ONRAMP WIRELESS

TOTAL VIEW

OTV Supplement: Obstruction Lighting

On-Ramp Wireless Incorporated
10920 Via Frontera, Suite 200
San Diego, CA 92127
U.S.A.

OTV Supplement: Obstruction Lighting Guide

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Revision History

Revision	Release Date	Change Description
A	October 6, 2014	Initial release supporting OTV 1.0.
B	May 1, 2015	Updated A1 error light table to correct mislabeling.

1 Introduction

This document provides On-Ramp Total View (OTV) administrators and operators with the following information:

- An overview of the Remote Monitoring Unit (RMU) Obstruction Light Monitoring application in OTV, release 1.0.
- An overview of the Obstruction Light Monitoring dashboard operation.

This supplemental document is intended to be used in conjunction with the following publications:

- OTV Operator Guide (010-0106-00)
- RMU Light Unit Wiring Guide (010-0007-00)
- EMS Operator Guide (010-0107-00)

This document focuses on Total View technology to support Obstruction Light Monitoring with the On-Ramp Wireless RMU.

Prerequisite Knowledge

It is assumed that the reader has a basic familiarity with On-Ramp Wireless Total Reach devices and network concepts.

This document does not provide the following information:

- Gateway (GW) hardware or software installation
- OTV hardware or software installation
- Element Management System (EMS) hardware or software installation
- Node physical installation of software or hardware.

2 Overview

The Total Reach Remote Monitoring Unit (RMU) is designed for integration with sensor devices for the following applications:

- Smart Grids
- Utilities
- Industrial applications
- Customized Integrations

The RMU is integrated with third-party obstruction lights to provide a complete out-of-box Obstruction Light Monitoring Total Reach Network application.

The RMU supports a cost-effective wide-area monitoring of obstruction lights that is centralized and automated. In addition, the application is in compliance with the Federal Aviation Administration (FAA) FAA AC N. 70/7460-1K. For additional information, see http://wireless.fcc.gov/antenna/documentation/faadocs/7460-1K.pdf

Each RMU-enabled obstruction light monitors and wirelessly reports the following information regarding the light and the status of the RMU unit:

- Outages: LED light or lamp
- 12VDC or 120V AC main power failure
- Night too short indication when using solar systems
- Solar panel charging system function status: Day to night and night to day
- Opened lid: Intrusion detection generates an alarm when the RMU unit lid is opened
- Missed updates: An alarm notification is sent if an RMU misses updates for a preset number of minutes.

  NOTE: The default missed interval for an alarm is 30 minutes. You can optionally configure the interval to align with the alarm monitoring procedures for a specific deployment when you set up your network.

  Examples:

  - Configure the Total Reach network to designate EMS operators as first responders to Total Reach network system issues.
  - Configure EMS node missed intervals to be set to severities of 1, 2, or 3 to correspond with minor, major, or critical EMS alarms.
  - Set the OTV RMU timeout configuration to 120 minutes to provide operators with a two-hour window in which to address Total Reach system issues before OTV application alarms start.

- Test button push: The test button switch generates:
  - A round-trip wireless message to confirm complete system operation prior to signaling success. This procedure facilities simple field commissioning prior to the LED being visible to the installer.
  - An OTV message that is visible to back-end office administrators.
- Backup battery replacement: The battery backup alarm signals time and then informs the OTV operator when to replace the backup battery.

For additional information on RMU obstruction light device configuration, see the *On-Ramp Wireless RMU Light Unit Wiring Guide (010-0007-00)*.

When installing the RMU device, an RMU DIP switch is configured that defines the operation of a device for a given light. The RMU contains a test push button that forces the RMU to send a test message to the Access Point (AP). When the AP receives the test message acknowledgment, it then sends a signal to on-board LEDs to notify the installer that the unit is ready and functioning properly. After the RMU is configured, installed, and joins the network, each RMU reports the unit health at 24-minute intervals. The unit health information displays on the OTV dashboard.

The operator must inform the FAA that a light is not functioning within 24 hours of detection. For devices that are automatically verified, the monitoring device must be configured to report to the system operator within 30 minutes of detecting an outage. Each light is designed to send a status message once every 24 minutes (60 per day) to inform the operator whether a light is functional or non-functional. In the event of a test push button or an intrusion detection alarm, the RMU immediately sends information to the operator.

The OTV dashboard shows a system-wide status of all RMUs in the Total Reach network. The operator can configure the OTV dashboard to send email alerts and Short Message Server (SMS) text messages to an email distribution list. The messages alert utility operators that the FAA must be notified when a light goes out.

2.1 Deployment

Deploying the RMU eliminates the need for utility companies to visually inspect obstruction lights, resulting in significant operational savings. Further control is provided with detailed histories of the device status and automated email notifications for alarms and event triggers.

The RMU is a flexible monitoring platform and has been integrated with several solar-powered DC LED lights and 120V AC lights. This provides a standard product that can be used for all obstruction lighting requirements. In addition, the flexibility of the RMU allows easy integration with other lights not listed in this document. Contact On-Ramp Wireless if you have a requirement to monitor lights not addressed in this document.

A typical deployment consists of hundreds of RMU-enabled lights dispersed on structures throughout the utility support area. Each RMU is wirelessly connected to an AP, and each AP is aggregated at a Gateway. When the operator uses the Total Reach network, the OTV dashboard logs the RMU application data into various databases for analytics. The view of the OTV dashboard generates a system-wide RMU application view of the state of RMUs and obstruction lights throughout the system.

Each RMU receives power from the 120VAC or 12VDC light. If the main system power goes out, each unit has a backup battery enabling the Total Reach radio to send a message to the OTV dashboard.

2.2 Certification

This release supports both FAA certified and non-FAA certified lights. Non-FAA certified lights may be used in situations that are outside the scope of FAA certification. For example, the RMU supports an infrared light and a lower intensity, red LED light that may be used in monitoring applications on military bases or for border patrol monitoring. The following third-party obstruction lights are currently supported:

- FAA certified lights:
- Dialight L810 RTO 12VDC Red LED Light Head, Part Number: RTO-1R08-002
- Crouse-Hinds® 120VAC Red Incandescent
- Dialight L810 860 120VAC Red LED, Part Number: 860-1RO1-002
- Dialight D64 Series Red Medium Intensity Beacon. Part Number: D464-A13-001
- Non-FAA certified lights
- Avlite® 125C Red LED 100%/Red LED 25%/IR

2.3 FAA Style A Lights

The FAA AC 70/7460-1K specification includes the *Red Obstruction Lighting Standards, FAA Style A* definitions. This specification designates which type of L810 and/or L864 light head combinations must be deployed for various tower heights. The RMU currently supports pre-packaged solutions for both type A0 and A1 deployments utilizing both L810 and/or L864 light head combinations.

Additional provisions are provided in the RMU Firmware (FW) for supporting *Medium Intensity White Obstruction Lighting Standards, FAA Style D.*

NOTE: For additional information on the following topics, contact On-Ramp Wireless:

Pricing for single sourcing of either type of system, including RMU, Lights, Solar Panels, Batteries, Cabling, and Mounting Hardware.

Requirements for FAA Style D or FAA Style A (A2-A6) systems. Although out-of-box systems for these lights are not currently available, the RMU is readily adaptable to be able to support these light types.

2.3.1 FAA Style A–A0 0 feet < Tower Height < 150 feet

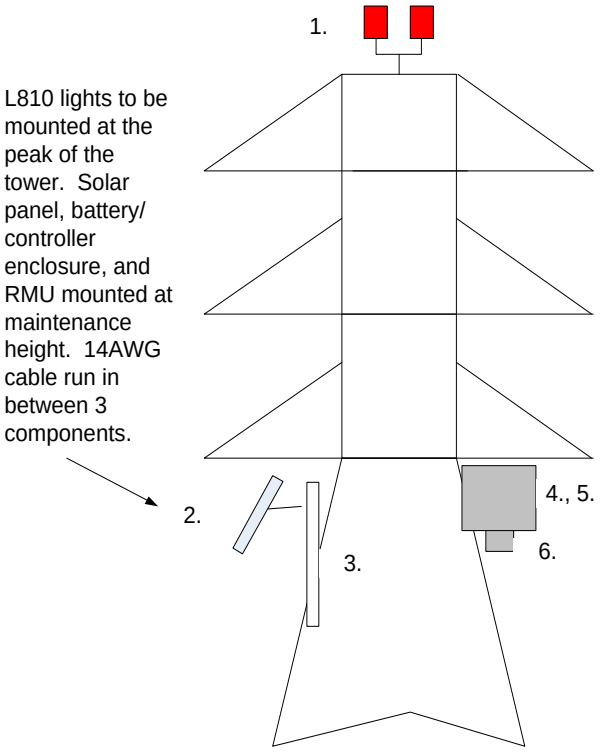
A0 style lights are intended for deployment on towers less than 150 feet in height. The RMU supports 3 specific light models intended to meet this requirement. There are two 120V AC light options that do not require solar panels if 120VAC power is available:

The RMU supports the following light models:

- Dialight L810 RTO 12VDC Red LED Light Head, Part Number: RTO-1R08-002
- Crouse-Hinds® 120VAC Red Incandescent
- Dialight L810 860 120VAC Red LED, Part Number: 860-1RO1-002 12VDC (Solar Rechargeable option when 120VAC power is not available)

NOTE: Contact On-Ramp Wireless for additional information about pricing and single-sourcing of all components of the 12VDC L810 system. A typical deployment and system Bill of Materials (BOM) is shown in the following figure:

A0—12VDC L810 Only Tower Mock Up (<150 feet)



Components Parts List:

1. Dialight RTO-1R08-002 12VDC Dual RED led light head	4.6 lbs
2. BP 350 50 W Solar Panel	13.2 lbs
3. 2" Pole Mounting Kit (ubolts, channel mounting, rails)	15 lbs (estimated)
4. Stahlin Enclosure (RJ1816HPL)	19.25 lbs
5. Deka Solar Voltaic 12V battery	70 lbs
6. ORW Remote Monitoring Unit	6 lbs

Total Weight: approximately 128 lbs

Figure 1. FFA Style A Tower Mock-Up

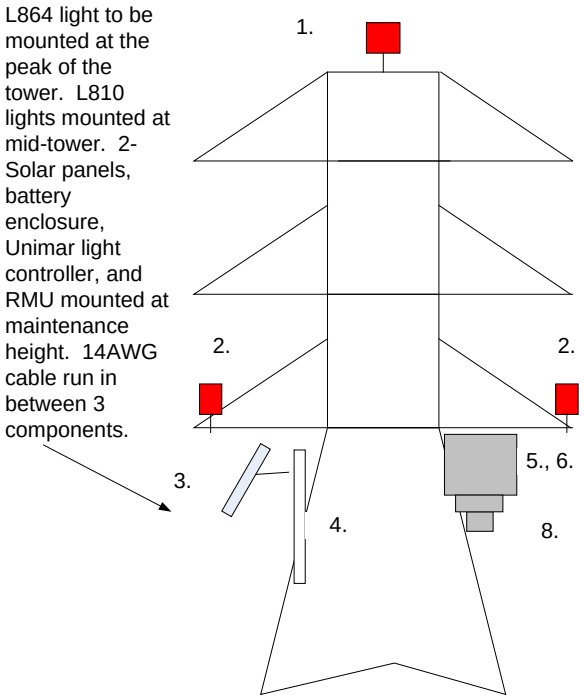
2.3.2 FAA Style A–A1 > 150 feet Tower Height < 350 feet

A1 style lights are intended to be deployed on towers greater than 150 feet and less than 350 feet in height. The A1 system configuration includes multiple light types deployed at various structure heights. Typically an L864 light beacon is located at the top of the structure and two or more L810 lights are deployed at mid-structure height.

The RMU supports two specific light systems intended to meet this requirement. Each system includes one L864 beacon and two or more L810 lights with an associated light controller from Unimar. Options include one 120V AC light or one 24-48VDC light.

NOTE: Contact On-Ramp Wireless for pricing information or single-sourcing of all components of either A1 system. A typical deployment and system Bill of Materials (BOM) is shown in the following figure for the A1 light system.

(A1) L864 + L810 Tower Mock Up (150 – 350 feet)



Components Parts List:

1. Dialight D64 Series Red Med Int Beacon (D464-A13-001)	20 lbs
2. 2-Dialight RTO-1R07-002 120VAC Dual RED led light heads	9.2 lbs
3. 2-BP 125 W Solar Panel	30 lbs (estimated)
4. 2" Pole Mounting Kit (ubolts, channel mounting, rails)	25 lbs (estimated)
5. Direct Power and Water Chest Style Enclosure (BB2)	50 lbs
6. 4-Deka Solar Voltaic 12V battery	280 lbs
7. Unimar Light Controller	30 lbs
8. ORW Remote Monitoring Unit	6 lbs

Total Weight: approximately 450 lbs

Figure 2. FAA Style A—A1 150 feet < Tower Height < 350 feet

3 OTV Operation

This section details the OTV configuration and operation of RMU Obstruction Light Monitoring.

3.1 Configuring the RMU Obstruction Light Application

Configure the following items to set up the RMU Obstruction Light Application in OTV:

- Missed interval timeout (**FAA Max Status Interval**)
- Email alerts on alarm events
- FAA Light Properties File

The RMU obstruction light application supports the **FAA Max Status Interval** in OTV, which is a configurable missed interval timeout. The setting for this parameter defines the maximum amount of time, in minutes, between two successive updates for any RMU before OTV generates an alarm. This is an application-level alarm that alerts RMU operators when significant issues occur in the Total Reach network that would prevent automated RMU monitoring.

NOTE: This is a redundant Total Reach system alarm. Missed RMU intervals are noted in both the EMS and OTV. You may need to allow time for an IT group managing the Total Reach network to debug missed interval alarms prior to having the alarm event propagate to application operators. The configuration of the EMS Node Missed Intervals and OTV Missed Interval Timeout controls the alarm order. A typical example is described in the following section.

3.1.1 FAA Max Status Interval Timeout Settings

Change the timeout setting for this application type by editing the configuration file found in /opt/onramp_apps/otv/instance_1/config.properties, as follows:

1. Open the OTV configuration file and locate the setting for the status interval, labeled ‘faalight.status.interval.max.minutes’.
2. Enter the maximum amount of time (in minutes) between two successive RMU OTV updates before OTV generates an alarm.

   NOTE: Organizations may structure alarms to designate EMS operators as first responders to system alarms. Configure EMS missed interval alarm defaults to be set to minor, major, and critical, such as severities 1, 2, and 3, missed intervals. RMUs operate on 24-minute interval updates. EMS operators receive a minor alarm after 24 minutes, a major alarm after 48 minutes, and a critical alarm after 72 minutes. When the **FAA Max Status Interval** is set to 120 minutes, EMS first responders have two hours to address Total Reach system issues before the OTV application notifies OTV application operators.

3. Save the file when finished configuring the RMU application. Otherwise, continue with other configuration changes as described in the following sections.

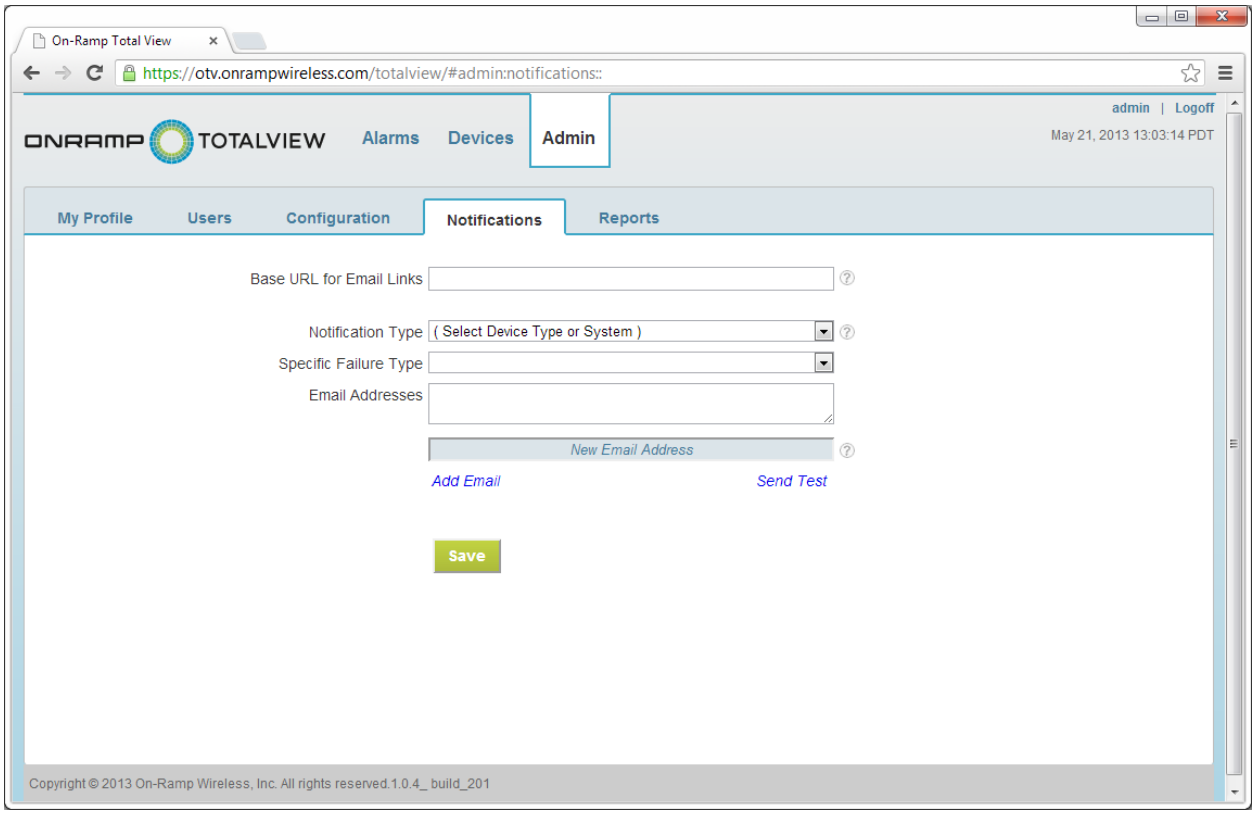
3.1.2 RMU Email Alarm Configuration Settings

Complete the following steps to configure the RMU email alarm:

1. Log in to OTV with an admin account.

   NOTE: The Admin page enables configuration of all data applications, such as the RMU and FCI. In this section, only RMU settings are defined. Settings unrelated to configuration of the RMU should not be changed.

2. From the login page, click the **Admin → Notifications** tab.



3. Ensure that the OTV installer has preconfigured the SMTP/SMS settings in the OTV properties configuration file. This file is located in the following directory: `<otvserver>:/opt/onramp_apps/otv/instance_1/config.properties`

   For additional information, see the *OTV Operator Guide (010-0106-00)*.

4. For Notification Type, select RMU: Obstruction Light.
5. For Specific Failure Type, select a specific RMU alarm. There are eight RMU-specific alarm classes. Each RMU alarm can be configured to be sent to a different list of email addresses.
6. For Email Addresses field, add email addresses for individuals identified to receive automated email alerts from OTV when there are RMU alarms.
7. Click **Save**.
8. Repeat the steps above for each RMU alarm type.

Table 1. RMU Alarm Classes

RMU Alarm	Description
All failures for this device type	This alarm group generates an email for all RMU alarms regardless of type.
24 Hours Passed	This alarm group generates an email for one of the 12VDC solar charging light types (Dialight 810 12VDC Red LED or one of the 3 Avlite 125C units). This alarm displays when 24 hours have passed since a solar charging unit has changed day to night or night to day.
Button Depressed	This alarm group only generates an email when someone in the field has depressed the test push button on an RMU. Typically, this is only done during deployment.
GPIO bit *0* (*or 1, 2, 3, 4, 5, 6, 7*) is set	Used for software development; see Table 2 for definitions.
Invalid RMU DIP switch settings	This alarm group only generates an email for an RMU with incorrect DIP switch settings. See section 3.1.3 for setting these switches.
Lid Opened	This alarm group only generates an email for an RMU with an open lid. This typically only occurs during deployment or field repair.
Lights Failure	This alarm group only generates an email for lights out alarms.
Night period was too short	This alarm is only valid for units using solar panel systems. This alarm indicates when a solar system has indicated that the length of night shorter than expected. For example, the length of night was indicated as 1 hour and was expected to be 8 hours. The alarm captures the case when the light should have been on because it was night, but turned off too soon because of an indication from the solar system – not because of a light failure.
Replace Battery	This alarm group only generates an email when the backup battery for an RMU needs to be replaced.
Timeout Exceeded	This alarm group only generates an email for an RMU that has missed the interval period configured in faalight.status.interval.max.minutes in OTV's config.properties.
Using Battery	This alarm group only generates an email when the main power is out for an RMU. When this alarm is generated, the light is not on.

Table 2. GPIO Alarm Class Definitions

GPIO Bit Definitions	AUX Pin Mapping
Bit 0 Power Fail	AUX 1
1 L864 Beacon Fail	AUX 2
2 L864 Flasher Fail	AUX 3
3 L810 Light Failure	AUX 4

NOTE: OTV uses the term GPIO Bits and the RMU hardware documentation refers to connections to the daughter card as connections to AUX pins. The table above includes this mapping.

3.1.3 FAA Light Properties

The OTV application contains textual descriptions for the following fields for each light type:

- Tie Line Circuit
- Tower
- Manufacturer
- Model

Each of these fields is displayed in the OTV Alarms and Devices views.

The descriptions for **Tie Line Circuit** and **Tower** are configured after the deployment of lights. The descriptions for **Manufacturer** and **Model** are initially controlled by the OTV **faalight.properties** file, located on the OTV server at:

```
/opt/onramp_apps/otv/instance_1/faalight.properties
```

After initial installation the properties can be updated in the Admin section of OTV.

1. Login to OTV as an admin user.
2. Click on Admin → Configuration.
3. Click on Current Device Types.
4. Click the Edit link next to RMU: Obstruction Light.
5. Make any necessary changes and click Save.

The RMU contains four hardware DIP switches that signal the RMU firmware about which light system it is currently monitoring. These DIP switches are configured at deployment time and are dependent on the light type being monitored. When OTV receives data from an RMU, it detects which light system is being monitored based on these settings. The FAA Light Properties File allows a utility to configure the information that OTV displays for a particular light system.

The RMU DIP switches are numbered 1, 2, 3, and 4, as shown in Figure 3:

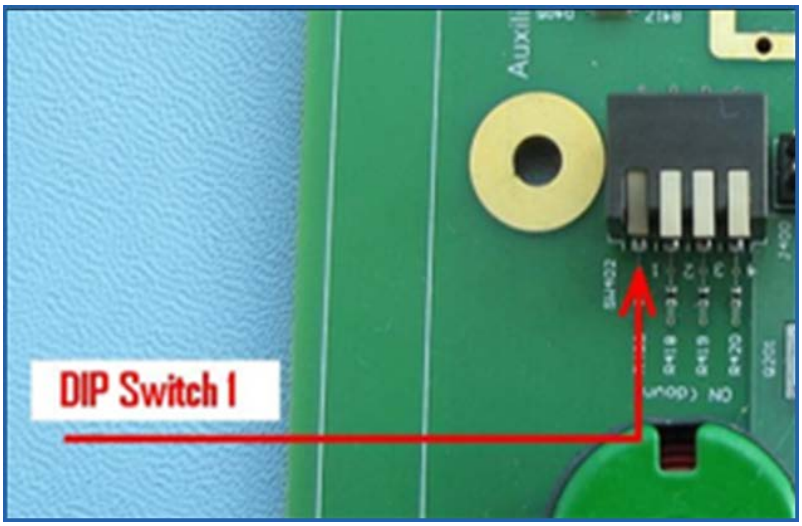


Figure 3. RMU DIP Switches

The following table shows the DIP switch setting for each light system supported (Up = 1; Down = 0).

Table 3. DIP Switch Settings

Setting (Dec)	Switch 4	Switch 3	Switch 2	Switch 1	Light System
0	Down	Down	Down	Down	Link Test
1	Down	Down	Down	Up	Reserved
2	Down	Down	Up	Down	Reserved
3	Down	Down	Up	Up	Dialight L810 860 120VAC Red LED (Part Number: 860-1RO1-002)
4	Down	Up	Down	Down	Dialight L810 RTO 12VDC Red LED Light Head (Part Number: RTO-1R08-002) + Dialight D64 Series Red Medium Intensity Beacon (D464-A13-001-Gen4) w/Unimar Controller AC
5	Down	Up	Down	Up	Dialight L810 RTO 12VDC Red LED Light Head (Part Number: RTO-1R08-002) + Dialight D64 Series Red Medium Intensity Beacon (D464-A13-001-Gen5) w/Unimar Controller DC
6	Down	Up	Up	Down	Reserved
7	Down	Up	Up	Up	Crouse-Hinds® 120VAC Red Incandescent
8	Up	Down	Down	Down	Reserved
9	Up	Down	Down	Up	Avlite 125C Red LED (25%)
10	Up	Down	Up	Down	Reserved
11	Up	Down	Up	Up	Avlite 125C Infrared LED
12	Up	Up	Down	Down	Reserved
13	Up	Up	Down	Up	Avlite 125C Red LED (100%)
14	Up	Up	Up	Down	Dialight L810 RTO 12VDC Red LED Light Head (Part Number: RTO-1R08-002)
15	Up	Up	Up	Up	Reserved

Using this table allows you to map entries in the faalight.properties file that correspond to specific lights in the Total Reach system. For example, the following two entries from the properties file show the default manufacturer and model number that displays for the Dialight L810 12VDC Red LED light type. In Table 3, this light type is signaled when the switches are set to Position 14. The default **faalight.properties** file has the following default textual description for this light type:

```
faalight.device.14.manufacturer=P&R Tech
faalight.device.14.model=(A0) Dialight L810 12VDC Red LED (Part
Number: RTO-1R08-002)
```

The following list highlights important considerations when editing the **faalight.properties**:

1. The **faalight.properties** can be edited at any time. OTV does not need to be restarted for the changes to take effect. Changes are implemented each time OTV receives a packet from a light.
2. Changes to this file are typically made only once–at initial system deployment time–or if a new light type is added to the system.
3. The descriptions used in this file affect both the display and text that appears on alert emails for a light type. It is possible that information downstream from OTV or other tools may be developed based on specific textual terminology used in those applications, as, for example, an email filtering built around specific anticipated text terminology for a specific light. For these reasons, you should carefully plan and consider any changes to this file.
4. When editing this file, do not make changes to any fields other than **faalight.device.xx.manufacturer** or **faalight.device.xx.model**. Changes to other fields may invalidate the ability of OTV to parse packets from devices being monitored.
5. See section 0 for the default **faalight.properties** file configured for obstruction lights.

3.2 Deploying an RMU-Monitored Light

Adding a remote RMU to the Total Reach system is a multi-step process that may span several days in a geographically diverse network. The following activities summarize this process:

- A work order requests that several devices are ready to be scheduled for deployment.
- The work order maps specific ORW Total Reach radio Mac Addresses for each RMU to be installed to a physical location and a light type for each unit to be installed.
- The work order proceeds to the EMS operator. The EMS operator adds the Mac Addresses to the EMS and then validates that security keys are in place as described in the *EMS Operator Guide (010-0107-00)*.
- After the Mac Addresses are added to the EMS, the physical installation of each device can then take place. There can potentially be a span of several days between adding the device to the EMS and the physical installation of the device in the field.
- The field technicians install and test each RMU in the field as described in the *RMU Light Unit Wiring Guide (010-0007-00)*. To close the work order, the installer must validate that the Mac Addresses were installed at each location and note each installation on the work order.
- The work order is then routed back to the EMS operator. The EMS operator moves the device from **Maintenance Mode,** as described in the *EMS Operator Guide (010-0107-00)*.
- The work order is then routed back to the OTV operator. For each deployed RMU, the OTV operator updates the **Tie Line Circuit** and **Tower** device attributes and takes the device out of **Maintenance Mode**.
- The work order is then complete.

NOTE: After each device is physically installed, the OTV dashboard begins to show data for each deployed RMUs as data it is received. The OTV operator must enter the **Tie Line Circuit** and **Tower** device attributes and take the device out of **Maintenance Mode** for

the information to properly display on the dashboard. Prior to making the attribute changes, devices will show up in the OTV dashboard.

To update the device attributes and complete the work order, the OTV operator must have the list of installed Mac Addresses and locations and complete the following steps:

1. Log in to OTV with an admin or operator account.

   NOTE: The login account must have permissions to work with the correct application data. For example, if RMU obstruction lights are being processed, the admin or operator account must have RMU data privileges.

2. From the log in window, click the **Devices** tab.

   NOTE: The **Devices** tab shows a listing of all devices that OTV controls. If the login account is limited to a specific application view, such as FCI or FAA lights, only those device types display. If the login account has access to all types of data, both types of devices will display. If the list is long, the operator can sort the columns by fields to quickly identify newly added devices.

   For example, if RMUs are added, the operator can perform the following sorting steps to quickly move the newly added devices to the top of the listing view:

3. From the Device Type drop-down list, select **RMU: Obstruction Light**.
4. Click the **Tower** column. Depending on the previous settings, you can click on this column heading twice.
5. A list of Mac Addresses and blank columns is displayed for the physical installation fields to be entered.
6. Select a Mac Address to be processed from the sorted list.
7. Click the **Properties** link.
8. Enter **Tie Line Circuit** and **Tower** data in the associated text field.
9. Click **Save**.
10. Repeat above steps for each node to update.

    NOTE: The information entered should be in a consistent format. As the network expands, this will aid in searching for devices in an alarm or listing view. Note that **Manufacturer** and **Model** fields are controlled by the **faalight.properties** file.

The following table lists and describes other device attribute fields.

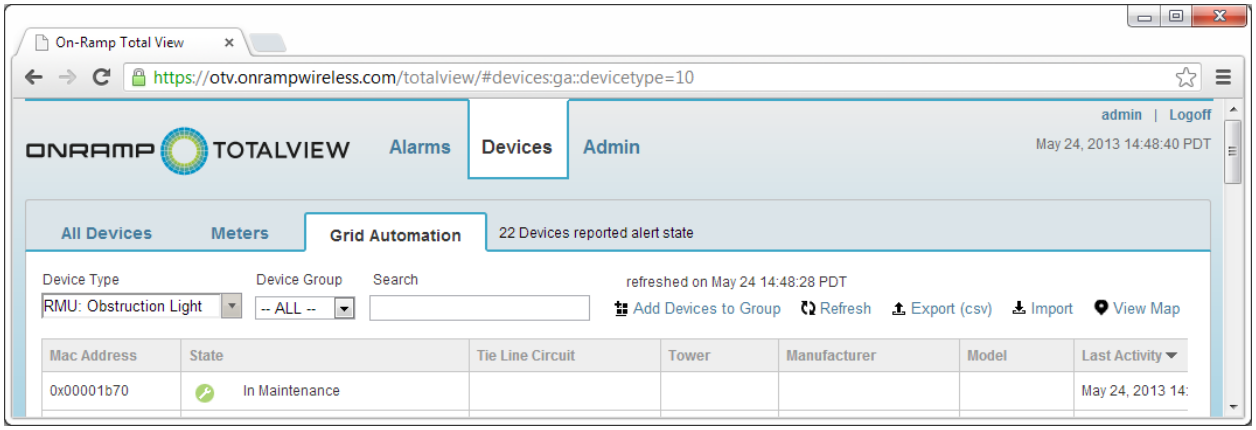
Table 4. RMU Device Attribute Descriptions

Device Attribute	Description
Tie Line Circuit	No specific recommendation. Use standard, customer-specific terminology. User entered post device deployment.
Tower	No specific recommendation. Use standard, customer-specific terminology. User entered post device deployment.
Manufacturer	Automatically entered by the system as specified in the **faalight.properties** file.
Model Number	Automatically entered by the system as specified in the **faalight.properties** file.
Latitude	This field is only used when the ORW geospatial mapping feature is licensed. If it is not, leave this field blank. For additional information about the Geospatial Mapping feature, contact an On-Ramp Wireless representative.
Longitude	This field is only used when the ORW Geospatial Mapping feature is licensed. If it is not, leave this field blank. For additional information about the Geospatial Mapping feature, contact an On-Ramp Wireless representative..

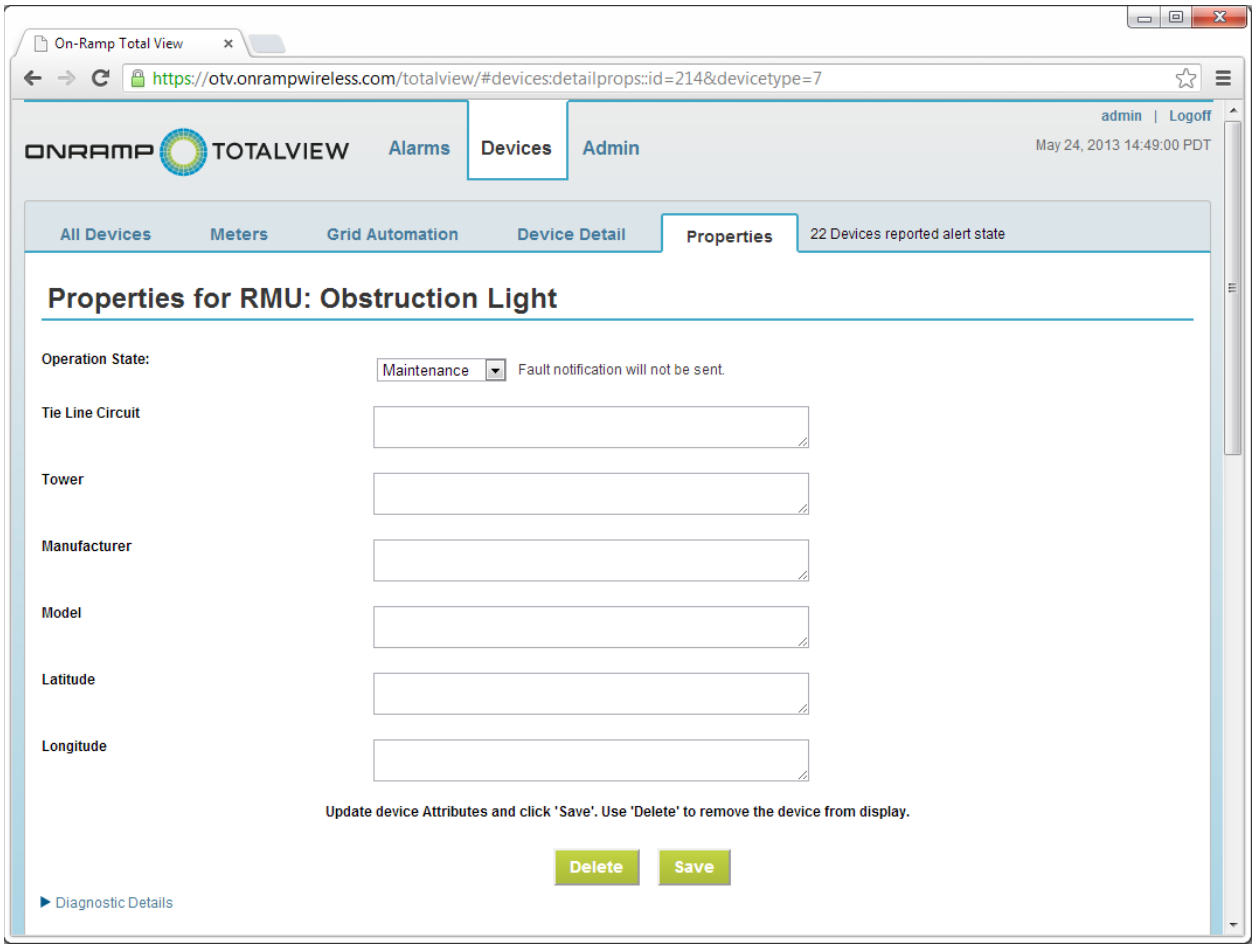
3.3 Maintenance Mode

The OTV Maintenance Mode offers a simple way to filter RMU email alarms for a device either during deployment or when an end device is undergoing physical maintenance. During either of these times, an end device can be in the maintenance state for a long period of time and cause unnecessary alarms. You can optionally disable alarms for devices that are known to be in maintenance.

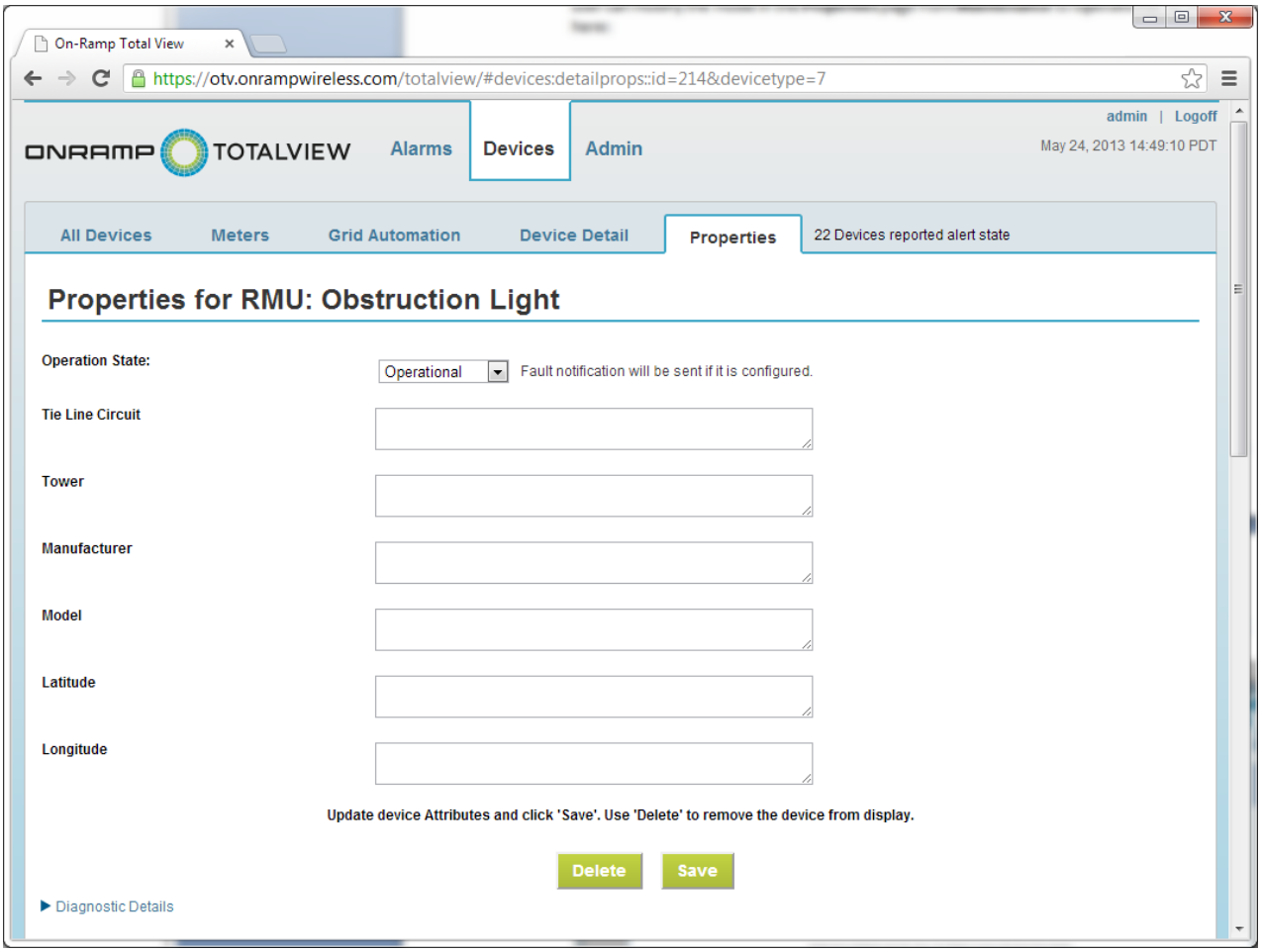
To aid deployment, RMUs are assumed to be in **Maintenance Mode** when they first join the system. When a device is in **Maintenance Mode,** it will not generate email alerts based on device alarms. In addition, the state of the device in the device or alarm list includes a wrench symbol in the *state* icon, as shown in the following example:



The device properties page shows the current mode, as shown below:



When the device is ready, out of maintenance mode, and ready for automated monitoring, the user can modify the mode in the **Properties** page from **Maintenance** to **Operational**, as shown here:



After clicking the **Save** button, the device alarm email notification is enabled.

NOTE: The Alarms and Devices screens do not immediately display entries that do not include the wrench icon. After **Operational Mode** is initiated, OTV begins to display operational entries without the wrench, as new data is received. The update rate is dependent on the device. For devices that operate with once daily update intervals, the new data may not be displayed without **Maintenance Mode** indications for up to 24 hours.

3.4 RMU Daily Operations

Operating RMU Obstruction Lights do not require regular day-to-day operations of the OTV dashboard. When OTV is configured, the RMU operator can rely on email alerts for notifications of RMU alarms. When an alarm email has been generated, the RMU operator views the OTV dashboard to verify the alarm. The operator can also view the OTV dashboard to analyze the detailed history of the alarm or view it on a regular basis to validate the system operation.

The RMU generates an email alert for one of the following alarm conditions shown in Table 5.

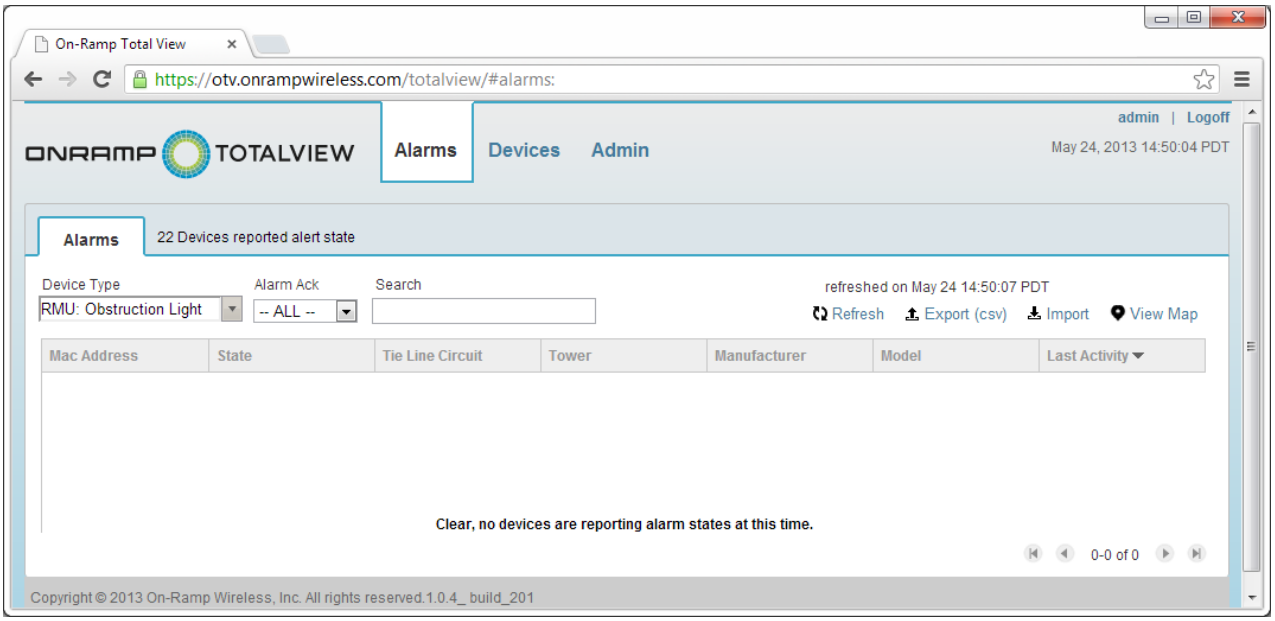
Table 5. List of RMU Generated Email Alerts for Alarms

Alarm Condition	Cause(s)
LED or lamp outage	■ 1 of 1 lights out for single light units ■ 1 of 2 or 2 of 2 lights out for dual light units ■ L810 or L864 failures for L864 light deployments ■ L864 flasher failures for L864 light deployments
24 Hours Passed	Solar panel charging system fails to change state in more than 24 hours, such as instances where there is no day-to-night or night-to-day transition within a 24-hour period
Night too short	This alarm is only valid for units using solar panel systems. This alarm indicates when a solar system has indicated that the length of night shorter than expected. For example, the length of night was indicated as 1 hour and was expected to be 8 hours. The alarm captures the case when the light should have been on because it was night, but turned off too soon because of an indication from the solar system – not because of a light failure.
Lid Opened	Intrusion detection. Occurs when the RMU unit lid is opened.
Timeout Exceeded	Alarm notification is sent if the number of minutes between successive RMU data receptions is exceeded.
Using Battery	Triggered when the RMU detects that the main system voltage is out and the unit is running on the backup battery. **NOTE:** When the RMU is running on the backup battery, the lights are out. The backup battery cannot supply enough power to run the lights on the RMU. The backup battery only has enough power to allow status reporting.
Power Fail	This alarm is specific to L864 light types and indicates that the main power to the Unimar controller and lights are out.
Button Depressed	Generates a round trip wireless message that confirms the complete system of an operation before signaling success on an LED that is visible to an installer. This alarm enables simple field commissioning.
Replace Battery	Signals when it is time to replace the backup battery.

Complete the following steps to view details regarding an alarm:

1. Log in to the OTV dashboard with an operator or admin account with privileges to view RMU FAA application data. The Alarms page displays.

   NOTE: The **Alarms** screen displays a network-wide summary of all RMU devices with active alarms. If the system is operating normally, there are no alarms. In the following example, the message **Clear, no devices are reporting alarm states at this time** is displayed on the **Alarms** tab screen.



Any of the following alarms can be displayed on the dashboard:

- **1 of 1 bulbs out**
  A light failure alarm for single light head units (Avlight 125C IR or Avlight 125C Red LED). If the RMU detects that an LED light element is out, meaning that the measured current threshold falls below the alarm trip point, an email alarm is generated. The dashboard displays a red circle.

- **2 of 2 bulbs out**
  A light failure alarm for dual light head units (Dialight 810 or Crouse-Hinds 120 VAC) that indicates both light elements are out. If the RMU detects that both light elements are out, meaning that the measured current threshold falls below the alarm trip point for a dual light failure, an email is generated. The dashboard displays a red circle.

- **L810 Light Failure**
  A light failure alarm for an L864 A1 system that indicates one of the L810 lights is out. The A1 light system includes multiple physical lights, such as 1 **L864 Beacon and two or more L810 lights**.

- **L864 Beacon/L864 Flasher Fail**
  A light failure alarm for an L864 A1 system that indicates an issue with the L864 beacon. The A1 light system includes multiple physical lights, such as 1 L864 Beacon and two or more L810 lights. This alarm indicates that either the L864 Beacon is out, the L864 is not flashing properly, or both.

- **Power Fail**
  A failure alarm for an L864 A1 system that indicates an issue with the main system power for the Unimar Controller and the Light Heads. This alarm also indicates that both the L810 side lights and L864 beacon lights are out as a consequence of the main power being out. The A1 light system has two power busses. One power bus goes to the RMU and the other goes to the Unimar controller and light heads. This power failure does not

indicate that the RMU power bus is out, only that the Unimar and Light Power bus is out. An RMU power bus failure is indicated from the Using Battery alarm.

- **Using Battery**
  An alarm triggered when the main source of power for the RMU is out and the RMU is running on the backup battery. The dashboard displays a red circle. Note that, for an L864 A1 system, this alarm indicates that the RMU power bus is out. The A1 light system has two power busses. One power bus goes to the RMU and the other goes to the Unimar controller and light heads. This power failure does not indicate that the Unimar and light power bus is out, only that the RMU power bus is out.

- **Timeout Exceeded**
  If the RMU has not sent a message in the amount of time specified in the missed interval timeout configuration, this alarm is generated and the following dashboard displays an alarm with a red circle after two hours of missed updates from the RMU.

- **Lid Opened**
  An intrusion detection alarm generated if the RMU lid is opened. The dashboard displays a yellow circle.

- **Replace Battery**
  An alarm is triggered when the RMU detects that the backup battery voltage (when stirred under load) has fallen below the threshold to trigger the time to replace the backup battery. The dashboard displays a yellow circle.

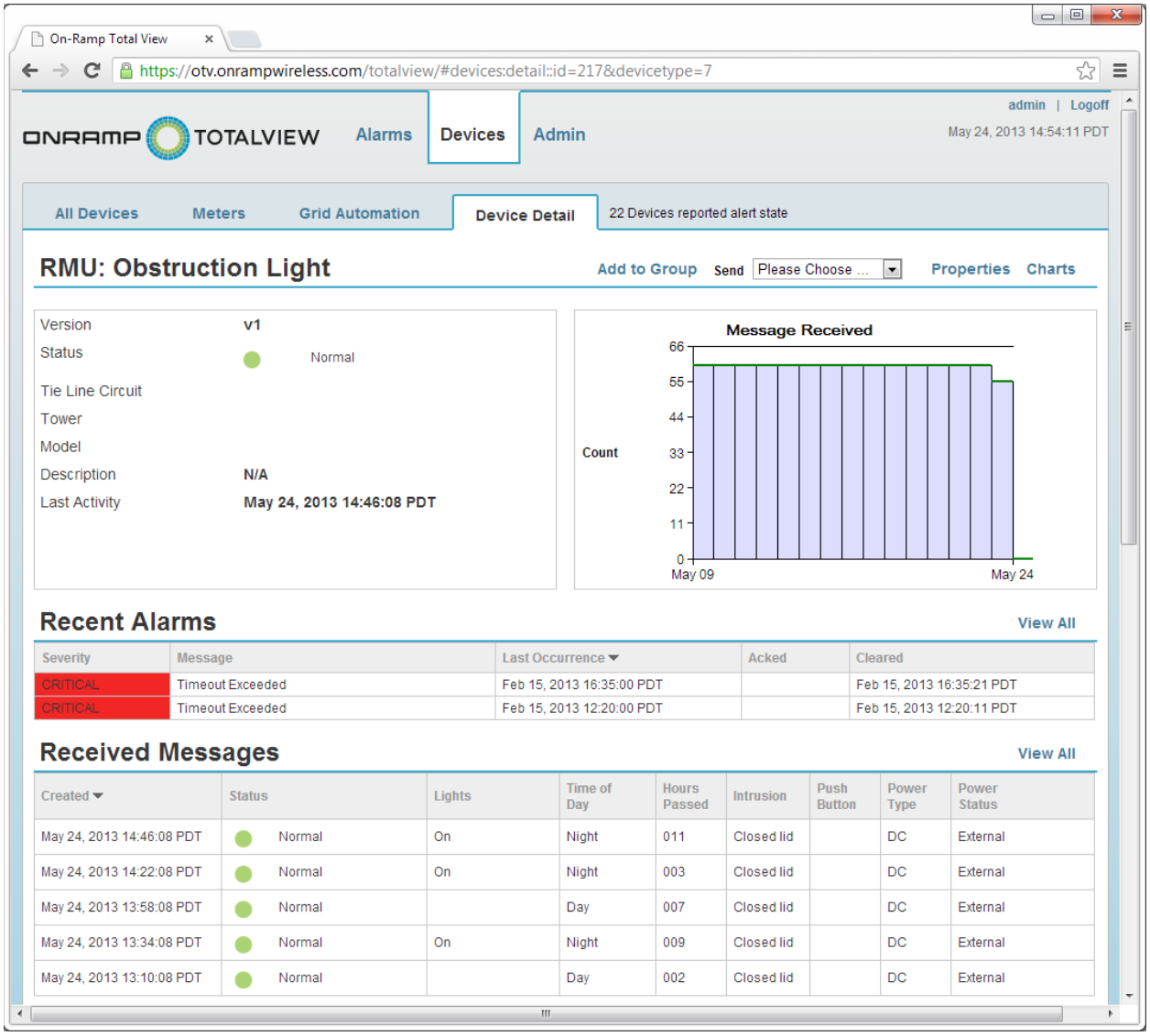
- **24-Hour Passed**
  This alarm is triggered only for 12VDC units using a solar recharging system. The Avlight 125C IR/Red LED, the Dialight 810, and the L864 units are the only units that generate this alarm. This alarm is triggered if there is no day-to-night or night-to-day transition within 24 hours. This alarm is an early warning of a potentially failing charging system.

  NOTE: If a day is too long, such as the power should be switching to night but it has not switched, OTV typically displays the **Running On Backup Battery** alarm. This is by design due to the nature of how solar recharging lights function. The solar recharging lights require the main power to have the ability to signal when it is day or night. If a day is measured as too long, it will signal a main power outage. If a night is too short, the RMU signals a **Night Too Short** alarm.

- **Night Too Short**
  This alarm is triggered when the RMU detects that it has measured the length of a night as too short when signaled by a unit using a solar system. This alarm is usually indicated during deployment due to the manual day-to-night and night-to-day transition during testing. In normal operation, this alarm signals that a light came on for a shorter length of time at night than expected. For solar-driven systems, the nighttime indication is signaled from the solar charging system and could indicate a problem with the solar charging system.

  You can use the OTV dashboard to monitor the state of the lights in a system. When an email alert is received, the operator can view the OTV dashboard to validate the state of the device that generated the alarm and analyze the history of that device.

2. After logging in to the system, click the **Devices** tab to display a list of lights in the system. To help sort by the state of a light type, you can use a combination of tabular column sorting functions by clicking on a column heading. You can also use the **Search** field to search for a partial or complete text string. If an RMU is listed, click on the RMU to display a detailed history listing for the device. The following figure shows an example of a detailed alarm condition.



RMU OTV alarms represent the current state of a device. Most alarms are latched when detected and will not be cleared without a physical RMU reset or an over-the-air reset.

The following table highlights alarm types, clearing conditions, and actions that must be taken when receiving the alarm.

Table 6. Summary of RMU Alarms and Actions

Alarm Type	Clearing Condition	Action
Lights Out	This alarm type indicates that an RMU has detected 1 of 1, 1 of 2, 2 of 2, L810, L864 lights are out on a unit. The alarm is cleared when the failing light has been replaced and the RMU is reset.	Notify the FAA. Schedule a maintenance call to replace the light.
Lid Opened	This alarm indicates that an RMU lid has been opened. The alarm is cleared when the lid is closed. If the lid remains open, the alarm persists.	If this is an unplanned alarm, schedule maintenance to see why the lid was opened. If the light status does not report that the light is out, you do not need to notify the FAA.
Using Battery	This alarm indicates that the main power (Main 12VDC battery for 12VDC lights or 120VAC power to 120VAC lights) to the RMU unit is off and the RMU unit is running on the backup battery. **NOTE:** For all light systems other than A1 L864 system, the light is off when receiving this alarm. The alarm is cleared only if the main power is restored and the RMU is reset. For A1 L864 systems this alarm indicates that the RMU power bus is out. A separate Power Fail alarm indicates when the Unimar controller and L864/L810 power is out.	Notify the FAA. **NOTE:** The backup battery does not power on the lights; therefore, the lights will not be on. If the reason for the power outage is known, such as the 120VAC is out and restored, you do not need to schedule maintenance. If you do not know the reason for the power outage, you should schedule maintenance. When the power is restored, the operator must physically reset the device or issue an-over-the air reset to the device.
Power Fail	This alarm is only indicated for A1 L864 systems and not triggered for any other systems. This alarm indicates that the main power to the Unimar Controller and L864/L810 lights is off. RMU power fail is signaled by the **Using Battery** alarm described above for A1 L864 systems. **NOTE:** This alarm implies that both the L864 and L810 lights in an A1 L864 system are off as a consequence of the lost power. The alarm is cleared only if the main power is restored and the RMU is reset.	Notify the FAA. If the reason for the power outage is known, such as the 120VAC is out and restored, you do not need to schedule maintenance. If you do not know the reason for the power outage, you must schedule maintenance. When the power is restored, you must physically reset the device or issue an over-the-air reset to the device.
External (Replace Backup Battery)	This alarm indicates that the backup battery needs to be replaced. The alarm clears itself when a new battery is placed in the RMU.	Schedule maintenance to replace the backup battery with a LSH 20 3.6V Li-SoCl2 battery manufactured by SAFT (or equivalent battery). If the status check of the unit shows a lights-out condition, notify the FAA. Otherwise, notification is not required.

Alarm Type	Clearing Condition	Action
Exceeded Timeout	This alarm is triggered when an RMU has not sent a back-to-back message within the timeout period configured during the RMU missed interval alarm set up. This alarm is cleared when normal RMU communication is restored. This alarm could be due to a Total Reach network problem. The alarm can also indicate an RMU issue if there are no known Total Reach network issues.	Notify the FAA. Coordinate with the Total Reach EMS operator to clarify if the issue is a device problem or a Total Reach network-wide issue. If there is a known Total Reach network problem, this alarm can clear itself when the network issue resolves. If there is not a known network issue, it is likely an RMU issue. Schedule a maintenance call to investigate.
Pushbutton Pushed	No action required. The alarm will not repeat and generate each time the pushbutton is depressed.	This alarm is normally only expected during installation or scheduled maintenance. If this alarm occurs during a non-scheduled event, schedule a maintenance call to investigate. If the light status indicates no lights are out, FAA notification is not required.
24 Hour Alarm	This alarm indicates that it has been 24 hours since a solar-charged light has transitioned from day to night or night to day. The condition will clear if the solar panel detects day/night and/or night/day transitions. The alarm will not be cleared until a physical device reset or an over-the-air reset is received.	If the light status does not show that the lights are out, FAA notification is not required. Schedule a maintenance call to investigate. This alarm may indicate that the solar panel is not charging the battery correctly. Upon receipt of this alarm, there is a limited time (a day or two at the most) before triggering the main battery alarm.
Night Too Short	This alarm is only valid for solar panel systems. This alarm indicates that the RMU has determined that the measured length of the night is too short and the light was possibly turned off while it was still dark. This alarm will only be cleared upon a device reset or an over-the-air reset.	Notify the FAA. Schedule a maintenance crew to inspect the light. This type of alarm is typically associated with a failing solar system main battery. Many of the solar light systems have low voltage detect electronics which will turn off power to the light systems when the voltage on the main battery drops below a safe level. When this occurs, the units are turning off the lights while it is still dark. The monitored tower will therefore not have a light on, even though it is night. The maintenance crew must inspect the system and verify the solar panel charging and wellness of the main system battery. **NOTE: This alarm might trigger d**uring deployment of a light or specific testing where a technician may be manually switching the light between day and night, and there is no issue with the main system battery. In the case of testing, reset the RMU to clear the alarm.

3.4.1 Alarm Management

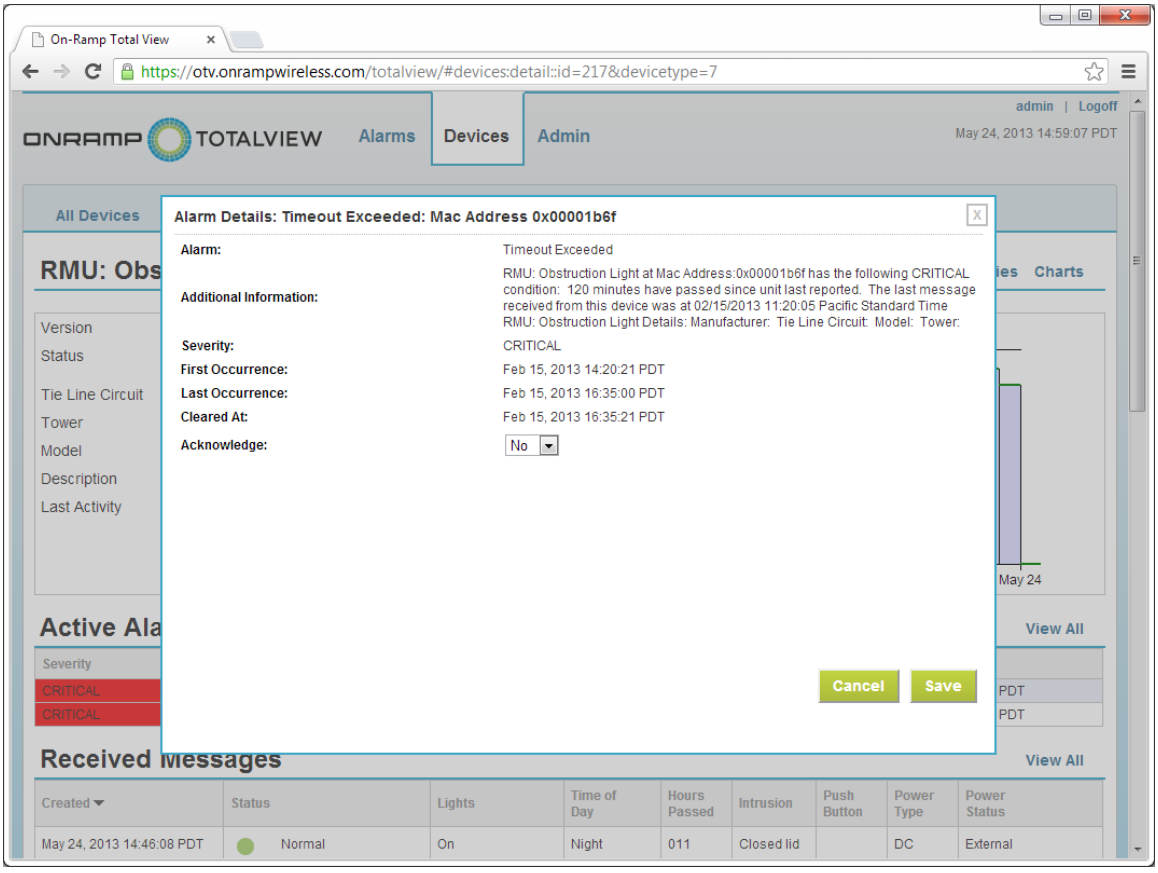
OTV supports the concept of alarm acknowledgement and detailed alarm history. Alarm acknowledgement is useful in deployments that have multiple operators running a common system. Additionally, device alarms may take multiple days to rectify. The concept of acknowledging alarms provides multiple OTV operators a mechanism to coordinate post alarm processes and manage device alarms through the alarm life cycle. Finally, using detailed alarm history multiple operators are able to better coordinate and track detailed history of device alarm events.

NOTE:
- Alarms are cleared by the alarming RMU device itself once the alarming event has been corrected. There is no operator action required to clear alarms.
- Using the alarm acknowledgement feature is optional and not required for proper operation of OTV.

3.4.1.1 Alarm Acknowledgement

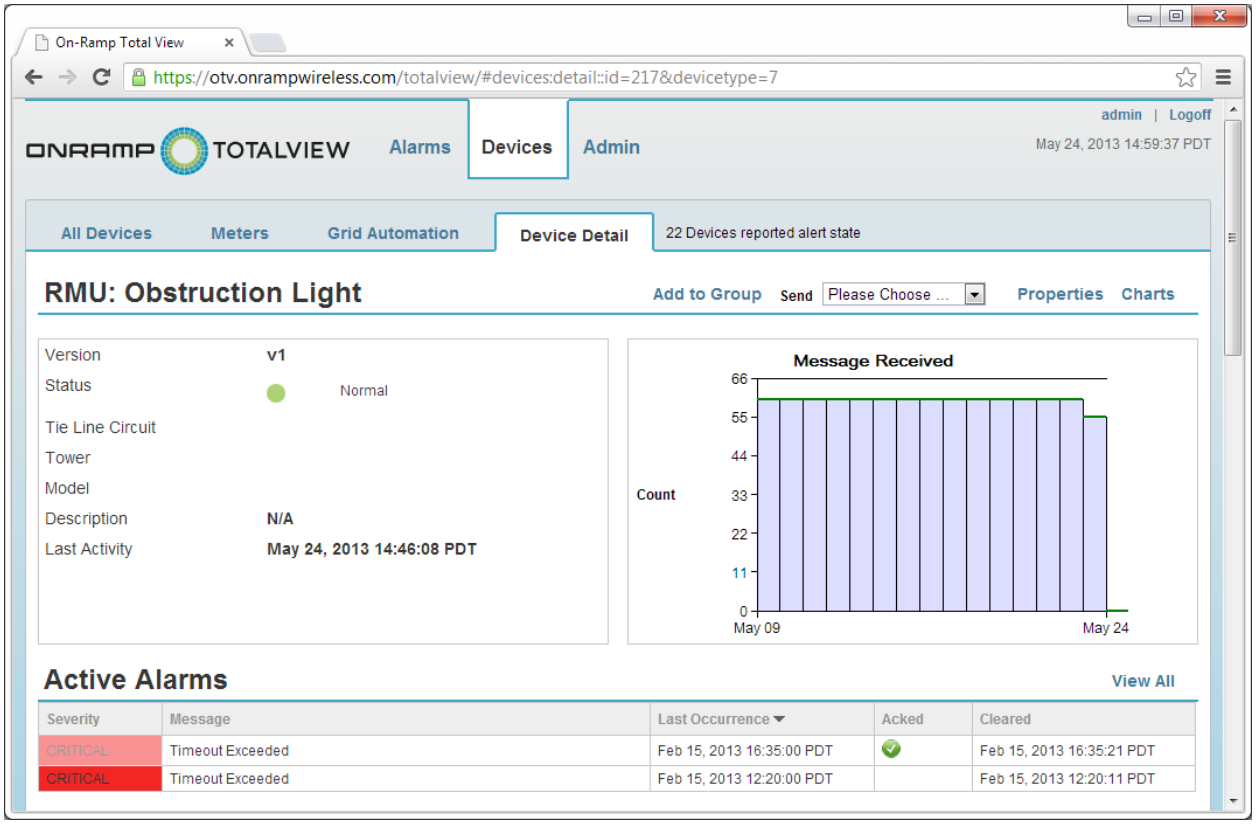
To acknowledge an alarm select the alarming device from the **Alarms** or **Devices** tab, follow the procedure below:

1. From the device detail screen, find the alarm in the Active Alarms section. To acknowledge an alarm, click on the row containing the alarm:

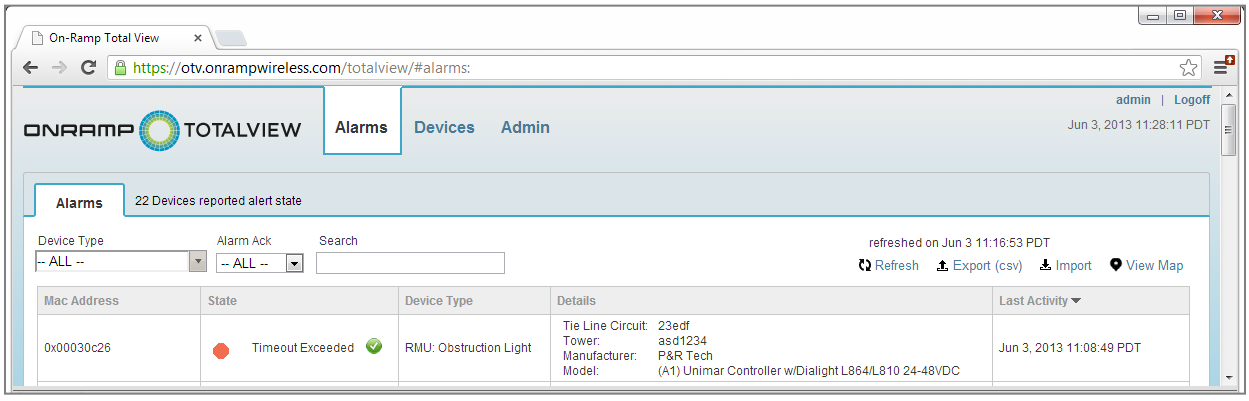


2. From the detailed alarm information page, select **Yes** from the **Acknowledge** pull-down box, and then click **Save**.

   NOTE: The Active Alarms section now shows an alarm acknowledged checkmark as shown below.



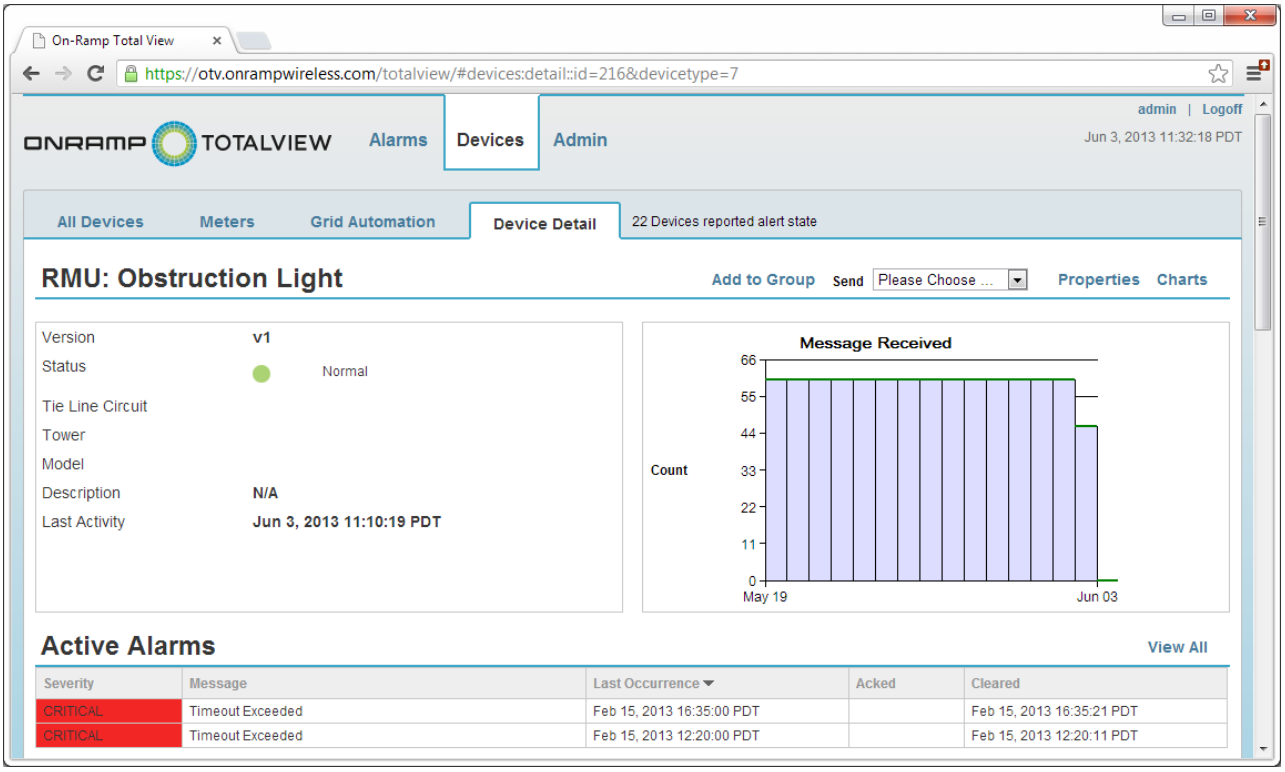
   NOTE: The Alarms and Devices entries will now be updated to show an alarm acknowledged checkmark as shown below.



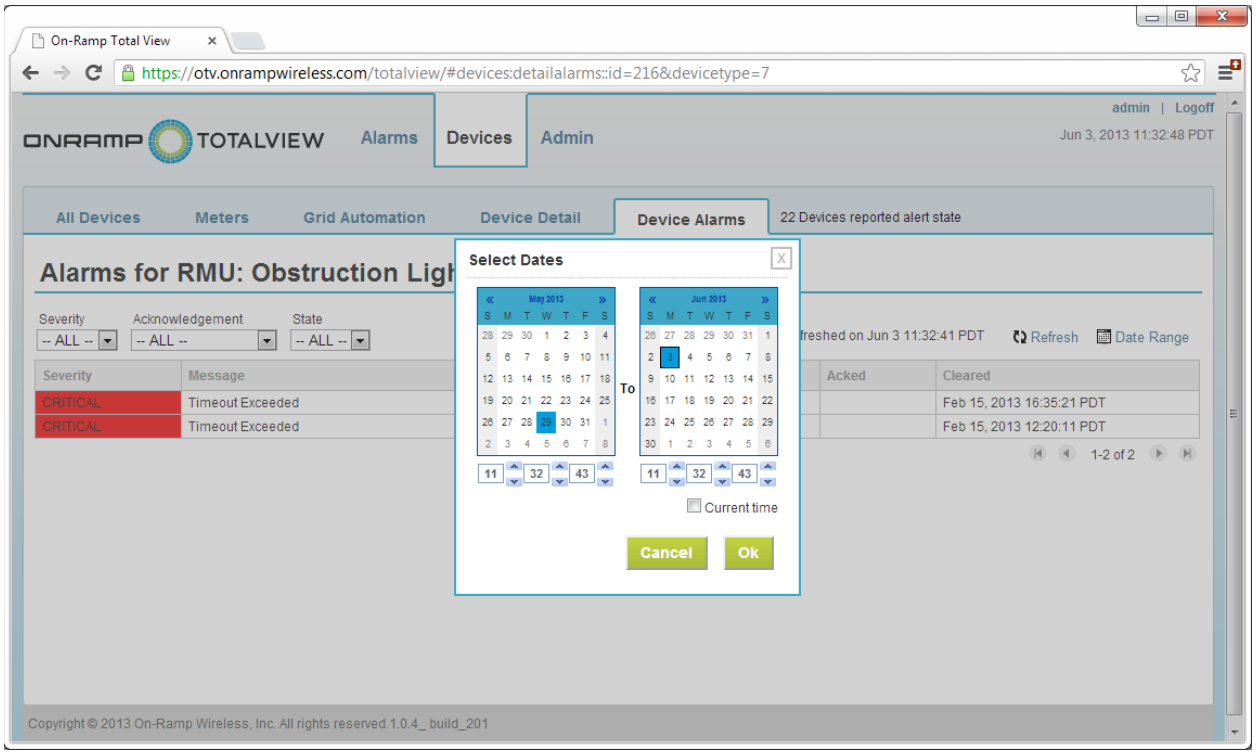
3. As shown above, use the Alarms Ack dropdown box to aid in sorting within the Alarms tab.

3.4.1.2 Alarm History

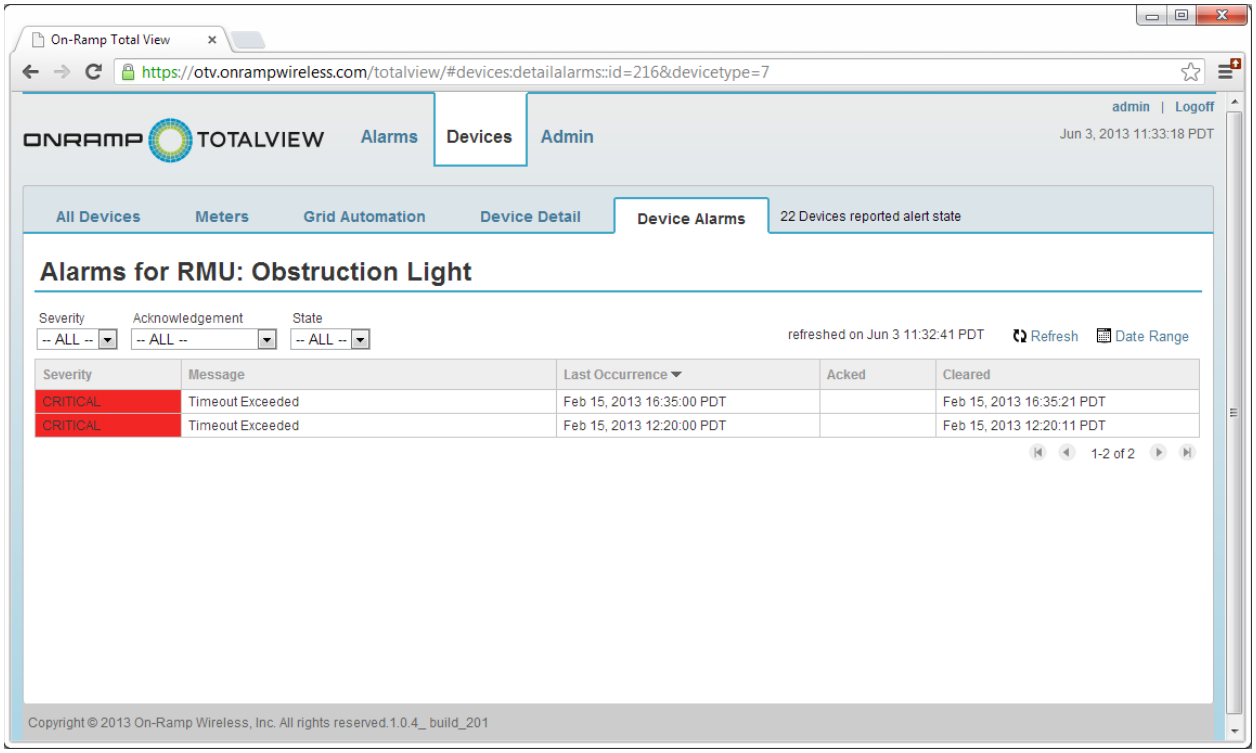
The detailed alarm history page includes the following features to aid in search and sorting through historical device alarms. This view is available from the device detail page by clicking **View All** in the Active Alarms section.



Use the date range feature to set the date and time around specific events as shown below.



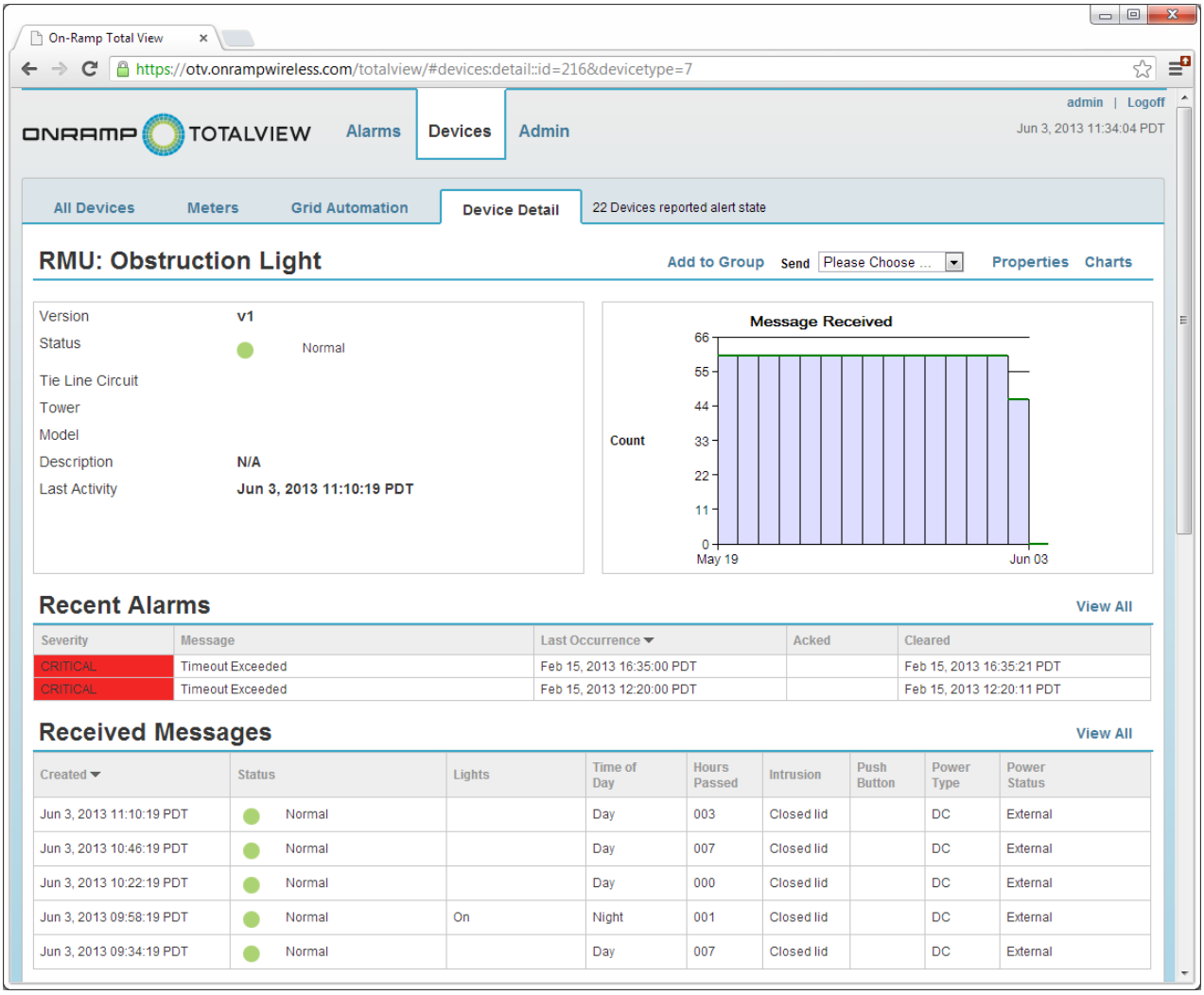
Severity, **Acknowledgement**, or **State** filters may be used to narrow down the list.



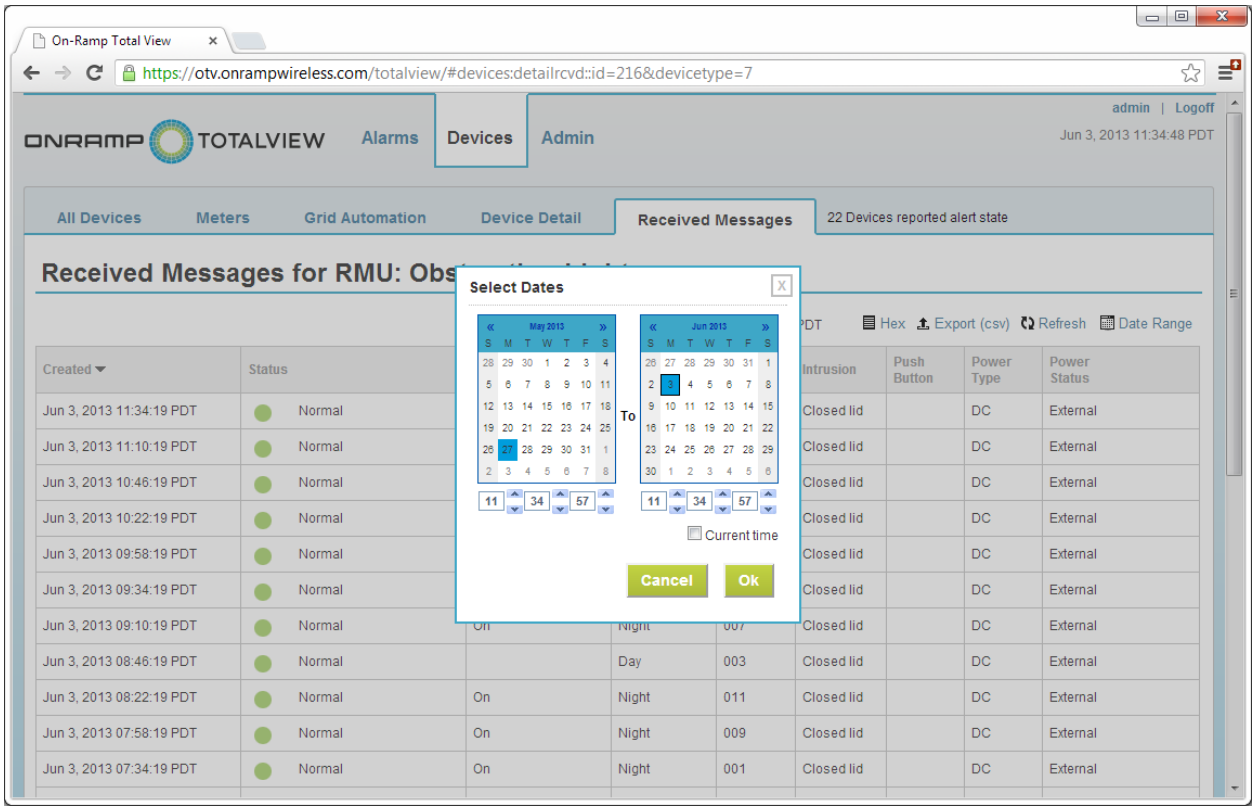
3.4.2 Data Export

OTV provides a mechanism for an operator to export a .csv file of device history.

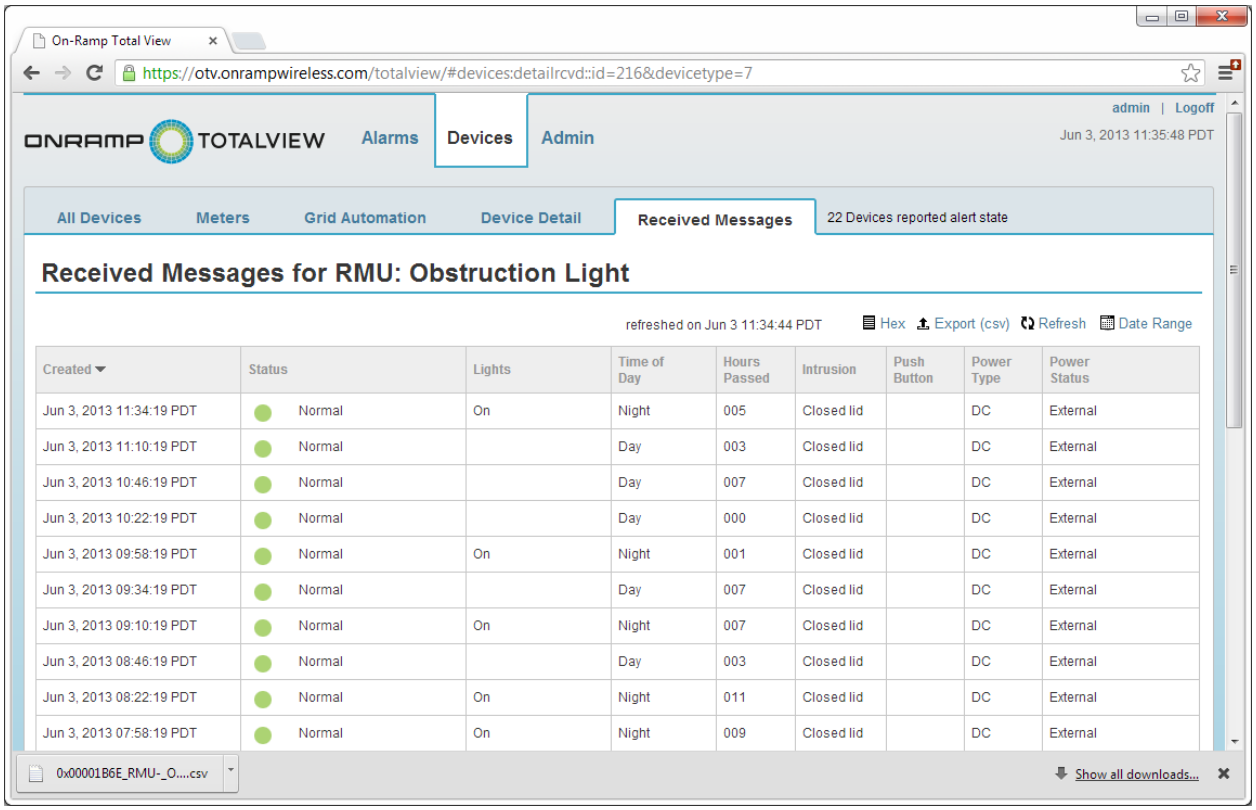
1. From the **Alarms** or **Devices** tab select an RMU of interest.



2. Click the **View All** link in the Received Messages section. Then use the date range to select the historical range of interest.



3. Click the **Export (csv)** link to export the current list to a csv file.



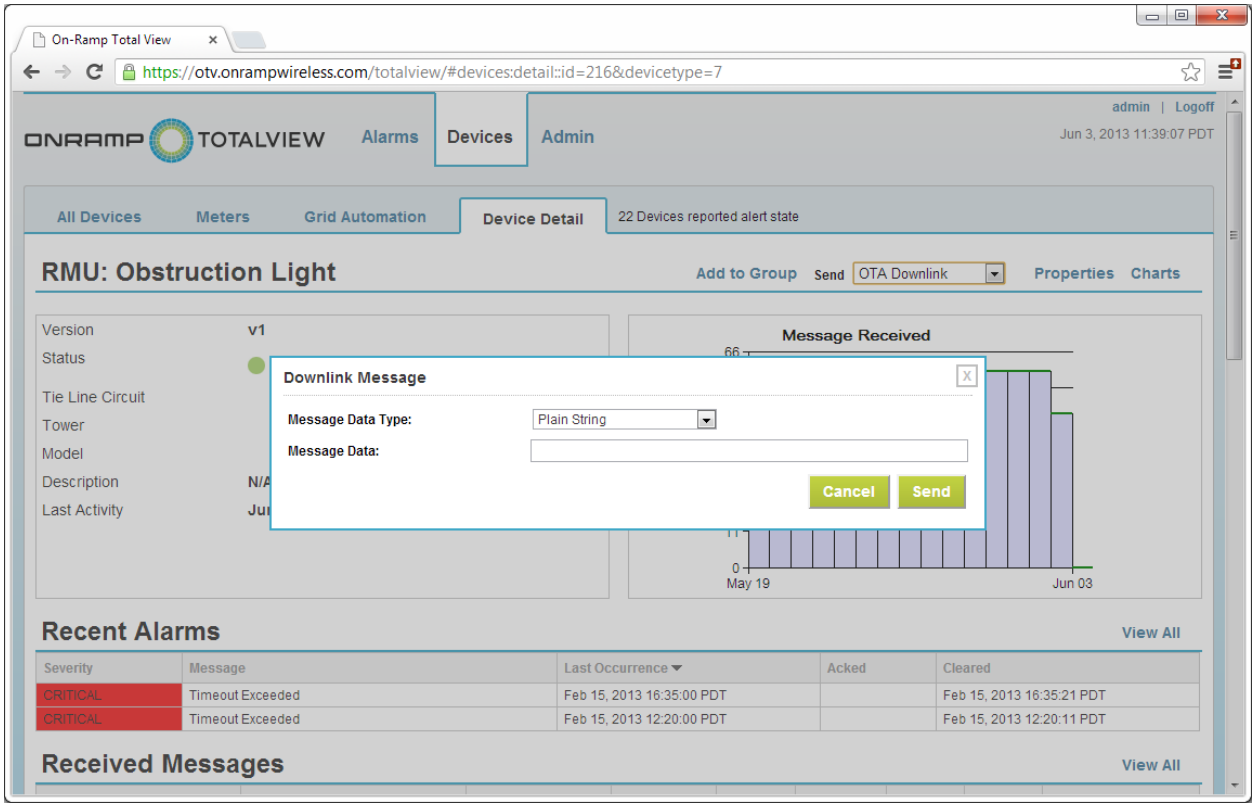
NOTE: The filename includes the node ID and device type of the selected device as well as the date that the export file was created.

3.4.3 RMU Reset

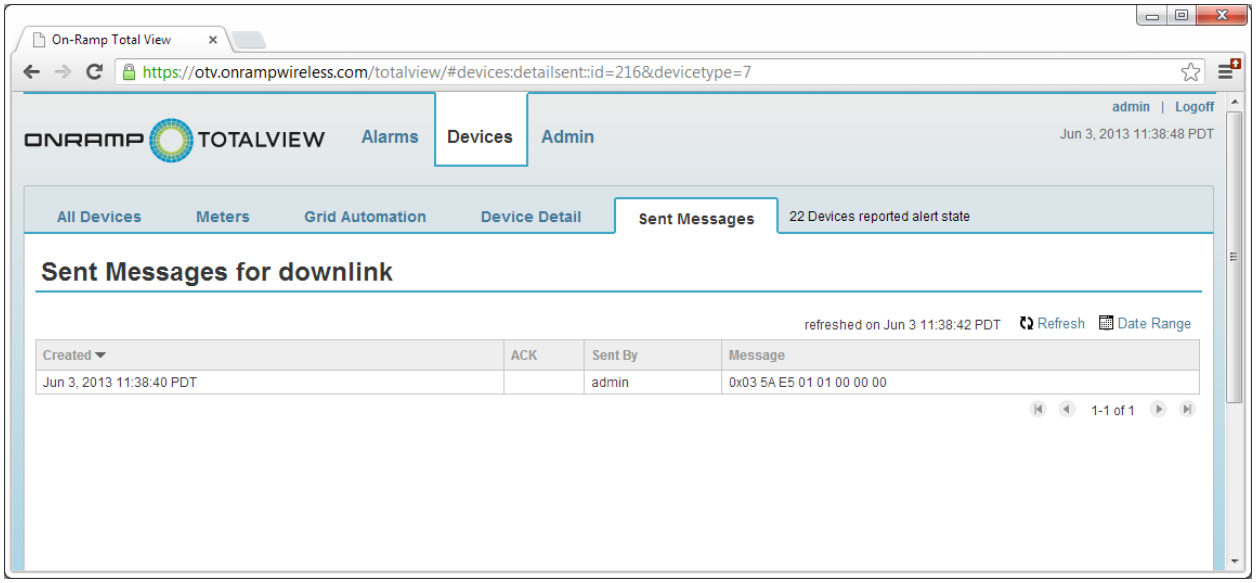
The RMU will latch many of its alarms to ensure that the alarms do not prematurely disappear or go off and on throughout the day. For latching alarm types, you must physically reset the RMU to clear the alarm by pressing the RESET button on the RMU or by issuing an over-the-air reset.

Use the following steps to issue an over-the-air reset:

1. Log in to the OTV dashboard with an operator or admin account with privileges to view the RMU Obstruction Light application data. The Alarms page displays.
2. Select the **Devices** tab.
3. Use the Search and or Sort features to locate the RMU that is to be reset.
4. Select the RMU for a detailed device view.
5. On the top right of the page, select the **OTA Downlink** option in the Send drop down menu.

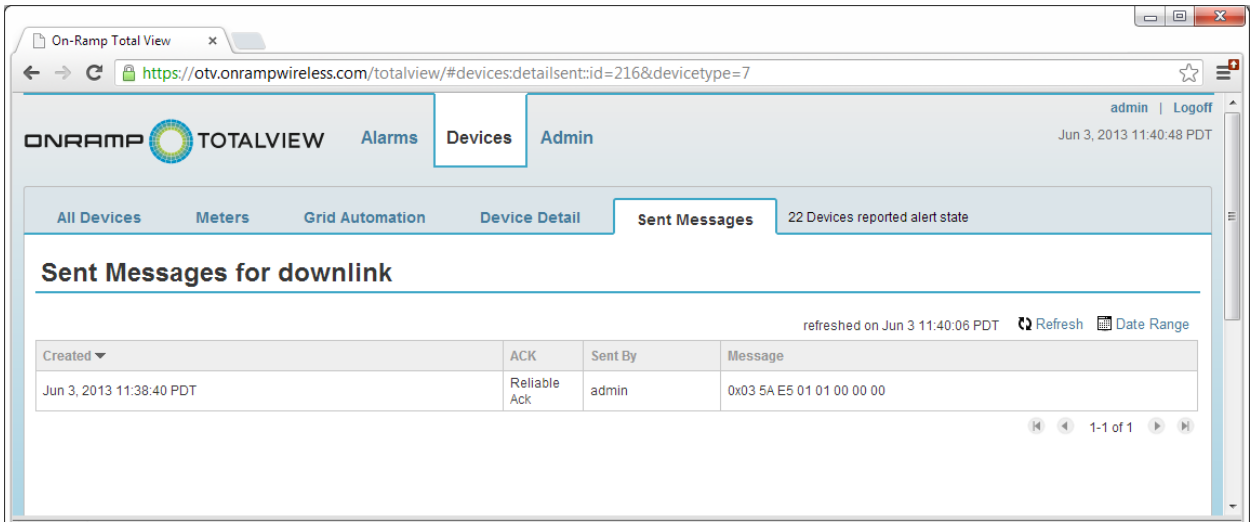


6. From the **Message Data Type** pull-down menu, click **Hex String (No leading '0x')**.
7. In the **Message Data** Field, type: **035AE50101000000**
8. Click **Send**. The display indicates that the message is scheduled for delivery to the node.



9. The message is delivered to the node at the next scheduled update interval. The maximum time lapse for RMUs is 24 minutes. When the RMU message is received, the **Sent Messages**

section on the device dashboard is updated to indicate that the message acknowledged reliably. Note that it may take up to 24 minutes for the next update interval from the RMU to validate that the unit was reset.

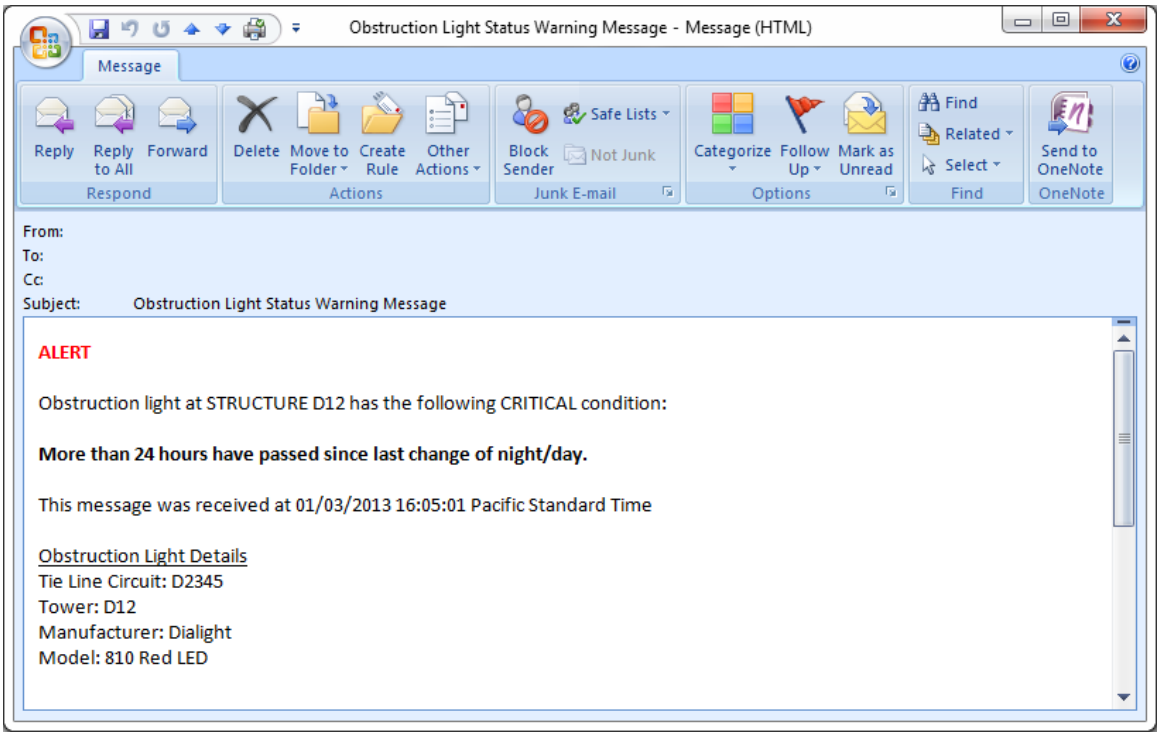


Appendix A Email Alert Examples

The following example shows an email alert generated by the OTV system. Each email identifies the following information:

- Structure Number, as entered into OTV for that device
- Short description of the alarm
- Time stamp for the message
- Manufacturing details specific to the light being monitored

This example message highlights a failure on a Dialight 810 RED LED light at structure D12 that is exhibiting a 24-hour charging system alert.



Appendix B faalight.properties File

The following text is added to the OTV config.properties file.

```
1  ####
2  # FAA Light config props that should be added to cima’s config.properties
3  ####
4
5  app_adapter.7.classpath=<CIMA_HOME>/dm/faalight-adapter
6  app_adapter.7.spring_app_ctx_file_names=faalightAdapterContext.xml
7
8  faalight.status.interval.max.minutes=30
9
```

Appendix C Abbreviations and Terms

Abbreviation/Term	Definition
AutoRANGER	A function of the FCI that configures fault detection trip values based on the load detected in the distribution line.
AP	Access Point. The Total Reach network component geographically deployed over a territory.
OTV	On-Ramp Total View. The network component that passes data from the Gateway to the associated upstream databases.
Dashboard	Web page view of the aggregated end-device monitoring data.
DMS	Data Management System
EDW	Engineering Data Warehouse
FAA	Federal Aviation Administration
FCI	Fault Circuit Indicator. The Schweitzer Engineering Laboratories (SEL®) designed end device that remotely monitors distribution lines for voltage and/or current faults.
FW	Firmware
GW	Gateway. The network appliance that provides a single entry point into the back office for the Total Reach network. A Gateway talks upstream to the EMS and OTV. It talks downstream to multiple APs.
LCV	Loss of Current and Voltage
LOC	Loss of Current
LOV	Loss of Voltage
EMS	Element Management System. The network component that provides a concise view of the Total Reach network for controls and alarms.
Node	The generic term used interchangeably with end point device.
OMS	Operating Management System
ORW	On-Ramp Wireless
RMU	Remote Monitoring Unit. The end device that monitors Federal Aviation Administration (FAA) obstruction lights.
SEL WSO	SEL Wireless Sensor for Overhead Lines
SMS	SMS Short Message Server
SMTP	Simple Mail Transfer Protocol
SOAP	Simple Object Access Protocol. A protocol specification for exchanging structured information in the implementation of web services in computer networks.
UI	User Interface