

Tensor Recorder User's Manual

Power Monitors, Inc.



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Help us improve our manual. Your comments and suggestions are important to us.

Please contact us at the email powerquality@powermonitors.com

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Safety Issues

Please read before installing the Tensor Recorder.

150 V CAT II, UL listed - UL 60730-1/CSA E60730-1 Indoor Use Only , Max Load 1875 VA

Operating Temperature: -20° F to +135° F

The Tensor Recorder Voltage contains dangerous voltage levels during operation. Do not disassemble the Recorder. **THERE ARE NO USER SERVICEABLE PARTS INSIDE.**

Do not install or operate near open bodies of water.

The Tensor is intended for use with a standard, indoor, 15 amp 120VAC receptacles.

Do not use outdoors or in a wet location (as determined by the National Electrical Code).

Although the Tensor Recorder Voltage has been designed and built to be as safe as possible, great care should always be exercised during operation and installation. The National Electric Code should always be followed.

The Tensor convenience receptacle is rated at 15 amps (continuous), for use with a 15 amp branch circuit. As per the National Electric Code, the maximum allowable load on this receptacle is 12 amps. When the Tensor is plugged into a 120VAC receptacle, this voltage is present on the convenience outlet. Use the same caution with this convenience outlet as with any 120VAC source.

Do not use this outlet where normal breaker operation could cause a loss of power to life critical equipment or cause a dangerous situation to exist.

A three-wire to two-wire isolation adapter may be used with the Tensor into a two-wire receptacle with no earth ground. If this is done, the ground on the convenience receptacle is not connected to earth ground. Do not plug devices which require an earth ground into the convenience receptacle if this grounding scheme has been defeated.

The Tensor is not designed for use with medical equipment or situations where life-critical equipment is being used. The convenience outlet in the Tensor is not a hospital grade receptacle.

Do not use near heat sources such as radiators and electric heaters.

Introduction

We founded Power Monitors Incorporated (PMI) to provide state-of-the-art, easy-to-use, and affordable electronic test equipment to the power industry. Our products have been developed by working directly with electric utilities to determine their specific needs. The Tensor Voltage Recorders have also been developed by following these same principles. The Tensor Recorder combines the powerful, high technology voltage analysis capabilities of our larger Voltage Recorders with precisely targeted end use specifically by plugging directly in a receptacle.

The Tensor Voltage Recorder was developed for diagnosing electric power problems at the outlet. The unit plugs into any standard 15 amp US wall receptacle, to detect outages, sags, swells, and flicker. The Tensor can record 2-Channels of voltage and 1-Channel of Current. Detectable voltage range is 0 to 140 volts RMS, with a sampling rate of 256 samples per cycle, allowing the measurement and recording of severe voltage variations on 120VAC single-phase lines. Inside its lightweight enclosure, state-of-the-art electronics measure and record true RMS line to neutral and neutral to ground voltage and load current.

Each unit has been individually calibrated to ensure high accuracy and stability. With its voltage and current measurement and digital processing circuitry based on the established Voltage Recorder line, the Tensor Recorder provides a voltage measurement processing, and reporting system with a proven performance history.

In summary, the Tensor Recorder Voltage was created with your needs in mind. It is perfect for analyzing voltage disturbances at the consumer level. After looking through this manual and using the Tensor Recorder, please contact us if you have any questions about its operation, ideas for new features, or ideas for additional products. We want you to be happy with this product and would appreciate any input that could help us develop products to meet your future needs.

Available Models

There are the available models of the Tensor.

The label on the front of the recorder identifies the model of the unit.

- Tensor with Wi-Fi Wireless Technology
- Tensor with Cellular Modem

Getting Started with the Tensor Recorder

The Tensor Recorder is an electronic recording device which plugs into a standard 15 amp receptacle. The unit measures and records 2-Channels of voltages: from line to neutral, and from neutral to ground as well as load current. The Tensor Recorder powers itself from the 120 volt line, consuming up to 4 watts of power.

Additionally the Tensor can operate for up to 5 minutes if power is lost. After recording, the data can be downloaded to ProVision, the PC data analysis software, over a cellular or Wi-Fi connection. With ProVision, data may be graphed, turned into reports, and exported to spreadsheets. The Tensor, if purchased with a cellular modem allows data to be sent to the PQ Canvass website for viewing and data analysis. Additionally the Tensor will record Temperature, Humidity and Barometric Pressure.

Contents of the Tensor Recorder Package

The Tensor Recorder is packaged with the following items:

- The Tensor Recorder

If any of these items are missing, please call PMI immediately.

Installing the PC software (ProVision®)

ProVision® is Power Monitors' Power Quality data analysis software. Sophisticated tools and advanced communications greatly expand the ability to record, manage and analyze power quality data.

The easy-to-use graphical user interface is designed to get both the novice and the advanced user up to speed quickly.

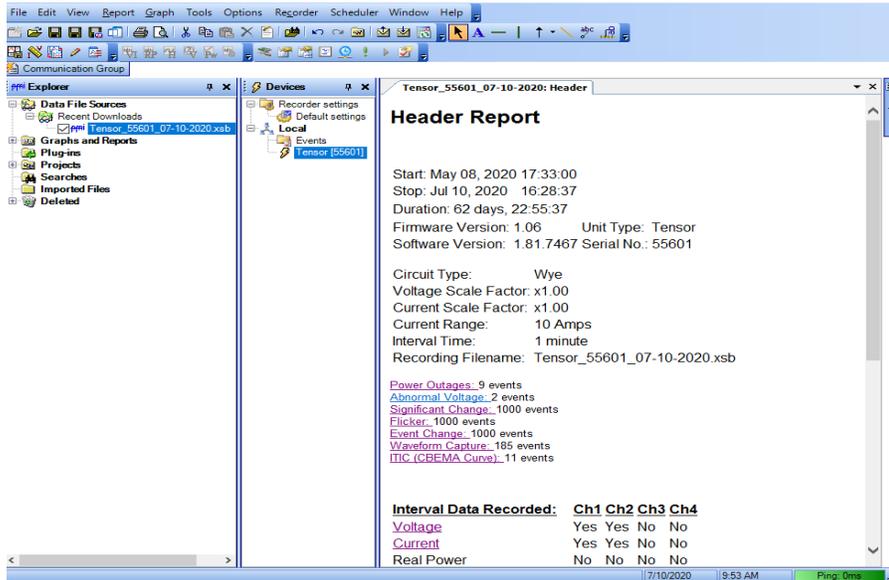
ProVision can be installed on Microsoft Window operating systems and is free to users.

ProVision software and the USB driver (driver not needed for the Tensor model) software are both available for download on the website: <https://powermonitors.com/downloads> (select Software).

The ProVision Wizard default settings are sufficient for most installations.

Graphs and reports recorded by the Tensor and available in ProVision and the PQ Canvass website include but are not limited to:

- Interval graph and histogram analysis for RMS voltage, RMS current, power factor, displacement power factor, real power, apparent power, reactive power, volt-amps, frequency, phase angle, and waveform capture
- Power outage report
- Abnormal voltage report
- Current or voltage out of limits report
- Significant change report
- Event change report
- Flicker Settings - IEEE 1453/ IEC 61000-4-15 and IEEE std. 141
- Voltage and Current Harmonics to the 51st harmonic



PQ Canvass Overview

Power Monitors has released a new cloud-based software product for power quality analysis, called PQ Canvass.

PQ Canvass incorporates the features and convenience of our previous online software, Canvass. Many of the power quality analysis and reporting tools of our desktop software, ProVision, and additional features to support the newly released recorders.

PQ Canvass, unlike Canvass, has been designed from the ground up to support a wide array of devices and screen sizes. This allows you to manage your devices, browse recordings, and even view live waveforms easily, whether at your computer in the office, or travelling with your smartphone or tablet.

PQ Canvass is a cloud-based application that runs completely in a standard web browser - no extra software is required. Recorders, such as the new Tensor, that support PQ Canvass, stream recorded data as it is gathered during the recording session - no need to wait until the “end” of the recording session and download the entire recorder memory.

Simply log into PQ Canvass and view all data gathered up to the present time. Live waveforms and meter displays are also available for real-time information from any PQ Canvass device. SMS and email alerts are also available for immediate notification on PQ events.

Contact your PMI sales representative for information on new PMI recorders and PQ Canvass.



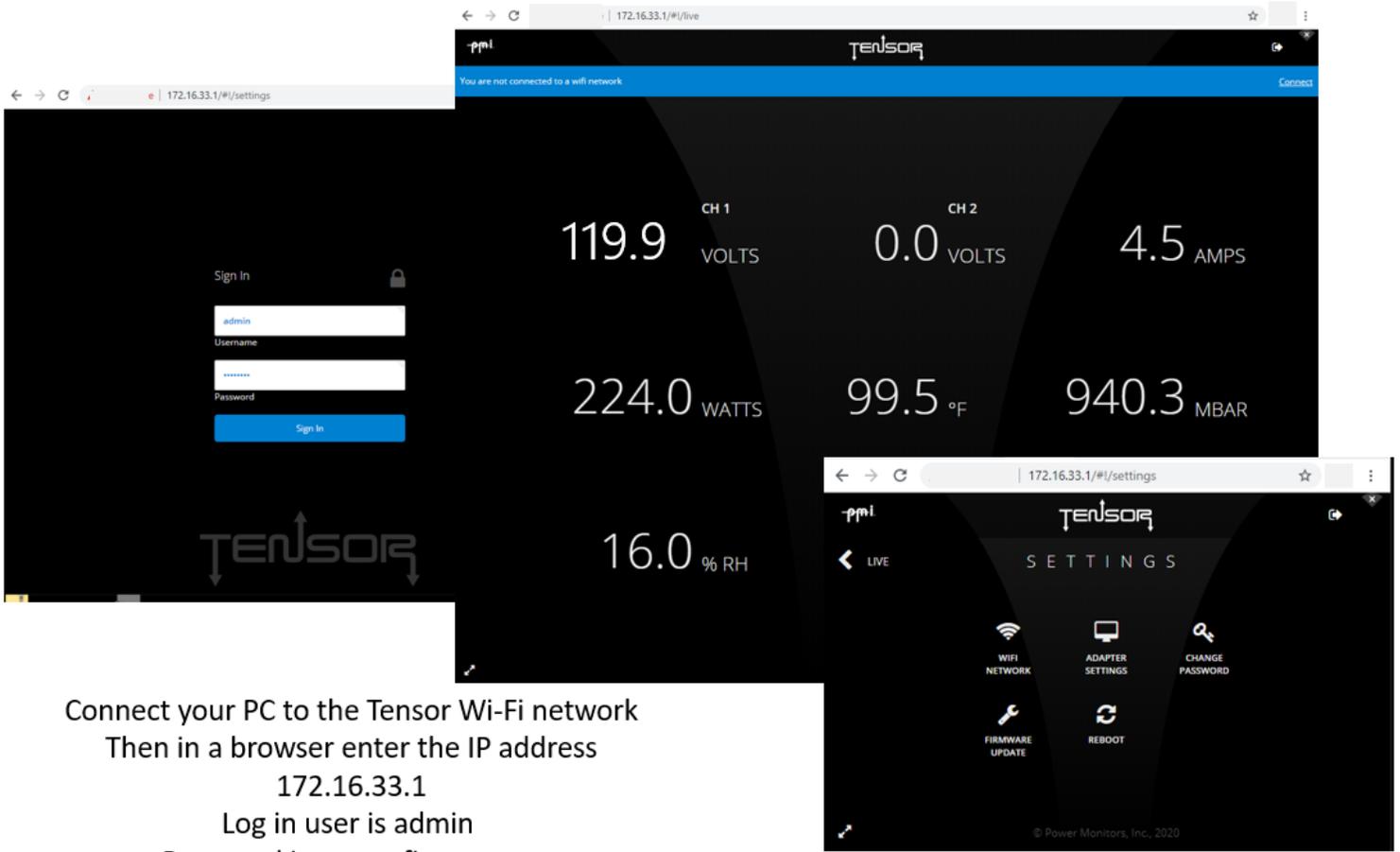
The Tensor will show Temperature, Humidity and Barometric Pressure in PQ Canvass

Web Administration for the Wi-Fi Tensor

The Wi-Fi Tensor has configuration settings that can be modified using a Web Browser to access the User Interface (UI). Live readings are also available in the UI.

Connecting the Wi-Fi Tensor to a wireless network allows data to be sent to the PQ Canvass website.

See Appendix 2: FAQs on how to **Join a Tensor to a new Wi-Fi network**.



Tensor Recorder Operation Overview

Using the Tensor Recorder consists of:

- Installation
- Initialization
- Recording,
- Downloading
- Analyzing

The Tensor Recorder is initialized with parameters appropriate for the recording session. These parameters include voltage thresholds, flicker limits, and a graph time interval, among others.

These initialization parameters are set using ProVision PC software or the PQ Canvass website.

When plugged into a standard receptacle, the Tensor Recorder begins a few second countdown during which the initialization settings are updated.

After the countdown, the Tensor Recorder starts recording using these settings.

Later, after the desired data is recorded, the information from the Tensor Recorder is downloaded into ProVision. If the Tensor has the cellular option, or a network configured WiFi Tensor, the data may also be sent to the PQ Canvass website.

ProVision or PQ Canvass is used to analyze the download data.

The Tensor Recorder may be reinitialized for the next recording or initialized at a later time.

With PQ Canvass, graphs or reports can be accessed at any time.

Tensor Recording Options

Standard features include current, power, harmonics, and waveform capture. The current is sampled just like the voltage channels, 256 times per cycle. These samples are used to create one cycle RMS values, and are recorded like the voltage channels. No external CTs or clamps are necessary to record current.

The power feature allows the Tensor Recorder to compute and record the power consumed by the load connected to the built-in receptacle. Real power (watts), reactive power (vars), apparent power (volt-amps), and power factor are computed for each leg. These are computed using the voltages from line to neutral, and current through each leg.

The Harmonics and Waveform Capture features give the Tensor Recorder the ability to measure and record voltage and current harmonics, as well as raw waveform data. graphs of selected voltage and current harmonics may be recorded, up to the 51st, as well as daily profiles of total harmonic distortion. In addition, raw voltage and current waveforms may be captured based on trigger conditions set with ProVision. This option also includes extra memory so that harmonic graphs may be recorded without lessening the total recording time.

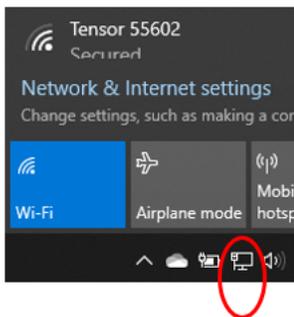
Using the Tensor Recorder

PC Communications with the Tensor Recorder

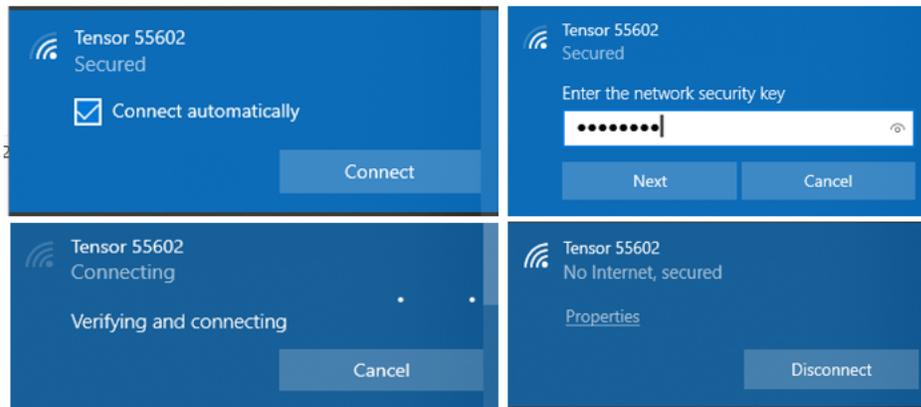
Wi-Fi communications

With the Wi-Fi option, select the Tensor that appears in your PC's network settings list. Once configured, ProVision connects with the Tensor using the Wi-Fi IP address.

The Tensor Recorder communicates with ProVision running on a PC or laptop to receive its initialization and to download data. The green LED flashes 5 seconds on, 1 second off, when connected to ProVision and in the idle mode.

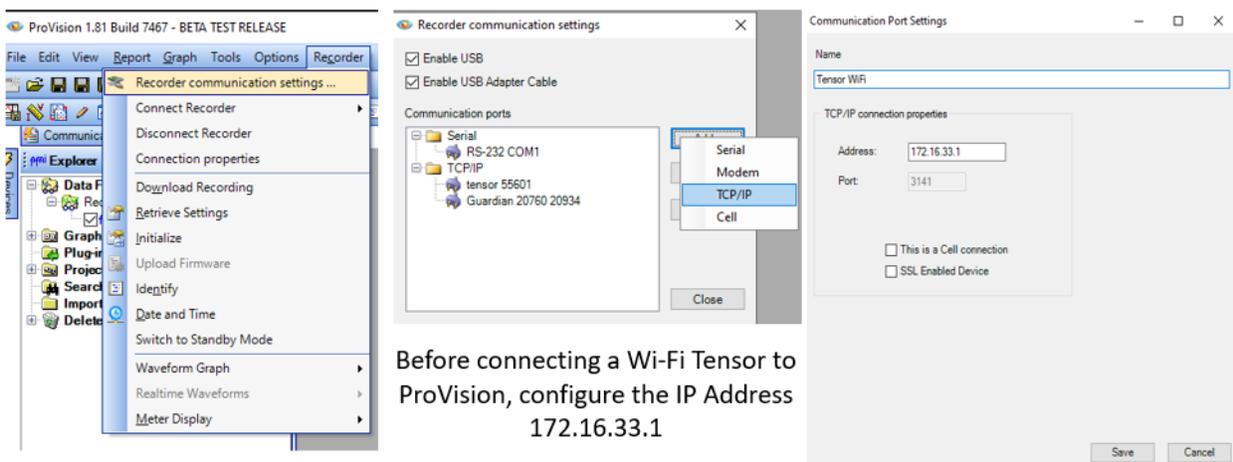


To Connect a Wi-Fi enable Tensor to Provision, Open your PC's **Network & Internet settings** found at the bottom of the screen, and select the Tensor



Select **Connect** , enter the password **pmi12345**, then select **Next** and verify connection

For questions and instructions on Wi-Fi connectivity, refer to the 'Frequently Asked Questions' at the end of this manual. For additional assistance, contact the PMI Technical Support Team.



Before connecting a Wi-Fi Tensor to ProVision, configure the IP Address 172.16.33.1

See the following section “Connect to ProVision” to complete the setup.

Cellular communications

The Tensor cell model can communicate with ProVision over a cellular communication connection.

The Cell Tensor is assigned a network IP Address by the Cell Plan Provider. ProVision is then configured with the network IP address to access the Cell Tensor.

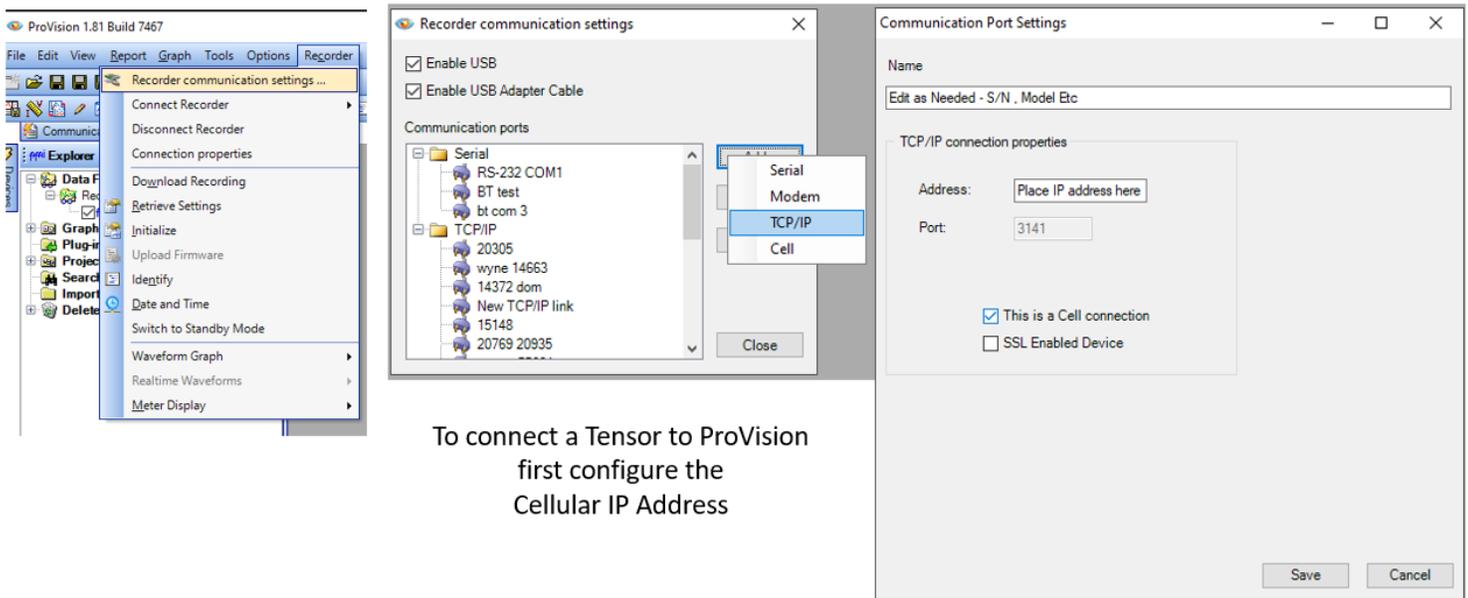
When connected to ProVision, the recorder serial number will appear in the Devices column.

The Tensor Recorder and ProVision are now ready to initialize or download.

For questions and instructions on cellular connectivity, refer to the ‘Frequently Asked Questions’ at the end of this manual.

A Tensor with the cellular option can send bursts of recorded data to the PQ Canvass website. A contract for PQ Canvass can be purchased through you PMI Sales Representative.

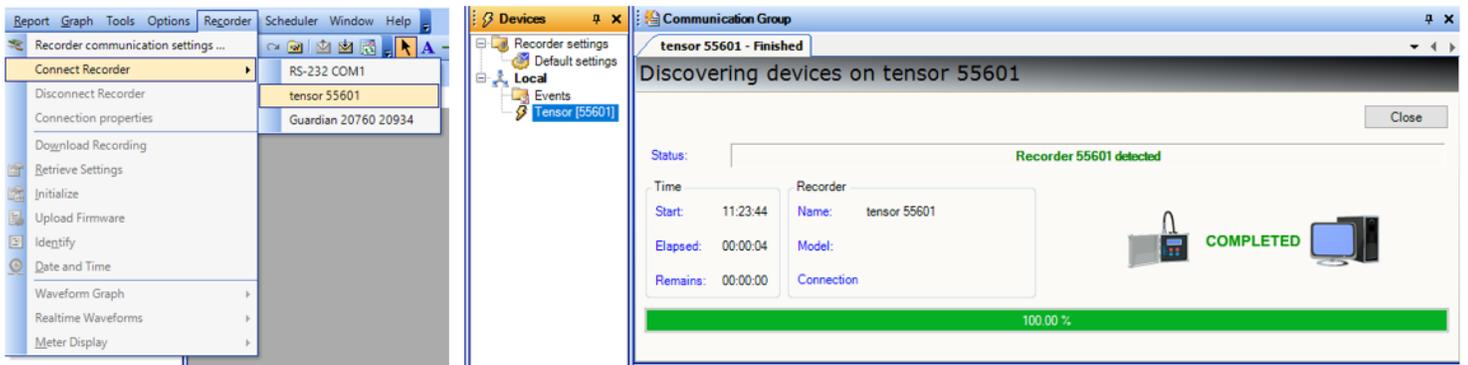
For additional assistance, contact the PMI Technical Support Team.



To connect a Tensor to ProVision first configure the Cellular IP Address

Connect to ProVision

After the Tensor Wi-Fi or Cellular IP address is configured in ProVision, select the **[Recorder]** tab in ProVision followed by the **[Connect]** command. Select the new connection to link the Tensor to ProVision.

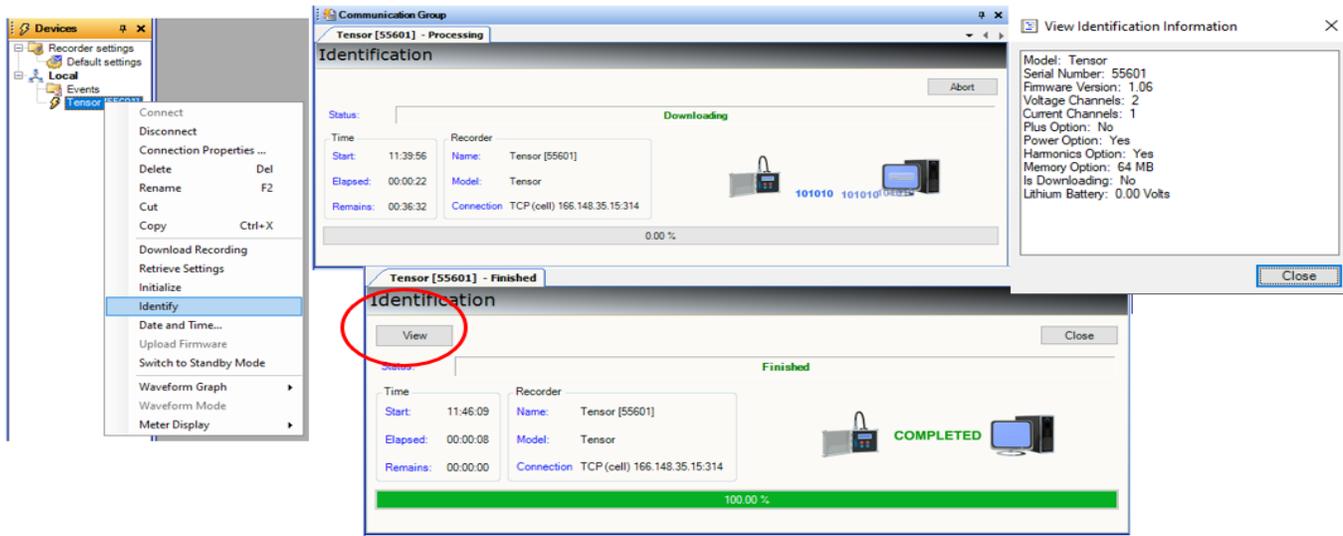


Once the Tensor is connected in ProVision The serial number will show in the Devices column

Identification

ProVision can be used to identify a PMI recorder. Identifying the Tensor using the ProVision software can provide you with useful information such as the model name, the serial number of your recorder, the firmware version, the number of voltage and current channels, lithium battery voltage and any options that your recorder may have. This is particularly useful when trying to gather information about your Recorder when requesting technical assistance.

To see information about your Tensor, connect your Tensor to the ProVision software, and select the **[Recorder]** tab in ProVision followed by the **[Identify]** command, then the **[View]** button that displays.



Right-click on the Device name or select the Recorder tab and then select **Identify**
After the information is retrieved
Select the **View** button to see Identification information

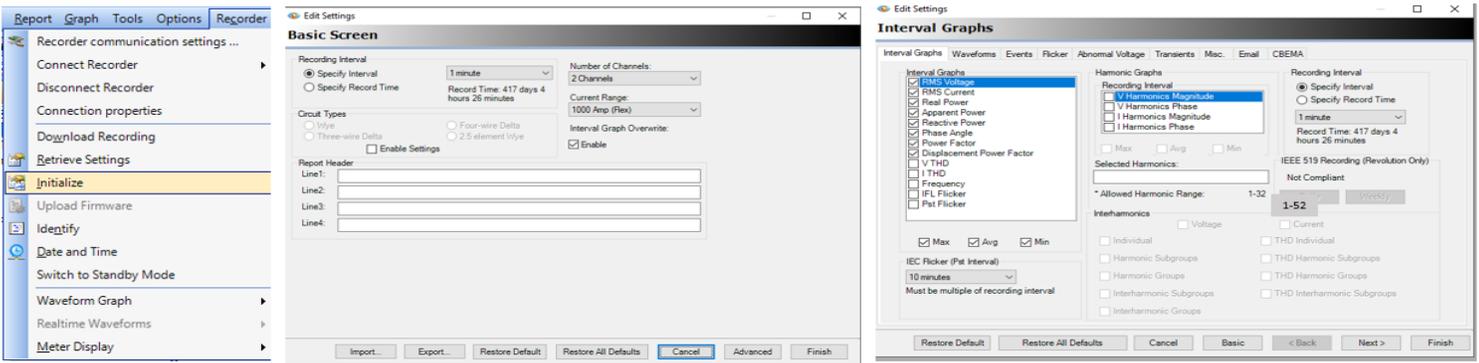
Initializing in ProVision

The Tensor Recorder is configured to record specific data by initializing using ProVision or PQ Canvass

To initialize using ProVision, connect your Tensor to your PC or laptop device then select the **[Recorder]** tab in ProVision followed by the **[Initialize]** command. The default settings shown in the Initialization menu pages will get you started until you are more familiar with the settings.

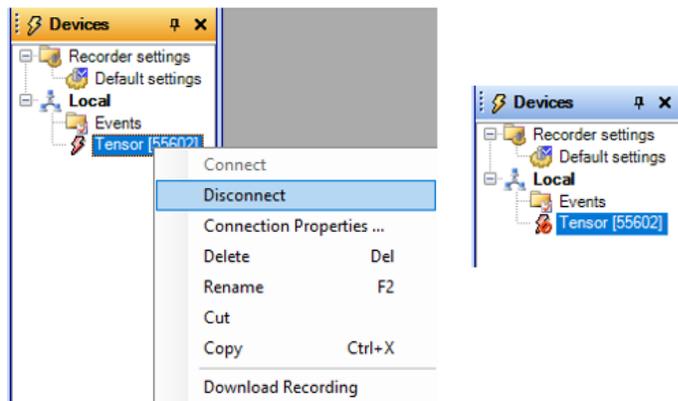
There are many initialization options. See the 'Provision Getting Started' video on the PMI website:

<https://powermonitors.com/support> for more detail.



Set the recording options by initializing in ProVision

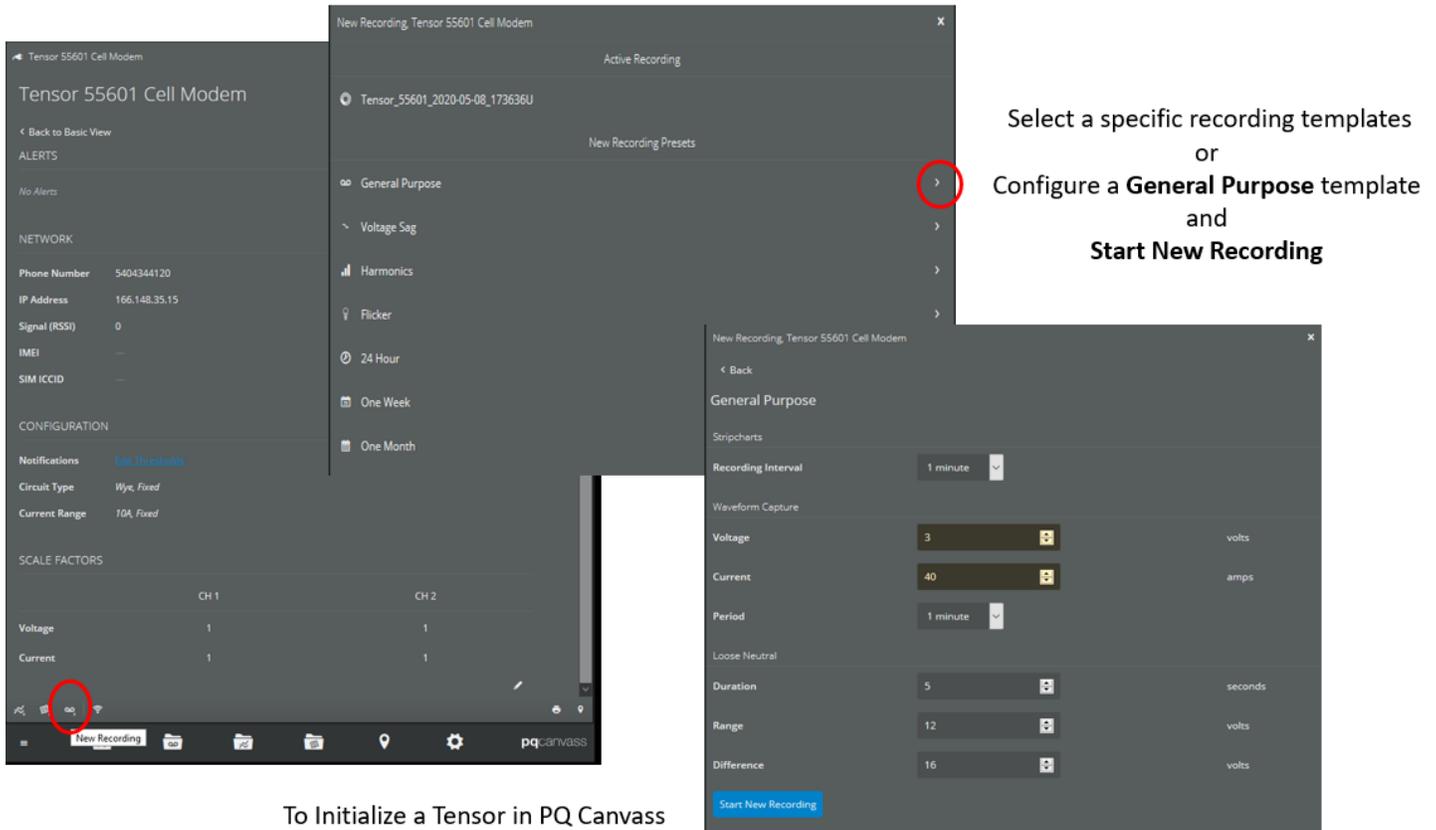
Remember to **Disconnect**.
A Wi-Fi or Cell Tensor will not record
until disconnected



Initializing in PQ Canvass

To initialize using the PQ Canvass website, select the Tensor device and **[Advanced]**, then the **[New Recording]** icon, then select a **General Purpose** setting or one of the pre-set options shown. Both can be modified.

See the section titled "What the Tensor records". You can also contact the Technical Support Team for additional assistance.



Select a specific recording templates
 OR
 Configure a **General Purpose** template
 and
Start New Recording

To Initialize a Tensor in PQ Canvass
 Select the **New Recording** icon found at the bottom of the Advanced View page

Installation

Please read the safety section before installation. Always exercise extreme caution when installing a Tensor Recorder. Install the Tensor Recorder in the receptacle socket by sliding the blades of the Recorder into the receptacles in the outlet. If you wish to monitor a load, plug in the object's AC cord into the front of the Recorder. The Tensor's outlet can be manually turned off or remotely turned off with the cellular Tensor model.

When the Recorder is plugged into a standard AC receptacle, the LED on the front of the Recorder will start blinking blue during the initialization process of the recorder. Then the LED will blink green every 5 seconds to indicate that recording is in progress.

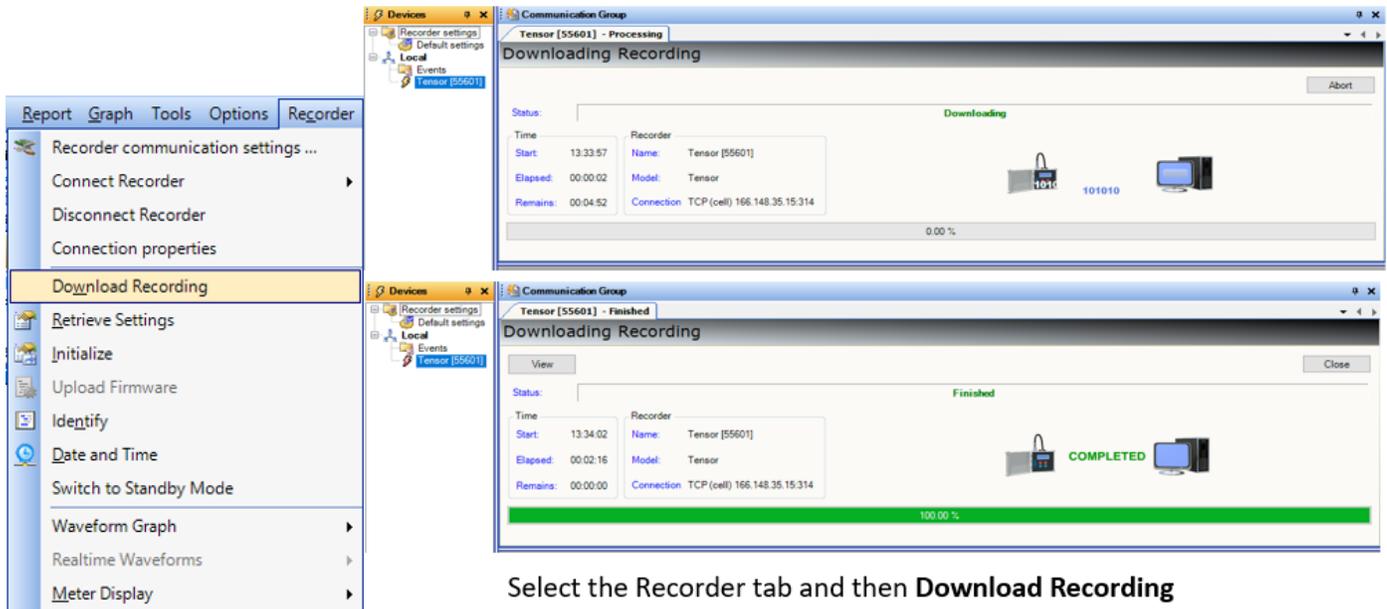
Note: If you have interrupted power to the receptacle during installation, the countdown will not begin until the power is restored.

Downloading Data

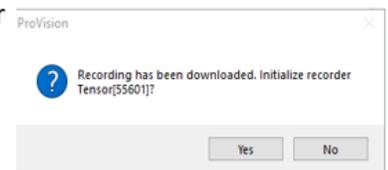
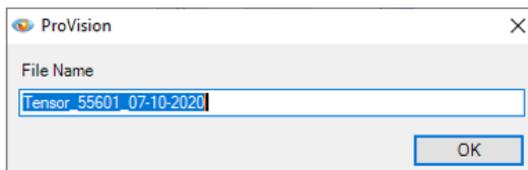
After the Tensor Recorder has recorded the desired data, it is downloaded into ProVision. Power the Tensor Recorder and connect to ProVision using the Wi-Fi or cellular connection.

The Tensor Recorder stops recording when connected to a PC and **[Retrieve Settings]** or **[Download Recording]** is selected in ProVision. If the cellular or Wi-Fi connection is dropped, the Tensor Recorder will continue recording, appending data to the existing recording session.

ProVision will ask for a file name when the download is completed. The file is placed in the Recent Download list in the Explorer column. Double clicking on the data file will bring up the Header Report which contains quick links to some graphs and reports. Other Graphs and Reports can be found under the tabs at the top of ProVision.



Select the Recorder tab and then **Download Recording**
Once the download complete, you will be asked to name the data file
Then chose to **Initialize** now or later



The Tensor Recorder also may be downloaded later. Simply remove the unit from the outlet and take it back to the office. The Tensor Recorder automatically stops recording when it is disconnected from an outlet. The recorded data is held in nonvolatile memory, so no data is lost.

If the Tensor Recorder is re-initialized, it will start the countdown when power is applied, and a new recording will begin. If the Tensor is not initialized after downloading, future data will be appended to the older data.

The recorded data is still in the Tensor Recorder and can be downloaded again even after it has been re-initialized. The old data is not erased until power is applied and the countdown completes.

PQ Canvass receives periodic data transmissions from the cell Tensor and continually adds data to the 'downloaded' PQ Canvass data file. When re-initialized, a new PQ Canvass data file is created.

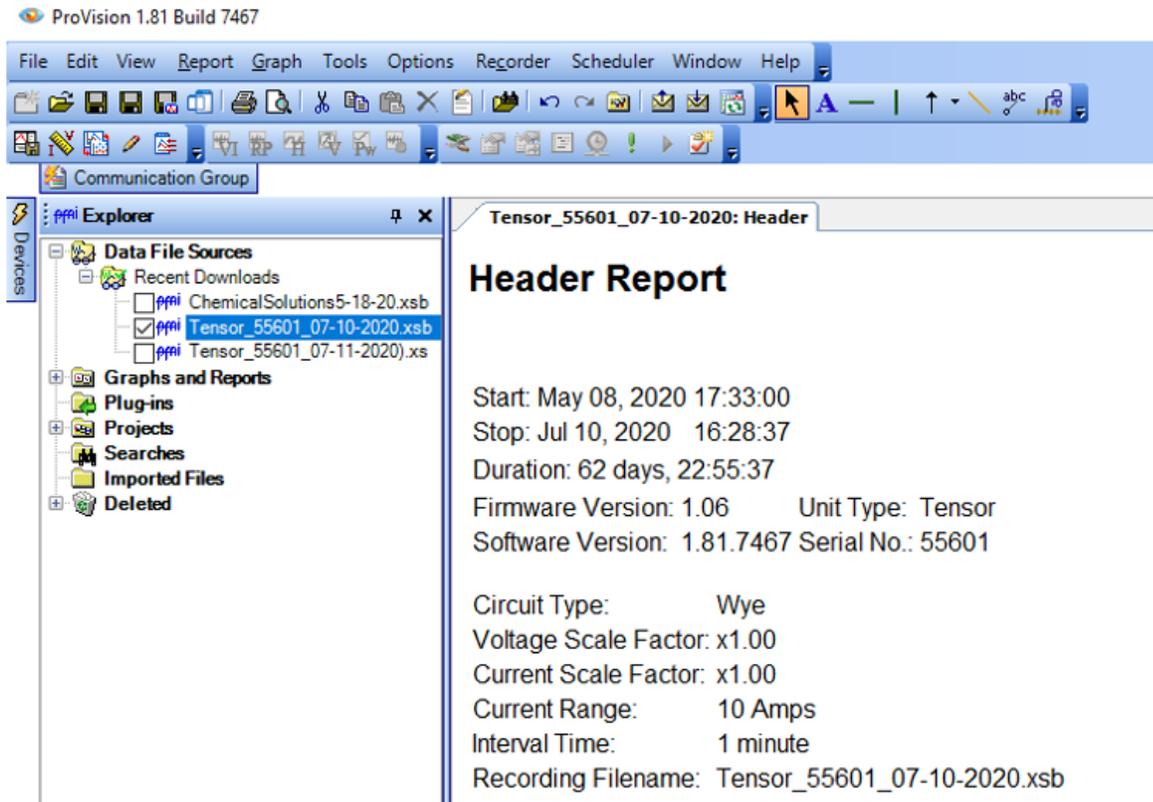
Analyzing Data

There are many graphs and reports as well as user created custom graphs and reports available in ProVision. See the ProVision documentation to learn about using ProVision to analyze Voltage Recorder data.

Videos can be found on the PMI website: <https://powermonitors.com/support>

Technical documents can be found in the PMI library: <https://library.powermonitors.com>

PMI Technical Support will also assist in analyzing data.



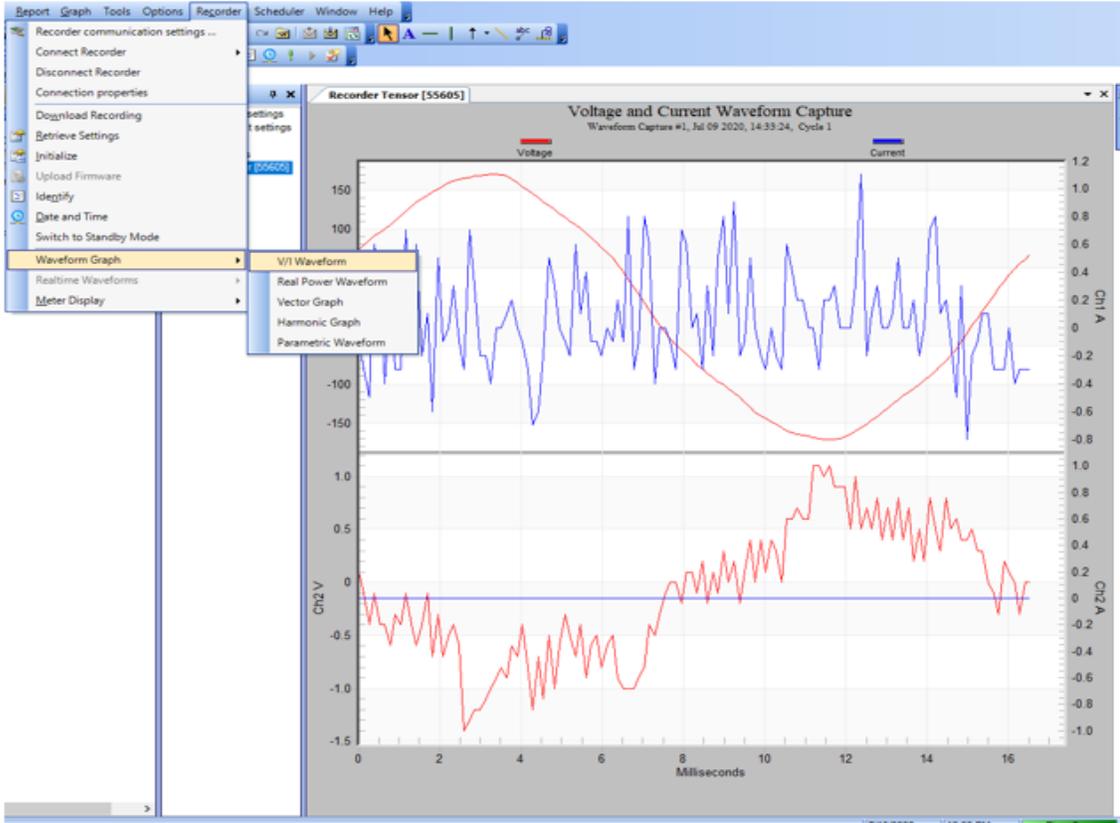
Data files are saved under the **Recent Downloads** heading

Double click the data file to open the Header Report

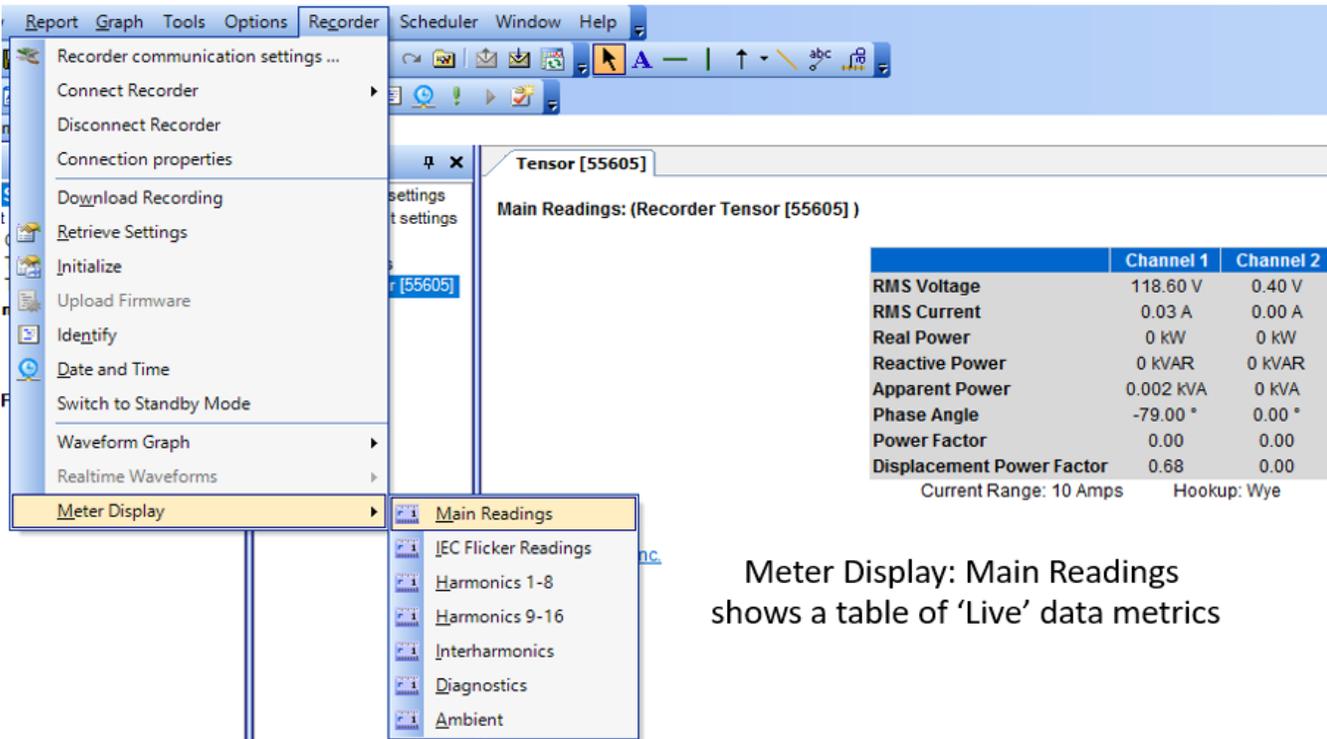
The Header Report contains recording information as well as quick links to common reports and graphs

Viewing Live Data

One of ProVision's features is the ability to view 'Live' data as a device is recording. To see 'Live' data, select the **Recorder** tab in ProVision and then **Waveform Graphs** or **Meter Display**.



Waveform Graph: V/I Waveform view



Meter Display: Main Readings shows a table of 'Live' data metrics

What the Tensor Records

Introduction

The job of any power monitor is to record all significant data and leave unrecorded a vast majority of background data. The tricky part for a monitor is deciding which events are important. This is a problem of data reduction. A recorder that captured every 60 Hz waveform during a week's recording would never miss an event but would present the user with millions of useless cycles. Conversely, a recorder whose thresholds are set incorrectly may not record anything. Staying somewhere between these two extremes involves a balance of thresholds, settings, and record types. The monitor will see an enormous amount of data on its voltage and current inputs– the Tensor Recorder sees over 1 billion samples per day! Ideally, all this data is reduced to a small report which just shows the important events and measurements. The sifting of data into specific record types accomplishes this task.

Triggered Record Types

PMI Recorder records can be divided into two classes. The first is event driven. These record types are triggered by a combination of triggering logic and adjustable thresholds, usually voltage based. If a trigger never happens, nothing is recorded for that record type. As more triggers occur, more records are collected for that record type. The advantage of this class is that nothing is recorded unless something happens. In the ideal case, no problems occurred, so nothing was recorded, and no data analysis is necessary. If a trigger did occur, then the monitor logged the event for later analysis. This is a powerful data-reduction tool and can reduce huge amounts of data into a few small records containing all the significant events. The disadvantage is that success completely depends on good thresholds and settings. A threshold that is too tight will cause the Recorder to log records that are not really worth analyzing.

These extraneous records often hide the (hopefully) few important ones. A threshold that is too loose will cause the Recorder to ignore important disturbances. Although it is often possible to use regulatory limits or other known standards to set thresholds, this can be a chicken-and-the-egg type problem: sometimes you need to know something about the disturbance before you can set proper thresholds to capture it. Despite these potential pitfalls, triggered record types are powerful tools in power line monitoring. They are most useful for capturing voltage disturbances and power quality problems. The captured events are usually presented in a text report. Triggered record types include Power Outage, Abnormal Voltage, Event Change, Significant Change, and Waveform Capture.

Non-triggered Record Types

The second class of record types is not event driven. These record types are always logging data, regardless of how interesting or important the data is. The classic example is a paper graph, which continuously logs data. There are no thresholds to set, although there may be a parameter to determine how often to collect data. The logged data is usually presented as a graph of data points. Although there may be a large amount of data, using a graph lets the eye pick out important data. Problems such as sags and swells are easy to see in the graph graphs. In addition to voltage quality studies, these record types are used for finding daily trends in current or power values, measuring power factor, etc. The advantage of not having thresholds to set is that there is no question about what data will be recorded. The disadvantage is that sometimes there is no question that a lot of data will be recorded, most of it unimportant. For non- power quality data such as power factor measurement, there is no disadvantage. These record types include graphs, Daily Profiles, Histograms, and Energy Usage.

What to Record

The PMI Recorder can record every available record type simultaneously. Each record type has its own fixed memory allocation, so there is no danger of one errant record type filling the Recorder memory to the exclusion of other record types (for example, Event Capture can never overflow into graph memory). The choice usually isn't what record types to record, but what record types to examine. To answer that question, a good understanding of each record type is required. The details of each record type, and potential uses, are described in the ProVision manual.

Additional Resources

Understanding Recorder Data

To View, Download and Search Technical Documents and Case Studies, visit the Library on the Power Monitors website: <https://library.powermonitors.com>

Calibration

An extensive Calibration Report is included with each Tensor unit. This report certifies the accuracy of your Tensor to factory specifications. Parameters that are measured during the calibration include RMS voltage, RMS current, real power, apparent power, reactive power, phase angle, power factor, frequency, PST flicker, power outage detection, battery ride through, and more. Each Tensor is carefully calibrated prior to shipment. The calibration is valid for one year after the calibration date. To have your Tensor re-calibrated, please contact our technical support department for a return authorization number and shipping instructions.

Technical Support

Help is always available if one needs additional assistance. The technical support team at PMI is widely considered to be the best in the industry. Use one of the following methods to obtain technical support:

E-mail Support

Send e-mail to: techsupport@powermonitors.com

Web Support

Submit a support request via the web at <https://www.powermonitors.com/support>

Telephone Support

Contact PMI 24 hours a day, 7 days a week for live tech support by calling: (800) 296-4120

Postal Mail Support

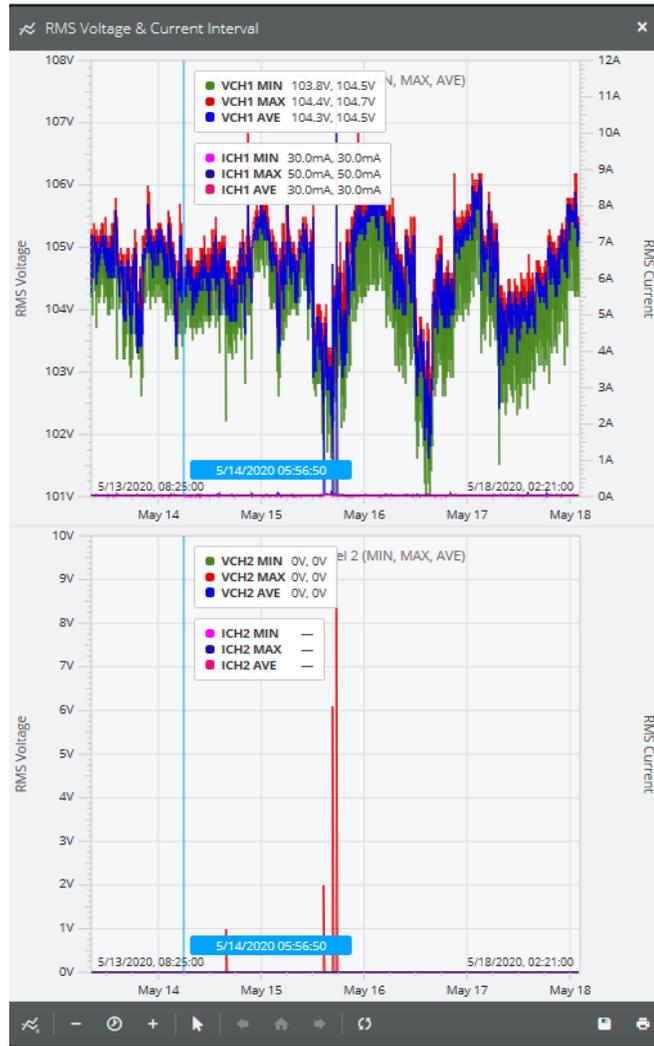
All correspondence by post should be addressed to:

Power Monitors, Inc.
800 North Main Street
Mt. Crawford, VA 22841USA

Appendix 1: PQ Canvass

PQ Canvass is a Web-Based version of ProVision and more

1. PQ Canvass provides a cloud-based system for power quality data analysis, storage, and real-time display to recorders in the field.
2. Browser and tablet friendly interfaces allow for graph and report generation, live readings, email and SMS alerts, and recorded data management
3. All collected data up to the present is immediately available in a web browser. This eliminates the need to wait for a recording session to finish or go back in the field to see what has been collected so far.
4. The combination of always-connected recorders and PQ Canvass makes gathering and analyzing power quality data easier and faster.
5. Recorders, such as the Tensor support PQ Canvass stream recorded data as it is gathered during the recording session - no need to wait until the “end” of the recording session and download the entire recorder memory.
6. Simply log into PQ Canvass and view all data gathered up to the present time. Live waveforms and meter displays are also available for real-time information from any PQ Canvass device. SMS and email alerts are also available for immediate notification on PQ events.
7. The latest version of PQ Canvass also shows continuous 1 second averages of data similar to the Canvass website and saves interval data to a file similar to ProVision.



PQ Canvass - Setting Alert Notifications

PQ Canvass can be configured with your Tensor or other models to send email or text messages when the trigger thresholds of a monitored setting is reached. The Notification List must be configured and each device will need it's Trigger Thresholds set.

Notification List

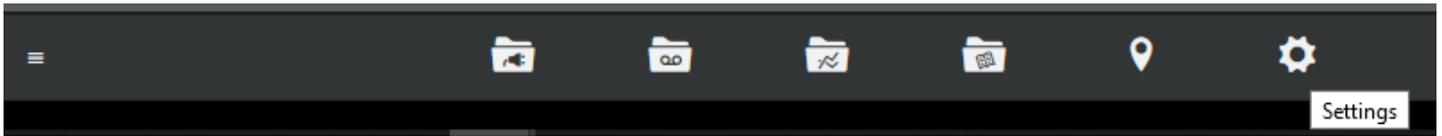
A Notification List or multiple Notification Lists must first be created. The list consists of one or more devices and one or more users who will receive the alerts. Also in the list are the Alerts or Events selected for the notification.

Before creating a Notification List decide which scenario is best for your needs:

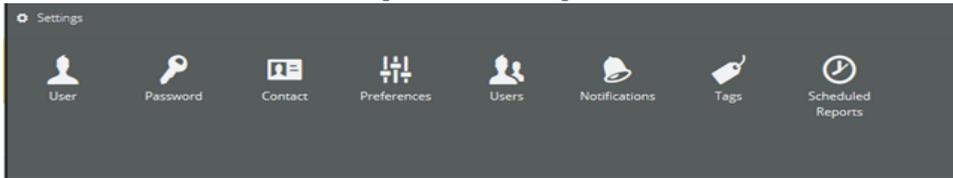
You can create a separate lists for each PQ Canvass user and assign them one or more devices; You can create a list with all users and all devices; You can create lists for each device and the user(s) responsible for the device; Or you can create lists depending on the alarm and the user(s) who responds to the alarm.

To Configure Notification Lists and set an Alert for one or more devices:

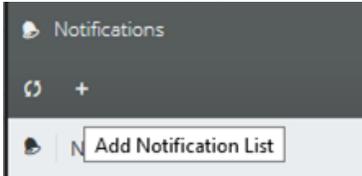
1. Login into PQ Canvass
 - a. You will need PQ Canvass Administrative privileges
 - b. Contact PMI Technical Support if you do not see the icons mentioned
2. Click on the Gear shaped Icon on the bottom of PQ Canvass to select **[Settings]**



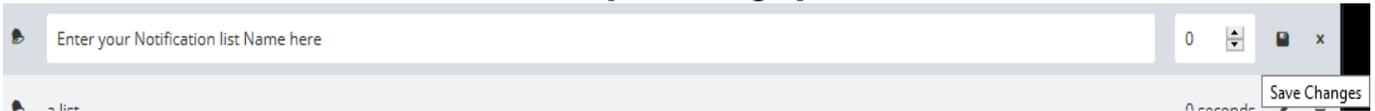
3. Click on the Bell Icon labeled **[Notifications]**



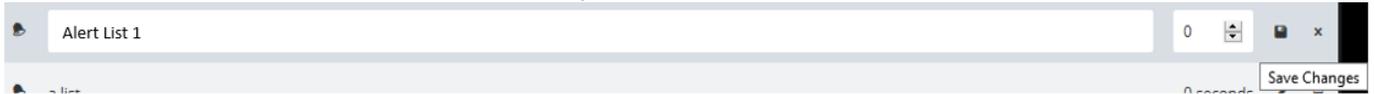
4. Click on the **[+]** symbol at the top left to Add a Notification list



5. Enter the List name and select the disk icon to **[Save Changes]**



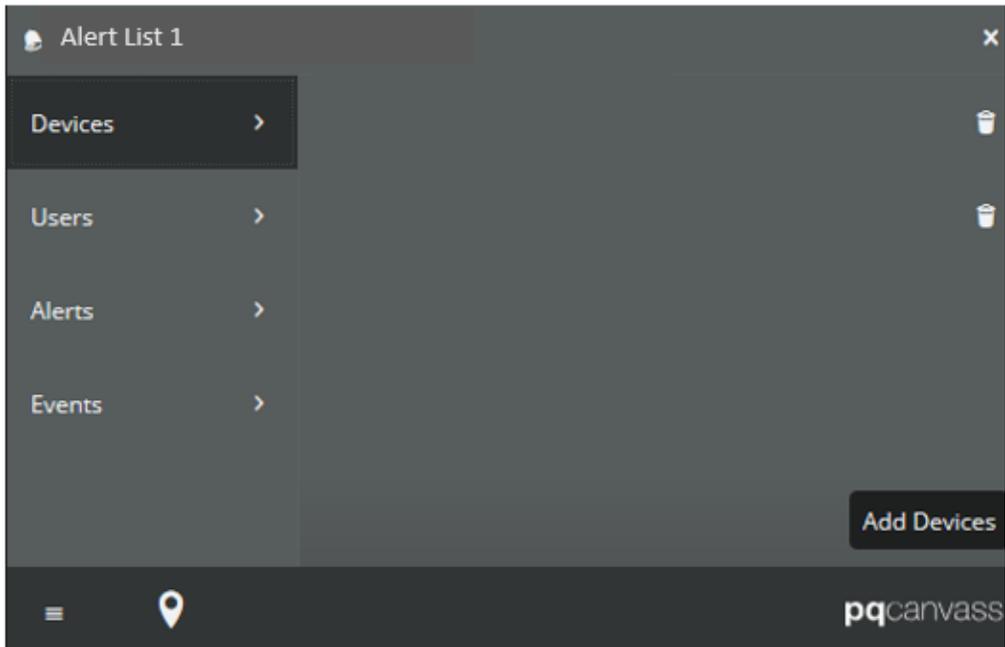
6. To set the notifications, click on the new list you created



7. The Holdoff time can be modified now or at a later date
- a. The Holdoff Time can limit the number of alerts sent
 - b. An alert will not be sent until the event reaches the specified number of minutes
 - c. No alert is sent if the alarm condition returns to normal before the Holdoff value is reached



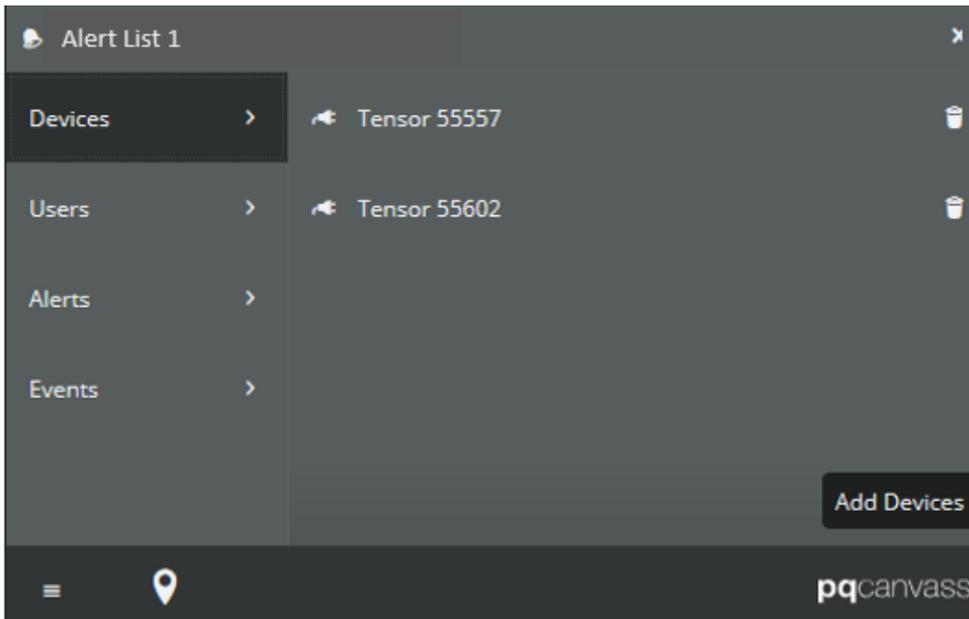
8. Select **[Devices]** and click on **[Add Devices]** at the bottom right



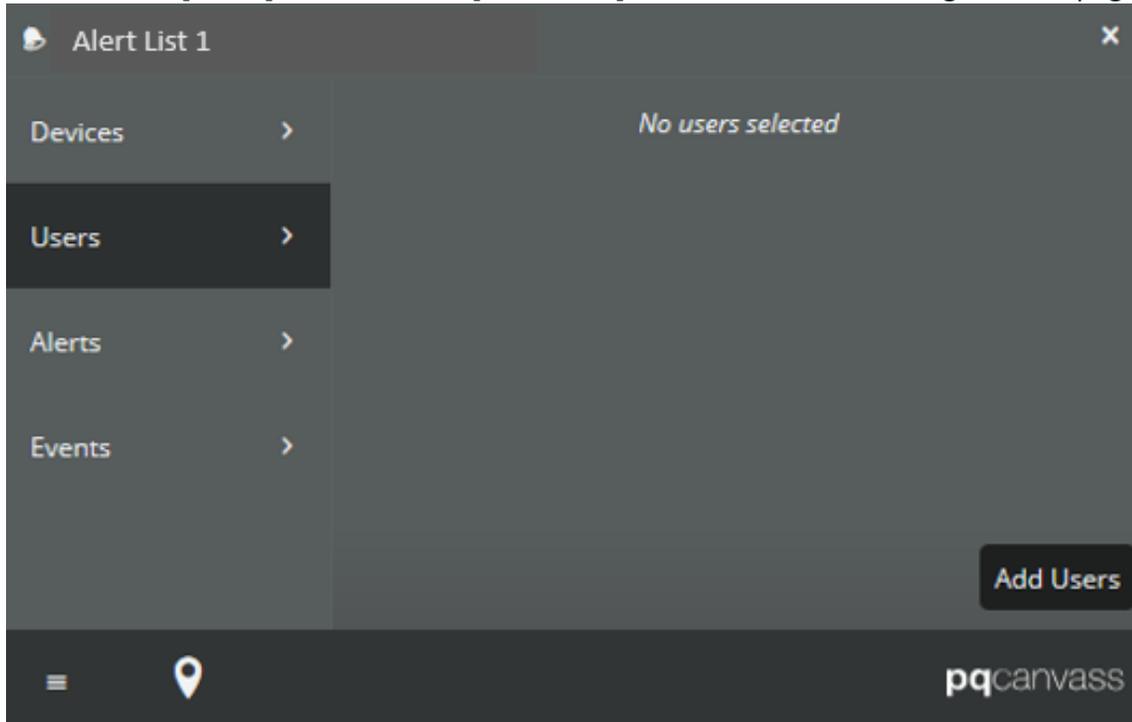
9. A list of all your configured devices will be displayed



10. Select each device you want to include in the Notification list
- A check mark will appear on the right margin of each selected device
 - When all devices are selected, click **[Done]** on the bottom right of the page
 - The selected devices will be listed

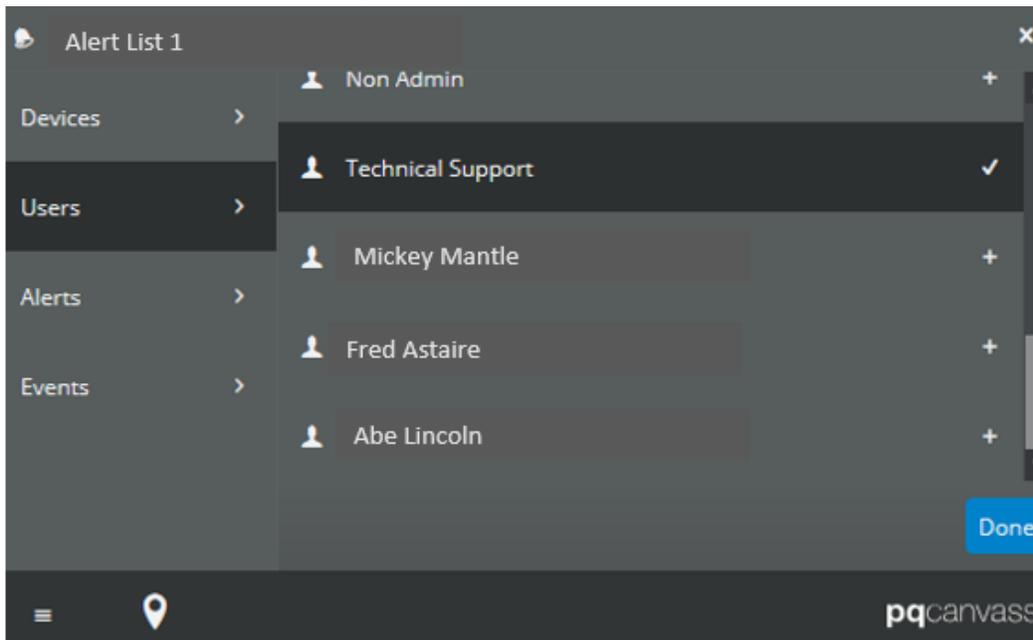


11. Next choose **[Users]** and select the **[Add Users]** button on the bottom right of the page



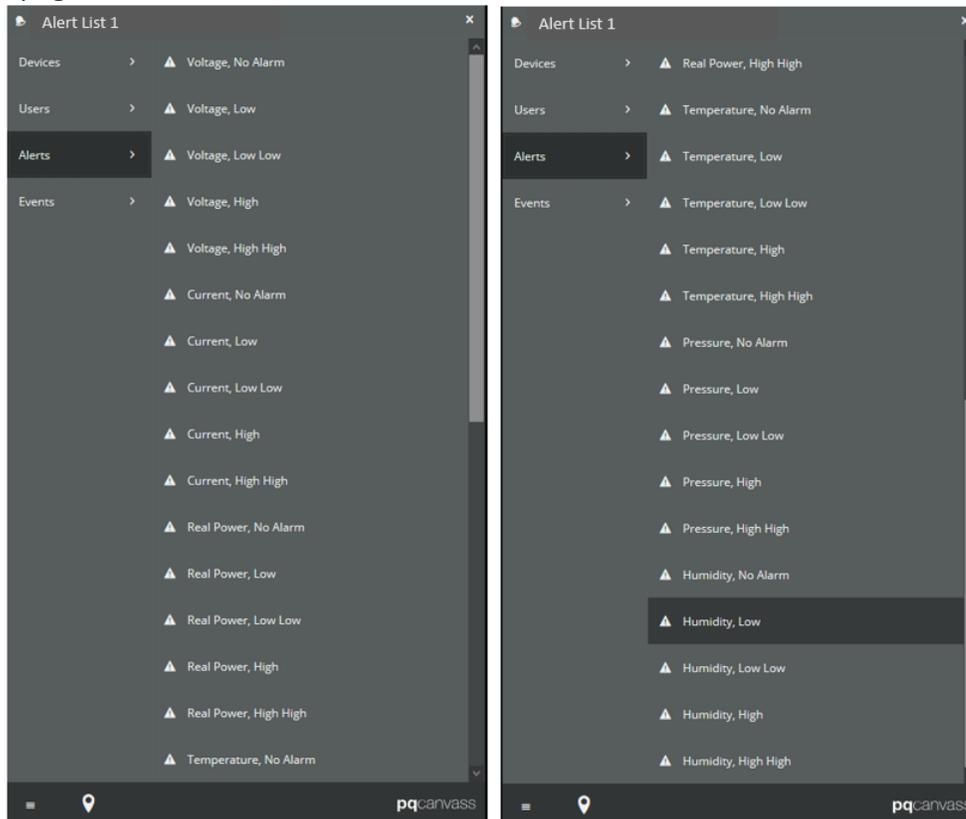
12. Select one or multiple users that will receive the alerts
- A check mark will appear on the right margin of each selected User
 - When all Users are selected, click **[Done]** on the bottom right of the page

c. The selected Users will be listed



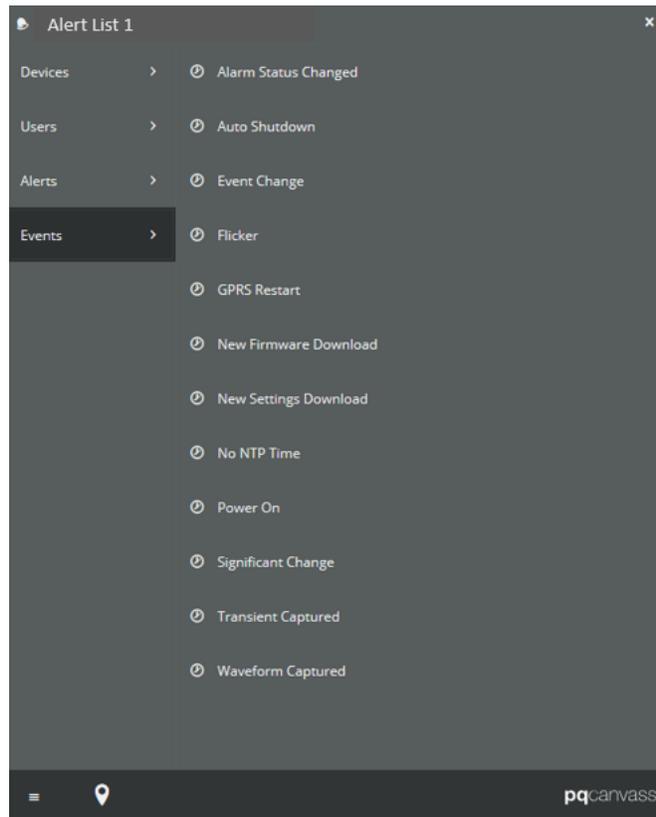
13. Next select **[Alert]** and choose one or many alerts

a. 2 pages of Alerts to choose from



14. Finally click on **[Events]** to select one or multiple event alerts

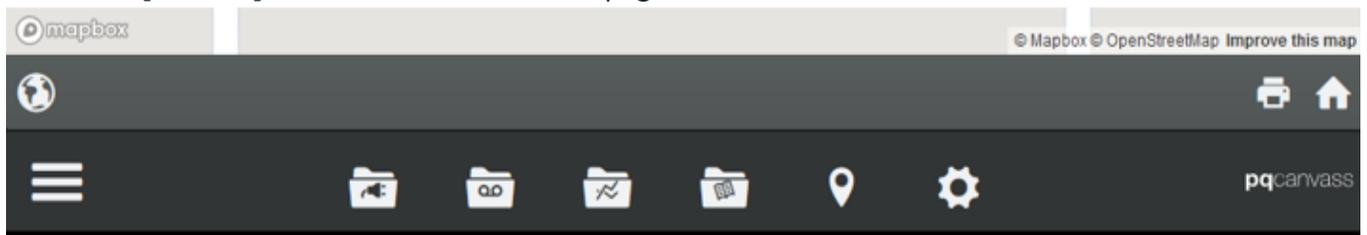
a. When finished, select the **[X]** in the upper right corner



Trigger Thresholds

To set Device Trigger Thresholds in PQ Canvass:

1. Trigger Thresholds are set according to the range that meets you or your companies procedures
2. Login into PQ Canvass
3. Select the **[Devices]** Icon at the bottom of the page



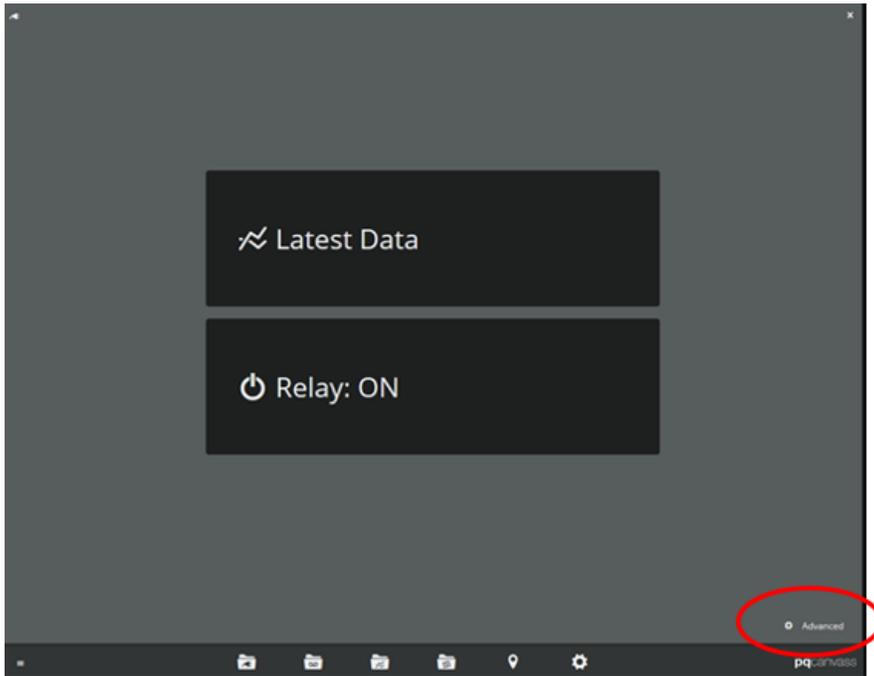
MAIN MENU

DEVICES RECORDINGS GRAPHS REPORTS MAP

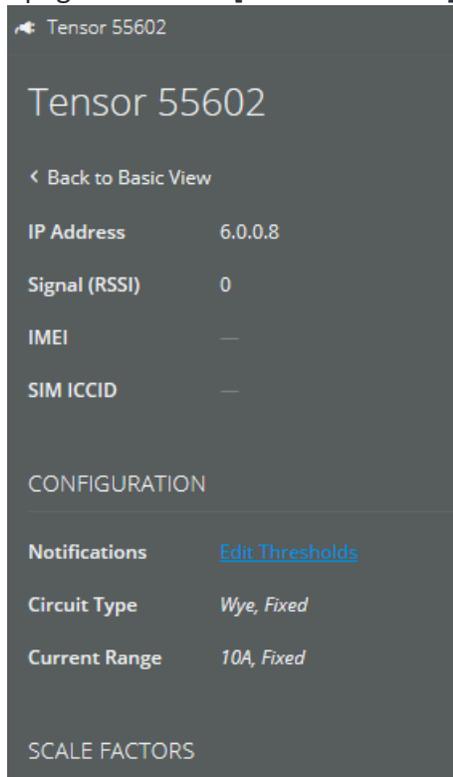
TOOLS

4. Select a specific Device you want to configure for Notification Alerts

5. Then Select **[Advanced]** on the right side at the bottom of the page



6. Scroll down the page and select **[Edit Thresholds]**



7. Set the specific trigger levels, then save settings by selecting **[Set Thresholds]**
 - a. The settings should match the Alerts set previously in the Notification List
 - b. Averaging Window - Defines the number of seconds over which the input values will be averaged before they are used to test against the threshold values. **[1(disabled) - 1800 seconds]**
 - c. Holdoff Time - Defines the number of seconds over which the input values will be averaged before they are used to test against the threshold values. **[1(disabled) - 1800 seconds]**
 - d. Hysteresis - The hysteresis value does not have any units associated with it. It is a numeric value ranging from **0-100** that will assume the units of each individual threshold. It is used as a pad value that defines a narrow band above and below each threshold. A measurement must exceed the programmed threshold plus (or minus) the hysteresis value in order for that measurement to be used for alert triggering.

Tensor 55602 (55602)

Average Window: 1

Holdoff Time: 1

Hysteresis: 0

RMS Voltage

Channel	Low-Low	Low	High	High-High
Ch 1	0	0	0	0
Ch 2	0	0	0	0

RMS Current

Channel	Low-Low	Low	High	High-High
Ch 1	0	0	0	0
Ch 2	0	0	0	0

Real Power

Channel	Low-Low	Low	High	High-High
Ch 1	0	0	0	0
Ch 2	0	0	0	0

Temperature

Channel	Low-Low	Low	High	High-High
Ch 1	0	0	0	0
Ch 2	0	0	0	0

Pressure

Channel	Low-Low	Low	High	High-High
Ch 1	0	0	0	0
Ch 2	0	0	0	0

Humidity

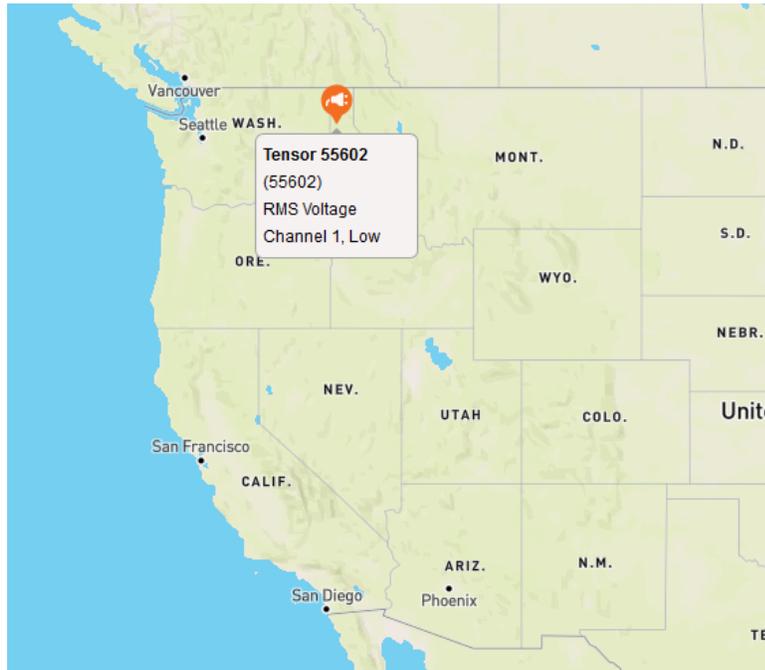
Channel	Low-Low	Low	High	High-High
Ch 1	0	0	0	0
Ch 2	0	0	0	0

Set Thresholds

PQ Canvass Alert Example



The device icon will turn orange when in an alert state



Appendix 2: Frequently Asked Questions (FAQs)

Firmware: How do I check the firmware version using ProVision?

1. To check the firmware version of your recorder, connect the Recorder to the PC or Laptop using the Wi-Fi, Cellular connection or USB port depending on the model of the device, and then connect to ProVision.
2. View the recorder information by clicking the **[Recorder]** tab and then selecting **[Identify]**.
3. After the identification is complete, click on **[View]** and the “View Identification Information” window will appear, showing the firmware version of your Tensor.
4. Go to the website: <https://www.powermonitors.com/support>
5. View the Firmware Chart
6. Look at the latest firmware for the Tensor listed on the Firmware Chart and compare this with the firmware version of your Tensor recorder.

Firmware: How do I use ProVision to upgrade the Tensor recorder’s firmware?

1. First update Provision with all the Firmware files
 - a. In ProVision, select the **[Help]** tab and then **[Check for Updates]**
 - b. The Wizard will inform you if your ProVision or your Firmware files need updating
2. Upon completion of downloading a data file, if the Firmware on the recorder is out of date, ProVision will ask you to Update the Firmware.
3. Keeping your recorder’s firmware current is essential for proper operation.

Firmware: How do I manually update Firmware using ProVision:

1. Connect your device to Provision
2. In Provision select **[Options]** and **[Show Advanced Operations]**
3. Then select **[Recorder]** and **[switch to standby mode]** (if shown)
4. Next select **[Recorder]** and **[Upload firmware]**

Initializing: How do I initialize my Tensor recorder?

1. Connect to the device to ProVision.
2. Click on **[Recorder]** or right-click on your Tensor in the devices tree.
3. Select **[Initialize]**, which should open up the “Basic Screen” window.
4. Set the desired intervals, channels, circuit types, etc. If necessary, select **[Advanced]**. For more information on using this, see the ProVision documentation.
5. Click **[Finish]**.
6. Answer “Yes” to “Would you like to initialize the recorder?”
7. When the recorder has finished initializing, select **[Disconnect]**.
8. Since the Tensor is only powered in an AC outlet, it will begin recording after countdown is completed. Other recorders will begin recording when powered on.

How do I check for or upgrade to the most current version of ProVision?

1. In ProVision, select the **[Help]** tab and then **[Check for Updates]**
2. The Wizard will inform you if your ProVision or your Firmware files need updating

How do I export data files into Microsoft Excel or Word?

Note: There are limits to the number of lines Excel allows, as well as PC memory limitations.

1. Open the data file
2. Right-click the file and select **[Export to Word]** or **[Export to Excel]**

How do I save my favorite Tensor initialization settings for later use?

1. In ProVision, go to the “Recorder Settings” folder in the devices tree.
2. Right-click on the folder and click **[Create Template Settings]**.
3. Select **[Tensor]** from the “Recorder Type” drop-down menu and click **[OK]**.
4. Select the desired settings on the Basic and Advanced pages
5. Click **[Finish]** when done
6. Name the new settings template. (e.g. “Default Tensor Settings”)
7. Select **[OK]**
8. The new template should now be listed under the “Recorder Settings” Folder in the Device Tree column.
9. Drag and drop the template onto the connected recorder you wish to initialize (also listed in the Device Tree)
10. Answer “Yes” to “Would you like to initialize with these settings?”

How should I interpret the data recorded by my Tensor?

1. There are many Documents and videos listed on the Power Monitors website.
2. Videos are located on the Support Page: <https://powermonitors.com/support>

3. To View, Download and Search Technical Documents and Case Studies, go to the Library on the Power Monitors website: <https://library.powermonitors.com>
4. Or call the Technical Support Team at 1-800-296-4120

How do I change the scaling (upper or lower bounds) on a graph?

1. While looking at a graph, select **[Tools]** and then **[Axis Bounds]**.
2. In the “upper/Lower Bounds” window, select “Manual Scaling.”
3. You can now change the upper and lower bounds to values of your choice.
If you would like to set the bounds to all plots, simply click **[Set all scales to this scale]** after typing in your desired bounds.
4. Select **[Apply]**

My Tensor will not communicate. What should I do?

1. See Appendix 3 : Troubleshooting
2. Contact the Technical Support Team at 1-800-296-4120.

Will I need to buy a site license for ProVision to install it on multiple computers?

1. No, ProVision only works with PMI equipment, and there is no charge to the user.

How can I get notified of updated versions of ProVision as they are released?

1. Your Sales Representative can register you to get email updates from PMI
2. Use the ProVision Upgrade Manager to check for new releases.
In ProVision, select the **[Help]** tab and then **[Check for Updates]**

How do I activate my cell Tensor data plan?

1. To communicate with your cell Tensor, the cell modem must be set up with a Verizon cell plan (a public static IP address is preferred) using the SIM and IMEI numbers that can be found in the shipping material.
 - a. A cell plan can be purchased through PMI and the Tensor or other cell device will be configured with an IP address and tested before shipping.
2. Internal IP addresses can be supplied to Verizon by your company’s IT group
 - a. Your PC must be on the internal network to access internal IP addresses
3. Once Verizon has configured the cell data plan, plug the Tensor into a standard AC outlet.
4. The Tensor will get the information from the local cell tower
5. When connected to the cell modem, you can use Provision to download the data file to your PC and also use the PQ Canvass website to view data.

How do I add a cell connection to Provision?

1. In ProVision, select **[Recorder]** and **[Recorder Communication Settings]**
2. Select **[Add]** and **[TCP/IP]**
3. In the **Name** area, enter the serial number of the Tensor
4. In the **Address** area, enter the IP address given to you by Verizon
5. Select the check box; ‘**This is a Cell Connection**’

6. Select [**Save**]
7. The previous pop-up will have the new TCP/IP entry, [**close**] this pop-up
8. Repeat for each cell Tensor

How do I connect my PC to a Wi-Fi Tensor?

1. At the bottom of your PC or Laptop, select the Network icon
2. If a PMI Wi-Fi device is within range, the Model and Serial Number will be displayed
3. Select the Tensor and use the password: pmi12345
4. Follow the FAQ instructions for 'How do I add a Wi-Fi connection to ProVision'

How do I add a Wi-Fi connection to Provision?

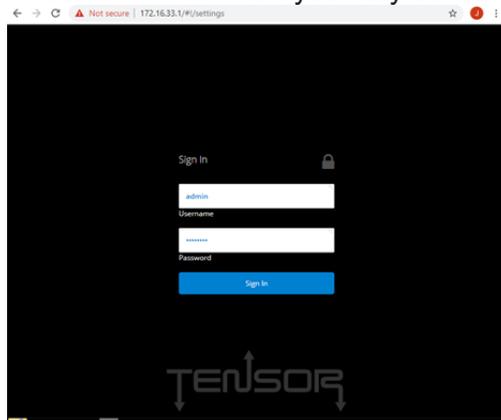
1. In ProVision, select [**Recorder**] and [**Recorder Communication Settings**]
2. Select [**Add**] and [**TCP/IP**]
3. In the **Name** area, enter the serial number of the Tensor
4. In the **Address** area, enter the IP address given to you by the PMI Tech Support Team
5. Select [**Save**] and [**close**]

How do I connect ProVision to my cell or Wi-Fi Tensor?

1. After you have added the IP to Provision, select [**Recorder**] and [**Connect**]
2. Select the new entry for you cell or Wi-Fi Tensor
3. Once connected, the Tensor is displayed in the Devices column and is ready to download, initialize or view live data
4. Remember to select the [**Recorder**] tab and [**Disconnect**] when completed

How do I join a Tensor to a new Wi-Fi network?

1. Open the Wi-Fi settings on your phone or tablet, and select the Wi-Fi network named "Tensor <serial number>", in a few seconds, a captive portal screen will pop up and prompt you to log in to the Tensor's web interface. Or manually connect a browser to: 172.16.33.1
2. Enter the username (admin) and password (pmi12345) on the login screen to access the main screen of the Tensor Web UI. On first connection you may be asked to set a password.

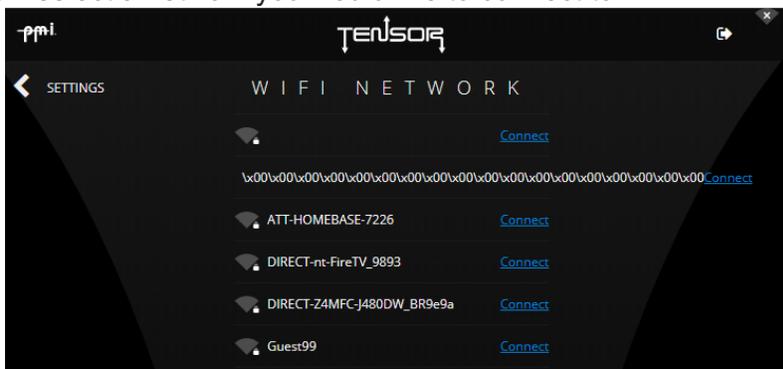


3. If the Tensor is not already connected to a Wi-Fi network, there will be a blue banner across the top of the 'Live' data page prompting you to connect to a Wi-Fi network.
 - a. Select [**Connect**]

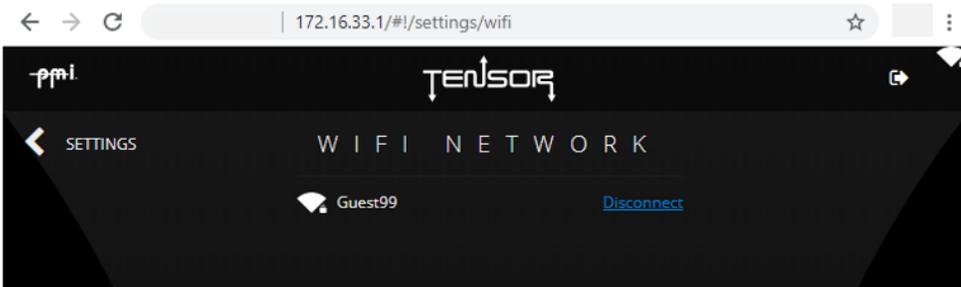
- b. You can also select **[Settings]** at the bottom of the page, then **[WiFi Network]**



4. If the Tensor is already connected to a Wi-Fi network, you can tap on the Wi-Fi symbol in the top right in order to display the currently connected network, and other nearby networks.
5. Now select a network you would like to connect to.



6. If the desired network is secured, enter the password for that Wi-Fi network.



7. The captive portal window may close as the Tensor reconfigures the Wi-Fi network (which is warned on the network password entry screen).
8. If your phone or tablet does not automatically reconnect to the "Tensor <serial number>", simply tap on that network again to reconnect.
9. The Tensor should now be connected to the desired network.
10. Once connected to a network, the Wi-Fi Tensor can send data to the PQ Canvass website.

How do I connect my PC and Tensor using Bluetooth?

1. The Tensor does not support BlueTooth communication

Appendix 3: Troubleshooting

There are several things that could cause communication/download problems with PMI equipment.

1. If your device connects using a cable, or if the load is directly connected to the device, check all connections for a tight fit and free of any corrosion or any debris
 - a. For safety always check connections for physical defects, such as cuts or abrasions and missing connector pins
2. For the Tensor check the LED color and pattern
(see specific manual for LED patterns of other PMI models)
 - a. solid blue, 2 seconds, boot stage 1
 - b. solid green, 10 seconds, boot stage 2
 - c. blue heartbeat, 10 seconds, system initialization

Basic rules

- d. There is always a flash rate after boot
- e. Max flash rate pattern is 6 seconds before repeating
- f. Both pattern and color are informative
- g. Red LED with no other colors involved is a hardware error condition

Defined flashing patterns...

- h. Idle: 5s on, 1s off, repeat
- i. Recording: 1s on, 5s off, repeat
- j. Countdown: 1s on, 1s off, repeat
- k. Wink: 2s on, .1s off, repeat
- l. Heartbeat: .2s on, .2s off, .2s on, 1.2 off, repeat
- m. Strobe: .15s on, .15s off, repeat

Run time possibilities...

- n. yellow wink, waiting for NTP connection (Wi-Fi or modem) to set time of day
 - o. green idle, uninitialized
 - p. green recording, recording in progress
 - q. green countdown, after initializing but prior to recording
 - r. orange wink, recording paused
 - s. magenta strobe, firmware update in progress
 - t. white strobe, visual locate mode
3. Disconnect the recorder and allow it to power down
 4. Close the ProVision program and re-open
 5. Try the operation again
 6. If you still have communications or download problems after trying the above suggestions, then there is possibly a hardware problem in the recorder
 7. Call Technical Support at 1-800-296-4120
 8. If there appears to be a hardware problem, call PMI at 1800-296-4120 to arrange for a return authorization to send your unit to the repair department

Appendix 4: Warranty Clause

Power Monitors Inc. (PMI) warrants each new product manufactured and sold to be free from defects in material, workmanship, and construction, and that when used in accordance with this manual will perform to applicable specifications for a period of one year after shipment.

If examination by PMI discloses that the product has been defective, then our obligation is limited to repair or replacement, at our option, of the defective unit or its components. PMI is not responsible for products that have been subject to misuse, alteration, accident, or for repairs not performed by PMI.

The foregoing warranty constitutes PMI's sole liability and is in lieu of any other warranty of merchantability or fitness. PMI shall not be responsible for any incidental or consequential damages arising from any breach of warranty.

Equipment Return

If any PMI product requires repair or is defective, call PMI at (800) 296-4120 before shipping the unit to PMI. If the problem cannot be resolved over the phone, PMI will issue a return authorization number. For prompt service, all shipments to PMI must include:

1. The billing and shipping address for return of equipment
2. The name and telephone number of whom to contact for further information
3. A description of the problem or the work required
4. A list of the enclosed items and serial numbers
5. A return authorization number
6. If possible, a copy of the original invoice

Equipment returned to PMI must be shipped with freight charges prepaid. After repair, PMI will return equipment F.O.B. factory. If equipment is repaired under warranty obligation, freight charges (excluding airfreight or premium services) will be refunded or credited to the customer's account. Return equipment to:

Power Monitors Inc.
800 North Main Street
Mount Crawford, VA 22841 USA
Attention: Repair Department

Appendix 5: Regulatory Information

U.S. FCC Part 15 and Industry Canada RSS 210 Statements

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
and
2. This device must accept any interference received, including interference that may cause undesired operation.

The FCC and Industry Canada (IC) ID numbers applicable to the Tensor product are:

FCC ID: RO9REVOL0608

IC: 4806A-REVOL0608

FCC Warning

Changes or modifications to this product not expressly approved by Power Monitors Inc. could void the user's authority to operate this equipment.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.