ONRAMP WIRELESS

TOTAL VIEW

OTV Supplement: KONWPT Sensor

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OTV Supplement: KONWPT Sensor

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Revision History

Revision	Release Date	Change Description
A	November 6, 2013	Initial release.
B	November 13, 2014	Updates for Generation 2 devices supported in OTV 1.1.11.

1 Introduction

This document focuses on On-Ramp Wireless Total Reach Network operation to support Sensor Monitoring with the KONČAR KONWPT Sensor. It also provides On-Ramp Total View (OTV) administrators and operators with an overview of the Sensor (KONČAR KONWPT) application in OTV.

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

- *OTV Operator Guide (010-0106-00)*
- *EMS Operator Guide (010-0107-00)*
- *KONW_T ULP Message Specification, Version 2.3*

It is assumed that the reader has a basic familiarity with 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. These network components should be installed and ready to use.

2 Overview

On-Ramp Wireless Total Reach technology has been integrated into the KONWPT Sensor by KONČAR. The KONWPT Sensor with integrated Total Reach technology provides pipeline operators remote battery-powered pipeline pressure sensors that are centrally monitored through a Total Reach network.

KONWPT Sensors are battery-operated devices that operate up to several years (depending on the update rate) when they are directly installed on a pipeline. KONWPT Sensors are installed system-wide on distribution pipelines throughout a system. In a typical system, there may be hundreds of KONWPT Sensors geographically dispersed throughout the pipeline coverage area.

Each KONWPT Sensor detects and wirelessly reports the following types of information regarding the pipeline on which it is installed:

- Time stamped Periodic Pressure Measurement. Default one (1) hour update interval (UI)
- Time stamped Periodic KONWPT Sensor Battery Voltage. Default is one (1) hour update interval (UI)
- Configurable Over Threshold Alarm
- Configurable Under Threshold Alarm
- Configurable Rate-of-Pressure Change Too High Alarm
- Configurable Temperature Over Threshold Alarm (OTV 1.1.10 and later)
- Pressure Sensor Failure Alarm
- Battery Low Alarm
- Historical pressure information

Each KONWPT Sensor is connected wirelessly to an Access Point (AP). The APs are aggregated at a Gateway. The On-Ramp Wireless OTV system can log the KONWPT Sensor application data into various databases for analytics using the Total Reach network. The OTV view generates a system-wide application view of the state of pressure throughout the pipeline system.

A typical deployment consists of multiple APs connected to hundreds of KONWPT Sensors deployed on the pipeline at ground level, as shown in the figure below:

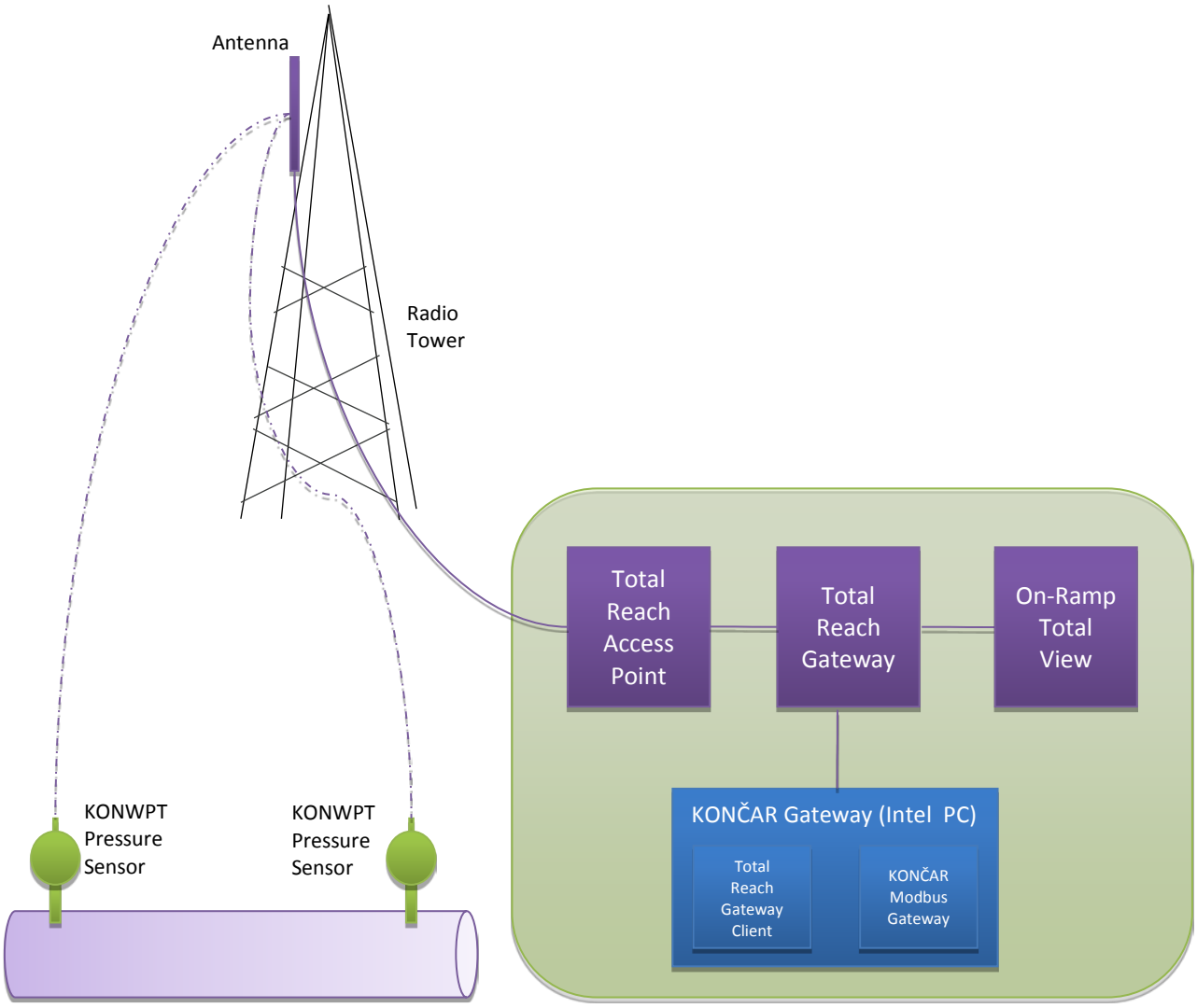


Figure 1. Deployment of Multiple KONWPT Sensors

- In a normal, non-faulted operation, each KONWPT Sensor defaults to sending a periodic measurement packet once an hour.
- If any of the supported alarms are enabled, then an asynchronous exception packet is sent immediately when the enabled alarm condition is detected.

Each periodic measurement or alarm packet received by OTV contains the fields shown in the following table:

Table 1. Reported Fields and Values for OTV

Reported Field	Description
Event	The Event field shows the reason for the packet: ■ Periodic: Periodic Pressure/Battery Voltage Measurement ■ Over Threshold: Over pressure threshold alarm. ■ Under Threshold: Under pressure threshold alarm. ■ Rate of Change High: Rate of pressure change too high alarm. ■ Battery Failure: Pressure Sensor battery needs replacing.
Measurement: Pressure (Bar) or Temperature (K)	Absolute value of the measured pressure or temperature at the time stamped time of measurement. The pressure is reported in bar units. Temperature is reported in Kelvin.
Voltage (V)	Absolute value of the measured KONWPT Sensor battery voltage at the time stamped time of measurement. The voltage is reported in Volts.
Timestamp	The time of the measured pressure and voltage or associated enabled alarm. The time format is reported based on the current OTV display settings.
Received	The time that OTV received the KONWPT Sensor message. The time format is reported based on the current OTV display settings. **Note:** This time stamp is typically after the time stamp of the measurement and represents the time of flight of the packet from the KONWPT Sensor to the AP and associated TCP delays between the AP and OTV.

3 KONWPT Sensor Application Operation

This section details the OTV configuration and operation of the KONČAR KONWPT Sensor Application.

3.1 Configuring the KONWPT Sensor Application

To initially set up the KONWPT Sensor application in OTV, the following items must be configured:

- Max Status Interval Timeout
- Email alerts on alarm events
- Min and max values per sensor type to convert raw data to actual measurement data (OTV 1.1.10 and later)

The KONWPT Sensor application supports the **KONWPT: Max Status Interval** field in OTV, which is a configurable missed interval timeout. This is an optional OTV feature.

The setting of this parameter defines the maximum amount of time (in minutes) between two successive updates for any KONWPT Sensor before OTV generates an alarm. This is an application-level alarm that alerts operators when there are significant issues in the Total Reach network that would prevent automated KONWPT sensor monitoring.

NOTE: This is a redundant Total Reach system alarm. Missed KONWPT Sensor intervals are noted in the EMS and OTV systems. The default KONWPT Sensor update rate is one (1) hour. For a one (1) hour default update rate, an operator may typically configure this setting to 305 minutes (5 hours + 5 minutes). The default setting of EMS missed interval alarms is 3, 4, and 5 for Minor, Major, and Critical missed interval alarms. With this OTV setting, the resulting system operation is that the ULP EMS alarms before the OTV system alarms. This setting produces a configuration in which EMS operators are the first responders to **Node Missed Interval** alarms.

3.1.1 KONWPT Sensor 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 “konwpt.status.interval.max.minutes”.
2. Enter the maximum amount of time (in minutes) between two successive KONWPT Sensor OTV updates before OTV generates an alarm.
3. Save the file when finished configuring the KONWPT Sensor application. Otherwise, continue with other configuration changes as described in the following sections.

3.1.2 KONWPT Sensor Email Alarm Configuration Settings

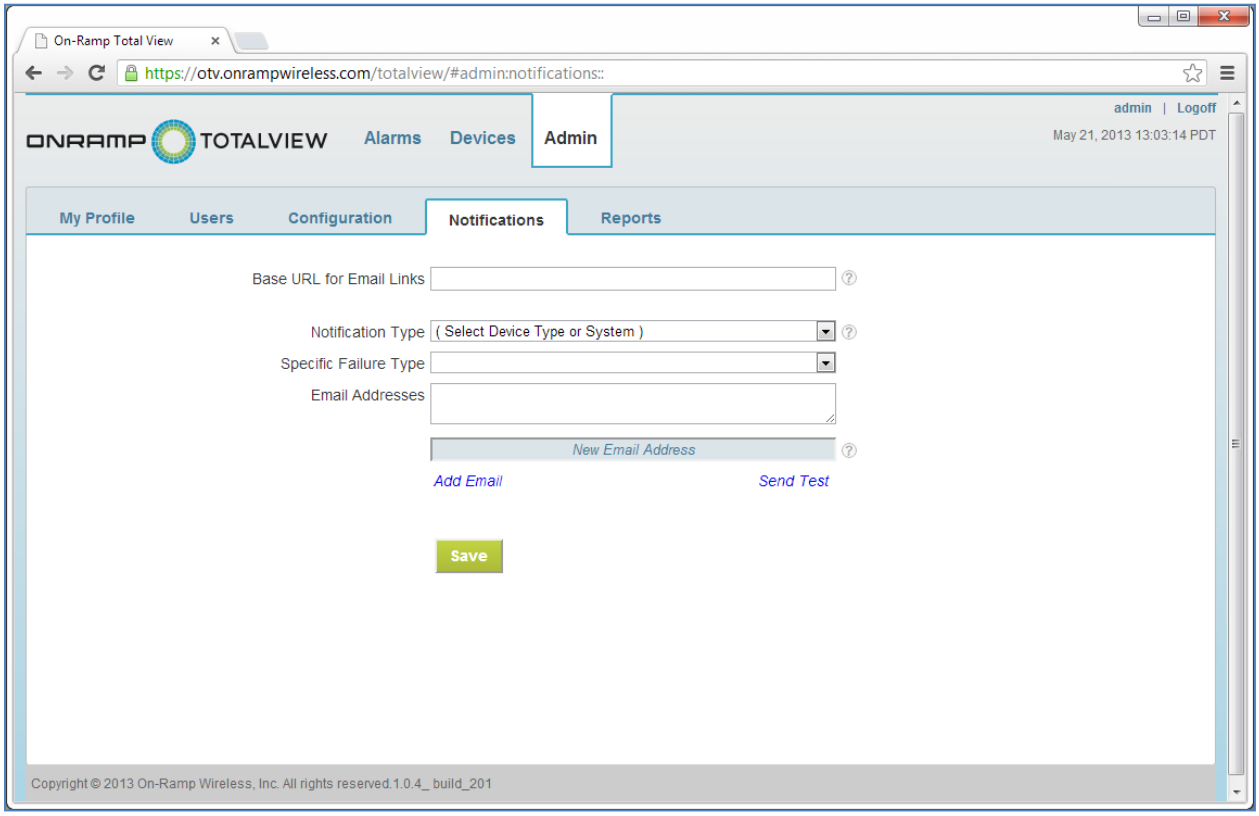
OTV supports an optional KONWPT Sensor email alarm alerting engine. The application enables an operator to monitor the OTV display instead of using the email alerting capabilities of the system. Depending on operating procedures, the operator can use the email system to supplement day-to-day operations of the KONWPT Sensor.

Use the following steps to configure the KONWPT Sensor email alarm configuration:

1. Log in to OTV with an admin account.

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

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



   NOTE: Make sure that the OTV installer has already preconfigured the SMTP/SMS configuration settings in the OTV properties configuration file. This file is located in the <otvserver>:/opt/onramp_apps/otv/instance_1/config.properties directory. For more information, see the *OTV Software Installation Guide*.

3. For Notification Type, select KONWPT: Gas Pressure Sensor.

4. For Specific Failure Type, select the specific KONWPT Sensor alarm. There are seven (7) KONWPT Sensor-specific alarm classes shown below. Each KONWPT Sensor alarm can be configured to be sent to a different list of email addresses.
5. For Email Addresses field, add email addresses for those individuals identified to receive automated email alerts from OTV when there are KONWPT Sensor alarms.
6. Click **Save**.
7. Repeat the steps above for each KONWPT Sensor alarm type.

Table 2. KONWPT Sensor-specific Alarm Classes

Alarm	Description
All failures for this device type	This alarm group generates an email for all enabled KONWPT Sensor alarms, regardless of type.
Below Threshold	This alarm group only generates an email for a KONWPT Sensor that detects pressure below a configurable threshold. **Note:** Each gas pressure sensor can enable or disable this alarm independently from other sensors in the system. At least one (1) KONWPT Sensor must have this alarm enabled for it to be active.
Over Threshold	This alarm group only generates an email for a KONWPT Sensor that detects pressure above a configurable threshold. **Note:** Each gas pressure sensor can enable or disable this alarm independently from other sensors in the system. At least one (1) KONWPT Sensor must have this alarm enabled for it to be active.
Rate of Change High	This alarm group only generates an email for a KONWPT Sensor that detects pressure rate of change higher than a configurable threshold. **Note:** Each gas pressure sensor can enable or disable this alarm independently from other sensors in the system. At least one (1) KONWPT Sensor must have this alarm enabled for it to be active.
Temperature Over Threshold (OTV 1.1.10 and later)	This alarm group only generates an email for a KONWPT Sensor that detects temperature higher than a configurable threshold. **Note:** Each sensor can enable or disable this alarm independently from other sensors in the system. At least one (1) KONWPT Sensor must have this alarm enabled for it to be active.
Sensor Failure	This alarm group only generates an email for a KONWPT Sensor that detects a failing sensor.
Low Battery	This alarm group only generates an email for a KONWPT Sensor that detects a low battery. **Note:** Each sensor can enable or disable this alarm independently from other sensors in the system. At least one (1) KONWPT Sensor must have this alarm enabled for it to be active.
Timeout Exceeded	This alarm group only generates an email for a KONWPT Sensor that has missed the interval period configured in the section titled 3.3.1 KONWPT Sensor Daily Operation.

3.1.3 KONWPT Sensor Type Configuration

OTV supports different KONWPT Sensor types on a given network. The following table shows the supported types. Type IDs 1-7 are supported in OTV 1.1.11 and later.

Table 3. KONWPT Sensor Types

Type ID	Sensor Type
0x00	This is reserved for generation 1 devices
0x01	Pressure 0 - 60 bar
0x02	Pressure 0 - 100 bar
0x03	Pressure 0 - 250 bar
0x04	Pressure 0 - 600 bar
0x05	Temperature 223.15 – 523.15 K
0x06	Reserved
0x07	Custom

OTV will come with default settings for each sensor type to convert raw battery and measurement values to actual battery and measurement data. These defaults can be overridden in the konwpt.properties file located at:

```
<otvserver>:/opt/onramp_apps/otv/instance_1/konwpt.properties
```

Generation 1 devices have the following configurable settings:

```
konwpt.advalue_0bar=770.515
konwpt.advalue_100bar=3852.576
konwpt.battary_constant=5.0
konwpt.battary_factor=4095.0
```

Generation 2 devices have the following configurable settings per sensor type (OTV 1.1.10 and later):

```
konwpt.type.x.battery_constant=5.0
konwpt.type.x.battery_factor=4095.0
konwpt.type.x.min=0
konwpt.type.x.max=60
```

Where x is a valid Type ID from 1-7. The following are the default settings in OTV:

```
# konwpt.type.1.battery_constant=5.0
# konwpt.type.1.battery_factor=4095.0
konwpt.type.1.min=0
konwpt.type.1.max=60

# konwpt.type.2.battery_constant=5.0
# konwpt.type.2.battery_factor=4095.0
konwpt.type.2.min=0
konwpt.type.2.max=100
```

```
# konwpt.type.3.battery_constant=5.0
# konwpt.type.3.battery_factor=4095.0
konwpt.type.3.min=0
konwpt.type.3.max=250

# konwpt.type.4.battery_constant=5.0
# konwpt.type.4.battery_factor=4095.0
konwpt.type.4.min=0
konwpt.type.4.max=600

# Type ID 5 is specific for Temperature
# konwpt.type.5.battery_constant=5.0
# konwpt.type.5.battery_factor=4095.0
konwpt.type.5.min=223.15
konwpt.type.5.max=523.15

# konwpt.type.6.battery_constant=5.0
# konwpt.type.6.battery_factor=4095.0
konwpt.type.6.min=0
konwpt.type.6.max=60

# konwpt.type.7.battery_constant=5.0
# konwpt.type.7.battery_factor=4095.0
konwpt.type.7.min=0
konwpt.type.7.max=60
```

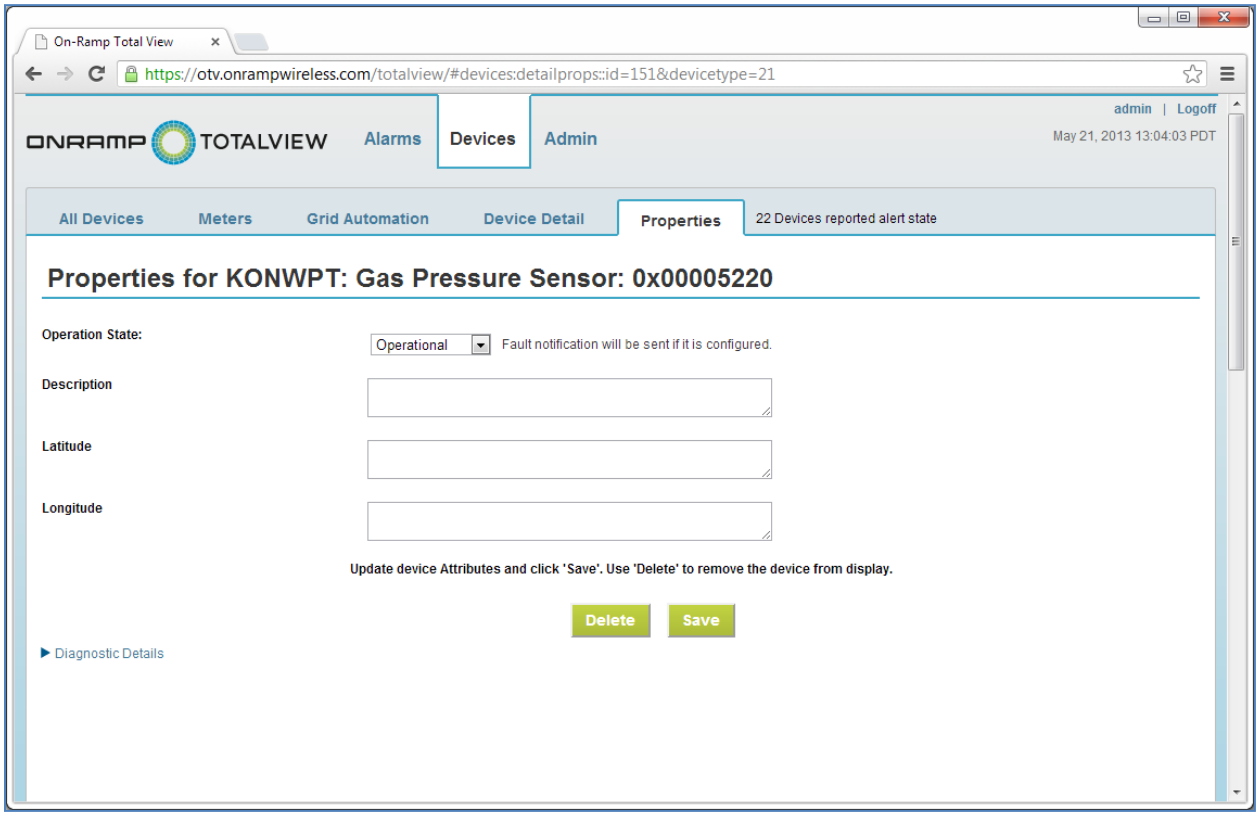
3.2 Deploying a KONWPT Sensor

Adding a KONWPT Sensor to the Total Reach system is a multi-step process that may span several days in a geographically diverse network.

The following steps summarize the high-level process:

1. An operator typically issues work order requests for several devices that are ready to be scheduled for deployment.
2. The work order maps specific Total Reach Mac Addresses for each KONWPT Sensor to be installed to a physical location.
3. The work order proceeds to the EMS operator.
4. 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*.
5. 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.
6. The field technicians install and verify each KONWPT Sensor operation in the field. 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.
7. 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*.

8. The work order is then routed back to the OTV operator. For each deployed KONWPT Sensor, the OTV operator updates the **Description, Latitude, and Longitude** device attributes and takes the device out of **Maintenance Mode**.



9. The work order is now complete.

3.2.1 Updating Device Attributes and Completing the Work Order

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 KONWPT Sensors are being processed, the administrator or operator account must have KONWPT Sensor 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 KONWPT Sensors or FAA lights), only those device types display. If the login account has access to all types of data, all 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 KONWPT Sensors are added, the operator can perform the following sorting steps to quickly move the newly added devices to the top of the listing view:

a. From the Device Type pull-down list, select **KONWPT: Gas Pressure Sensor**.

b. Click the **Description** column.
Depending on the previous settings, you can click this column heading twice.

c. A list of Mac Addresses and blank columns is displayed for the physical installation fields to be entered.

3. Select a Mac Address to be processed from the sorted list.
4. Click the **Properties** link.
5. Enter **Description, Latitude, and Longitude** data in the associated text fields.
6. Click **Save**.
7. 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.

The following table lists and describes other device attribute fields.

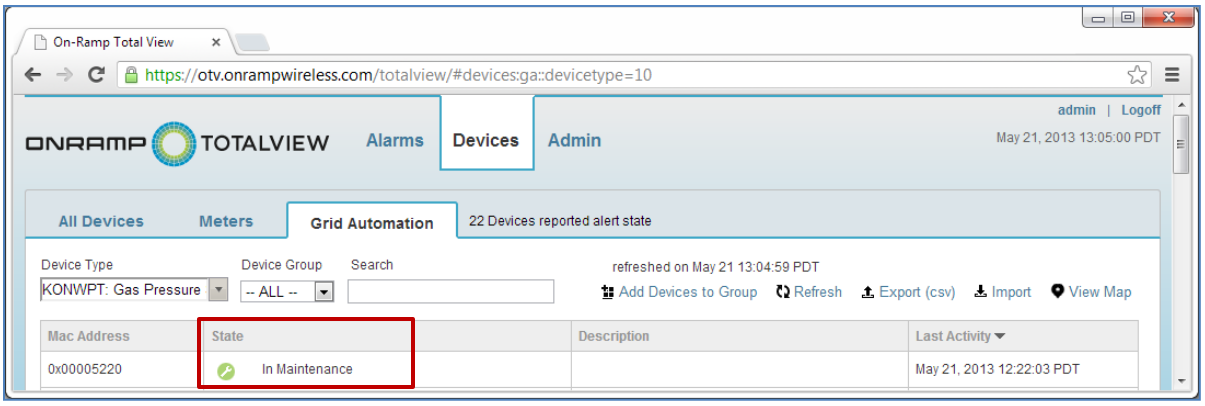
Table 3. KONWPT Device Attribute Descriptions

Physical Information	Description
Description	Customer-specific nomenclature. This is a generic text field to help in describing this unit. A customer may include relevant pipeline identification information or any other information that helps them in understanding the characteristics of this deployed device.
Latitude	This field is only used when the On-Ramp Wireless geospatial mapping feature is licensed. If not using this system, leave this field blank. Contact an On-Ramp Wireless Customer Support for more information.
Longitude	This field is only used when the On-Ramp Wireless geospatial mapping feature is licensed. If not using this system, leave this field blank. Contact an On-Ramp Wireless Customer Support for more information.

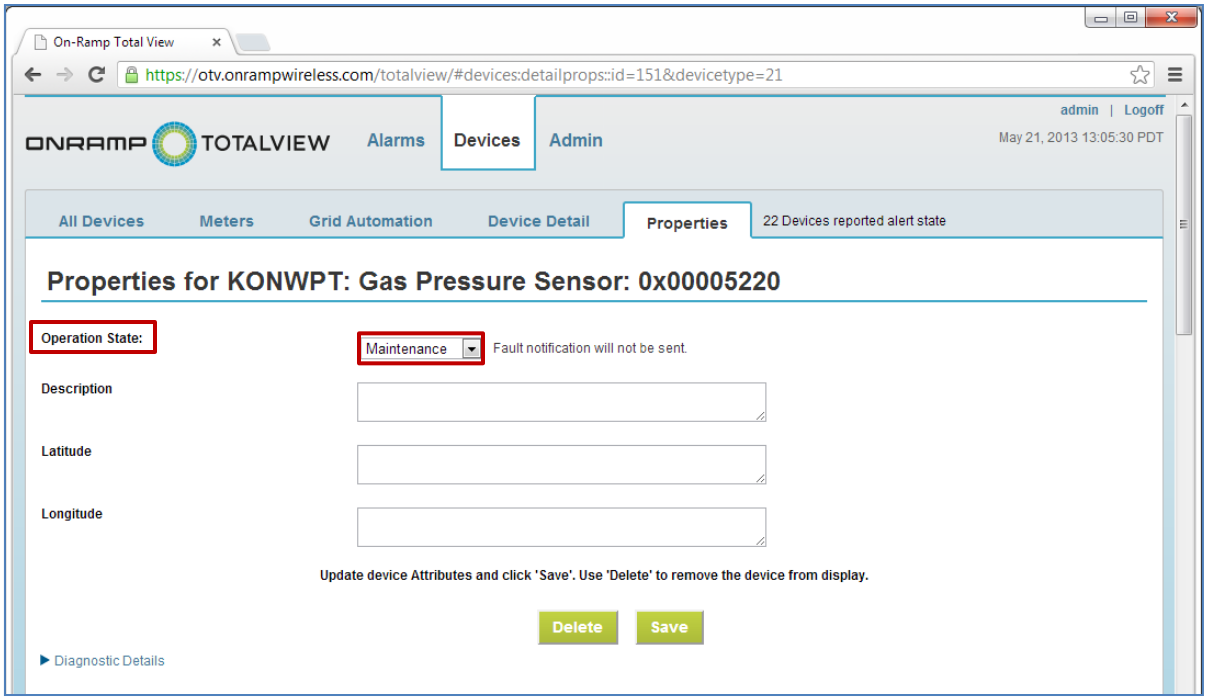
3.2.2 Maintenance Mode

The OTV Maintenance Mode offers two simple ways to filter email alarms for a KONWPT device: 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.

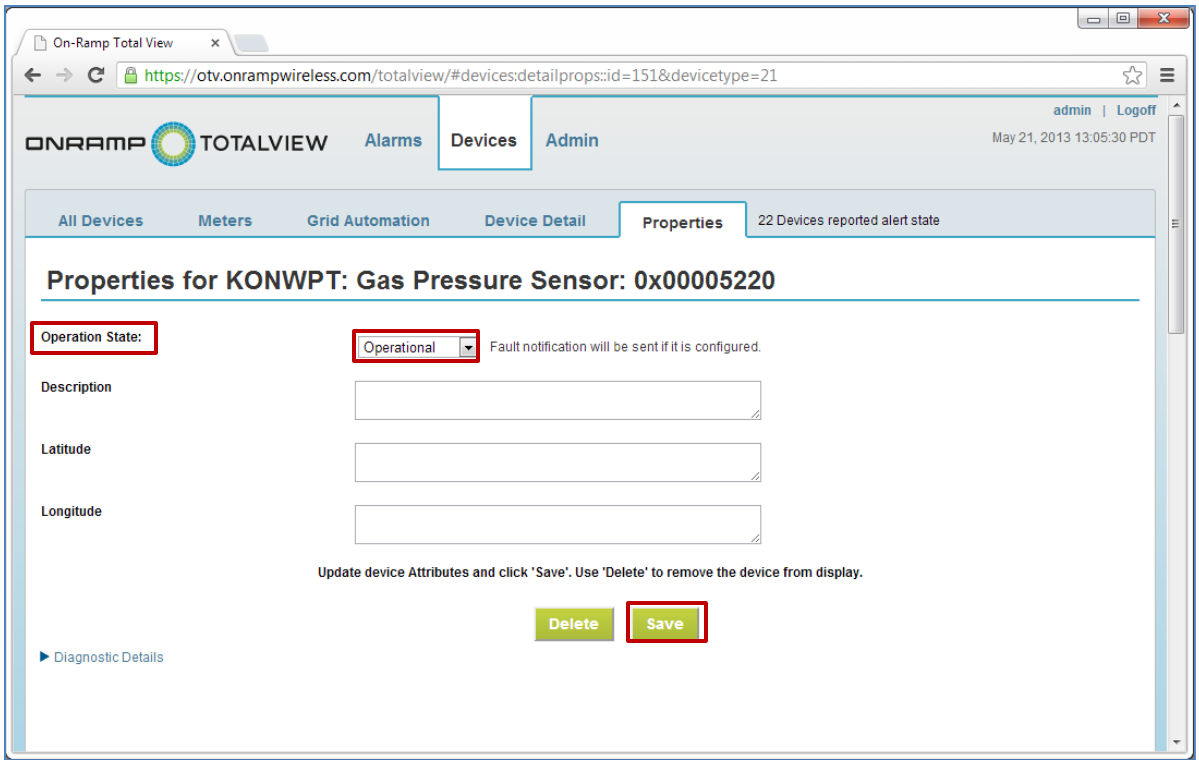
To aid deployment, KONWPT Sensors are assumed to be in **Maintenance Mode** when they first join the system. When a device is in **Maintenance Mode,** it does not generate email alerts based on device alarms. In addition, the state of the device in the device list or alarm list includes a wrench symbol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



The device a properties page shows the current mode in the Operation State pull-down menu, as shown below.



After all changes for this device have been completed and it is ready for automated monitoring, the user can change the mode from **Maintenance** to **Operational**. To do this, select the **Operation State** pull-down menu → **Operational** mode and click **Save**. This moves the device from **Maintenance Mode** to **Operational Mode**.



After changing the mode and 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.

3.3 Day-to-Day Operation of KONWPT Sensors

3.3.1 KONWPT Sensor Daily Operation

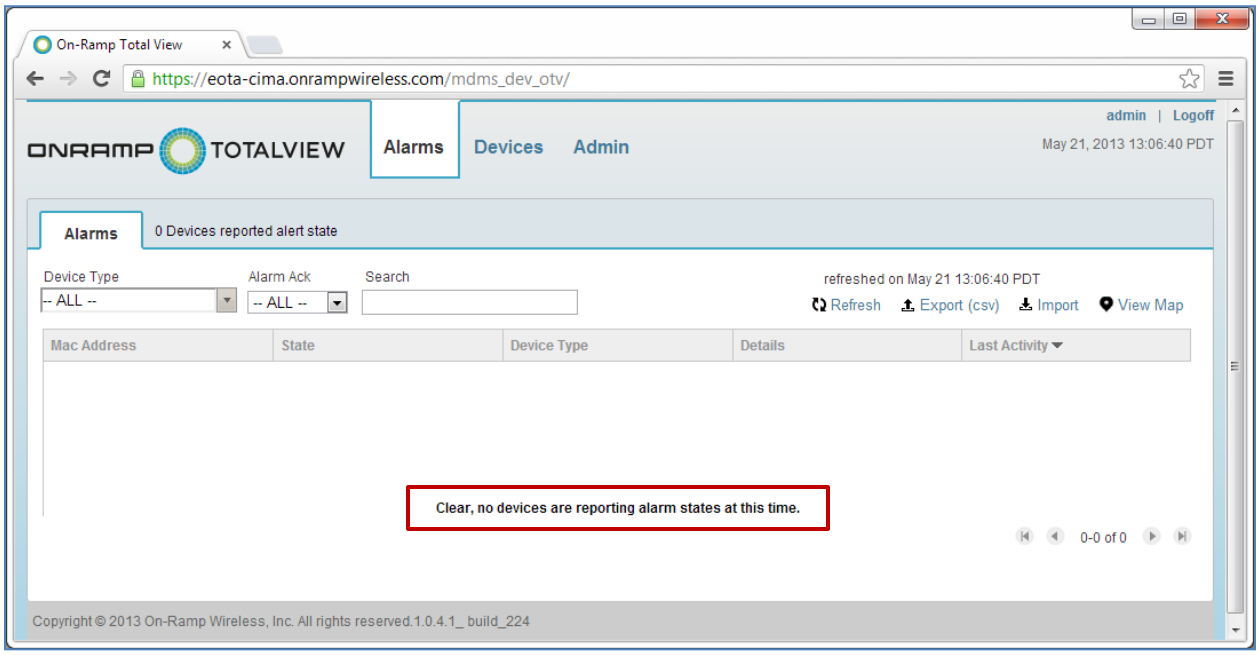
For day-to-day operations of the KONWPT Sensor, an operator may be continuously logged in to the OTV system. Optionally, operators can enable OTV email alerts to help facilitate day-to-day KONWPT Sensor operations. Each operator must have an operator account with KONWPT Sensor data viewing capabilities enabled and be logged in to OTV for application operation. Each KONWPT Sensor in the system has the capability to enable and disable the following alarms on an individual device basis:

- Over Threshold
- Under Threshold
- Rate of Change too high
- Temperature Over Threshold (OTV 1.1.10 and later)
- Low battery alarm

Each device reports a general sensor failure, regardless of the enabled state of the alarms above. A general sensor failure alarm is enabled by default and you cannot enable or disable this alarm. See the *KONW_T ULP Message Specification, Version 2.3* for more information about alarm enabling and disabling within a specific KONWPT Sensor.

The operator is typically logged in and leaves the OTV view on the login page, defaulted to the **Alarms** tab. The **Alarms** tab screen shows a network-wide summary of all KONWPT Sensors that currently have an active alarm. In a normal operating system, there are no alarms.

In this example, the following is displayed on the **Alarms** tab screen: **Clear, no devices are reporting alarm states at this time**.



When a KONWPT Sensor generates an alarm, the alarm is displayed on this screen.

NOTE: If there are multiple alarms from a single device, only the most recent alarm is highlighted on this screen.

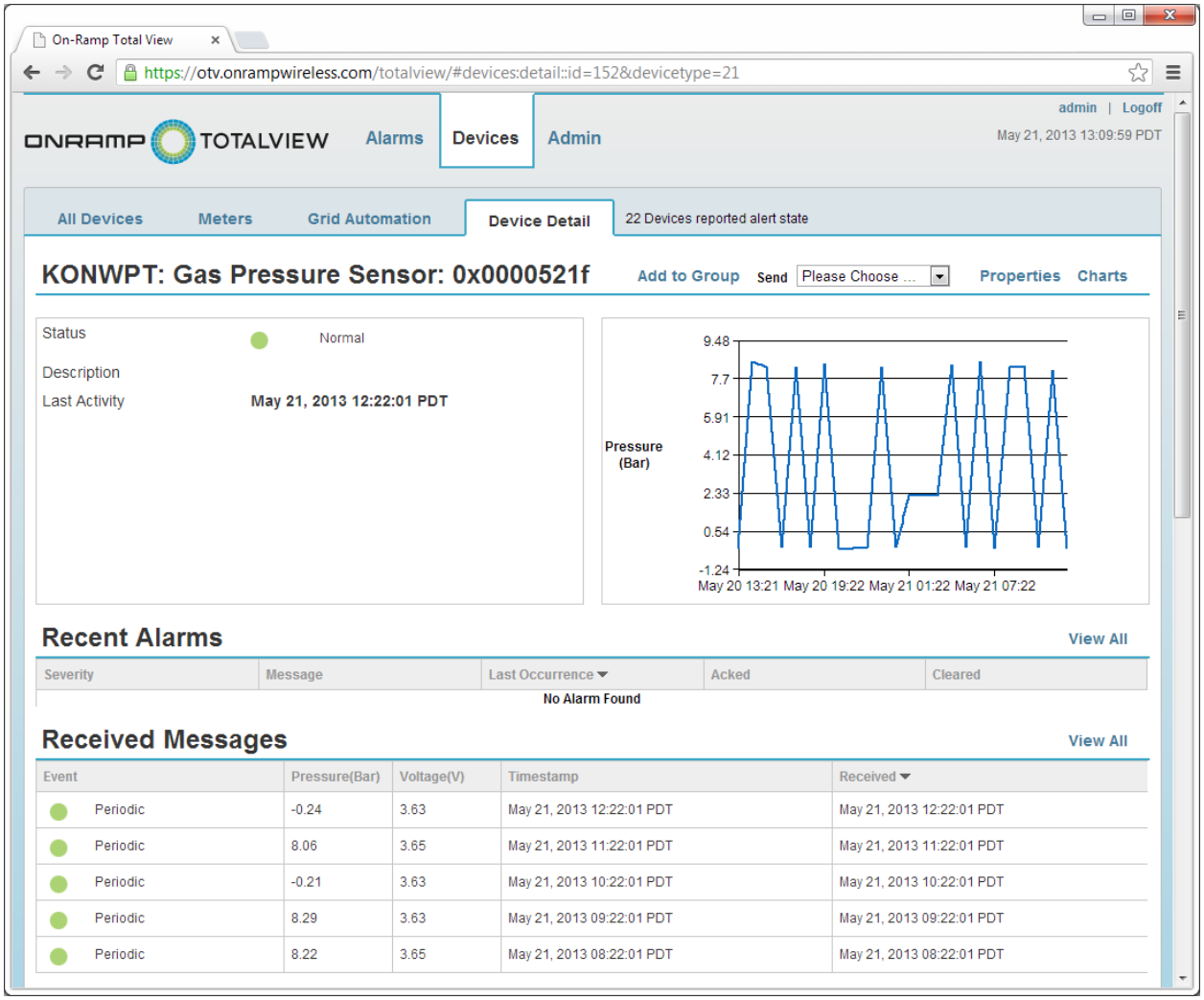
Each KONWPT Sensor can generate an alarm for the following conditions:

- **Sensor Failure:** This is a general purpose alarm that indicates a generic KONWPT Sensor failure.
- **Over Threshold**: This alarm is generated when a KONWPT Sensor detects pressure above a configurable threshold. Each gas pressure sensor can enable or disable this alarm independently from other sensors in the system.
- **Below Threshold**: This alarm is generated when a KONWPT Sensor detects pressure below a configurable threshold. Each gas pressure sensor can enable or disable this alarm independently from other sensors in the system.
- **Rate of Change High**: This alarm is generated asynchronously when a KONWPT Sensor detects pressure rate of change higher than a configurable threshold. Each gas pressure sensor can enable or disable this alarm independently from other sensors in the system.

- **Temperature Over Threshold**: This alarm is generated asynchronously when a KONWPT Sensor detects temperature above a configurable threshold. Each sensor can enable or disable this alarm independently from other sensors in the system. (OTV 1.1.10 and later)

Operators can view in-depth details about a KONWPT Sensor, regardless of its current state. When a device is displayed on the screen, the operator can click on the device to view more information regarding its current state. From the Alarms screen or the Devices screen, click on a device to view its detailed history. The detailed history for the device may provide important information to aid diagnosing particular KONWPT Sensor alarms. When receiving an alarm, the operator can view the detailed history to find the cause of the alarm or to see if there is a history on the device that can explain the behavior.

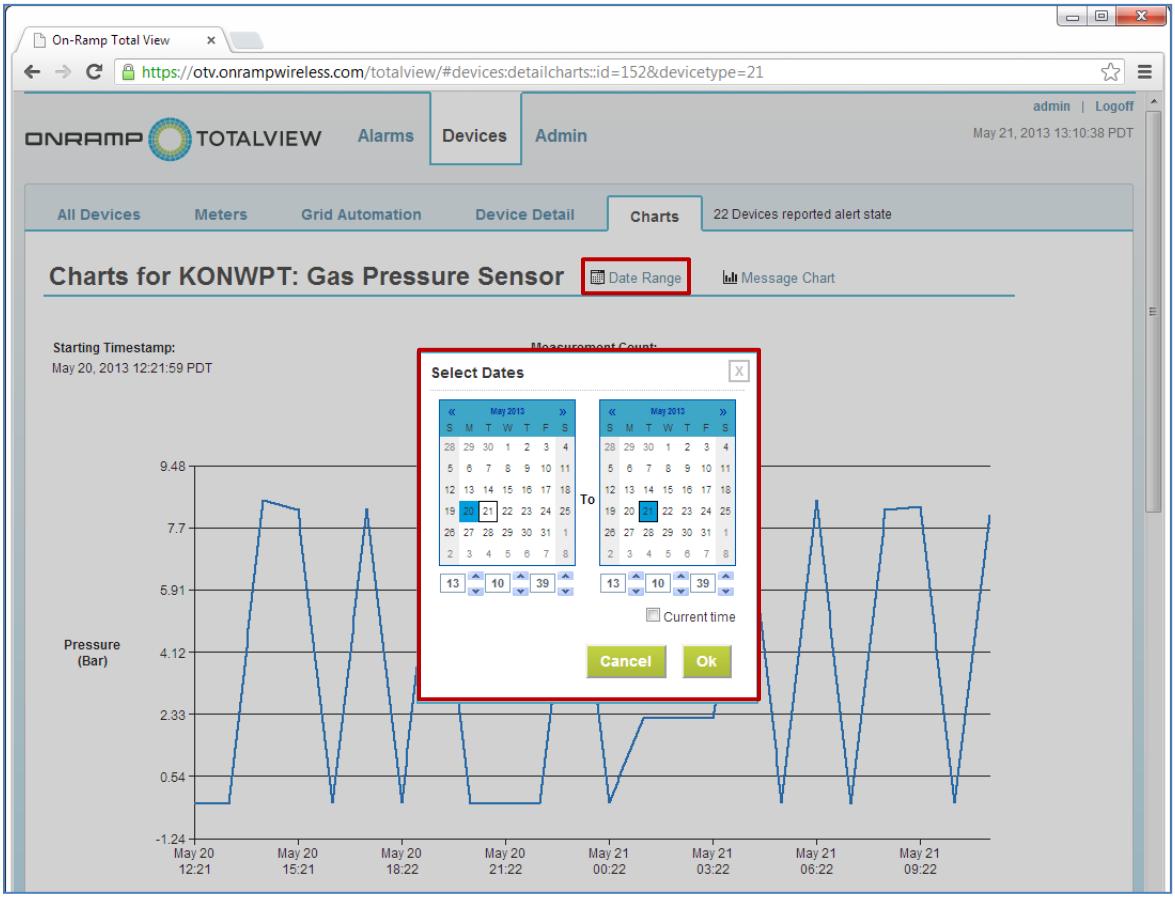
There are typically no alarms for any deployed devices, in which case the operator may simply need to review typical history for a given device, as shown below.



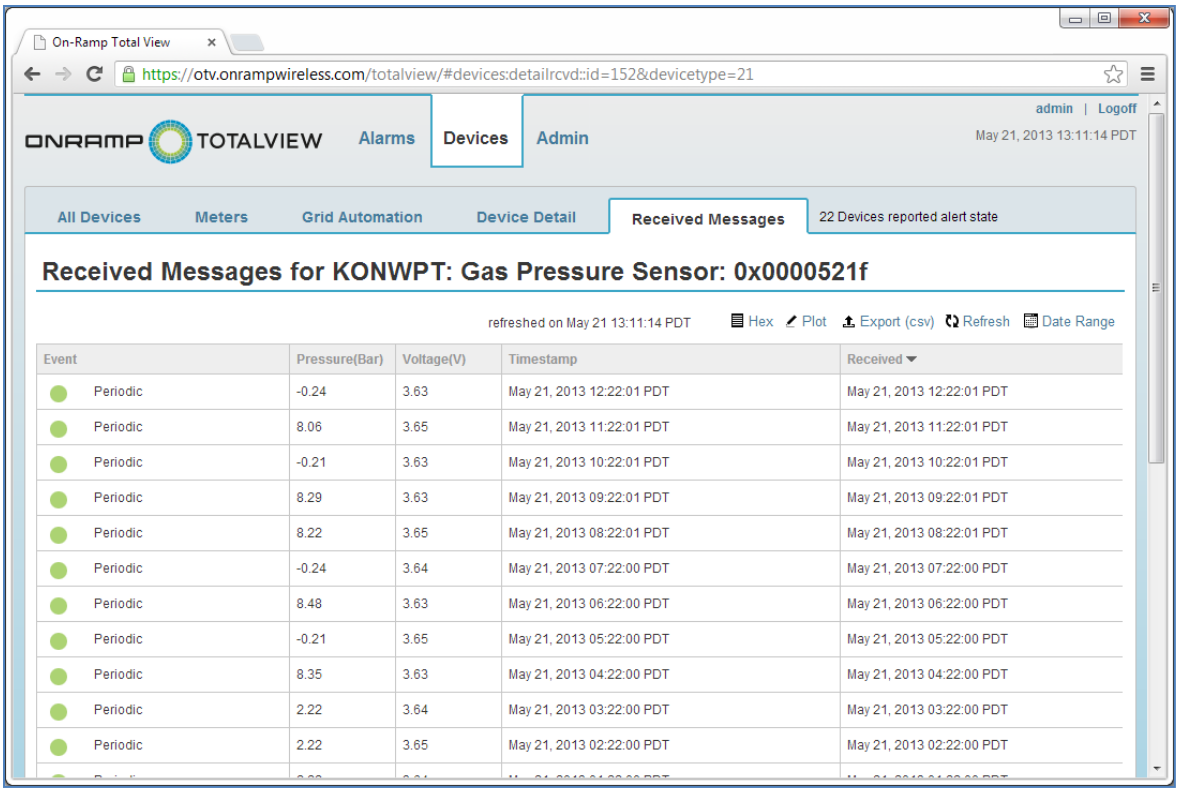
3.3.2 Historical View of a Deployed KONWPT Sensor (Generating Plots)

Typical day-to-day operations result in a historical view of pressure for a deployed device. OTV provides a mechanism to generate a plot of pressure measurements over time, as described below. Use the following steps to generate a plot of pressure measurements over time:

1. Select a KONWPT Sensor from the **Alarms** or the **Devices** screen.
2. The detailed device view displays a default chart on the top right of the page displaying data from the past 24 hours.
3. To change the date range and time interval, go to the **Charts** page. Click the **Charts** link on the top right of the detailed device view. Click the **Date Range** link and select a date and range. Note that if you select a large date span or time range, it may take longer to generate a plot.



4. As another option, you can export data for post processing outside of OTV. In the detailed device view, select **View All** from the **Received Messages** section. Then click the **Export (csv)** link to export a comma-separated value (csv) text file.



Event	Pressure(Bar)	Voltage(V)	Timestamp	Received
Periodic	-0.24	3.63	May 21, 2013 12:22:01 PDT	May 21, 2013 12:22:01 PDT
Periodic	8.06	3.65	May 21, 2013 11:22:01 PDT	May 21, 2013 11:22:01 PDT
Periodic	-0.21	3.63	May 21, 2013 10:22:01 PDT	May 21, 2013 10:22:01 PDT
Periodic	8.29	3.63	May 21, 2013 09:22:01 PDT	May 21, 2013 09:22:01 PDT
Periodic	8.22	3.65	May 21, 2013 08:22:01 PDT	May 21, 2013 08:22:01 PDT
Periodic	-0.24	3.64	May 21, 2013 07:22:00 PDT	May 21, 2013 07:22:00 PDT
Periodic	8.48	3.63	May 21, 2013 06:22:00 PDT	May 21, 2013 06:22:00 PDT
Periodic	-0.21	3.65	May 21, 2013 05:22:00 PDT	May 21, 2013 05:22:00 PDT
Periodic	8.35	3.63	May 21, 2013 04:22:00 PDT	May 21, 2013 04:22:00 PDT
Periodic	2.22	3.64	May 21, 2013 03:22:00 PDT	May 21, 2013 03:22:00 PDT
Periodic	2.22	3.65	May 21, 2013 02:22:00 PDT	May 21, 2013 02:22:00 PDT

Appendix A Email Alert Example

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

- **Description**, as entered into OTV for that device
- **Mac Address,** of the KONWPT Sensor
- Short description of the alarm
- Time stamp that the message was received and processed in OTV

The following example message highlights an Over Threshold pressure failure on Mac Address: 0x1026d.

Appendix B Abbreviations and Terms

Abbreviation/Term	Definition
AP	Access Point. The Total Reach network component geographically deployed over a territory.
CSV File	Comma-Separated Values File. A file that stores tabular data (numbers and text) in plain-text form.
EMS	Element Management System. The network component that provides a concise view of the Total Reach network for controls and alarms.
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.
KONWPT Sensor	KONČAR KONWPT Sensor
Node	The wireless module developed by On-Ramp Wireless that integrates with OEM sensors and communicates sensor data to an Access Point. Also, the generic term used interchangeably with end point device.
On-Ramp Total Reach	The On-Ramp Wireless' proprietary wireless communication network and technology.
On-Ramp Total View	The network component that passes data from the Gateway to the associated upstream databases.
ORW	On-Ramp Wireless
OTV	On-Ramp Total View
UI	Update Interval