

Automatic Load Shedding upon High Temperature Alarms with Sentry -48VDC Remote Power Managers

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Purpose

This technical note provides a brief overview and detailed instructions for automating the sending of SNMP Set commands from a networked Microsoft® Windows PC to a Server Technology Sentry -48VDC Remote Power Manager (RPM) to power OFF (load shed) an outlet, or multiple outlets, in response to high temperature alarms received from the Sentry unit. When ambient temperature returns to an acceptable level, any outlets that had been switched OFF can also be automatically switched back ON (Auto-Recover).

Overview

Automated outlet control in response to temperature status data from the temperature probe of a Sentry -48VDC RPM requires the following:

- Trap Receiver® v7.20 utility program
- Net-SNMP v5.5.0 suite of tools
- Networked Microsoft Windows PC
- Sentry -48VDC Remote Power Manager with at least one temperature/humidity (T/H) probe

Configured properly, the system will load shed as follows:

1. Temperatures measured by a Temperature/Humidity probe on a Sentry -48VDC RPM that exceed a pre-defined threshold will cause the Sentry unit to send an SNMP Trap to a destination that is a Windows PC.
2. Trap Receiver running on the Windows PC will receive and decode the trap, then respond by passing data to a batch file during execution of the batch file.
3. The batch file will run a Net-SNMP command, or commands, that sends SNMP Set instructions to the originating Sentry -48VDC Remote Power Manager to change outlets to a powered-OFF state.

An over-threshold temperature will switch OFF outlets. A return-to-normal temperature will switch ON outlets.

A brief description for each component is provided next, followed by detailed instructions with examples.

Trap Receiver[®] Program

Trap Receiver is a free-of-charge program from Network Computing Technologies (TrapReceiver.com) that may be used to receive SNMP traps and respond with an extensive set of actions. Trap Receiver performs raw decoding off the wire and there is no dependency on the Microsoft snmptrap service, although you will have to stop the Microsoft snmptrap service first. Trap Receiver supports full decoding and archiving of SNMP v1 and v2 traps. As each trap is decoded, the data is presented in a user interface window.

An important Trap Receiver feature is to allow the operator to define a watch: an SNMP field, a trigger value, and the action or actions to be taken. Trap Receiver enables the following fields to be watched:

- Community String
- Generic Trap Type
- Sender IP Address
- Sender Object ID
- Specific Trap Type
- Varbind Object ID
- Varbind Value

When a trap is received that contains the specified field with matching value, an action is then performed. The following actions can be taken:

- Explode the trap to multiple destinations.
- Execute a program.
- Generate an e-mail message.
- Play a sound file.
- Discard the trap.

Trap Receiver will be used to watch for temperature status traps from one or more Sentry -48VDC RPM units. Trap Receiver will identify "tempHigh" and "normal" status traps, the IP address of the Sentry unit that sent the trap, and will execute a batch file to respond to the appropriate Sentry unit with an SNMP Set command to switch an outlet OFF or ON, respectively.

Net-SNMP Suite

Net-SNMP is a free-to-use package of various tools relating to the Simple Network Management Protocol, including:

- An extensible agent
- An SNMP library
- Tools to request or set information from SNMP agents
- Tools to generate and handle SNMP traps

Use of the Net-SNMP tools for this technical note is limited to the **snmpset.exe** command. The **snmpset** command will exist in batch files executed by Trap Receiver as actions after a Sentry sends a high-temperature or normal-temperature trap.

Networked Microsoft Windows PC

The solution defined in this technical note requires an always-on PC with a standard installation of the Windows operating system. The applications/programs required are available for 32-bit and 64-bit versions of Windows and have been tested on Windows XP x86 and Windows 7 x64 systems, respectively.

The Microsoft Windows PC must be networked and IP-accessible. The system will act as a management server to run the applications for receiving traps from the Sentry -48VDC RPM unit, and to respond with Net-SNMP **snmpset** commands to control outlets.

Sentry -48VDC Remote Power Manager with T/H Probes

One or more Sentry -48VDC Remote Power Managers (RPMs) are required. Each Sentry RPM must contain at least one combination temperature/humidity (T/H) probe and must be SNMP-enabled. For this technical note it is assumed that all pertinent Sentry units are already installed, configured, operating, and accessible over the TCP/IP network.

The Sentry -48VDC RPM measures temperature and reporting, both over-threshold and return-to-normal temperature states to the networked Microsoft Windows PC through the SNMP Trap. The Sentry -48VDC RPM will also be configured to accept SNMP Set commands that will allow Trap Receiver on the Windows PC to run Net-SNMP **snmpset** commands to control selected outlets.

Instructions

The following instructions define how to accomplish automated temperature-based load shedding and recovery.

Note 1: Screen samples in this document are from a model 4805/35-XLS-12 running firmware release version 5.3s.

Note 2: Examples throughout this document are based on these IP addresses:

Sentry -48VDC Remote Power Manager (RPM) - 10.1.2.135

Microsoft Windows PC - 10.1.2.144

Before You Begin

Make sure that:

- A folder named "Sentry" has been created directly off the root drive. Batch files created as described in this document will be placed in this location.
- Each Sentry switched power distribution unit has been installed on the network, has been assigned a static IP address, and is accessible by a web browser. Refer to the applicable Installation and Operations Manual at www.servertech.com for additional information.

Obtain and Install the Trap Receiver Program

1. Download the Trap Receiver v7.20 program at: <http://trapreceiver.com>. Be sure to select the correct version, either "Windows 7 /Server 2008" or "Windows 7 /Server 2008 64 bit".

Obtain and Install the Net-SNMP Suite

2. Download and install the Net-SNMP v5.5.0 binary package of SNMP tools. Be sure to select the correct version.
 - Standard Windows release, filename: **net-snmp-5.5.0-1.x86.exe**
<http://sourceforge.net/projects/net-snmp/files/net-snmp%20binaries/5.5-binaries/net-snmp-5.5.0-1.x86.exe/download>
 - Windows 64-bit release, filename: **net-snmp-5.5.0-2.x64.exe**
<http://sourceforge.net/projects/net-snmp/files/net-snmp%20binaries/5.5-binaries/net-snmp-5.5.0-2.x64.exe/download>

Note: This document assumes a folder named "Net-SNMP" has been created directly off the root drive (C:\Net-SNMP) and that Net-SNMP has been installed to this location.

Obtain the Sentry Management Information Base (MIB) and Object Identification Tree (OID Tree)

- The following files must be downloaded and saved to the “C:\Net-SNMP\share\snmp\mibs” folder that was created during the Net-SNMP installation:

Sentry3.MIB: <ftp://ftp.servertech.com/pub/SNMP/sentry3/Sentry3.mib>

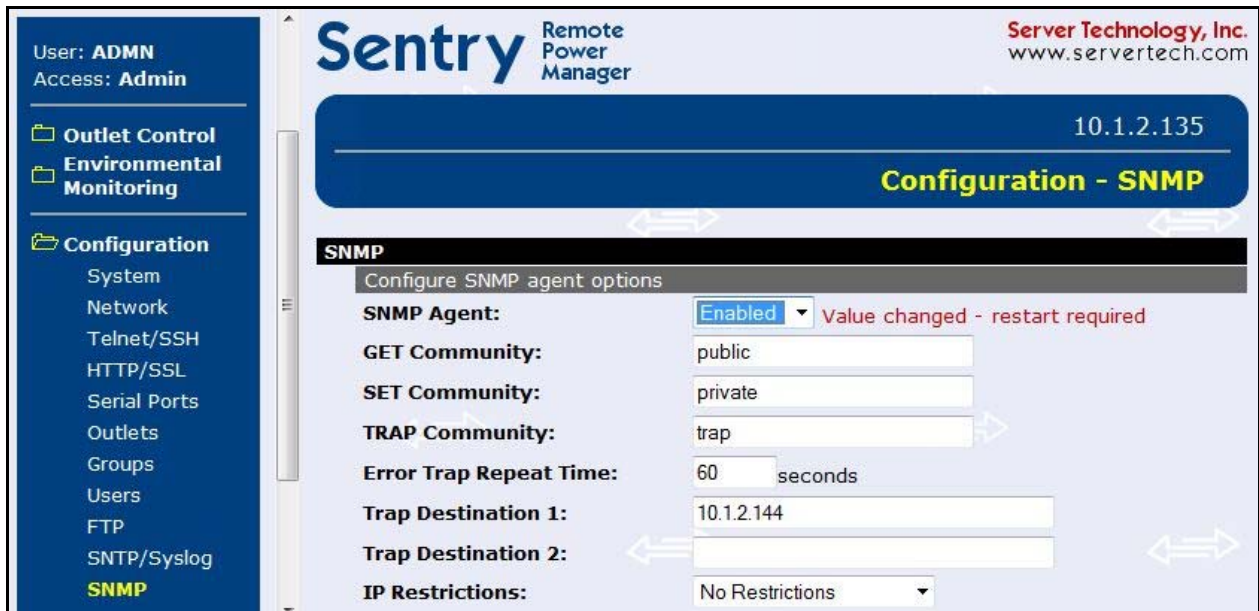
Sentry3OIDTree.txt: <ftp://ftp.servertech.com/pub/SNMP/sentry3/Sentry3OIDTree.txt>

Enable and Configure SNMP on the Sentry -48VDC Remote Power Manager

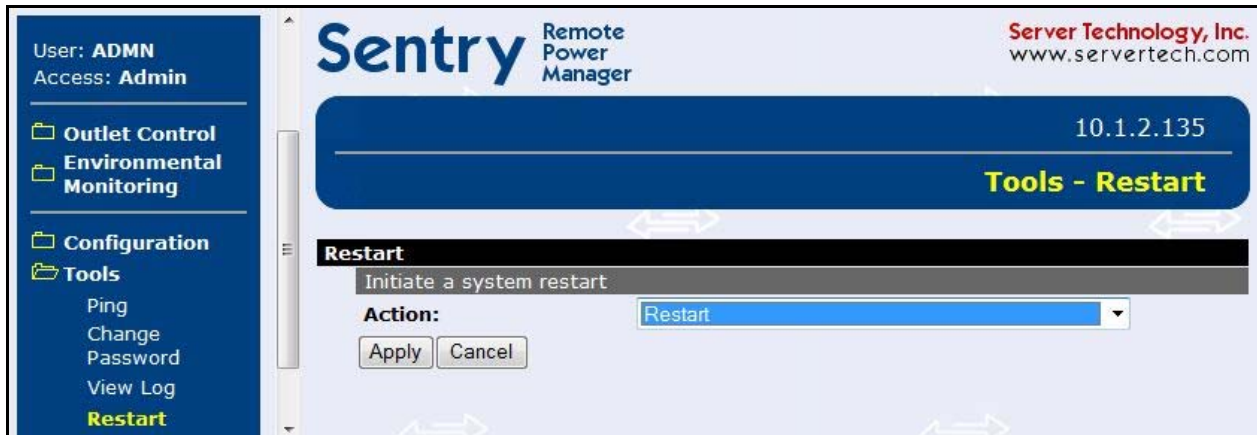
- Login to the Sentry unit as an Administrator and use the menu links in the left pane of the Web interface to navigate to the **Configuration > SNMP/Thresholds** page, as follows:



- From the SNMP Agent drop-down list, select the Enabled option. Type the IP address of your Microsoft Windows PC in the Trap Destination 1 field, and then click **Apply**. The message “Value changed – restart required” displays:



6. To perform the restart, navigate to the **Tools > Restart** page, Click the drop-down list arrow to display a list of options, select the **Restart** option, and then click **Apply**:



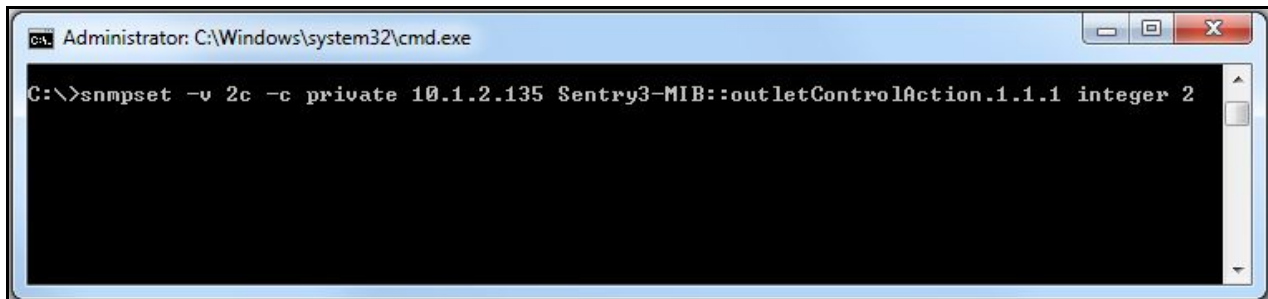
When the message “Are you sure” is displayed, click **OK**. Wait about one minute for the system to restart. Outlet status is not affected; outlets remain in their last state as the system restarts.

Verify Outlet Control with Net-SNMP's *snmpset.exe*

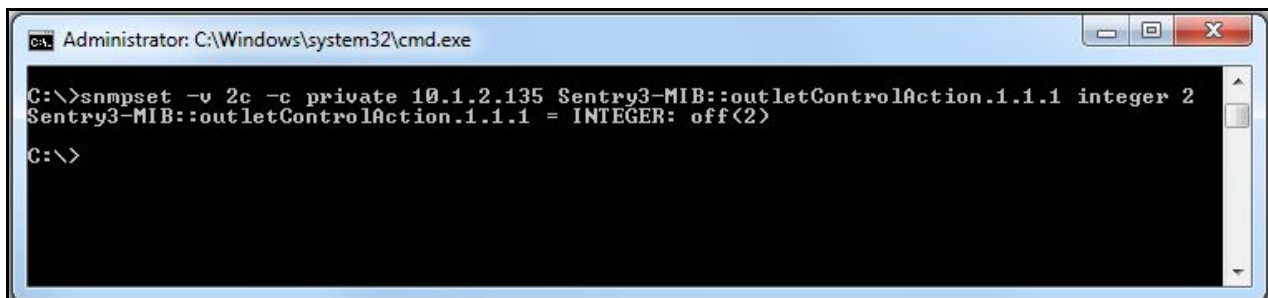
7. To verify that the Windows PC can successfully send Net-SNMP **snmpset** instructions to the Sentry unit, proceed to a Windows command prompt and issue the following command:

```
snmpset -v 2c -c private xxx.xxx.xxx.xxx Sentry3-MIB::outletControlAction.1.1.1 integer 2 <Enter>
(...where “xxx.xxx.xxx.xxx” is the IP address assigned to the target Sentry -48VDC RPM unit.)
```

Note: The above command will switch OFF outlet A1 on the Sentry -48VDC Remote Power Manager!



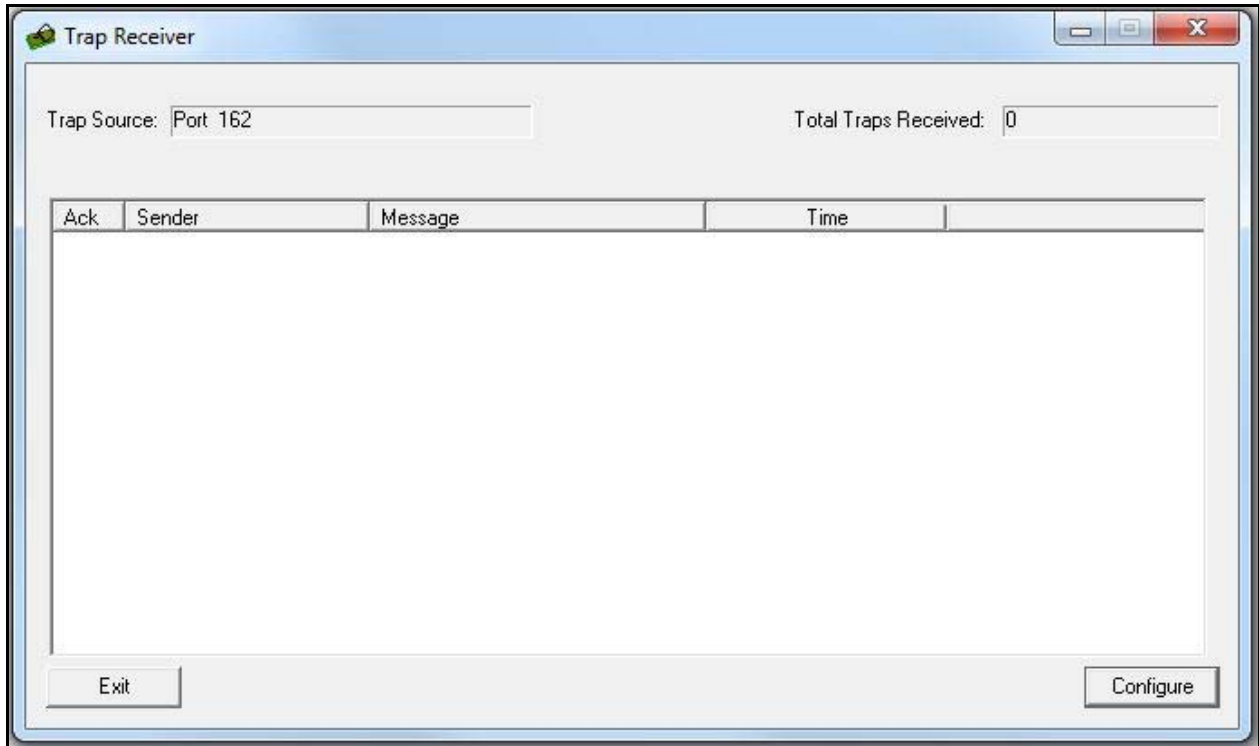
When you press **<Enter>**, Net-SNMP should send a command that instructs Outlet A1 on the Sentry -48VDC Remote Power Manager to switch OFF. A command response similar to the following should appear:



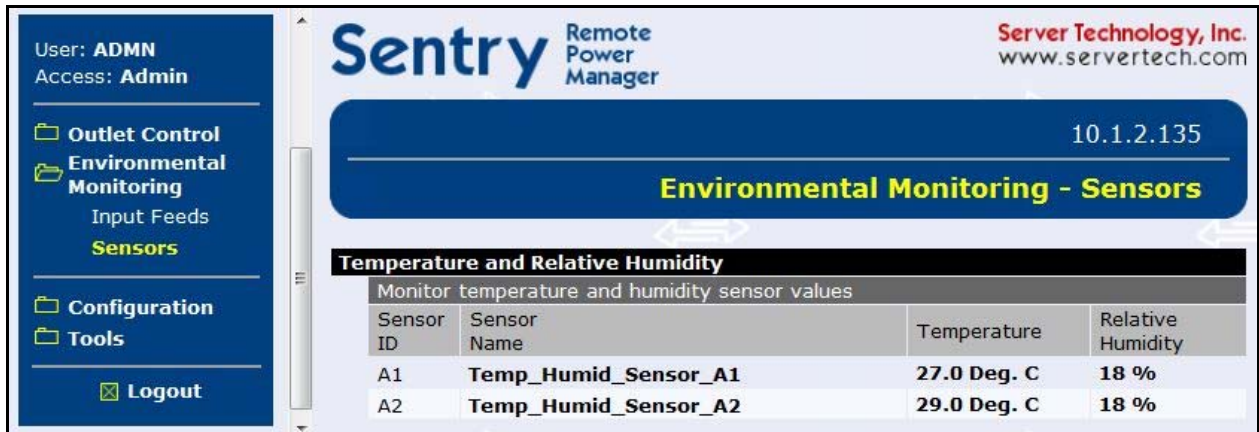
Log in to the Sentry unit and go to the **Outlet Control** page to view the status and verify success. If already logged in, refresh the browser to view the current state.

Verify Receipt of Sentry Traps with Trap Receiver

- To verify that Trap Receiver can receive high-temperature alarm traps from the Sentry -48VDC RPM unit, launch the Trap Receiver GUI using the Windows Start menu. The application should appear as follows:



- Log in to the Sentry -48VDC web interface as an Administrator and use the menu links in the left pane of the web interface to navigate to the **Environmental Monitoring > Sensors** page:



Make note of the current temperature reading for temperature/humidity sensor “A1”, which corresponds to the combination temperature/humidity probe attached to the physical port labeled “T/H 1” on the Sentry -48VDC RPM unit. In the example above, the current reading is 27.0°C.

10. Navigate to the **Configuration > SNMP** page, scroll to the bottom of the main screen, and click the **Sensor Traps** link at the bottom of the page to get to the configuration section for Sensor Traps and Sensor Thresholds:

Configuration - SNMP - Sensor Traps

10.1.2.135

Temperature and Relative Humidity Sensor Traps

Configure temperature and relative humidity sensor traps

Sensor ID	Sensor Name	Status Trap	Temp Trap	Humid Trap
Apply Cancel		All None	All None	All None
A1	Temp_Humid_Sensor_A1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
A2	Temp_Humid_Sensor_A2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Apply Cancel		All None	All None	All None

Temperature and Relative Humidity Sensor Thresholds

Configure temperature and relative humidity sensor thresholds

Sensor ID	Sensor Name	Low Temp	High Temp	Low Humid	High Humid
Apply Cancel		Deg. C	Deg. C	% RH	% RH
A1	Temp_Humid_Sensor_A1	0	40	0	100
A2	Temp_Humid_Sensor_A2	0	40	0	100

11. Verify that the “Temp Trap” check boxes for both probes are checked (which is the default), then change the “high Temp” threshold for sensor “A1” to be a value *less than* was noted in Step 9 on the previous page. For example, the noted temperature value was 27.0°C, so the threshold should be temporarily changed to something less, such as 26°C:

Configuration - SNMP - Sensor Traps

10.1.2.135

Temperature and Relative Humidity Sensor Traps

Configure temperature and relative humidity sensor traps

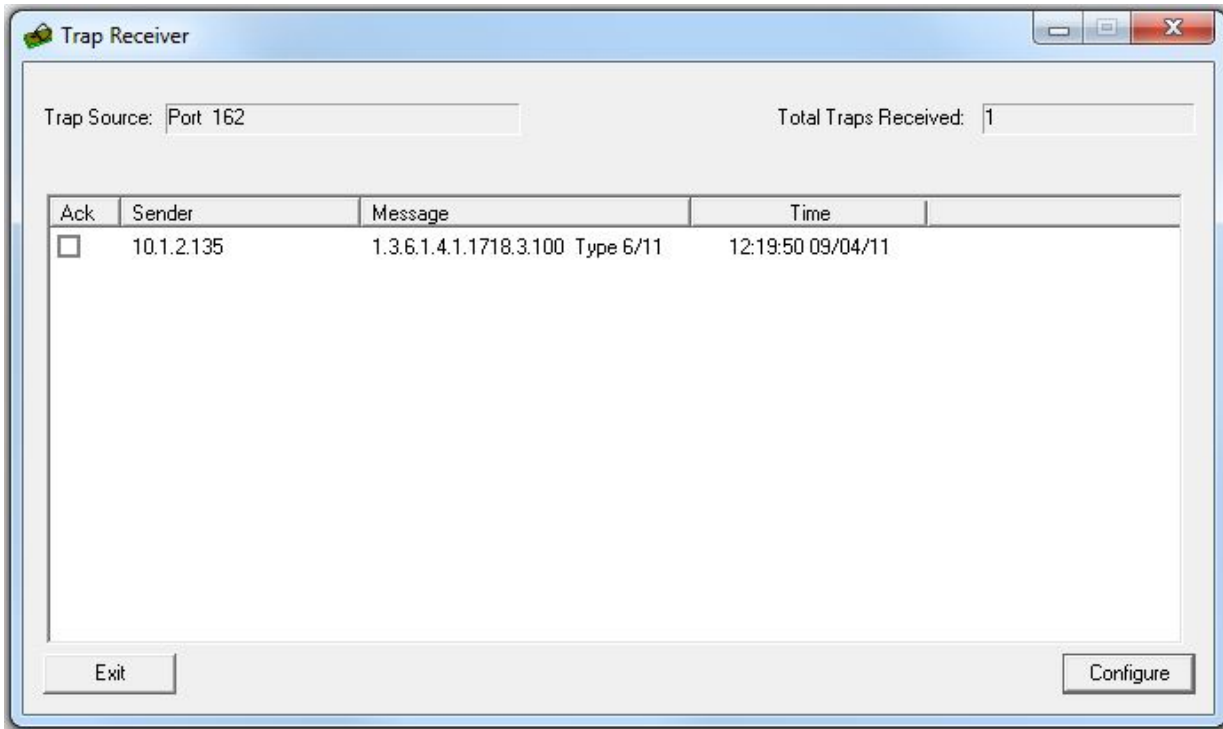
Sensor ID	Sensor Name	Status Trap	Temp Trap	Humid Trap
Apply Cancel		All None	All None	All None
A1	Temp_Humid_Sensor_A1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
A2	Temp_Humid_Sensor_A2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Apply Cancel		All None	All None	All None

Temperature and Relative Humidity Sensor Thresholds

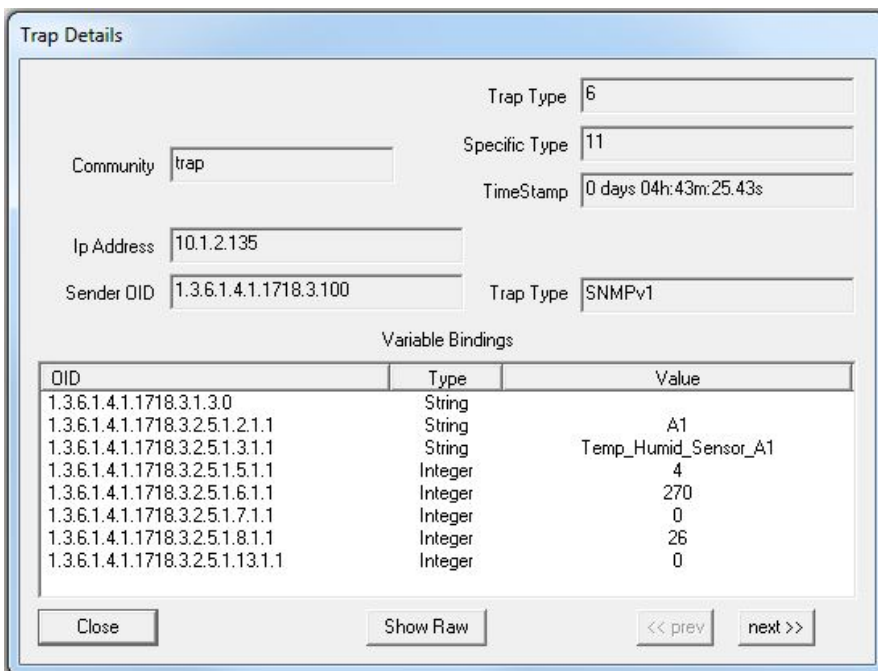
Configure temperature and relative humidity sensor thresholds

Sensor ID	Sensor Name	Low Temp	High Temp	Low Humid	High Humid
Apply Cancel		Deg. C	Deg. C	% RH	% RH
A1	Temp_Humid_Sensor_A1	0	26	0	100
A2	Temp_Humid_Sensor_A2	0	40	0	100

- After changing the threshold to be less than the current temperature reading and clicking **Apply**, the trap information displays in the Trap Receiver display area:



The trap information shown in the above example validates that Trap Receiver is receiving traps from the Sentry unit. By default, the same trap data will repeat every 60 seconds until the measured temperature is again below the configured high-temperature threshold. Double-clicking the line of trap data in the Trap Receiver display area will present additional trap information:



Note: Before proceeding, follow the guidelines in Step 10 and Step 11 to return the temperature thresholds to the desired values. Another trap should be received to indicate temperature is again normal.

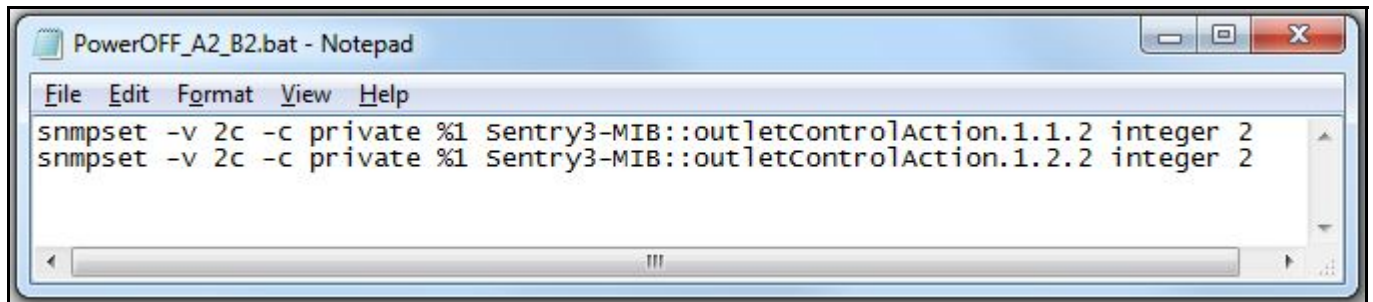
Create Batch Files

Individual batch files must now be created that will contain Net-SNMP **snmpset** commands and a field delimiter. These batch files will be executed by Trap Receiver as actions in response to “high-temp” and “return-to-normal” traps received from various Sentry -48VDC RPM units.

In its simplest form—such as to instruct just one outlet to switch OFF or ON—a batch may contain only one command. If multiple outlets are to be switched OFF and ON in response to high-temp and normal-temp traps, the batch files will contain multiple commands.

Using the text editor of your choice (for example Notepad or the MS DOS Editor), create batch files with the appropriate Net-SNMP commands for state changes of outlets. The following batch files are only examples intended to outline the basics for defining desired actions. Your own batch files may vary.

13. Create a batch file with commands that will result in outlets switching OFF when a particular Sentry unit sends a high-temp alarm trap. The following example will switch OFF outlets A2 and B2:



```
PowerOFF_A2_B2.bat - Notepad
File Edit Format View Help
snmpset -v 2c -c private %1 Sentry3-MIB::outletControlAction.1.1.2 integer 2
snmpset -v 2c -c private %1 Sentry3-MIB::outletControlAction.1.2.2 integer 2
```

Note 1: Save the batch files with the **.bat** extension. Saving the batch files to the C:\Sentry folder is assumed.

Note 2: The “%1” in each line is a field delimiter that Trap Receiver uses to automatically respond to the same Sentry -48VDC RPM unit that sent the high-temp trap. Trap Receiver will automatically insert the IP address of the originating Sentry unit in place of the “%1” during execution.

Note 3: The “.1.1.2” and “1.2.2” in the lines above directly address the outlets on the Sentry -48VDC RPM unit.

The **first** digit represents the Enclosure ID, either a Master enclosure (Sentry -48VDC RPM unit with “-XLS-” in the model number), or an Expansion enclosure (Sentry unit with “-XMS-” in the model number):

If a Master XLS enclosure, the first digit = 1

If an Expansion XMS enclosure, the first digit = 2

The **second** digit represents the Infeed ID which identifies an outlet powered by either the Sentry unit’s “A” infeed or the Sentry unit’s “B” infeed:

If the outlet is powered by infeed “A”, the second digit = 1

If the outlet is powered by infeed “B”, the second digit = 2

The **third** digit represents the number of the outlet:

Possible values are: 1, 2, 3, 4, 5 and 6

Some Sentry -48VDC RPM models contain less than six outlets per infeed. Examples in this Technical Note are based on a standalone Master model 4805/35-XLS-12 that has two infeeds (A and B), and a total of 12 outlets (6 powered from the A-feed and 6 powered from the B-feed).

Note 4: The final character in each line (the digit following the word “integer”), defines the control action:

0 = no action

1 = power ON

2 = power OFF

3 = reboot (power OFF, delay, automatic power ON)

The following screen capture is from the individual Outlet Control page of a standalone Master model #4805-XLS-12. The web interface identifies the 12 outlets as "AA1" through "AB6":

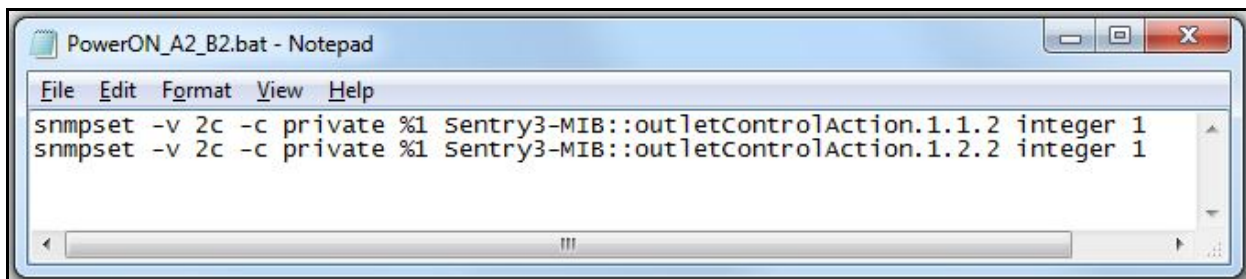
Individual Outlet Control

Outlet ID	Outlet Name	Outlet Status	Outlet Load	Control State	Control Action
AA1	TowerA_InfeedA_Outlet1	On	0.00	On	None
AA2	TowerA_InfeedA_Outlet2	On	0.00	On	None
AA3	TowerA_InfeedA_Outlet3	On	0.00	On	None
AA4	TowerA_InfeedA_Outlet4	On	0.00	On	None
AA5	TowerA_InfeedA_Outlet5	On	0.0	On	None
AA6	TowerA_InfeedA_Outlet6	On	0.0	On	None
AB1	TowerA_InfeedB_Outlet1	On	0.00	On	None
AB2	TowerA_InfeedB_Outlet2	On	0.00	On	None
AB3	TowerA_InfeedB_Outlet3	On	0.00	On	None
AB4	TowerA_InfeedB_Outlet4	On	0.00	On	None
AB5	TowerA_InfeedB_Outlet5	On	0.0	On	None
AB6	TowerA_InfeedB_Outlet6	On	0.0	On	None

The web interface's Outlet ID's directly translate to SNMP ID's as follows:

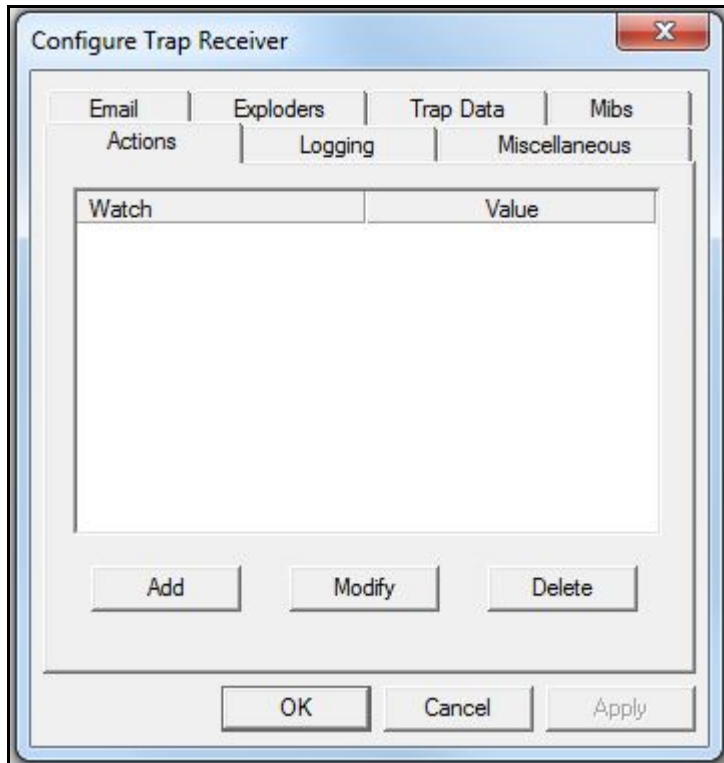
- AA1 = .1.1.1
- AA2 = .1.1.2
- AA3 = .1.1.3
- AA4 = .1.1.4
- AA5 = .1.1.5
- AA6 = .1.1.6
- AB1 = .1.2.1
- AB2 = .1.2.2
- AB3 = .1.2.3
- AB4 = .1.2.4
- AB5 = .1.2.5
- AB6 = .1.2.6

14. Create a batch file with commands that will result in outlets switching ON when a particular Sentry unit sends a (return to) normal temperature trap:

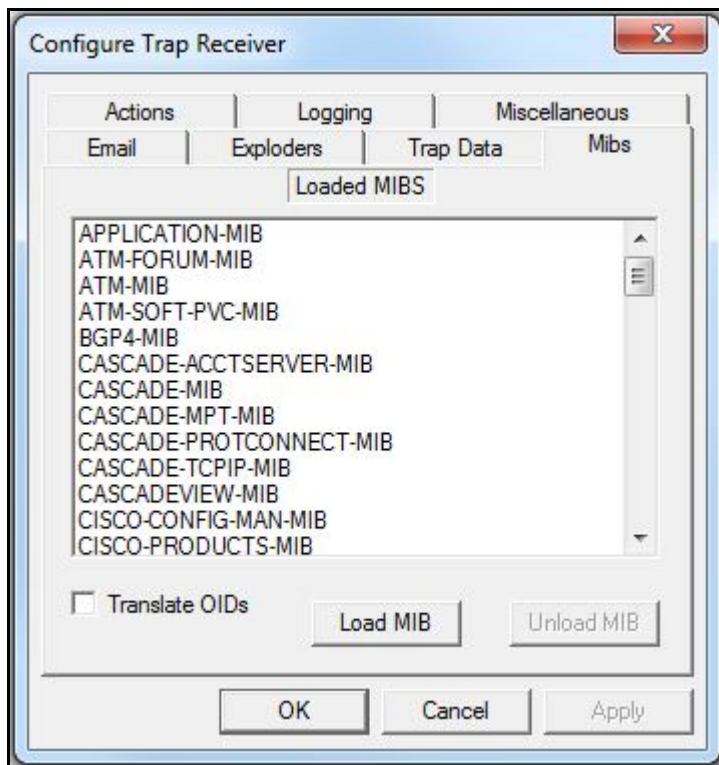


Configure Trap Receiver Load Shed Actions

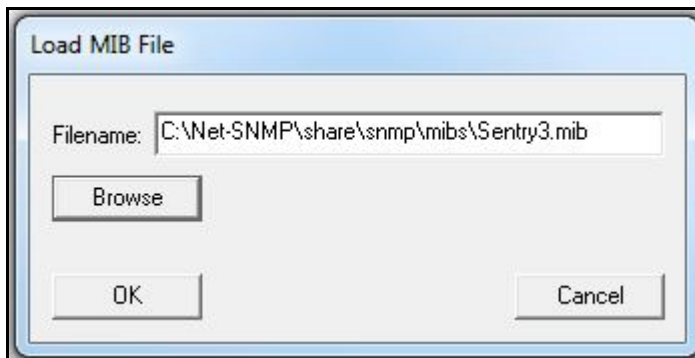
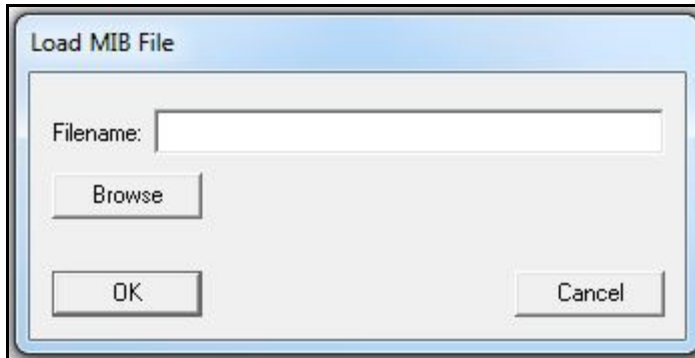
15. Click the **Configure** button in the lower right-hand corner of the main Trap Receiver windows (see screen capture from Step 12). The Configure Trap Receiver windows will appear:



16. Click the Mibs tab to get to a screen that allows you to view and load Mibs:

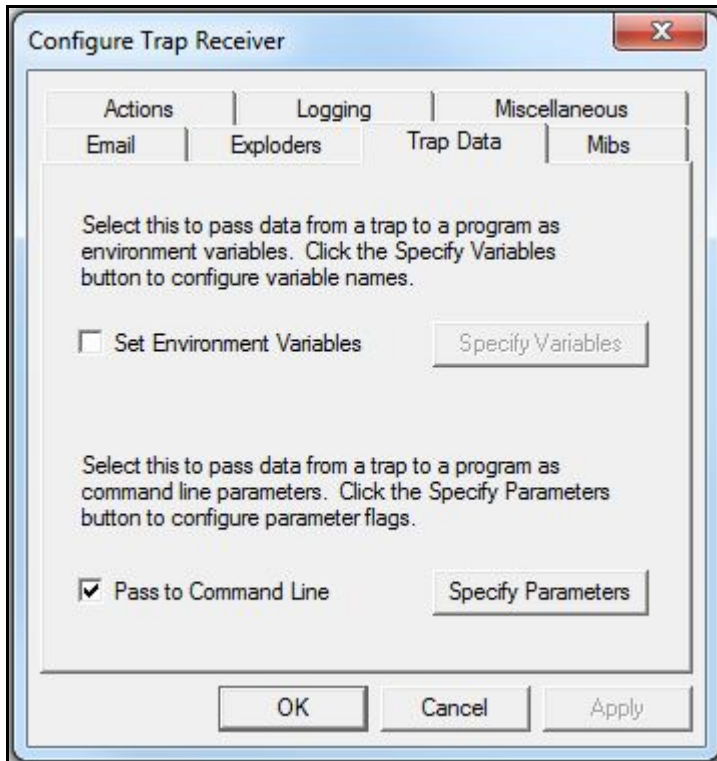


- Click the **Load Mibs** button, then use the **Browse** button to locate the "Sentry3.mib" file that was saved to the C:\Net-SNMP\share\snmp\mibs folder in Step 3:

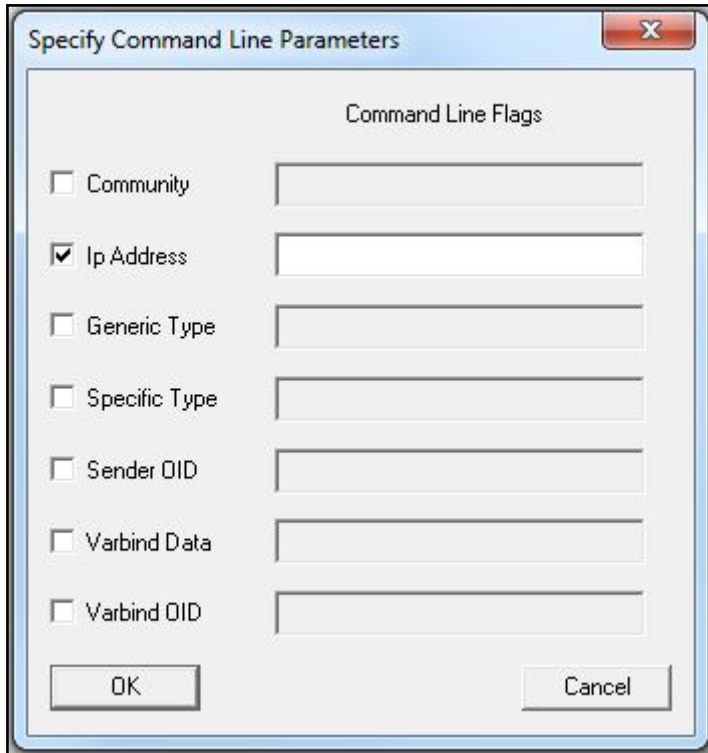


Click **OK** to add the Mib and return to the Configure Trap Receiver window.

- Click the Trap Data tab and check the box titled "Pass to Command Line":

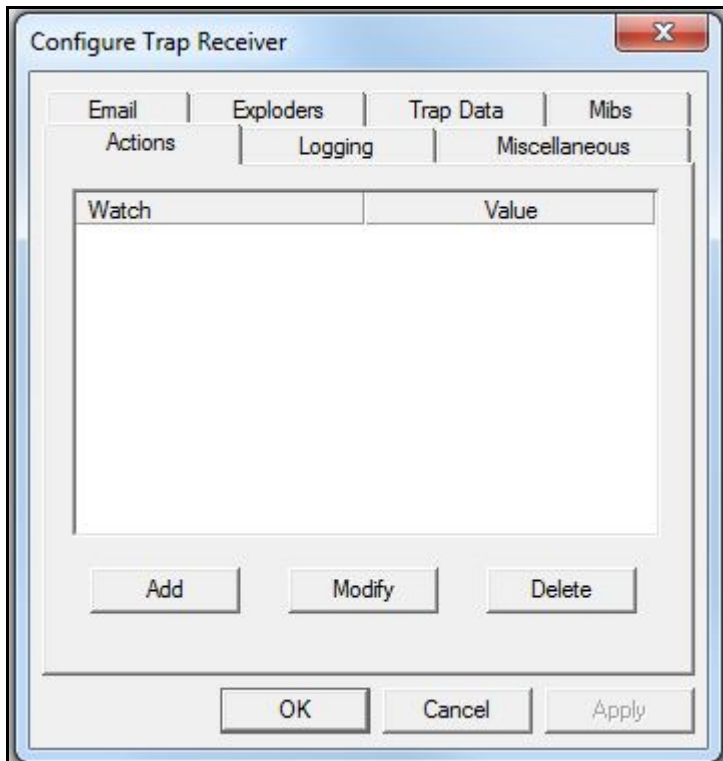


- Click the **Specify Parameters** button (see previous screen capture) and then select the IP Address” checkbox. Leave the “Command Line Flags” field blank. This step causes Trap Receiver to identify the IP address of the Sentry unit that has sent a high-temp or normal-temp trap, and to pass the IP address data to the batch file that it will execute as an action:



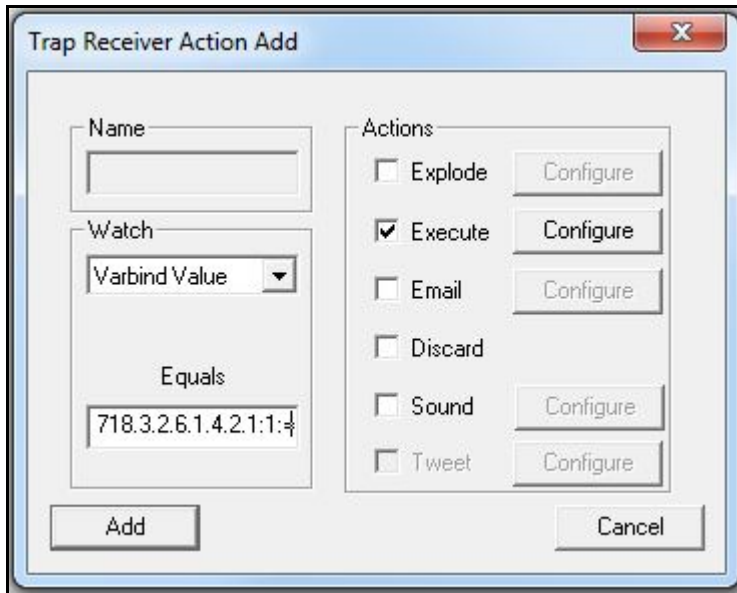
Click **OK** to return to the Configure Trap Receiver window.

- Click on the Actions tab to get to this screen again:



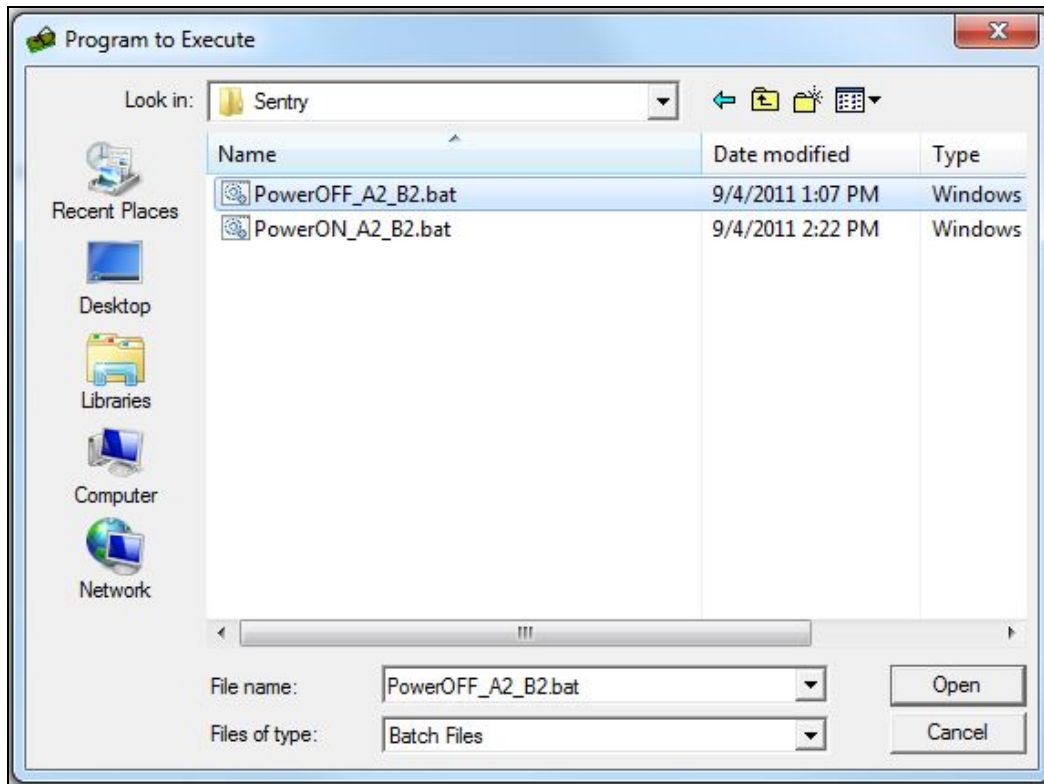
21. Click the **Add** button, then proceed to:

- Set the Watch field to “Varbind Value” (scroll to bottom of drop-down list).
- Mark the checkbox next to “Execute”.
- Carefully add 1.3.6.1.4.1.1718.3.2.5.1.5.1.1:4:= to the Equals field. Note that the entire string for the Equals field cannot be seen in the following screen capture:

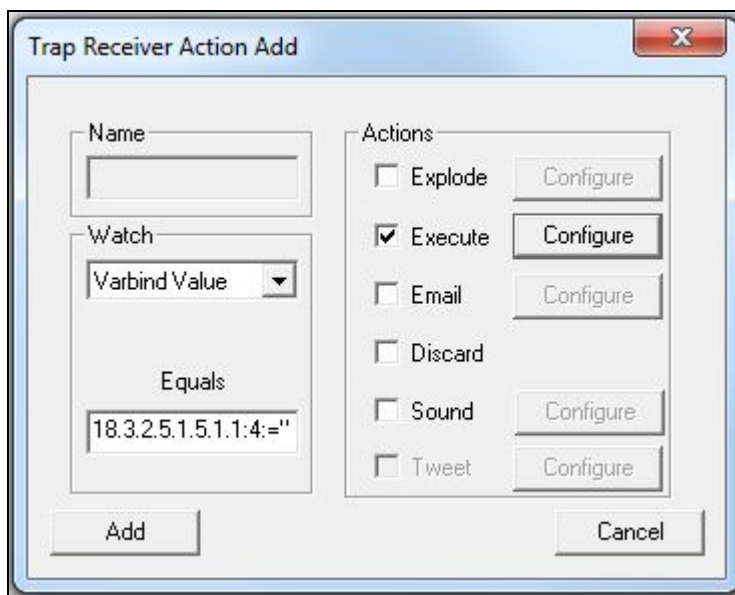
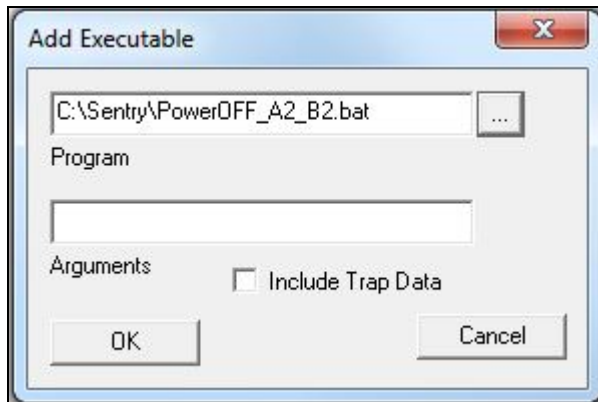


This step configures Trap Receiver to watch for traps that indicate a tempHigh (4) status from T/H probe #1 of any Sentry -48VDC Remote Power Manager.

22. Click the **Configure** button next to the Execute checkbox, then browse and select the batch file you have previously created for switching OFF outlets when the temperature threshold is exceeded:



Click **Open** to finalize the selection (see previous screen capture), then click **OK** on the following screen, and the **Add** button on the subsequent screen, to add the executable to the configuration:



Trap Receiver is now configured to watch for tempHigh status indicators from T/H probe #1 of any Sentry -48VDC RPM unit, and to respond to the sending Sentry unit by executing a batch file that will instruct pre-defined outlets to power OFF.

23. To configure Trap Receiver to watch for tempHigh indicators from T/H probe #2 of any Sentry unit, repeat Steps 21 and 22, but carefully add **1.3.6.1.4.1.1718.3.2.5.1.5.1.2:4:=** to the Equals field during Step 21. The second-to-last digit in the string (now a “2” instead of a “1”), configures Trap Receiver to watch for tempHigh indicators when the threshold for T/H probe #2 on a Sentry unit is exceeded.

Note: Because Trap Receiver will watch for status from both probes independently, different batch files can be created and executed. Thus, for a tiered approach to temperature-based load shedding (for example, switch OFF certain outlets when the threshold for T/H probe #1 is exceeded, then switch OFF additional outlets if temperature still climbs and a higher threshold for T/H probe #2 is exceeded), all that is needed is to create a different power-OFF batch file and select it for the execute action when watching for tempHigh status from the second probe.

The system is now configured to load shed (switch OFF certain outlets) in response to tempHigh indicators triggered by temperatures beyond the thresholds of probes #1 and #2 of all Sentry -48VDC units configured to send traps to the IP address of the Windows system. Actions can be different for the two temperature values, and the actual thresholds configured in multiple Sentry units can also vary.

Configure Trap Receiver Auto-Recover Actions

24. Follow the process outlined in Step 21 through Step 23, but use the following strings in the watch Equals field for Steps 21 and Step 23:

- To watch probe #1 for normal (0) temperature status in Step 21, use this watch string:
1.3.6.1.4.1.1718.3.2.5.1.5.1.1:0:=
- To watch probe #2 for normal (0) temperature status in Step 23, use this watch string:
1.3.6.1.4.1.1718.3.2.5.1.5.1.2:0:=

Note that the final digit in the string (now a “0” instead of a “4”) configures Trap Receiver to watch to for (return to) normal temperature status instead of tempHigh.

When selecting the batch files to be executed for these watch Equals strings, be sure to select the batch files with the commands that instruct the outlets to power ON instead of power OFF.

Security Considerations

A variety of security features exists within the general SNMP protocol and Sentry switched power distribution systems. However, to increase security of SNMP interactions, use the following additional measures:

- Configure each Sentry unit with a unique “SET Community:” string. The default is “private”.
Changing this string to something unique and secret requires the Net-SNMP **snmpset.exe** command syntax in each line of each batch file to be modified to contain a matching string.
- Change the “IP Restrictions” option in the **Configuration - SNMP** page of each Sentry unit to the “Trap Destinations Only” option, and click **Apply**.

This effectively enables the access control list feature wherein the Sentry unit will only accept SNMP Set commands that originate from one of the IP addresses that are specified in the “Trap Destination 1:” and “Trap Destination 2:” field on the same screen. In the examples above, setting the IP Restrictions option to Trap Destinations Only will configure the Sentry unit to only accept SNMP Set instructions from the Windows system running Trap Receiver.

 end

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