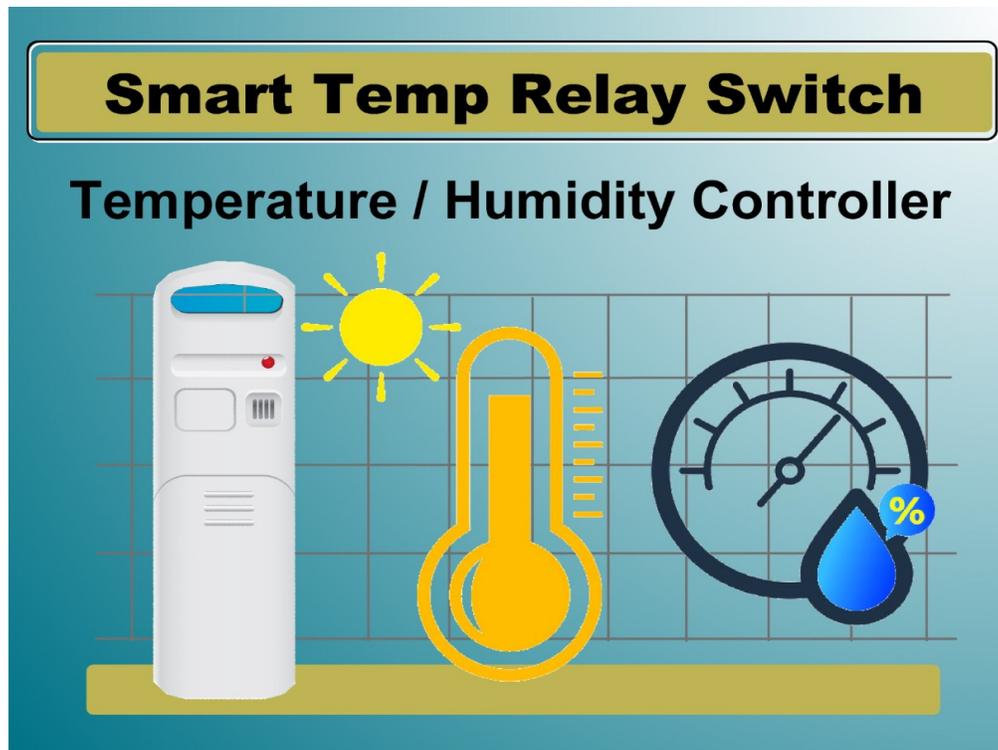


Smart Temperature Relay Switch (STRS)

User Manual



Kenneth Delahoussaye Consulting
web: www.kadtronix.com
email: kadtronix@att.net

Copyright © 2018
All rights reserved

Table of Contents

1 - Introduction.....	<u>4</u>
1.1 - Features.....	<u>5</u>
1.2 - Trigger Activation.....	<u>6</u>
2 - Setup.....	<u>7</u>
3 - Wireless Sensors.....	<u>8</u>
4 - Wired Switches.....	<u>9</u>
5 - TB-1 Wiring Connections.....	<u>10</u>
6 - Windows Host Software.....	<u>11</u>
6.1.1 - Device List.....	<u>12</u>
6.1.2 - Temperature Units.....	<u>16</u>
6.1.3 - Color-Coded Aging.....	<u>16</u>
6.1.4 - Sensor Messages.....	<u>16</u>
6.1.5 - Application Status.....	<u>17</u>
6.2 - Settings.....	<u>18</u>
6.2.1 - Serial Com Port.....	<u>18</u>
6.2.2 - Message Aging.....	<u>19</u>
6.3 - Controller Setup.....	<u>20</u>
6.3.1 - Audio / Visual.....	<u>21</u>
6.3.2 - Wired Switch Inputs.....	<u>22</u>
6.3.3 - Trigger Settings.....	<u>23</u>
6.4 - Sensor Properties.....	<u>26</u>
6.4.1 - Sensor Description.....	<u>28</u>
6.4.2 - Trigger Limits.....	<u>29</u>
6.4.3 - Sensor List.....	<u>34</u>
6.5 - Forced Relay Activation.....	<u>35</u>
6.6 - Enable Audible Alerts.....	<u>36</u>
6.7 - Enable Data Logging.....	<u>36</u>
6.8 - Log Preexisting Triggers.....	<u>37</u>

6.9 - View Data Logs.....	<u>38</u>
7 - ASCII Commands.....	<u>40</u>
7.1 - Settings.....	<u>42</u>
7.1.1 - Assign General Settings.....	<u>42</u>
7.1.2 - Retrieve General Settings.....	<u>44</u>
7.1.3 - Assign RF Sensor Settings.....	<u>45</u>
7.1.4 - Retrieve RF Sensor Settings.....	<u>46</u>
7.1.5 - Restore Default Settings.....	<u>46</u>
7.2 - Peripheral Activation.....	<u>47</u>
7.2.1 - Activate Relay.....	<u>47</u>
7.2.2 - Activate Beeper.....	<u>47</u>
7.3 - Miscellaneous Commands.....	<u>48</u>
7.3.1 - Clear Sensor States.....	<u>48</u>
7.3.2 - Get Firmware Version.....	<u>49</u>
7.3.3 - RF Signal Test.....	<u>49</u>
8 - ASCII Data Messages.....	<u>50</u>
8.1.1 - Format.....	<u>50</u>
8.1.2 - Decoding.....	<u>51</u>
8.1.2.1 Trigger / Relay Status.....	<u>51</u>
8.1.2.2 Measurement Data.....	<u>52</u>
8.1.2.3 Trigger Processing Indicator.....	<u>54</u>
8.1.2.4 High Temperature Limit.....	<u>54</u>
8.1.2.5 Low Temperature Limit.....	<u>54</u>
8.1.2.6 High Relative Humidity Limit.....	<u>55</u>
8.1.2.7 Low Relative Humidity Limit.....	<u>55</u>
8.1.2.8 Sum.....	<u>56</u>
9 - Care and Maintenance.....	<u>57</u>
10 - Warranty.....	<u>58</u>
11 - Contact Information.....	<u>59</u>

1 - Introduction

The Smart Temperature Relay Switch (STRS) provides switched control of user equipment based on specified trigger criteria. Useful in a vast array of applications, the STRS is designed to provide many years of reliable operation.

Companion Windows application software permits configuration of a variety of settings including trigger limits (temperature and/or relative humidity). The STRS communicates with the host PC via a USB-to-RS232 adapter cable (included). Once configuration is complete, the Windows application is no longer needed (unless [logging](#) is desired).

The STRS accepts wireless (RF) sensors as well as optional wired peripherals such as temperature-activated switches. (Virtually any non-voltage switch may be an acceptable wired input.) The system is expandable up to four (4) wireless sensors and four (4) wired switches.

The STRS is ideally suited for any application where it may be necessary to evoke an action based on changes in temperature and/or relative humidity such as the following:

- Exhaust systems
- Farming & agriculture
- Climate control
- Greenhouse monitoring
- Environmental control
- Industrial automation
- Plant & produce cultivation
- Freezer alarms & refrigeration systems



1.1 - Features

The STRS provides an array of viable features and options:

- Configurable settings including setpoint triggers for temperature and/or relative humidity
- Four (4) LED indicators show trigger status:
 - Trigger-pending = solid red
 - Trigger-active = flashing red
- Available low-cost RF sensors for remote temperature/humidity monitoring. Applicable temperature range listed below (Celsius and Fahrenheit).
 - -40 deg.C to 70 deg.C
 - -40 deg.F to 158 deg.F

Note: Accurate to +/- 2 deg.F

- Applicable humidity range listed below:
 - 1% to 99%

Note: Accurate to +/- 3%, +/- 5%

- Four (4) wired inputs for optional wired switches, thermostats, etc.
- Expandable up to four (4) RF sensors and four (4) wired switches
- Onboard Form-C relay (contact ratings: 10A @ 125VAC, 6A @ 277VAC, 5A @ 30VDC)
- Windows host monitoring via USB (adapter cable included)
- DB-9F (female) connector

1.2 - Trigger Activation

The STRS utilizes compatible wireless sensors for transmitting temperature and relative humidity measurements. You may define [trigger limits](#) values relevant to these measurements. For each desired sensor, a unique set of high and low limits can be configured.

Note: Limits may be defined for temperature and/or relative humidity.

A trigger activation occurs when a defined temperature or humidity [trigger limit](#) is breached. The violation can result in relay activation and/or piezo (beeper) annunciation, depending on your prescribed [trigger settings](#).

Note: Optional [wired switches](#) may also be utilized to generate trigger activations.

2 - Setup

Setup primarily involves the following operations:

- Install USB drivers (using the CD included with the adapter cable)
- Install STRS host application software (using download file “strs_setup.zip”).
- Connect the USB adapter cable (DB-9 end to STRS controller and USB end to the host PC)
- Connect the AC power adapter (barrel plug end to STRS controller and opposite end to a 110vac outlet).

Additional setup & installation details are provided in subsequent sections of this manual.

3 - Wireless Sensors

The following Acurite wireless (RF) devices are compatible:

- 6002M - Temperature + humidity, indoor/outdoor, a.k.a, 6002RM, 592TXR
- 6044M - Temperature + humidity, indoor only, featuring LCD display
- 6053M - Range extender/repeater, indoor/outdoor

Follow the instructions included with your Acurite device for installation instructions and operational details.

Notes:

- *Acurite sensors typically include a channel select switch (A, B, or C). The STRS places no dependence on this setting. Therefore, you may choose any desired channel.*

4 - Wired Switches

WARNING: Be sure that power is disconnected until all wiring has been completed and verified.

The STRS controller accepts four optional wired peripherals such as push-button switches, temperature-activated switches, thermostats, etc. (Virtually any non-voltage switch may be applied to a wired input.) To apply your switch device to a wired input, perform the following operations:

- Disconnect the STRS power source.
- Detach cover by removing the retaining screws.
- Locate the 14-position wiring terminal connector. (Refer to [TB-1 Wiring Connections](#).)
- Attach wires as necessary, being careful to utilize the proper wire slots. (Each switch has a designated input terminal and a return.)
- Replace the cover and secure with retaining screws.
- Restore power to the STRS controller.

Note: Wired switch input(s) must be appropriately [configured and enabled](#).

5 - TB-1 Wiring Connections

The STRS controller provides a 14-position wiring block with the following screw terminal connections.

Terminal	Description
1	+12VDC in/out
2	Ground
3	Reset (active-low)
4	Wired switch / thermostat #1
5	Wired switch / thermostat #2
6	Wired switch / thermostat #3
7	Wired switch / thermostat #4
8	Switch return #1
9	Switch return #2
10	Switch return #3
11	Switch return #4
12	Relay contact - COM
13	Relay contact - N/C
14	Relay contact - N/O

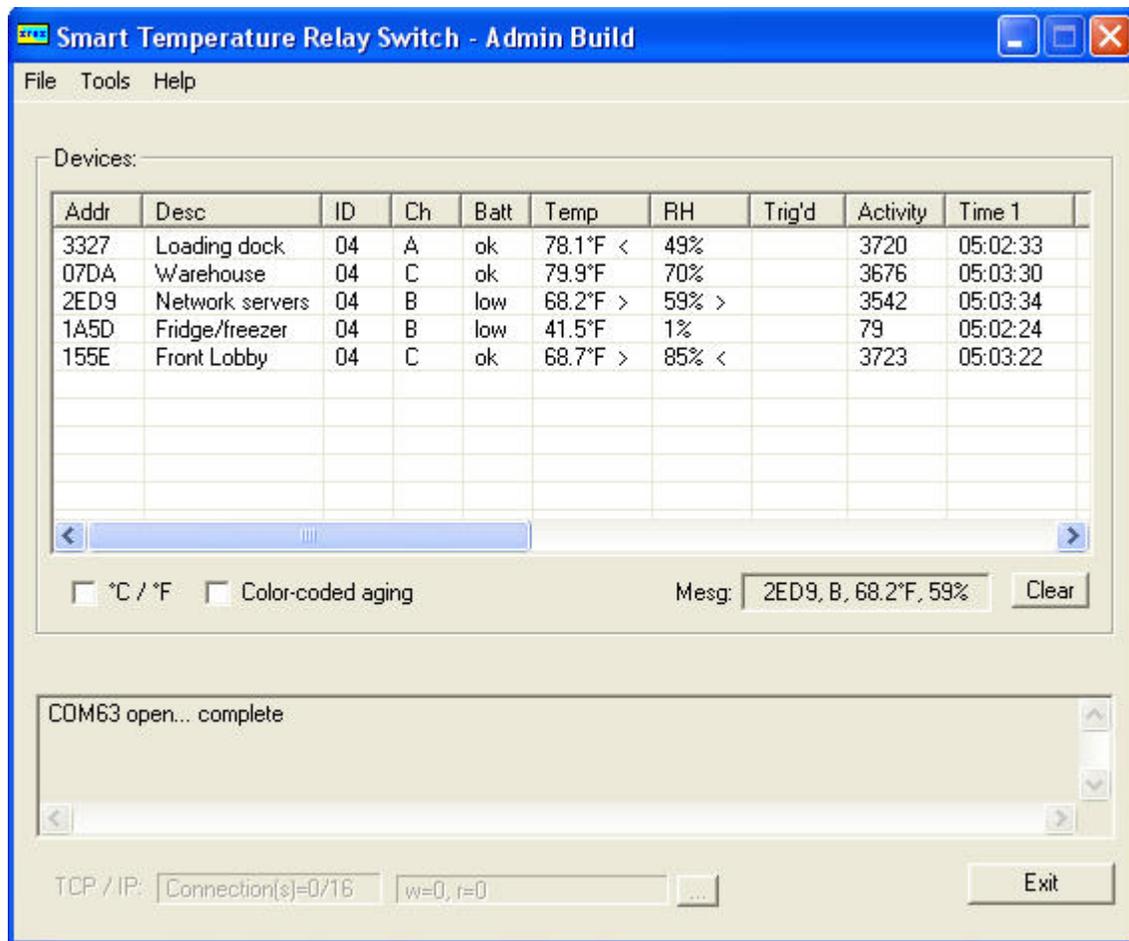
Notes:

- *Only a subset of the above connections will be required in a given application.*
- *If supplying your own power source at terminals 1 & 2, do not also concurrently provide power with the ac adapter at the barrel connector.*

6 - Windows Host Software

Available STRS host software for Windows provides functionality for configuring trigger parameters as well as performing realtime monitoring. The following is a summary list of software features

- Establish trigger parameters
- Monitor sensor measurement



These are the requirements for installing the host software on your PC or laptop computer:

- Pentium or compatible CPU
- 8 MB RAM
- 1 MB available hard disk space
- 1 available RS-232 or USB port
- Windows XP or higher

6.1.1 - Device List

The device list shows a collection of detected sensor devices and their operating parameters.

Addr	Desc	ID	Ch	Batt	Temp	RH	Trig'd	Activity	Time 1
3327	Loading dock	04	A	ok	78.1°F	49%		3733	05:07:26
07DA	Warehouse	04	C	ok	79.9°F	70%		3687	05:07:02
2ED9	Network servers	04	B	low	68.5°F >	58%		3555	05:07:30
1A5D	Fridge/freezer	04	B	low	41.5°F	1%		79	05:02:24
155E	Front Lobby	04	C	ok	70.0°F >	79% <		3736	05:07:28

Use the horizontal scroll bar to display additional data columns.

3	Tr En.	Tr Hi Tm	Tr Lo Tm	Tr Hi RH	Tr Lo RH	Tm Max - Min	RH Max - Min
05	Y	-	50.0°F	-	-	80.2°F , 77.9°F	51% , 49%
56	?	-	-	-	-	86.7°F , 79.9°F	71% , 63%
49	Y	70.0°F	-	65%	40%	77.5°F , 64.2°F	64% , 54%
31	Y	50.0°F	-	-	-	44.8°F , 41.2°F	01% , 01%
49	Y	79.9°F	64.8°F	-	-	80.6°F , 59.4°F	95% , 55%

Each row corresponds to a particular sensor, while each column shows a specific detail or data parameter as listed below:

- Addr – numeric sensor address, displayed in hexadecimal format.
- Desc – user-specified description and/or location for the sensor.
- ID – device identifier (specified by the sensor manufacturer).
- Ch – channel code (selectable at the sensor).
- Batt – battery status (“ok” / “low”).

- Temp – temperature (reported in degrees Fahrenheit or degrees Celsius, depending on the selected [temperature units](#)).

Notes:

- [Trigger-activated](#) temperature data will be indicated by a flashing (blinking) measurement reading.
- The application provides an automatic trending feature. When a trend is detected, the appropriate indicator is shown to the right of the measurement:
 - > - indicates upward (increasing) trend
 - < - indicates downward (decreasing) trend
- RH – relative humidity, a reading that occurs in the range of 0 to 100%.
 - [Trigger-activated](#) relative humidity data will be indicated by a flashing (blinking) measurement reading.
 - The application provides an automatic trending feature. When a trend is detected, the appropriate indicator is shown to the right of the measurement:
 - > - indicates upward (increasing) trend
 - < - indicates downward (decreasing) trend
- Trig'd – reports whether the temperature and/or humidity measurement(s) have resulted in a [trigger event](#) (i.e., relay activation). One of the following indicators will be shown:
 - “T” - the temperature has reached a high or low limit threshold, resulting in a trigger-ready condition (see note).
 - “RH” - the relative-humidity has reached a high or low limit threshold, resulting in a trigger-ready condition (see note).
 - None - the field is blank or empty when there is no [trigger activation](#).

Note: A trigger-ready measurement is indicated by a reading that is shown flashing (blinking). [Trigger-activation](#) occurs when the following conditions are met for a trigger-ready measurement:

- [Pre-trigger delay](#) has elapsed, if applicable
- Trigger activation is not already in progress (by another sensor)

- Activity – numeric counter that increments for every data message received from the sensor.

Note: Activity counters are derived by the Windows host application. They are not initiated by the controller device.

- Time 1, 2, 3 – three adjacent columns of timestamp data. Each column records the time at which sensor measurements were captured. Time 1 is the most recent capture.

Note: Time values are derived by the Windows host application. They are not initiated by the controller device.

- Tr En. – trigger-enable indicates whether triggering is enabled for the specified sensor. One of the following indicators will be shown:

- “Y” - enabled.
- “N” - disabled
- “?” - triggering is not applicable for the designated sensor. This occurs when the sensor is not defined in one of the controller's list of four available trigger slots.

- Tr Hi Tm – the high temperature trigger defines the upper limit temperature threshold. A [trigger activation](#) occurs when the current temperature rises to this level. Symbol “-” indicates the parameter is undefined, i.e., there is no high temperature limit.

- Tr Lo Tm – the low temperature trigger defines the lower limit temperature threshold. A [trigger activation](#) occurs when the current temperature drops to this level. Symbol “-” indicates the parameter is undefined, i.e., there is no low temperature limit.

- Tr Hi RH – the high humidity trigger defines the upper limit relative-humidity threshold. A [trigger activation](#) occurs when the current relative-humidity rises to this level. Symbol “-” indicates the parameter is undefined, i.e., there is no high relative-humidity limit.

- Tr Lo RH – the low humidity trigger defines the lower limit relative-humidity threshold. A [trigger activation](#) occurs when the current relative-humidity drops to this level. Symbol “-” indicates the parameter is undefined, i.e., there is no low relative-humidity limit.

- Tm Max - Min – this column displays the maximum and minimum temperature readings.

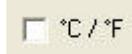
Note: Max / Min values are derived by the Windows host application. They are not initiated by the controller device.

- RH Max - Min – this column displays the maximum and minimum relative-humidity readings.

Note: Max / Min values are derived by the Windows host application. They are not initiated by the controller device.

6.1.2 - Temperature Units

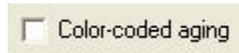
This check-box control selects the preferred units for displaying temperature measurements. Choose Fahrenheit (°F) or Celsius (°C).



For Celsius units, the box must be checked.

6.1.3 - Color-Coded Aging

The aging feature permits you to visually determine the relative age of displayed sensor data.



When enabled, each row of sensor data within the device list will be assigned a background color. If a new sensor data message is not received in a timely manner, its corresponding row color will automatically change to indicate the anomaly. Refer to [Message Aging](#) for color assignment details.

6.1.4 - Sensor Messages

When a sensor message is received, the data is displayed in the message field, shown below:

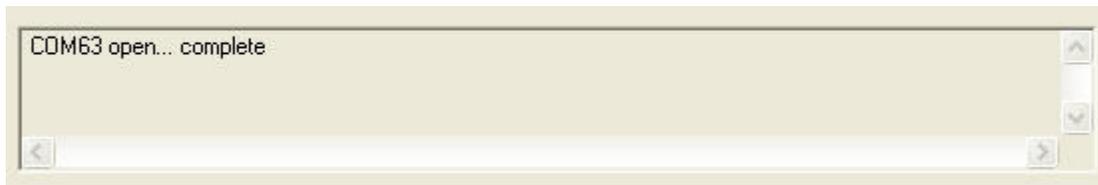
Mesg: 3327, A, 78.3°F, 49%

Compatible sensors transmit data on a periodic basis, typically every 16 seconds. Each received data message contains the following elements:

- Sensor address (e.g., 3327)
- Channel (e.g., A)
- Temperature (e.g., 78.3 °F)
- Relative humidity (e.g., 49%)

6.1.5 - Application Status

The lower edit field contains status and event messaging.

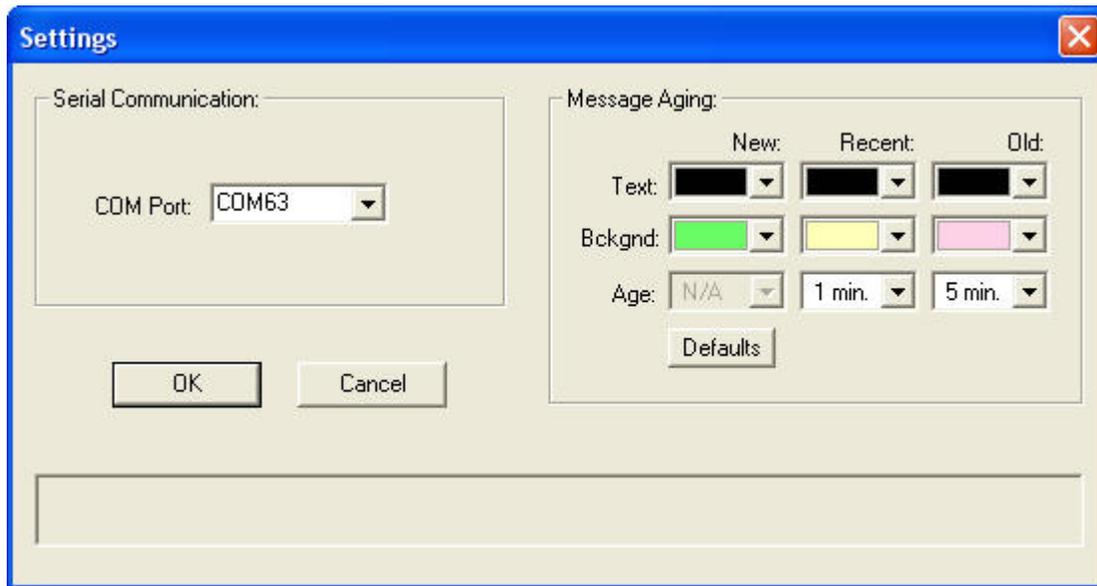


One of the primary purposes for this field is to provide com port status. (Refer to [Serial Com Port](#) for details.)

6.2 - Settings

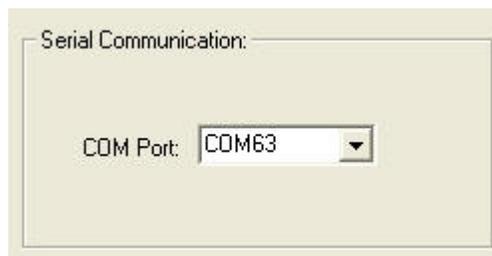
The setting option provides fields for specifying the serial com port and message aging colors. The following menu item invokes program settings:

File → Settings...



6.2.1 - Serial Com Port

The com port selection enables communication with the STRS controller.

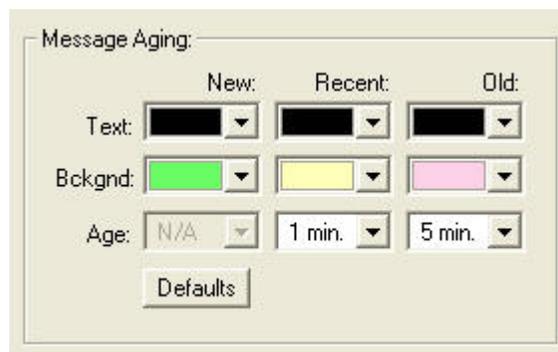


Use the combo-box to select the virtual com port associated with your USB adapter cable.

6.2.2 - Message Aging

The application receives periodic [sensor messages](#) from the STRS controller. These messages report temperature and humidity conditions along with other pertinent data. Message aging is useful for identifying possible sensor device issues. It permits you to choose appropriate colors (text and background) for identifying the age of sensor messages.

Newly received messages can be displayed in one chosen set of colors, while older (stale) messages can be shown differently. (Compatible sensors transmit data on a periodic basis, typically every 16 seconds.) Use the combo-box controls to select the desired text and background colors. You may also designate the desired aging time periods for old and recent messages.



The image shows a 'Message Aging' configuration dialog box. It has three columns for 'New:', 'Recent:', and 'Old:' messages. Each column has three rows of controls: 'Text' (color selection), 'Bckgnd' (background color selection), and 'Age' (time period selection). A 'Defaults' button is located at the bottom.

	New:	Recent:	Old:
Text:	[Black]	[Black]	[Black]
Bckgnd:	[Green]	[Yellow]	[Pink]
Age:	[N/A]	[1 min.]	[5 min.]

In the listing below, the application has received new data from all sensors shown in green. However, the sensor designated at address 1A5D is shown in pink, indicating nothing has been received in more than 5 minutes.



The image shows a table of sensor data. The table has 10 columns: Addr, Desc, ID, Ch, Batt, Temp, RH, Trig'd, Activity, and Time 1. The rows are color-coded: green for recent data and pink for old data. The row for address 1A5D is pink, indicating it is old data.

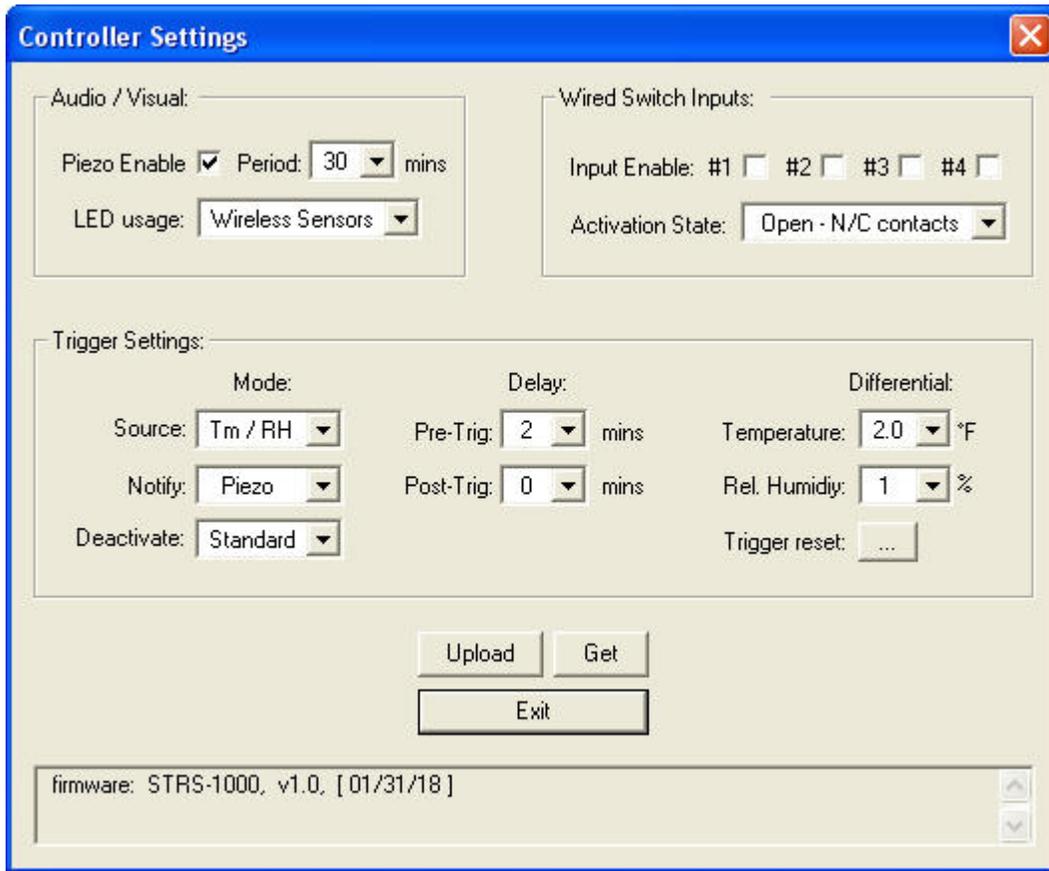
Addr	Desc	ID	Ch	Batt	Temp	RH	Trig'd	Activity	Time 1
3327	Loading dock	04	A	ok	78.1°F	50%		4952	06:19:23
07DA	Warehouse	04	C	ok	81.0°F	87%		4956	06:19:33
2ED9	Network servers	04	B	low	69.6°F >	60%		4736	06:19:32
1A5D	Fridge/freezer	04	B	low	40.8°F	14%		291	05:44:20
155E	Front Lobby	04	C	ok	72.9°F	77% <		4938	06:19:28

Note: Message aging is [enabled](#) with a check-box on the main display.

6.3 - Controller Setup

The controller setup page establishes operating parameters for the STRS device. It is invoked with the following menu item selection:

Tools → Controller Setup...



The screenshot shows a window titled "Controller Settings" with a blue title bar and a close button (X) in the top right corner. The window is divided into several sections:

- Audio / Visual:** Contains a "Piezo Enable" checkbox which is checked, a "Period" dropdown menu set to "30" with "mins" to its right, and an "LED usage" dropdown menu set to "Wireless Sensors".
- Wired Switch Inputs:** Contains four "Input Enable" checkboxes labeled #1, #2, #3, and #4, all of which are unchecked. Below them is an "Activation State" dropdown menu set to "Open - N/C contacts".
- Trigger Settings:** A larger section containing three columns of controls:
 - Mode:** "Source" dropdown set to "Tm / RH", "Notify" dropdown set to "Piezo", and "Deactivate" dropdown set to "Standard".
 - Delay:** "Pre-Trig" dropdown set to "2" with "mins" to its right, and "Post-Trig" dropdown set to "0" with "mins" to its right.
 - Differential:** "Temperature" dropdown set to "2.0" with "°F" to its right, "Rel. Humidity" dropdown set to "1" with "%" to its right, and a "Trigger reset" button with an ellipsis "...".

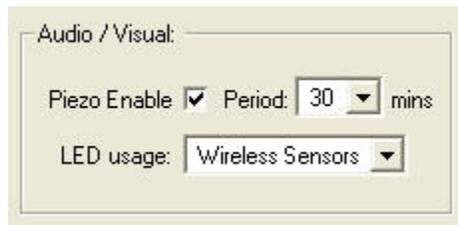
At the bottom of the window, there are three buttons: "Upload", "Get", and "Exit". Below the buttons is a text area containing the text "firmware: STRS-1000, v1.0, [01/31/18]" with scroll arrows on the right side.

Individual field controls are described in subsequent sections.

Note: Settings are stored and maintained at the STRS controller. User changes and adjustments do not take effect until they are uploaded.

6.3.1 - Audio / Visual

The STRS controller provides both audible and visual options for identifying [trigger activity](#).



Audio / Visual:

Piezo Enable Period: 30 mins

LED usage: Wireless Sensors

Field descriptions are listed below:

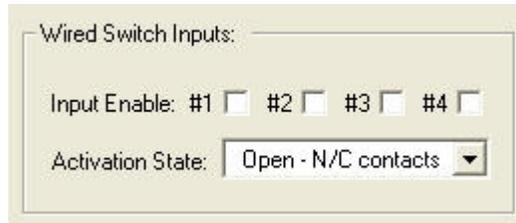
- Piezo Enable – this check-box enables audible beeper annunciation. When enabled, it permits the beeper to sound when a [trigger activation](#) occurs. Use the adjacent selector to choose the notification period. (The beeper will sound at this periodic rate until the the [trigger activation](#) event has cleared.)

Note: Piezo (beeper) annunciation requires appropriate trigger notification. See [Trigger Settings](#) for details.

- LED Usage – defines LED utilization. Four red LEDs are available at the STRS controller for the purpose of indicating trigger status for compatible sensors. Each LED corresponds to one of four possible trigger slots. Depending on the selection, they can be utilized to represent wired switches or wireless sensors:

6.3.2 - Wired Switch Inputs

The STRS controller accepts up to four wired switch inputs. [Wired switch](#) activation has the same [trigger activation](#) effect as wireless temperature/humidity sensors.



Wired Switch Inputs:

Input Enable: #1 #2 #3 #4

Activation State: Open - N/C contacts ▼

Each of the four available wired switch inputs may be utilized to evoke [trigger activations](#). To enable one or more inputs, use the appropriate check-boxes. You must also choose the activation state that represents the applicable switch contacts:

- N/C – normally-closed contacts (i.e., activation occurs when the circuit opens)
- N/O – normally-open contacts (i.e., activation occurs when the circuit closes)

. Refer to the [wiring terminal block](#) layout for switch wiring details.

6.3.3 - Trigger Settings

These settings permit you to define the behavior of [trigger activations](#).

Trigger Settings:

Mode:	Delay:	Differential:
Source: Tm / RH	Pre-Trig: 2 mins	Temperature: 2.0 °F
Notify: Piezo	Post-Trig: 0 mins	Rel. Humidity: 1 %
Deactivate: Standard		Trigger reset: ...

Relevant fields are described below:

- Source – defines allowable [trigger activation](#) source(s). Choose one of the following:
 - Disabled – no trigger source
 - Temp – temperature only
 - Humidity – relative humidity only
 - Tm / RH – both temperature and relative humidity

Note: The source field applies only to wireless sensors. It has no effect on [wired switch inputs](#).

- Notify Mode – selects the action to perform in response to a [trigger activation](#) event. The following notifications are possible:
 - None – no notifications
 - Relay – activate relay
 - Piezo – sound the piezo (beeper)
 - Rly / Pz – activate the relay and sound the beeper

- Deactivate Mode – Defines the preferred deactivation method. Deactivation occurs when a [trigger activation](#) event clears (i.e., the violating measurement returns to the normal, pre-trigger range). The following deactivation mode selections are available:
 - Standard – Deactivate when the measurement returns to the normal, pre-trigger range and remains so for a minimum time period specified by the post-trigger delay field.
 - Automatic – Deactivate after the time period specified by the post-trigger delay field, regardless of whether the measurement has returned to the normal, pre-trigger range.
- Pre-Trig Delay – A pre-trigger delay is invoked following a measurement [trigger limit](#) breach. It is the time period that must elapse before [trigger activation](#) can occur. A [trigger activation](#) is invoked only if the breach endures for the entire pre-trigger duration. Select a delay period in the range of 0 to 60 minutes.
- Post-Trig Delay – A post-trigger delay is invoked when a breached measurement returns to the normal, pre-trigger state. It is the time period that must elapse before the [trigger activation](#) event clears. The [trigger activation](#) event clears only if the measurement remains in the normal, pre-trigger state for the entire post-trigger duration. Select a delay period in the range of 0 to 60 minutes.
- Temperature Differential – Defines the minimum change in temperature that must occur below the [trigger limit](#) threshold before a breached measurement is considered eligible to return to the normal, pre-trigger state. It is useful in guarding against trigger toggling, an unwanted effect that occurs when the current temperature “hovers” at or near a [trigger limit](#) threshold. Without an appropriate differential, there can be repetitive trigger activation and subsequent deactivation as the temperature fluctuates back and forth across the [trigger limit](#) threshold.
- Rel. Humidity Differential – Defines the minimum change in relative humidity that must occur below the [trigger limit](#) threshold before a breached measurement is considered eligible to return to the normal, pre-trigger state. It is useful in guarding against trigger toggling, an unwanted effect that occurs when the current relative humidity “hovers” at or near a [trigger limit](#) threshold. Without an appropriate differential, there can be repetitive trigger activation and subsequent deactivation as the humidity fluctuates back and forth across the [trigger limit](#) threshold.

- Trigger Reset – Use this button to cancel an existing [trigger activation](#) or reset a pending one. Doing so deactivates the relay (if activated), and directs the STRS controller to a known, stable state. This function may be especially useful following settings adjustments.

Note: If the measurement has breached a [trigger limit](#) threshold and endures in that state, then a trigger reset (cancel) has only a temporary effect. Until the measurement returns to a normal, pre-trigger state, a canceled trigger will simply re-activate.

- Upload – Settings changes must be subsequently issued to the STRS controller where they are stored and invoked. Use the upload button to transmit the field values to the controller. (Requires compatible USB-to-RS232 adapter cable.)
- Get – Use this button to retrieve (download) current settings from the STRS controller. Display fields will be updated accordingly. (Requires compatible USB-to-RS232 adapter cable.)
- Exit – The exit button closes the settings page.

6.4 - Sensor Properties

The Sensor Properties page provides the means to specify [trigger activation](#) attributes for your sensor(s). It is invoked with the following menu item selection:

Tools → Sensor Properties...

Select:

Addr: 3327 Desc: Loading dock

Trigger Limits:

Slot	Addr	Label	- Temperature °F -		- Rel. Humidity % -		Edit	Clear
			High	Low	High	Low		
1: <input checked="" type="checkbox"/>	3327	Loading dock	-	50.0	-	-	...	...
2: <input checked="" type="checkbox"/>	2ED9	Network servers	70.0	-	65	40	...	...
3: <input checked="" type="checkbox"/>	1A5D	Fridge/freezer	50.0	-	-	-	...	...
4: <input checked="" type="checkbox"/>	155E	Front Lobby	79.9	64.8	-	-	...	...

Upload Get Trigger Reset...

ok

Device List:

Address	Label / Description	Tr En.	Tr Hi Tm	Tr Low Tm	Tr Hi RH	Tr Low RH
3327	Loading dock	Y	-	50.0	-	-
07DA	Warehouse	-	-	-	-	-
2ED9	Network servers	Y	70.0	-	65	40
1A5D	Fridge/freezer	Y	50.0	-	-	-
155E	Front Lobby	Y	79.9	64.8	-	-

Controller Settings... Delete... OK Cancel

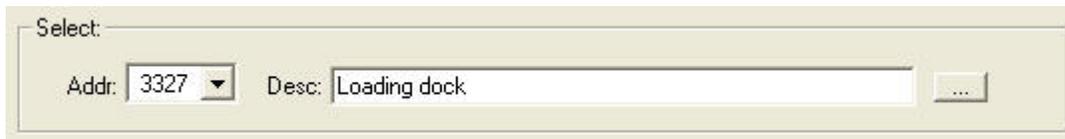
There are four (4) available trigger slots. Each slot can be assigned a wireless sensor for the purpose of [trigger activation](#).

Notes

- *Available sensors are shown in the device list at the bottom of the properties page. While the STRS controller can detect an unlimited number of sensors, only four (4) can be earmarked for [trigger activation](#).*
- *[Wired switches](#) may also cause [trigger activations](#), but do not require trigger slot assignment. Refer to [Wired Switch Inputs](#) for details.*

6.4.1 - Sensor Description

Specify a descriptive label that identifies the sensor.



The image shows a screenshot of a web-based form for configuring a sensor. The form is titled "Select:" and contains two main input fields. The first field is labeled "Addr:" and is a drop-down menu with the value "3327" selected. The second field is labeled "Desc:" and is a text input field containing the text "Loading dock". To the right of the "Desc:" field is a small button with three dots "...".

Relevant fields are listed below:

- Addr – This drop-down combo-box allows you to select the desired sensor.
Note: Sensors are distinguished by unique address. Displayed in four-digit hexadecimal format, this numeric identifier is encoded by the device manufacturer.
- Desc – Supply a description that identifies the sensor's purpose and/or location.
Note: The description is a convenience intended to make sensor identification easier.

6.4.2 - Trigger Limits

These controls permit you to set desired limits for specified sensor(s). Applicable to temperature and/or relative humidity measurements, breached limits invoke [trigger activations](#).

Slot:	Addr:	Label:	- Temperature °F -		- Rel. Humidity % -		Edit:	Clear:
			High:	Low:	High:	Low:		
1: <input checked="" type="checkbox"/>	3327	Loading dock	-	50.0	-	-	...	...
2: <input checked="" type="checkbox"/>	2ED9	Network servers	70.0	-	65	40	...	...
3: <input checked="" type="checkbox"/>	1A5D	Fridge/freezer	50.0	-	-	-	...	...
4: <input checked="" type="checkbox"/>	155E	Front Lobby	79.9	64.8	-	-	...	...

Upload Get Trigger Reset...

Trigger slots support limits assignment for as many as four (4) wireless sensors. Create optional high and/or low limits using available fields.

Slot:	Addr:	Label:	- Temperature °F -		- Rel. Humidity % -		Edit:	Clear:
			High:	Low:	High:	Low:		
1: <input checked="" type="checkbox"/>	3327	Loading dock	-	50.0	-	-	...	...

Relevant fields are listed below:

- Slot – Use this check-box to enable or disable [trigger activation](#) for the given sensor.
- Addr – This drop-down combo-box allows you to select the desired sensor.

Note: Sensors are distinguished by unique address. Displayed in four-digit hexadecimal format, this numeric identifier is encoded by the device manufacturer.

- Label – Identifies the sensor's purpose and/or location.

- High Temperature (limit) – Trigger activation occurs when the current temperature ascends to this value or above. (An unassigned value, indicated by “-”, disables the limit.)

Note: A breached measurement remains triggered until it returns to the normal, pre-trigger range and complies with the specified differential setting.

- Low Temperature (limit) – Trigger activation occurs when the current temperature descends to this value or below. (An unassigned value, indicated by “-”, disables the limit.)

Note: A breached measurement remains triggered until it returns to the normal, pre-trigger range and complies with the specified differential setting.

- High Rel. Humidity (limit) – Trigger activation occurs when the current relative humidity ascends to this value or above. (An unassigned value, indicated by “-”, disables the limit.)

Note: A breached measurement remains triggered until it returns to the normal, pre-trigger range and complies with the specified differential setting.

- Low Rel. Humidity (limit) – Trigger activation occurs when the current relative humidity descends to this value or below. (An unassigned value, indicated by “-”, disables the limit.)

Note: A breached measurement remains triggered until it returns to the normal, pre-trigger range and complies with the specified differential setting.

- Trigger Reset – Use this button to cancel an existing [trigger activation](#) or reset a pending one. Doing so deactivates the relay (if activated), and directs the STRS controller to a known, stable state. This function may be especially useful following settings adjustments.

Note: If the measurement has breached a [trigger limit](#) threshold and endures in that state, then a trigger reset (cancel) has only a temporary effect. Until the measurement returns to a normal, pre-trigger state, a canceled trigger will simply re-activate.

- Upload – Settings changes must be subsequently issued to the STRS controller where they are stored and invoked. Use the upload button to transmit the field values to the controller. (Requires compatible USB-to-RS232 adapter cable.)
- Get – Use this button to retrieve (download) current settings from the STRS controller. Display fields will be updated accordingly. (Requires compatible USB-to-RS232 adapter cable.)
- Controller Settings – Use this button to invoke the [controller setup](#) page.
- Cancel – The cancel button closes the properties page.
- Clear – Four (4) buttons are provided, one per trigger slot. Use the appropriate button to clear the slot fields, removing all content including sensor address, description, and limit values.



- Edit – Four (4) buttons are provided, one per trigger slot. Use the appropriate button as an alternate means to specify or adjust parameters including sensor description and trigger limits. When invoked, the following page appears:

Trigger Slot #1

Enter a description for this sensor: 3327

Loading dock Clear

Select:

Use the checkbox below to enable triggering (necessary if readings from the sensor are to invoke relay activations for equipment control).

Enable

Choose a trigger slot. (The STRS controller supports up to four wireless sensors, each corresponding to a sensor slot for limit triggering.)

Trigger Slot: 1 2 3 4 Clear...

Limits:

- Temperature °F -		- Rel. Humidity % -	
High:	Low:	High:	Low:
-	50.0	-	-
-	-	-	-

OK Cancel

Field details are provided below.

- Supply a description that identifies the sensor's purpose and/or location.

Note: The description is a convenience intended to make sensor identification easier.

Enter a description for this sensor: 3327

Loading dock

- Choose a trigger slot for the sensor. There are four (4) available slots for [trigger activation](#). Use the check-box to enable or disable [trigger activation](#) for the given sensor.

Select:

Use the checkbox below to enable triggering (necessary if readings from the sensor are to invoke relay activations for equipment control).

Enable

Choose a trigger slot. (The STRS controller supports up to four wireless sensors, each corresponding to a sensor slot for limit triggering.)

Trigger Slot: 1 2 3 4

- Define [trigger limit\(s\)](#) for the sensor. (An unassigned value, indicated by “-”, disables the limit.)

Limits:

- Temperature °F -		- Rel. Humidity % -	
High:	Low:	High:	Low:
<input type="text" value="-"/>	<input type="text" value="50.0"/>	<input type="text" value="-"/>	<input type="text" value="-"/>
<input type="button" value="-"/>	<input type="button" value="-"/>	<input type="button" value="-"/>	<input type="button" value="-"/>

6.4.3 - Sensor List

Similar to the [device list](#) that occurs on the main page, this field contains a subset of columns, displaying primarily trigger-related parameters.

Device List:

Address	Label / Description	Tr En.	Tr Hi Tm	Tr Low Tm	Tr Hi RH	Tr Low RH
3327	Loading dock	Y	-	50.0	-	-
07DA	Warehouse	-	-	-	-	-
2ED9	Network servers	Y	70.0	-	65	40
1A5D	Fridge/freezer	Y	50.0	-	-	-
155E	Front Lobby	Y	79.9	64.8	-	-

Using the left mouse button, single-click the desired entry to select a sensor. (You may double-click an entry to invoke trigger-slot editing.)

Use the “Delete...” button to remove an entry from the listing.

Note: The delete button remains grayed (disabled) until a sensor entry is selected from the list.

6.5 - Forced Relay Activation

This option manually activates the STRS relay. It is invoked with the following menu item selection:

Tools → Activate Relay...



Several activation modes are possible:

- ON – Activate
- OFF – Deactivate
- Timed – Activates for the specified period and then deactivates.

Note: Forced relay activation is permissible only in the absence of a trigger activation.

6.6 - Enable Audible Alerts

Use this option to enable or disable audible alerts. If enabled, an alert is announced when a [trigger activation](#) occurs. It is invoked with the following menu item selection:

Tools → Enable Audible Alerts

Notes:

- *Audible alerts are sounded at the host computer and require suitable speakers.*
- *When the feature is enabled, a check-box appears beside the menu selection.*

6.7 - Enable Data Logging

Use this option to enable or disable data logging. If enabled, trigger events will be logged to ASCII data files for subsequent [viewing](#). It is invoked with the following menu item selection:

Tools → Enable Data Logging

Log files will be stored to the following folder:

C:\Program Files\Smart Temperature Relay\Data\drpts

Notes:

- *Audible alerts are sounded at the host computer and require suitable speakers.*
- *[Trigger activation](#) events are captured and logged at the host application.*
- *When the feature is enabled, a check-box appears beside the menu selection.*
- *Logging is available only with the premium software package.*

6.8 - Log Preexisting Triggers

Use this option to log active (preexisting) trigger events. It is utilized in conjunction with [data logging](#) and is invoked with the following menu item selection:

Tools → Log Preexisting Triggers

When enabled, this selection will log active (preexisting) trigger events detected at host application start-up.

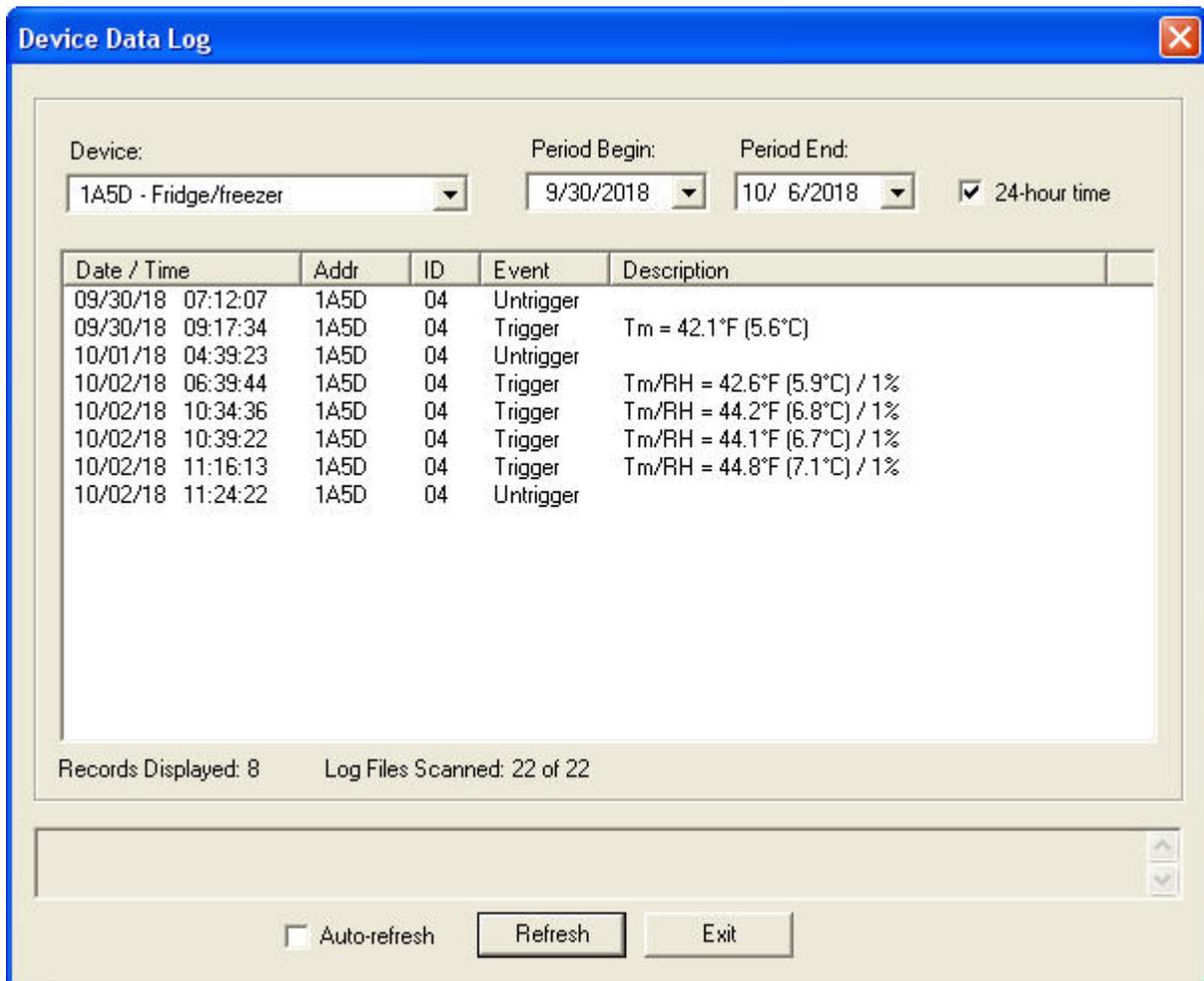
Notes:

- *A preexisting trigger is an ongoing [trigger activation](#) that was initiated prior to host application start-up.*
- *Logging preexisting triggers has the side-effect of storing duplicate instances of the same event. This easily occurs if the host application is terminated and then re-started during a persistent [trigger activation](#).*
- *[Trigger activation](#) events are captured and logged at the host application.*
- *[Data logging](#) must be enabled before this option can be utilized.*
- *When the feature is enabled, a check-box appears beside the menu selection.*
- *Logging is available only with the premium software package.*

6.9 - View Data Logs

This option displays a history of [logged trigger events](#). It is invoked with the following menu item selection:

Tools → View Data Logs...



The screenshot shows a window titled "Device Data Log" with a blue title bar and a close button. The window contains a form for filtering data and a table of log entries.

Device: 1A5D - Fridge/freezer
Period Begin: 9/30/2018
Period End: 10/ 6/2018
 24-hour time

Date / Time	Addr	ID	Event	Description
09/30/18 07:12:07	1A5D	04	Untrigger	
09/30/18 09:17:34	1A5D	04	Trigger	Tm = 42.1°F (5.6°C)
10/01/18 04:39:23	1A5D	04	Untrigger	
10/02/18 06:39:44	1A5D	04	Trigger	Tm/RH = 42.6°F (5.9°C) / 1%
10/02/18 10:34:36	1A5D	04	Trigger	Tm/RH = 44.2°F (6.8°C) / 1%
10/02/18 10:39:22	1A5D	04	Trigger	Tm/RH = 44.1°F (6.7°C) / 1%
10/02/18 11:16:13	1A5D	04	Trigger	Tm/RH = 44.8°F (7.1°C) / 1%
10/02/18 11:24:22	1A5D	04	Untrigger	

Records Displayed: 8 Log Files Scanned: 22 of 22

Auto-refresh Refresh Exit

The upper set of controls comprise a filter for attaining a focused set of data results. Select the sensor device of interest and a range of dates.

Device: Period Begin: Period End: 24-hour time

The listing below displays data records that meet your prescribed filter settings:

Date / Time	Addr	ID	Event	Description
09/30/18 07:12:07	1A5D	04	Untrigger	
09/30/18 09:17:34	1A5D	04	Trigger	Tm = 42.1°F (5.6°C)
10/01/18 04:39:23	1A5D	04	Untrigger	
10/02/18 06:39:44	1A5D	04	Trigger	Tm/RH = 42.6°F (5.9°C) / 1%
10/02/18 10:34:36	1A5D	04	Trigger	Tm/RH = 44.2°F (6.8°C) / 1%
10/02/18 10:39:22	1A5D	04	Trigger	Tm/RH = 44.1°F (6.7°C) / 1%
10/02/18 11:16:13	1A5D	04	Trigger	Tm/RH = 44.8°F (7.1°C) / 1%
10/02/18 11:24:22	1A5D	04	Untrigger	

Use the refresh button to update the record listing. Auto-refresh automatically updates the listing on a periodic basis.

Auto-refresh

Notes:

- *Auto-refresh updates the record listing every 10 seconds.*
- *Logging is available only with the premium software package.*

7 - ASCII Commands

The STRS controller accepts optional ASCII host commands on the RS-232 port (via DB9 connector). Commands are subdivided into the following types:

- Settings
 - Assign general settings
 - Assign RF sensor settings
 - Restore default settings
- Peripheral activation
 - Activate relay
 - Activate beeper
- Miscellaneous commands
 - Clear sensor states
 - Report firmware version
 - RF signal test

All commands are prepended with a special three-byte header sequence. The command header is shown below, indicated in both ASCII text and hexadecimal representations:

Command Header	
ASCII Text	Numeric (Hex)
<code>\SOH \STX ></code>	01 02 3E

All transactions must be appropriately followed by a termination character as shown below:

Terminator	
ASCII Text	Numeric (Hex)
<code>\CR</code>	0D

The example below illustrates a complete command sequence and is shown in both ASCII text and hexadecimal representations:

Command Example (Activate Relay)	
ASCII Text	Numeric (Hex)
<code>\SOH \STX > ! 0 5 \CR</code>	<code>01 02 3E 21 30 35 0D</code>

Notes:

- *The command format contains no spaces. (Spaces are included in the example above only for clarity.)*
- *All command sequences must be preceded by the special 3-byte header. (Subsequent command listings have omitted the header for the sake of clarity.)*
- *Commands which assign parameter setting(s) also allow you to poll/retrieve the current setting(s). To do this, simply issue the command without parameters.*
- *Commands must be terminated with a carriage-return character (13 dec. or 0D hexadecimal). (Subsequent command listings have omitted the terminator for the sake of clarity.)*
- *Unless the command is to return a specific response, the reply will be “ok” if completed successfully. Otherwise, an error string may be reported.*

7.1 - Settings

Settings commands permit you to assign or retrieve those parameters designating operational behavior of the STRS controller. Available commands are listed below:

- Assign / Retrieve General Settings
- Assign / Retrieve RF Sensor Settings
- Restore Default Settings

7.1.1 - Assign General Settings

A number of general settings exist for the purpose of configuring STRS operational parameters. These settings can be set or retrieved at any time and include the following:

- Piezo-enable state
- LED usage
- Wired switch #1 input enable
- Wired switch #2 input enable
- Wired switch #3 input enable
- Wired switch #4 input enable
- Wired switch activation state
- Temperature differential
- Relative humidity differential
- Trigger type
- Activation type
- Trigger deactivation mode
- Pre-trigger delay period
- Post-trigger delay period
- Piezo annunciation period

The command format is defined below:

Command	Syntax	Comment
Assign General Settings (SGS)	SGSPzUsW1W2W3W4WaDtDrTtAtDmPaPiPp	see below
Example: SGS1010001231310000600006001800		
Description: Pz=enabled, Us=wireless, W1=enabled, W2=disabled, W3=disabled, W4=disabled, Wa=open, Dt=23, Dr=1, Tt=both, At=relay, Dm=standard, Pa=60sec, Pi=60sec, Pp=1800sec		

- Pz = Piezo-enabled: **0=disabled**, 1=enabled
- Us = Usage for the 4 red LEDs; **0=wireless sensors**, 1=wired switches
- W1 = Wired switch #1 enable/disable; **0=disable**, 1=enable
- W2 = Wired switch #2 enable/disable; **0=disable**, 1=enable
- W3 = Wired switch #3 enable/disable; **0=disable**, 1=enable
- W4 = Wired switch #4 enable/disable; **0=disable**, 1=enable
- Wa = Wired switch activation state; 0=closed (normally-open), **1=open** (normally-closed)
- Dt = Temperature differential (2 digits); 0 – 99 (tenths of deg.C), **default = 10**
- Dr = Relative humidity differential; 0 – 9 %, **default = 1%**
- Tt = Trigger type (temperature, humidity); 0=disabled, 1=temp, 2=RH, **3=both**
- At = Activation type (relay, periodic piezo); 0=disabled, **1=relay**, 2=piezo, 3=both
- Dm = Trigger deactivation mode; **0=standard** (sensor measurement must return to normal range), 1=auto (trigger deactivates automatically, even if readings have not returned to the normal range)
- Pa = Pre-trigger delay period (5 digits); 0 – 65535 seconds (**default = 0**). Trigger (relay activation) occurs if the sensor continuously reports readings that are outside the normal range for this minimum duration.
- Pi = Post-trigger delay period (5 digits); 0 – 65535 seconds (**default = 0**). A triggered activation is cleared (relay deactivated) when the sensor continuously reports readings that are within the normal range for this minimum duration.
- Pp = Piezo annunciation period (5 digits); 0 – 65535 seconds (**default = 0**). If non-zero, this parameter enables periodic beeper annunciation which occurs at the specified period until the trigger clears. (Note: The piezo setting “Pz” must be enabled.)

Notes:

- *Adjusting certain settings may yield undesirable effects when applied during a triggered or pending-trigger condition. Therefore, you are advised to apply the [Clear Sensor States](#) command immediately following a relevant settings change.*
- *To retrieve existing settings, issue the command with no parameters.*

7.1.2 - Retrieve General Settings

This command retrieves general settings. (Refer to [Assign General Settings](#) for parameter definitions.)

The command format is defined below:

Command	Syntax	Comment
Retrieve General Settings (SGS)	SGS	Request general settings.
Example: SGS		
Response: Pz=0; Us=0; W1=1; W2=0; W3=0; W4=0; Wa=1; Dt=10; Dr=1; Tt=3; At=1; Dm=0; Pa=00060; Pi=00060; Pp=01800		

Notes:

- *This command uses the same mnemonic as [Assign General Settings](#), but without parameters.*

7.1.3 - Assign RF Sensor Settings

This command permits you to assign/modify operational parameters associated with a specified wireless RF sensor. The request provides a means of defining [trigger activation](#) limits. These settings include the following:

- Sensor enable state
- Sensor address
- Sensor ID
- High temperature limit
- Low temperature limit
- High relative humidity limit
- Low relative humidity limit

The command format is defined below:

Command	Syntax	Comment
Assign RF Sensor Settings (STRS)	STRS IxEnAdIdThTlRhRl	see below
Example: STRS31123450040126001250060050		
Description: Ix=3, En=enabled, Ad=12345, Id=4, Th=1260, Tl=1250, Rh=60, Rl=50		

- Ix = sensor index: 0 - 3
- En = enable/disable: 0 = disable, 1 = enable
- Ad = 14-bit sensor address (5 digits), 65535 = n/a
- Id = sensor ID (3 digits)
- Th = high temp. limit (5 digits), tenths deg.C, offset +100 to avoid negative integers, 65535 = n/a
- Tl = low temp. limit (5 digits), tenths deg.C, offset +100 to avoid negative integers, 65535 = n/a
- Rh = high relative humidity limit (3 digits), 255 = n/a
- Rl = low relative humidity limit (3 digits), 255 = n/a

Notes:

- *Temperature and/or relative humidity outside the range defined by high/low limits constitutes a trigger (relay) activation condition.*
- *Adjusting certain settings may yield undesirable effects when applied during a triggered or pending-trigger condition. Therefore, you are advised to apply the [Clear Sensor States](#) command immediately following a relevant settings change.*

7.1.4 - Retrieve RF Sensor Settings

This command retrieves settings associated with wireless RF sensors. (Refer to [Assign RF Sensor Settings](#) for parameter definitions.)

The command format is defined below:

Command	Syntax	Comment
Retrieve RF Sensor Settings (STRS)	STRSIX	Request RF sensor settings.
Example: STRS3		
Response: Ix=3; En=1; Ad=12345; Id=004; Th=1260; Tl=1250; Rh=060; Rl=050		

- Ix = sensor index: 0 - 3

Notes:

- *This command uses the same mnemonic as [Assign RF Sensor Settings](#), but with fewer parameters.*

7.1.5 - Restore Default Settings

This command restores all settings to their original factory-assigned states.

The command format is defined below:

Command	Syntax	Comment
Restore Default Settings (SDS)	SDS	There are no parameters associated with this command.
Example: SDS		

Notes:

For a list of applicable settings, refer to [Assign RF Sensor Settings](#).

7.2 - Peripheral Activation

Peripheral activation commands are used for activating optional onboard peripherals including relay and/or piezo beeper. Available commands are listed below:

- Activate relay
- Activate beeper

7.2.1 - Activate Relay

The onboard relay (if equipped) may be used to activate an external device or specialized equipment. It can be commanded in one of two available methods: 1) activated for a timed duration, or 2) activated on or off for an indefinite period. The command format is defined below:

Command	Syntax	Example	Comment
Activate Relay	!xxxxxx	!00005	Activate relay for 5 seconds
	RELAY=n	RELAY=1	Activate relay (on)

Note: Onboard relay has a switching capacity of 10A @ 125VDC, 5A @ 100VDC

Field designators:

- xxxxxx = 5-digit relay activation period in seconds
- n = activation designator: 0=off, 1=on

7.2.2 - Activate Beeper

The onboard piezo beeper (if equipped) may be used for audible annunciation and can be commanded in one of two available methods: 1) cyclically annunciate on and off for a specified number of repetitions, or 2) annunciate once for a specified duration. The command formats are defined below:

Command	Syntax	Example	Comment
Activate Beeper	&nn	&15	Sound the beeper 1.5 seconds
	&xrrr	&x005	Cycle the beeper (on & off) 5 times

Field designators:

- nn = 2-digit value indicating the activation period in hundreds of milliseconds
- rrr = 3-digit value indicating the number of beeper repetitions to perform

7.3 - Miscellaneous Commands

These commands have specialized purposes in the STRS. The following miscellaneous commands are available:

- Clear sensor states
- Get firmware version
- RF signal test

7.3.1 - Clear Sensor States

On occasion, it may be necessary to reset the STRS state machine, especially when settings changes are desired while a [trigger activation](#) is pending or in progress. This command cancels a trigger and resets the relay to its non-activated state.

The command format is defined below:

Command	Syntax	Comment
Clear Sensor States (CLS)	CLS	There are no parameters associated with this command.
Example: CLS		

Notes:

Settings commands may require cleared sensor states. Refer to [Settings Commands](#) for details.

7.3.2 - Get Firmware Version

This command reports a string containing the firmware version.

The command format is defined below:

Command	Syntax	Comment
Report firmware version (V)	V	Request firmware version.
Example: V		
Response: STRS-1000, v1.0, [01/31/18]		

7.3.3 - RF Signal Test

The RF signal test is an offline test intended only for testing and troubleshooting. Useful for evaluating RF signal strength, the command may be invoked by the host at any time. When invoked, the STRS controller identifies a received sensor signal by illuminating one or more red LED indicators. The number of active LEDs is an indication of signal quality.

The command format is defined below:

Command	Syntax	Comment
RF Signal Test (RFSE)	RFSE	Enable (activate) RF signal test.
RF Signal Test (RFSD)	RFSD	Disable (deactivate) RF signal test.
Example: RFSE		

Notes:

Normal operation ceases during RF signal testing. There will be no [trigger activation](#) until testing is disabled.

8 - ASCII Data Messages

The STRS controller outputs unsolicited sensor data in standard ASCII format via RS-232 (i.e., DB9 connector). The output also includes [trigger activation](#) status and user-specified limits (if applicable). All except the first field are represented in numeric or hexadecimal digits. Data messages contain the following:

- [Trigger activation](#) status & limits
- Sensor channel
- Temperature and relative humidity
- Battery status

8.1.1 - Format

Data message strings are formatted as comma-separated fields:

Tr, X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 X14, En, Th, Tl, Rh, Rl, Sm

- Tr – Trigger/relay status
- X1 – X14 = Sensor data, ASCII-formatted hexadecimal nibbles, 1 through 14
- En = Trigger processing: enabled/disabled (if disabled, limits are bypassed)
- Th = High temp. limit (5 digits), tenths deg.C, offset +100, 65535 = n/a
- Tl = Low temp. limit (5 digits), tenths deg.C, offset +100, 65535 = n/a
- Rh = High relative humidity limit (3 digits), 255 = n/a
- Rl = Low relative humidity limit (3 digits), 255 = n/a
- Sm = binary sum of all ASCII digits in the data string, truncated to two least significant digits and formatted in ASCII decimal

All transactions must be appropriately followed by a termination character:

Terminator	
ASCII Text	Numeric (Hex)
\CR	0D

The example below illustrates a complete data message and is shown in both ASCII text and numeric hexadecimal representations:

Message Example	
ASCII Text	Numeric (Hex)
0,93024421096C6F,1,01266 ,01211,055,045,26\CR	30 2C 39 33 30 32 34 34 32 31 30 39 36 43 36 46 2B 31 2C 30 31 32 36 36 2C 30 31 32 31 31 2C 30 35 35 2C 30 34 35 2C 32 36 0D

8.1.2 - Decoding

Host processing is necessary to decode incoming data message strings. The decode procedure is best explained in the following example message string:

```
0,93024421096C6F,1,01266,01211,055,045,26
```

Subsequent sections detail the parsing procedure for fields comprising the string.

8.1.2.1 Trigger / Relay Status

Begin by deciphering the trigger/relay status indicator:

Trigger /Relay Status “Tr”:

- 0 = no trigger
- 1 = temperature trigger
- 2 = humidity trigger
- 3 = temperature and humidity triggers

Note:

- *Temperature and/or relative humidity outside the range defined by high/low limits constitutes a trigger (relay) activation condition.*

8.1.2.2 Measurement Data

The realtime measurement data is contained in a 14-character field, “X1” - “X14”:

93024421096C6F

Convert ASCII-formatted data from hexadecimal to binary:

Hex:

93 02 44 21 09 6C 6F

Binary:

```
1 0 0 1 0 0 1 1 0 0 0 0 0 0 1 0
0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 1
0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 0
0 1 1 0 1 1 1 1
```

Parse the binary string into individual data fields:

Ch	Address	Bt	ID	Humdity	Temperature	Checksum
10	010011 00000010	01	000100	00100001	00001001 01101100	01101111

Ch - channel identifier (2 bits):

- A = 11
- B = 10
- C = 00

Address - logical address (14 bits)

Device address (unique for each sensor)

Bt - battery status

- Good = 01
- Low = 10

ID - Identifier (6 bits)

Humidity - relative humidity (8-bits, msb is even parity bit)

0 0 1 0 0 0 0 1 -- 8-bit composite value
0 1 0 0 0 0 1 => 33% RH -- 7 bits (parity bit stripped)

Temperature - temperature (16-bits, two msb's are even parity bits)

Raw byte values: 09 6C

0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 0 -- 16-bit composite value
0 0 0 1 0 0 1 1 1 0 1 1 0 0 -- 14 bits (parity bits stripped)
1 0 0 1 1 1 0 1 1 0 0 -- 11 bits (upper 3 bits unused)

1 0 0 1 1 1 0 1 1 0 0 => 1260 -- integer value, raw temp measurement

1260 / 10 = 126.0 -- divide by 10.0
126 - 100 = 26.0 C -- subtract 100, yields degrees C
(26.0 * 1.8) + 32 = 78.8 F -- convert to degrees F

Checksum - error sum (8-bits, unsigned)

Modulo 256 computation on the previous 6 bytes.

In the sample message above, compute as follows:

93 + 02 + 44 + 21 + 09 + 6C = 16F -- Take the sum
16F & FF = 6F -- Mask the high bits, preserving 8 lower bits

8.1.2.3 Trigger Processing Indicator

Decipher the trigger processing indicator:

Trigger processing state, “En”:

- 1 = enabled
- 0 = disabled (see note)
- -1 = indicates the sensor device is unknown to the STRS controller and therefore trigger processing is not applicable and limits are undefined.

Note:

- *If trigger processing is disabled, limits are bypassed*

8.1.2.4 High Temperature Limit

When the actual temperature exceeds the specified high temperature limit, a trigger/activation is invoked. To convert the temperature limit, “Th”, follow the steps outlined below:

$$\begin{aligned} 1266 / 10 &= 126.6 && \text{-- divide by 10.0} \\ 126.6 - 100 &= 26.6 \text{ C} && \text{-- subtract 100, yields degrees C} \\ (26.6 * 1.8) + 32 &= 79.9 \text{ F} && \text{-- convert to degrees F} \end{aligned}$$

Notes:

- *A limit value of 65535 indicates the limit is not defined (i.e., disabled)*
- *-1 indicates the sensor device is unknown to the STRS controller.*
- *Refer to [Assign RF Sensor Settings](#) for additional details.*

8.1.2.5 Low Temperature Limit

When the actual temperature falls below the specified low temperature limit, a trigger/activation is invoked. To convert the temperature limit, “Tl”, follow the steps outlined below:

$$\begin{aligned} 1211 / 10 &= 121.1 && \text{-- divide by 10.0} \\ 121.1 - 100 &= 21.1 \text{ C} && \text{-- subtract 100, yields degrees C} \\ (21.1 * 1.8) + 32 &= 70.0 \text{ F} && \text{-- convert to degrees F} \end{aligned}$$

Notes:

- *A limit value of 65535 indicates the limit is not defined (i.e., disabled)*
- *-1 indicates the sensor device is unknown to the STRS controller.*
- *Refer to [Assign RF Sensor Settings](#) for additional details.*

8.1.2.6 High Relative Humidity Limit

When the actual relative humidity exceeds the specified high relative humidity limit (“Rh”), a trigger/activation is invoked. (No conversion is necessary.)

055 = 55% relative humidity

Notes:

- *A limit value of 255 indicates the limit is not defined (i.e., disabled)*
- *-1 indicates the sensor device is unknown to the STRS controller.*
- *Refer to [Assign RF Sensor Settings](#) for additional details.*

8.1.2.7 Low Relative Humidity Limit

When the actual relative humidity falls below the specified low relative humidity limit (“Rl”), a trigger/activation is invoked.

045 = 45% relative humidity

Notes:

- *A limit value of 255 indicates the limit is not defined (i.e., disabled)*
- *-1 indicates the sensor device is unknown to the STRS controller.*
- *Refer to [Assign RF Sensor Settings](#) for additional details.*

8.1.2.8 Sum

This field (“Sm”) represents a summation of all characters in the data string (excluding the termination character). It provides a means for the host to verify that the string was received properly and without error. Refer to the example data string below:

0,93024421096C6F,1,01266,01211,055,045,**71**

To compute the sum, convert each digit and perform binary addition as shown below:

30 + 2C + 39 + 33 + 30 + 32 + 34 + 34 + 32 + 31 + 30 + 39 +
36 + 43 + 36 + 46 + 2B + 31 + 2C + 30 + 31 + 32 + 36 + 36 +
2C + 30 + 31 + 32 + 31 + 31 + 2C + 30 + 35 + 35 + 2C + 30 +
34 + 35 + 2C

= 7B3 (hexadecimal)

= 1971 (decimal)

Extract the lower two digits:

$1971 \% 100 = 71$

Notes:

- Comma separators are included in the summation
- The terminating character is excluded from the summation
- The two sum characters (shown in bold, blue above) are excluded from the summation

9 - Care and Maintenance

The product requires no special care or maintenance other than protection from direct exposure to the elements. It is vital to shield the hardware from exposure to the elements, hazardous environments, and otherwise extreme conditions.

10 - Warranty

This product is warranted for a period of 1 year from the date of purchase and is guaranteed to be free from defects. The warranty covers the entire unit, except if any part or component has been modified or otherwise converted from its original form. The warranty does not cover damage or failure due to neglect, improper use, or unshielded exposure to moisture, power surges, hazardous environments and the like.

IMPORTANT: The customer is responsible to provide protection against potential over-voltage situations including power surges, spikes, and lightning strikes. The use of adequate surge protection is recommended.

11 - Contact Information

Should you have any questions or comments please contact us :

Delahoussaye Consulting
<http://www.kadtronix.com>
support@kadtronix.com