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T°Sentry ALERT System

SOFTWARE OPERATIONS MANUAL

June 2020

TABLE OF CONTENTS

SCOPE

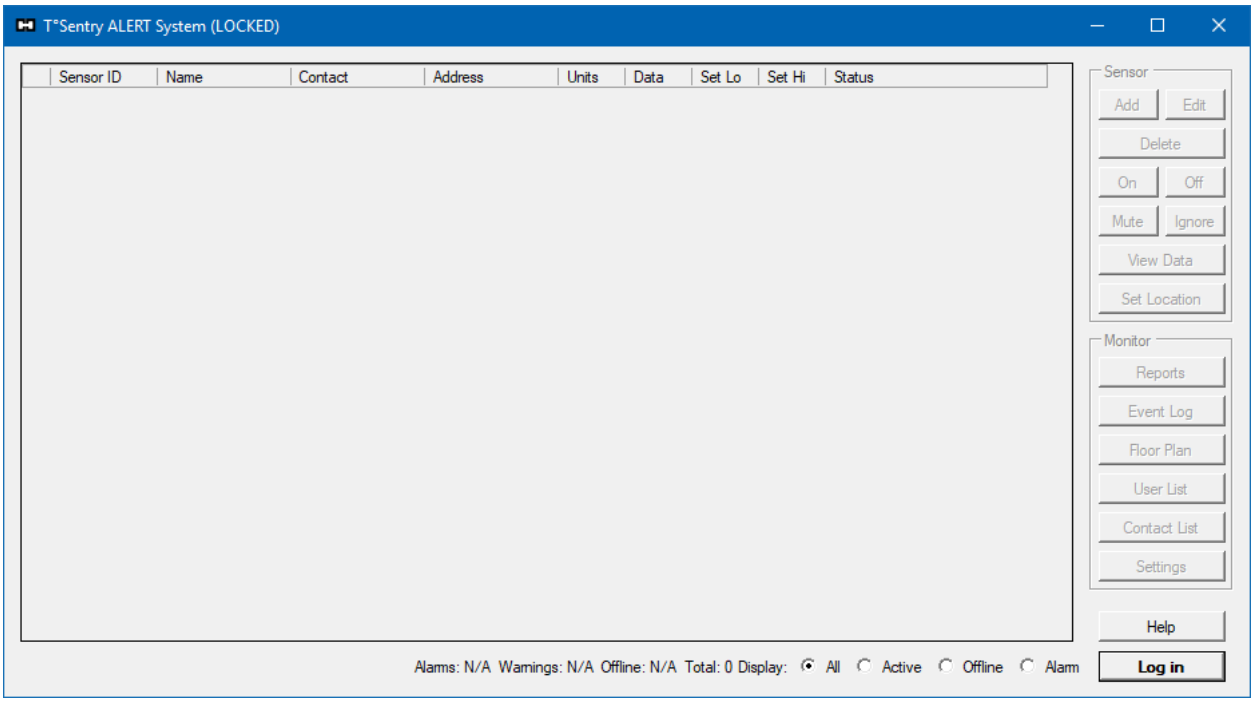
This manual is intended to be used by system installers and end users as a guide for the configuration and daily operation of the *T°Sentry ALERT System* software. It does not cover software installation, or installation and configuration of the system hardware (including the computer, network equipment, and sensors).

Prerequisites

As the *T°Sentry ALERT System* software is a Microsoft Windows application, a basic knowledge of the Microsoft Windows graphical user interface (GUI) is required.

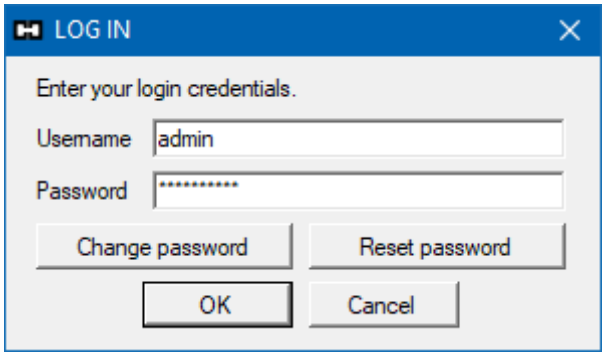
THE SENSOR STATUS SCREEN (PART 1)

The main window of the *T°Sentry ALERT System* software is the sensor status screen (shown below). It contains a table of all the sensors that are being monitored by the system, as well as a number of buttons which are used to access information about the system configuration and the configuration and data for each sensor. If you are setting up a new system, the sensor table will be empty, as shown below.

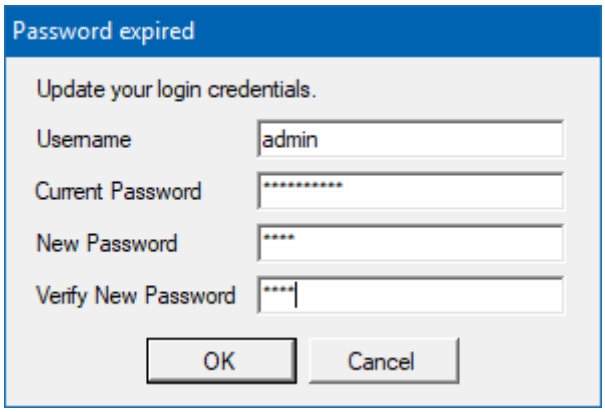


Logging In

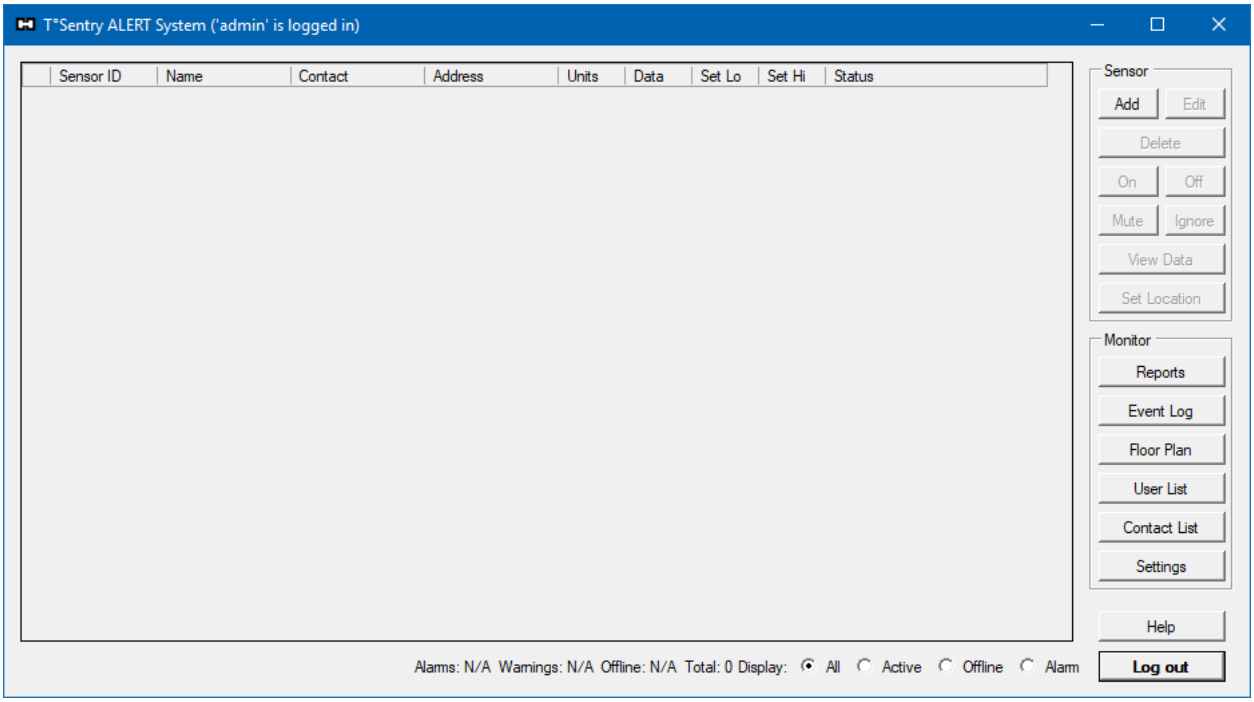
The *T°Sentry ALERT System* software contains a user list feature to allow for system access control and accountability logging. Initially this list only contains two users: *admin* and *guest*. To configure the system you must login as *admin* (administrator) using the password "adminpass!". Start by clicking the **Log In** button. You will be presented with the user authentication dialog box, shown to the right. After entering the username and password, click the **OK** button.



If this is the first time you have logged into the system, you will be presented with the Password Expired dialog box. You must change your password at this time. Enter the current *admin* password (adminpass!), and then enter your newly chosen password twice and click **OK**. Initially, the only restriction on the new password is that it must be four or more characters. If there are any errors with the passwords you enter, you will be prompted to make corrections. Otherwise, you will get a "Password change was successful" notification.



After logging in, you will notice that some of the controls on sensor status screen change. The title bar will now display the name of the current logged in user, and a number of the buttons are enabled. As the system administrator, you now have full control of the system and can begin the steps required to configure the system for operation.



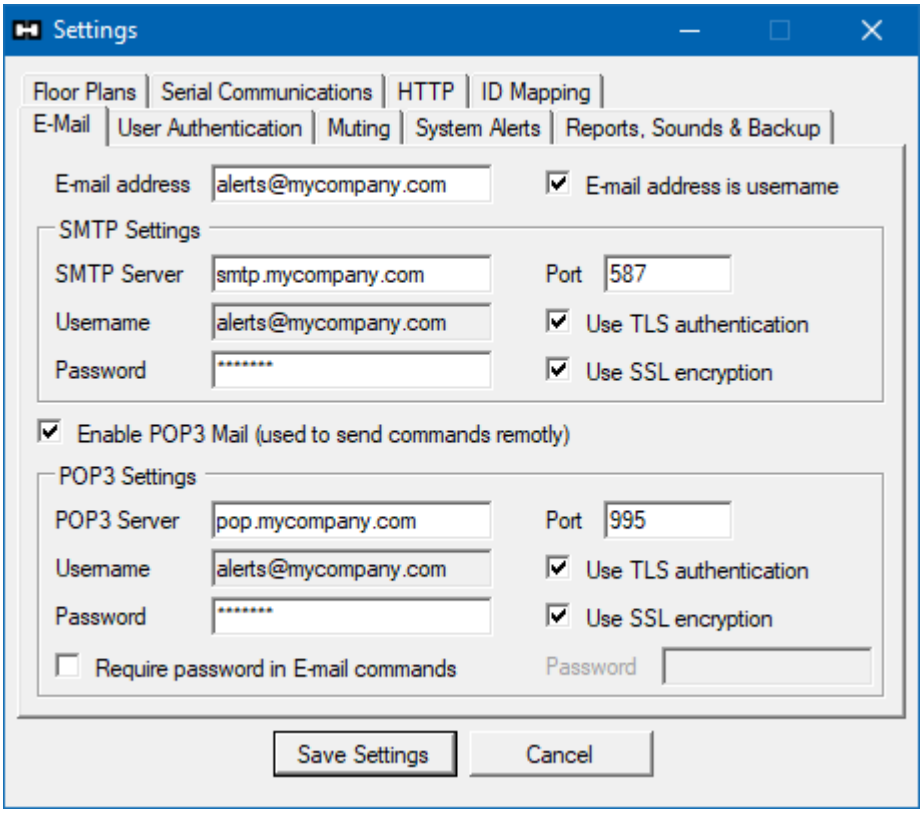
SYSTEM SETTINGS

The system settings dialog box is accessed by clicking the **Settings** button on the sensor status screen. This is where you will configure settings for basic and advanced system functionality, including e-mail account access, user authentication, floor plans, alarm muting options, and others. Each tab of the settings dialog box will be covered in this section.

E-mail Server Settings

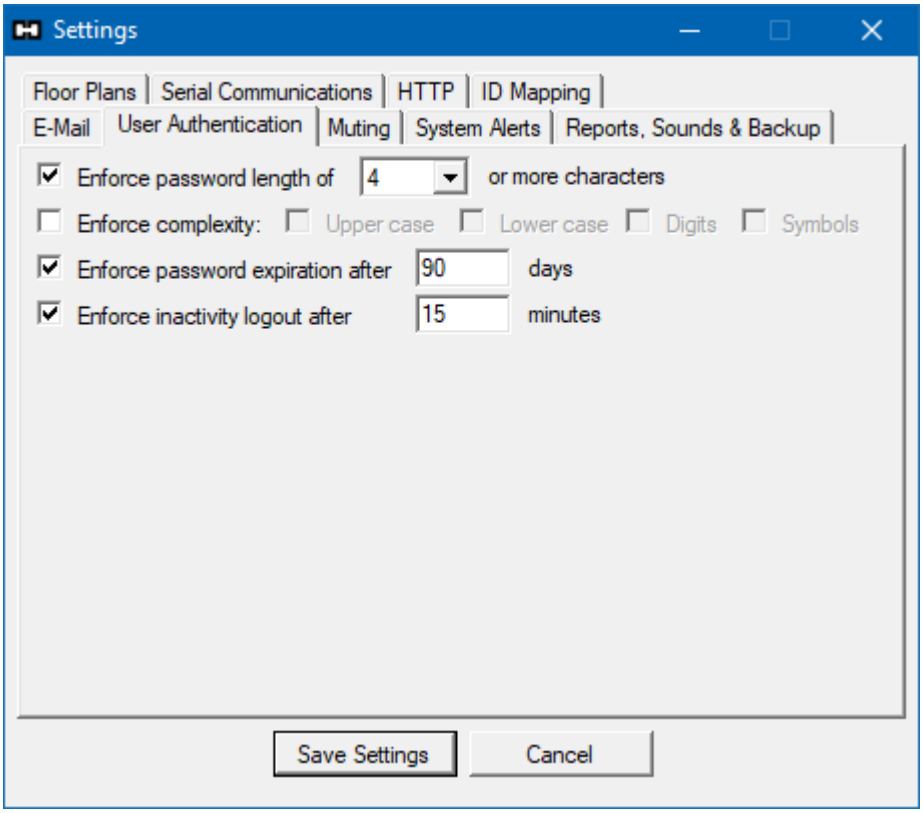
When the settings dialog box is opened, you will be presented with the e-mail configuration tab (example shown below). In order for the system to be able to send alerts when the sensors are in their alarm state, you must configure the SMTP Settings shown in this tab. This requires that you have an e-mail mailbox created specifically for the system. We recommend using an easily recognizable e-mail account name such as "alerts@mycompany.com". If required, contact your local IT professional for assistance with creating the e-mail mailbox.

To allow the system to retrieve e-mail from a POP3 mail server, check the Enable POP3 Mail option and configure the POP3 Settings. This allows users to send certain commands to the system via e-mail, to get status reports, or to mute alarms and make some configuration changes remotely. To prevent unintended system modification by users sending e-mail commands, check the "Require password" option. All e-mail commands are logged along with the incoming e-mail address.



User Authentication Settings

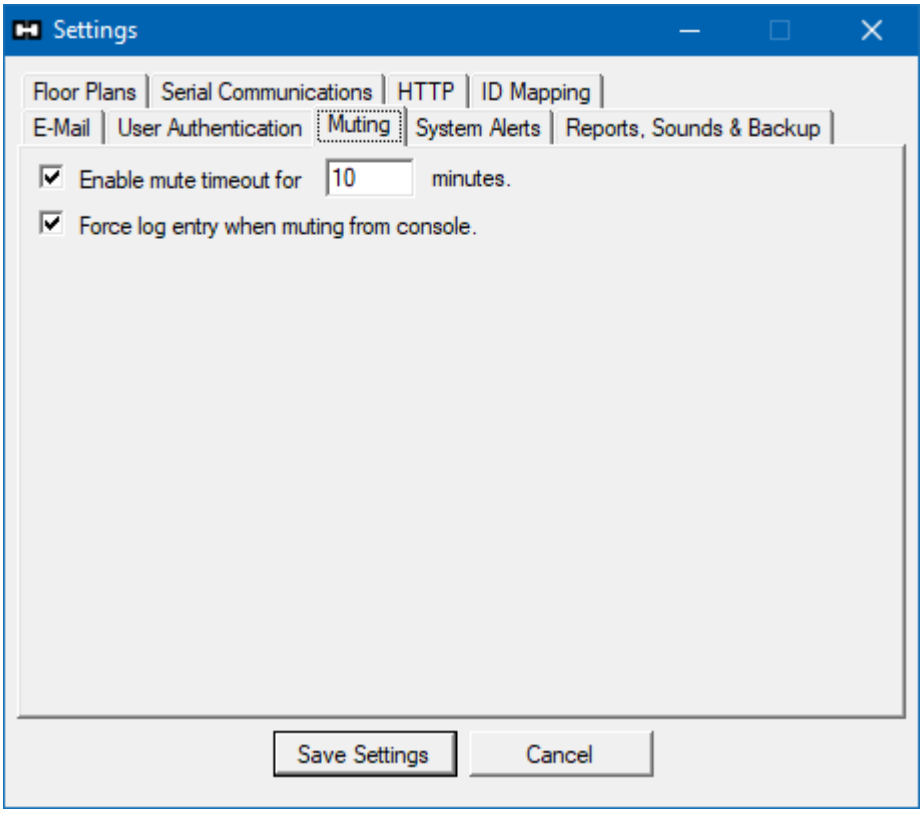
The user authentication settings allow some control over password complexity, password expiration, and user inactivity logout. The default values are shown below.



Changing these settings does not affect the security settings of the computer. User authentication is only used by the *T°Sentry ALERT System* software to log system activity and limit what options within the application are available to specific users. This is described in more detail in the **USER LIST** section.

Muting Settings

Muting a sensor stops alert messages from being sent during an alarm condition. The mute timeout setting configures the amount of time that mute will remain active before sending an additional alert message (if the alarm condition is still active when the mute time expires). Additionally, a setting is available to force the user to add an event log entry (explanation of alarm event) when muting the alarm.



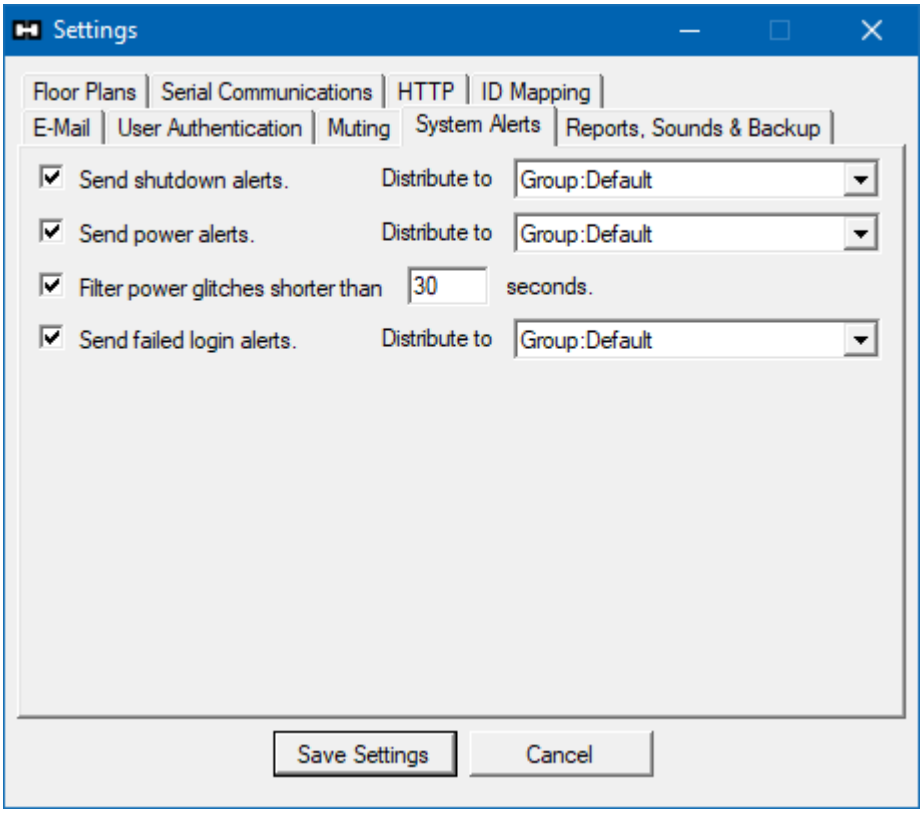
System Alert Settings

The *T°Sentry ALERT System* software has the ability to send alert messages for more than just sensor alarm conditions. This group of settings allows you to customize the additional alert messages.

If you enable shutdown alerts, the system will send a message to the selected e-mail distribution list whenever the application is shutdown or started. Enabling this alert is highly recommended.

If you have the *T°Sentry ALERT System* PC connected to a UPS (battery backup) and that UPS has a data port that is connected to the PC (via RS-232 or USB), the power alert option can send an e-mail when the UPS switches between line-power and battery. Additionally, battery life notifications will be sent when the UPS is running on battery power. An option is available to prevent sending the alert if the line-power is off for only a short amount of time.

The final system alert is for failed login attempts. This would send alerts in the event that someone is attempting to access the system without authorization.

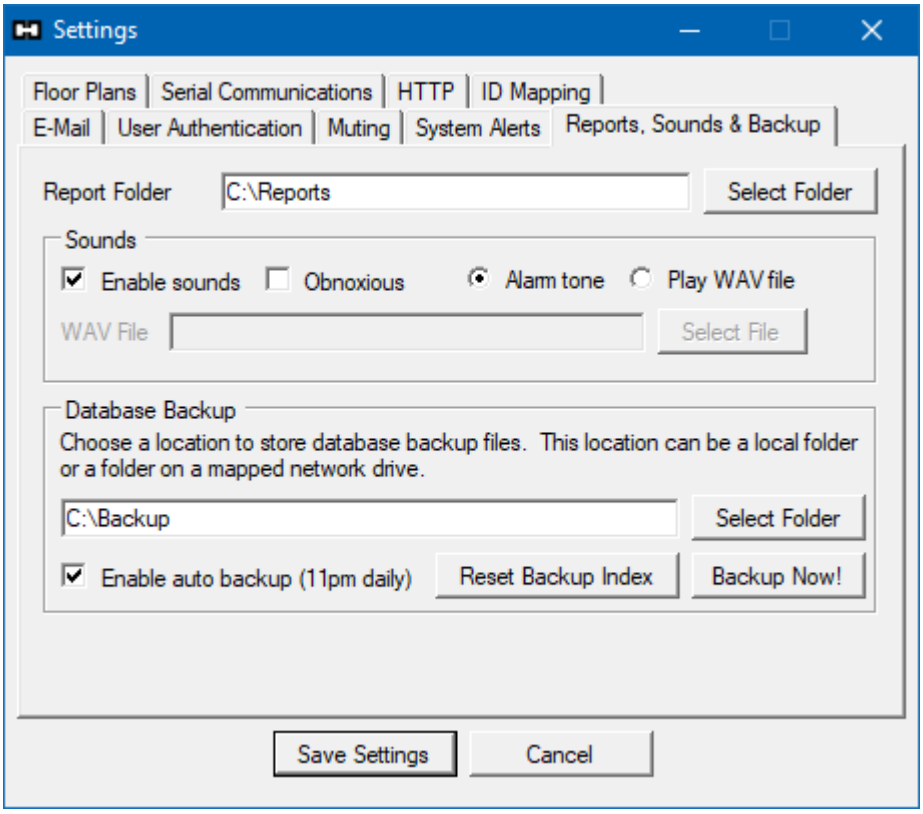


Reports, Sound & Backup Settings

The *T°Sentry ALERT System* software can automatically generate reports on a preset schedule (explained in the **REPORT SETTINGS** section). These reports can be directly e-mailed to a distribution list; however, you must also specify a location on the PC for them to be stored.

If the PC is equipped with internal or external speakers, you can enable alert sounds. During alarm events the *T°Sentry ALERT System* software will generate an audible tone to alert you of the alarm condition. The standard alarm tone is a simple periodic "tweedle". However, if this is not attention getting enough for your liking, you may enable the "obnoxious" option (repeating increasing pitch tone). Alternately, you may supply your own WAV file. **NOTE: The WAV file audio length MUST BE 6 seconds or less.**

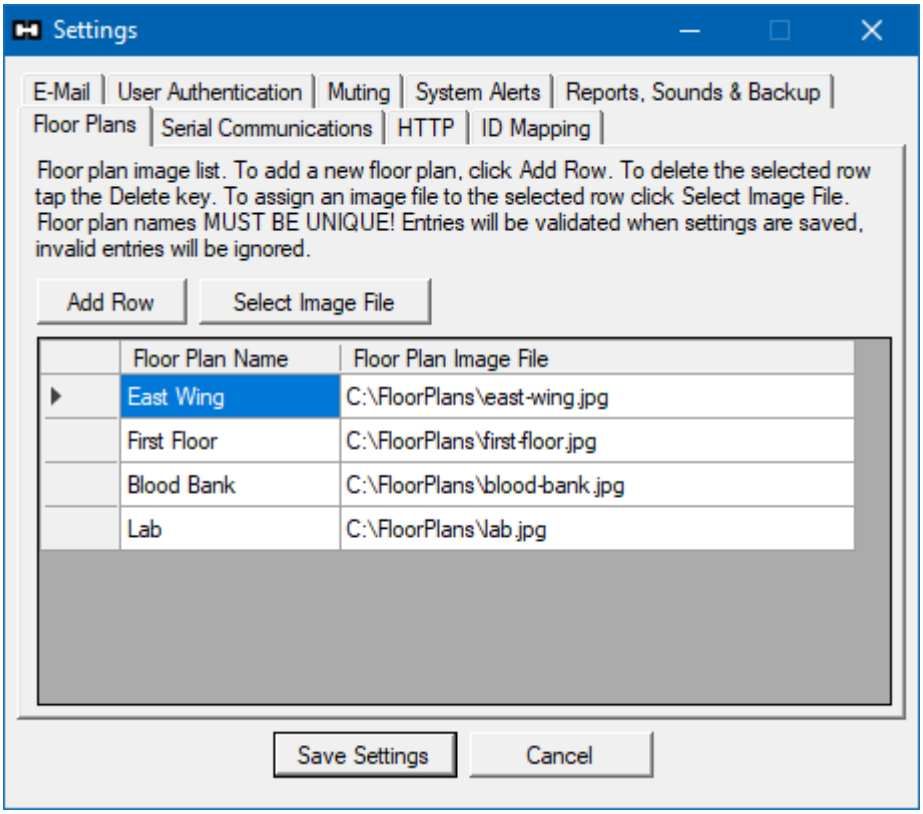
The last option on this tab is for automated backup of data. You first must assign a location for backups to be stored. Then, every night at 11pm (23:00) the system will back up the settings file and the entire SQL database (data log and event log). The system uses a mix of full and incremental backups over a 4 week cycle.



Floor Plan Settings

The *T°Sentry ALERT System* software can map status icons for each sensor onto image files that depict floor plans of your facility. This settings tab is where you define the names and images you would like to use as floor plans. The instructions for adding/deleting are shown in the dialog box. After adding rows, you can click on and edit each cell in the table directly. To more easily select image files, just click on the row header (or any cell in the row) and click the Select Image File button.

Floor plan files must use raster image file formats such as PNG, JPG, GIF, TIFF, or BMP.

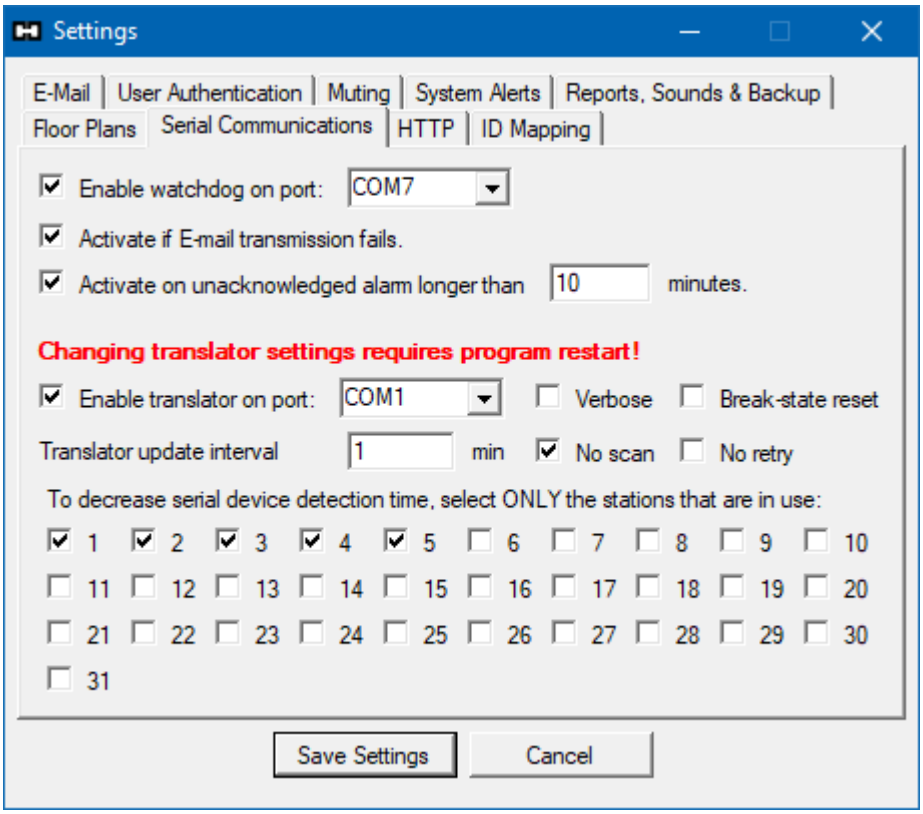


Serial Communication Settings

The serial communication settings allow the *T°Sentry ALERT System* to connect to specific Hampshire Controls Corp. data acquisition systems and external alarm triggers which use the RS-232 or RS-485 serial communication standards.

The top three checkboxes are for interfacing with the USB-connected AMS Relay or "watchdog". This device provides a set of dry-contacts to connect to a telephone dialer or building automation or alarm system hardware. In the event of Internet outage or unacknowledged alarms, the relay can trigger the phone-dialer or alert building maintenance (or security) that an alarm condition is present.

The bottom section of the dialog is for "legacy" two-wire serial monitoring systems (Hampshire Controls Corp. CMS). These systems consist of 16 device "Translator Stations" or 16 thermocouple "Analog Stations". The system can support 31 stations on a single two-wire RS-485 serial bus. Connectivity is provided by a USB (or RS-232) to RS-485 adapter.

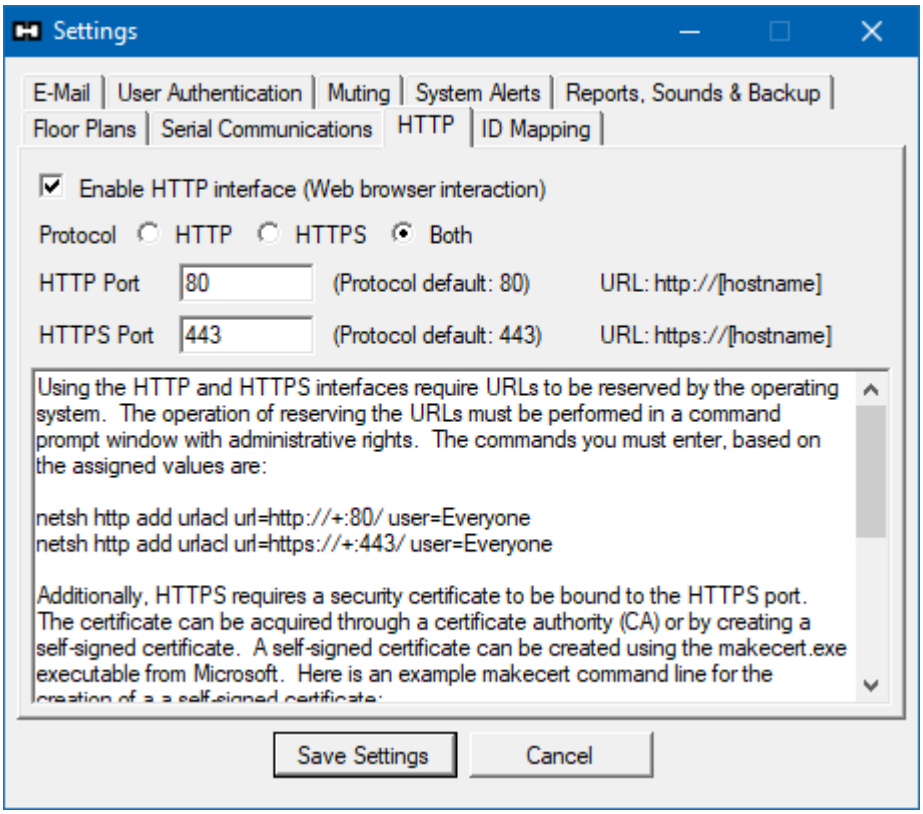


CONSULT WITH HAMPSHIRE CONTROLS CORP. BEFORE MAKING ANY CHANGES TO THESE SETTINGS!

HTTP Settings

The *T°Sentry ALERT System* software has a built-in HTTP/HTTPS interface that provides a method of remote access to the system. Details of the HTTP/HTTPS interface are discussed in the **HTTP/HTTPS Interface** section of the document. The settings on this tab are used to enable those features. You should have some knowledge of HTTP/HTTPS, network ports, and SSL certificates to make changes to these settings. Consult with Hampshire Controls, or your local IT support staff, if you have questions about these settings.

Making changes to these settings may require additional system commands to be executed and firewall exceptions to be added for proper operation of the HTTP/HTTPS interface.



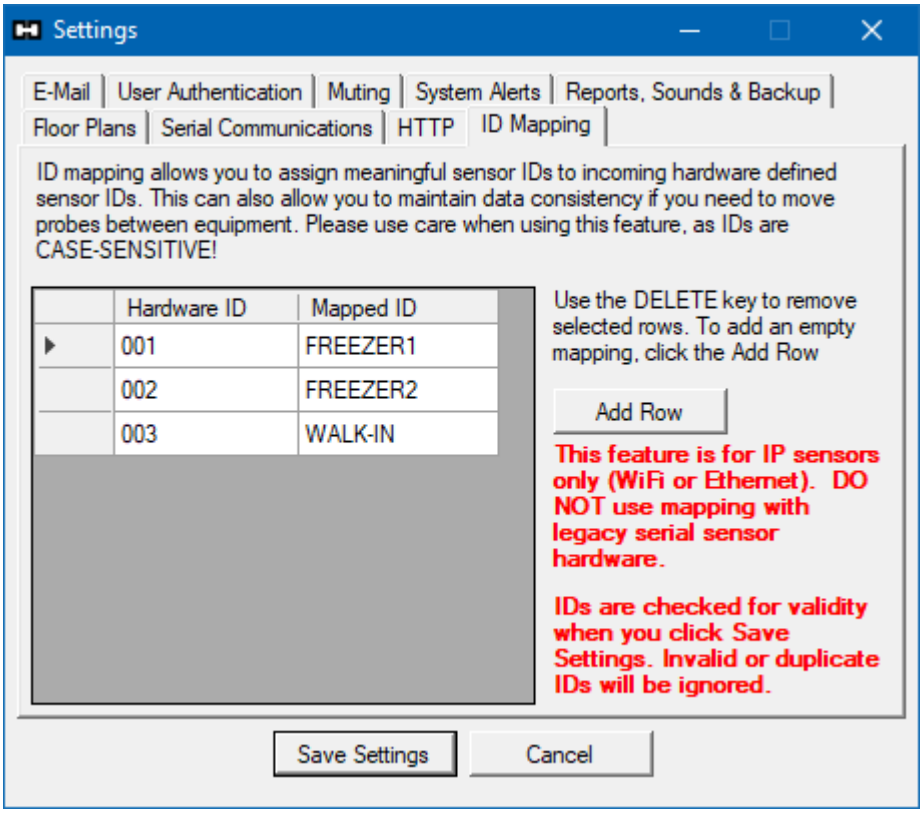
ID Mapping Settings

ID mapping provides a method to assign more descriptive IDs for each sensor. This feature can be useful if changes at your facility require moving sensor hardware to different equipment. Since all data logging is referenced to the mapped ID, this would allow maintaining data consistency for the equipment being monitored, rather than the sensor monitoring it.

For example, in the settings dialog below we have mapped three hardware IDs (001, 002, and 003) to more descriptive IDs (FREEZER1, FREEZER2, and WALK-IN). If, for any reason, equipment is rearranged and sensors 001 and 002 need to be swapped, you can just update the mapping to 001=FREEZER2 and 002=FREEZER1 and all historical data for FREEZER1 and FREEZER2 will remain intact.

Currently, this feature is most appropriate for Hampshire Controls multi-probe (MPS) devices. Hardware IDs for the MPS probes are assigned based on "unit" ID and "channel number", such as U1C1 to U1C4 for a 4-probe device. Assigning more descriptive mapped IDs to these probes may make it easier to interface with a system with a large number of sensors.

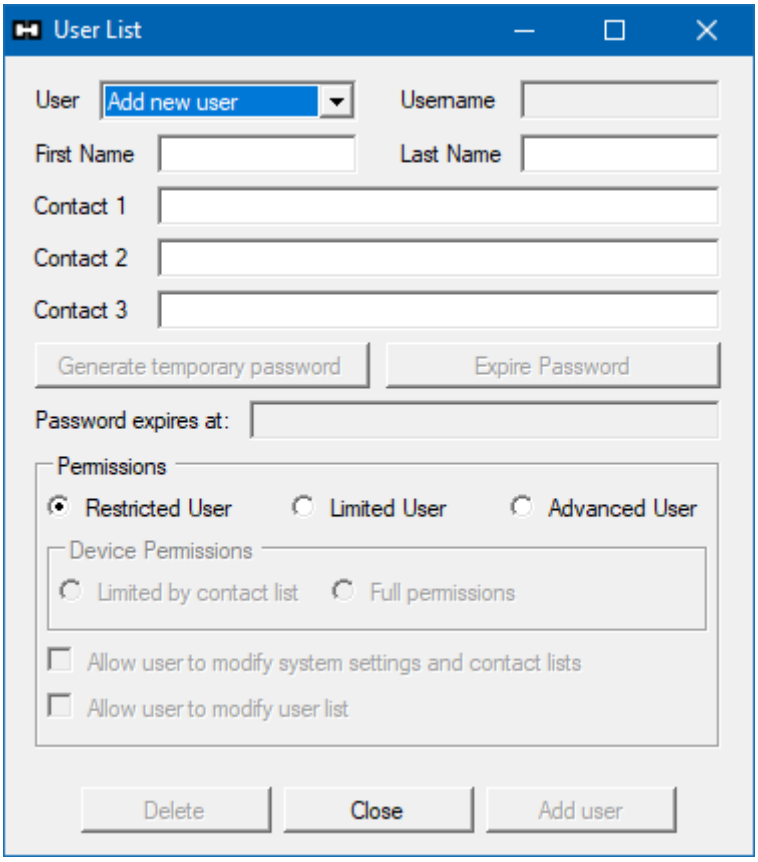
NOTE: DO NOT use this feature with two-wire serial sensor systems! Instead, just edit the sensor and reassign its station and channel numbers.



USER LIST

Every person that will need to have access to the *T°Sentry ALERT System* should have an entry in the user list. This allows the system to keep a log of the activities that are performed on the system by each user. In addition, each user can have three associated contact addresses for receiving system alert messages. The system has two default users: *admin* and *guest*.

To access the user list click the **User List** button on the sensor status screen.

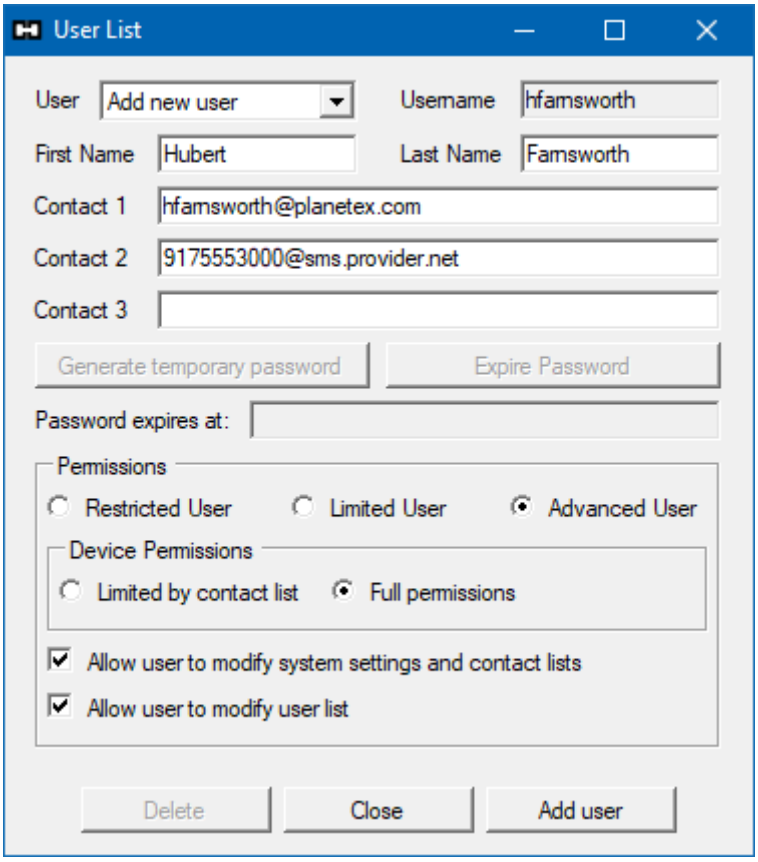


Adding a User

By default the User List dialog box opens in "Add new user" mode. Follow these steps to add a new user to the list:

1. Enter the first and last name of the user. The username will be created from the first letter of the users first name followed by the entire last name. If by some chance two users share the same last name and first initial, the system will add an incrementing digit to the duplicate username.
2. Enter up to three contact addresses for the user. The contact addresses must be in the form of an e-mail address. For text messaging, the address is usually the 10 digit phone number followed by a server name which can be obtained from your mobile service provider. It is also recommended that "Contact 1" be a true e-mail address, as this is where the temporary passwords are sent. YOU MUST ENTER ONE CONTACT ADDRESS.

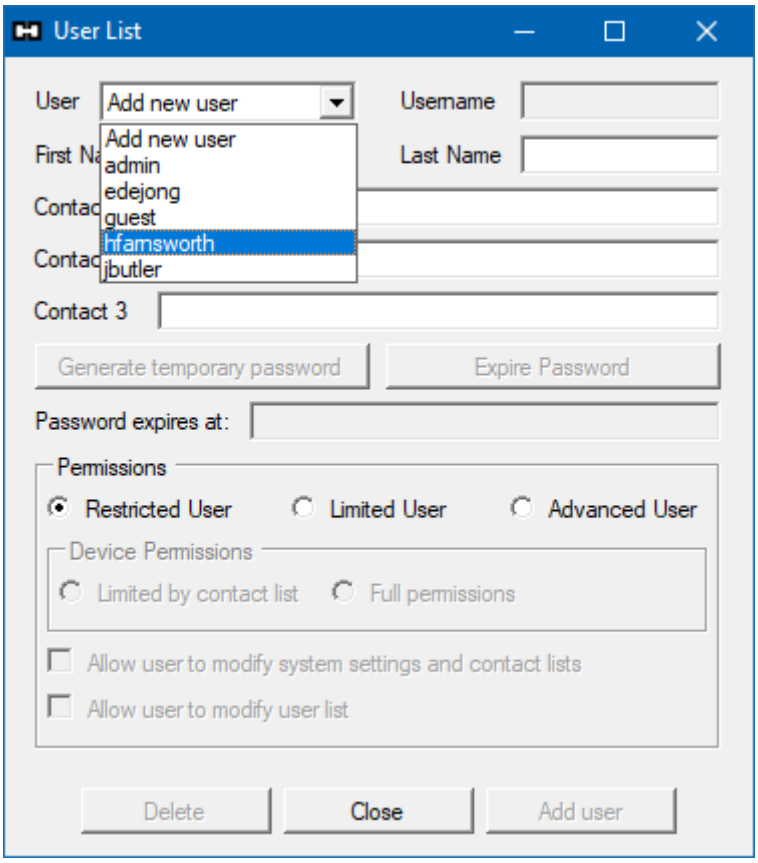
3. Select the permissions you would like this user to have when accessing the system.
    a. Restricted User – A restricted user may only view sensor data. They cannot make any changes to the system, including muting any alarms. The *guest* user has restricted user permissions.
    b. Limited User – A limited user has additional permission to mute (acknowledge) alarms and add messages to the event log.
    c. Advanced User – An advanced user has additional permission to modify sensor settings. In addition, only advanced users may be given the additional permission to modify system settings and/or modify the user list.
    d. Limited by contact list – This option reduces the permission of limited and advanced users. Users are only allowed to modify a sensor if they are included in the sensors contact list. Instructions for defining contact lists are given in the **Contact List** section of this manual.
    e. Full permissions – This option allows the limited or advanced user to access ANY of the sensors in the sensor list.
4. Click the Add User button to place the new user into the list.



After adding the user, you must select the user from the drop-down user list and then click on the Generate temporary password button. A temporary password will be e-mailed to the users "Contact 1" address. SMTP server settings MUST be configured for this to work!

Editing a User

To edit a user, select the username you wish to edit from the drop-down list.



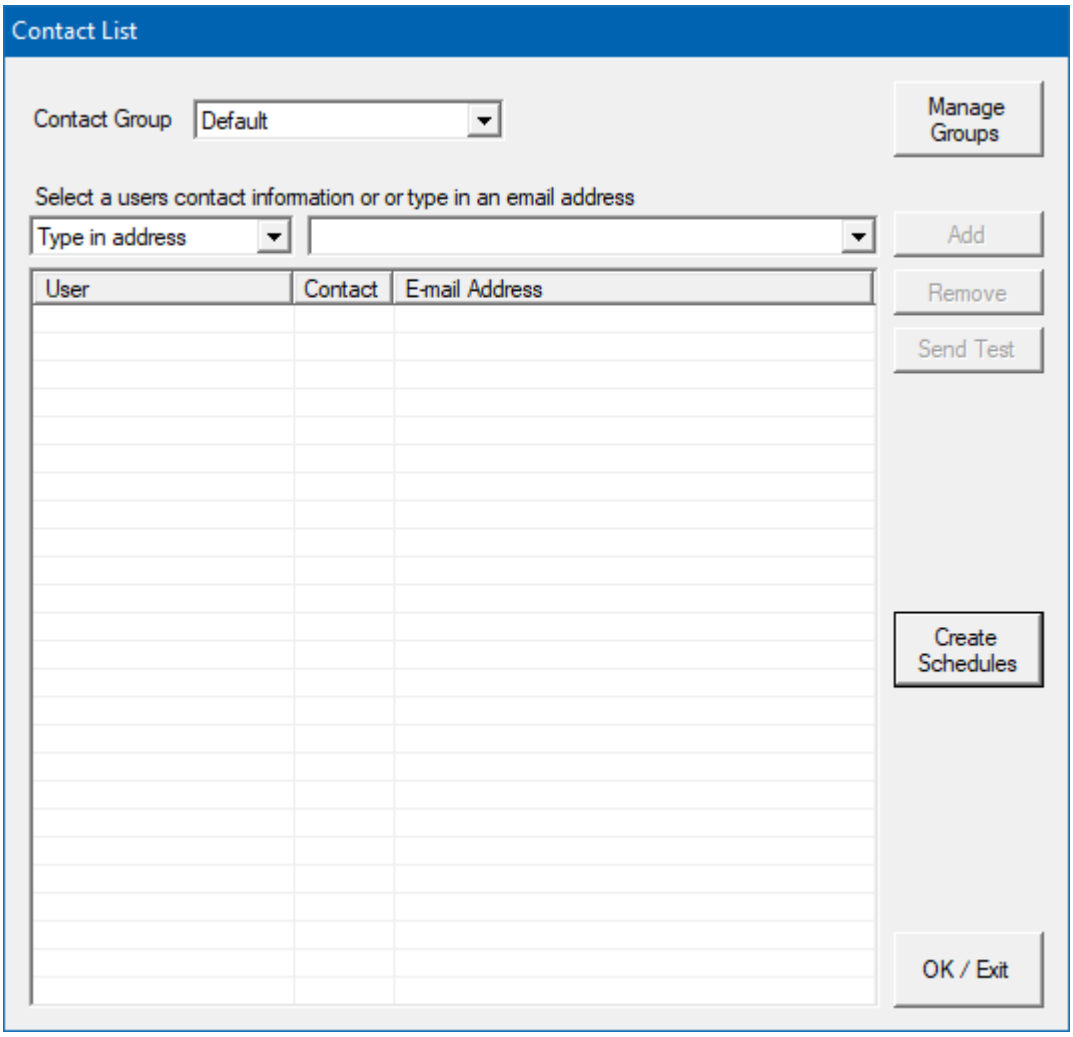
After you select the user ID, the dialog box will be populated with the settings for the selected user. You may then make changes to the users settings. When done, click the **Save Changes** button (replaces the **Add User** button).

Deleting a User

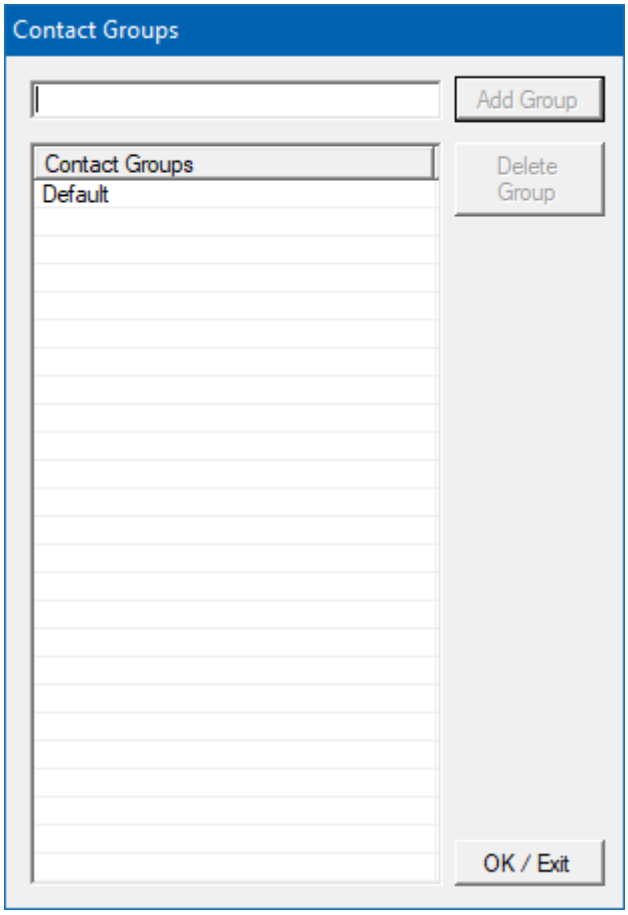
To delete a user, select the username you wish to edit from the drop-down list. Click the Delete button. You will be prompted to acknowledge the deletion, click **Yes** to delete the user.

CONTACT LIST

The contact list consists of groups and schedules which may be used to control when certain persons receive alert messages for each sensor during an alarm condition. To access the contact list click the **Contact List** button on the sensor status screen.



Creating Contact Groups



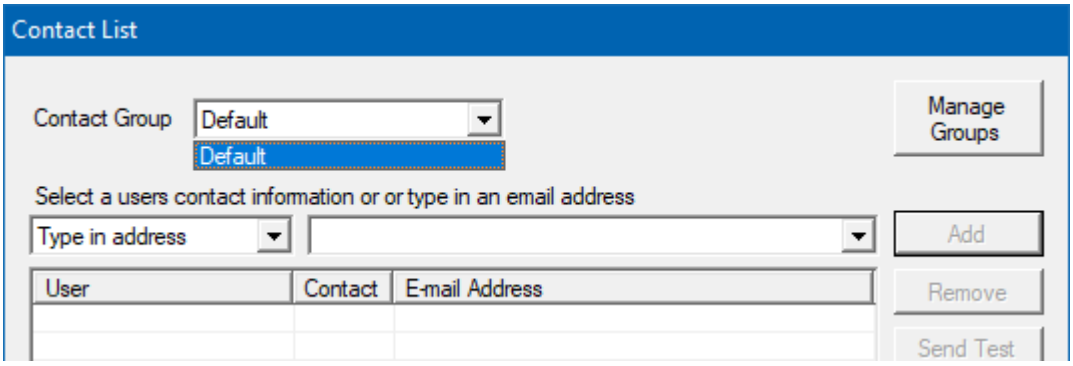
The first step in editing the contact list is to create groups. From the contact list dialog, click the **Manage Groups** button to open the Contact Groups dialog.

There is always a group named "Default". Adding a group is accomplished by typing a new group name into the text box and clicking **Add Group**. It is recommended to add a group named "Reports" for the distribution of periodic sensor reports generated by the *T°Sentry ALERT System*. If you intend to use schedules, then some group names could relate to work shifts or the time of day or week, such as "Days", "Nights", and "Weekends". If the system monitors many sensors, then the group names could refer to specific entities within your organization, such as "Vaccine Storage" or "Biology Lab".

The maximum number of groups is 20, including the "Default" group. When you are done adding groups click the **OK/Exit** button.

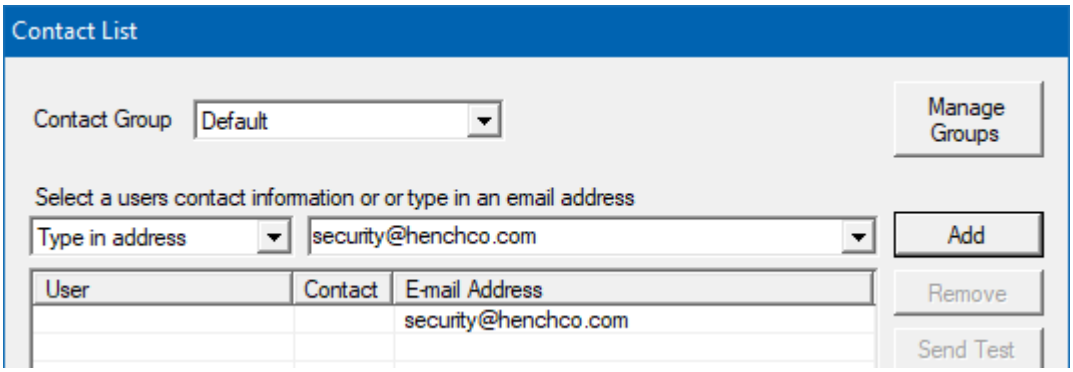
Adding Contacts to a Group

In the Contact List dialog, first select a group from the Contact Group drop-down list.

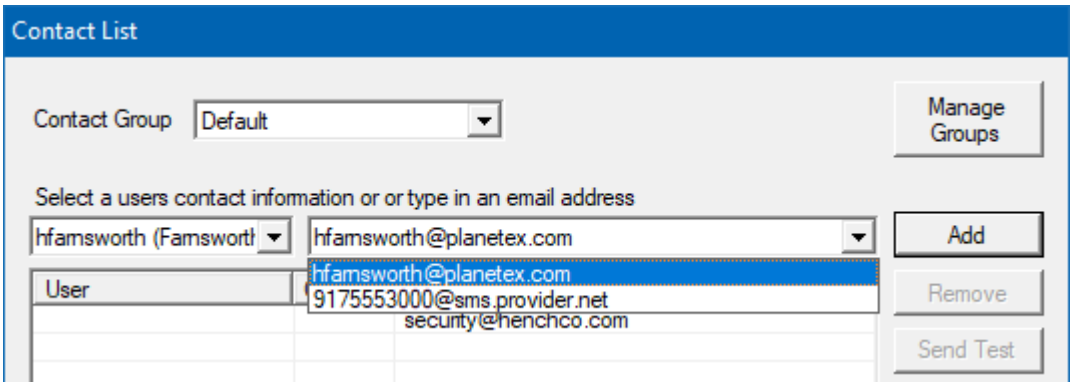


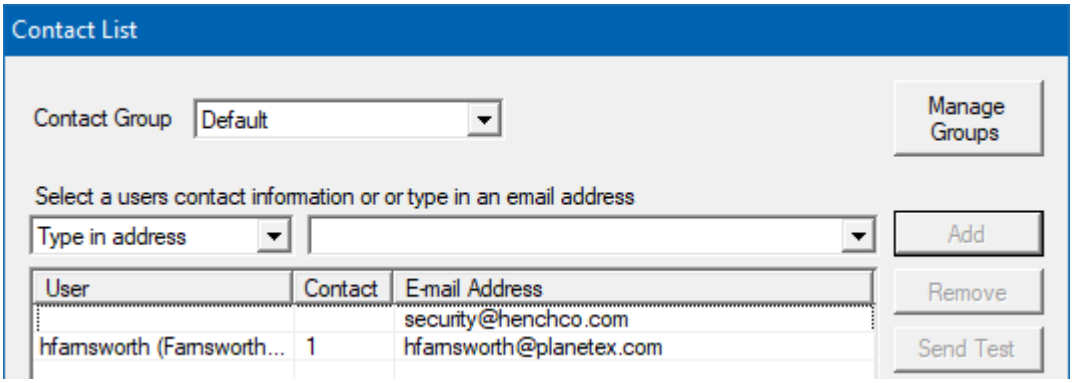
In this case we have chosen the only group (the "Default" group).

There are two ways to enter contacts into the group. First, you may add them by typing any e-mail address into the text box and clicking the **Add** button (as shown in the example below).



The second method is to select a user name from the left drop-down menu, and then select one of the user's contact addresses from the right drop-down menu (as shown in the example below).

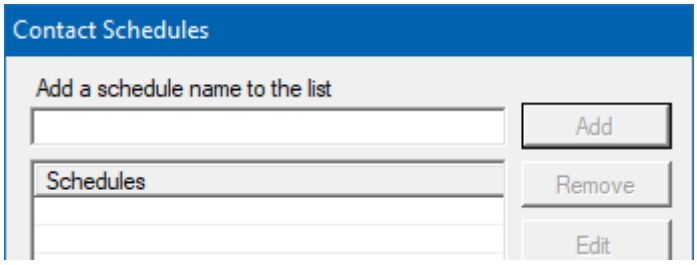




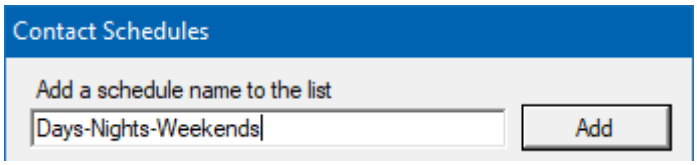
The second method has the added benefit of linking the contact list with the user list. Therefore, the user's contact information is only stored in one location, the user list. If the user's contact information is updated, the contact list links will be updated as well.

Creating Contact Schedules

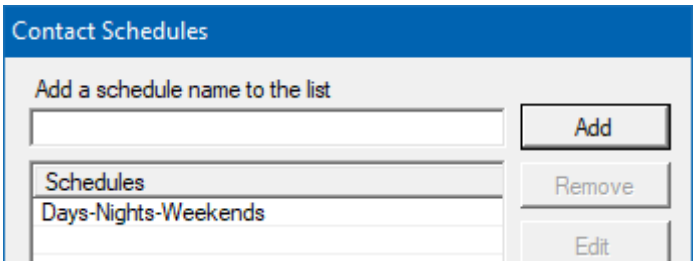
Once you have created the necessary contact groups for your organization, you may then create schedules to control when each group should receive sensor alarm notifications. It is not necessary to create schedules for groups that are intended to receive alerts 24/7.

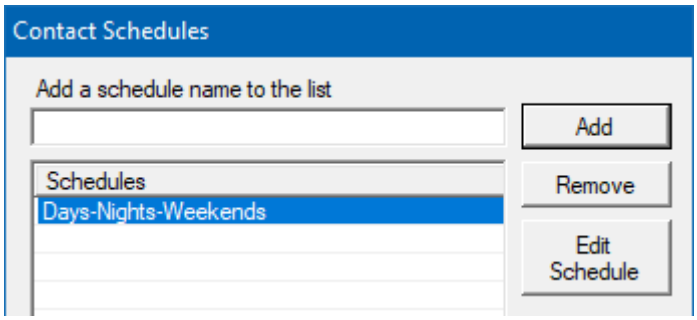


To add scheduling to your contact list click the Create Schedules button in the main contact list dialog. The Contact Schedules dialog will open.

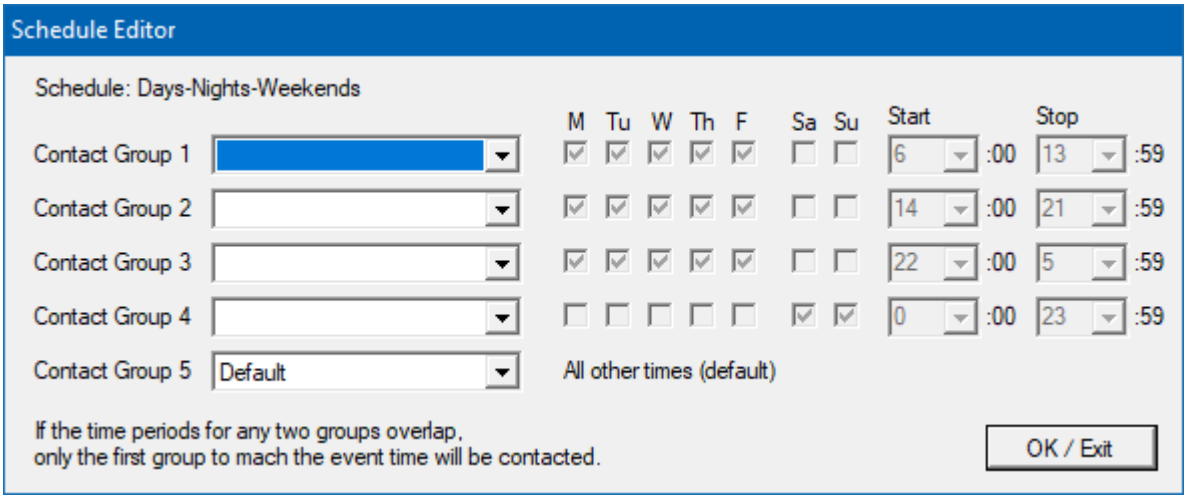


Enter a name for a schedule in the text box and click the **Add** button. Repeat this procedure for each schedule you would like to create. Up to 20 schedules may be created. When you have added the required schedules, select any one schedule from the list by clicking on it, then click the **Edit Schedule** button.

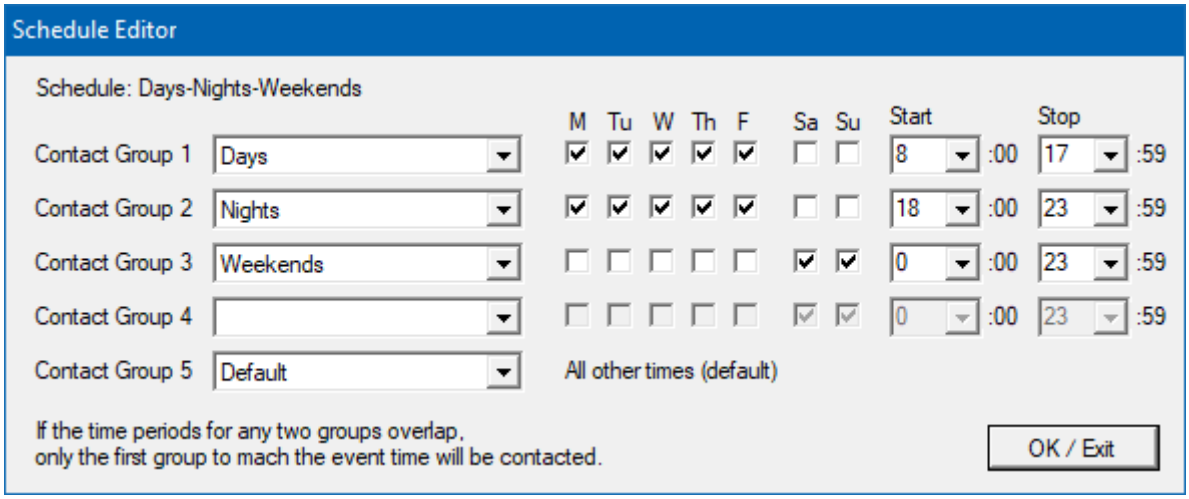




In the Schedule Editor you may schedule up to 4 contact groups to receive alerts during defined days and hours. Any time period that is not covered by the defined times will be sent to the 5th group. This ensures that all times are covered in the event that a mistake was made in the time range selections.



The following is an example schedule:



The contact group "Days" is scheduled to receive alerts Monday through Friday at 8:00 to 17:59.

The contact group "Nights" is a special case where the stop time is earlier than the start time. In this situation the start time is assumed as "current day" and the stop time is "following day". Therefore, "Nights" will receive alerts starting on each day Monday through Friday at 18:00 and ending the following day Tuesday through Saturday at 8:00.

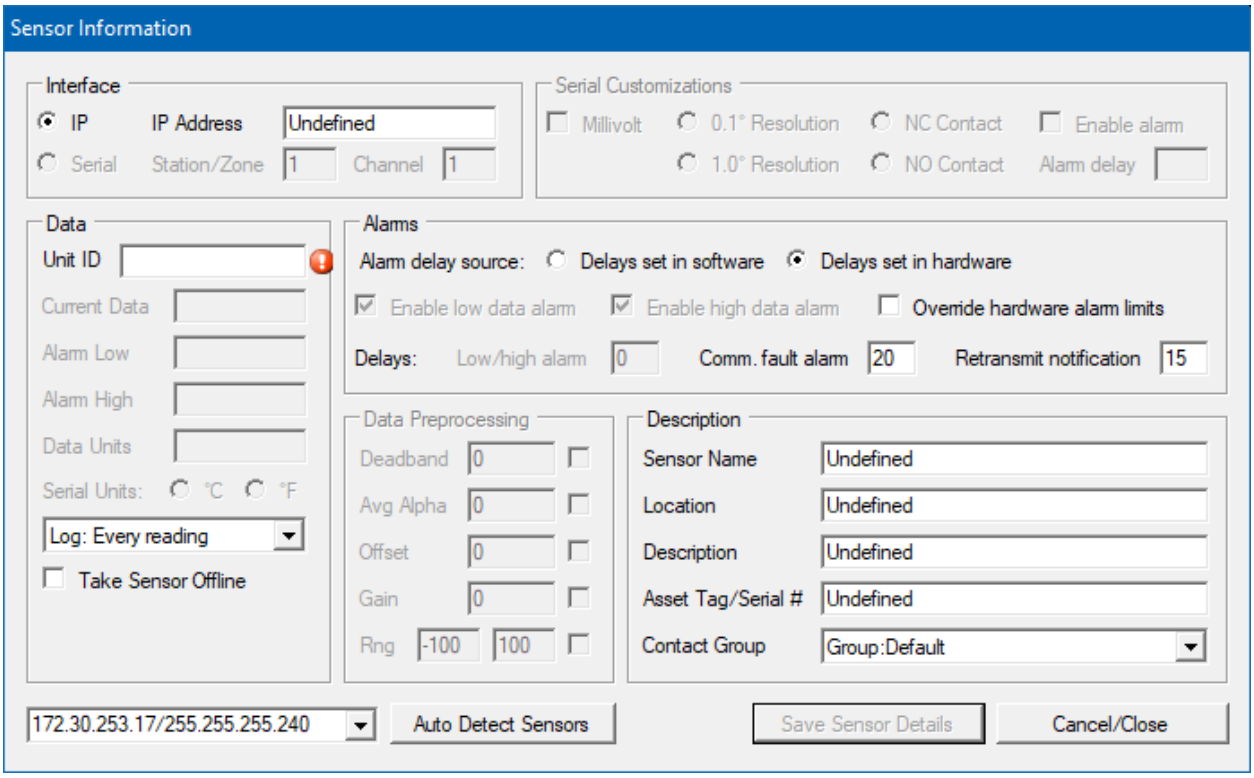
The "Weekends" contact group is scheduled to receive alerts all day Saturday and Sunday. However, since the "Nights" group is higher priority, and the two schedules overlap on Saturday from 0:00 to 8:00, "Nights" will receive the alerts during the overlapping time and "Weekends" will begin receiving alerts on Saturday at 8:00.

Also notice that the time period on Monday from 0:00 to 7:59 is NOT covered by the three scheduled times. Therefore, the "Default" contact group will receive alerts during that time.

When you are done editing the schedule, click the **OK/Exit** button.

ADDING SENSORS

Now that the *T°Sentry ALERT System* settings have been configured you can start to add sensors. When you click the Add button in the upper right of the sensor status screen, you will be presented with the Sensor Information dialog box shown below.



Sensor Interface

Unless you are using the *T°Sentry ALERT System* with legacy serial hardware, the sensor interface will be IP (Internet Protocol). Depending on the type of sensor you have purchased from Hampshire Controls, you may or may not need to specify the sensor IP address when adding the sensor. Contact Hampshire Controls for assistance with adding sensors to your system.

Auto Detecting Sensors

Certain types of sensors can be automatically detected and added to the sensor list. If you have your sensors configured, powered on, and attached to the network, you can use the Auto Detect button to automatically find the networked sensors and add them to the sensor list with default values. If your computer has multiple network interfaces, be sure to select the correct network segment before clicking the Auto Detect button. After the sensors have been detected and added to the list you can edit the sensors individually to change the default values.

Sensor Data Settings

In the Sensor Data section, you need to supply a unique Unit ID for the sensor, and the sensor must be programmed with the same unique ID. Some sensor IDs are factory programmed. The Unit ID may only contain upper and lowercase letters, numbers, the period (.), the underscore (_), the dash/minus (-) or the plus (+). It is also limited to 8 characters. A red exclamation point icon will appear if you try to enter an existing ID or IDs with invalid characters.

The Current Data, Alarm Low, Alarm High and Data Units fields are populated from data received by the sensor and are not configurable.

By default the sensor data is not logged. To enable the reporting feature of the *T°Sentry ALERT System* you should select a logging interval for the sensor. Currently, sensors supplied by Hampshire Controls transmit data at intervals of 1 or 3 minutes. If you require data to be logged at that rate, select "Log: Every reading". If your application can accept a longer delay between sensor readings, you may decrease the logging interval accordingly. This has the added benefit of decreasing the rate of growth of the database file.

By selecting "Take Sensor Offline", the program will not make any attempt to contact the sensor, or to generate any alarm notifications for the sensor. This is useful if the sensor has not been configured or attached to the network, or if you are performing maintenance on the sensor or the equipment that the sensor is monitoring.

Alarm Settings

The Alarms section of the dialog contains the settings to specify when and why the sensor should send alarm notifications to the contact list. These should be configured in conjunction with the settings in the sensor hardware. This section will describe the operation and interaction of both the sensor hardware settings and the settings in the Alarms section of the Sensor Information dialog.

Sensor Hardware Alarm Settings

In the sensor hardware purchased from Hampshire Controls (MPS, Model 140 w/ Ethernet, TT-150, etc.) you can configure the low and high alarm set points and the alarm delay. These settings affect when the sensor activates its local alarm. For instance, if the alarm delay is set to 0 minutes, when the sensor probe data goes above the high set point or below the low set point, the sensor will immediately activate its local alarm (usually indicated by a red flashing LED and loud periodic beeping). The sensor also communicates this information to the *T°Sentry ALERT System*. By default, the *T°Sentry ALERT System* will use these values in determining when to send alert messages due to alarm events.

T°Sentry ALERT System Alarm Settings

The first option in the Alarms settings section is whether to allow the sensor hardware to control when the *T°Sentry ALERT System* sends alarm notifications for the sensor (Delays set in hardware), or to override the hardware and use the software settings to control the alarm notifications (Delays set in software). By selecting "Delays set in hardware" the *T°Sentry ALERT System* will send alarm notifications when the sensor hardware activates its alarm. By selecting "Delays set in software", you may configure a delay between the time the sensor

hardware alarm sounds, and when the *T°Sentry ALERT System* sends its alarm notification. If staff is on site at the time of alarm, having this delay may allow for a correction of the alarm event before inactive personnel are notified and required to respond.

If "Delays set in software" is selected, you then have options of enabling or disabling notifications for both the high-limit alarm and the low-limit alarm, and setting the time delay from sensor hardware alarm activation to transmission of alarm notifications.

In the case where you are using software delay, you may also choose to "override the hardware alarm limits". This would allow you to have a tight range for the hardware limits and the local audible alarm, and wider limits in the software, possibly preventing alerting off-site personnel to alarms that might be handled by on-site personnel.

The Comm. fault delay sets an allowable time in minutes for the sensor to fail to send data readings.

The "Retransmit notification" delay is the time period between retransmission of alarm notifications should an alarm condition remain in effect.

The following alarm notification conditions cannot be disabled:

- Communication failure – notification of when data is not being received from a sensor. This may indicate a network malfunction or a problem with the sensor hardware.
- Sensor power alerts – this may be an indication that the batteries in a battery powered sensor are low, or that an AC powered sensor is running on its internal battery back-up power (depending on sensor hardware options).

Data Preprocessing

There are five options for preprocessing incoming data prior to logging.

Deadband

Deadband allows you to specify a jitter tolerance or rate-of-change tolerance to incoming data. When combined with long data logging intervals this creates an adaptive data log interval. For example, without deadband enabled, if your log interval is 30 minutes, your sensor data is logged every 30 minutes. However, if you enable a deadband of say 0.3, then if your sensor data changes by ±0.3 or more in fewer than 30 minutes, than the log interval will be determined by how fast the sensor data is changing.

Average

Enabling averaging (Avg Alpha) allows you to apply an exponential moving average to the data. The equation used for averaging is:

NewValue = PriorValue * (1 - *Alpha*) + NewReading * *Alpha*

The value that you specify for *Alpha* must be a decimal value between 0 and 1. Reasonable values are between 0.05 and 0.75.

Offset

This option allows you to apply a fixed offset to all incoming sensor readings. This can allow you to calibrate the sensor reading for a limited range around a fixed value, or when combined with the gain option, it allows for two-point calibration adjustment. See **Gain** below for equations.

Gain

The gain setting applies a fixed multiplier to all incoming sensor readings. This could be used for adjusting readings by powers of ten, or to apply a two-point calibration when used in conjunction with the offset setting. When this feature is disabled, the text box will show a gain value of "0", but the actual value being used is "1" (unity gain).

The equation for applying gain to most sensor types is:

AdjustedValue = (CurrentReading + Offset) * Gain

However, for °F temperature probes the calculation is referenced to 0°C so the equation becomes:

AdjustedValue = (CurrentReading + Offset - 32.0) * Gain + 32.0

Range Validation

A low and high range (Rng) limit may be specified for each sensor. Usually this would be specified as the hardware sensor limits, or some physical limit of the unit of measure. Should the system receive a spurious reading outside of the specified range, that reading will be treated as if it was never received.

Preprocessing Order

Preprocessing of the incoming sensor readings is performed with the following order of operations: *Range Validation* followed by *Offset and Gain* followed by *Averaging* and finally *Deadband* (in conjunction with the logging rate).

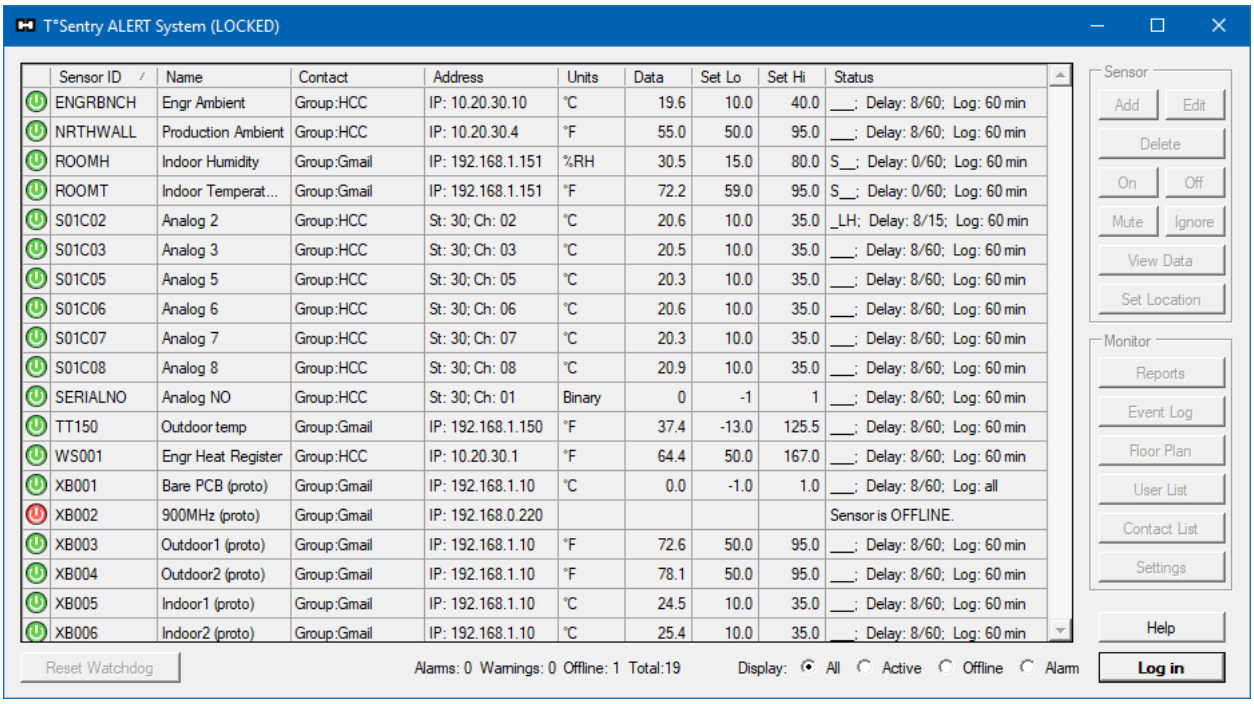
Sensor Description

The fields in the sensor description group, except for the contact group, are optional. In the Sensor Information section, you may choose to configure the following items:

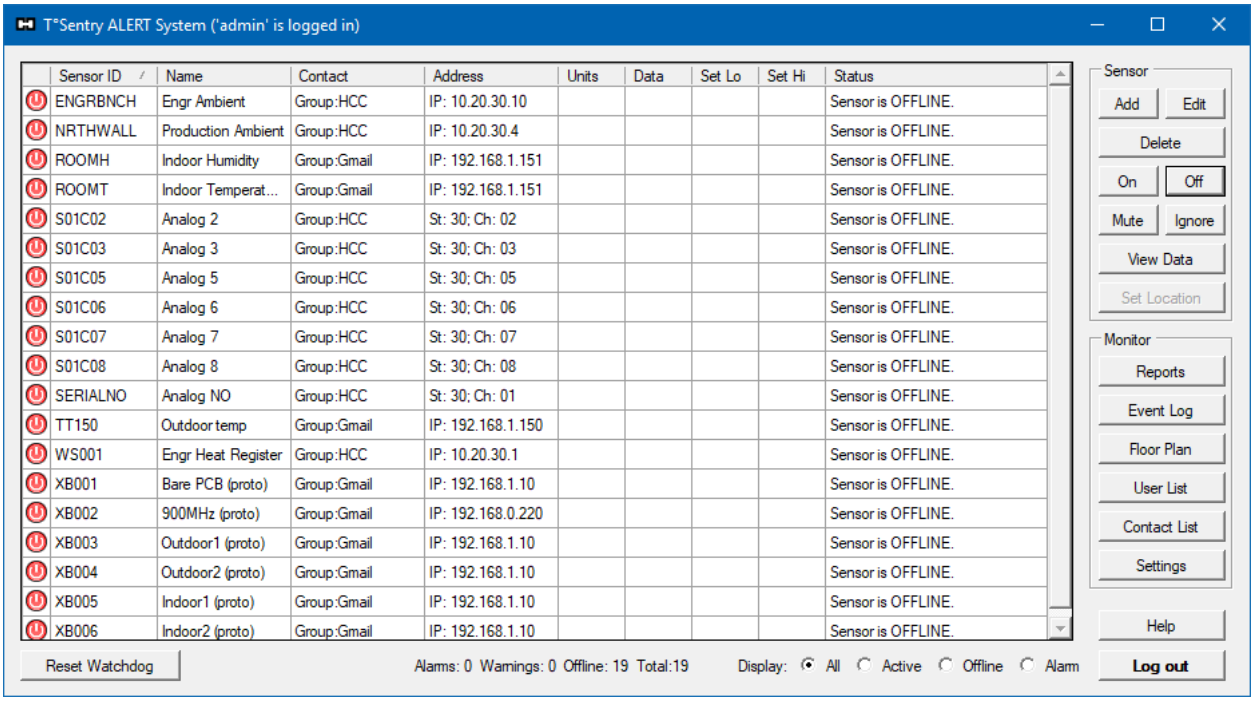
- Name – a more descriptive name for the sensor (i.e. "Freezer 1", "Cold storage", "Server room temperature")
- Asset Tag – an optional asset tag or serial number related to the sensor or the equipment the sensor is monitoring
- Location – a description of the physical location of the sensor (ie. room number, lab location, floor number)
- Description – a description of what the sensor is monitoring (ie. the contents of the freezer or refrigerator)
- Contact Group – the selection of which contact group, or contact schedule should receive alarm notifications from this sensor

SENSOR STATUS SCREEN (PART 2)

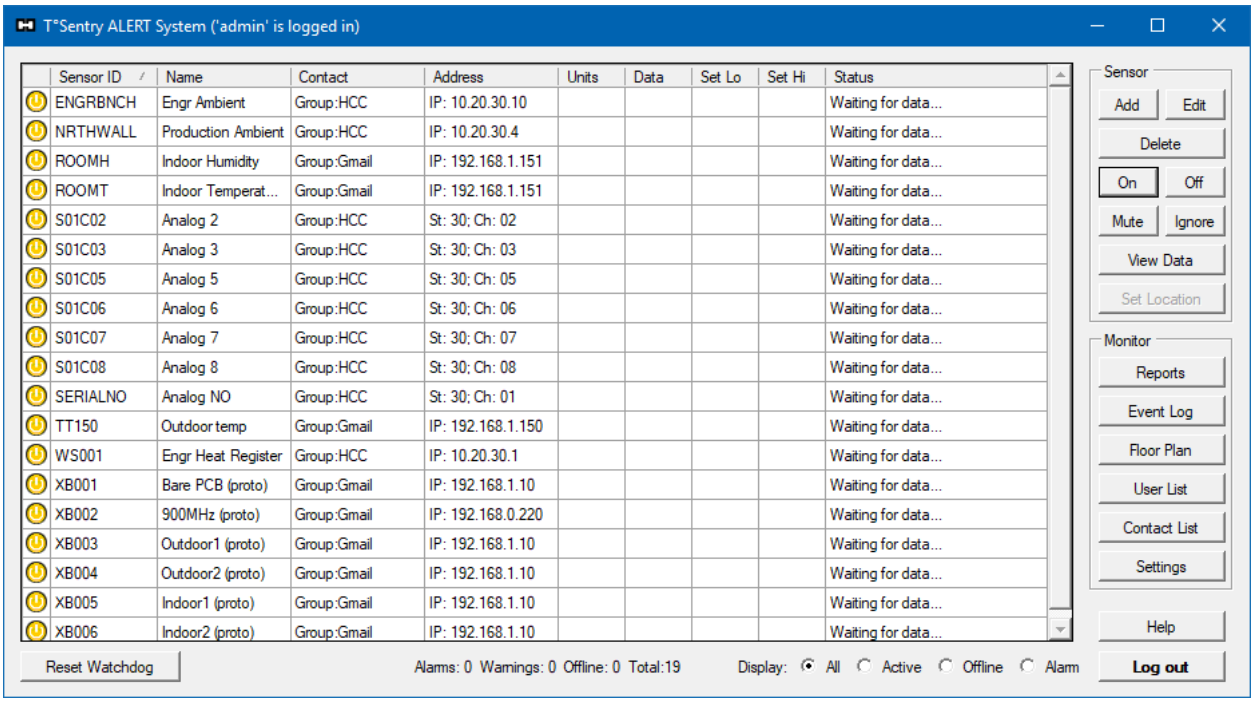
After the sensor list has been populated, the sensor status screen will display information pertaining to the operational condition of each sensor. An example is shown here with various types of sensors.



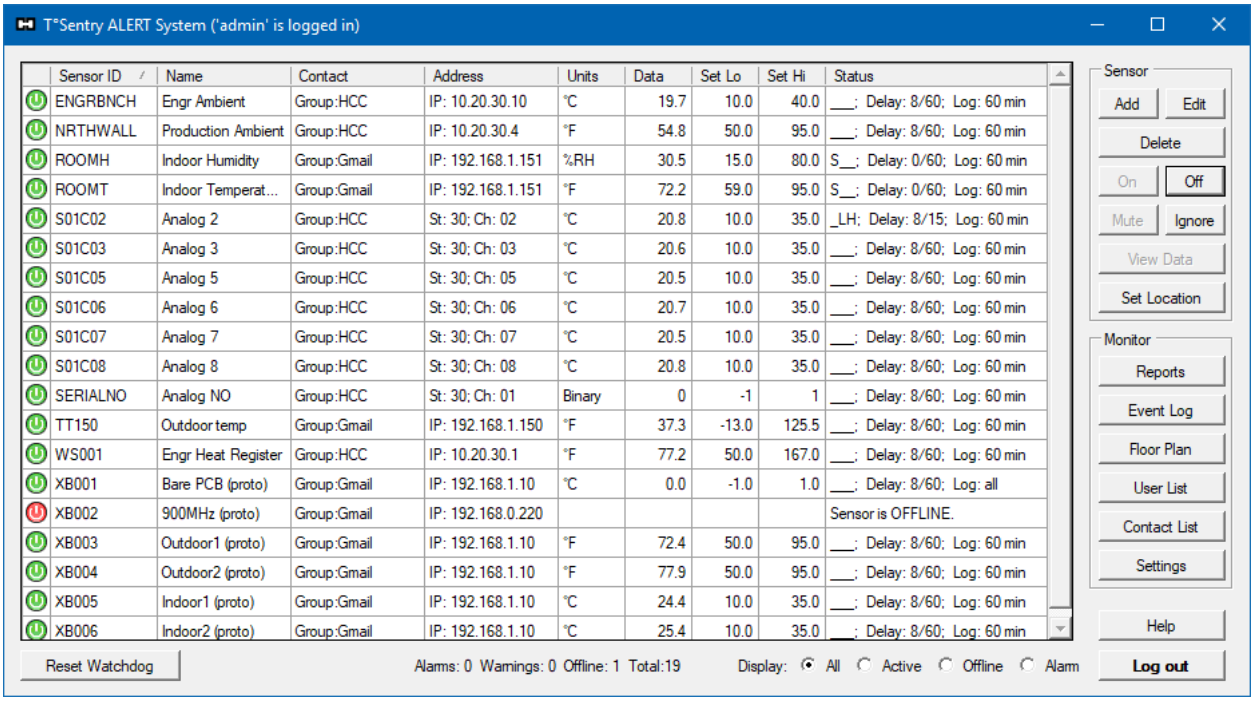
Here is the status screen with all sensors taken offline (“Off” button in Sensor group).



Status screen just after sensors are put online, before they have received any data.



As the *T°Sentry ALERT System* begins to receive data from each sensor, the sensor icons will turn green and the fields in the sensor table will be populated with the data received from the sensors.



The Sensor List

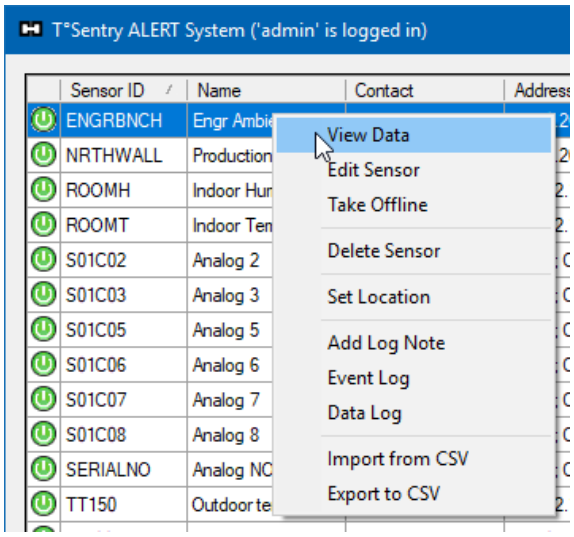
For the most part, the data in the sensor list is relatively self-explanatory. This section discusses a few key features and controls within the sensor list.

Selecting Sensors

Sensors are selected by clicking on the table row for any particular sensor. To select multiple sensors use the CTRL or SHIFT key in conjunction with your mouse click (basic Microsoft Windows operations).

Sorting the List

The column headers in the sensor list are clickable. Clicking on any particular header will cause the table to be sorted based on the values in the selected column. The default sorting is based on the "Sensor ID" column.



Context Menus

By using the context-click (usually the right mouse button) you can get pop-up menus that relate to the selected item (or items). The context menu may duplicate some functions that are also available as buttons on the sensor status screen. An example context menu is show to the right. Two features that are only available via the sensor list context menu are import and export of CSV files.

CSV import/export allows easier editing of a large list of sensors, by using a text editor, Microsoft Excel, or another program capable of reading and editing CSV files.

Sensor Status Icons

The following list shows examples of the status icons and their meanings.

- - **Offline:** The sensor is not being monitored
- - **Stand-by:** The system is waiting to receive data from the sensor
- - **Online:** The sensor is online an within the alarm limits
- - **Communication fault:** The sensor is online but no data has been received for 15 minutes (normal time between data packets is 1 or 3 minutes, depending on sensor type)
- - **Exceeding high limit:** The sensor data is above the high limit, but the alarm delay has not elapsed
- - **High limit alarm:** The sensor data has remained above the high limit for the alarm delay period and is now in the alarm state
- - **Exceeding low limit:** The sensor data is below the low limit, but the alarm delay has not elapsed
- - **Low limit alarm:** The sensor data has remained below the low limit for the alarm delay period and is now in the alarm state
- - **Door open:** The sensor door switch input indicates the door is open (not supported by all sensors)
- - **Door open alarm:** The sensor door switch input indicates the door is open and the alarm delay has elapsed (not supported by all sensors)
- - **Battery low / on battery:** The sensor batteries are low or the sensor is running on its back-up battery (not supported by all sensors)

Sensor Status Column

The right-most column in the sensor table displays a short message about the status of the sensor. When the sensor is online and within its alarm limits it contains three comma separated fields about the sensor settings.

The possible contents of the first field are three characters which have the following meanings:

- S__ – Sensor controls alarm notifications (“Delays set in hardware” is enabled)
- _L_ – Low limit alarm enabled (“Delays set in software” is enabled)
- __H – High limit alarm enabled (“Delays set in software” is enabled)
- _LH – Both low and high limit alarms are enabled (“Delays set in software” is enabled)

The second field shows the alarm delay and the retransmit delay separated by a “/”. If “Delays set in hardware” is selected, the alarm delay will be “0”.

The final field shows the data logging interval of the sensor.

If the sensor is in any state other than online, then the Status column will display a brief message about the current sensor condition.

Quick List Filtering

Below the bottom-right corner of the sensor list are 4 radio buttons which may be used to quickly filter the list, displaying only the requested sensors:

- **All**: Displays all sensors.

- **Active**: Only shows sensors that are online.
- **Offline**: Only shows sensors that are offline.
- **Alarm**: Only shows sensors that are exceeding their alarm set points.

These buttons allows quick access to the problem sensor on a system with a large number of sensors.

Sensor Controls

The **Sensor** button group, located at the top right of the sensor status screen, are activated based on the selected sensor (or sensors) and the sensor status. Add, edit, and delete, are fairly self-explanatory. However, for information about the **View Data** button, please refer to Data Visualization on page 32. For information on the **Set Location** button, please refer to Floor Plan on page 42.

The **On**/**Off** buttons enable or disable monitoring and logging for the specified sensor(s). The operation of the sensor hardware is not affected by changes to the on/off-line status within the *T°Sentry ALERT System* software.

The **Mute** function will temporarily suspend alert message transmission during an alarm event. The duration of the mute is configurable in the system settings. If the sensor recovers from the alarm event before the mute duration expires, the mute function will automatically turn off.

The **Ignore** function will ignore all alarm events on the specified sensor(s) for the given time period (up to 8 hours). During this time, no alert messages will be sent for the specified sensor(s). You can manually reset the ignore function by setting the ignore time to zero.

Monitor Controls

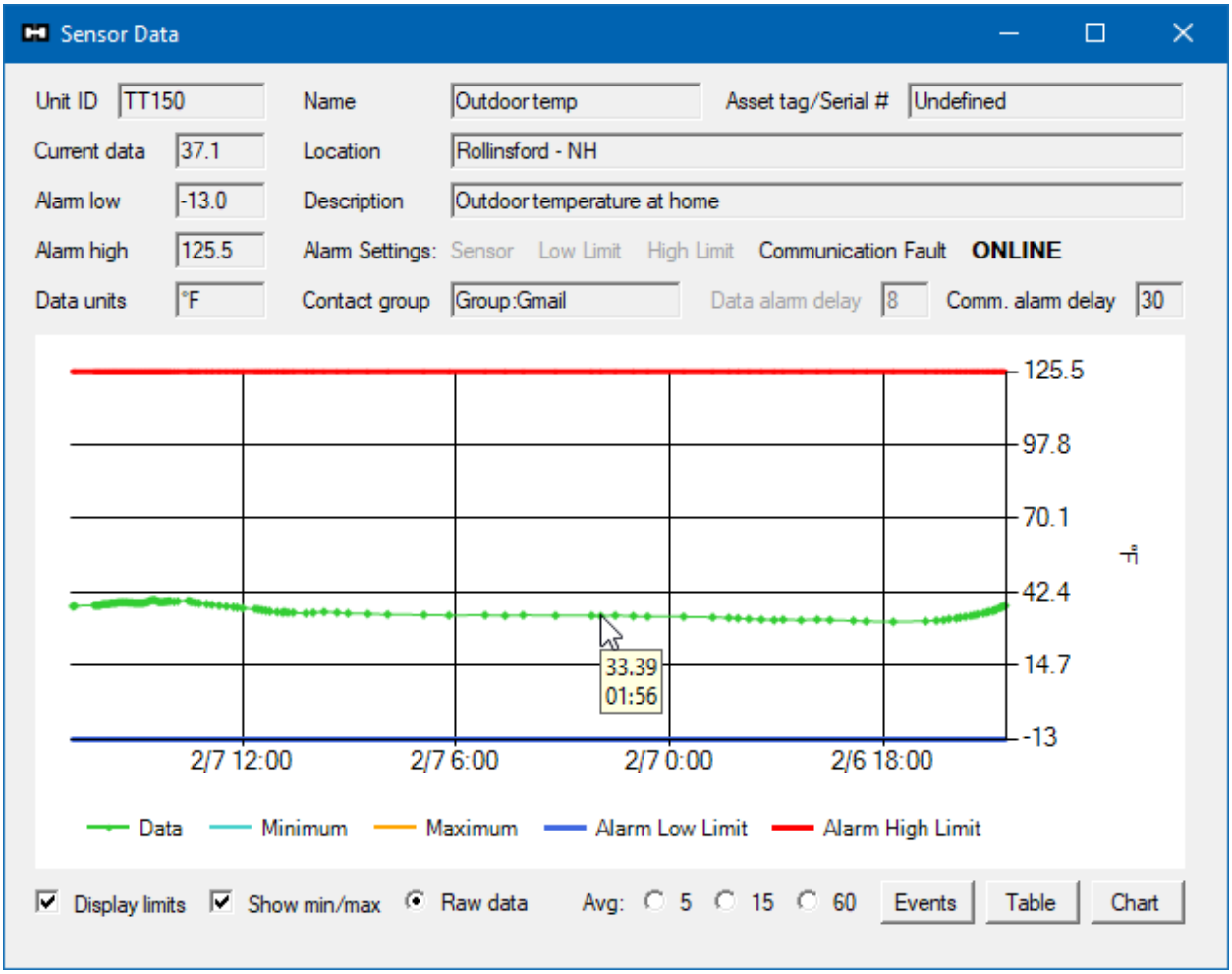
Most of the button controls in the monitor section of the sensor status screen have been discussed previously, and concern the configuration of the *T°Sentry ALERT System*. However, for information about the **Event Log** button, please refer to Event Log on page 43. For information about the **Floor Plan** button, please refer to Floor Plan on page 42.

DATA VISUALIZATION

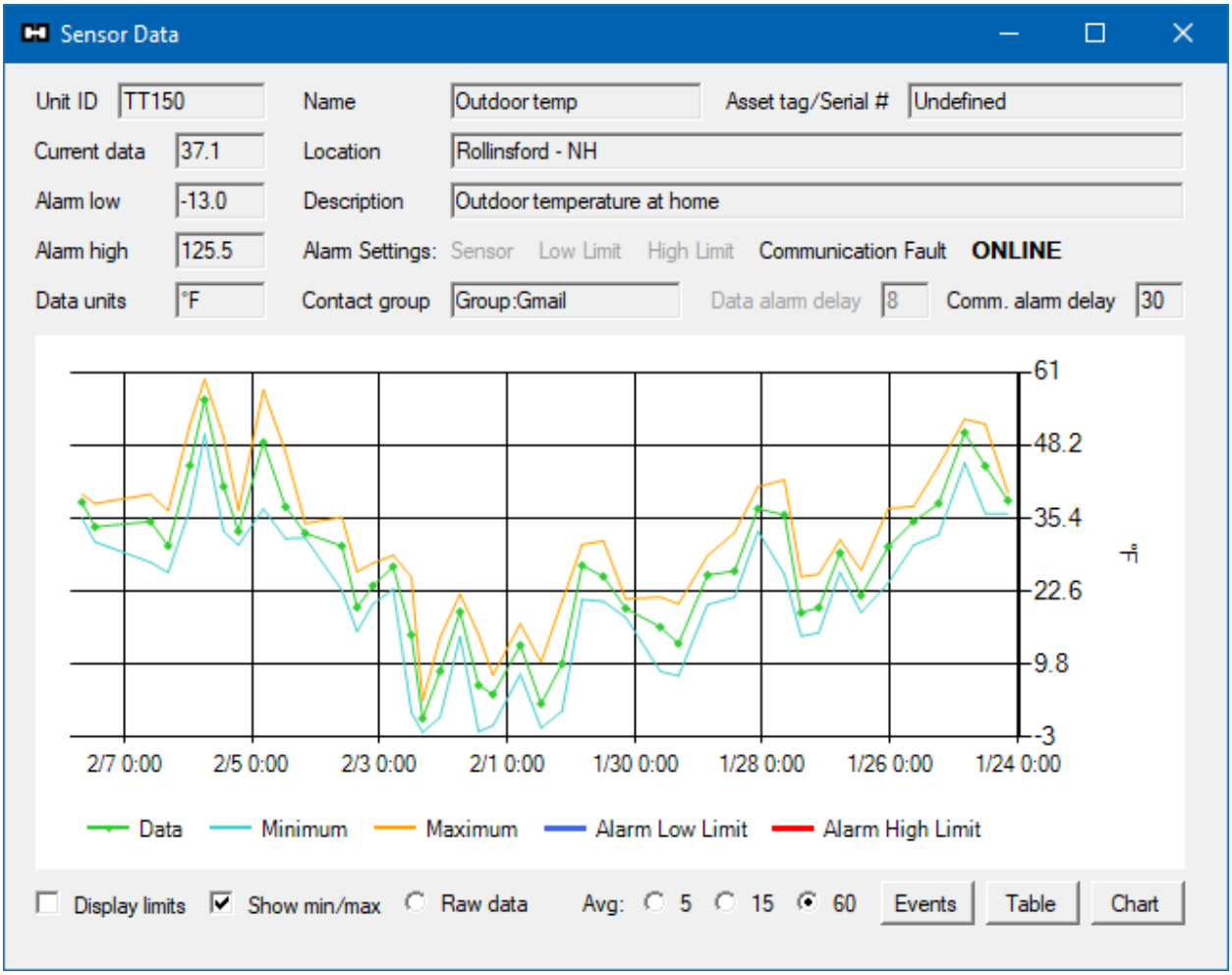
The *T°Sentry ALERT System* has two data visualization options, both of which are activated by the **View Data** button on the sensor status screen (or in the sensor list context menu). The dialog you open is dependent on the number of sensors you select.

Single Sensor Data

When you select only one sensor from the list and click the **View Data** button, you will see the single sensor data dialog shown below. This presents the sensor description, along with current readings and a chart showing the last 120 received data points (raw data). By hovering over any point you will get a pop-up showing the value and time stamp for that point.



At the bottom of the chart are a few options to show or hide certain features. "Display limits" will show red and blue horizontal lines denoting the high and low alarm set points, respectively. You may also choose to display data-point averages of 5, 15 or 60 points. Raw and average options display only the most recent 120 data points of each type. The example on the following page shows the 60 point average with limits disabled. A min and max line are plotted, showing the min and max during each 60 point sample period.

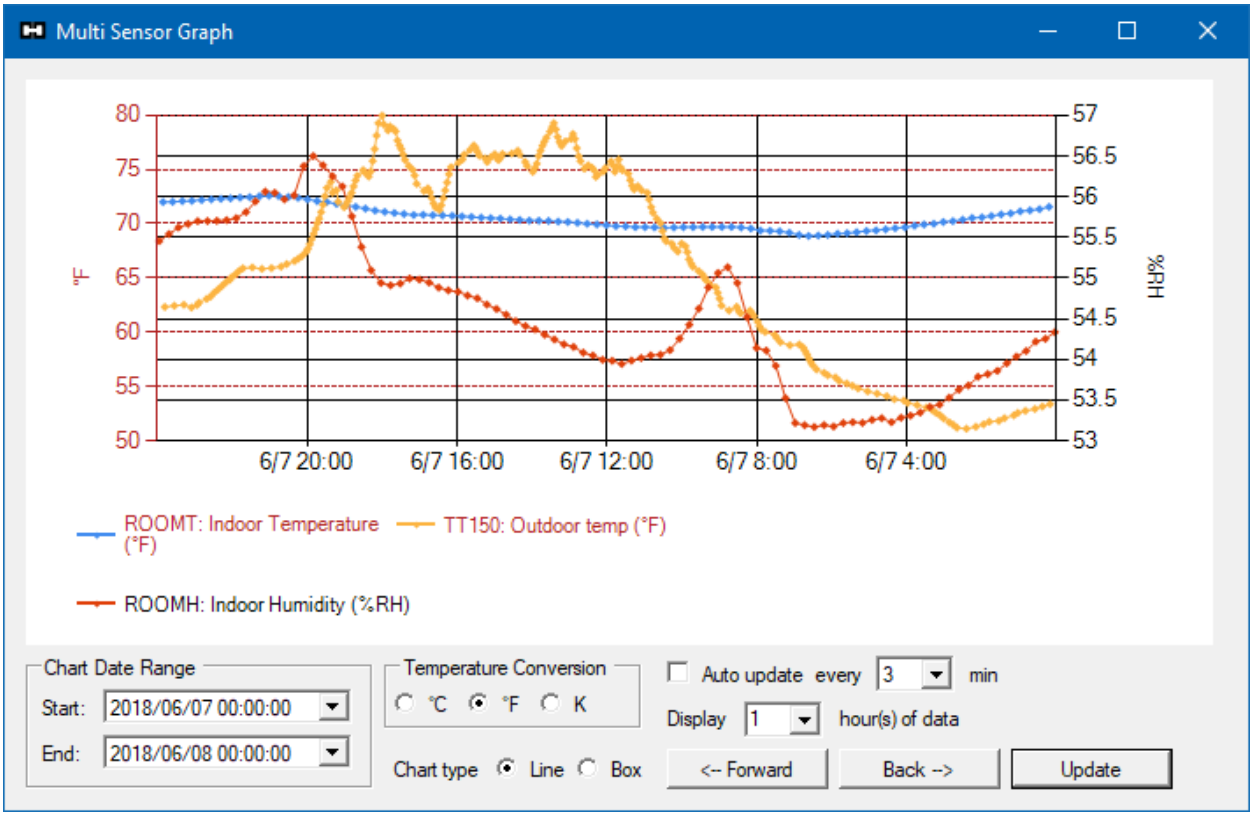


By clicking **Events**, **Table**, or **Chart** you will be presented with dialogs for the Event Log, the Data Log, and a time-selectable chart specifically for this sensor. These dialogs are each discussed in detail in following sections. The **Chart** button opens the multi-sensor graph discussed in the next section.

Multi-sensor Data

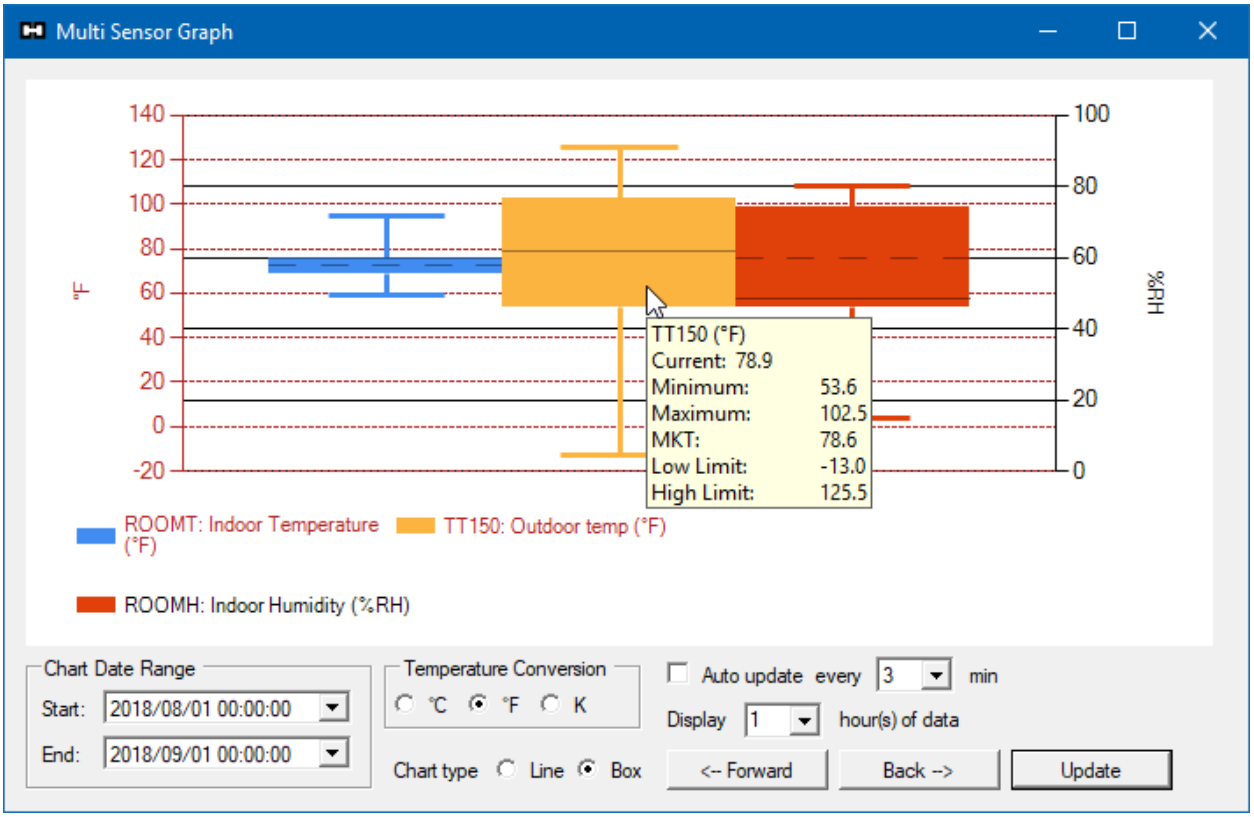
If you select multiple sensors in the sensor list, then the View Data button opens the Multi-sensor Graph as shown below. By default the time range for the graph is set to the current 24-hour day.

The example below also shows the dual-Y-axis when plotting sensor data with different units of measurement. In this case, temperature in °F on the left Y-axis and relative humidity (%RH) on the right Y-axis. The color of the sensor names in the legend match the axis color of their respective units.



To view your data over a specific timeframe, you may edit the time range shown on the x-axis. One way to do this is to explicitly set a start and end time in the Chart Date Range date selectors, and then click the **Update** button. Alternately, you may start by selecting a time span in the hours of data drop-down. This will automatically set the end time to the current time and the start time to the number of hours selected, prior to the current time, then click the **Update** button. The **<-- Forward** and **Back -->** buttons will then allow you to step forward and backward in time in increments of the number of hours selected.

Another option for data visualization is the box plot. The box plot allows you to show data for a large time range in a very condensed visual format. By changing the chart type to box, selecting a large time range, and clicking the Update button, you will be presented with a box plot similar to that shown in the example below.



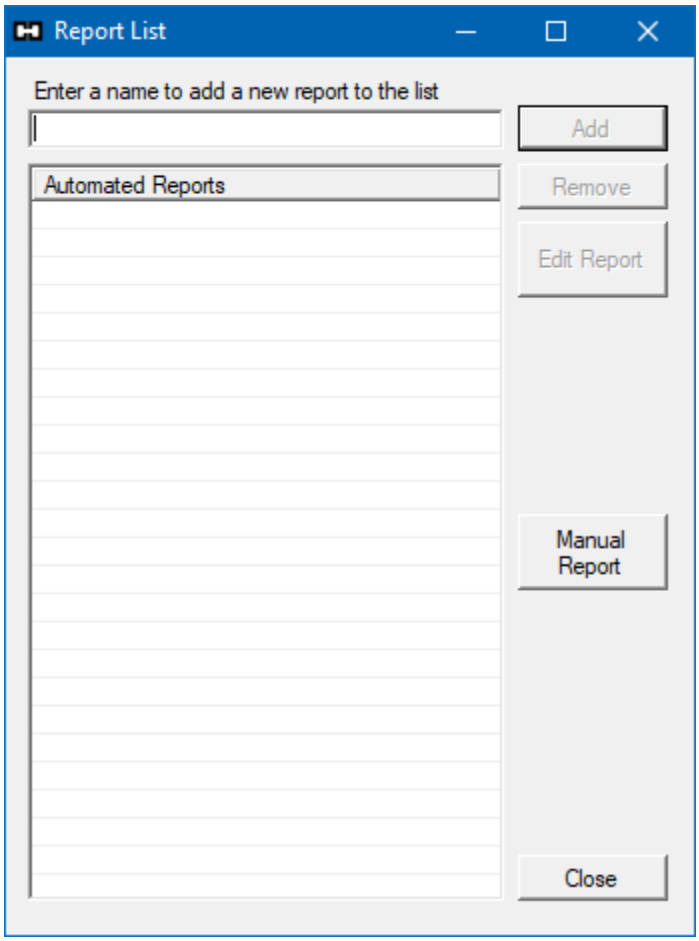
The whiskers of the box plot (which look like a T and an inverted T) show the high and low alarm limits for the sensor. The upper and lower extent of the box show the minimum and maximum data value during the time span. The dashed line inside the box shows the average value for the time span (or MKT for temperature sensors). Finally, the solid line inside the box shows the value of the most recent data point in the range. Also, if you hover the mouse over one of the boxes, you will get a pop-up which lists the box plot values (as shown in the above image).

REPORT SETTINGS

The *T°Sentry ALERT System* can generate periodic reports which may contain current sensor readings, charts, statistical data, and logged events. Reports are saved to the computer hard disk drive but may also be sent to users via contact list distribution. Click the **Reports** button on the sensor status screen to open the report list dialog.

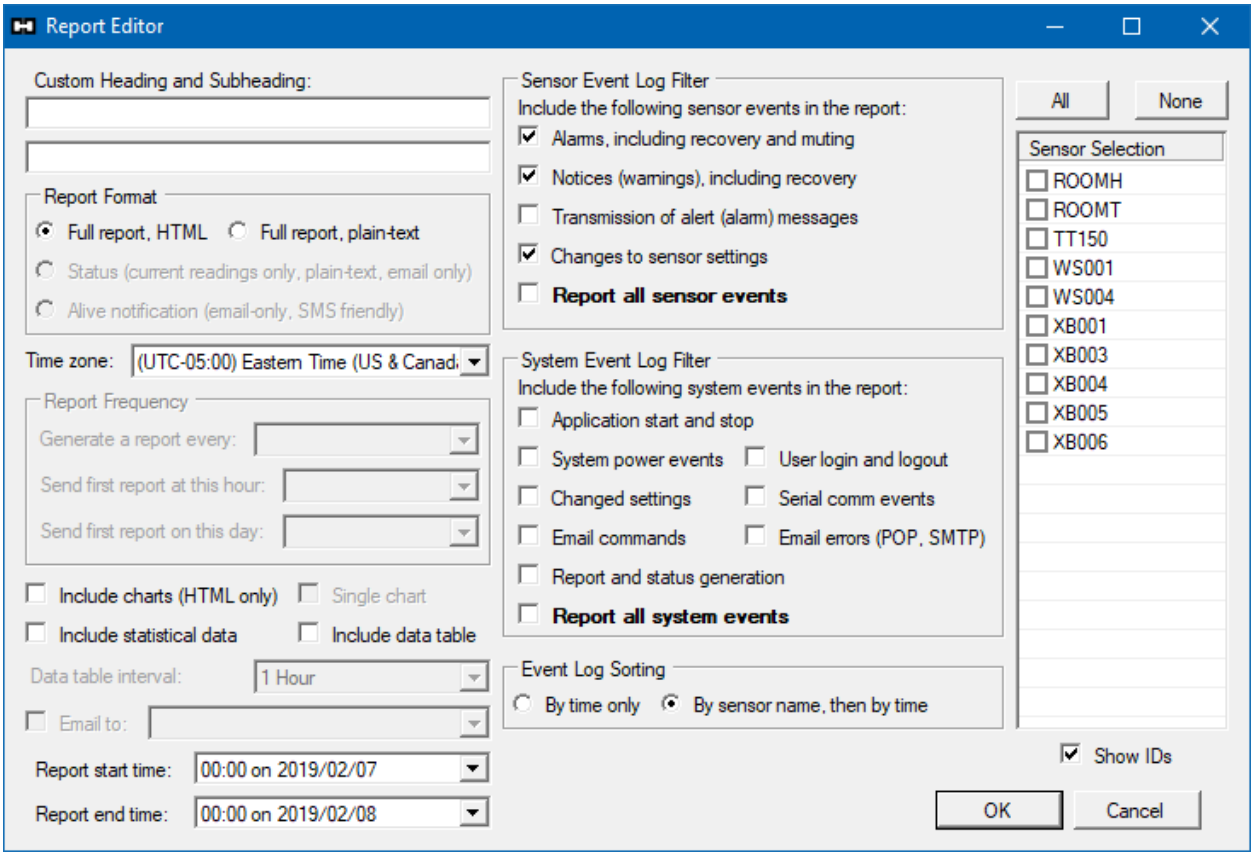
For automated reporting, start by typing a report name into the textbox, then click the Add button. The report name will be added to the list. Now select the report name in the list and click the Edit Report button to open the report editor dialog box.

For manual report generation click on the Manual Report button, this also opens the report editor dialog but with slightly different available options.



Report Editor

The report editor dialog is shown below. The same editor dialog is used for both manual and automated reporting. However, some options may differ between report types. Each of the options will be described in detail below.



Report Heading

The report heading and subheading are simply two lines of text that will appear at the top of your report providing a description of the report. For example the heading could be the name of your organization “ACME Frozen Foods”, and the subheading could be the title of the report “Daily Freezer Temperature Report”.

Report Format

There are four report format choices HTML, plain-text, status, and “alive notification”.

The HTML report uses the same language as web sites to create a graphical report that is readable by any modern web browser.

The plain-text report is simple ASCII text readable by any “txt” file viewer. Graphical report features will not be available using this format.

The status report is only available as an automated report. It is ASCII text and only includes the current sensor readings and status.

The “alive notification” is a short message indicating that the system is operational. This is also only available as an automated report.

Time Zone

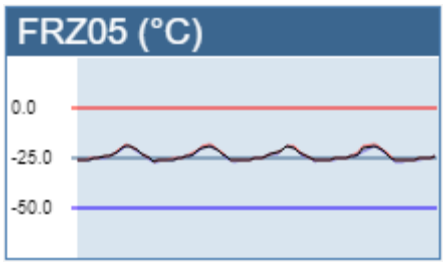
The report can be generated for any time zone. For instance, if your AMS receives data over the Internet from facilities based in other time zones, individuals from those other zones can create reports that display data readings based on their local time.

Report Frequency

The report frequency determines when automated reports are generated. The frequency can be from hourly to monthly. The additional options further refine the day or hour of the report creation.

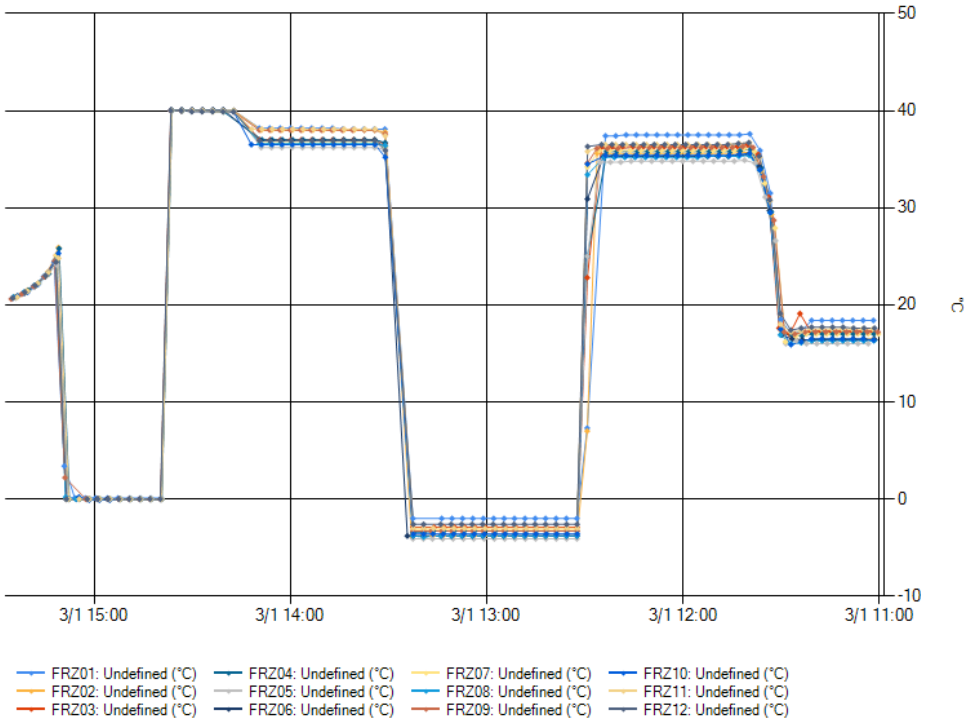
Data Content Options

The “Include charts” option can create simple individual charts for each sensor in the report, or a “Single chart” with all sensors as separate traces.



The simple individual charts (example shown to the right) display the high and low alarm set points as red and blue horizontal lines. The middle value is shown as a slate-blue horizontal line. If the number of sensor readings for the report time range is too large to display on the chart, the data from the sensor is broken into time slices and statistical data (min, max and average) is computed for each slice. The statistical data is then plotted using three traces; red for the max values, black for the average, and blue for the minimum. The example chart shown here was computed using 461 data readings over 24 hours from a sensor in a commercial freezer.

An example of the “Single chart” option is shown below (manual reports only). This example depicts twelve sensors during calibration at 0°C and 40°C (calibrated readings between 14:30 and 15:00 toward the left). In this example the sensor names were not entered, thus “Undefined” is shown next to the sensor IDs. This chart type plots all data readings as dots on each trace.



The “Include statistical data” option will calculate statistics for each sensor over the entire report period. The statistical data includes the minimum value and the time it occurred, the maximum value and the time it occurred, the average value, the standard deviation, and if it is a temperature sensor the MKT (Mean Kinetic Temperature). An example is shown below (for the Central Daylight Time zone).

FRZ05 - Freezer 5 (°C)							
Readings:	151	**Mean:**	-23.8	**Std. Dev:**	2.434	**MKT:**	-23.2
Min:	-26.6	**Minimum occured:** 2018/08/28 02:44 CDT					
Max:	-18.3	**Maximum occured:** 2018/08/28 06:51 CDT					

To create a report with tabular data readings, select the "Include data table" option, then select a time interval for the data readings. Each selected sensor will have a column in the data table with data readings on each row at the specified time interval. A 24-hour data table with readings every 4 hours is shown below (for the Central American Standard Time zone).

	R2	R3	R4	R5	R6	R8	R10	R15	R16	C1	C2	C3	C7	C8	C9	C10	Regional 1	Regional 2
Time	U1C1 °C	U1C2 °C	U1C3 °C	U1C4 °C	U2C1 °C	U2C2 °C	U2C3 °C	U2C4 °C	U3C1 °C	U3C2 °C	U3C3 °C	U3C4 °C	U4C1 °C	U4C2 °C	U4C3 °C	U4C4 °C	U5C1 °C	U5C2 °C
2018/08/27 00:00 CAST	1.4	3.9	5.3	3.4	4.7	5.1	3.8	2.3	3.8	-35.5	-27.6	-29.1	-28.0	-22.9	-26.5	-27.9		
2018/08/27 04:00 CAST	1.2	3.9	5.5	3.1	4.8	5.1	3.9	2.5	3.6	-36.3	-25.0	-29.0	-28.8	-27.4	-26.6	-26.4		
2018/08/27 08:00 CAST	1.7	4.2	5.9	3.1	4.9	5.0	3.8	5.5	3.6	-34.9	-27.7	-29.1	-26.2	-27.9	-26.5	-27.8		
2018/08/27 12:00 CAST	1.5	4.1	4.0	3.4	4.9	5.2	3.9	2.8	3.7	-35.7	-25.1	-28.9	-27.8	-22.9	-26.2	-25.9		
2018/08/27 16:00 CAST	1.5	4.1	4.5	2.9	3.8	5.1	4.0	2.8	4.0	-31.3	-27.3	-28.6	-28.5	-27.1	-25.8	-26.2		
2018/08/27 20:00 CAST	1.3	4.0	4.0	3.1	3.0	5.1	3.9	2.7	3.6	-34.6	-22.7	-29.0	-26.2	-27.9	-26.1	-25.6		

NOTE: if a device is offline during the report period, the data will be blank.

E-mail

You can choose to automatically send the report to the selected contact list. The file will be included as a attachment. This is for automated reports only.

It is recommended that the contact group used for reports only contain true e-mail addresses; **DO NOT** use e-mail-to-SMS gateway addresses, as the report will be broken into a large number of text messages, formatting information will be lost, and the report will be unreadable by the recipient.

Report Time

Two date-time selectors at the bottom-left of the Report Editor dialog are used to select the time-span for the report. The report time selector is only applicable to manual reports.

NOTE: Reports for long time-spans and many sensors can take a significant amount of time to produce.

Sensor Event Log Filter

The sensor event log filter selection allows you to customize the level of detail about sensor events provided in the report.

- **Alarms:** This option will include all events related to alarm events. This includes when the sensor went into alarm, if and when the alarm was muted, and when the alarm condition was cleared (recovery).
- **Notices:** If you have alarm delays configured in your system, this will include events when the sensor exceeds the alarm limits prior to the expiration of the alarm delay.
- Transmission of alerts: This option will include when e-mail alerts were sent during an alarm event.
- **Changes to settings:** This will list any changes that were made to sensor settings during the report period, such as adjustments to high and low set points and alarm delays.

- **All sensor events:** This box can be used to include all events, or clear all other options (if checked, then un-checked).

System Event Log Filter

The system event log filter can be used to customize the level of detail about system interaction during the reporting period.

- **Application start/stop:** Shows when the TSentryMonitor.exe application was started or stopped.
- **System power:** If connected to the data terminal of a UPS, this option can show events related to system (UPS) power, such as loss of line power and battery state-of-charge.
- **User log in/out:** Shows entries for each login/logout operation.
- **Changed settings:** Shows all changes to system settings.
- **Serial comm.:** Shows messages relating to serial communications (errors).
- **E-mail commands:** Shows if any directed e-mail commands were sent to the system and the e-mail address from which they were sent.
- **E-mail errors:** Lists any communication problems with e-mail sending (alerts) and receiving (commands).
- **Report generation:** Lists any reports created during the report period.
- **All system events:** This box can be used to include all events, or clear all other options (if checked, then un-checked).

Event Log Sorting

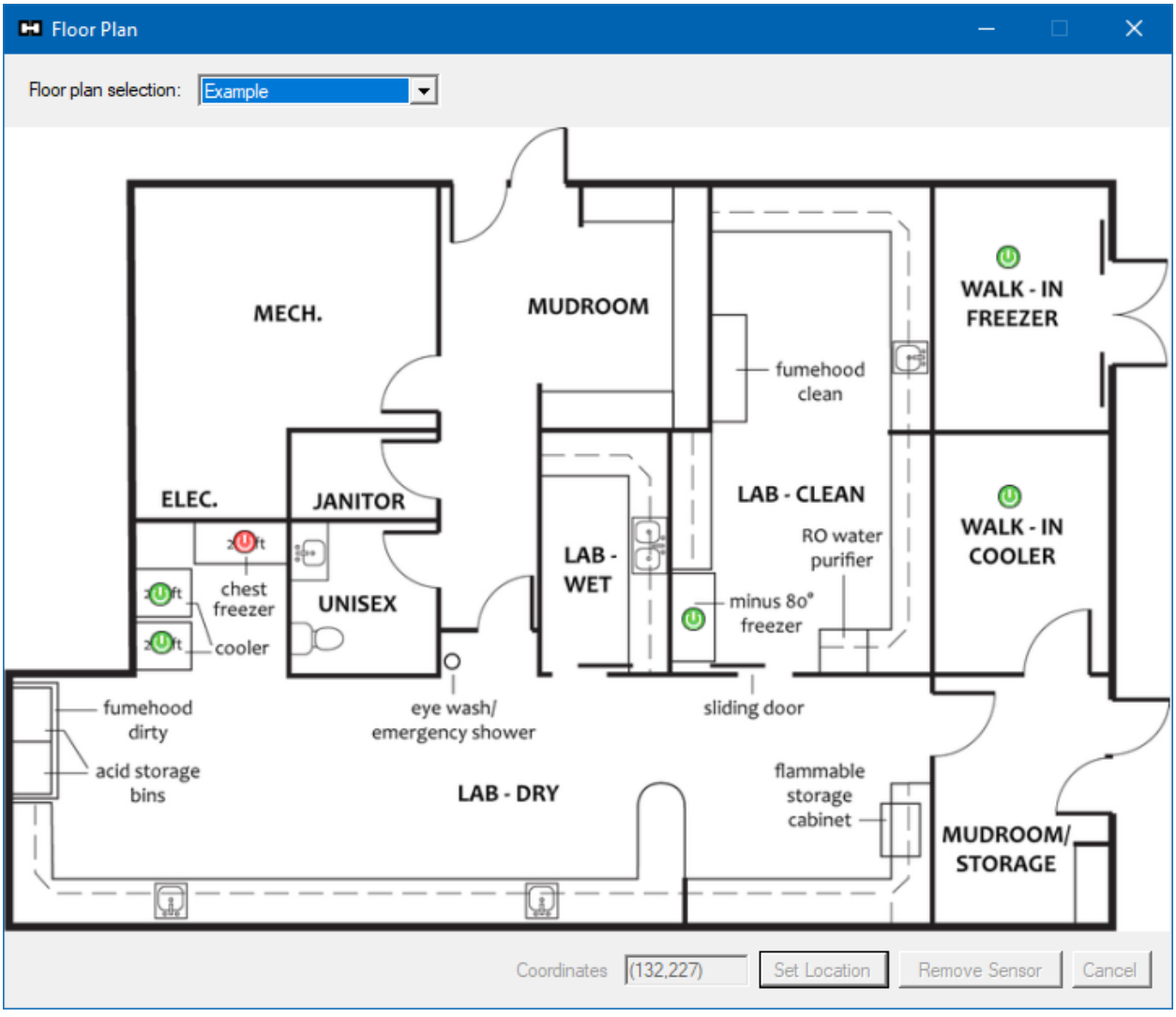
The event log can be sorted and reported in one of two ways. The "By time only" option will include one log listing for all events, sorted chronologically. The "By sensor name, then by time" option will create a separate log listing for each sensor (and the system events) and each individual log will be sorted chronologically.

Sensor Selection

The final option is the sensor selection on the right side of the dialog box. The sensor list shows the names of all the sensors associated with the system. A checkbox allows you to switch the list to display sensor IDs vs. sensor Names. Two buttons "All" or "None" allow easy selection of all or none of the sensors. If you are only generating a report for a few sensors it is easiest to scroll through the list and check the appropriate names. For reporting on more than half of the sensors, click the "All" button and then de-select (un-check) the sensors you don't want to include in the report.

FLOOR PLANS

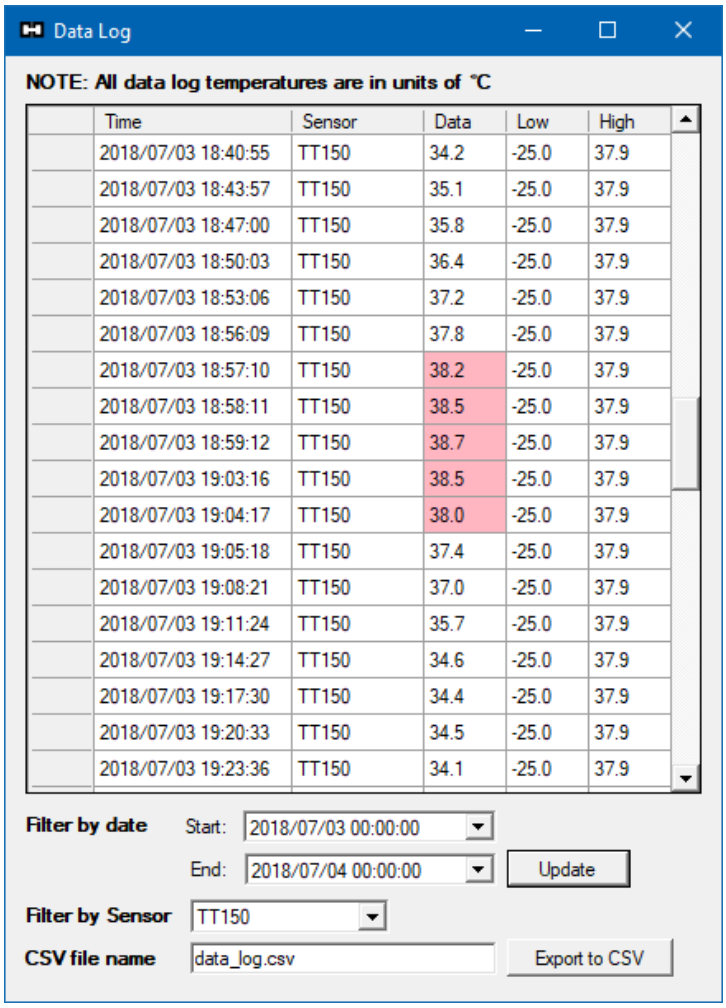
The floor plan is another, optional way of visualizing sensor data, or in this case, sensor status. You may create images with as many or few details about the location of the sensors as you want. The images should be at least 640x480 pixels with a resolution of 96 DPI, and saved as a JPG (JPEG), PNG, GIF or BMP image file. However, avoid making the images too large, as the image scaling will reduce the size of the status icons. The 16x16 pixel sensor status icons may then be placed on the image using the **Set Location** button on the sensor status screen, or from the sensor list context menu. Click on the image to position the sensor icon, and then click the **Set Location** button in the Floor Plan dialog. The result is interactive map showing the current status and location of each sensor in your system. An example is shown below.

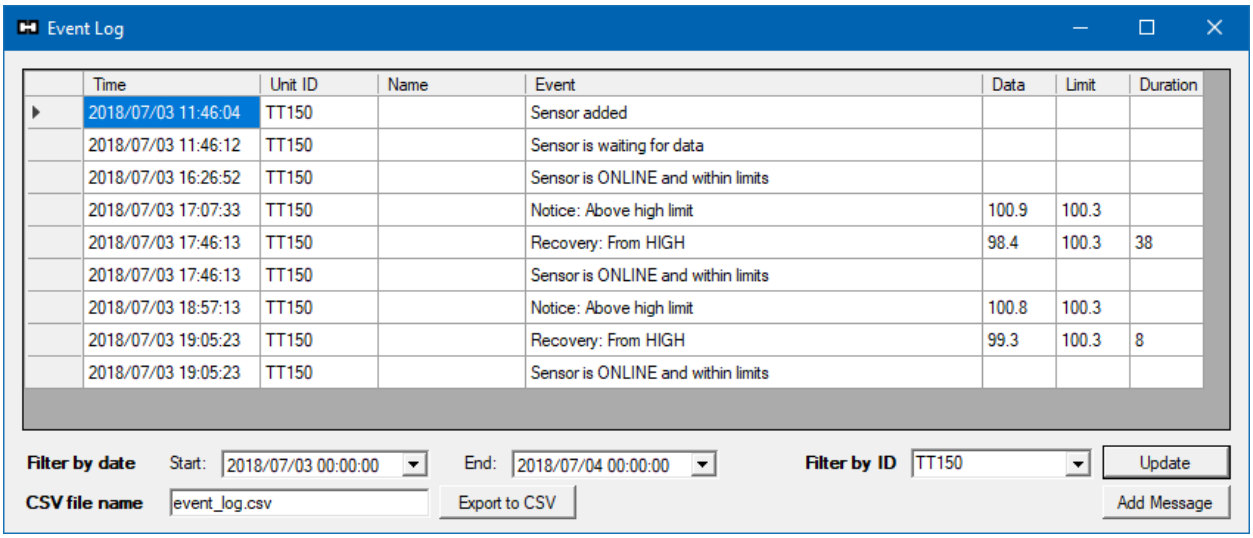


If you click the left mouse button on any of the sensor icons, a pop-up will display the sensor data (not shown). Also, if you right-click on a sensor icon, you will be presented with a context menu of available options for the sensor (not shown).

EVENT AND DATA LOGS

The event and data logs display tables of data directly from the database. This allows you to view the data from the sensors and the events logged by the monitoring system. You may select specific sensors and time ranges and then export the data to CSV files for use outside of the *T°Sentry ALERT System*. The event log dialog also allows you to add messages into the event log, to annotate other events that may have occurred. Examples of event and data logs are shown here.



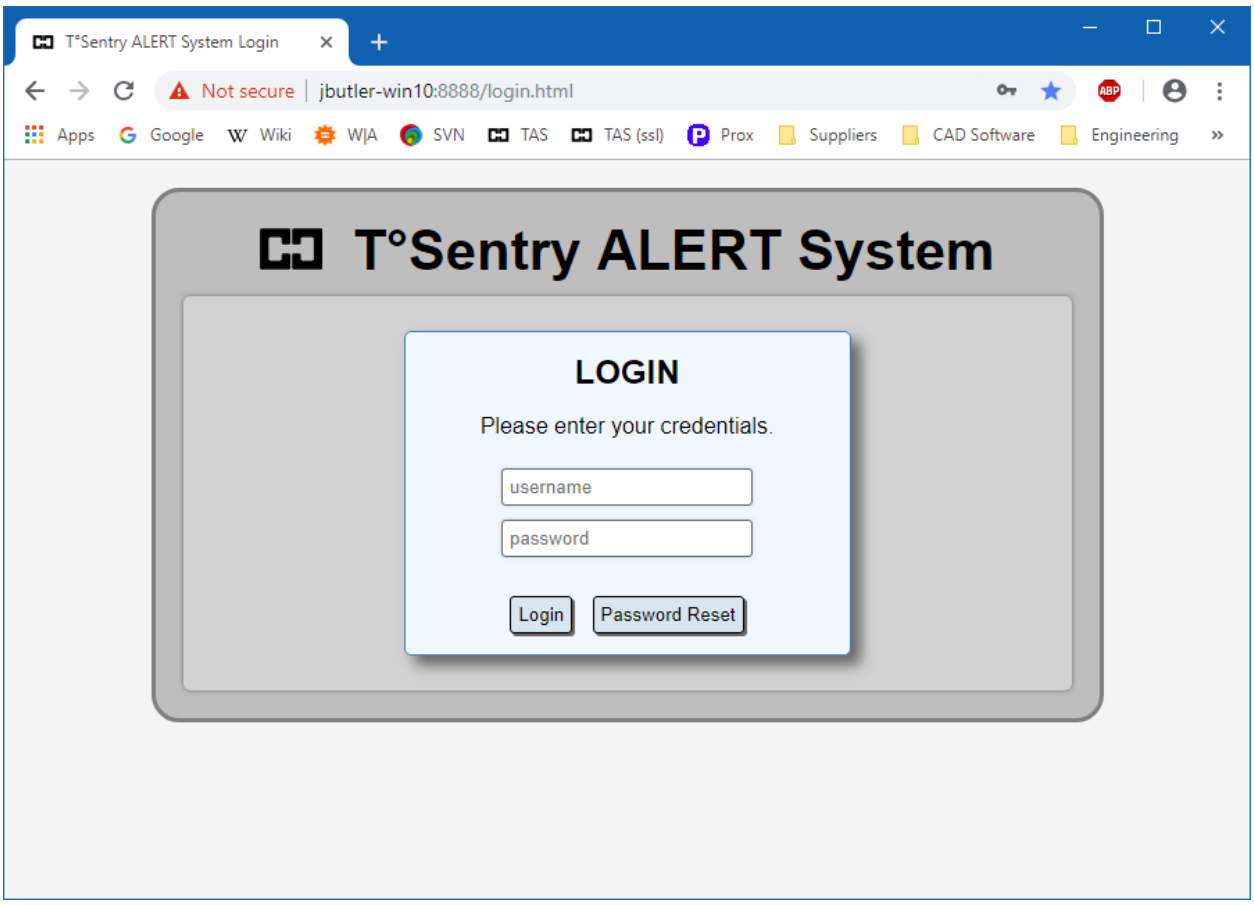


HTTP/HTTPS Interface

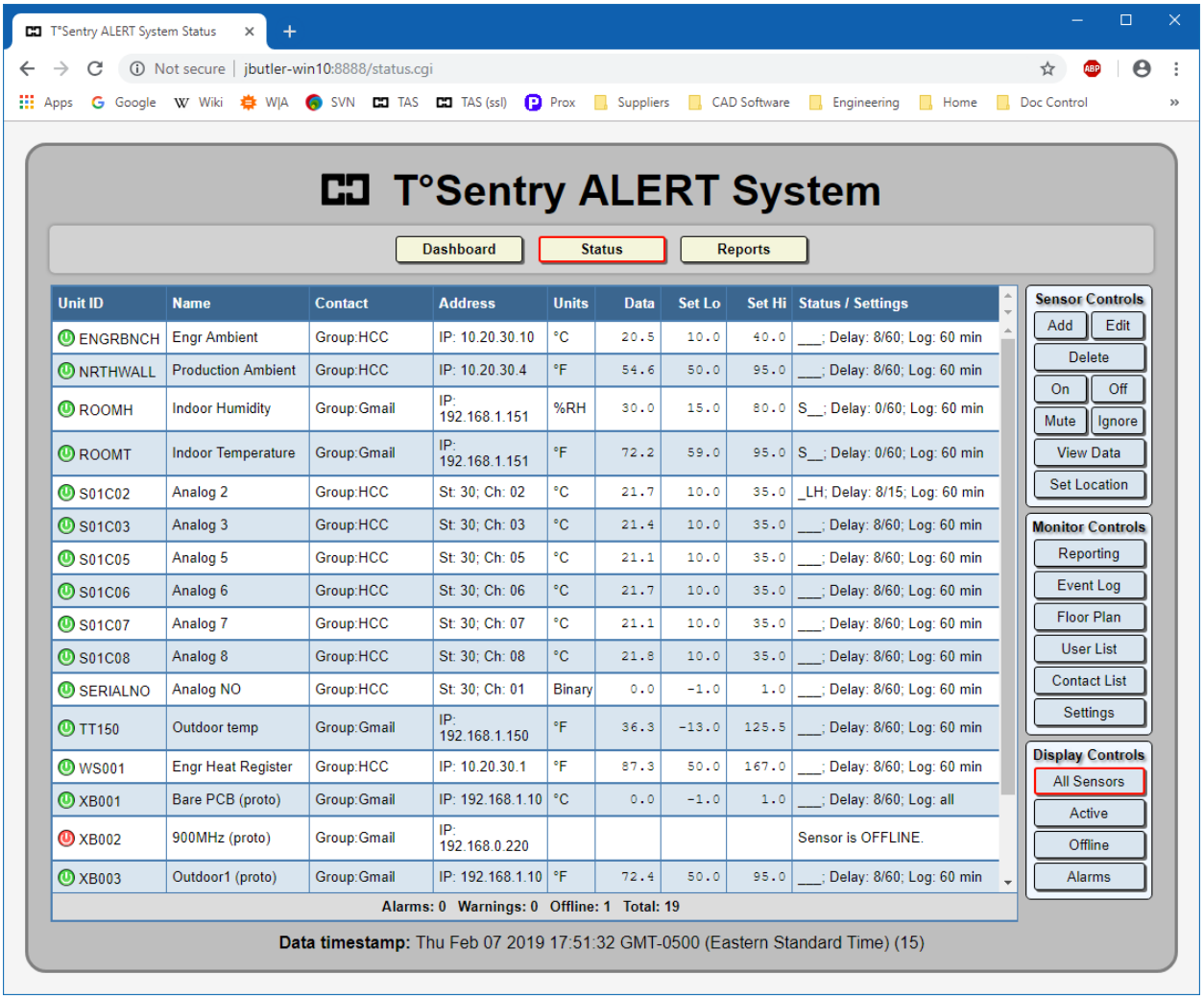
The HTTP/HTTPS interface is accessed by directing a web browser on your facility's LAN to the appropriate URL, which could include the AMS PCs IP address or a hostname, depending on configuration of your network. Consult Hampshire Controls and/or your IT personnel for more information.

The HTTP/HTTPS interface is designed to be very similar to the Windows dialog boxes of the *T°Sentry ALERT System* application. This section will show a selection of the interface pages.

Login Page

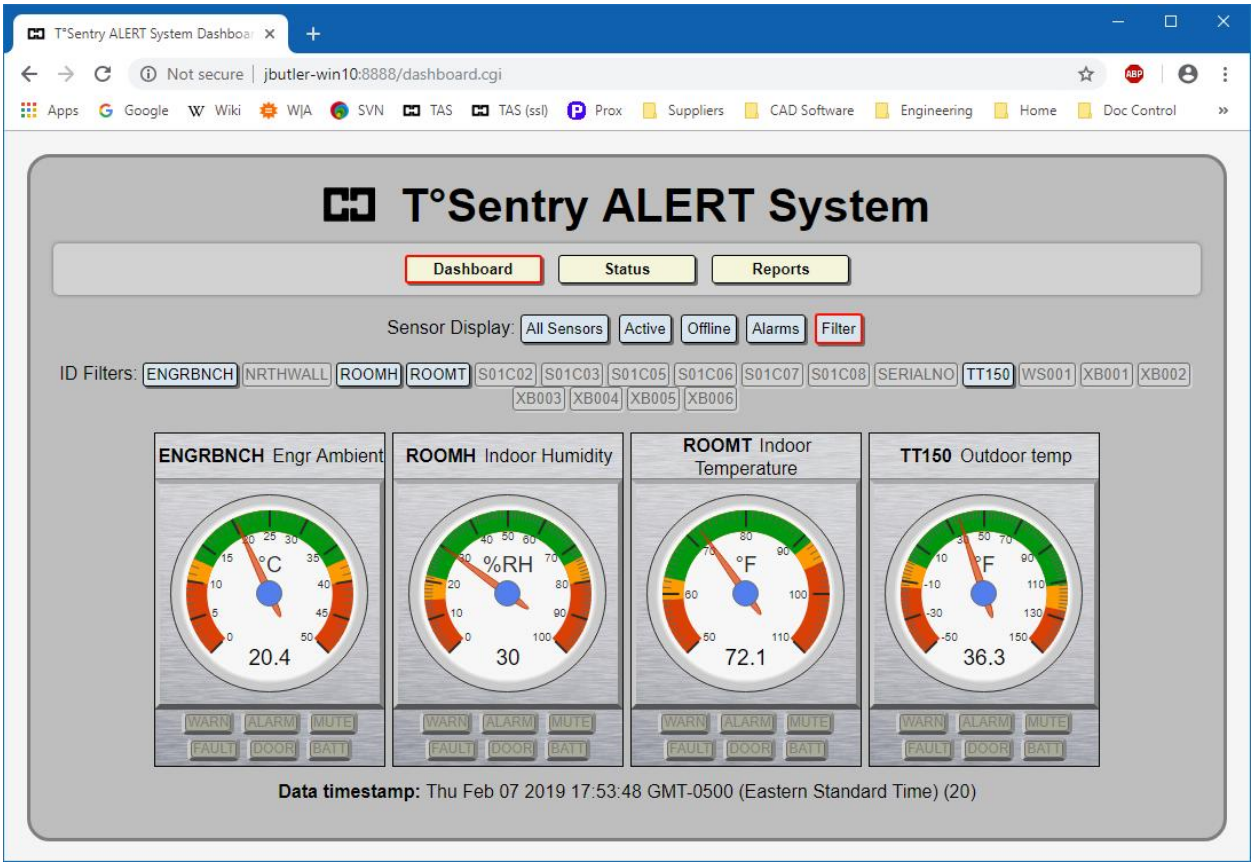


Sensor Status



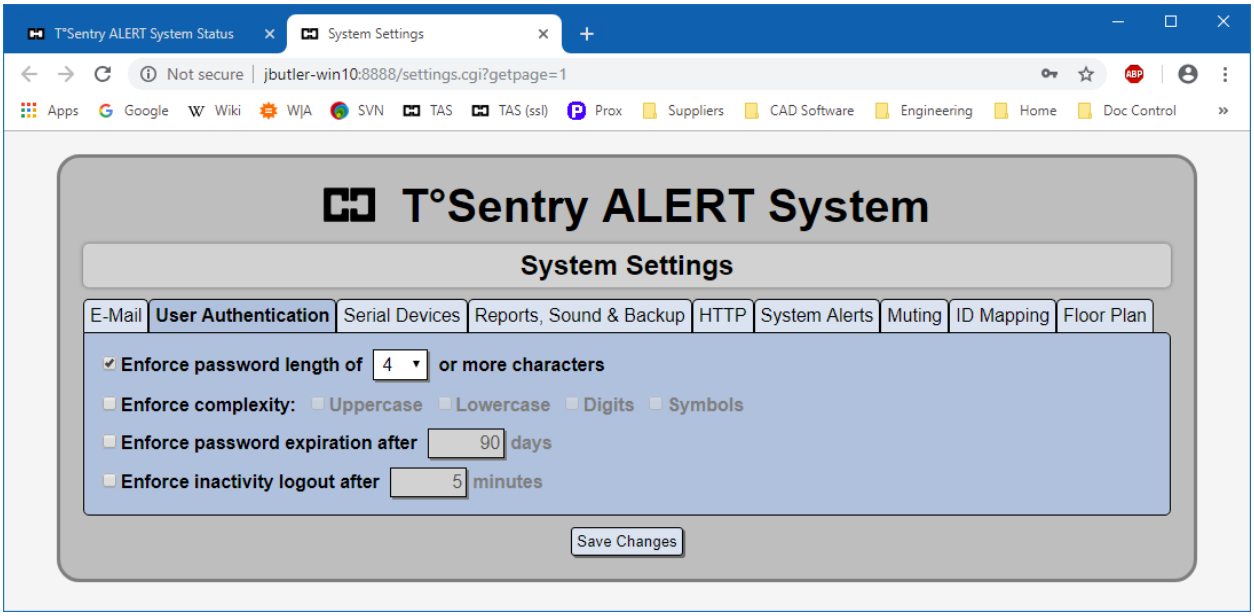
The layout of the status page is much like the Windows application with a table displaying the sensor data and grouped button controls on the right.

Dashboard

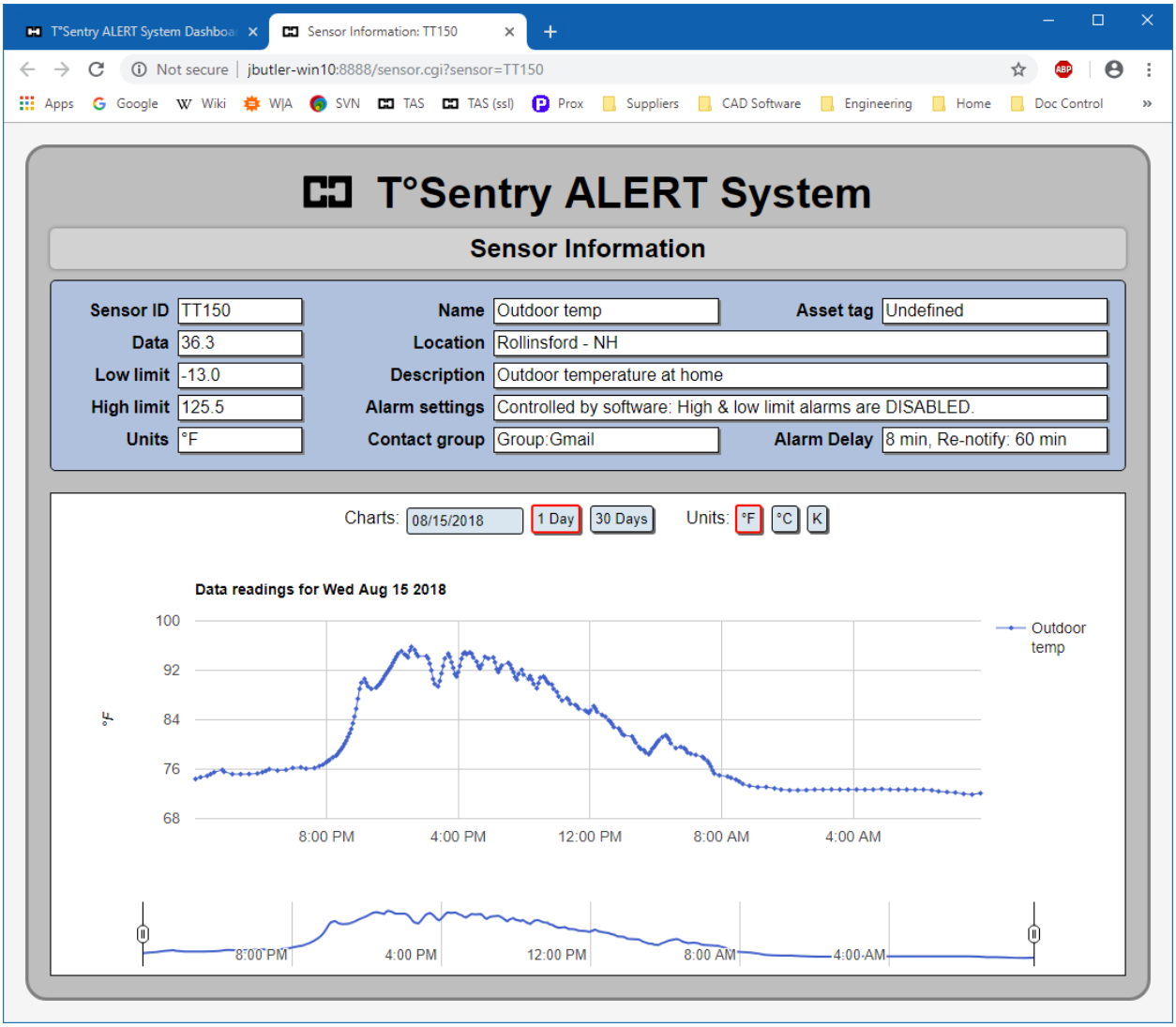


The dashboard displays gauge-style images for each sensor with the red zones denoting the alarm conditions. Buttons at the top allow for turning on and off the display of specific sensors.

Settings

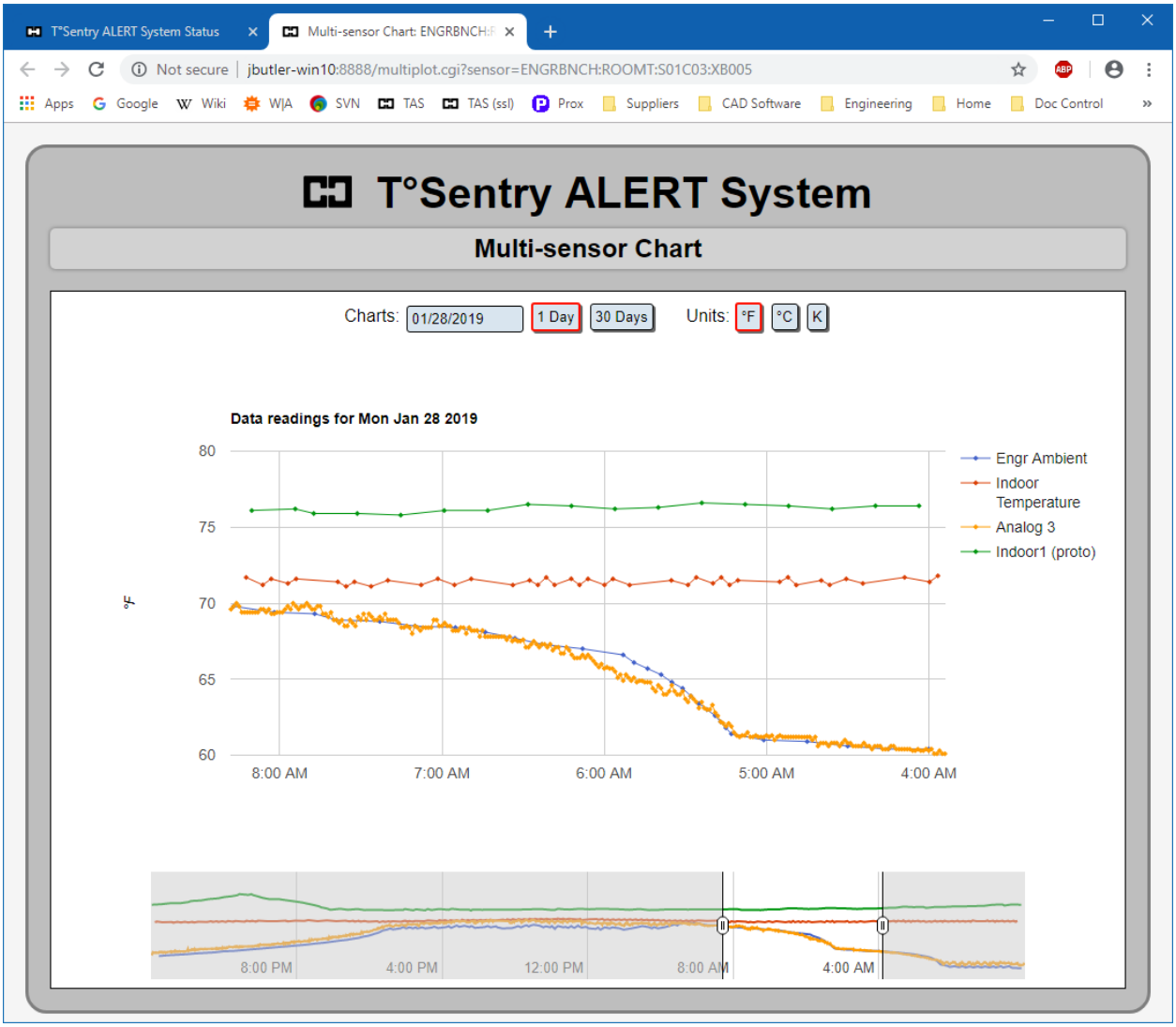


Sensor Data View



This page can display a 24-hour zoom-able line chart, or 30 days of “candle-stick” (aka. “box” or “box-and-whisker”) charts.

Multiple Sensor Data View



This is the data view when multiple sensors are selected. The zoom feature is shown in operation on this page.

EXAMPLE ALARM E-MAILS AND REPORTS

E-mail Notifications

High Limit Alarm

```
From:         [SMTP Username]
To:           [Contact list address(es)]
Subject:      ALARM! Above HIGH limit on: FRZ17 - Freezer 17
ALARM! Above HIGH limit on: FRZ17 - Freezer 17
Time of deviation: 10/7/2014 5:41:38 PM
Time of alarm: 10/7/2014 5:56:43 PM
Duration: 15 minutes
Current data: 1.5  Limit: 0.0
```

High Limit Recovery

```
From:         [SMTP Username]
To:           [Contact list address(es)]
Subject:      RECOVERY. Data within limits on: FRZ17 - Freezer 17
RECOVERY. Data within limits on: FRZ17 - Freezer 17
Time of deviation: 10/7/2014 5:41:38 PM
Time of alarm: 10/7/2014 5:56:43 PM
Time of recovery: 10/7/2014 5:58:56 PM
Duration: 17 minutes
Current data: -0.4  Lo/Hi limits: -50.0/0.0
```

Automated HTML Report

Here is an example of a report formatted in HTML. The HTML rendering has been screen captured and split into multiple images for inclusion in this document.

Example Report

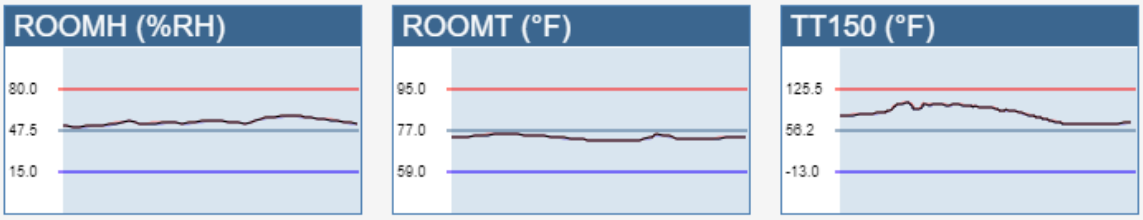
Indoor/Outdoor Temperature Data

Report generated: 2019/02/07 17:18 EST
Report period: 2018/07/05 00:00 EDT to 2018/07/06 00:00 EDT

CURRENT READINGS

Unit	Name	Data		Low	High	Status
ROOMH	Indoor Humidity	30.2	%RH	15.0	80.0	
ROOMT	Indoor Temperature	72.0	°F	59.0	95.0	
TT150	Outdoor temp	36.7	°F	-13.0	125.5	

CHARTS



STATISTICAL DATA

ROOMH - Indoor Humidity (%RH)							
Readings:	99	**Mean:**	54.4	**Std. Dev:**	2.411	**MKT:**	N/A
Min:	50.3	**Minimum occured:** 2018/07/05 22:57 EDT					
Max:	59.3	**Maximum occured:** 2018/07/05 05:41 EDT					

ROOMT - Indoor Temperature (°F)							
Readings:	101	**Mean:**	74.0	**Std. Dev:**	0.912	**MKT:**	74.0
Min:	72.4	**Minimum occured:** 2018/07/05 09:50 EDT					
Max:	75.6	**Maximum occured:** 2018/07/05 19:18 EDT					

TT150 - Outdoor temp (°F)							
Readings:	261	**Mean:**	88.0	**Std. Dev:**	11.325	**MKT:**	88.4
Min:	66.8	**Minimum occured:** 2018/07/05 05:14 EDT					
Max:	104.1	**Maximum occured:** 2018/07/05 18:30 EDT					

EVENT LOG

No event log entries for ROOMH

No event log entries for ROOMT

Time	Unit	User ID (Name)	Event	Data	Limit	Duration
2018/07/05 14:26 EDT	TT150		High alarm limit updated by sensor: From 100.3 to 125.5			

END OF REPORT

E-MAIL COMMANDS

Overview

The *T°Sentry ALERT System* software can be configured to monitor incoming e-mail at a specified e-mail address. The inbox is checked for new messages every five minutes. During each e-mail check all new messages will be retrieved. Messages that are interpreted as commands are logged, executed, and if successful will reply to the sender. All retrieved messages are then deleted from the inbox.

Command Structure

E-mail commands have a "subject line only" structure. That is, the command is given in the subject line of the message, the message body is ignored. The command interpreter is not case sensitive (i.e. the command "STATUS" is the same as "status"), however, **sensor IDs are case sensitive!** Only one command can be given per message. Command arguments cannot contain spaces.

The basic command e-mail syntax is as follows:
To: ams-system@yourcompany.com
Subject: COMMAND [ARGUMENTS] [PASSWORD]

Command Password

A command password may be enabled in the *T°Sentry ALERT System* settings dialog. If the password is enabled, you must append the password to the command prior to sending the e-mail. For example, if the password is "please", then in order to generate a status report, the command string would be "STATUS please", or to mute all alarms you would use "mute all please". DO NOT use spaces in the password.

Command Logging

All incoming e-mail commands are written to the Event Log and can be displayed in the periodic system reports. The sender's e-mail address is included in the event description for tracking who issued the command.

Command Security

The sender address of each received command e-mail is checked against the e-mail addresses contained in the Contact Groups.

Commands have two security levels:

Global: Any e-mail address in any Contact Group may execute the command.

Sensor: Only e-mail addresses in the specified sensor's Contact Group may execute the command.

Commands

Quick Reference

List current readings and status: STATUS

30 minute data log, all sensors:	HISTORY
30 minute data log, specified sensor:	HISTORY [SENSOR]
Data log, specified sensor & time:	HISTORY [SENSOR] [MINUTES]
HTML system report, all sensors:	REPORT [END-DATE] [END-TIME] [PRIOR-HOURS]
Suspend alarm notifications:	MUTE [SENSOR|ALL]
Modify sensor parameters:	SET [SENSOR|ALL] [PARAM] [VALUE]

STATUS Command

Description: Generates a status report displaying current sensor readings, returns it to the E-mail address that sent the command.

Security: Global
Response: On success: The generated status report
On failure: None
Syntax: STATUS
Arguments: None

HISTORY Command

Description: Returns a data log for the specified time period and sensor ID[1], or 30 minutes for the specified sensor ID[2], or 30 minutes for all sensors[3].

Security: Global
Response: On success: The data log is sent
On failure: None
Syntax: HISTORY [SENSOR] [MINUTES] [1]
HISTORY [SENSOR] [2]
HISTORY [3]
Arguments: SENSOR: Must be a valid Sensor ID or "ALL"
MINUTES: Number of past minutes of data to report
Examples: HISTORY U1C2 60
HISTORY U3C1
HISTORY

REPORT Command

Description: Returns a basic, HTML formatted, system report for the specified time period.

Security: Global
Response: On success: The report is sent.
On failure: None
Syntax: REPORT [END-DATE] [END-TIME] [PRIOR-HOURS]
Arguments: END-DATE: The END date of the report expressed as MONTH/DAY/YEAR (ex. 6/25/2015)
END-TIME: The END time of the report expressed as HOUR24:MINUTE (ex. 18:30) or HOUR:MINUTE[AM/PM] (ex. 8:30am)
PRIOR-HOURS: The number of hours PRIOR to the end date/time to report
Examples: REPORT 6/25/2015 0:00 24
REPORT 6/29/2015 8:00PM 168
REPORT 6/25/2015 12:00 12

MUTE Command

Description: Acknowledge sensor alarm and suspend further alarm notification e-mails. Notifications will resume after the existing alarm condition clears.

Security: Sensor
NOTE: In the case of "MUTE ALL", only sensors which include the sender in the Contact Group will be affected.
Response: On success: "SUCCESS: [received command]"
On failure: None
Syntax: MUTE [SENSOR]
Arguments: SENSOR: Must be a valid Sensor ID or "ALL"
Examples: MUTE REF02
MUTE ALL

SET Command

Description: Change program sensor configuration parameters (does not change limits and delays programmed into sensor).

Security: Sensor
NOTE: In the case of "SET ALL", only sensors which include the sender in the Contact Group will be affected.

Response: On success: "SUCCESS: [received command]"
On failure: None

Syntax: SET [SENSOR] [PARAM] [VALUE]

Arguments: SENSOR: Must be a valid Sensor ID or "ALL"
PARAM: (See parameter list below)
VALUE: (See parameter list below)

Parameter list:

SENSALARM: Select whether the hardware sensor parameters or the software sensor parameters are used to determine when alarm notifications are sent.
VALUE: "ON" – Sensor parameters determines when to send alerts
"OFF" – Monitor software sensor settings determine when to send alerts

LOALARM: Enable/disable the low-limit alarm (only if SENSALARM=OFF)
VALUE: "ON" – Alert sent when conditions are met
"OFF" – No alerts sent

HIALARM: Enable/disable the high-limit alarm (only if SENSALARM=OFF)
VALUE: "ON" – Alert sent when conditions are met
"OFF" – No alerts sent

ALARMDLY: Sets the lo/hi limit alarm delay (only if SENSALARM=OFF)
VALUE: Integer value indicating number of minutes to delay before sending alert (0-60)

COMMDLY: Sets the communications fault delay
VALUE: Integer value indicating number of minutes to delay before sending alert (20-60)

RETRANS: Sets the alert retransmission delay
VALUE: Integer value indicating number of minutes to wait before sending another alert message (0-60)

LINE: Set operational status of sensor
VALUE: "ON" – Put sensor ON-LINE
"OFF" – Take sensor OFF-LINE

IGNORE: Ignore alarm conditions for a specified amount of time.
VALUE: Decimal value indicating number of minutes to ignore alarm conditions (0.0 - 8.0)

Examples:
SET FRZ01 COMMDLY 30
SET REF02 ALARMDLY 15
SET U2C3 LINE ON
SET FRZ02 IGNORE 1.5
SET ALL LINE OFF

REVISIONS

Revision	Date	Changes
Rev A	19 Jun 2013	Initial draft.
Rev B	21 Oct 2014	Re-write to incorporate changes and new features.
Rev C	07 Feb 2019	Replaced all images with Win10 screen captures. Additions and corrections as necessary to match latest software version.
Rev D	18 Mar 2019	Edits to mute and ignore descriptions.
Rev E	25 Sep 2019	Grammatical corrections and minor edits.
Rev F	04 Jun 2020	Changes to implementation of averaging, gain, and range (new).