded	Yes	ED5 408a [7801]: Communications Degraded - Encountered Five Non-Consecutive Errors in a 24-Hour Period	dr
7899	Eth Switch is added or removed from system	No	ED5 408a [7899]: MOXA Switch Operational	dr
8200	Interface Status Failure	Yes	ACE-IDS [8200]: Interface Status Failure (Failure Message If Available)	NIDS.cpp
8201	Encountered Five Consecutive Communication Errors	Yes	ACE-IDS [8201]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	NIDS.cpp
8202	Failure Counts Exceeded 20% in a 24-Hour Period	Yes	ACE-IDS [8202]: Communications Degraded - Failure Counts Exceeded 20% in a 24-Hour Period	NIDS.cpp
8204	ACE-IDS to ASOS Communications Now Active	No (Resolves Maintenance State Condition for ACE-IDS)	ACE-IDS [8204]: ACE-IDS to ASOS Communications Now Active	NIDS.cpp
8205	ACE-IDS to ASOS Communications Now Inactive	Yes	ACE-IDS [8205]: ACE-IDS to ASOS Communications Now Inactive	NIDS.cpp
8297	ACE-IDS is added or removed from the system.	No	ACE-IDS [8297]: Configured - (Configuration Key) set to (Configuration Value)	
8700	Interface Status Failure	Yes	Navy ATC [8700]: Interface Status Failure (Failure Message If Available)	NavySWS.cpp
8797	Navy-ATC is added or removed from the system.	No (Resolves Maintenance State Condition for Navy ATC)	Navy ATC [8797]: Configured - (Configuration Key) set to (Configuration Value)	
8799		No (Resolves Maintenance State Condition for Navy ATC)	Navy ATC [8799]: Interface Operational	NavySWS.cpp
8900	Interface Status Failure	No	WSP [8900]: Interface Status Failure (Failure Message If Available)	WSP.cpp
8999	WSP operational	No	WSP [8999]: Interface Operational	dr
9000	GTA Radio Failure	Yes	GTA Radio [9000]: Communication Failure	dr
9001	GTA Radio Hard Fail	Yes	GTA Radio [9001]: Communications Hard Fail - Encountered Five Consecutive Communication Errors	dr
9002	GTA Radio Degraded	Yes	GTA Radio [9002]: Communications Degraded - Encountered Five Non-Consecutive Errors in a 24-Hour Period	dr
9003	GTA Radio Port Error	Yes	GTA Radio [9003]: Port Error	dr
9004	GTA Radio Voltages Outside Thresholds	No	GTA Radio [9004]: Voltages Outside Thresholds	dr
9099		No	GTA Radio [9099]: GTA Radio Operational	dr
9191	Dialin Phone Overview	No	Dialin Phone [9191]: Nightly dial-in overview message	

Appendix D. OID gap analysis

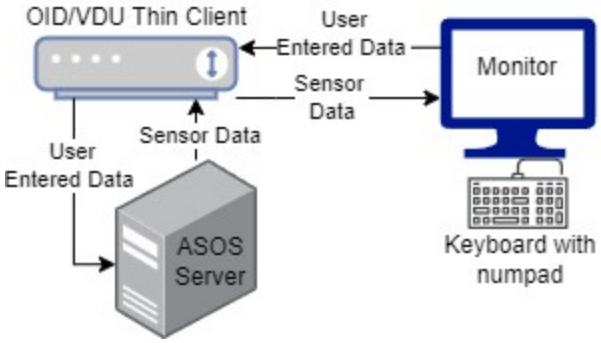
The Operator Interface Device is a system of interactable terminal screens which both display information as well as accept input from users. The Operator Interface Device will be referred to as the OID from this point forward. Due to the rich set of capabilities available through the OID, this document will not be covering features in detail. Rather this document will outline the system and identify the main differences between the legacy OID and what will be available in the Campbell Scientific OID. Below is a screen shot of the One-Minute screen. Within each minute the values displayed on this main screen will be updated with the latest values from the sensors.

In order to navigate between the various screens and to activate various functions, the 10 digit numpad is used. The numbers 1 – 9 are used to navigate and activate various features.



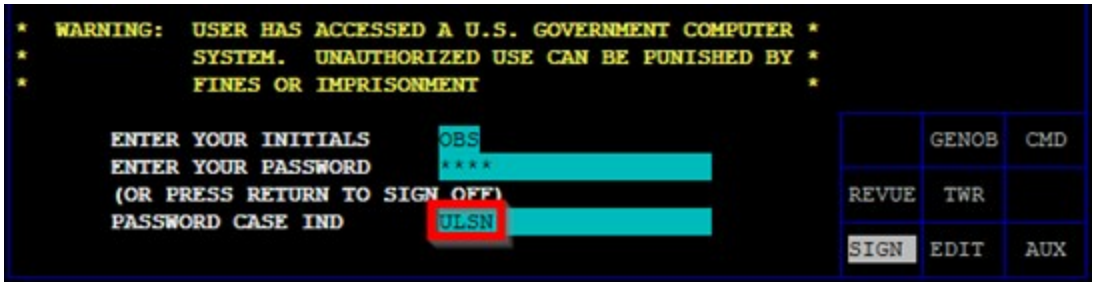
The number 0 will take the user to a help guide. Pressing 0 from a help screen will exit the help screen. A keyboard without a numpad will be unable to navigate. For systems operating without a numpad, an on-screen keyboard may be used. For all official (non-test) ASOS installations, the system will include the OID/VDU thin client along with a monitor and a keyboard including a numpad. When editing values, the numeric keys above the alphabetic keys must be used rather

than the numpad. The numpad will remain for navigational use during editing. The OID involves three hardware devices: the monitor + keyboard , an OID/VDU thin client and the ASOS server.

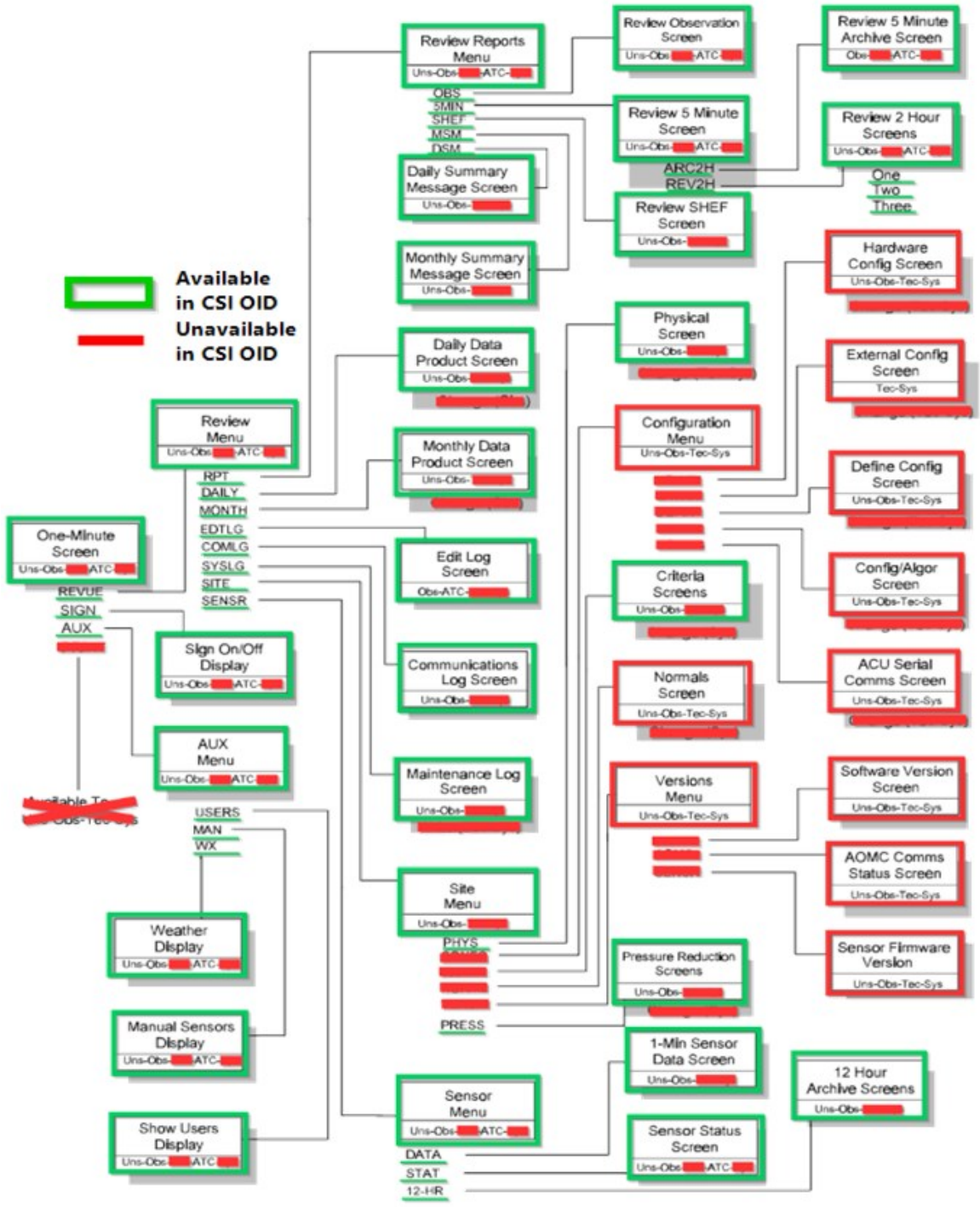


When operating in automated mode, the ASOS will generate data values and issue reports, displaying available data on the OID screen for an unsigned user; this is called unattended mode or Automated mode. In the screen shot above we can see that the METAR contains the AUTO designator indicating the report was generated by sensor data during unattended operation. When an Air Traffic controller or Weather Observer is signed into the OID terminal this is called Augmented Mode. All issued reports will no longer contain the AUTO indicator and the user will have the availability to edit report content and manually initiate SPECI transmissions.

When using the OID without signing in, users initially have access to review data as well as the sign in function. This is accessed by pressing 1 on the numpad from the One-Minute Screen. Enter the initials of the user and press enter. The password field will obscure entered characters indicating what type of character was entered. U meaning an Upper-case alpha character, L is a Lower-case alpha character, S is a Special character and N is for Numeric. After entering a password press enter again to authenticate and sign in.

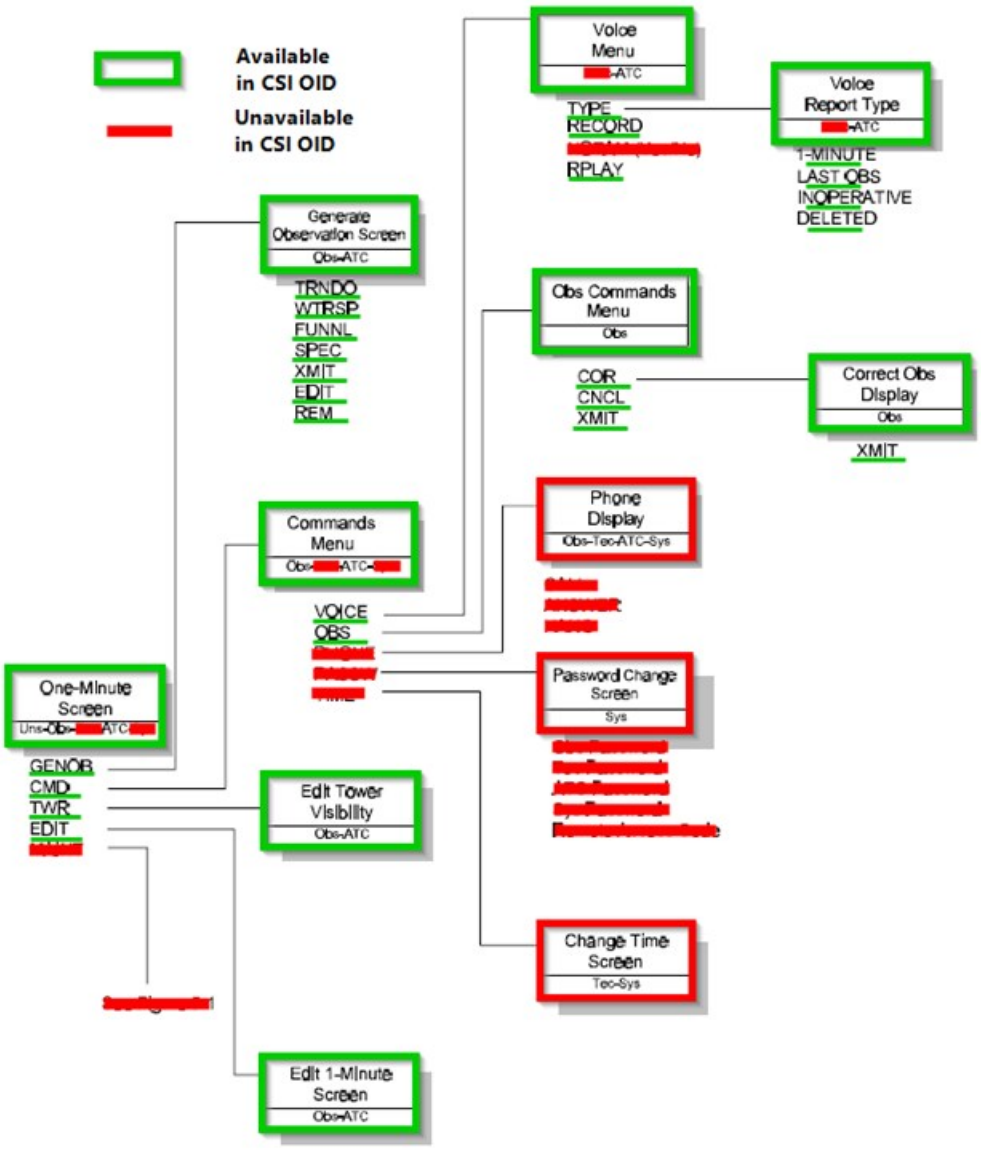


After signing in, depending on the user, different options will become available within the navigation pad. This document will not go into detail on all of the available features within the OID. The following section will highlight the feature sets which have been migrated from the OID into the web browser user interface. This image was taken from the ASOS Software User's Manual, it shows the screens and features which are no longer found in the CSI ASOS OID.



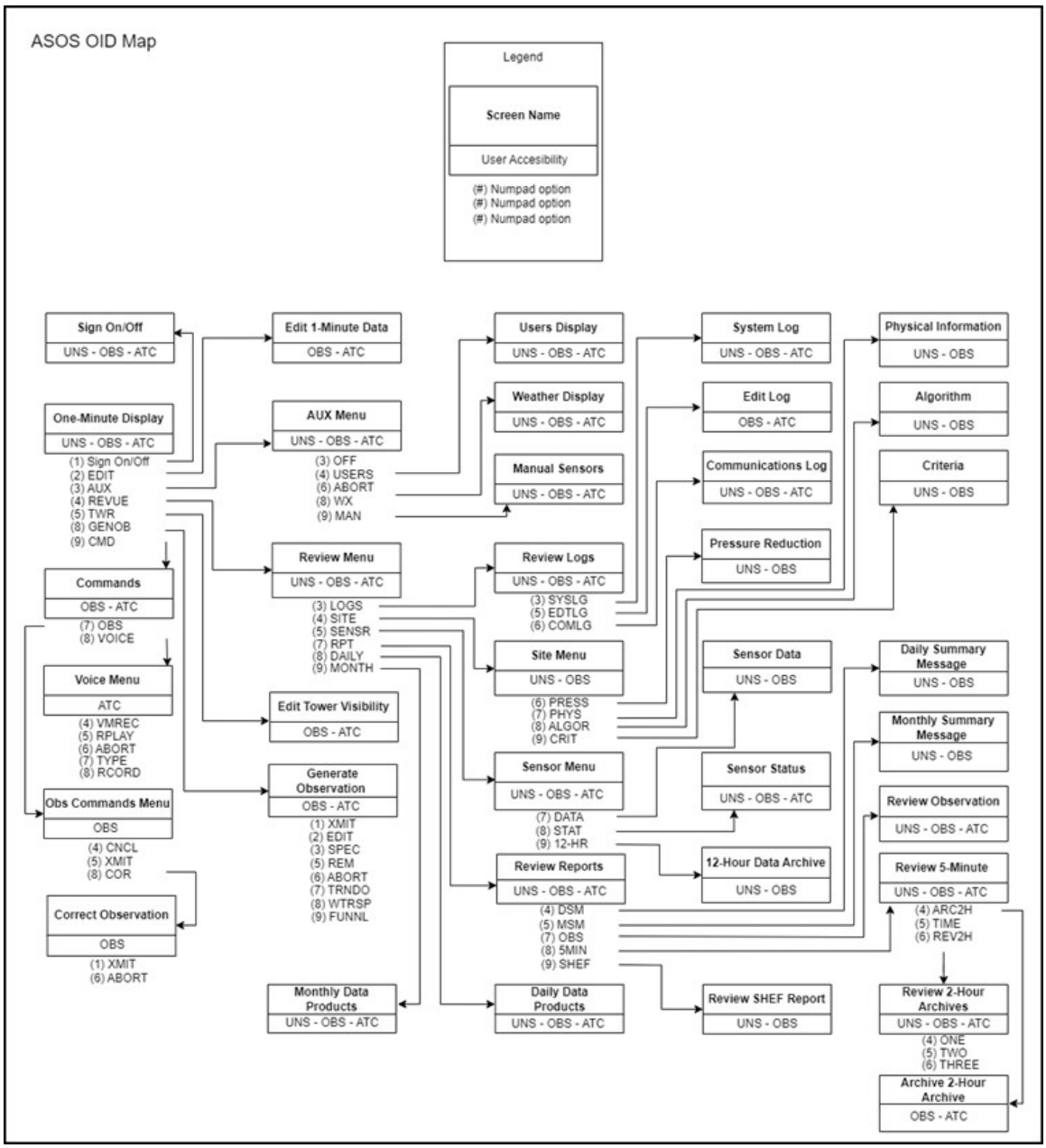
The Legacy ASOS system required Technicians and Administrators to use the OID screens in order to configure and maintain the system. In the Campbell Scientific ASOS system, these features have been migrated to the Web Browser interface through screens such as the **Technician** screen, **Logs and History** and **Configuration** screens. Administrators and Technicians should access the system capable of supporting a web browser and with access to the same network as the ASOS system.

This image shows additional screens and functionality available from the One-Minute screen when an Observer or ATC user has signed in. As described before, the maintenance features have been migrated to the web browser interface. The image below was taken from the ASOS Software User's Manual along with the previous image. Information relating to phone calls will be found on the **Technician** screen of the web browser UI. The Password and Time management features have been moved into the **Configuration** tool which is accessible through the web browser UI.



This diagram shows the CSI OID screen ecosystem with updated screen, feature, and user accessibility information. Each square represents a screen or function. Below relevant screens are lists of the available navigation options along with the number to press in order to navigate or activate that feature. Each screen and feature indicates which users can access and use that

screen/feature. Arrows show connections between screens and features. Depending on what user is signed in, a subset of the options may be visible on screen.



Appendix E. Maintenance Interface design document

E.1 Maintenance Interface description

The Campbell Aero ASOS Maintenance Interface will combine several existing Campbell Aero functionalities as well as adding some unique functionality such as the entry and exit from the Maintenance State and a number of sensor diagnostic utilities. This design meets all of the requirements defined in the Maintenance Interface SSDD (see System/Subsystem Design Description (SSDD) for the Maintenance Interface (MI) of Automated Surface Observing System (ASOS) (p. 140).

The fundamental aspects of the ASOS Maintenance Interface are as follows:

- Evaluation of sensor data, diagnostic data, quality check and algorithmic output, recording all maintenance related events in the Maintenance Log
- Allow a technician to perform various diagnostic tests including calibration of sensors and equipment. Such activities include:
    1. Directly connect to sensors with a terminal and send various commands.
    2. Configuration, Un-configuration, Re-configuration, Disable, Enable, Suspend available sensors, components, interfaces and protocols while the remaining system is operational.
    3. Initiate Sensor Self Test procedures and analyze results
- Monitor the power supply of the ACU/SCA and DCP's and issue appropriate alerts.
- Dependent on the status of system components, interfaces algorithmic activity and sensors, either enter or leave the "Maintenance State". This is indicated by the presence or absence of the '$" symbol in Reports.

The following is a text description of how the MI operates. The data will come into the system from the suite of sensors, interfaces, and devices such as power supplies, radios and networking hardware devices. This data includes diagnostic data. Each device will produce diagnostic data of varying complexity and impact. In simple cases you have sensors with a Passing or Failing status. Some sensors produce complex diagnostic data with various flags. For example, the Ceilometer will produce a multi character diagnostic string with status flags relating to various

subcomponents of the sensor. A sensor diagnostic string might relay information about heater status and voltage levels. Devices such as the radios and power supplies will provide a level of insight into their operation such as battery level, voltage levels, whether the system is running on battery or main power. These are the primary sources of data. Once the data has entered the system through one of these streams it will pass through at least one filter. For data from the radio, data loggers, power supplies and networking devices the diagnostic data will be directly evaluated by the MI and as needed conditionally trigger the system to enter the Maintenance State. The remaining data, coming from sensors and interfaces, will pass through algorithmic processing in the form of the quality check and weather algorithms. During algorithmic processing, various conditions will trigger log messages many of which will cause the system to enter the maintenance state. Within the algorithmic processing stage, the algorithms may also produce messages which will cause the system to exit the maintenance state. For example, let's say we have a fully operational system which is not in the maintenance state. Then the wind sensor hangs for a bit and causes the sensor to not respond for a full minute. The Quality Check algorithm picks this up and flags the sensor as inoperative and announces the message to the MI. The MI posts the message to the Maintenance log with the associated error code, updates the state variable by manipulating the System Status objects. The system has entered the maintenance state, reports now contain the '$' symbol. After a few minutes the sensor recovers and starts reporting data regularly. The quality check algorithm will pick up these conditions and post a message that the sensor has returned to regular operation. The MI receives this announced message and evaluates the list of active error codes. The incoming sensor operational message resolves the previously raised error related to the wind sensor and removes that error from the active list. Now that there are no active errors in the MI's state variable, the system Status objects are updated and the '$' is removed from transmitted reports. An alternative example, a sensor experiences a heater failure. The sensor reports a Heater failure in its diagnostic repose to a diagnostic poll form Aero. This heater failure causes the system to enter the maintenance state, a technician comes to the site, initially disabling the sensor to perform maintenance. Once the sensor has been repaired the technician re-enables the sensor. Re-enabling the sensor removes the error related to the heater and the system can return to regular operations.

Appendix F. System/Subsystem Design Description (SSDD) for the Maintenance Interface (MI) of Automated Surface Observing System (ASOS)

Table F-1: Revision record

Revision letter	Description	Date	Entered by
1.0	Revising to update document references and standards from original MID SSDD provided to CSI.	08/1/2022	Product Testing and Compliance CSI
2.0	Revising to update Interface Design	08/3/2022	Product Testing and Compliance CSI
3.0	Adding additional content to match Aero MID development	3/25/2024	Jared Scott

F.1 Scope

F.1.1 Identification

This document applies to Automated Surface Observation System (ASOS) post Service Life Extension Program (SLEP).

F.1.2 System overview

The ASOS is an operational surface weather observing system that was implemented as a joint program to meet the requirements of the Federal Aviation Administration (FAA), National

Weather Service (NWS), and Department of Defense (DoD).

The Maintenance Interface (MI) is the primary technician interface for Campbell Aero. The MI displays configuration, settings, and current data states, as well as accepts user inputs.

F.1.3 Document overview

This System/Subsystem Design Description (SSDD), which is prepared in accordance with DID-FAA-026-06, describes the design of a Maintenance Interface (MI). It describes the Software Configuration Item (SCI)-wide design decisions, the SCI architectural design, and the detailed design needed to implement the software.

The SSDD is used as the basis for further system development.

F.2 Referenced documents

The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those in effect on the release date of this document.

Table F-2: Government Specifications, Standards, and Documents

Document	Description
FAA Order 7900.5	Surface Weather Observations METAR
FCM-H1-2005	Federal Meteorological Handbook (FMH-1) – Surface Weather Observations and Reports
DWA documents	Documented Weather Algorithm documents (several)
NAS-IC-25083101 Rev G	INTERFACE CONTROL DOCUMENT Between Automated Weather Observing System (AWOS), Automated Weather Sensor System (AWSS), & Automated Surface Observing System (ASOS) and Automated Weather Observing System Data Acquisition System (ADAS) (file: ADAS AWSS ncp25789.pdf)
ASOS_to_AWIPS ICD	INTERFACE CONTROL DOCUMENT Between AWIPS and ASOS
ASOS_RVR_Interface_QC_ Baseline_v1	INTERFACE CONTROL DOCUMENT Between RVR and ASOS
ICD document library	Interface Control Document (ICD) between Sensors and components with the ASOS

F.3 Subsystem-wide design decisions

All design decisions are explicit in the requirements or are deferred to the design of subsystem components.

The MI subsystem is designed as a user-intuitive referential navigation system that provides needed functionality for maintenance users. The referential navigation system was chosen over the hierarchical navigation system of the previous system due to absence of a strictly hierarchical relation between the serviceable components in the new system. The referential navigation system allows multiple relations to be shown for maintenance purposes rather than just strictly communications paths, which reduces the time technicians must spend navigating the interface when diagnosing and resolving complex issues involving multiple components.

The MI subsystem interface consists of a Graphical User Interface (GUI) that accepts input via a Human Interface Devices such as a trackpad, mouse, or keyboard. The GUI will alert and/or restrict detectable erroneous inputs in certain situations, while allowing input that may be out of bounds but will not endanger the stability of the whole system.

The MI subsystem interfaces with stored database configuration items.

The MI subsystem is designed as a display layer, not a translation or processing layer. Outside of formatting adjustments to adapt to GUI display principles and intuitiveness, data displayed through the MI should be unaltered from the system that makes it available. The MI subsystem is not designed to diagnose or make recommendations on its own, only to provide the data in a clear, intuitive, accessible format for the technicians.

The data displayed in the MI shall be specified in the associated ICDs, Sensor Quality Control Documents, and Documented Weather Algorithms (DWA) of the interfaces, sensors, components, and algorithms that are configured on the system.

All security functions of the MI must be in accordance with NIST 800-53.

F.4 System architectural design

F.4.1 System components

MI components can be represented as primarily SCIs that consists of a Main Screen. The Main Screen contains four sections:

1. The top title bar is static and contains site specific information (Current screen, Site Identification, Time).
2. The navigation menu lists all screens available for the user to visit.

3. The middle display area contains dynamically changing user actions and options based on the current configuration and usage.
4. The bottom status bar indicates overall system status based on current maintenance conditions. The bottom ribbon also gives the user control over the visual theme of the MI.

The dynamic data that the MI displays consists of data made available through the Campbell Aero system.

F.4.2 Concept of execution

MI execution and operations are primarily user-event driven. Due to the variety of configuration possibilities, the available maintenance functions can vary.

F.4.3 Interface design

F.4.3.1 User-level functionality

MI shall restrict access to specified functions based on login access rights. Typically, a maintenance technician and administrator have access to the main maintenance screen and associated functions. All other users are restricted from seeing this maintenance screen.

F.4.3.2 Maintenance Interface (MI) Login screen

- MI must display a government warning banner on the first screen visible. The Warning Banner shall be as follows:

  You are accessing a U.S. Government information system, which includes: 1) this computer, 2) this computer network, 3) all Government-furnished computers connected to this network, and 4) all Government-furnished devices and storage media attached to this network or to a computer on this network. You understand and consent to the following: you may access this information system for authorized use only; unauthorized use of the system is prohibited and subject to criminal and civil penalties; you have no reasonable expectation of privacy regarding any communication or data transiting or stored on this information system at any time and for any lawful Government purpose, the Government may monitor, intercept, audit, and search and seize any communication or data transiting or stored on this information system; and any communications or data transiting or stored on this information system may be disclosed or used for any lawful Government purpose. This information system may contain Controlled Unclassified Information (CUI) that is subject to safeguarding or dissemination controls in accordance with law, regulation, or Government-wide policy. Accessing and using this system indicate your understanding of this warning.

- Login screen must have an Accept option (for the warning).
- Accepting the warning will allow the user to submit login credentials. (Pressing Login)

- Login screen must have username field.
- Login screen must have password field.
- Login screen must have login button.

F.4.3.3 MI login requirements

- Login screen must give appropriate feedback about rejected login attempts. The potential feedback the system will provide is outlined in the table below.

Table F-3: Login screen feedback

Feedback	Reason	Resolution
Invalid Username/Password	The Username and Password provided are invalid according to system records.	Enter valid user credentials.
Too Many Requests	The user has attempted to sign into the system with invalid credentials three times in a row.	Wait for the throttle time to pass and attempt to log in with valid credentials.
You must accept the conditions.	The user has not accepted the "I Accept" option.	Accept the "I Accept" prompt.
Request user: login timed out	The request to login took too long to process successfully.	Verify connection then attempt to login with valid credentials again.

- Login screen must alert user when a password is expired; prompt the user to change the password; and provide password requirements. Password requirements are outlined as follows:
    - Minimum length: 6 Characters
    - Maximum length: 12 Characters
    - Max Repeated Characters: 3
    - Valid Characters: Lower Case, Upper Case, Numeric and Special Characters
    - Special Characters Allowed: $, %, &, !
    - First character can be a Special: False
- Login screen must limit consecutive invalid logins after 3 invalid attempts (At the same terminal).

- After 7 consecutive invalid logins, further login attempts from the same terminal will be blocked until administrative action is taken

F.4.3.4 MI screen accessibility

Screen name (In Aero)	Functionality	Users who have access
ATC	Displays live weather data	ATC, Admin, Obs
Meteo	Displays live weather data with graphs	Admin, Tech, Obs
Meteo Alarms	Displays system alarms, allows user to set alarm conditions	Obs
Logs and History	Display Logs, History and Query data	Admin, Tech, Obs
Metar	Display Metar Report data and allow user to edit Metar elements for Special Observations	
Technician	Display sensor and system information, view system variables and alarms	Admin, Tech
Server Overview	Display Server information as well as software versioning	Admin, Tech
User Accounts	Allow the user to adjust user settings, passwords and data	Admin
ASOS Mapview	Allow the user to see all available ASOS stations	Admin, Tech
Configuration	Allow the user to adjust configuration values for the site as well as usergroups and protocols.	Admin, Tech

F.4.3.5 MI UI requirements

- UI must display if the system does not have a valid configuration.
- UI must show the current date and time in UTC and LST.
- UI must display software version(s), configuration details, system information, and logging information.
- UI must allow a user to log out.
- Logout option must return the user to the Login screen.
- UI must provide a means to view the logs created by the system.
- UI must indicate what user is currently logged into the system. (Admin, Tech, OBS, ATC)
- UI must show the site information (site ID and site name) of the connected site.
- UI must show all DCPs attached to the system.
- UI must show all sensors and interfaces attached to the system.
- UI must show the communication status of configured sensors and interfaces.
- UI must show the report processing status of configured sensors and interfaces
- UI must allow the user to toggle the report processing status of attached sensors and interfaces.
- UI must provide an option to view additional information about a sensor.

- UI must provide an option to view additional information about an interface.
- UI must allow sending a diagnostic poll to the sensor and display the results.

F.4.3.6 MI colors (for sensors, interfaces, logs, and alarms)

- All error status indicators must use the color red. A red indicator means that an error has occurred, the ASOS can continue to operate. An error could indicate user action must be taken.
- All passing status indicators must use the color green. (Sensor operational)
- All unknown status indicators must use the color black (Not configured).
- All suspended sensor indicators must use the color gray (No data polling performed).
- All disabled sensor indicators must use the color blue (Report processing off, or sensor is polled but values are not used in calculations, final output should be '?' or missing).
- All warning status indicators must use the color yellow.
- All Informational log messages must use the color white.

F.4.3.7 Site configuration

- UI must show information for physical, SPECI, local, SHEF, and pressure data.
- UI must display Boolean options as a checkbox, where true is shown as checked and false is unchecked.
- UI must display text data as text.
- UI must display multiple choice data as a combo box.
- UI must display calculated values as a read-only text box.
- UI must warn users of improperly formatted text input using a red highlight. (When format is specified).
- UI must prohibit users from entering improper input types. (When format is specified, IE: ASCII for a Numeric input)
- UI must have an Apply button when saving new data.
- UI must have a cancel button when changing data, Pressing cancel clears all data changes and returns to the operational state prior to changes being made.
- UI must display an indication when information is changed from the saved state. (During edits, before Applying)

F.4.3.8 Sensor types

- UI must display each sensor with a unique ID.

F.4.3.9 Log view

- UI must provide the ability to view all logs created/used by the system.
- UI must allow a user to query for any log created/used by the system.
- UI must allow the user an option to limit the query for a log based on start and end timestamps.
- UI must provide a means to apply search filters to queried logs.
- UI must provide a means to clear the search filters.
- UI must allow Administrator and Technician users to add manual entries to the system log.

F.4.3.10 Data archive

- UI must provide a means to view the system data archive.
- The data query UI must default to showing no results when opened.
- UI must provide a means to clear the data archive query parameters.

F.4.3.11 Maintenance codes

- All Maintenance Codes must be unique.
- Maintenance Events will trigger the Maintenance State, resolve the Maintenance State, or be informational which does not affect the Maintenance State of the ASOS system.
- All Maintenance Codes must be a 4-digit positive integer.
- Maintenance Codes will appear in the Maintenance log in the form [####].
- Maintenance Codes are separated into groups of 100 codes per sensor/device/module/component.
- The Maintenance Code group for a given aspect of the system is identified by the first two digits [##]##].
- For each Maintenance Code group, the code ending in 99 will resolve the Maintenance State for that group. [##99]

- Resetting a sensor's report processing status will remove that sensor from the Maintenance state.
- Informational messages often fall in the [##90] – [##98] codes.

> NOTE:
> There are anomalies which use numbers in the < [##90] range of codes, these events are reported in the Maintenance Log in the color White and do not affect the state of the system. Refer to MI code list for detailed descriptions of each code.

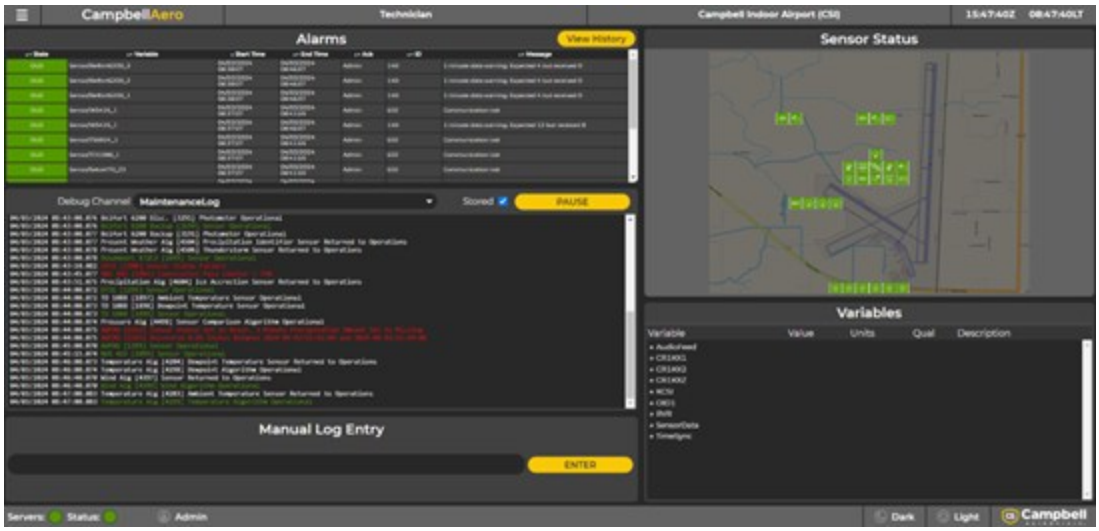
- The MI must allow a user to review the devices which are causing the system to be in a Maintenance State.
- The MI must allow a user to review the active Maintenance State events.
- The MI must allow an authorized user to clear active Maintenance State events.

F.5 Maintenance Interface screens

The Maintenance Interface consists of a few distinct screens which provide users with specific sets of features related to the Maintenance of the ASOS system. This section will outline these screens and their functionalities

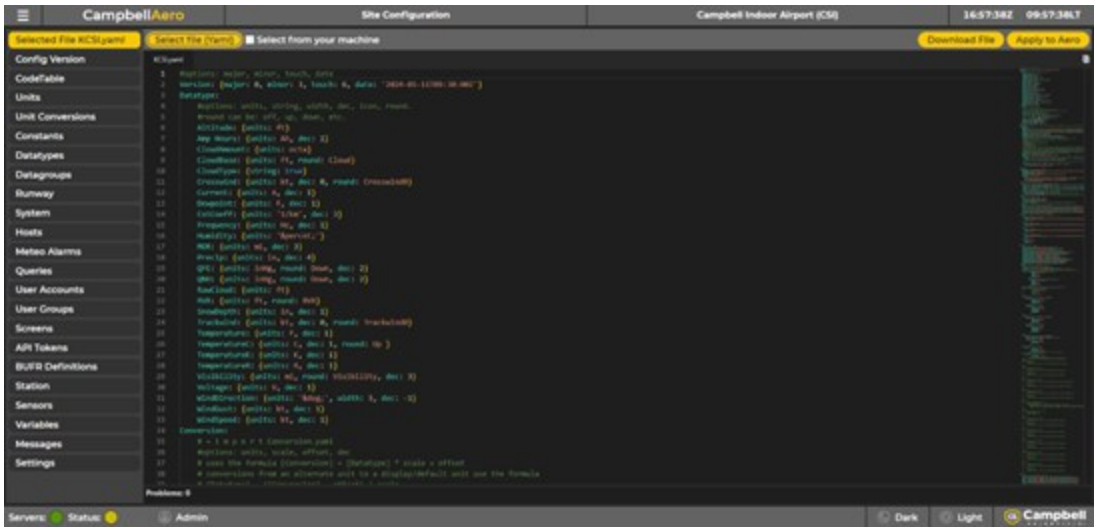
F.5.1 Technician screen

The Aero Technician screen is the primary location for accessing system status information, logs, variables, and sensor status screens. The sensor information screens are accessible through the sensor map on the top right. Active system alarms are visible in the top left. System variables are available in the Variable view window. There are several Debug channels which are useful for diagnostics and maintenance. For more information see the procedure documentation for the ASOS Maintenance Interface.



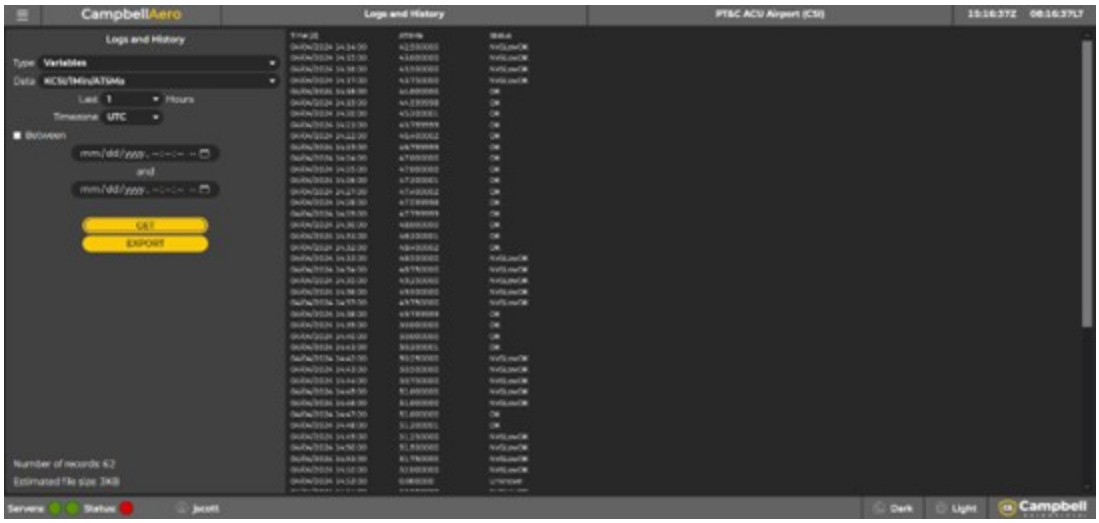
F.5.2 Configuration Editor

The Configuration Editor allows a technician to add/remove sensors and interfaces. Redefine ports and hostnames, adjust system definitions and a wide suite of configurable features. See documentation specific for the Configuration Editor for more details.



F.5.3 Logs and History

The Logs and History screen allows a technician to retrieve the available logs, sensor data, variable values as well as execute configured queries. See documentation related to the Logs and history screen for more details.



F.6 Acronyms and Definitions

F.6.1 Acronyms

Acronym	Definition
ACL	Access Control List
ACU	Acquisition Control Unit
ASOS	Automated Observing System
ATC	Air Traffic Controller OID User Level
AJW-1444	FAA Weather Sensors & Display Systems Group
CSCI	Computer Software Configuration Item
DCP	Data Collection Package
DBDD	Database Design Document
DDS	Data Distribution Service
DoD	Department of Defense
DWA	Documented Weather Algorithm
FAA	Federal Aviation Administration
FRU	Field Replaceable Unit
GUI	Graphical User Interface
ICD	Interface Control Document

Acronym	Definition
IDD	Interface Design Document
MI	Maintenance Interface
NAS	National Airway Systems
NWS	National Weather Service
OBS	Observer OID User Level
OFCM	Office of the Federal Coordinator for Meteorology
RMID	Remote Maintenance Interface Device
SCA	Single Cabinet Assembly
SCI	Software Configuration Item
SSDD	System/Subsystem Design Description
SLEP	Service Life Extension Program
SUM	Software User Manual

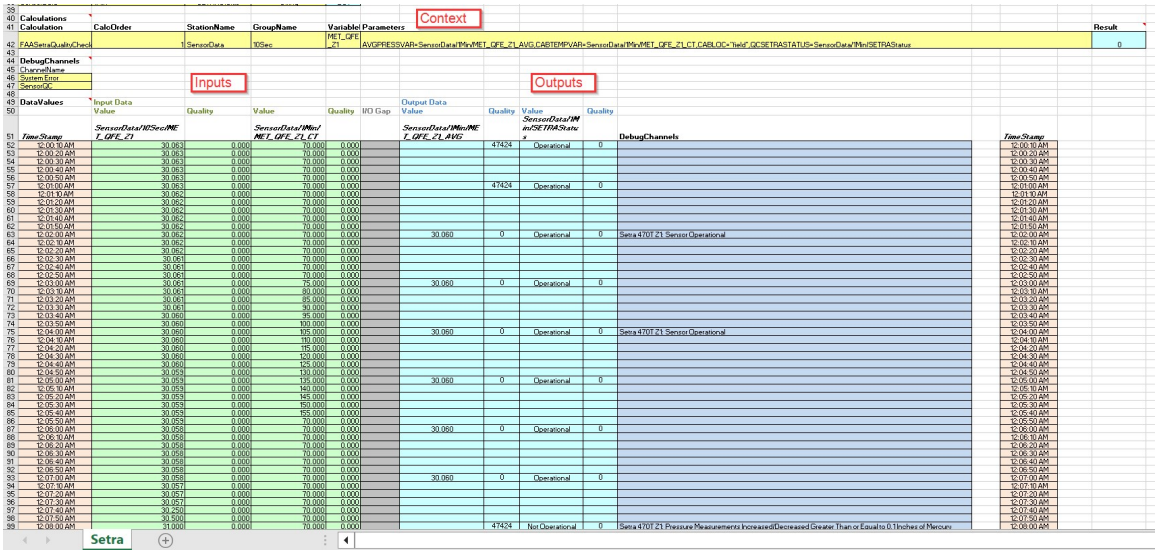
F.6.2 Definitions:

Button	A GUI control that is activated with a click or keypress
Clicked	Activating a GUI control by hotkey, keypress while focused, or clicked by mouse
Component	Any non-sensor/interface hardware located in an enclosure
Control	An object of the GUI
Dialog	A GUI control that is displayed, usually over other GUI elements, intended to supply information or receive user input
Docked	When a control is alignment fixed relative to another control layout
Dropdown	A GUI Control that expands out when clicked to show docked controls
Enclosure	ACU/DCP/SCA
Endcap	An adornment on the end of a line, indicating source or direction
Field	A GUI control that allows entry or display
Main Screen Status Bar Information	Any information displayed on the status bar on the bottom of the main screen

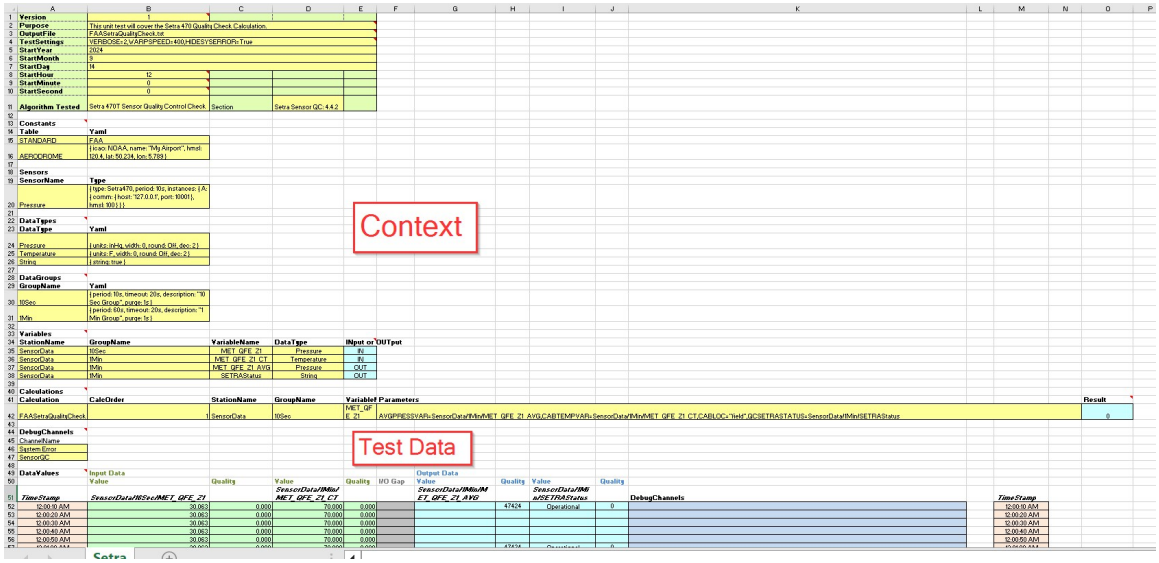
Menu Bar	A GUI control that when activated expands downward to show additional information, options, or controls
Module	A subsystem of WARS
Ping	An IP network communication check testing reachability of a device
Plugin	A library that extends WARS functionality
Popup	A type of dialog that blocks interaction or focus switching with lower GUI elements until closed
Reserved Context Dependent	A button that is re-utilized depending on the context of the current view to do situation ally dependent functionality
Screen	A GUI that when displayed uses up the entire viewing space
View	A GUI subsection that only displays on part of the viewing space and is changed depending on current context.
Sensor Type	Meteorological sensor data type
Sensor Type Number	Unique identification number paired with a sensor type
Sub-screen	A GUI screen that is displayed within a view

Appendix G. The xlsx testing system

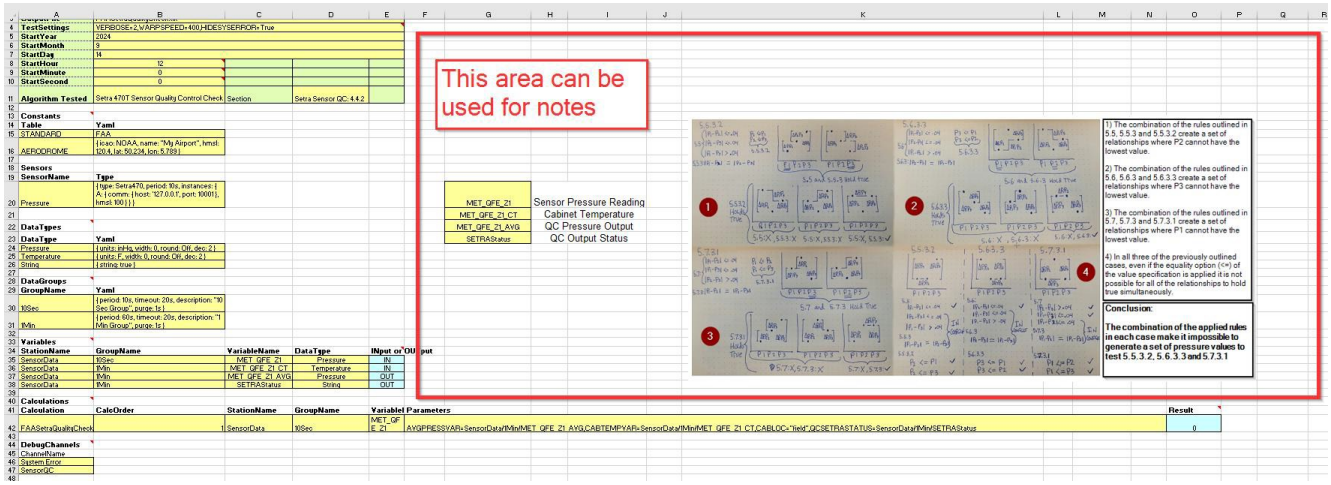
Campbell Aero (ASOS Server Software) as an application includes a collection of calculations. These calculations are run regularly during operation, and they are the principal source for all data products produced by the ASOS. Campbell Scientific maintains a collection of unit tests which are run every time a new build of Campbell Aero is prepared for distribution. The bulk of these tests are run in C++ and are executed every time new code is submitted for regression testing. These tests require access to the source code for Campbell Aero and will require knowledge of C++ to understand their content. In order to make the algorithms more accessible for testing, the xlsx testing system was implemented which can accept input data as well as output expectations in order to execute the desired calculation and compare the results with the expected output. These tests take the form of spread sheets which both set up the context for the test (time, station information, elevations, sensors, settings, etc) and outline the inputs and outputs for that test.



At the top of each xlsx file will be a section of data setting up the context for the test. Tests have been prepared with the context predefined for each calculation. For the most part, you should not need to make any adjustments to the contextual information. Exceptions include wanting to change the elevation of a sensor as a test parameter, adjusting speci thresholds or wind average periods. This would be done by adjusting the sensor definition within the context portion of the test. See the section of this document about adjusting contextual settings.



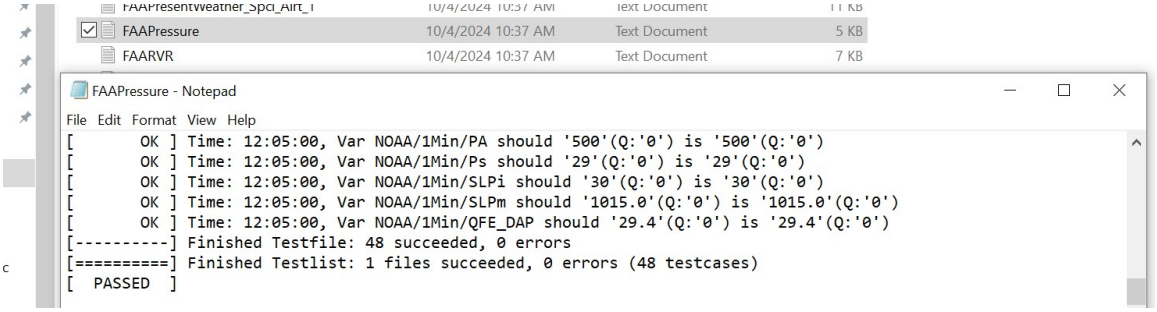
Keep in mind that the cells to the right of the contextual information are not used by the program and can be used for notes and data storage.



The spread sheets introduce the possibility of formatting errors. **The data stored in the colored cells within the xlsx files is format sensitive and the deletion or hiding of rows or column may cause the unit test to be unusable**. In the case that making an edit breaks the unit test, consult with Campbell Scientific to resolve the issue and get the test working once again. **It is best practice to make a backup of a test file in a working state before making adjustments.** Accidental additions of characters in the configuration section may break the test, and at times reverting to a known working version then copying over only the desired changes will resolve problems.

1	**Version**	1			
2	**Purpose**	This unit test will cover the Setra 470 Quality Check Calculation.			
3	**OutputFile** (1)	FAASetraQualityCheck.txt			
4	**TestSettings**	VERBOSE=2,WARPSPEED=400,HIDESYSERROR=True			
5	**StartYear**	2024			
6	**StartMonth**	9			
7	**StartDay**	14			
8	**StartHour** (2)	12			
9	**StartMinute**	0			
10	**StartSecond**	0			
11	**Algorithm Tested**	Setra 470T Sensor Quality Control Check	Section	Setra Sensor QC: 4.4.2	

At the top of each file is a block of data which may be useful during testing. (1) The **OutputFile** parameter defines the name of a file where the results of the test will be stored. For more information about the output, see the section of this document about interpreting results. This file can be found in the working directory of the Aero process.



(2) Within this block of contextual data, one can define the starting time for the test from the year to the second. The time specified is the time set when the test is initialized. The first validation occurs at the initial time + the shortest variable period. Meaning if the shortest variable period is 30 seconds, then the first output validation occurs at the start time + 30 seconds.

12			
13	**Constants**		
14	**Table**	**Yaml**	
15	STANDARD	FAA	
16	AERODROME	{ icao: NOAA, name: "Campbell Indoor Airport", hmsl: 1358, lat: 41.0, lon: -111.51 }	(1)
17	TIMEZONE	{ stdOff: '-7:00', start: never, end: never, tzFormat: LST }	
18			
19	**Sensors**		
20	**SensorName**	**Type**	
21	Wind	{ type: WS425, period: 5Sec, instances: { '1': { comm: {host: DCP1, port: 10006, }, opt: {} } } }	(2)
22			
23	**Settings**		
24	**SettingName**	**Yaml**	
25	ICEFREEWD DS-AVG'	5	(3)
26	ICEFREEPKWD DS-AVG'	3	
27			

The next sections of contextual information relate to station details such as elevation, latitude, longitude, sensor instances and settings.

(1) The **Constants** section will define attributes such as the FAA standard. This constant is needed to enable the FAA calculations. The Aerodrome constant defines the site elevation (useful for pressure tests) as well as the latitude and longitude for the site. Additional constants related to the Timezone or the Declination of the site are defined here. (2) The **Sensors** section defines any sensor instances needed. (3) The **Settings** section defines settings such as special alert thresholds, wind averages, and other settings.

The next sections within the contextual information relate to the test variables. The **DataTypes** section is where parameters such as the unit, decimal precision and rounding can be defined for variables. Data Types are then used in the **Variables** section. The **DataGroups** section defines any atypical data groups such as OID and Async. All of the time-based groups are available by default. In other words, groups such as 5Sec, 10Sec, 30Sec, 1Min, 5Min, and so on are available by default.

27						
28	**DataTypes**					
29	**DataType**	**Yaml**				
30	Temperature	{ units: F, width: 0, round: Off, dec: 0 }				
31	WindDirection	{ units: °, width: 3, round: Off, dec: 1}				
32	WindSpeed	{ units: kt, width: 0, round: Off, dec: 1}				
33						
34	**DataGroups**					
35	**GroupName**	**Yaml**				
36	OID	{ period: 60s, timeout: 20s, description: "OID", purge: 1s }				
37	Async	{ period: 5s, timeout: 2s, description: "Async", purge: 1s }				
38						
39	**Variables**					
40	**StationName**	**GroupName**		**VariableName**	**DataType**	**INput or OUTput**
41	NOAA	5Sec		WS3sa_1	WindSpeed	IN
42	NOAA	OID		WD3sa_1	WindDirection	IN
43	NOAA	Async		WS3sp_1	WindSpeed	IN
44	NOAA	10Sec		WD3sp_1	WindDirection	IN
45	NOAA	1Min		WS2Ma_1	WindSpeed	OUT
46	NOAA	5Sec		WD2Ma_1	WindDirection	OUT
47	NOAA	5Sec		WD2Mn_1	WindDirection	OUT
48	NOAA	5Sec		WD2Mx_1	WindDirection	OUT
49	NOAA	5Sec		WS2Mg_1	WindSpeed	OUT
50	NOAA	5Sec		WD2Mg_1	WindDirection	OUT
51	NOAA	5Sec		WS2Ml_1	WindSpeed	OUT
52	NOAA	5Sec		WASS_1	String	OUT

The most important section of the contextual information is the **Variables** table. The **Variables** table defines the inputs and outputs variables and designates a time group and type for each variable.

In the image below, there are 4 variables defined. The first variable is in the **10Sec** group. This variable will need to have a value for each 10 second time increment. In the following image, notice how the green highlighted variable has a data value on each row, where the **1Min** variables only have data values every 6th row. This is because the other three variables in the example provided are 1**Min** variables meaning they are only updated at the time stamp associated with each minute. For both input and output variables, the **GroupName** determines how often that variable will be updated.

Variables

StationName	GroupName	VariableName	DataType	INput or OUTput
SensorData	10Sec	MET_QFE_Z1	Pressure	IN
SensorData	1Min	MET_QFE_Z1_CT	Temperature	IN
SensorData	1Min	MET_QFE_Z1_AVG	Pressure	OUT
SensorData	1Min	SETRAStatus	String	OUT

Calculations

Calculation	CalcOrder	StationName	GroupName	VariableNa	Parameters
FAASetraQualityCheck	1	SensorData	10Sec	MET_QFE_Z1	AVGPRESSVAR=SensorData/1Min/MET_QFE_Z1_AVG,CABTEMPVAR=SensorData/1Min/MET_QFE_Z1_CT,CABLOC="field",QC

DebugChannels

ChannelName
System Error
SensorQC

DataValues

	Input Data					Output Data			
	Value	Quality	Value	Quality	I/O Gap	Value	Quality	Value	Quality	
TimeStamp	SensorData/10Sec/MET_QFE_Z1		SensorData/1Min/MET_QFE_Z1_CT			SensorData/1Min/MET_QFE_Z1_AVG		SensorData/1Min/SETRAStatus		DebugChannels
12:00:10 AM	30.063	0.000								
12:00:20 AM	30.063	0.000								
12:00:30 AM	30.063	0.000								
12:00:40 AM	30.063	0.000								
12:00:50 AM	30.063	0.000								
12:01:00 AM	30.063	0.000	70.000	0.000			47424	Operational	0	
12:01:10 AM	30.062	0.000								
12:01:20 AM	30.062	0.000								
12:01:30 AM	30.062	0.000								
12:01:40 AM	30.062	0.000								
12:01:50 AM	30.062	0.000								
12:02:00 AM	30.062	0.000	70.000	0.000		30.060	0	Operational	0	Setra 470T Z1: Sensor Operational
12:02:10 AM	30.062	0.000								
12:02:20 AM	30.062	0.000								
12:02:30 AM	30.061	0.000								

The final portions of contextual information are the calculation initialization definition and the section initializing the debug channels. The calculation initialization definition will match the listing for that calculation within the AllCalculations.txt file. The calculation definitions outlines the main variable of the calculation and the parameters used by that calculation are linked to the variables defined in the **Variables** table. The **DebugChannels** definition allows the **System Error** log as well as the **Maintenance Log**.

AllCalculations.txt

```
CalculationName(order), main variable, [parameters]
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z1,          [AVGPRESSVAR=SensorData/1
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z2,          [AVGPRESSVAR=SensorData/1
FAASetraQualityCheck(10),     SensorData/10Sec/MET_QFE_Z3,          [AVGPRESSVAR=SensorData/1
QualityCheck(10),    SensorData/10Sec/AT 1,     [LIMITS=SensorData/10Sec/AT 1 > -80 and SensorD
```

Calculations

Calculation	CalcOrder	StationName	GroupName	VariableNa	Parameters
FAASetraQualityCheck	1	SensorData	10Sec	MET_QFE_Z1	AVGPRESSVAR=SensorData/1Min/MET_QFE_Z1_AVG,CABTEMPVAR=SensorData/1Min/MET_QFE_Z1_CT,CABLOC="field",QCSETRASTATUS=SensorData/1Min/SETRAStatus

DebugChannels

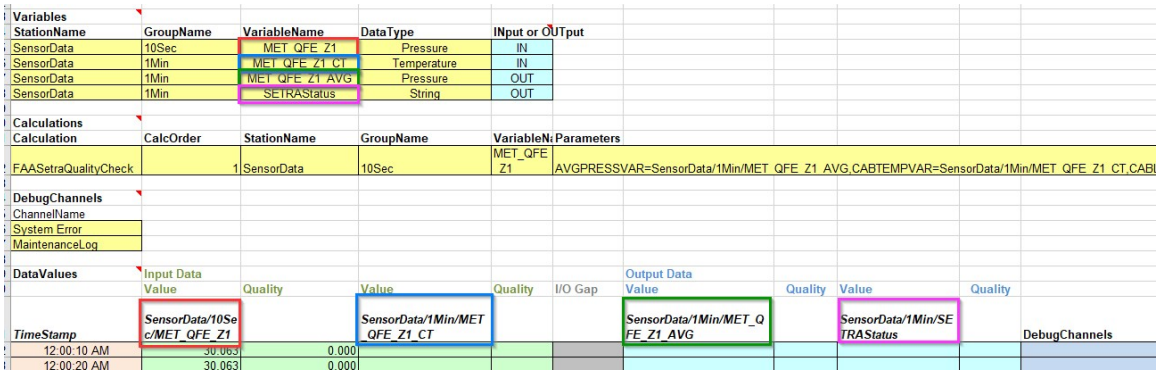
ChannelName
System Error
MaintenanceLog

This definition enables the Debug Channel output column

DataValues

	Input Data					Output Data				
	Value	Quality	Value	Quality	I/O Gap	Value	Quality	Value	Quality	
TimeStamp	SensorData/10Sec/MET_QFE_Z1		SensorData/1Min/MET_QFE_Z1_CT			SensorData/1Min/MET_QFE_Z1_AVG		SensorData/1Min/SETRAStatus		DebugChannels
12:00:10 AM	30.063	0.000								
12:00:20 AM	30.063	0.000								
12:00:30 AM	30.063	0.000								
12:00:40 AM	30.063	0.000								
12:00:50 AM	30.063	0.000								
12:01:00 AM	30.063	0.000	70.000	0.000			47424	Operational	0	Setra 470T 1 [2099] Sensor Operational
12:01:10 AM	30.062	0.000								
12:01:20 AM	30.062	0.000								
12:01:30 AM	30.062	0.000								
12:01:40 AM	30.062	0.000								
12:01:50 AM	30.062	0.000								
12:02:00 AM	30.062	0.000	70.000	0.000		30.060	0	Operational	0	Setra 470T 1 [2099] Sensor Operational
12:02:10 AM	30.062	0.000								
12:02:20 AM	30.062	0.000								
12:02:30 AM	30.061	0.000								

The most significant portion of the test file is the **Input** and **Output** data block. Notice how the columns align with the variables defined in the **Variables** table. This order is strict with the first variable occupying the first set of columns.



Variables				
StationName	GroupName	VariableName	DataType	INput or OUTput
SensorData	10Sec	MET_QFE_Z1	Pressure	IN
SensorData	1Min	MET_QFE_Z1_CT	Temperature	IN
SensorData	1Min	MET_QFE_Z1_AVG	Pressure	OUT
SensorData	1Min	SETRAStatus	String	OUT

Calculations					
Calculation	CalcOrder	StationName	GroupName	VariableN:	Parameters
FAASetraQualityCheck	1	SensorData	10Sec	MET_QFE Z1	AVGPRESSVAR=SensorData/1Min/MET_QFE_Z1_AVG,CABTEMPVAR=SensorData/1Min/MET_QFE_Z1_CT,CABI

DebugChannels
ChannelName
System Error
MaintenanceLog

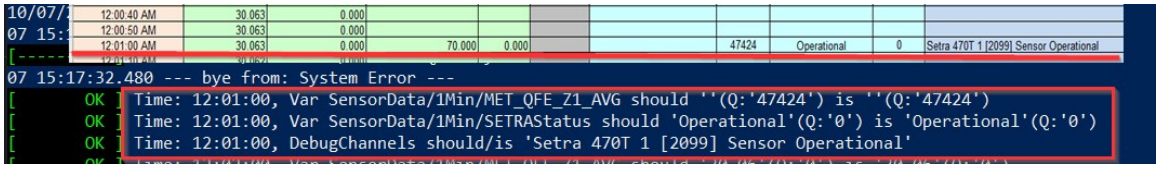
DataValues	Input Data					Output Data				
	Value	Quality	Value	Quality	I/O Gap	Value	Quality	Value	Quality	
TimeStamp	SensorData/10Sec/MET_QFE_Z1		SensorData/1Min/MET_QFE_Z1_CT			SensorData/1Min/MET_QFE_Z1_AVG		SensorData/1Min/SETRAStatus		DebugChannels
12:00:10 AM	30.063	0.000								
12:00:20 AM	30.063	0.000								

G.1 Adjusting Input data and Output-expectations

DataValues	Input Data					Output Data				
	Value	Quality	Value	Quality	I/O Gap	Value	Quality	Value	Quality	
(1) TimeStamp	SensorData/10Sec/MET_QFE_Z1		SensorData/1Min/MET_QFE_Z1_CT			SensorData/1Min/MET_QFE_Z1_AVG		SensorData/1Min/SETRAStatus		(4) DebugChannels
12:00:10 AM	30.063	0.000								
12:00:20 AM	30.063	0.000								
12:00:30 AM	30.063	0.000								
12:00:40 AM	30.063	0.000								
12:00:50 AM	30.063	0.000								
12:01:00 AM	30.063	0.000	70.000	0.000			47424	Operational	0	Setra 470T 1 [2099] Sensor Operational
12:01:10 AM	30.062	0.000								
12:01:20 AM	30.062	0.000								
12:01:30 AM	30.062	0.000								
12:01:40 AM	30.062	0.000								
12:01:50 AM	30.062	0.000								
12:02:00 AM	30.062	0.000	70.000	0.000		30.060	0	Operational	0	Setra 470T 1 [2099] Sensor Operational
12:02:10 AM	30.062	0.000								
12:02:20 AM	30.062	0.000								
12:02:30 AM	30.061	0.000								
12:02:40 AM	30.061	0.000								
12:02:50 AM	30.061	0.000								
12:03:00 AM	30.061	0.000	75.000	0.000		30.060	0	Operational	0	
12:03:10 AM	30.061	0.000								
12:03:20 AM	30.061	0.000								
12:03:30 AM	30.061	0.000								

(2) (3)

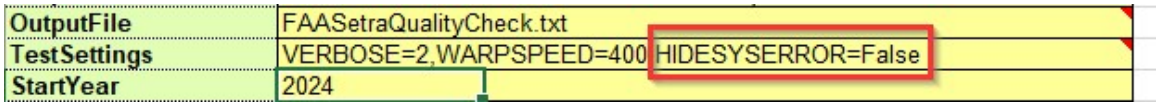
The **Input** and **Output** data block is a sensitive data structure. The format of this block is necessary for Aero to extract the data properly. The block of data is colored to make the structure more easily seen. (1) On the far left, there is the Timestamp column. This is informational and is not consumed by AAero during test execution. **It is possible that these timestamps are mismatched with the actual time during test execution**. To validate synchrony, you can check the output of the test. Notice how the timestamp of the output in the image below matches the timestamp of the highlighted row in the test file.



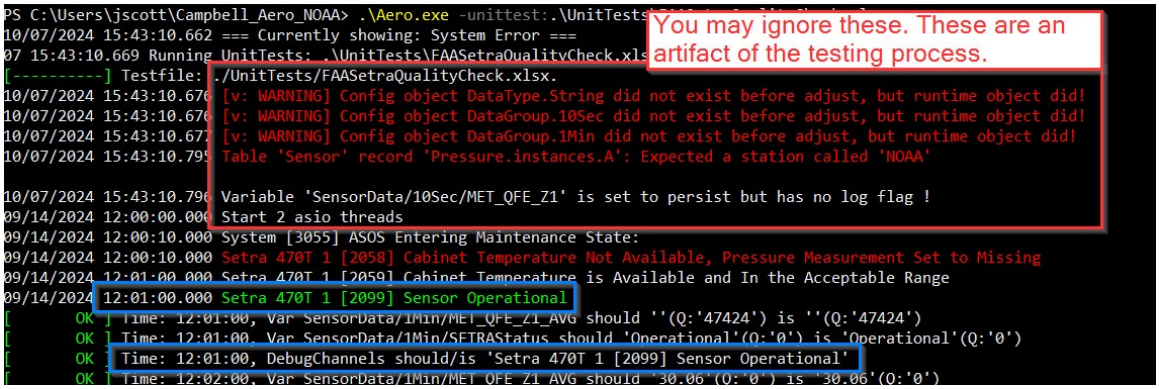
If the timestamp in the xlsx file is incorrect, you can correct it by editing the text in the first 2 cells and then using the drag pattern to extend the timestamp for the desired range. Timestamps must increment at the shortest period within the variables. If a unit tests has 10 second, 30

second, and 1 Minute variables, the time stamps must change by 10 seconds per row. Depending on the increment of the variable, there may be blank cells in the rows where that variable is not updated. In other words, a 30 second variable in the example provided earlier would only need a value assigned every 3 rows. A 1 Minute variable would only need to be provided a value every 6 rows. If a test contains only 30 second and 1 minute variables, the time stamp would increment by 30 seconds. The 30 second variables would be provided a value in each row, and the 1 minute variables would be provided values every other row.

Each calculation has been built into a unit test scaffolding which has the context prepared. The intention of the xlsx files, which were delivered with this document, is to act as a starting point where testing agents can extend the time range and add input and output data without needing to edit the contextual data unless desired. For each test, the test technician will need to review the variables available within each test and add the input and output data into this structured block. (2) The input data is highlighted in green. Notice how each variable uses two columns. The first column holds the variable's value, and has the variable name as a header. Within the input column, the value provided is what Aero will assign to that variable before running the calculation. The second column (this is the same for the output column) holds the quality designation for the value provided. Refer to the table in Quality designation for variables (p. 161) for the common quality values and descriptions. A blank cell in the quality column is interpreted as "Missing" and will resolve to the quality designation of 47424. (3) The output columns are highlighted in blue and have the same format as the input columns. Aero will assign the defined variables to the provided input values and run the designated calculation. After the calculation has completed execution, Aero will compare the results of the calculation against the data provided in the output columns. See Interpreting the results of a unit test (p. 163) for more information. (4) Any Maintenance Log messages can be validated by entering text into the purple DebugChannels column. If no text is entered into this column, no query is made for the last Maintenance Log event. Maintenance Log messages are still produced by Aero even if there is no query to check it. A technician can adjust the **HIDESYSERROR TestSettings** at the top of the unit test to cause all Log Messages to appear in the test output.

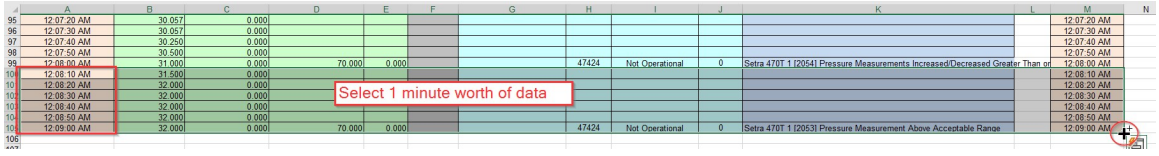


WARNING:
If you adjust the HIDESYSERROR setting to show all messages, you will see configuration warnings which are an artifact of the unit testing system and are not errors which the technicians caused or need to resolve.



Notice how the Log message is posted first, (blue highlighted lines in above image) then the results of the test validation are printed with matching time stamps. It is possible to have untested log messages, or log messages that occur without being validated by the unit test. At the 12:00:10 time stamp, the calculation produces a "Setra 470T 1 [2058] Cabinet Temperature Not Available, Pressure Measurement Set to Missing" log message yet no validation is performed on this log message. Only when text is entered into the DebugChannels column of the unit test is the Maintenance Log queried for the last posted message. At 12:01:00 there was an additional log message "Setra 470T 1 [2058] Cabinet Temperature is Available and In the Acceptable Range", since this co-occurs with the "Setra 470T 1 [2099] Sensor Operational" message. We are only able to query for the last posted log message. The second log message is obscuring the initial log message. Due to algorithm logic, there may be situations where two log messages are posted at the same time stamp. In these cases, only the last log message can be validated using the Debug Channels column in the unit test.

When wanting to add larger amounts of data, it is easy to introduce timing errors. To avoid this, select blocks of data in 1 Minute groups. You can select a range of cells representing 10,5,2,etc minutes worth of data, but ensure you start your selection after a minute time stamp and end your selection on a minute time stamp. You may use the pattern painter (click the bottom left corner) to drag the range of data down adding duplicated rows of data. Using this method, you can add larger blocks of data quickly without disrupting the synchrony between the variables.



The empty cells above to the right and below the input/output data block can be used for notes. You may add additional sheets to the xlsx file. Only the first sheet of the xlsx file is interpreted by Aero.

G.2 Quality designation for variables

Within the Campbell Aero application, each Variable has a value as well as a quality designation for that value. The quality designation is used to track attributes such as Pre QC check and Post QC check. The table below is an outline of the quality designations you will encounter while working with the xlsx tests. The most common quality designations are **0** for a valid value and **47424** which is used for invalid values otherwise interpreted as "Missing". An input value with quality 47424 is "Missing" for algorithm compliance and an output with the quality designation of 47424 is considered "Missing".

Table G-1: Variable quality designation

Quality Designation	Description
0	OK. Checked, this value is valid and has good quality.
47424	Fatal. This value is unusable for calculation.
8192	OK. Unchecked, this value is valid but not filtered by a QC calculation.

G.3 Running a unit test

A unit test can be run while a system is live. Unit tests can be run on a Windows sandbox instance of Aero or on Linux.

For Windows:

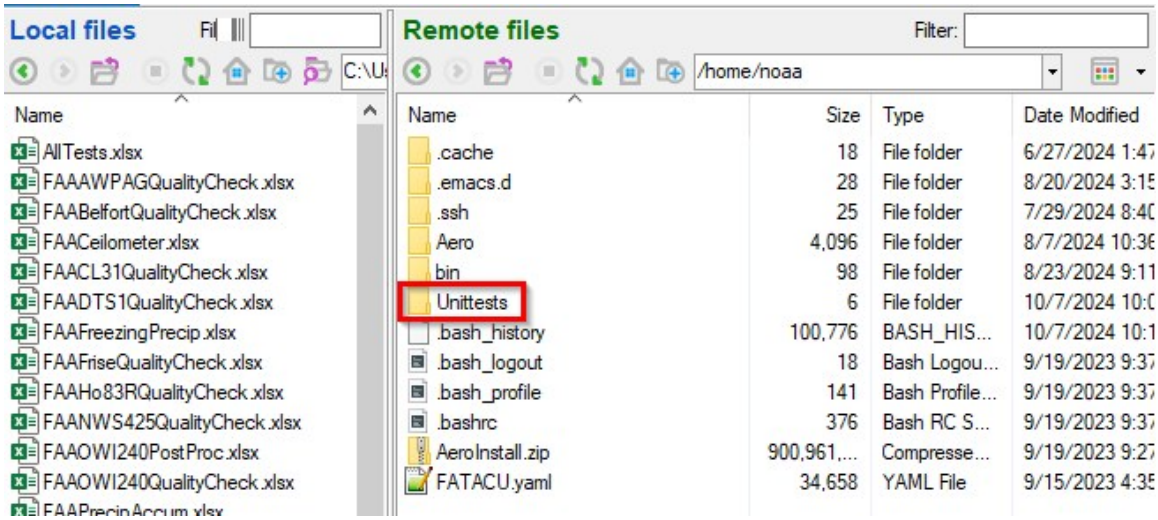
1. Launch a PowerShell instance (or terminal of your choice).
2. Navigate using the 'cd' command to move into the working directory for Aero
3. Ensure your unit test files are in an accessible location from the working directory for Aero.
4. Run the following command from the working directory of Aero:

   'Aero.exe -unittest:.\Unittests\FAATestFileName.xlsx'

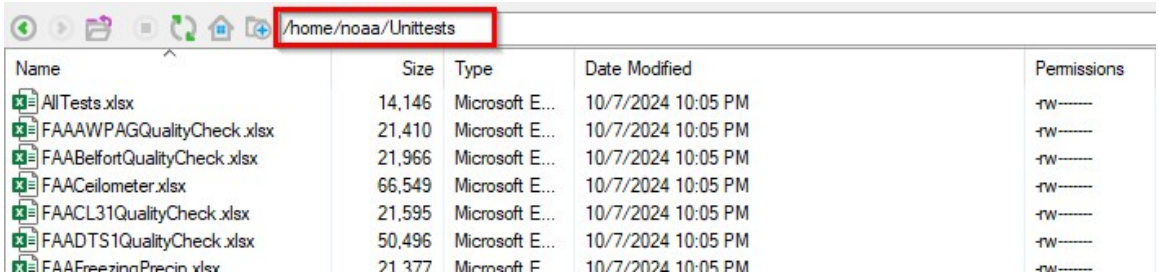
For Linux the process has a few more considerations:

1. Collect all of the tests you would like to run in a single location accessible on a machine with network access to the ASOS Server.
2. Use a SSH connection client of your choice to connect with the ASOS server. Preferably you will connect to the active or "Hot" server in order to avoid file sync issues.
3. Open a file transfer connection with the server.

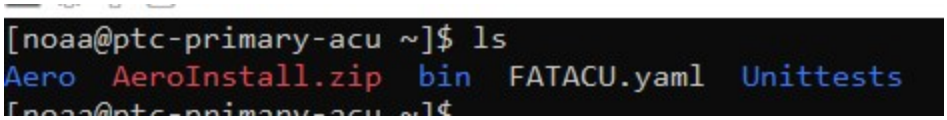
4. Create a folder named **Unittests** within the NOAA home directory.



5. Copy all of the Unittests into this folder.



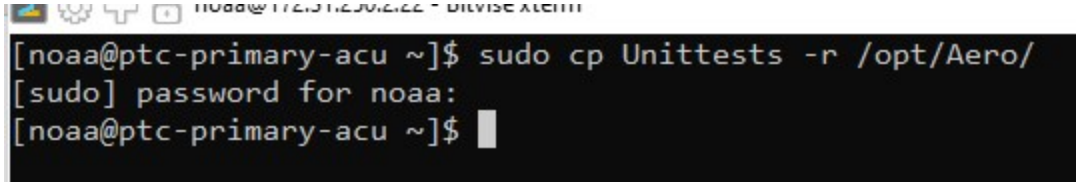
6. Open a terminal connection to the same server.
7. Use cd to navigate to the home directory for NOAA.



8. Copy the Unittests folder to the /opt/Aero location with the following command:

   'sudo cp Unittests -r /opt/Aero/'

9. Unless you are already the super user, you will need to enter the root password.



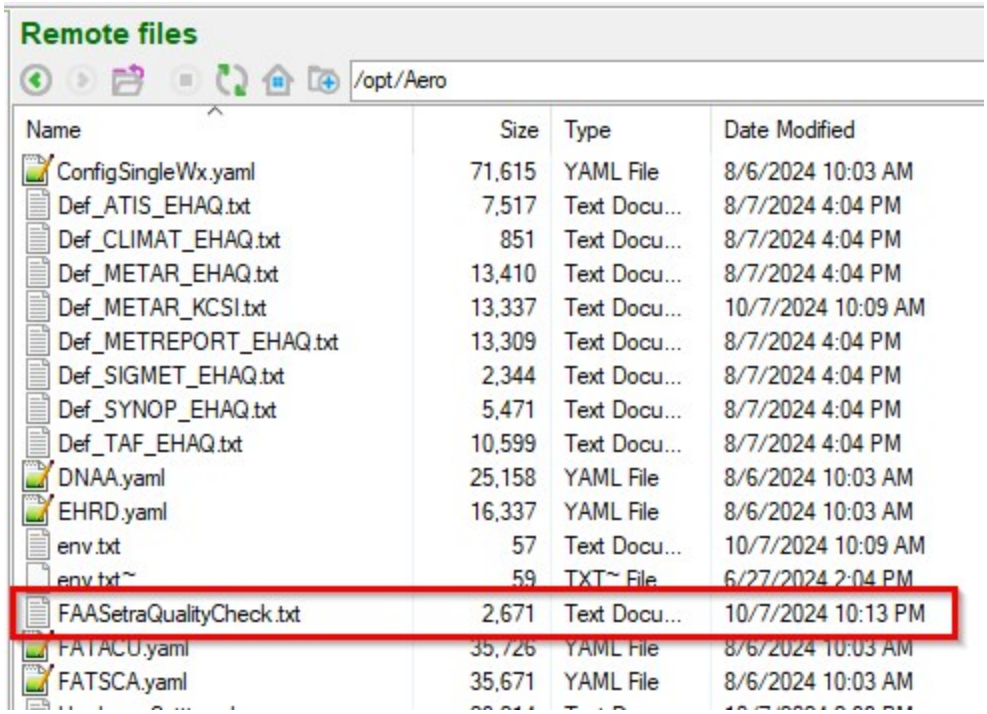
10. Use cd to navigate to /opt/Aero/.

    'cd /opt/Aero/'

11. Run the desired unit test with the following command:

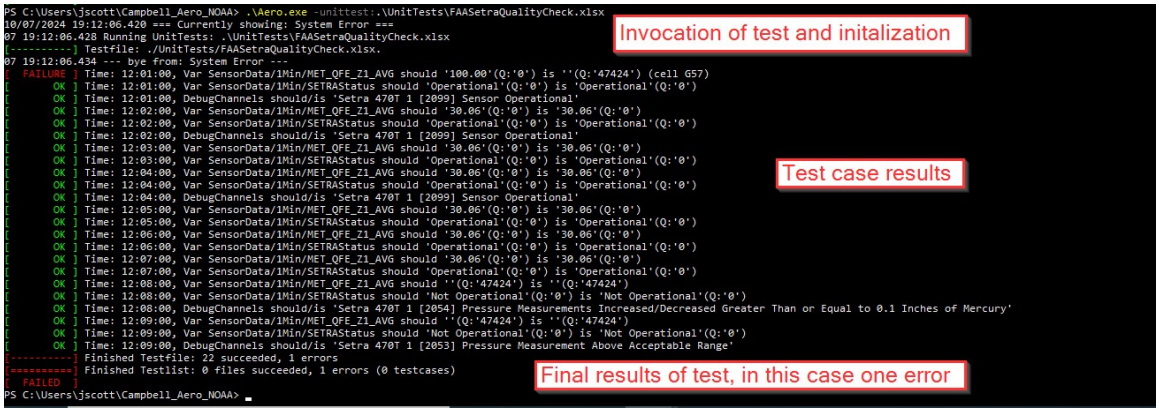
    'sudo ./Aero -unittest:Unittests/FAASetraQualityCheck.xlsx'

12. Unless already the super user, enter the root password.
13. The results will appear in the terminal window as well as in an output file within the working directory of Aero.

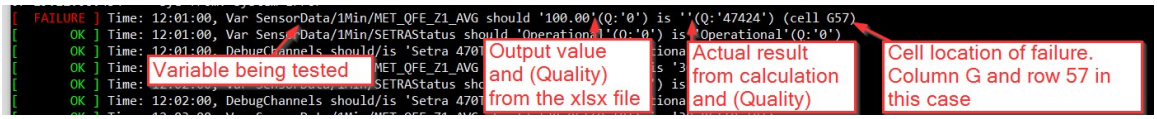


G.4 Interpreting the results of a unit test

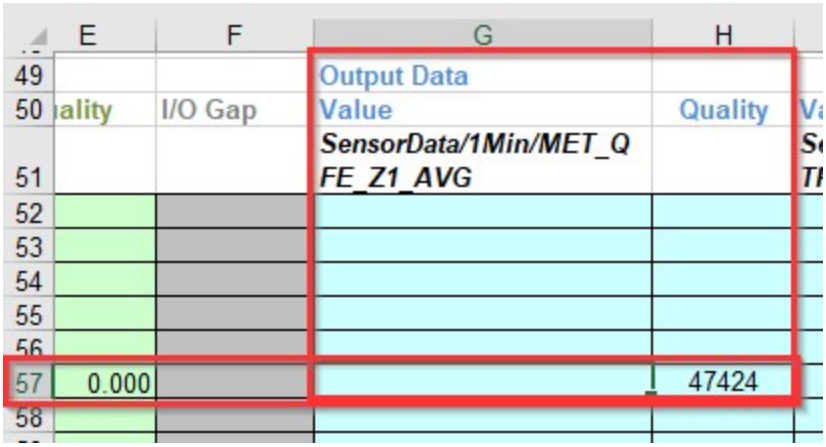
There are two methods to review the results of running a unit test. One is through the command line where the unit test is run. Within the terminal window where the invocation of the test was entered, you will see a read out of the results from the test.



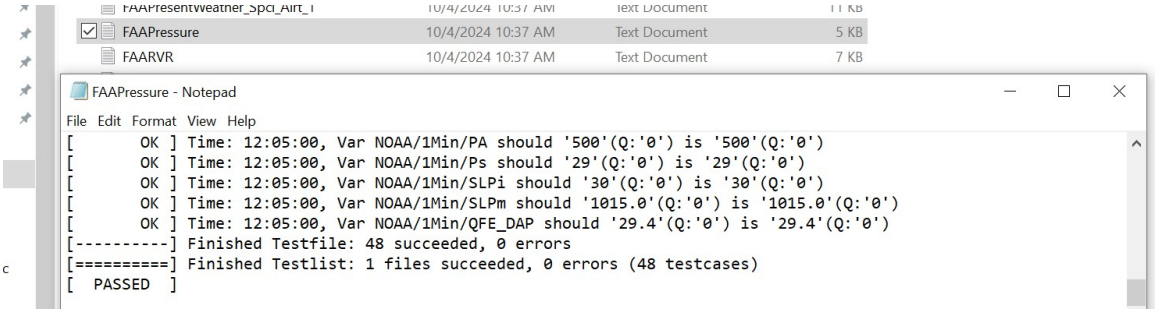
On the left you will see red Failures and green OKs. The first few lines are System read outs. The test case lines correspond to the output data contained within the spreadsheets. Each result line indicates the variable being tested, the expected result as retrieved from the xlsx file, and the actual result from running the calculation with the provided inputs.



When there is a failure, the last section of the failure result will be a cell location of the output data which conflicts with the result of the calculation. This is either because your output expectation is incorrect or there is a bug in the algorithm logic. Double check the input data with your output expectations and ensure they are correct. If a failure persists, contact Campbell Scientific through designated communication channels in order to resolve the issue. Within the result print out, you will see the value and the quality within () symbols.



The second method for reviewing the results is through the OutputFile mentioned in The xlsx testing system (p. 153). A filename can be specified at the top of the test file which will contain the results of the test. This file will be generated within the working directory of the Aero process.

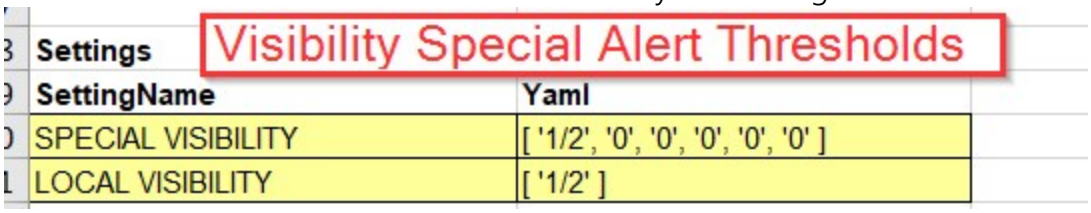


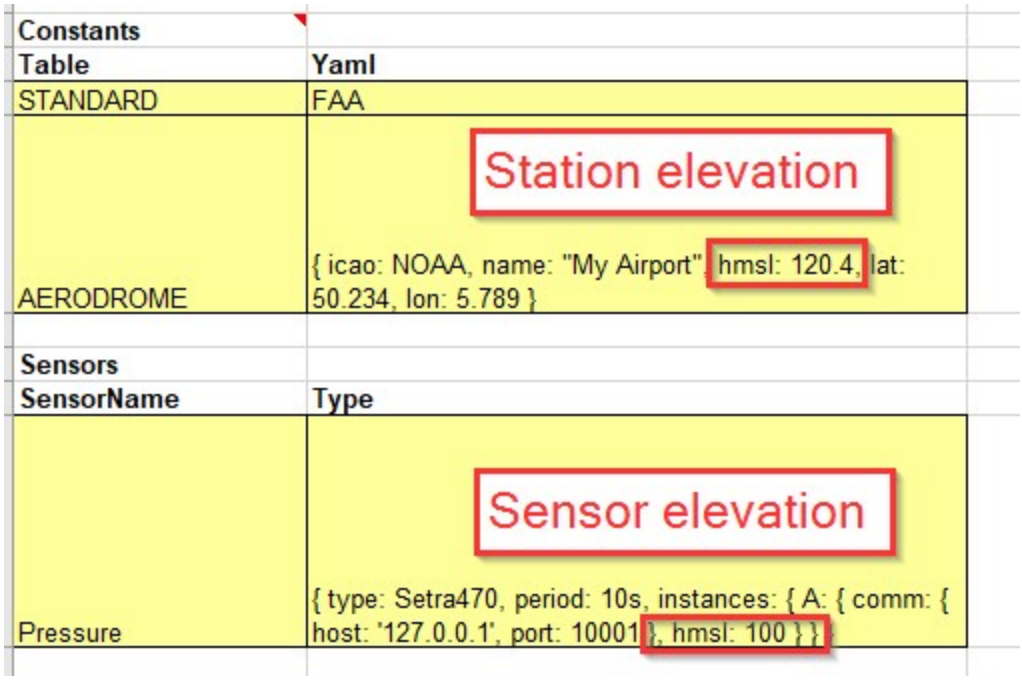
When all test cases are passing within the file, the results will indicate success.

```
[       OK ] Time: 12:09:00, DebugChannels should/is 'Setra 470T 1 [2053] Pre
[----------] Finished Testfile: 23 succeeded, 0 errors
[==========] Finished Testlist: 1 files succeeded, 0 errors (23 testcases)
[  PASSED  ]
PS C:\Users\iscott\Campbell_Aero_NOAA> _
```

G.5 Adjusting settings within the xlsx test

For some algorithms, it may be useful to adjust settings which are defined in the contextual information. Cases such as testing the special alerts, sensor or station elevations, and the wind averaging periods. You may adjust values in the contextual data as long as the formatting is consistent with properly formatted yaml. Be sure not to add extra ' ' characters or extra new lines or brackets. Refer to the system configuration if there are questions regarding yaml formatting. The text in the xlsx file will match the text in the system configuration.

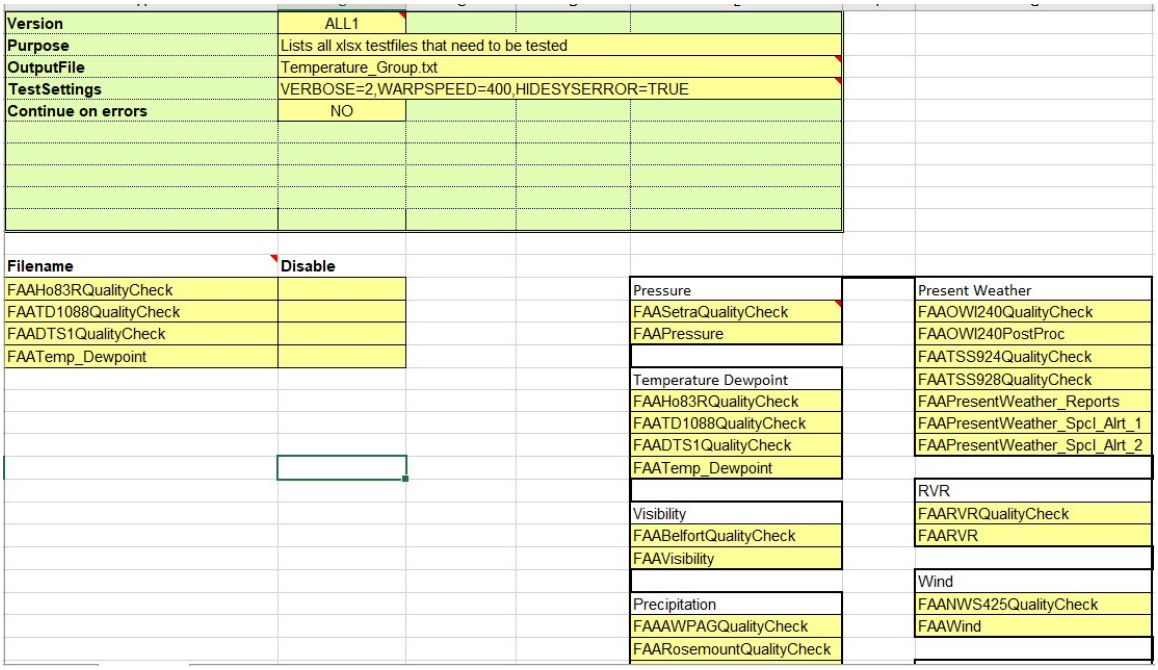




G.6 AllTests.xlsx

There may be times when it is useful to run multiple tests in series. This is possible through a special file format called AllTests.xlsx. This special file format allows multiple tests to be run in

series. This can present issues with timing and shared variables. Since all of the tests being run will share memory and time variables, any variables which are present in multiple files may have unexpected starting conditions due to a previous test operating on that variable. If there are unexpected errors when using the AllTests.xlsx, check the failures against any shared variables and adjust expectations as needed. There is an included AllTests.xlsx file with prepared groups of tests. The Present Weather group has shared variables meaning there are a small collection of variable conflicts.



Version	ALL1
Purpose	Lists all xlsx testfiles that need to be tested
OutputFile	Temperature_Group.txt
TestSettings	VERBOSE=2,WARPSPEED=400,HIDESYSERROR=TRUE
Continue on errors	NO

Filename	**Disable**
FAAHo83RQualityCheck	
FAATD1088QualityCheck	
FAADTS1QualityCheck	
FAATemp_Dewpoint	

Pressure	
FAASetraQualityCheck	
FAAPressure	
Temperature Dewpoint	
FAAHo83RQualityCheck	
FAATD1088QualityCheck	
FAADTS1QualityCheck	
FAATemp_Dewpoint	
Visibility	
FAABelfortQualityCheck	
FAAVisibility	
Precipitation	
FAAAWPAGQualityCheck	
FAARosemountQualityCheck	

Present Weather
FAAOWI240QualityCheck
FAAOWI240PostProc
FAATSS924QualityCheck
FAATSS928QualityCheck
FAAPresentWeather_Reports
FAAPresentWeather_Spcl_Alrt_1
FAAPresentWeather_Spcl_Alrt_2
RVR
FAARVRQualityCheck
FAARVR
Wind
FAANWS425QualityCheck
FAAWind

Appendix H. Glossary

A

AFTN

Aeronautical fixed telecommunication network. A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics.

air traffic services unit

A generic term meaning variously, air traffic control unit, flight information center or air traffic services reporting office.

aircraft

Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth surface.

aircraft observation

The evaluation of one or more meteorological elements made from an aircraft in flight.

airport

An aerodrome with extended facilities that imply or confer a certain stature upon the aviation facility that other aerodromes may not have achieved.

airport elevation

The elevation of the highest point of the landing area.

airport reference point

The designated geographical location of an airport.

ALS

Ambient light sensor. Also called background luminance sensor (BGL).

altitude

The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

AMHS

Aeronautical Message Handling System

ASOS

Automated Surface Observing System. A weather reporting system that provides surface observations via digitized broadcasts and standardized reports.

ATC

Air traffic control

ATIS

Automatic terminal information service. The continuous broadcast of recorded non-control information in selected terminal areas. Its purpose is to improve controller effectiveness and relieve frequency congestion by automating repetitive transmission of essential but routine information.

AWOS

Automated Weather Observing System. An automated weather reporting system consisting of various sensors, a processor, and a means to broadcast weather data.

B

BGL

Background luminance sensor. Also called ambient light sensor (ALS).

briefing

Oral commentary on existing and/or expected meteorological conditions.

C

cloud of operational significance

A cloud with the height of cloud base below 1500 m (5000 ft) or below the highest minimum sector altitude, whichever is greater, or a cumulonimbus cloud or a towering cumulus cloud at any height.

consultation

Discussion with a meteorologist or another qualified person of existing and/or expected meteorological conditions relating to flight operations; a discussion includes answers to questions.

cruising level

A level maintained during a significant portion of a flight.

CTA

Control area. A controlled airspace extending upwards from a specified limit above the earth.

D

D-ATIS

ATIS information transmitted via the Datalink services.

datalink

Method of transmitting text messages directly to an aircraft. Worldwide a network of radios and satellites is setup to perform this communication.

E

elevation

The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

F

FAA

Federal Aviation Administration

FDCU

Field data collection unit

FL

Flight level. A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals. Note 1: A pressure type altimeter calibrated in accordance with the Standard Atmosphere: a) When set to a QNH altimeter setting, will indicate altitude. b) When set to a QFE altimeter setting, will indicate height above the QFE reference datum. c) When set to a pressure of 1013.2 hPa, may be used to indicate flight levels. Note 2: The terms “height” and “altitude”, used in Note 1, indicate altimetric rather than geometric heights and altitudes.

flight crew member

A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

flight documentation

Written or printed documents, including charts or forms, containing meteorological information for a flight.

forecast

A statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.

H

height

The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

I

ICAO

International Civil Aviation Organization

ILS

Instrument landing system

L

level

A generic term relating to the vertical position of an aircraft in flight and meaning variously height, altitude or flight level.

M

METAR

The international standard code format for hourly surface weather observations. METAR is the acronym that roughly translates to Aviation Routine Weather Report.

meteorological information

Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.

meteorological satellite

An artificial Earth satellite making meteorological observations and transmitting these observations to Earth.

mid RVR

The RVR readout values obtained from sensors located midfield of the runway.

minimum sector altitude

The lowest altitude which may be used which will provide a minimum clearance of 300 m (1000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 NM) radius centred on a radio aid to navigation.

N

navigation specification

A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications: Required navigation performance (RNP) specification: A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH. Area navigation (RNAV) specification: A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1. Note: The Performance-based Navigation (PBN) Manual (Doc 9613), Volume II, contains detailed guidance on navigation specifications.

NTP

Network Time Protocol. Time synchronization protocol can synchronize the server using NTP3 or NTP4.

O

observation (meteorological)

The evaluation of one or more meteorological elements.

OID

Operator Interface Device

operational control

The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight.

operational flight plan

The operator's plan for the safe conduct of the flight based on considerations of airplane performance, other operating limitations and relevant expected conditions on the route to be followed and at the airports concerned.

operational planning

The planning of flight operations by an operator.

operator

The person, organization or enterprise engaged in or offering to engage in an aircraft operation.

P

PIC

Pilot-in-command. The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

Q

QFE

The pressure set on an altimeter that indicates the height above the reference elevation being used. This is often the atmospheric pressure at the airport elevation (or at the runway threshold).

QNH

The pressure set on an altimeter that indicates the height above sea level. This is the altimeter sub-scale setting to obtain elevation when on the ground.

quality management

Coordinated activities to direct and control an organization regarding quality (ISO 9000*).

R

RLIM

Runway light intensity monitor

runway

A defined rectangular area on a land airport prepared for the landing and take-off of aircraft.

RVR

Runway visual range. The range over which the pilot of an aircraft on the center line of a runway can see the runway surface markings or the lights delineating the runway or identifying its center line.

S

search and rescue services unit

A generic term meaning rescue coordination center, rescue subcenter or alerting post.

SPECI

A non-routine report initiated either by a user or by algorithms. SPECI reports contain the content of the routine METAR but are not at the prescheduled time for transmission. Each measurement group has a defined method for initiating a SPECI report. These methods are defined in the Documented Weather Algorithms.

standard isobaric surface

An isobaric surface used on a worldwide basis for representing and analyzing the conditions in the atmosphere.

SYNOP

Meteorological message. Defined by WMO and operational all over the world. It is not aviation related but many aiports also make this message.

T

TC

Tropical cyclone. Generic term for a non-frontal synoptic-scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation.

TDZ

Touchdown zone. The portion of a runway, beyond the threshold, where it is intended landing airplanes first contact the runway.

threshold

The beginning of that portion of the runway usable for landing.

touchdown zone RVR

The RVR visibility readout values obtained from sensors serving the runway touchdown zone.

U

upper-air chart

A meteorological chart relating to a specified upper-air surface or layer of the atmosphere.

W

WMO

World Meteorological Organization. The meteorological authority defining most of the weather related messages and measurement methods.

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Australia

Location:	Garbutt, QLD Australia
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Email:	info@campbellsci.com.au
Website:	www.campbellsci.com.au

Brazil

Location:	São Paulo, SP Brazil
Phone:	11.3732.3399
Email:	vendas@campbellsci.com.br
Website:	www.campbellsci.com.br

Canada

Location:	Edmonton, AB Canada
Phone:	780.454.2505
Email:	dataloggers@campbellsci.ca
Website:	www.campbellsci.ca

China

Location:	Beijing, P. R. China
Phone:	86.10.6561.0080
Email:	info@campbellsci.com.cn
Website:	www.campbellsci.com.cn

Costa Rica

Location:	San Pedro, Costa Rica
Phone:	506.2280.1564
Email:	info@campbellsci.cc
Website:	www.campbellsci.cc

France

Location:	Montrouge, France
Phone:	0033.0.1.56.45.15.20
Email:	info@campbellsci.fr
Website:	www.campbellsci.fr

Germany

Location:	Bremen, Germany
Phone:	49.0.421.460974.0
Email:	info@campbellsci.de
Website:	www.campbellsci.de

India

Location:	New Delhi, DL India
Phone:	91.11.46500481.482
Email:	info@campbellsci.in
Website:	www.campbellsci.in

Japan

Location:	Kawagishi, Toda City, Japan
Phone:	048.400.5001
Email:	jp-info@campbellsci.com
Website:	www.campbellsci.co.jp

South Africa

Location:	Stellenbosch, South Africa
Phone:	27.21.8809960
Email:	sales@campbellsci.co.za
Website:	www.campbellsci.co.za

Spain

Location:	Barcelona, Spain
Phone:	34.93.2323938
Email:	info@campbellsci.es
Website:	www.campbellsci.es

Thailand

Location:	Bangkok, Thailand
Phone:	66.2.719.3399
Email:	info@campbellsci.asia
Website:	www.campbellsci.asia

UK

Location:	Shepshed, Loughborough, UK
Phone:	44.0.1509.601141
Email:	sales@campbellsci.co.uk
Website:	www.campbellsci.co.uk

USA

Location:	Logan, UT USA
Phone:	435.227.9120
Email:	info@campbellsci.com
Website:	www.campbellsci.com