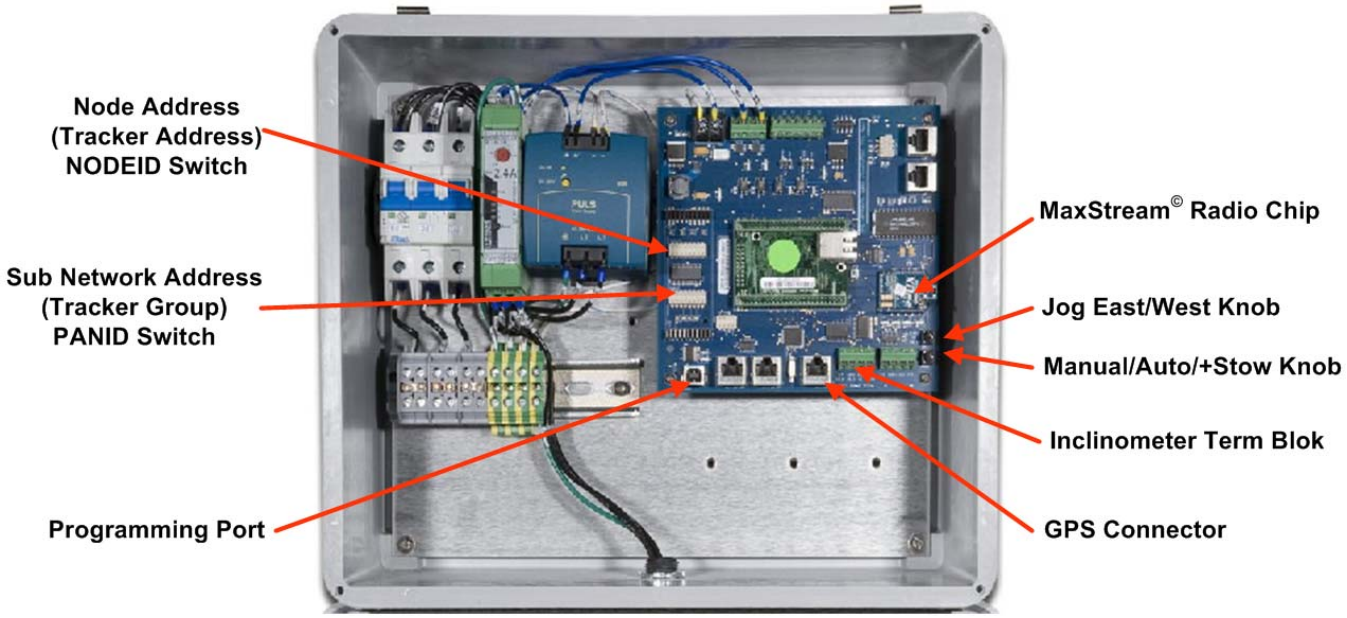
1.0 TMAC Tracker Controller Operations

1.1 Overview

The Tracker Monitoring and Control (“TMAC”) Advanced Tracker Controller controls the extension of the drive unit, which changes the rotation of the torque tubes and the position of the modules. By optimizing the angle of incidence between the sun and the modules, the system captures as much as 35% more sunlight than non-tracking solar electric systems.

The TMAC controller has full remote control capability that allows for stowing in adverse weather condition, equipment monitoring, and system optimization.

Here is an inside view of the TMAC controller:



TMAC Tracker Controller

1.2 Safety Procedures

Important! All personnel must adhere to the following safety procedures when working on the TMAC controller. These operating instructions are for use by qualified personnel only.

1.2.1 Radio Frequency Safety

- The design of the TMAC controller complies with the updated standard for safety levels with respect to human exposure to Radio Frequency (RF) signals adopted by the Federal Communications Commission (FCC) in August 1996. The hybrid standard consists of the existing standards of the Institute of Electrical and Electronic Engineering (IEEE) and the American National Standards Institute (ANSI), and its guidelines are published by the National Council of Radiation Protection (NCRP).
- Currently, the TMAC controller product is in the process of complying with the requirements of the FCC Radio Frequency Emission Guidelines and for FCC certification.

1.2.2 Electric Static Discharge

Warning! Static buildup and electrical discharge can damage the TMAC controller.

The avoid static buildup or discharge into the equipment:

- Before touching or connecting a laptop to the TMAC controller, SunPower recommends to discharge the laptop and yourself by simultaneously holding your laptop and grounding yourself to a metal service that is connected to the earth ground.
- Use a grounding strap when working on the TMAC control board.
- Use a grounding mat when working on the TMAC controller.

1.2.3 Shock Hazards

Warning! Lethal voltage is present in the TMAC control box. Use appropriate Personal Protection Equipment (PPE) when working on the equipment.

- The TMAC controller is designed to operate at 380 VAC–480 VAC 3-Phase power. Other voltages are not compatible.
- The TMAC controller is designed with finger guards to protect the user from electrical shock. However, SunPower requires that all personnel working on the equipment wear rubber insulating gloves.
- Ensure you avoid shocking the components on the controller circuit board.

1.3 Pre-Commissioning Steps

To ensure proper and efficient commissioning of each TMAC controller installed in a site, perform the pre-commissioning steps in this section.

1.3.1 Installing the Mitty© Application

To access the TMAC controller locally, the laptop you connect must have the Multi-Threaded TTY ("Mitty©") application installed. The Mitty application—an RS-232 serial terminal program developed by Microsoft® and modified by Netburner®—is used as the main command prompt controller page.

To download a free copy of the Mitty application:

1. Navigate to the NetBurner website www.netburner.com
2. On the NetBurner home page, hover your mouse over the **Support** tab.
3. Click *Public Downloads* in the **Support** tab drop-down menu (Fig. 1).

Fig. 1

4. On the Public Downloads page, locate the NetBurner RS-232 Terminal Program in the **NetBurner Utilities** section and click the **Download application** link (Fig. 2).

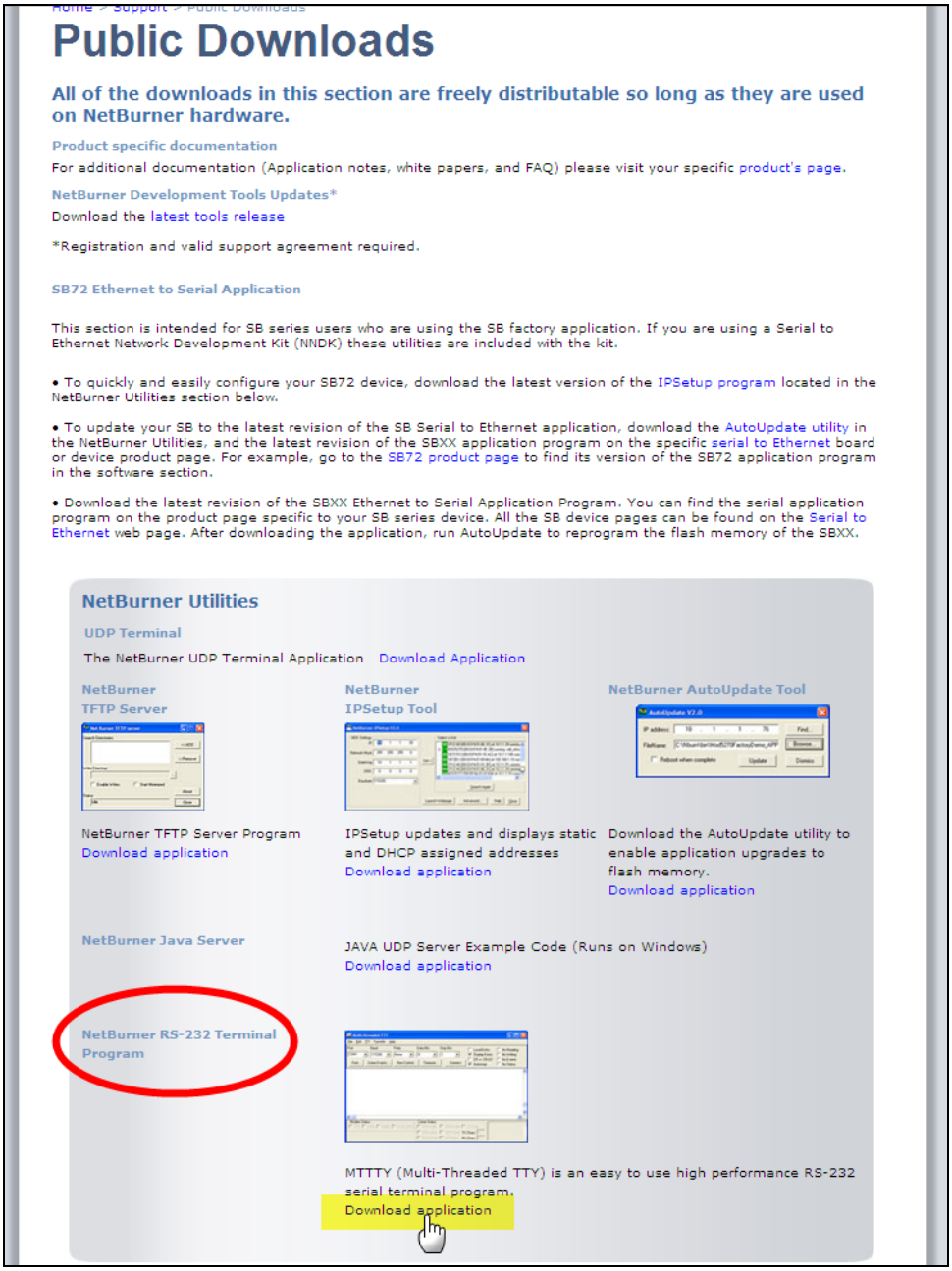


Fig. 2

5. Click *Run* in the **File Download** window to automatically install the program.
6. The Mitty application icon should appear on your desktop.

To start the Mitty application, refer to Section 1.4.1.

1.3.2 Identifying Coordinator TMAC Units

Refer to the project plans to identify which TMAC unit is assigned to function as the “coordinator”—that is, the TMAC node designated to manage the flow of communications for its associated network. The coordinator TMAC unit is hard-wired with Ethernet cable to a site network access point, typically located at the closest inverter station.

Verify that the coordinator TMAC unit has the specially labeled MaxStream© radio chip (Fig. 3). If an incorrect radio chip is installed, remove it and replace with the special coordinator chip.

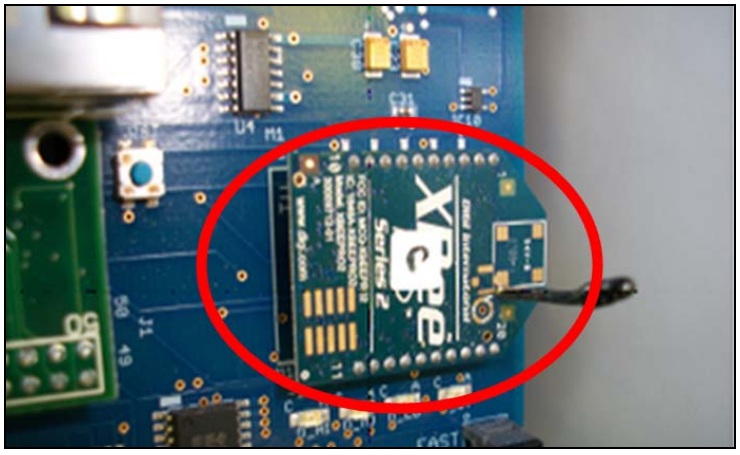
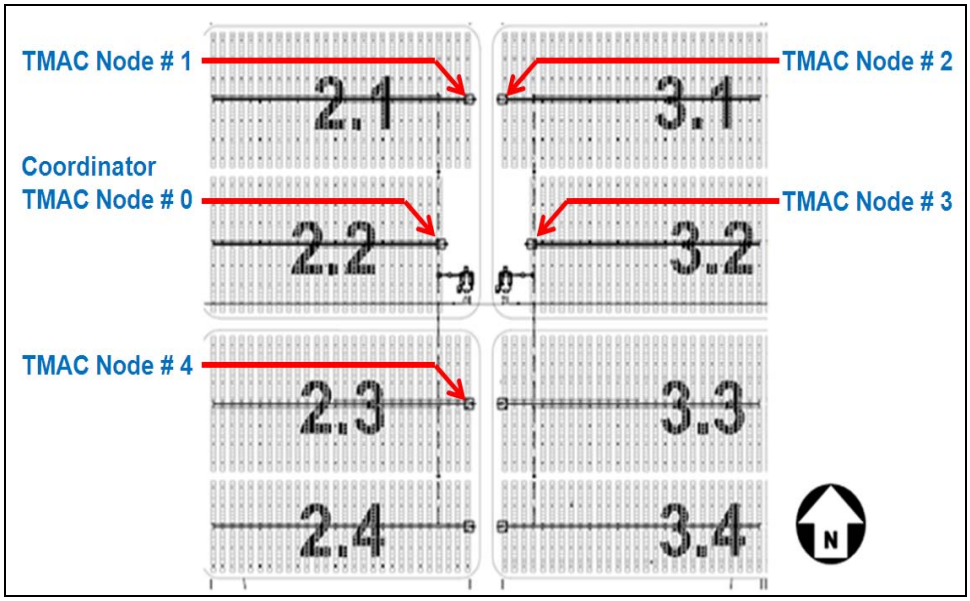


Fig. 3

1.3.3 Numbering TMAC Nodes In A Network

Each TMAC unit in a network must be identified by a node number that is a digit from 0 to 9. By default, the coordinator TMAC unit is always assigned node number *0*. Assign a node number to each noncoordinator TMAC unit by numbering each of the controller box locations NW→SE. Refer to the following sample diagram for illustration.



TMAC Node Numbering sample diagram

1.3.4 Setting Inclinometer Offset

After you install the controller and before verifying the east and west limits the system inclinometer offset must be set for a flat PV array. After completing the offset adjustment the east and west limits can be verified.

1.4 Setting Parameters and Verifying Functionality

You must enter all of the parameters and perform all the verifications for *each* TMAC controller on the site. This data is stored in non-volatile memory within the TMAC memory.

1.4.1 Setting System Parameters

To set the system parameters for each TMAC controller:

1. Power down the controller.
2. Refer to the project plans for the Sub Network Address Pan ID.
3. Configure the **Sub Network Address PANID Switch** (Fig. 4):

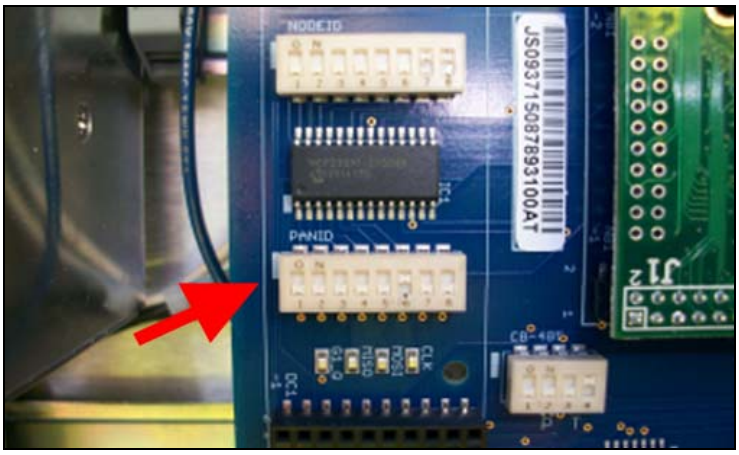


Fig. 4

- On the coordinator TMAC unit, set the binary switches to *00000000* (that is, all switches are down).
- For noncoordinator TMAC units, refer to the following table for the binary switch position.

Decimal (Node Number)	Binary Switch Position
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010

5. Configure the **Node Address NODEID Switch** (Fig. 5):

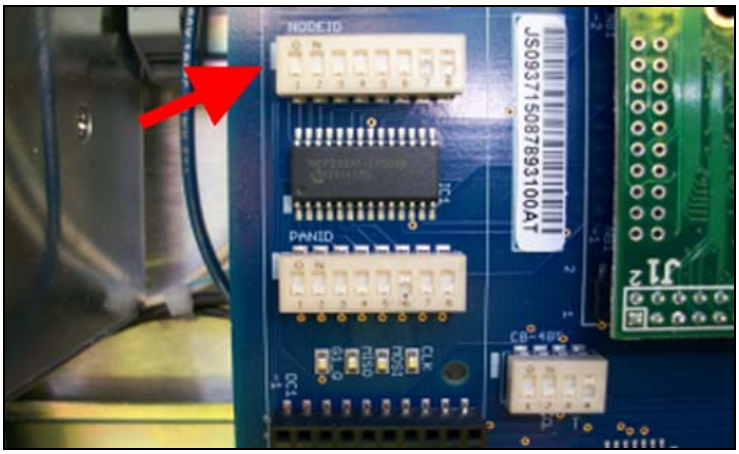


Fig. 5

- On the coordinator TMAC unit, set the binary switches to *00000000*.
- For noncoordinator TMAC units, refer to the following table for the binary switch position.

Decimal (Node Number)	Binary Switch Position
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010

6. Record the controller's Mac address and the PCB Number on the commissioning form (Fig. 6). The Mac address and the PCB number are used to assign the controller to a site on the TMAC Admin Server.

Fig. 6

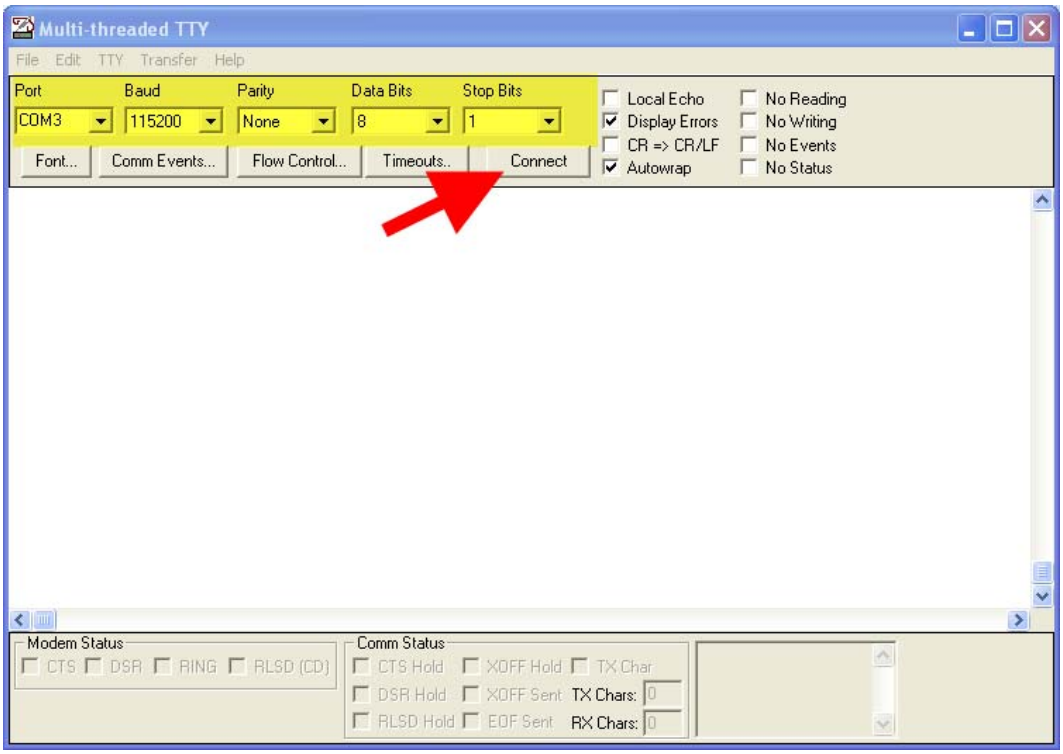
7. Power up the controller.
8. Use the USB A to USB B cable assembly to connect the laptop to the controller through the **Programming Port.**

9. Start the Mitty application.
10. The Multi-threaded TTY screen opens.
    a. If not already entered, select the following values in the respective fields:

Field	Value
Port	The COM Port you use in your computer
Baud	115200
Parity	None
Data Bits	8
Stop Bits	1

Important! To find the COM port number, open the **Device Manager** window on your laptop. Click *Start,* right-click *My Computer*, select *Properties,* click *Hardware* in the **System Properties** dialog box, and click *Device Manager.* If you're unable to get a port in the Multi-threaded TTY screen, restart the Mitty application and look for a new port in the **Port** drop-down list. Instructions on fixing the changing port issue is soon to be released.

    b. Click *Connect.*



Multi-threaded TTY screen

11. In the bottom left of the screen, a prompt appears (Fig. 7). The prompt indicates the Sub Network and Node ID being accessed, and the software programmed into the TMAC unit.

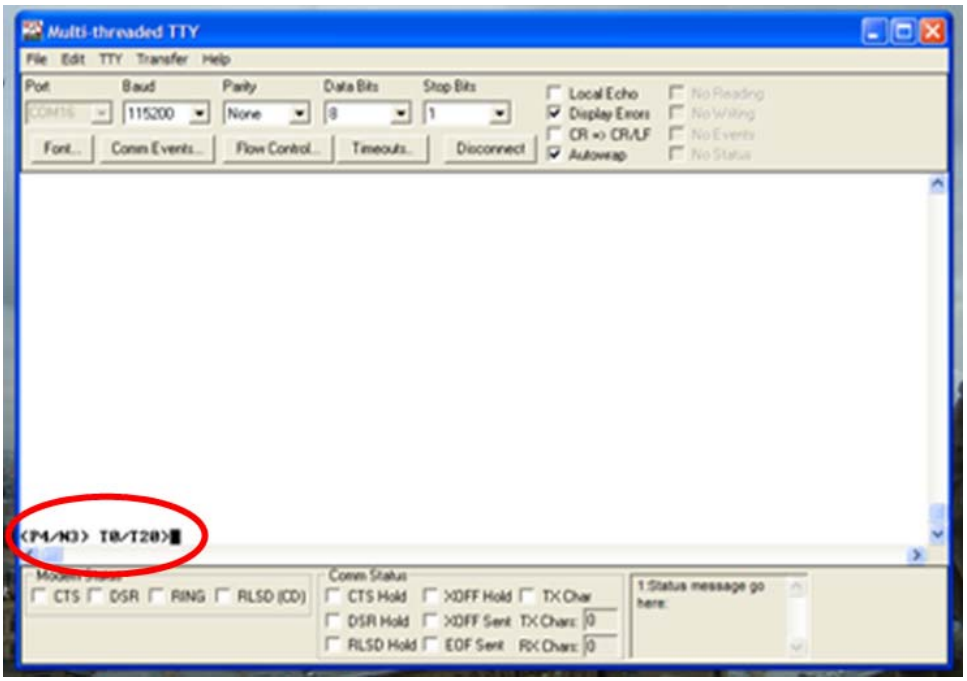


Fig. 7

12. Enter the following site parameters in any sequence:

Parameter	Description	Value
Mount	Refers to the side of the array on which the drive unit is installed	• Enter *spmw* for WEST Mount • Enter *spme* for EAST Mount.
Ground Coverage Ratio (GCR) **(East/West)**	The percentage of total ground surface taken up by the system when viewed from above with the modules flat. A smaller GCR means that modules are proportionally farther apart. GCR should typically be in the range of 0.35 for a ground-mounted system, and 0.50 for an elevated system.	Enter *spe.5* for a GCR of 0.50
GCR (North/South)	(Not used at this time)	
Stow Position (East/West)	A programmable position. This represents the number of degrees at which the modules are positioned and at which they remain overnight and during bad weather.	• Enter *spsp5* (5° west bound Stow) • Enter *spsp-5* (5° east bound Stow)

Stow Position (North/South)	(Not used at this time)	
North/South Torque Tube Slope	The slope of the fully installed torque tubes. The value is positive when the south end of the array is lower than the north.	• Enter *t1p5* (5° sloping to the South) • Enter *t1p-5* (5°sloping to the North)
East/West Site Slope	The E–W slope of the site on which the system is installed. The value is positive when the drive strut slopes downward toward the east.	• Enter *t1r5* (5° sloping to the East) • Enter *t1r-5* (−5° sloping to the West)
North/South Misalignment	The number of degrees by which the torque tube alignment is off from true N–S. If the value is positive, the tube alignment is clockwise from true N–S when assessed from overhead.	• Enter *t1y5* (5° to the East) • Enter *t1y-5* (5° to the West)
Inclinometer Calibration	The difference between the controller inclinometer reading and the digital level measurement for the tilt angle. This offset is expressed as a numerical value (after the space).	Enter *m1o 5*

Important! The coordinator TMAC units are equipped with a GPS device that will automatically set the longitude, latitude, and time for all controllers on the subnetwork.

13. Verify that all the entered data parameters are correct.

a. To verify all site parameters, enter “SP?” (Fig. 8).

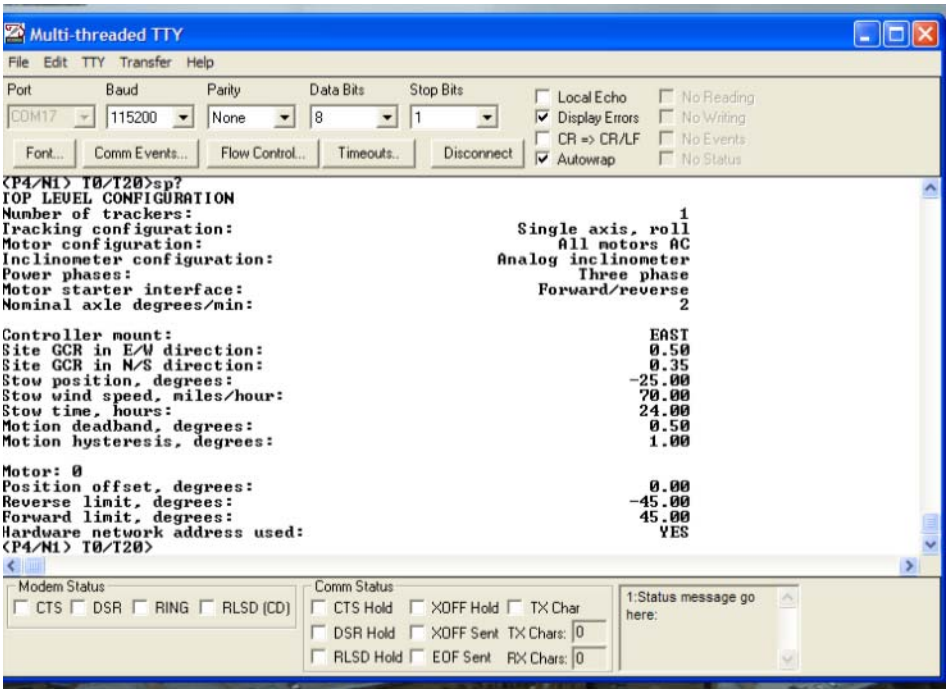


Fig. 8

b. To verify tracker status (Fig. 9), enter “TS?”.

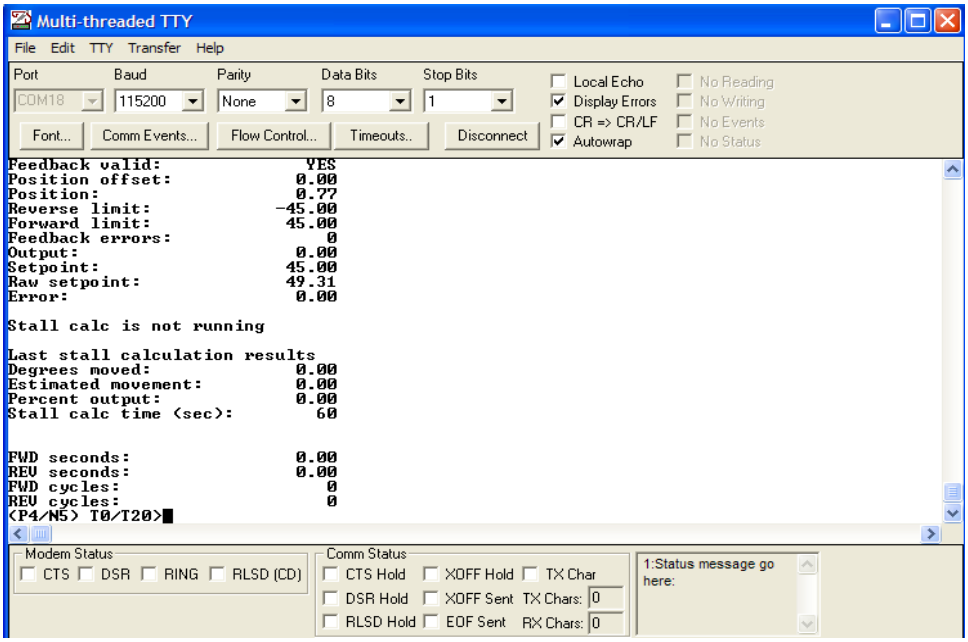


Fig. 9

14. To store the data parameters in the non-volatile memory, enter “fw” and press the **Return Key.**
15. To test the entered data:
    a. Power down the controller.
    b. Wait 10 seconds before powering the controller back up.
    c. Check the data parameters in the Multi-threaded TTY screen (refer to Step 12).

1.5 Commissioning Procedure

Warning! Lethal voltage is present in the TMAC control box. All personnel must use appropriate PPE when performing steps that require work on the TMAC controller.

To commission the TMAC controller:

1. Verify voltage on line side of breaker/disconnect.
2. Refer to the project plans for the Sub Network Address Pan ID or the address of the group of TMAC units that include the controller to be commissioned.
3. Configure the **Sub Network Address PANID Switch** (Fig. 10).

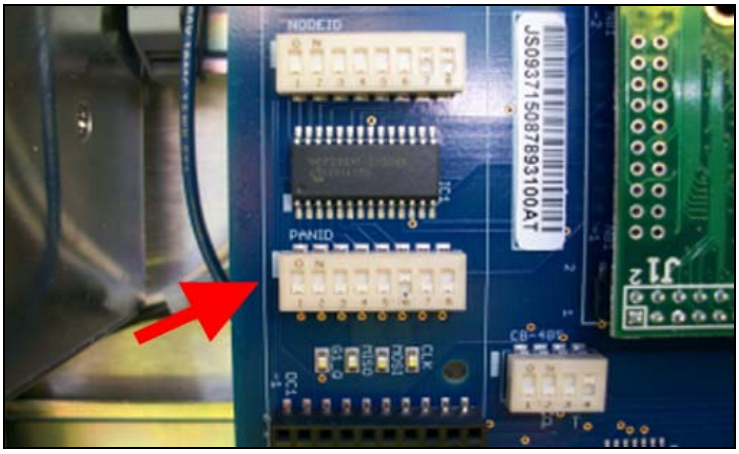


Fig. 10

- On the coordinator TMAC unit (Node 0), set the binary switches to *00000000*—that is, all switches are down.
- For the other TMAC nodes, refer to the following table for the binary switch position.

Decimal (Node Number)	Binary Switch Position
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010

4. Configure the **Node Address NODEID Switch** (Fig. 10).

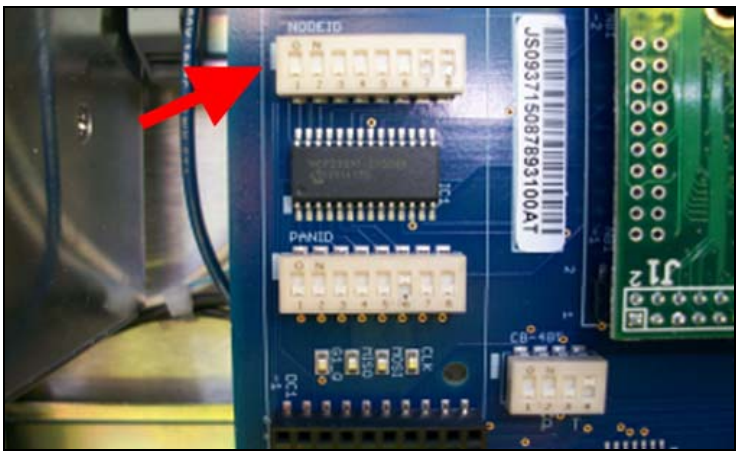


Fig. 10

- On the coordinator TMAC unit (Node 0), set the binary switches to *00000000*.
- For the other TMAC nodes, refer to the following table for the binary switch position.

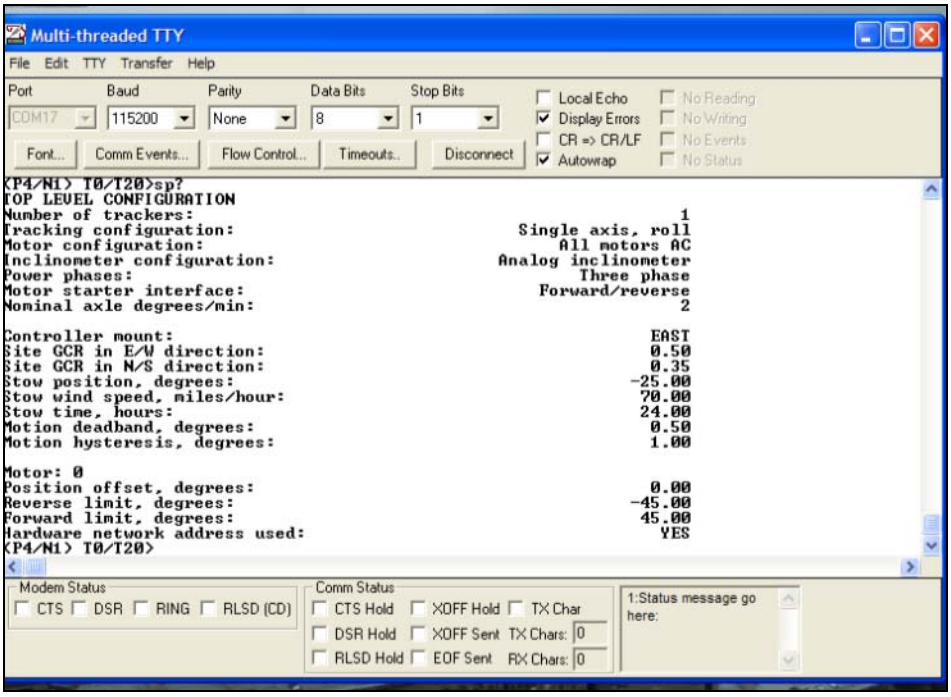
Decimal (Node Number)	Binary Switch Position
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010

5. Record the controller's Mac address and the PCB Number on the commissioning form (Fig. 11). The Mac address and the PCB number are used to assign the controller to a site on the TMAC Admin Server.

Fig. 11

6. Close the breaker/disconnect.
7. Use the USB A to USB B cable assembly to connect the laptop to the controller through the **Programming Port.**

8. Start the Mitty application.
9. In the Multi-threaded TTY screen, enter “SP?” to check the site parameters.



Multi-threaded TTY screen

10. Adjust if necessary tracker mounting, Check motor direction with in manual mode.
11. Using the TMAC controller in manual mode move the array to Flat.
12. Adjust inclinometer offset.
13. Verify East and West limit switches
14. Verify and adjust GCR
15. Verify and adjust Stow
16. Verify and adjust Site Slope
17. Verify and adjust Torque Tube Slope
18. Verify and adjust North/South Misalignment
19. Verify all setting and Program Memory by entering “fw” press Return
20. Set mode switch to “Auto”

1.5 Remote Access

1.5.1 Overview of Control Interface and Capabilities

Remote access to the TMAC controller enables better control of the entire network. By accessing the TMAC Admin Server, you can perform the following tasks:

- Stowing the array
- Checking array status
- Accessing weather data
- Accessing temperature readings for each TMAC controller
- Carrying out advanced control functions with outside data
- Performing advanced maintenance functions
- Generating email reports

Note. Most of these functions are add-ons and chargeable to our customers.

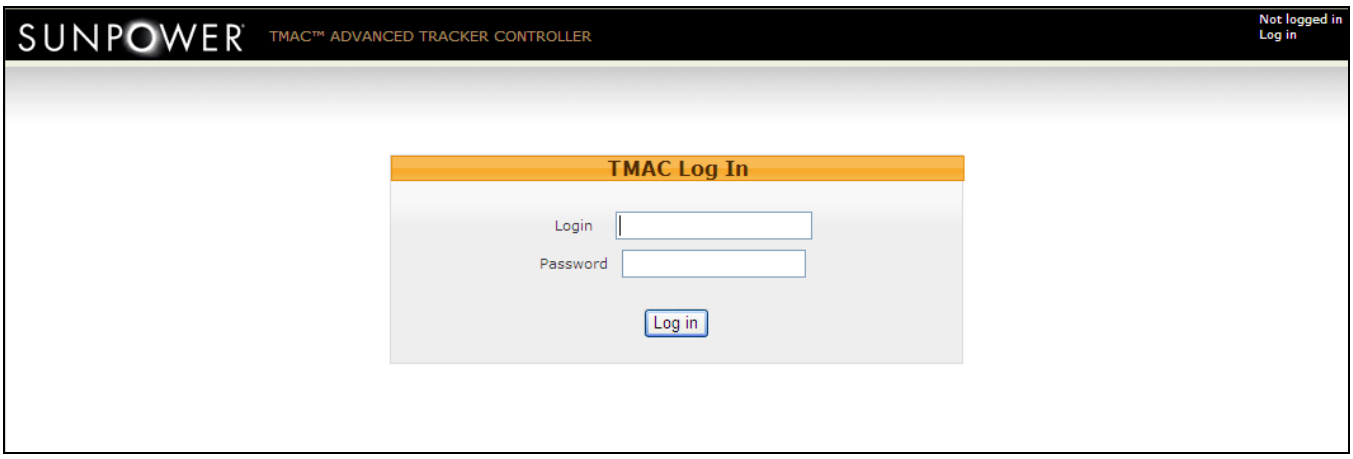
1.5.2 Accessing the TMAC Admin Server

To access the TMAC Admin Server, you need login information. Contact the Engineering Department to have an account set up for you.

1.5.2.1 Logging In

To log in to the server:

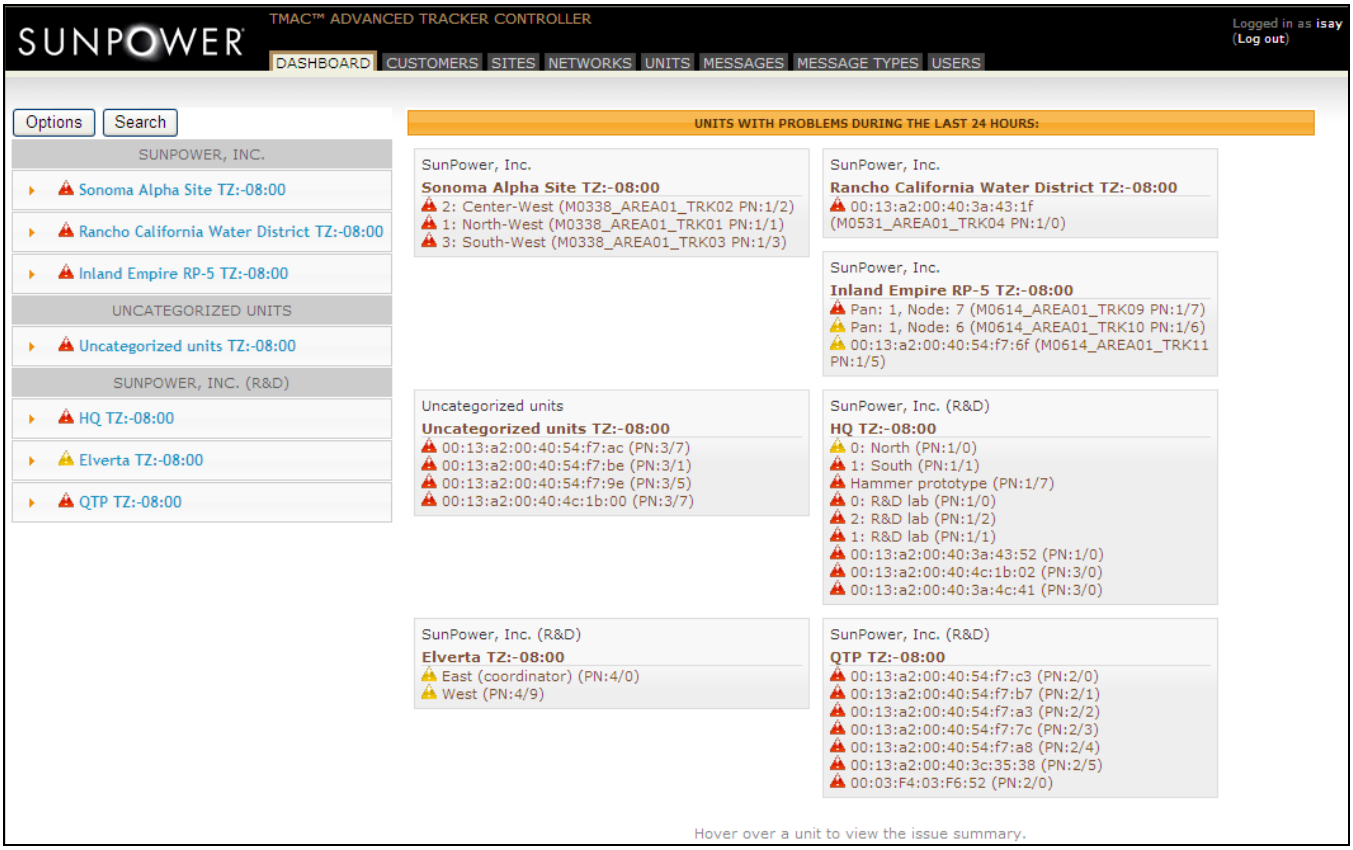
1. Navigate to the TMAC Admin Server website http://tmac.sunpowermonitor.com
2. On the TMAC Log In page, enter your username and password in the **Login** and **Password** fields, respectively and click *Log in.*



TMAC Log In page

Note. Passwords are case sensitive.

3. The TMAC Dashboard page appears. This page is the TMAC main page.



TMAC Dashboard page

1.5.2.2 Viewing Customer Site Information

To view customer site information on the TMAC Dashboard page:

1. In the list on the left side of the page, click the name of the customer site you want to view (Fig. 11).

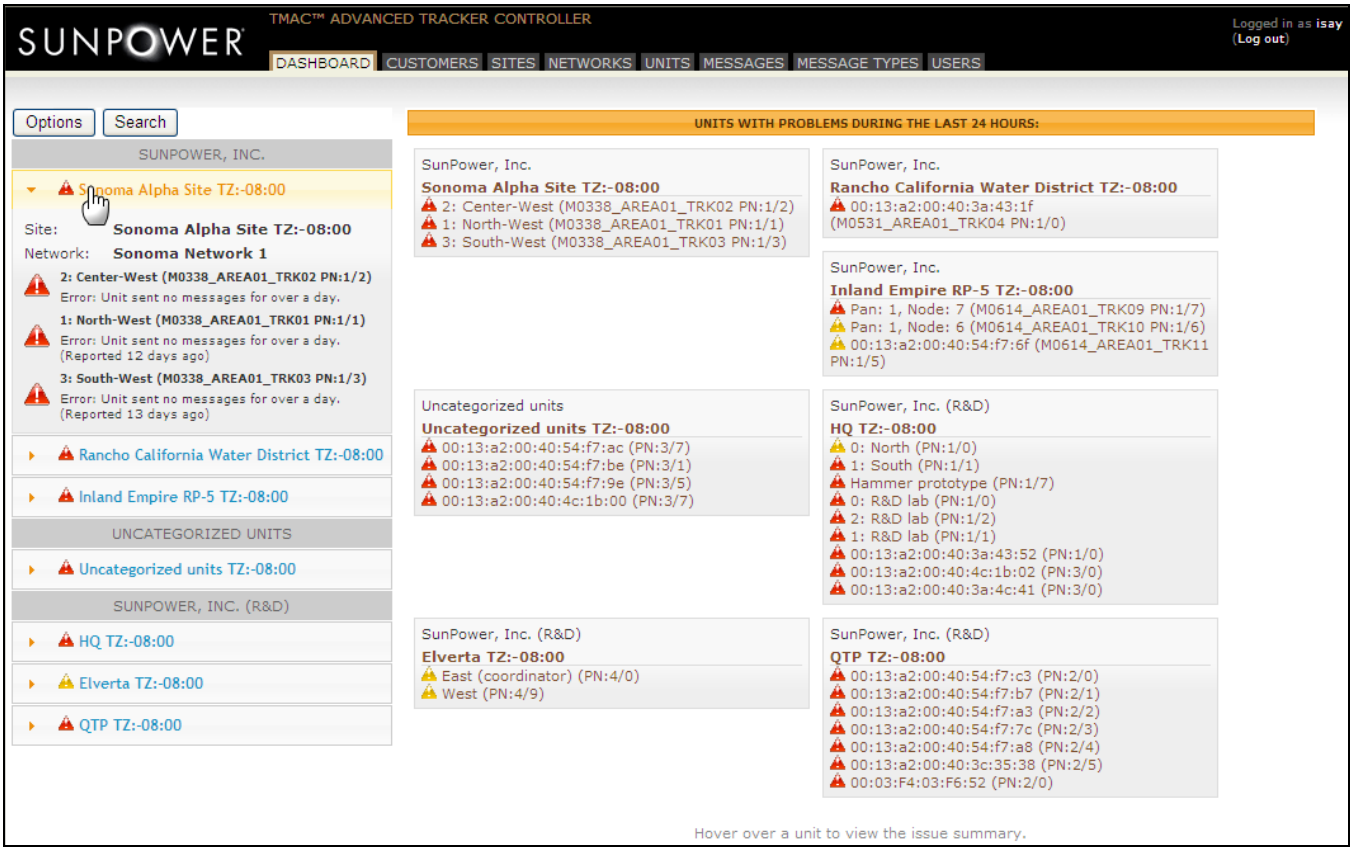


Fig. 11

2. In the collapsed pane below the customer site name, click the site name link to view the site-level details to the right (Fig. 12).

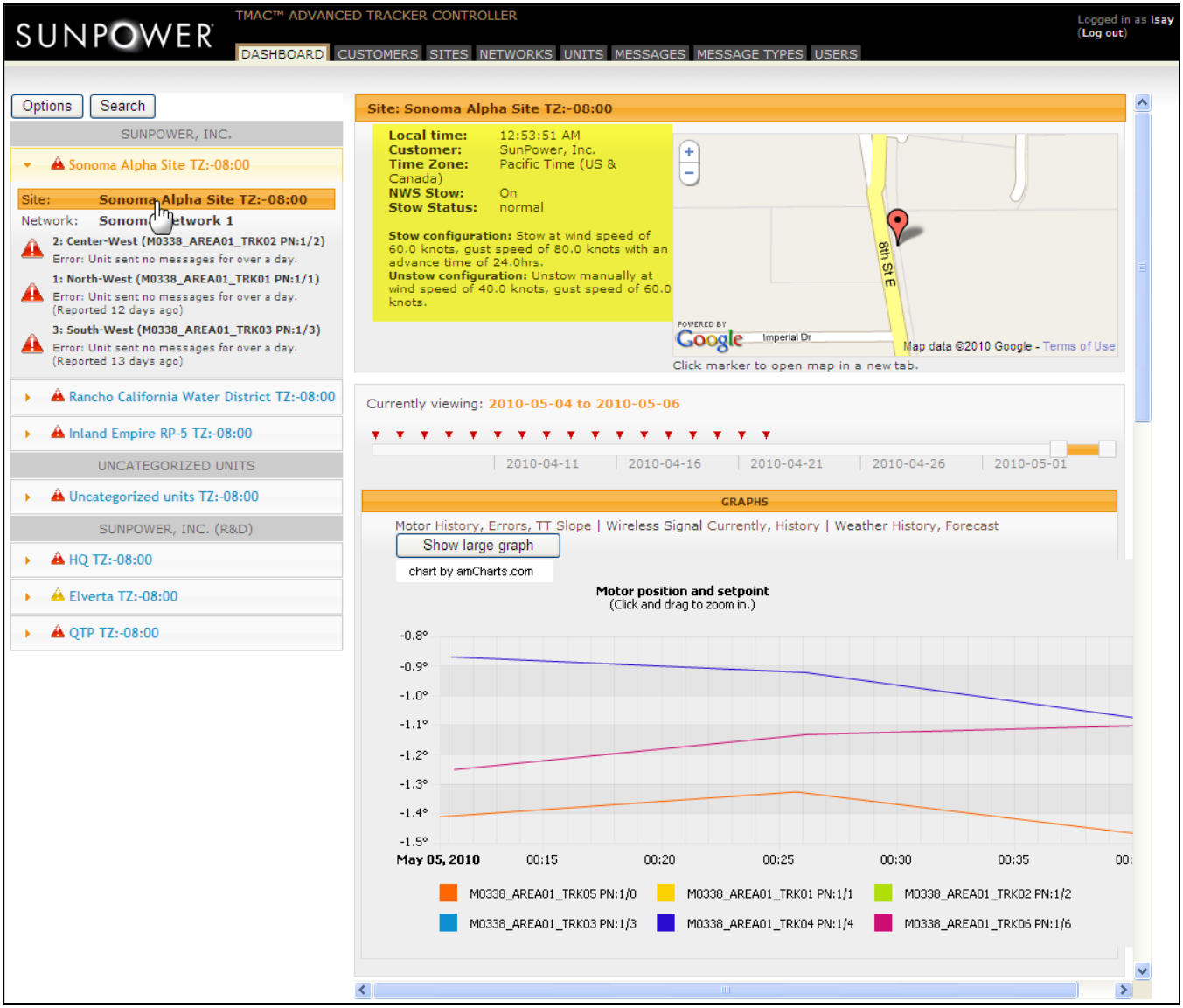

SUNPOWER
TMAC™ ADVANCED TRACKER CONTROLLER
Logged in as isay
(Log out)
DASHBOARD
CUSTOMERS
SITES
NETWORKS
UNITS
MESSAGES
MESSAGE TYPES
USERS
Options
Search
SUNPOWER, INC.
Sonoma Alpha Site TZ:-08:00
Site: Sonoma Alpha Site TZ:-08:00
Network: Sonoma Network 1
2: Center-West (M0338_AREA01_TRK02 PN:1/2)
Error: Unit sent no messages for over a day.
1: North-West (M0338_AREA01_TRK01 PN:1/1)
Error: Unit sent no messages for over a day.
(Reported 12 days ago)
3: South-West (M0338_AREA01_TRK03 PN:1/3)
Error: Unit sent no messages for over a day.
(Reported 13 days ago)
Rancho California Water District TZ:-08:00
Inland Empire RP-5 TZ:-08:00
UNCATEGORIZED UNITS
Uncategorized units TZ:-08:00
SUNPOWER, INC. (R&D)
HQ TZ:-08:00
Elverta TZ:-08:00
QTP TZ:-08:00
Site: Sonoma Alpha Site TZ:-08:00
Local time: 12:53:51 AM
Customer: SunPower, Inc.
Time Zone: Pacific Time (US & Canada)
NWS Stow: On
Stow Status: normal
Stow configuration: Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.
Unstow configuration: Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.
8th St E
Imperial Dr
Google
Map data ©2010 Google - Terms of Use
Click marker to open map in a new tab.
Currently viewing: 2010-05-04 to 2010-05-06
2010-04-11
2010-04-16
2010-04-21
2010-04-26
2010-05-01
GRAPHS
Motor History, Errors, TT Slope | Wireless Signal Currently, History | Weather History, Forecast
Show large graph
chart by amCharts.com
Motor position and setpoint
(Click and drag to zoom in.)
-0.8°
-0.9°
-1.0°
-1.1°
-1.2°
-1.3°
-1.4°
-1.5°
May 05, 2010
00:15
00:20
00:25
00:30
00:35
M0338_AREA01_TRK05 PN:1/0
M0338_AREA01_TRK01 PN:1/1
M0338_AREA01_TRK02 PN:1/2
M0338_AREA01_TRK03 PN:1/3
M0338_AREA01_TRK04 PN:1/4
M0338_AREA01_TRK06 PN:1/6

Fig. 12

3. View the customer site information:

Information	Description
Local time	Real-time, 12-hour format local time with AM/PM
Customer	Name of the customer
Time Zone	The time zone in text
NWS Stow	The National Weather Service Stow Enable indicator—*ON* indicates NWS is enabled; *OFF*, disabled. The stow and unstow perimeters are defined in the Stow and Unstow Configuration retrospect.
Stow Status	
Stow Configuration	Defines at what perimeters the tracker controller will stow the panels
Unstow configuration	Defines at what perimeters the tracker controller will allow the panels to resume normal operations

4. To view the site location map in a separate window, click the marker on the map (Fig. 13).

Fig. 13

1.5.2.3 Viewing Network Information

On the TMAC Dashboard page, you can view network information for a customer site:

1. In the list on the left side of the page, click the name of the customer site you want to view.
2. In the collapsed pane below the customer site name, click the network name link to view the network details to the right (Fig. 14).

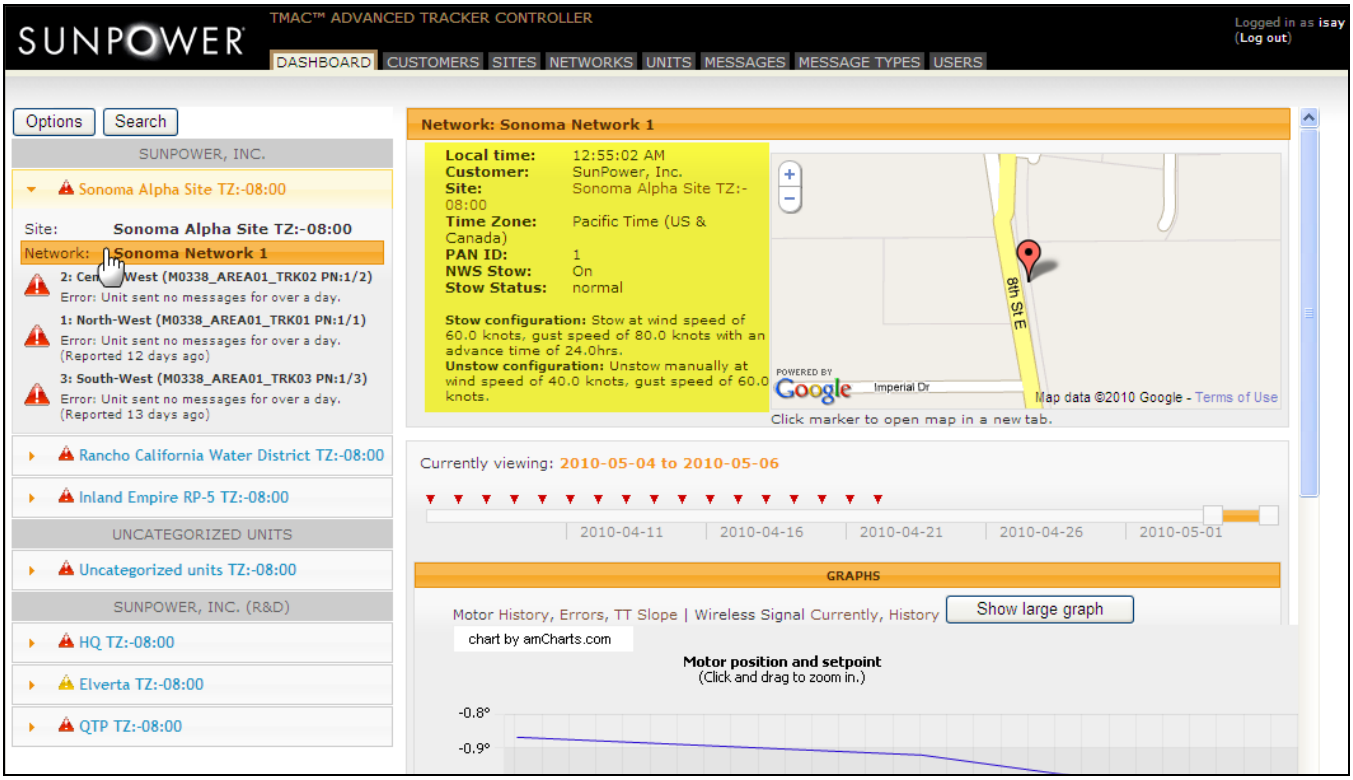


Fig. 14

3. View the network information:

Information	Description
Local time	Real-time, 12-hour format local time with AM/PM
Customer	Name of the customer
Site	The customer site name **Note.** The customer site name is an active link. Click to view the customer site information (refer to Section 1.5.2.2).
Time Zone	The time zone in text
PAN ID	The tracker group address used by the network

	communication
NWS Stow	The National Weather Service Stow Enable indicator—*ON* indicates NWS is enabled; *OFF*, disabled. The stow and unstow perimeters are defined in the Stow and Unstow Configuration retrospect.
Stow Status	Current system status: stowed/tracking/backtracking
Stow Configuration	Defines at what perimeters the tracker controller will stow the panels
Unstow configuration	Defines at what perimeters the tracker controller will allow the panels to resume normal operations

1.5.2.4 Viewing TMAC Unit Information

On the TMAC Dashboard page, you can view detailed information on each TMAC unit installed at the customer site:

1. In the list on the left side of the page, click the name of the customer site you want to view.
2. In the collapsed pane below the customer site name, click the TMAC unit link to view the unit details to the right (Fig. 15).

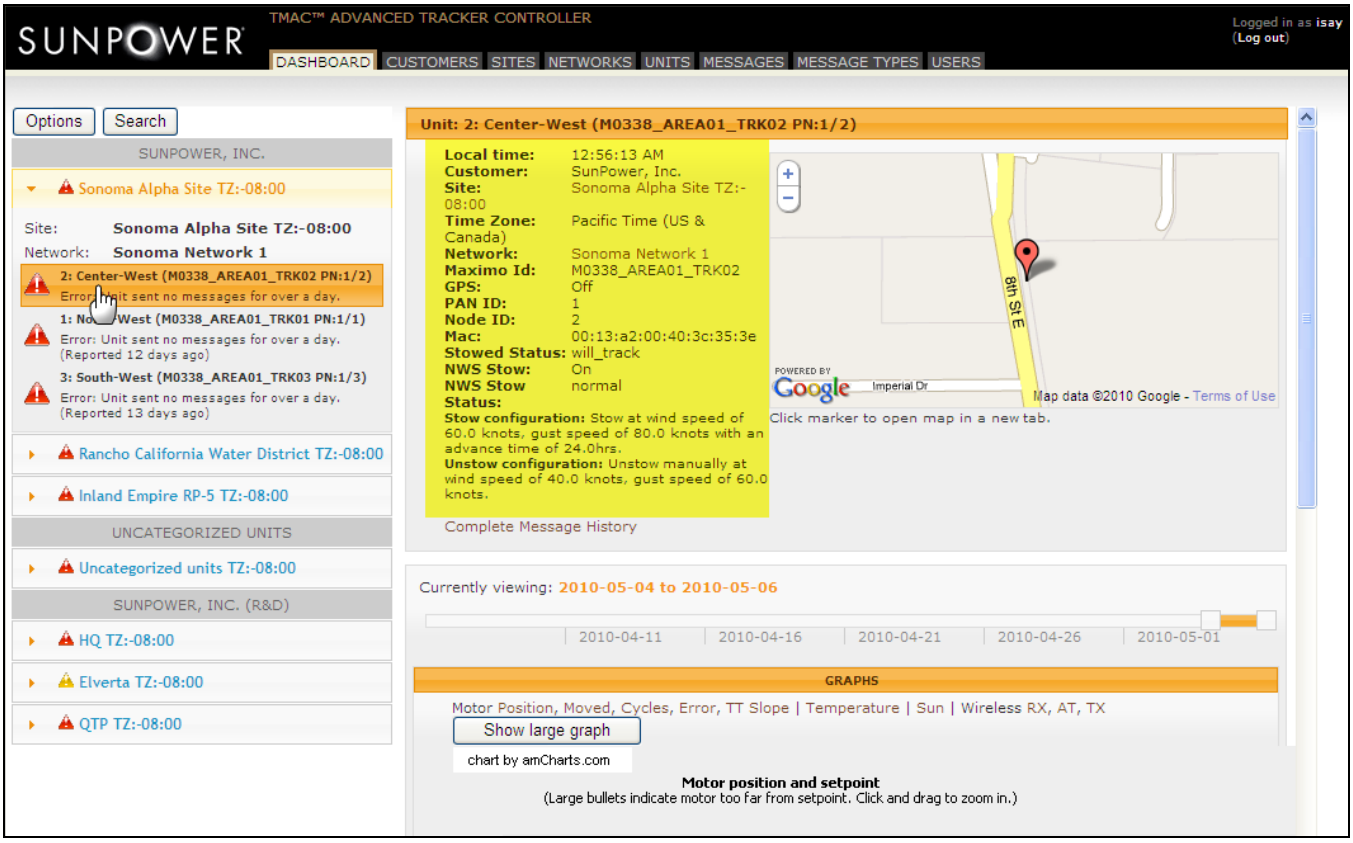


Fig. 15

3. View the TMAC unit information:

Information	Description
Local time	Real-time, 12-hour format local time with AM/PM
Customer	Name of the customer
Site	The customer site name **Note.** The customer site name is an active link. Click to view the customer site information (refer to Section 1.5.2.2).
Time Zone	The time zone in text
Network	The name of the network to which the TMAC unit belongs
Maximo ID	The description or name of the Tracker used as identifier for reporting in Maximo
GPS	GPS is enabled when a GPS receiver and antenna is installed

PAN ID	The tracker group address
Node ID	The individual tracker network address
Mac	This address is programmed at the factory in the network interface and cannot be changed
Stowed Status	Current system status: stowed/tracking/backtracking
NWS Stow	The National Weather Service Stow Enable indicator—*ON* indicates NWS is enabled; *OFF*, disabled. The stow and unstow perimeters are defined in the Stow and Unstow configuration retrospect.
NWS Stow Status	Indicates system stow status based on NWS forecast
Stow Configuration	Defines at what perimeters the tracker controller will stow the panels
Unstow configuration	Defines at what perimeters the tracker controller will allow the panels to resume normal operations

4. To view graphic and error reports for the selected TMAC unit, use the graph. To use the graph, refer to Section 1.5.2.5.

1.5.2.5 Using the Graph

On the TMAC Dashboard page, you can view the following level-specific graphs:

Level	Graph	Description
Site-level	**Motor History**	Plots motor position against programmed setpoint values for each tracker in the site
	Motor Errors	Plots the differential between motor position and setpoint values for each tracker in the site
	Wireless Signal Currently	Plots current minimum, maximum, and average signal strength values (in dB) for each tracker in the site
	Wireless Signal History	Plots historical signal strength values (in dB) for each tracker in the site
	Weather History	Plots historical temperature, wind speed, and gust speed values
	Weather Forecast	Plots temperature and wind-speed forecast for the next three days

Network-level	**Motor History**	Plots motor position against programmed setpoint values for each tracker within the network
	Motor Errors	Plots the differential between motor position and setpoint values for each tracker within the network
	Wireless Signal Currently	Plots current minimum, maximum, and average signal strength values (in dB) for each tracker within the network
	Wireless Signal History	Plots historical signal strength values (in dB) for each tracker within the network
TMAC unit-level	**Motor Position**	Plots the tracker's motor position against programmed setpoint values
	Motor Moved	Plots the amount of time the tracker motor is running in forward and reverse
	Motor Cycles	Plots the number of times the tracker motor is switched on and off
	Motor Error	Plots the differential between the tracker's motor position and setpoint values
	Temperature	Plots the tracker enclosure temperature over time
	Sun	Plots the position of the sun in both tracker and world frame throughout the day
	Wireless RX	Plots the quality of received data
	Wireless AT	(Wireless Communication Status: AT) [description]
	Wireless TX	Plots the quality of transmitted data

To illustrate, perform the following steps to view the graphed motor position and setpoint values for a TMAC unit—for example, *Unit: 00:13:a2:00:40:3a:43:1f (M0531_AREA01_TRK04 PN:1/0)* installed at *Rancho California Water District TZ:-08:00*—over the last three days.

1. In the list on the left side of the TMAC Dashboard page, click *Rancho California Water District TZ:-08:00.*
2. In the collapsed pane below the customer site name, click *00:13:a2:00:40:3a:43:1f (M0531_AREA01_TRK04 PN:1/0).*
3. View the **Motor Position** graph—the default graph view— for *Unit: 00:13:a2:00:40:3a:43:1f (M0531_AREA01_TRK04 PN:1/0)* (Fig. 16).

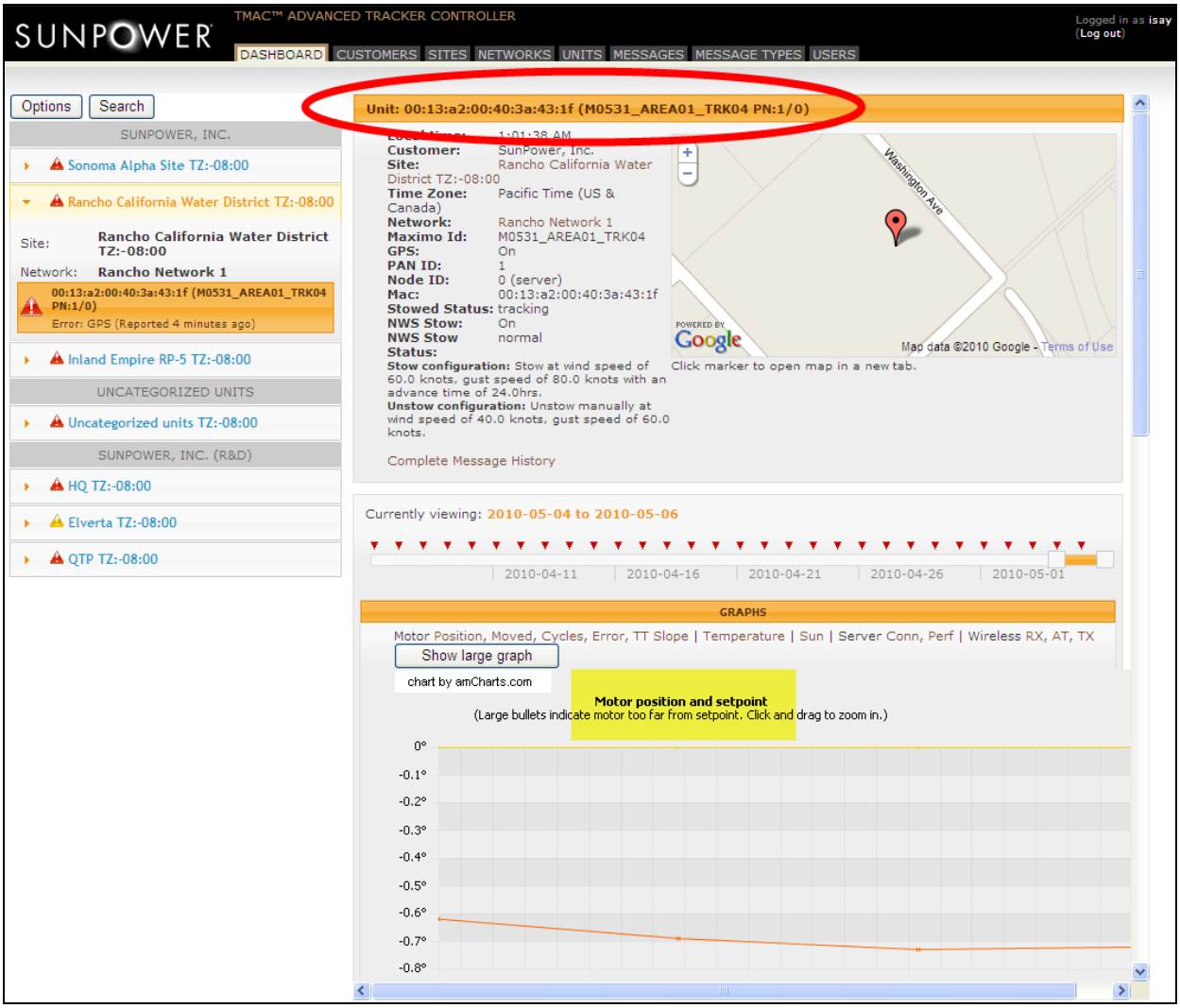


Fig. 16

4. To view older data, move the slider above the **Graphs** title bar. To view data a day or two days at a time instead of the maximum three, decrease the width of the slider.

   Important! You can view older data only if available. Small red triangles appear over the slider bar to indicate available older data.

If you want to view graph data for non-TMAC specific parameter such as temperature forecast for the next three days, select either the site- or network-level view and then click the *Weather Forecast* graph link (Fig. 17). Hover over interval points in the graph line to view the data details.

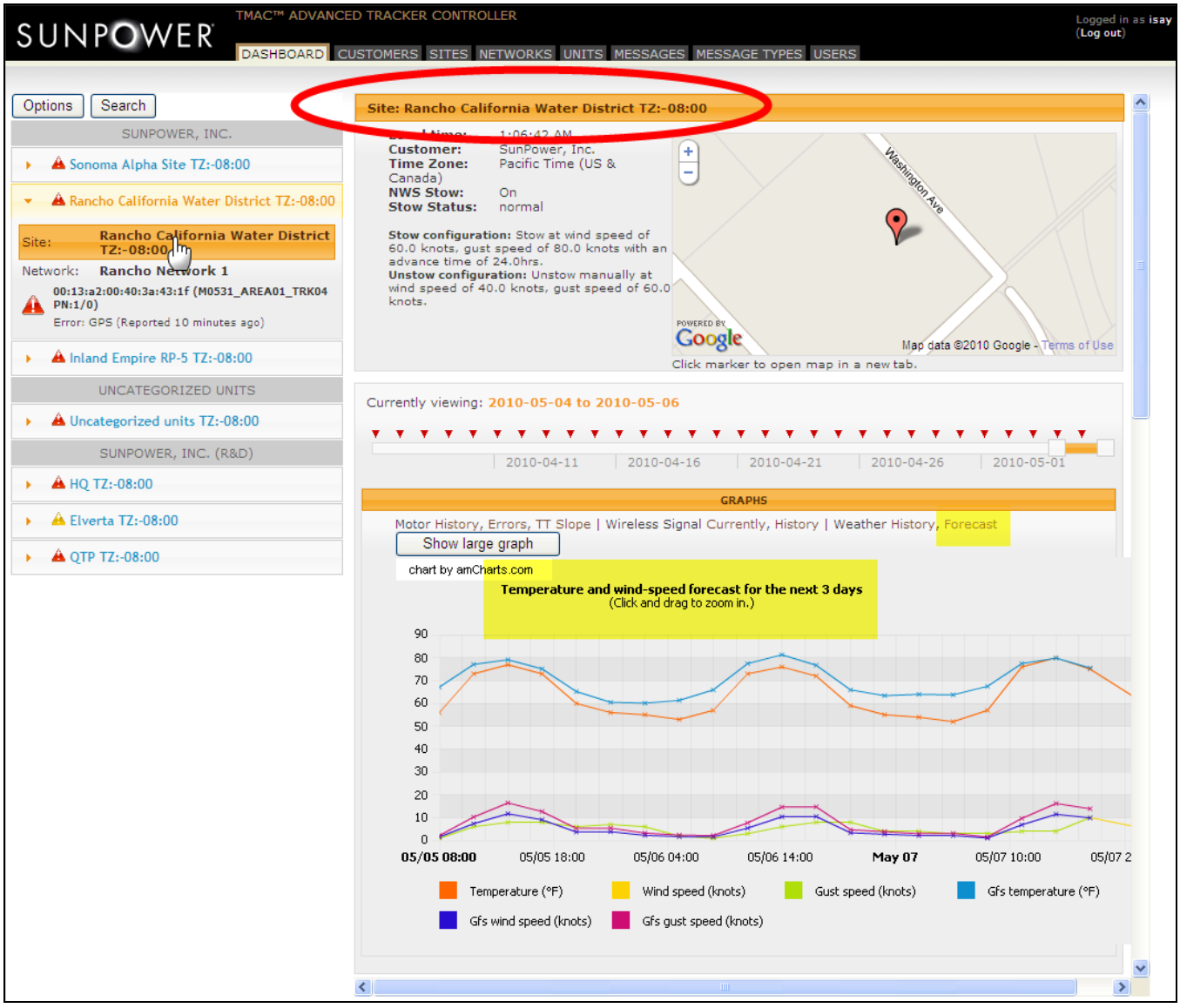

SUNPOWER
TMAC™ ADVANCED TRACKER CONTROLLER
Logged in as isay
(Log out)
DASHBOARD
CUSTOMERS
SITES
NETWORKS
UNITS
MESSAGES
MESSAGE TYPES
USERS
Options
Search
SUNPOWER, INC.
Sonoma Alpha Site TZ:-08:00
Rancho California Water District TZ:-08:00
Site: Rancho California Water District TZ:-08:00
Network: Rancho Network 1
00:13:a2:00:40:3a:43:1f (M0531_AREA01_TRK04 PN:1/0)
Error: GPS (Reported 10 minutes ago)
Inland Empire RP-5 TZ:-08:00
UNCATEGORIZED UNITS
Uncategorized units TZ:-08:00
SUNPOWER, INC. (R&D)
HQ TZ:-08:00
Elverta TZ:-08:00
QTP TZ:-08:00
Site: Rancho California Water District TZ:-08:00
Customer: SunPower, Inc.
Time Zone: Pacific Time (US & Canada)
NWS Stow: On
Stow Status: normal
Stow configuration: Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.
Unstow configuration: Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.
Washington Ave
Google
Map data ©2010 Google - Terms of Use
Click marker to open map in a new tab.
Currently viewing: 2010-05-04 to 2010-05-06
2010-04-11
2010-04-16
2010-04-21
2010-04-26
2010-05-01
GRAPHS
Motor History, Errors, TT Slope | Wireless Signal Currently, History | Weather History, Forecast
Show large graph
chart by amCharts.com
Temperature and wind-speed forecast for the next 3 days
(Click and drag to zoom in.)
90
80
70
60
50
40
30
20
10
0
05/05 08:00
05/05 18:00
05/06 04:00
05/06 14:00
May 07
05/07 10:00
05/07 2
Temperature (°F)
Wind speed (knots)
Gust speed (knots)
Gfs temperature (°F)
Gfs wind speed (knots)
Gfs gust speed (knots)

Fig. 17

1.5.2.6 Viewing System Status

On the TMAC Dashboard page, you can view system status details for each TMAC unit.

1. Perform the steps in Section 1.5.2.4 to open the unit-level page for the TMAC controller you want to view.
2. Scroll down the unit-level page. The **SYSTEM STATUS** section (below the **GRAPHS** section) lists message types and when each was last received (Fig. 18). Refer to Appendix A for full description of the message types.

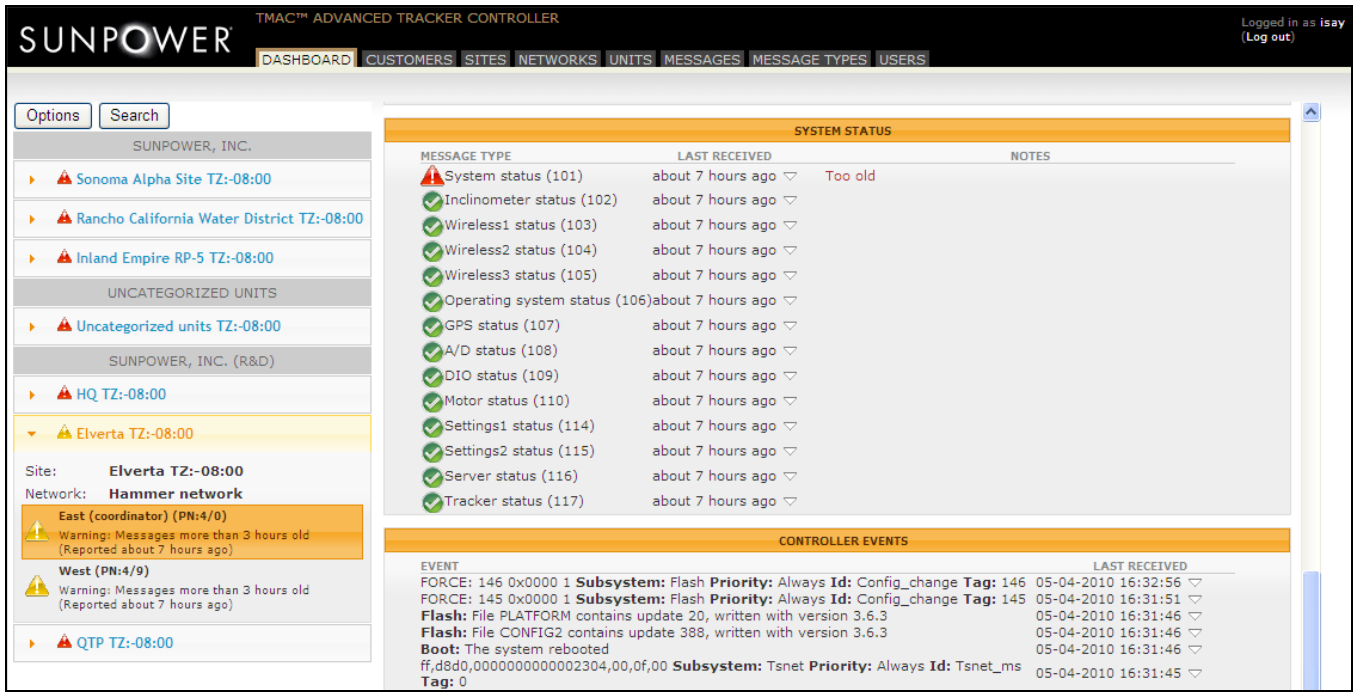


Fig. 18

3. To view the details of a message type—for example, *System status (101)*, click the *Arrow_down* button under the LAST RECEIVED column to collapse the selected row (Fig. 19).

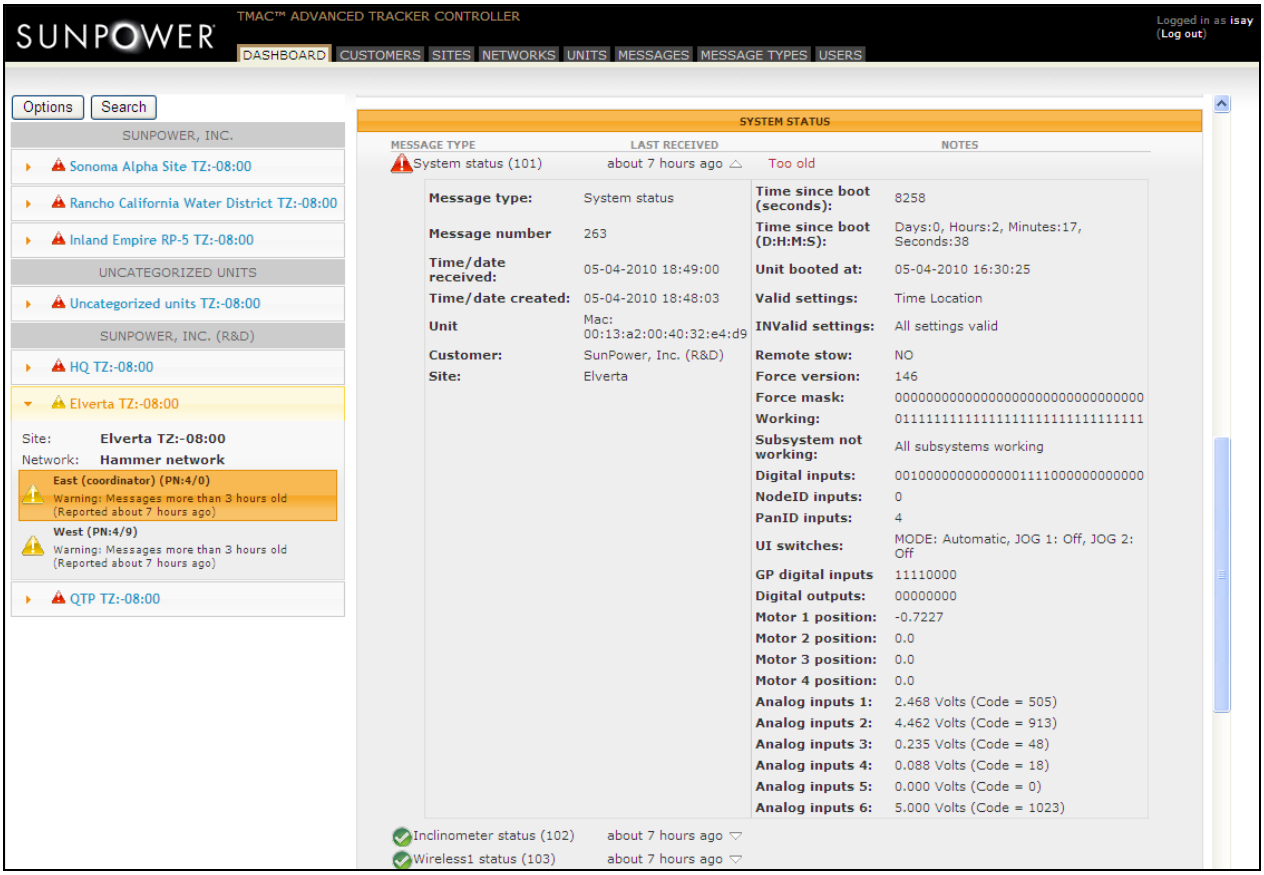


Fig. 19

4. Click the *Arrow_up* button to hide the details.
5. Perform Steps 3–4 to view the details of other message types.

1.5.2.7 Viewing Controller Events

On the TMAC Dashboard page, you can view details of controller events for each TMAC unit.

1. Perform the steps in Section 1.5.2.4 to open the unit-level page for the TMAC controller you want to view.
2. Scroll down the unit-level page. The **CONTROLLER EVENTS** section lists controller events and when each was last received (Fig. 20).

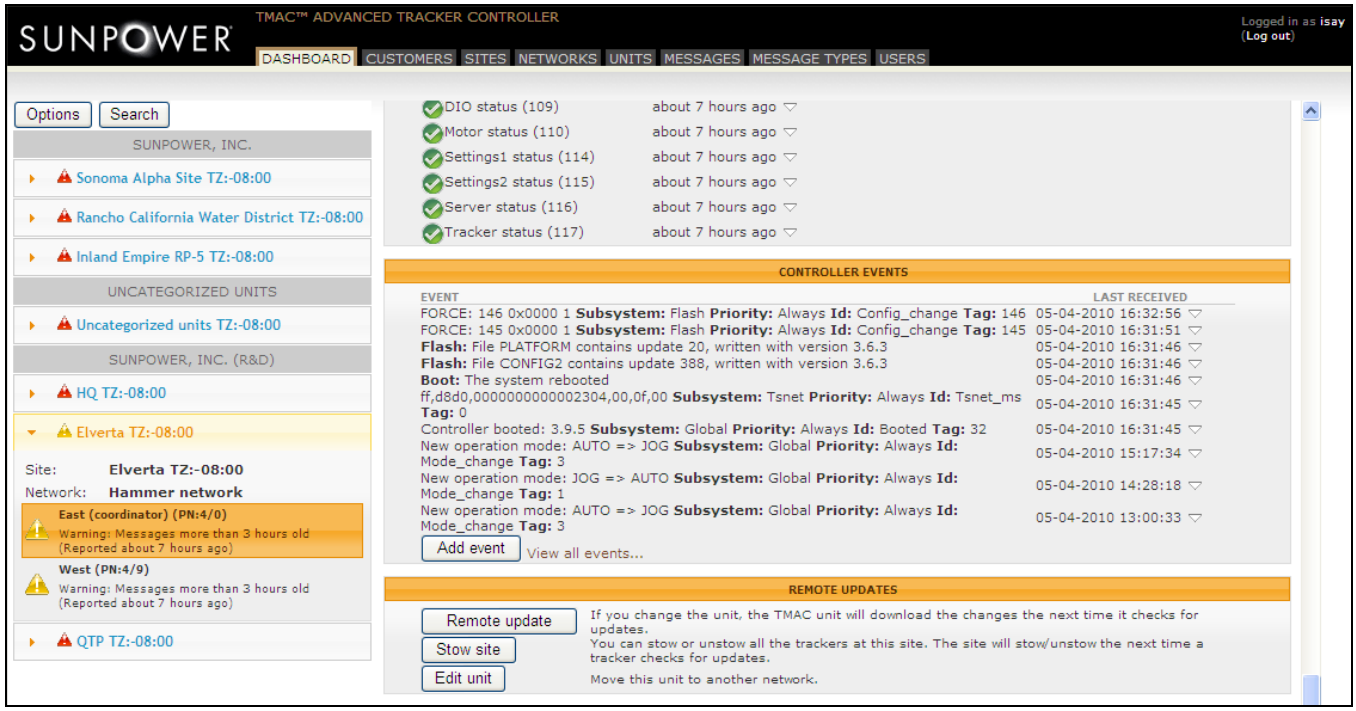


Fig. 20

3. To view the details of a controller event—for example, the event report at the top of the list, click the *Arrow_down* button under the LAST RECEIVED column to collapse the row (Fig. 21).

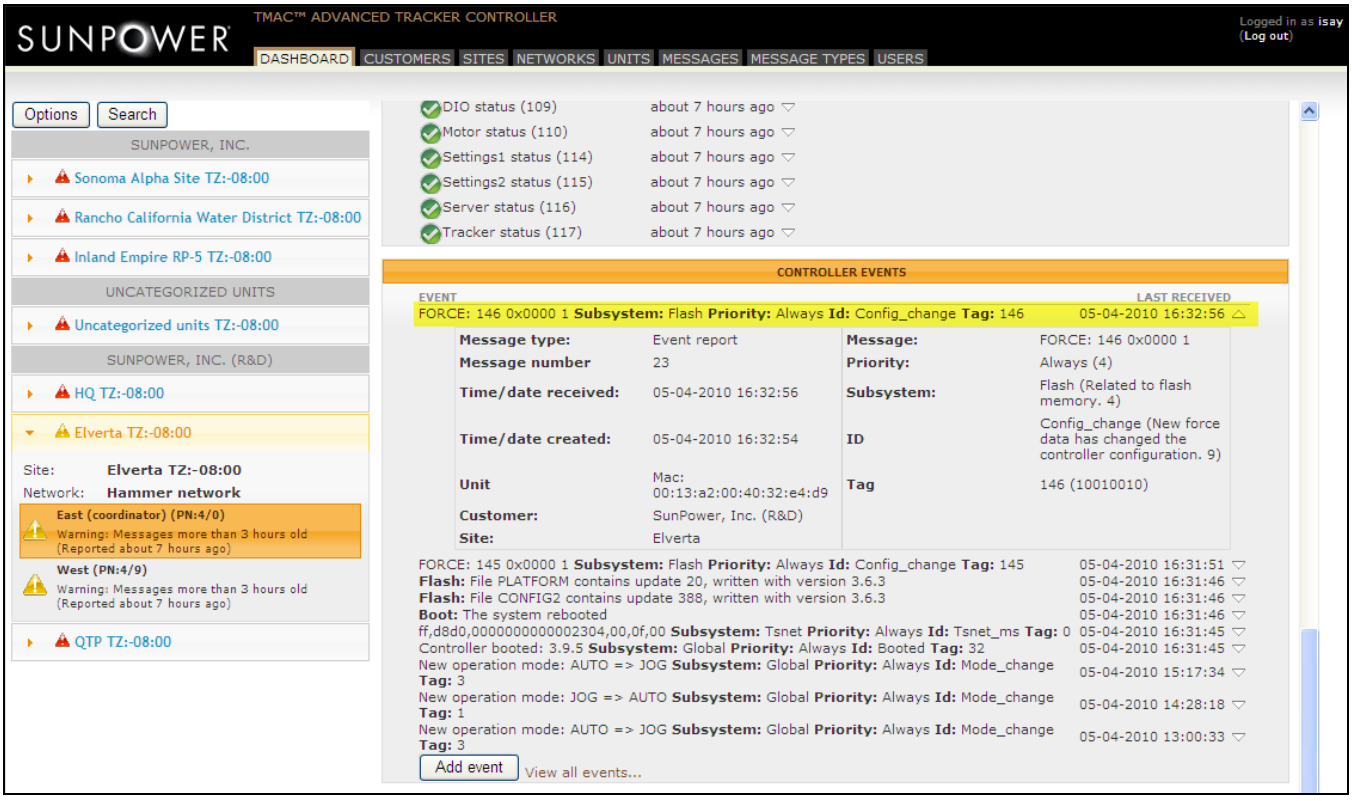


Fig. 21

4. Click the *Arrow_up* button to hide the details.
5. Perform Steps 3–4 to view the details of other controller events.

1.5.2.8 Sending Remote Updates

On the TMAC Dashboard page, you can send remote updates for each TMAC unit.

1. Perform the steps in Section 1.5.2.4 to open the unit-level page for the TMAC controller you want to view.
2. Scroll down the unit-level page. The **REMOTE UPDATES** section contains the *Remote update* button that enables you to send commands to the TMAC controller and enter values in the commissioning form (Fig. 22).

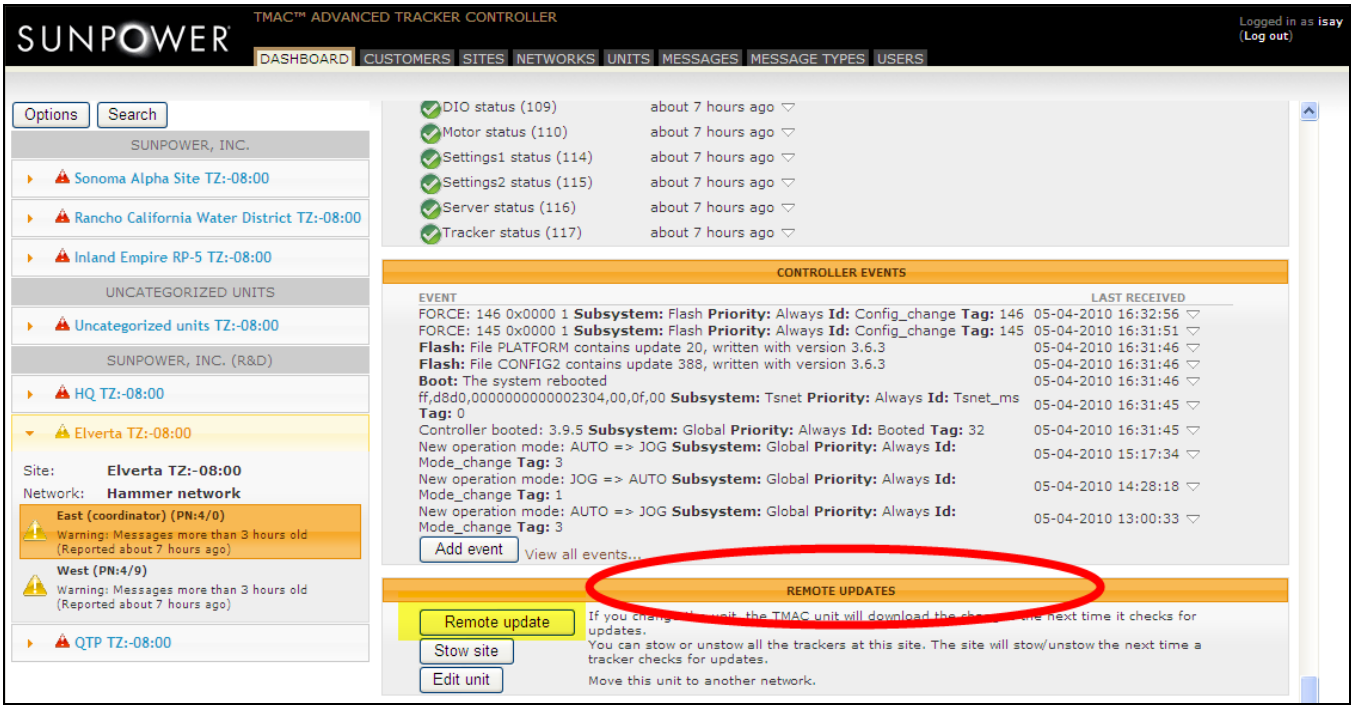


Fig. 22

3. Click *Remote update.*
4. A screen appears (Fig. 23).

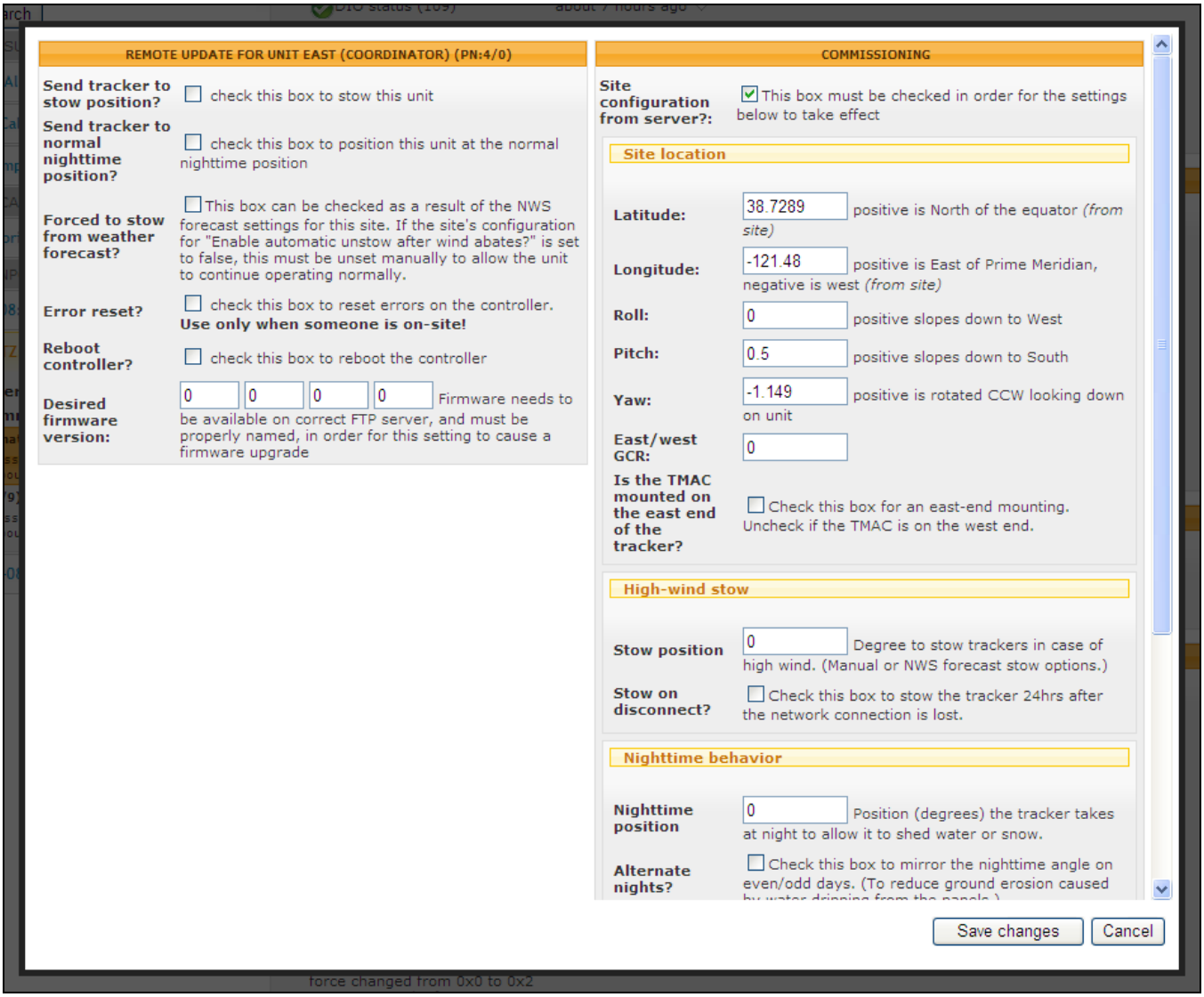


Fig. 23

- **REMOTE UPDATE** section:
- **COMMISSIONING** section:

1.5.2.9 Viewing Recent Updates

On the TMAC Dashboard page, you can view recent updates sent remotely to each TMAC unit.

1. Perform the steps in Section 1.5.2.4 to open the unit-level page for the TMAC controller you want to view.
2. Scroll down the unit-level page. The **RECENT UPDATES** section lists the updates on remote commands sent to the TMAC controller (Fig. 24).

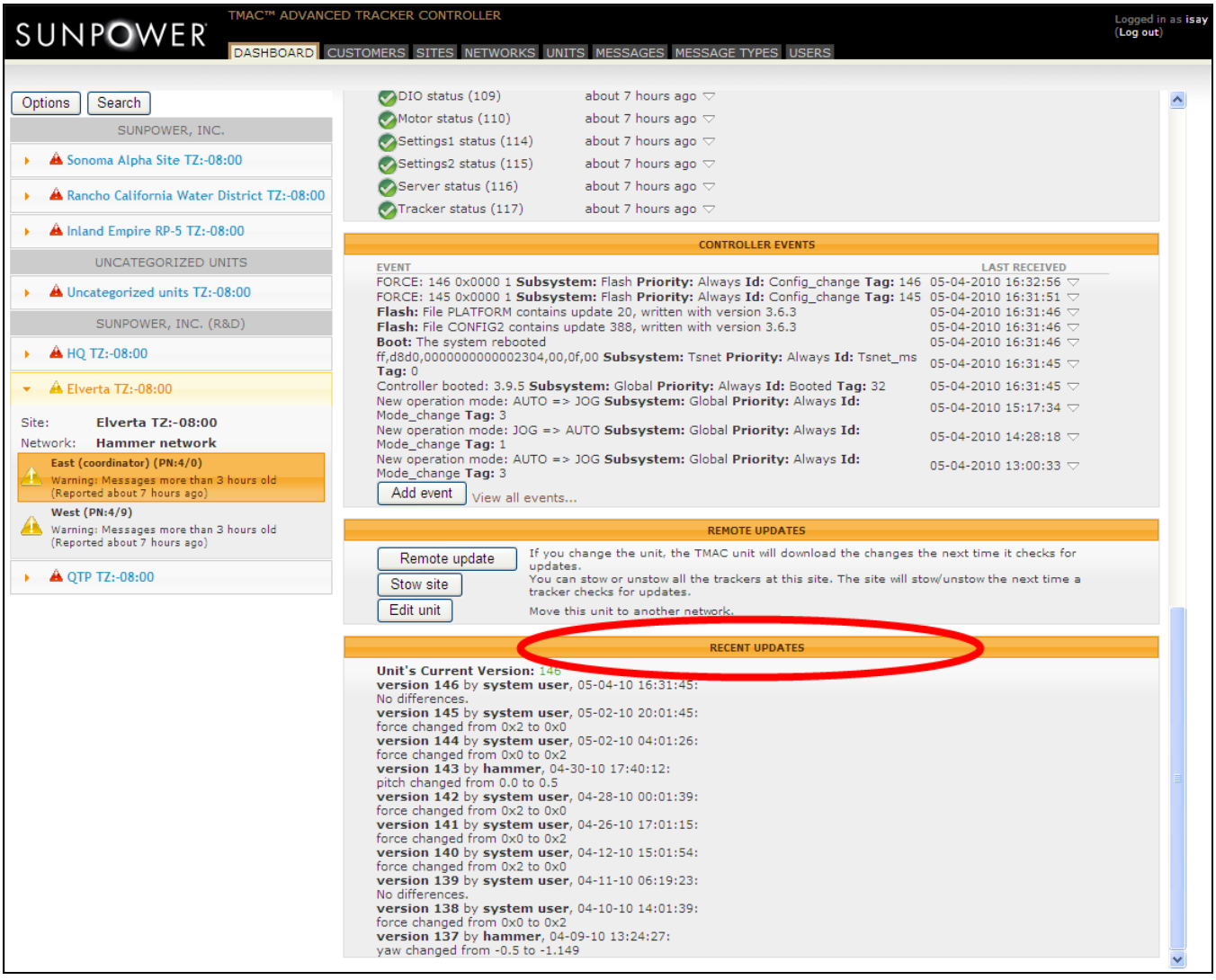
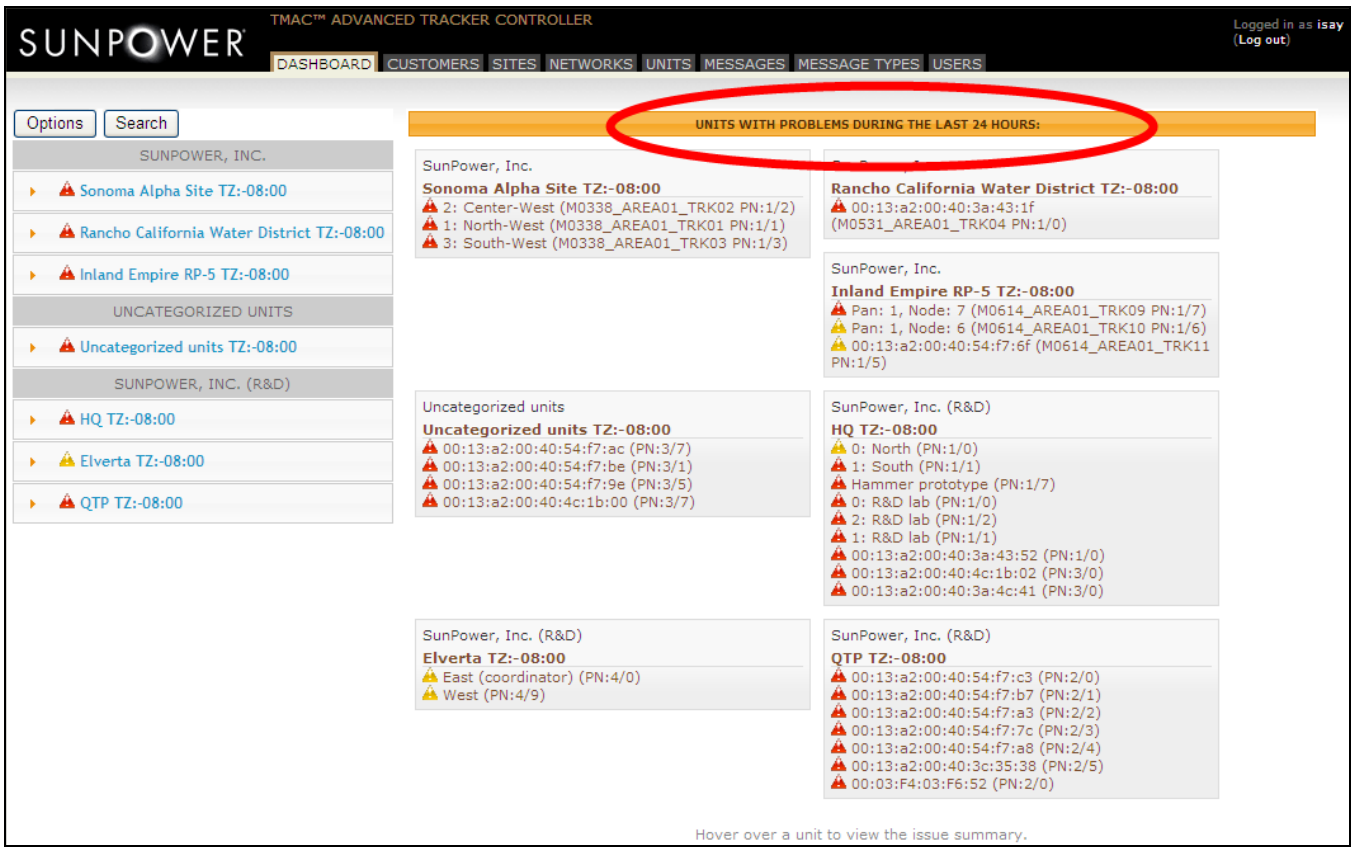


Fig. 24

1.5.2.10 Viewing Alerts

If there are TMAC units with problems during the last 24 hours, the TMAC Dashboard page displays the alerts by default.



TMAC Dashboard page

To see only the customer sites that have alerts, click the *Options* button below the SunPower logo. In the Dashboard Options window, select the **Show only errors?** check box and click *Save changes* (Fig. 25).

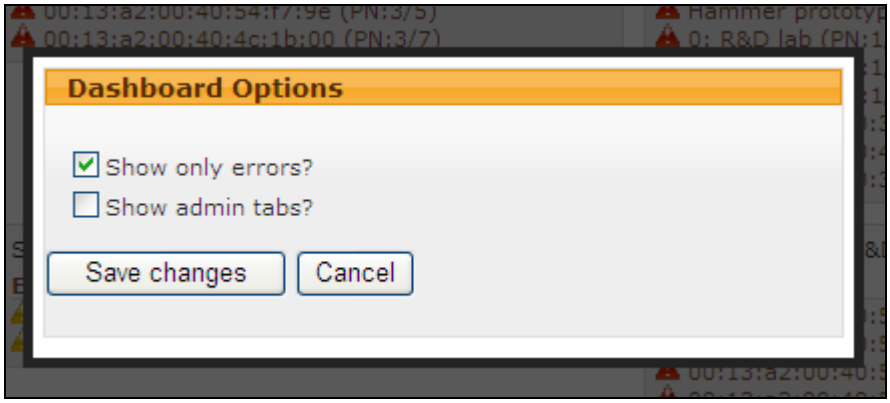


Fig. 25

Click *Reload Page* in the confirmation window (Fig. 26).

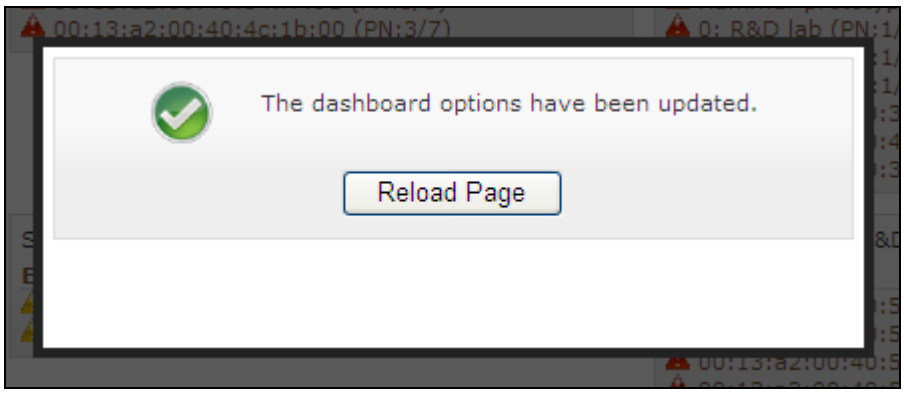


Fig. 26

Important! To see all customer sites on the TMAC Dashboard page, click *Options* and clear the **Show only error?** check box before saving the changes and reloading the page.

To view the issue summary, hover over the unit name (Fig. 27).

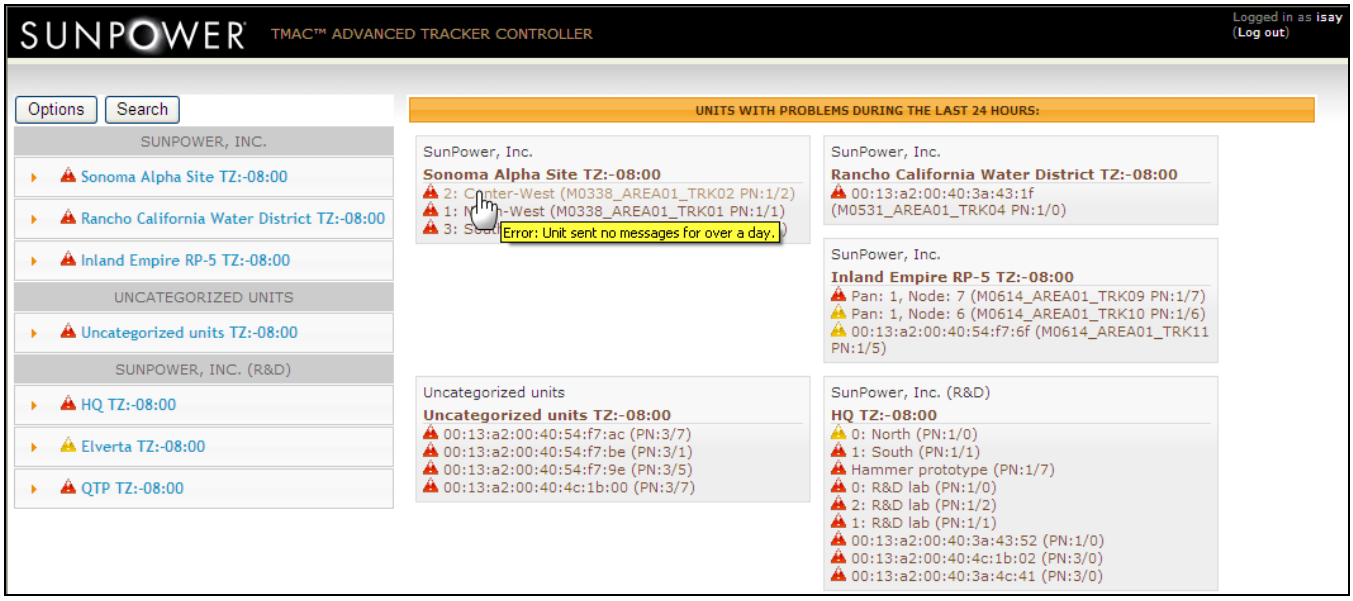


Fig. 27

Click the unit name link to open the unit-level view. Note that the graph does not show data for the unit with the issue (Fig. 28).

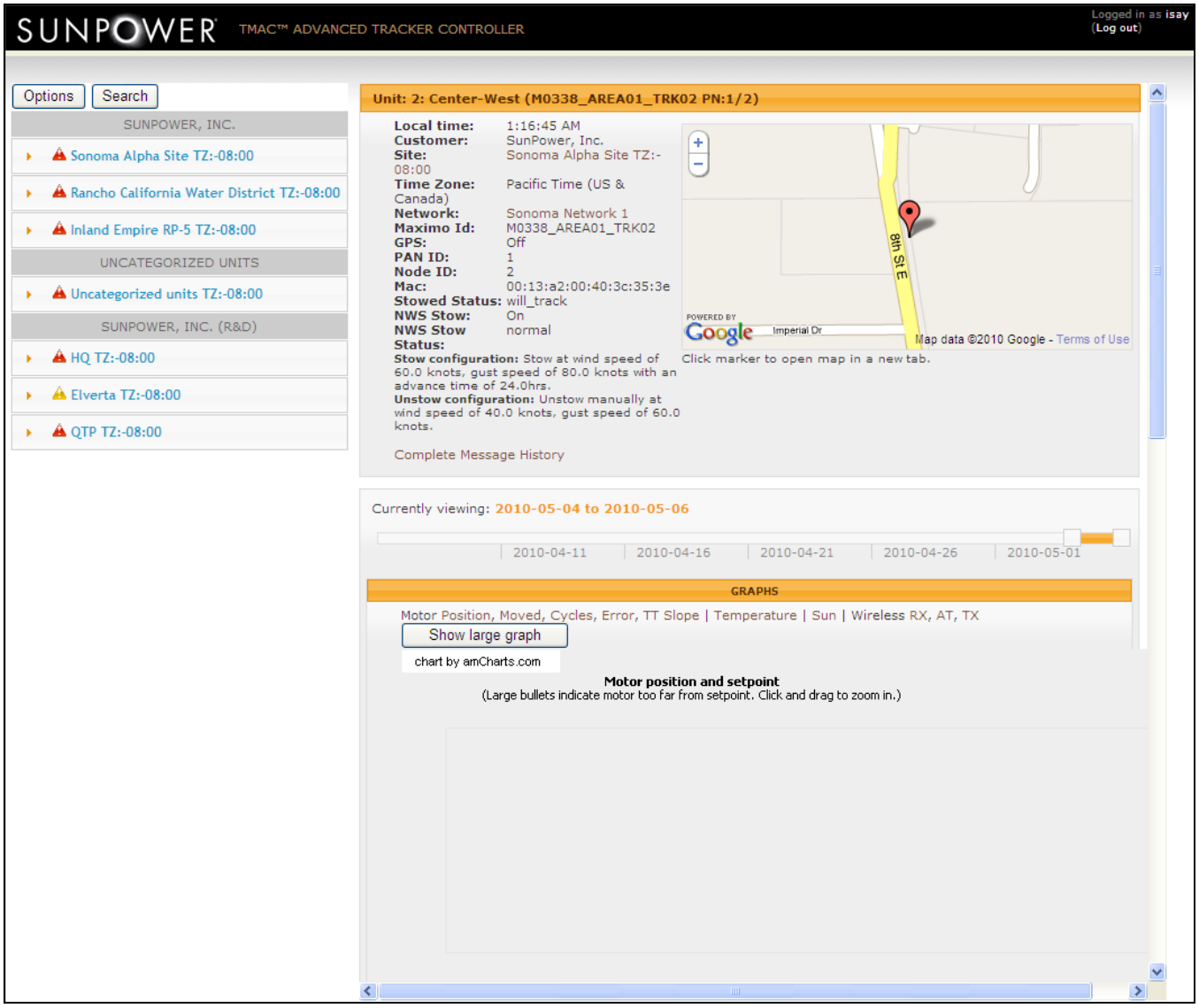


Fig. 28

Important! In the site-level view for a customer site where a unit has an issue, the graph will also not show any data.

1.5.2.11 Viewing and Managing Customer Information

To view, edit, or delete customer information, click the **CUSTOMERS** tab (Fig. 29).

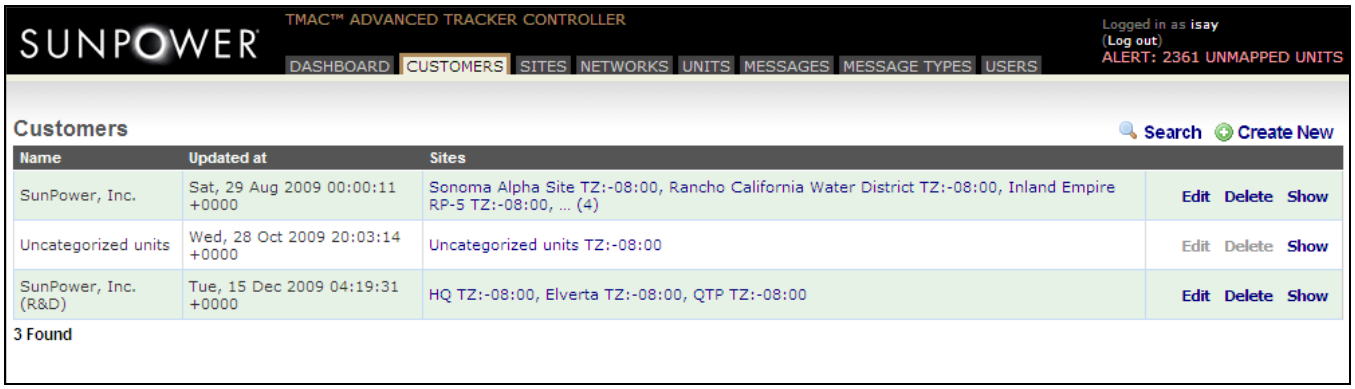


Fig. 29

The Customers page lists customer details in columns:

Column	Description
Name	The customer name…
Updated at	[description]
Sites	[description]

- To view customer information, click **Show** in the selected customer details row. The **Show Customer** window opens (Fig. 30). Click **Close** or the X button to close the window.

Fig. 30

- To change customer information details, click **Edit.** The **Update [Customer name]** window opens (Fig. 31).

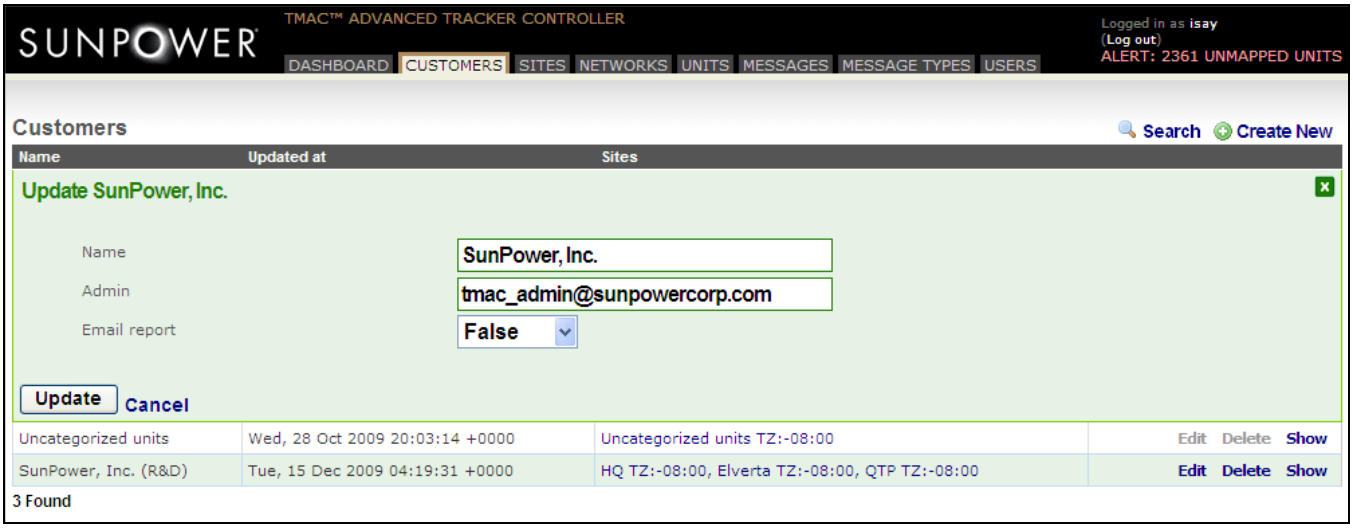


Fig. 31

a. Enter or select new values in the **Name, Admin,** and **Email report** fields.

b. Click *Update* to save the changes. Click *Cancel* or the X button to close the window.

- To delete customer information profile, click **Delete.** Click *OK* in the confirmation window.

1.5.2.12 Viewing and Managing Site Information

To view, edit, or delete site information, click the **SITES** tab (Fig. 32).

Name	Address	Customer	Networks	Latitude	Longitude	Stow status	Stow configuration	Unstow configuration	Site setting	Time zone	
HQ	Create New	SunPower, Inc. (R&D)	Back 40 trackers, R&D lab, R&D Lab 3	37.9125	-122.358	Stow site	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	TMAC:locked, Wireless:locked	Pacific Time (US & Canada)	Edit Delete Show
Sonoma Alpha Site	Sonoma CA USA	SunPower, Inc.	Sonoma Network 1	38.2528	-122.441	Stow site	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	TMAC:locked, Wireless:un-locked	Pacific Time (US & Canada)	Edit Delete Show
Uncategorized units		Uncategorized units	Uncategorized units	37.8715	-122.294	Unstowed	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	Create New	Pacific Time (US & Canada)	Edit Delete Show
Elverta		SunPower, Inc. (R&D)	Hammer network	38.7289	-121.48	Stow site	Stow at wind speed of 20.0 knots, gust speed of 30.0 knots with an advance time of 24.0hrs.	Unstow automatically at wind speed of 15.0 knots, gust speed of 25.0 knots.	Create New	Pacific Time (US & Canada)	Edit Delete Show
Rancho California Water District		SunPower, Inc.	Rancho Network 1, Rancho Network 2	33.53	-117.19	Stow site	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	Create New	Pacific Time (US & Canada)	Edit Delete Show
QTP		SunPower, Inc. (R&D)	QTP Network 1, QTP Network 2	37.38	-122.01	Unstow site	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	Create New	Pacific Time (US & Canada)	Edit Delete Show
Inland Empire RP-5		SunPower, Inc.	RP-5 Network 1	33.96	-117.67	Stow site	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	Create New	Pacific Time (US & Canada)	Edit Delete Show
Exelon Network 3		SunPower, Inc.	Exelon Network 3	41.68	-87.65	Stow site	Stow at wind speed of 60.0 knots, gust speed of 80.0 knots with an advance time of 24.0hrs.	Unstow manually at wind speed of 40.0 knots, gust speed of 60.0 knots.	Create New	Central Time (US & Canada)	Edit Delete Show

8 Found

Fig. 32

The Sites page lists site details in columns:

Column	Description
Name	The site name…
Address	[description]
Customer	[description]
Networks	[description]
Latitude	[description]

Longitude	[description]
Stow status	[description]
Stow configuration	[description]
Unstow configuration	[description]
Site setting	[description]
Time zone	[description]

- To view information for a site, click **Show** in the selected site details row. The **Show Site** window opens (Fig. 33). Click **Close** or the X button to close the window.

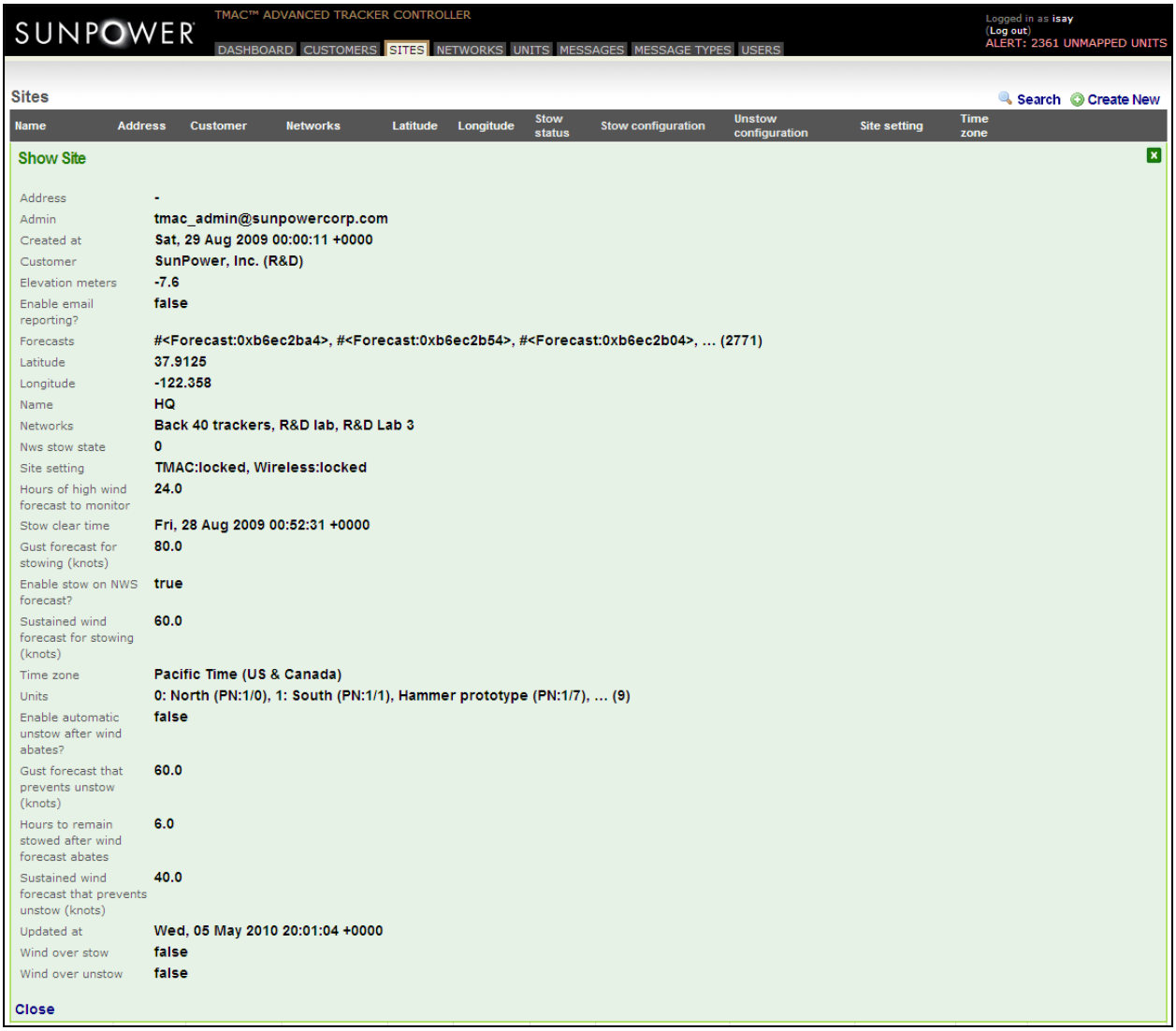


Fig. 34

- To change customer site information details, click **Edit.** The **Update [Site name]** window opens (Fig. 35).

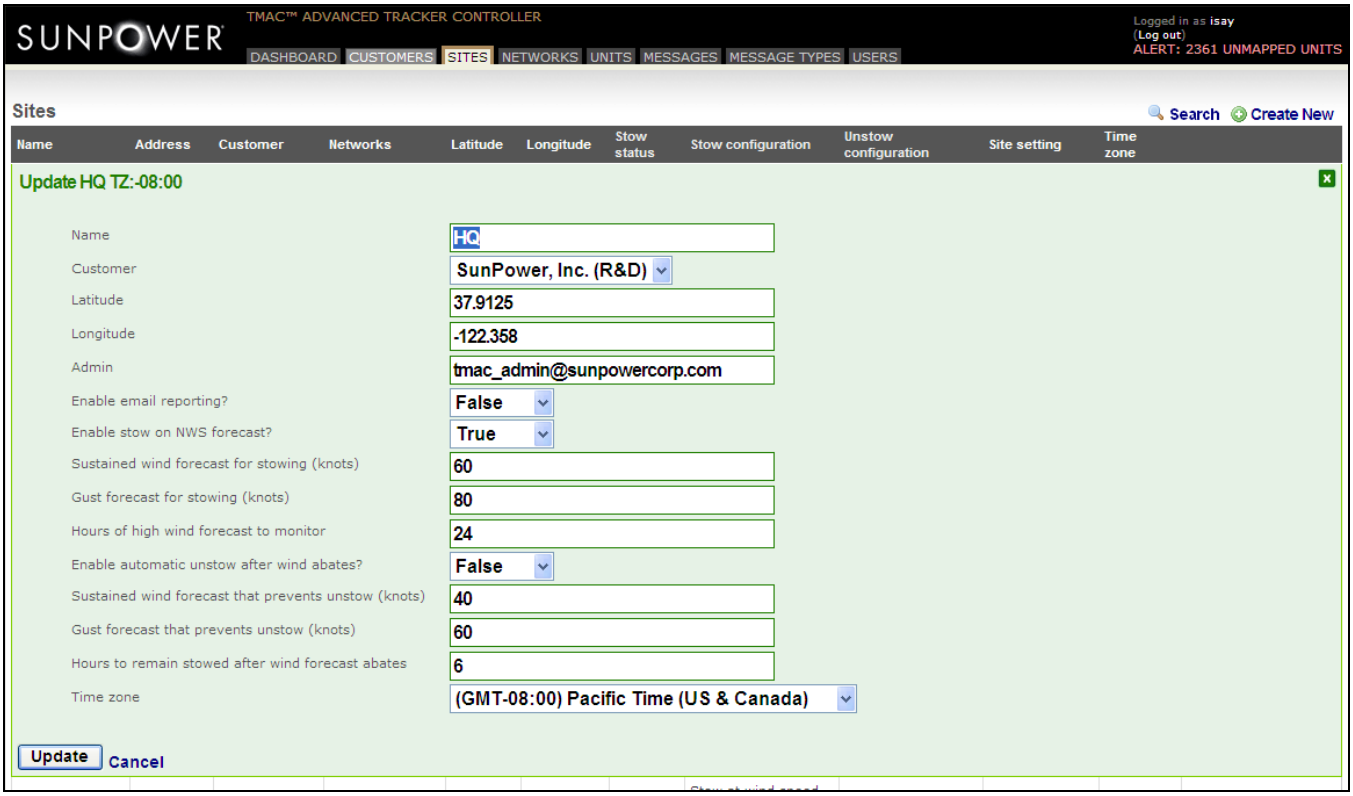


Fig. 35

a. Enter or select new values in the fields.

b. Click *Update* to save the changes. Click *Cancel* or the X button to close the window.

- To delete customer site profile, click **Edit.** Click *OK* in the confirmation window.

1.5.2.13 Viewing and Managing Network Information

To view, edit, or delete network information, click the **NETWORKS** tab (Fig. 36).

Site	Name	Pan	Units	Coordinator info	
HQ TZ:-08:00	Back 40 trackers	1	0: North (PN:1/0), 1: South (PN:1/1), Hammer prototype (PN:1/7)	166.131.61.17:2934 as root/sunpower1	Edit Delete Show
Sonoma Alpha Site TZ:-08:00	Sonoma Network 1	1	0: Center-East (M0338_AREA01_TRK05 PN:1/0), 2: Center-West (M0338_AREA01_TRK02 PN:1/2), 6: South-East (M0338_AREA01_TRK06 PN:1/6), ... (6)		Edit Delete Show
Uncategorized units TZ:-08:00	Uncategorized units	3	00:13:a2:00:40:54:f7:ac (PN:3/7), 00:13:a2:00:40:54:f7:be (PN:3/1), 00:13:a2:00:40:54:f7:9e (PN:3/5), ... (4)		Edit Delete Show
HQ TZ:-08:00	R&D lab	1	0: R&D lab (PN:1/0), 2: R&D lab (PN:1/2), 1: R&D lab (PN:1/1), ... (4)		Edit Delete Show
Elverta TZ:-08:00	Hammer network	4	East (coordinator) (PN:4/0), West (PN:4/9)	166.131.61.37:2954 as admin/password	Edit Delete Show
Rancho California Water District TZ:-08:00	Rancho Network 1	1	00:13:a2:00:40:54:f7:7f (M0531_AREA01_TRK06 PN:1/8), 00:13:a2:00:40:3a:43:1f (M0531_AREA01_TRK04 PN:1/0), 00:13:a2:00:40:3a:43:56 (M0531_AREA01_TRK13 PN:1/1), ... (9)	166.131.61.124:2954 as root/sunpower1	Edit Delete Show
Rancho California Water District TZ:-08:00	Rancho Network 2	2	00:13:a2:00:40:54:f7:7b (M0531_AREA01_TRK03 PN:2/1), 00:13:a2:00:40:3a:4c:33 (M0531_AREA01_TRK01 PN:2/0), 00:13:a2:00:40:30:0f:59 (M0531_AREA01_TRK02 PN:2/2), ... (4)	166.131.61.124:2955 as root/sunpower1	Edit Delete Show
QTP TZ:-08:00	QTP Network 1	2	00:13:a2:00:40:54:f7:c3 (PN:2/0), 00:13:a2:00:40:54:f7:b7 (PN:2/1), 00:13:a2:00:40:54:f7:a3 (PN:2/2), ... (6)		Edit Delete Show
Inland Empire RP-5 TZ:-08:00	RP-5 Network 1	1	Pan: 1, Node: 0 (M0614_AREA01_TRK08 PN:1/0), Pan: 1, Node: 7 (M0614_AREA01_TRK09 PN:1/7), Pan: 1, Node: 4 (M0614_AREA01_TRK12 PN:1/4), ... (15)		Edit Delete Show
QTP TZ:-08:00	QTP Network 2	2	00:03:F4:03:F6:52 (PN:2/0)		Edit Delete Show
Exelon Network 3 TZ:-06:00	Exelon Network 3	1	Tracker 4.2 (PN:1/0), Tracker 4.1 (PN:1/1), Tracker 4.3 (PN:1/5), ... (4)		Edit Delete Show
HQ TZ:-08:00	R&D Lab 3	3	00:13:a2:00:40:4c:1b:02 (PN:3/0), 00:13:a2:00:40:3a:4c:41 (PN:3/0)		Edit Delete Show

12 Found

Fig. 36

The Networks page lists network details in columns:

Column	Description
Site	The name…
Name	[description]
Pan	[description]
Units	[description]
Coordinator info	[description]

- To view the network information, click **Show** in the selected network details row. The **Show Network** window opens (Fig. 37). Click **Close** or the X button to close the window.

Fig. 37

- To change network information details, click **Edit.** The **Update [Network name]** window opens (Fig. 38).

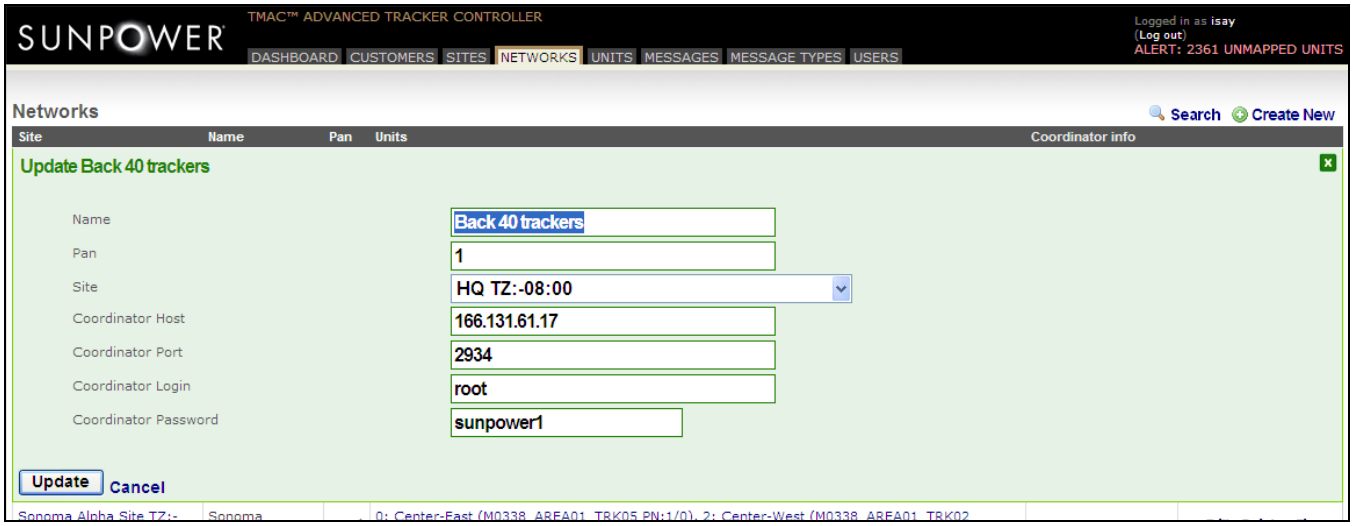


Fig. 38

a. Enter or select new values in the fields.

b. Click *Update* to save the changes. Click *Cancel* or the X button to close the window.

- To delete a network profile, click **Delete.** Click *OK* in the confirmation window.

1.5.2.14 Viewing and Managing Units Information

To view all the TMAC units in the field, and edit, or delete TMAC controller information, click the **UNITS** tab (Fig. 39).

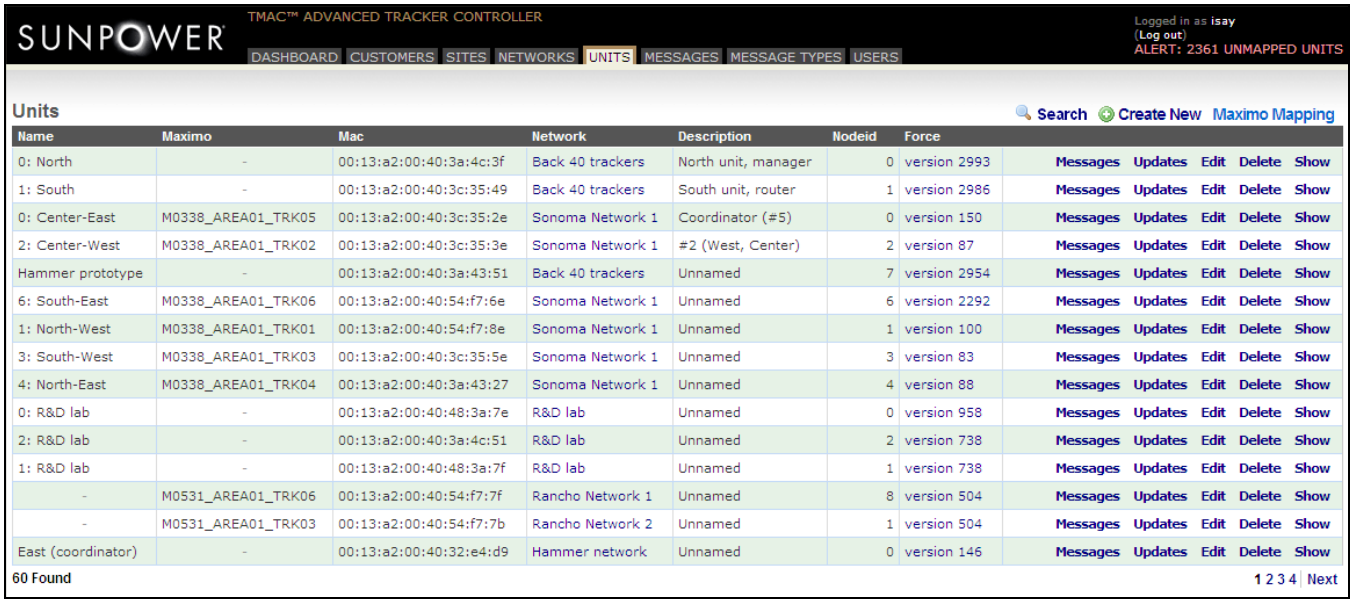


Fig. 39

The Units page lists TMAC unit details in columns:

Column	Description
Name	The name…
Maximo	[description]
Mac	[description]
Network	[description]
Description	[description]
Nodeid	[description]
Force	[description]

- To view information on a TMAC unit, click **Show** in the selected TMAC unit details row. The **Show Unit** window opens (Fig. 40). Click **Close** or the X button to close the window.

Fig. 40

- To change unit information details, click **Edit.** The **Edit for unit [Unit name]** window opens (Fig. 41).

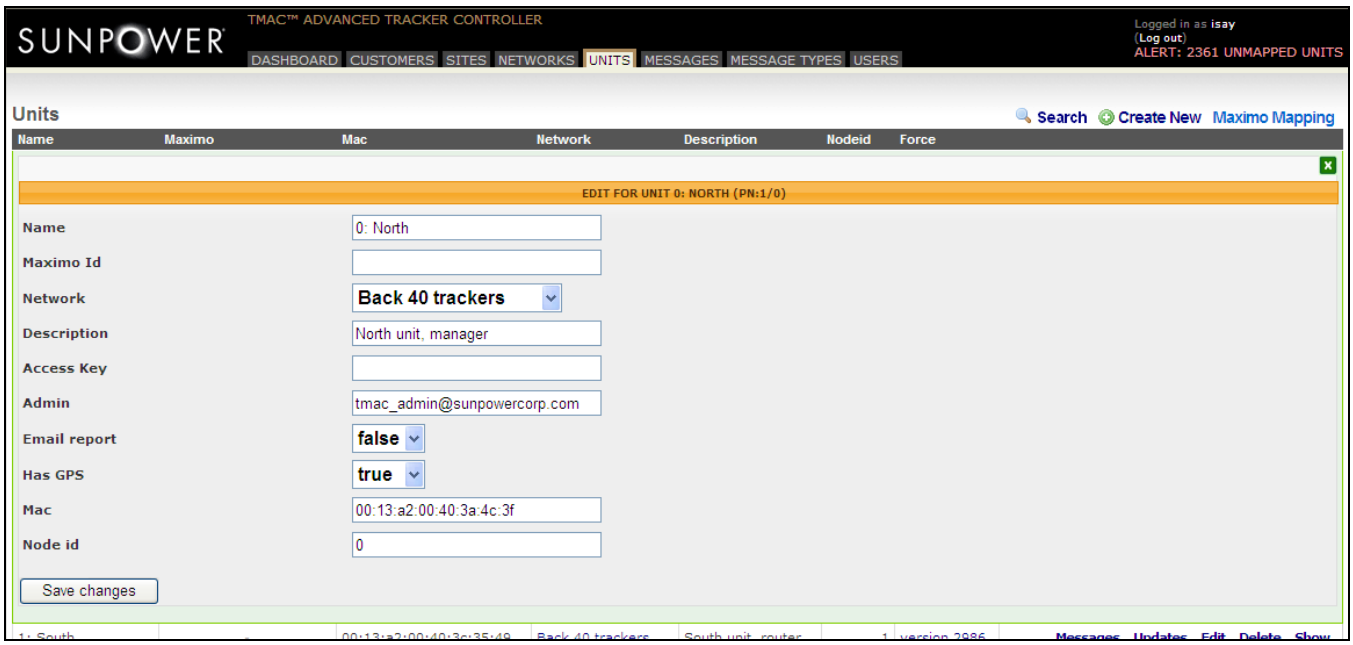


Fig. 41

a. Enter or select new values in the fields.

b. Click *Save changes.*

- To delete a unit profile, click **Delete.** Click *OK* in the confirmation window.

1.5.2.15 Viewing Messages

To view messages, click the **MESSAGES** tab (Fig. 42).

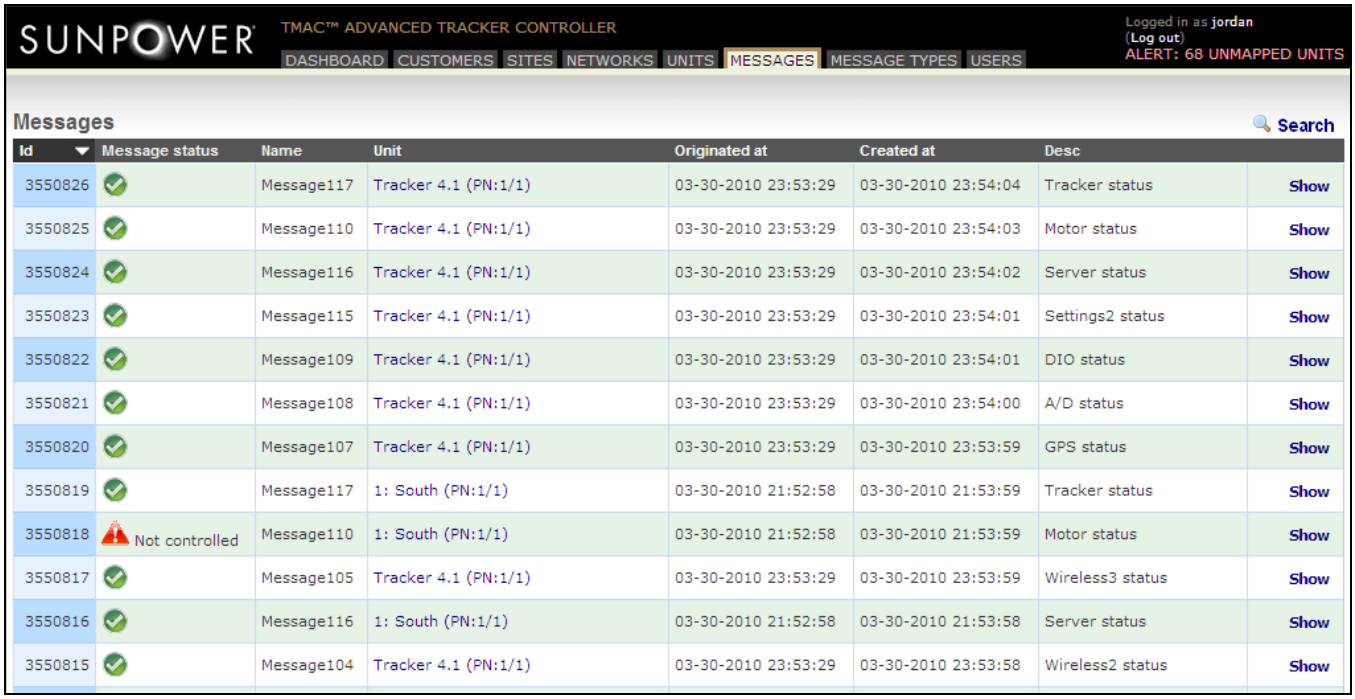


Fig. 42

The following table lists the descriptions of each message number.

Message Number	Short Description	Full Description
109	DIO Status	See Appendix A
111	Flash messages	See Appendix A
104	Wireless2 messages	See Appendix A
113	Boot messages	See Appendix A
105	Wireless3 messages	See Appendix A
114	Settings1 messages	See Appendix A
112	Event messages	See Appendix A
110	Motor messages	See Appendix A

116	Server messages	See Appendix A
106	Operating system messages	See Appendix A
115	Settings2 messages	See Appendix A
107	GPS messages	See Appendix A
117	Tracker messages	See Appendix A
102	Inclinometer messages	See Appendix A
	Test messages	See Appendix A
112	Event messages	See Appendix A
108	A/D messages	See Appendix A
101	System messages	See Appendix A
	SCADA messages	See Appendix A
103	Wireless1 messages	See Appendix A

- To view the details of a message, click **Show.** A pop-up window opens and displays the details (Fig. 43). Refer to Appendix A for a full description of message types.

Fig. 43

- To search for a specific message, click **Search** in the upper right of the table**.** Enter the [message ID] into the **Search Terms** field that opens and click *Search* (Fig. 34)*.* Click **Reset** to return to the unfiltered message list.

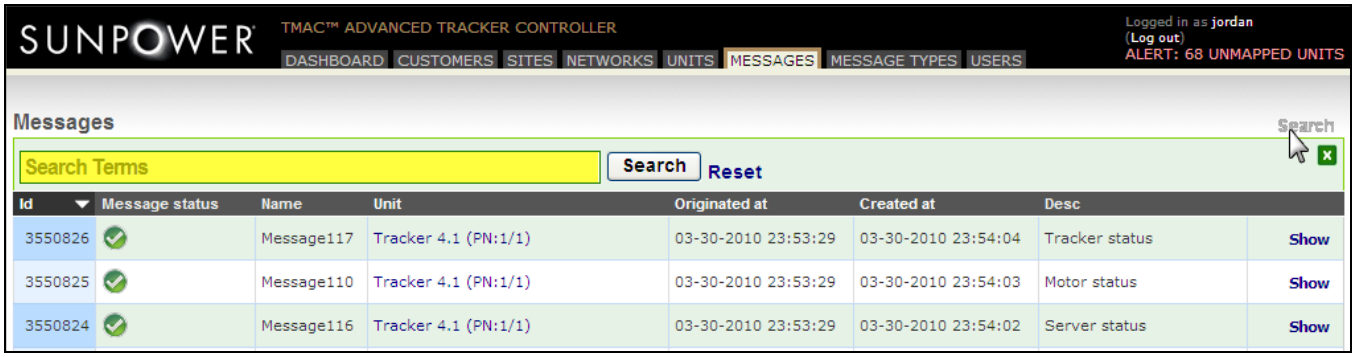


Fig. 43

1.5.2.16 Viewing Message Types

To view the list of message types, click the **MESSAGE TYPES** tab (Fig. 44).

Fig. 44

1.5.2.17 Viewing and Managing User Information

To view, edit, or delete user information, click the **USERS** tab (Fig. 45).

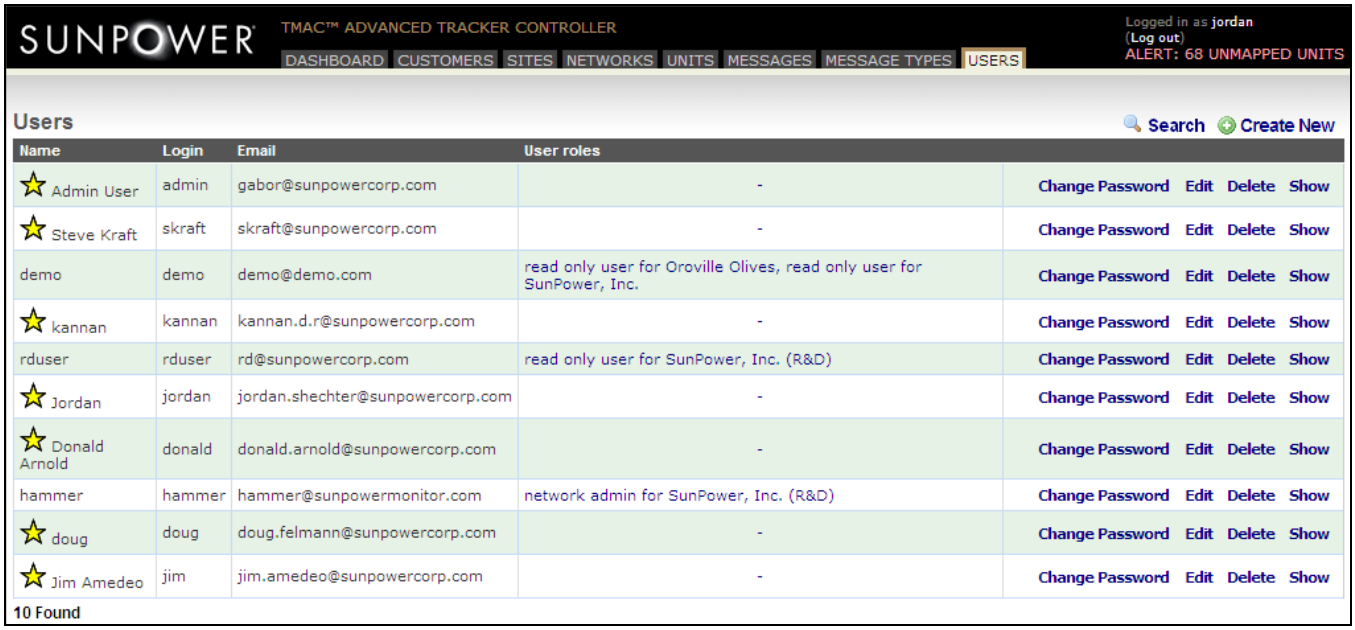


Fig. 45

- To create a new user, click **Create New** in the upper right of the table. In the **Create User** window, enter or select values in the following fields (Fig. 46):

Name	Enter the user's name or user role.
Login	Enter the login username.
Email	Enter the email address of the user.
Password and **Password confirmation**	Enter and re-enter the user password.
Admin	Select *True* or *False.*
User roles	Select from the **Customer** dropdown list the customer name to which account the user will be given access/assigned permission. Enter [value] in the **Role** field.
Create Another	

- To view user information, click *Show.* The **Show User** window opens (Fig. 36). Click **Close** or the X button to close the window.

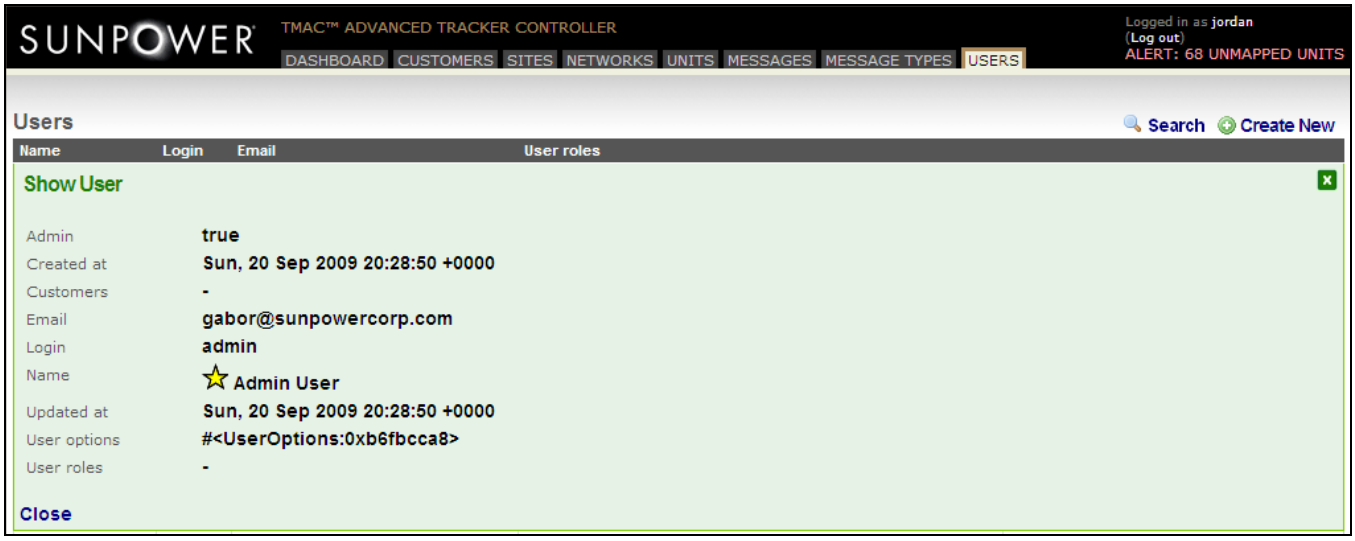


Fig. 46

- To change user information details, click *Edit.* The **Update [User name]** window opens (Fig. 47).

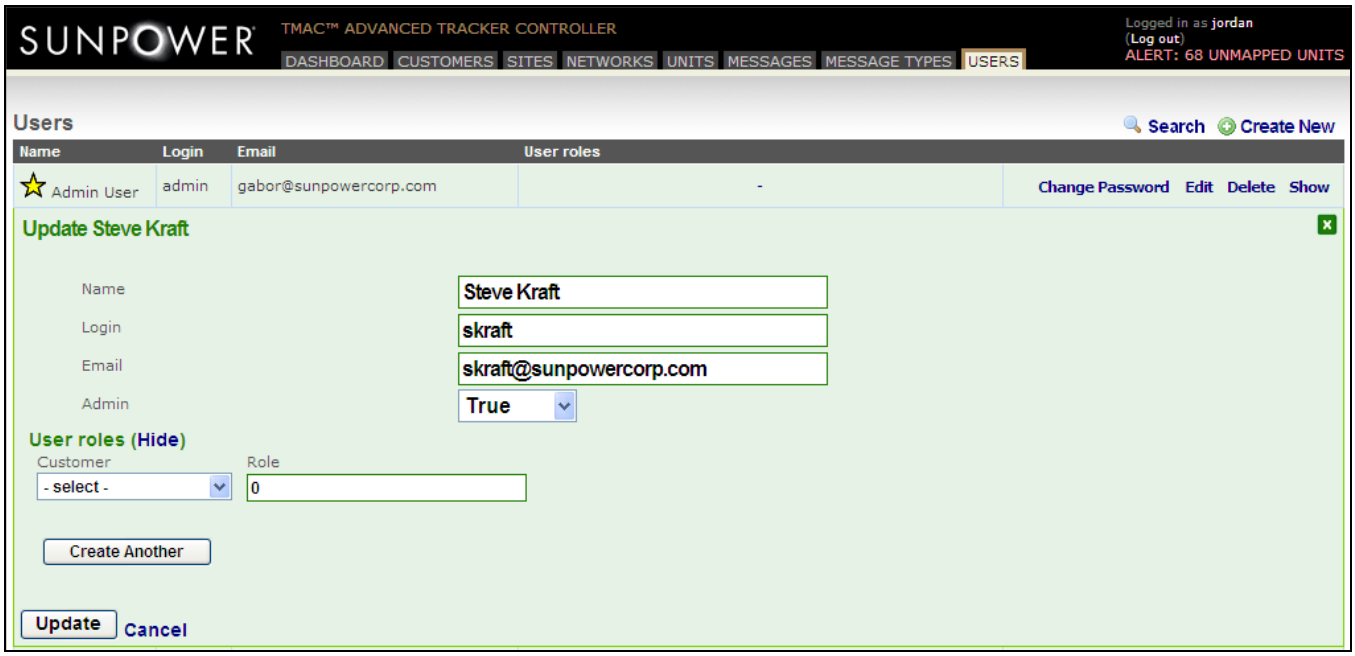


Fig. 47

- To change user passwords, click *Change Password.* The **Change password for user [User name]** window opens (Fig. 48).

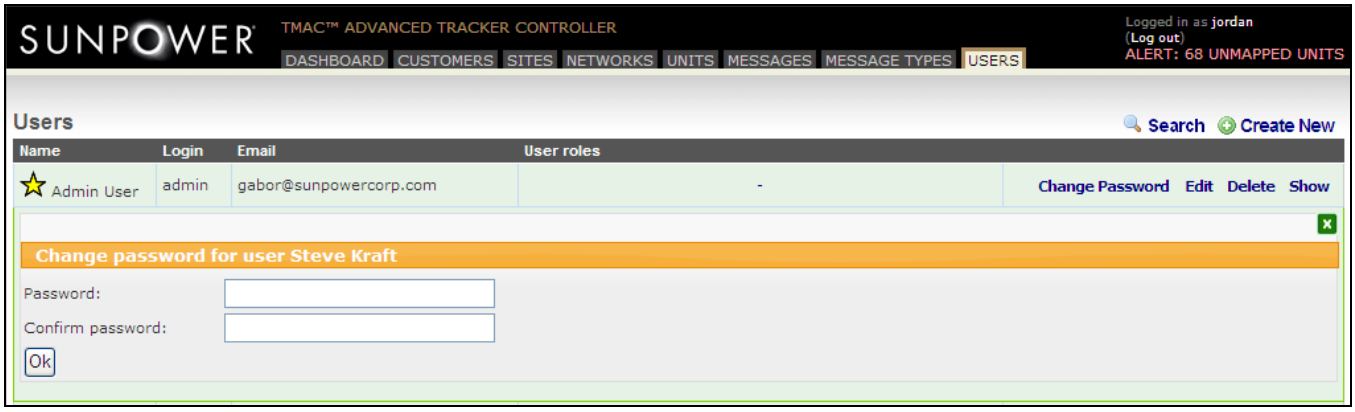


Fig. 48

a. Enter the new password and re-enter to confirm.

b. Click *Ok.*

- To delete a user profile, click *Delete.* Click *OK* in the confirmation window.

Appendix A: Message Types

A.1 System Status: (101)

Message type	System status
Message number	12957
Time/date received	03-15-2010 15:54:49
Time/date created	03-15-2010 15:53:58
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Time since boot (seconds)	964038
Time since boot (D:H:M:S)	Days:11,Hours:3,Minutes:47,Seconds:18
Unit booted at	03-04-2010 11:06:40
Valid settings	Time Location
Invalid settings	All settings valid
Remote stow	NO
Force version	4
Force mask	00000000000000000000000000000000
Working	00000000000011111111111111111111
Subsystem not working	All subsystems working
Digital inputs	11000000000000001111000000000000
NodeID inputs	0
PanID inputs	3
UI switches	MODE:Automatic,JOG1: Off,JOG2: Off
GP digital inputs	11110000

Digital outputs	00000000
Motor1 position	−44.44
Motor2 position	0.0
Motor3 position	0.0
Motor4 position	0.0
Analog inputs 1	2.542 Volts (Code=520)
Analog inputs 2	1.085 Volts (Code=222)
Analog inputs 3	0.523 Volts (Code=107)
Analog inputs 4	0.083 Volts (Code=17)
Analog inputs 5	1.119 Volts (Code=229)
Analog inputs 6	0.904 Volts (Code=185)

A.2 Inclinometer Status (102)

Message type	Inclinometer status
Message number	12960
Time/date received	03-15-2010 15:54:52
Time/date created	03-15-2010 15:54:00
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Number	0
Reading valid	VALID
Reading, +/- 180	−44.91
Reading, 0-360	0.0
Temperature	0.0 C, 32.0 F

Maximum temperature	−999.0 C, −1766.2 F
Minimum temperature	999.0 C, 1830.2 F
Power supply voltage	0.0
Attempts	61647190
Updates	61647190
Failures	0

A.3 Wireless 1 Status (103)

Message type	Wireless1 status
Message number	13030
Time/date received	03-15-2010 16:55:04
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Wireless MAC	00:13:a2:00:40:3c:35:61
Address	0 (0x0)
Network	45995 (0xb3ab)
Rx: OK	28951
Rx: Out of frame	22
Rx: Bad checksum	0
Rx: Unknown packet ID	0
Rx: AT OK	57097
Rx: AT timeout	1
Rx: AT error	0

Rx: AT invalid command	0
Rx: AT invalid parameter	0

A.4 Wireless 2 Status (104)

Message type	Wireless2 status
Message number	13031
Time/date received	03-15-2010 16:55:05
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Tx: attempts	6800
Tx: OK	6800
Tx: failures	0
Tx: characters	176608
Tx: retries	0
# of decibel measurements	122
Average decibel measurement	−75
Minimum decibel measurement	−89
Maximum decibel measurement	−60
Wireless chip firmware version	2.1.6.4
Wireless chip hardware version	6724 (0x1a44)

A.5 Wireless 3 Status (105)

Message type	Wireless3 status
Message number	13032
Time/date received	03-15-2010 16:55:06
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Tx: bad state	0
Tx: packet timeout	0
Tx: route discovery	0
Tx: address discovery	0
Tx: CCA fail	0
Tx: invalid destination	0
Tx: ACK fail	0
Tx: unjoined	0
Tx: self addressed	0
Tx: address not found	0
Tx: route not found	0
Tx: unknown err	0
Tx: unknown err	0
Network resets	0
Network hardware resets	0

A.6 Operating System Status (106)

Message type	Operating system status
Message number	13027
Time/date received	03-15-2010 16:55:02
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Ethernet MAC	00:03:f4:03:f6:41
Minimum watchdog (ticks)	37366
Minimum watchdog (seconds)	4.61
Thread Watchdog Max (seconds)	0
Firmware version	3.2.6
PCA Serial Number	JS09371508789310000
Sun position valid	true
Sun azimuth (earth)	−66.59 (sun position is West of South)
Sun elevation (earth)	21.44 (sun is above horizon)
Enclosure temperature (deg. C)	21.94

A.7 GPS Status (107)

Message type	GPS status
Message number	13033
Time/date received	03-15-2010 16:55:07
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61

Customer	SunPower, Inc.
Site	Exelon Network 3
Errors	0
Total bytes	371934969
Latitude	41.68 N
Longitude	−87.65 W
Receiver status	A
GPS time	2010-03-15 21:54:21 UTC
UART status	

A.8 A/D Status (108)

Message type	A/D status
Message number	13034
Time/date received	03-15-2010 16:55:07
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Point updates	580489830
Full updates	96748305

A.9 DIO Status (109)

Message type	DIO status
Message number	13035
Time/date received	03-15-2010 16:55:08

Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Updates	404042

A.10 Motor Status (110)

Message type	Motor status
Message number	13038
Time/date received	03-15-2010 16:55:11
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Number	0
Enabled	YES
Controlled	YES
Setpoint valid	YES
Feedback valid	YES
Actual position	−29.55 degrees
Setpoint position	−28.73 degrees
Position error	0.82 degrees
Output	0.0 percent
Forward limit (H/W)	OK
Reverse limit (H/W)	OK

Forward limit (S/W)	45.0
Reverse limit (S/W)	−45.0
Feedback errors	0
FWD seconds	676.19
REV seconds	0.0
FWD cycles	47
REV cycles	0

A.11 Settings 1 Status (114)

Message type	Settings1 status
Message number	13028
Time/date received	03-15-2010 16:55:03
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Latitude	41.68
Longitude	−87.65
Location source	GPS (2)
Wind speed current (miles/hour)	0.0
Wind speed source	Invalid (0)
Wind speed peak (over interval)	0.0
Wind speed avg (over interval)	0.0
Time source	GPS (1)

A.12 Settings 2 Status (115)

Message type	Settings2 status
Message number	13036
Time/date received	03-15-2010 16:55:09
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3
Tracker type	Single axis, roll (0)
Inclinometer type	Analog (voltage) inclinometer (1)
Motor type	AC motors (0)
East to west GCR	0.5
North to south GCR	0.35
Stow position	25.0
Motion deadband (in)	0.5
Motion deadband (out)	1.0
Controller mount	East
Nominal degrees per minute	

A.13 Server Status (116)

Message type	Server status
Message number	13037
Time/date received	03-15-2010 16:55:10
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61

Customer	SunPower, Inc.
Site	Exelon Network 3
Attempts	14760
Successes	13642
Host transactions	26970
MS per host transaction	788.74
DNS OK	13949
Dns fail	811
Connect OK	26953
Connect fail	17
Bad command	0
Bad key	0
Bad status	290
Read fail	0
Write fail	17
Telnet Port	0

A.14 Tracker Status (117)

Message type	Tracker status
Message number	13039
Time/date received	03-15-2010 16:55:12
Time/date created	03-15-2010 16:54:22
Unit	Mac: 00:13:a2:00:40:3c:35:61
Customer	SunPower, Inc.
Site	Exelon Network 3

Number	1
Azimuth	−66.59
Elevation	21.44
Site Roll	0.0
Site Pitch	0.0
Site Yaw	0.0