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LEAP WIRELESS SENSOR SYSTEM

GENERAL SYSTEM USER MANUAL

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1. About this Manual

This user manual will guide you through the installation and use of the Leap Wireless Sensor System. First, it explains the components in the system, then explains how to set up or install the system and software so that it can begin monitoring your equipment. Finally, it describes each individual piece of software and how it is used to perform common tasks with the system.

1.1 Audience

This manual assumes that you are already familiar with the Windows operating system and are responsible for performing installation and monitoring of the test system.

2. Quick Start - Setting up the Gateway

This section describes the process of connecting to a Gateway via your web browser and how to interface with it to start collecting sensor data.

2.1 Installing Drivers (Mac only) – Not Needed on Windows PC

There are two things to install when using a Mac, the network driver which is here: <http://beagleboard.org/static/Drivers/MacOSX/RNDIS/HoRNDIS.pkg>

and the serial driver which is here: http://beagleboard.org/static/Drivers/MacOSX/FTDI/FTDI_Ser.dmg

Once the drivers are installed open Network from System Preferences and you should see the Beagle Bone Black (BBB) showing up as a network connection.

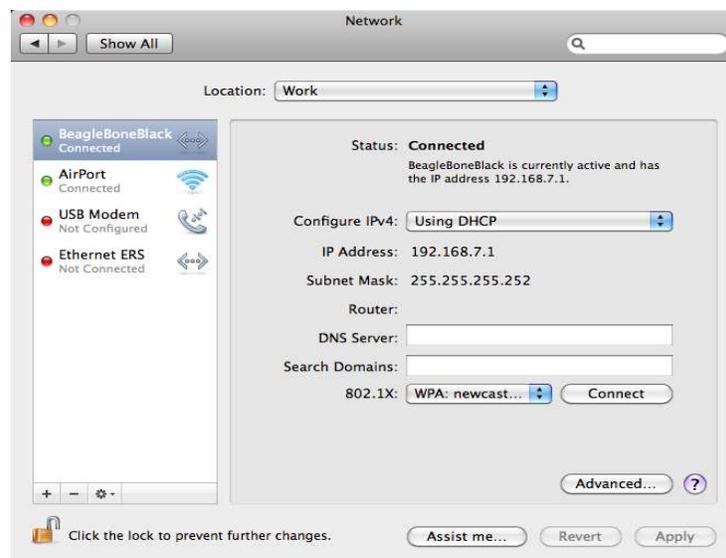


Figure 1: Mac Network Window

2.2 Connecting the Gateway to a PC, Local Area Network, or to the Cloud

The following are the typical configurations for Gateway Communications:

- **LP-SW-SA:** Standalone Gateway, data is only accessible locally and will require an ethernet or USB connection be made to access the data via your web browser. Either connection can be used to make configuration changes.
- **LP-SW-CE-1-X:** Ethernet Based Cloud Instance, data is forwarded to the Phase IV Engineering Cloud Instance from your Local Gateway via an ethernet connection to your router and all data is stored remotely through <https://leapsensormanager.com/>. This gateway can be accessed locally by USB or Ethernet for access to make configuration changes.

- **LP-SW-CC-1-X:** Cellular Based Cloud Instance, data is forwarded to the Leap Phase IV Engineering Cloud Instance from your Local Gateway via a built-in cellular modem and all data is stored remotely through <https://leapsensormanager.com/>. This gateway can only be accessed by a USB connection for configuration changes.
- **LP-SW-SRV-1-X:** Local Gateway data is forwarded to a Local Data Server (Application File for Downloading the Data Server to your Remote Host included with purchase). The Gateway can be accessed via ethernet, USB, or the Remote Host. Device level configuration changes can only be made via the Remote Host.



All Gateways Require Surge Protection for 5VDC Power Supply. Failure to have Surge Protection in the event of a Power Surge will result in damaged components.

See the sections below that describe your gateway-to-computer connection.

2.2.1 Connecting to the Gateway with a USB Cable

- Start by ensuring all device (Gateways and sensors) power switches are in the OFF position.
- Plug the wall transformer into the wall and the other end into the Gateway. Wait ~5 minutes while the Gateway boots up.
- Plug-in the provided USB cable from the Gateway to the PC. Use the mini-USB end of the cable on the Gateway.
 - *Note: If you prefer to connect the Gateway to your PC with an Ethernet cable, see section 2.1.2.*
- Once the Gateway has booted, a window should automatically open like the one shown below. *

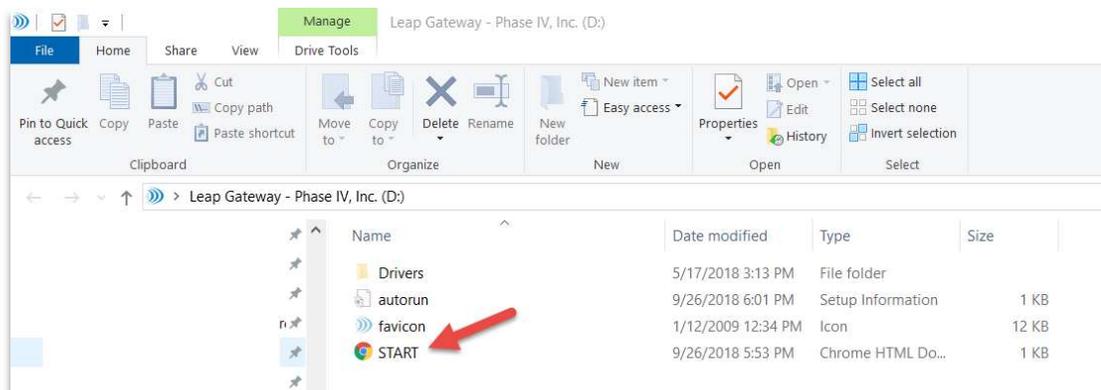
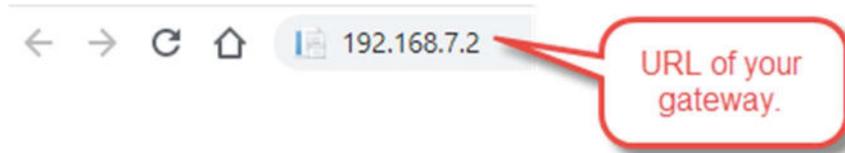


Figure 2: Window displayed upon Gateway Boot

- The computer will then go to a web browser and will try to connect to the Gateway. In the example above, the Gateway has the default URL of 192.168.7.2.
 - **It takes the Gateway about 5 minutes to fully power-up.** It is common for a “site can’t be reached” message to appear because the software on the Gateway is not yet running.

- **NOTE: The way some browsers are configured, this window may not appear. If this window does not appear, type the URL on the gateway directly into the Browser (as shown below) – then wait 5 minutes for the Leap software to start.*



- Local Login Information for USB Connection:
 - Username: admin
 - Password: “Default Password” found on the bottom of Gateway

2.2.2 Connecting the Gateway to a PC with an Ethernet Cable

In some situations, it works better to connect the gateway to a PC using an Ethernet cable. Follow these instructions to enable this.

The Gateway can still be accessed using the USB cable after this is done by using the existing IP address.

To begin, connect to the user interface via the USB cable and log-in. See the detailed instructions below.

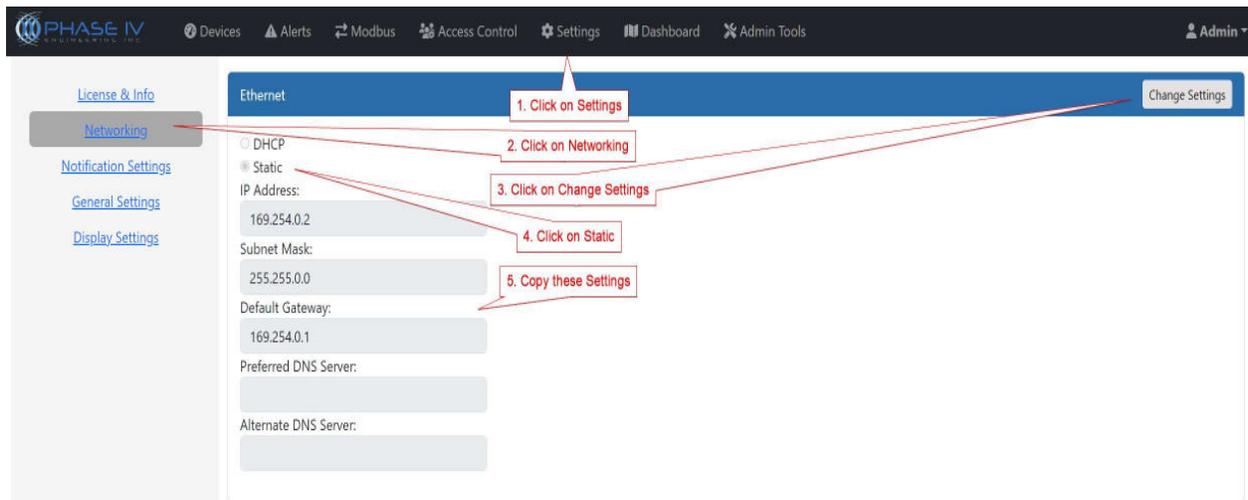


Figure 3: Instructions for Connecting to a Gateway via Ethernet

Settings to Use:

- IP Address: 169.254.0.2
- Subnet Mask: 255.255.0.0
- Default Gateway: 169.254.0.1
- Preferred DNS Server: <blank>
- Alternative DNS Server: <blank>

After you finish filling in the settings, click the green “Save” button in the top-right corner. The Gateway can now be accessed via Ethernet cable by using the IP Address 169.254.0.2.

- This IP address should only be used with an Ethernet connection.
 - The same Local Login information used for USB Connection can be used when connecting to the Gateways configured IP address via Ethernet
 - The IP address that comes-up when the system initially starts (see Section 2.1) should be used with the USB cable.
- Open a web browser on your internet connected device (PC, tablet, phone)
 - **Chrome and Firefox work best with the Leap Software.**

2.2.3 Connecting the Gateway to LeapSensorManager.com Cloud Interface

- Start by ensuring all sensors power switches are in the OFF position.
- Plug the wall transformer into the wall and the other end into the Gateway. **Wait ~5 minutes while the Gateway boots up.**
- Plug-in the provided Ethernet cable from the Gateway to your local area network router.
- Open a web browser on your internet-connected user device (PC, tablet, phone)
 - **Chrome and Firefox work best with the Leap Software**
- Your SensorManager software IP address is located at the top of the Log In sheet that was provided with the system. Type in the SensorManager Software IP Address into your web browser.

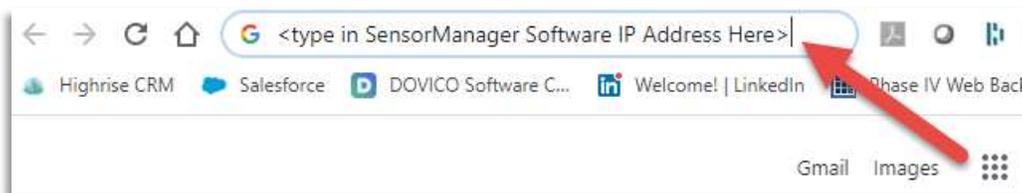


Figure 4: Inputting SensorManager Software IP Address

The SensorManager software should open in the web browser.

2.2.3.1 Verifying the Gateway Connection

After the gateway connects, there should be 2 green LEDs lit on the gateway.

The first LED indicates that the gateway has power.

If the 2nd LED comes on, then the Gateway has formed a Thread network that the Sensor Devices can connect to.

If the 2nd LED does not come on, then either the Radio Board isn't communicating correctly, or the Thread settings are invalid. The user should contact support if only one LED is lit on the gateway.

2.2.3.2 Verify Devices are communicating with the Gateway and Software

Once the gateway is set-up, test the system to verify each device is communicating to gateway.

2.2.4 Using the Power Switch LEDs to Determine Device to Gateway Connection

If the sensor Device Node has an LED with the power switch, LED blinking sequence will let you know if the Device Node has connected to the gateway.

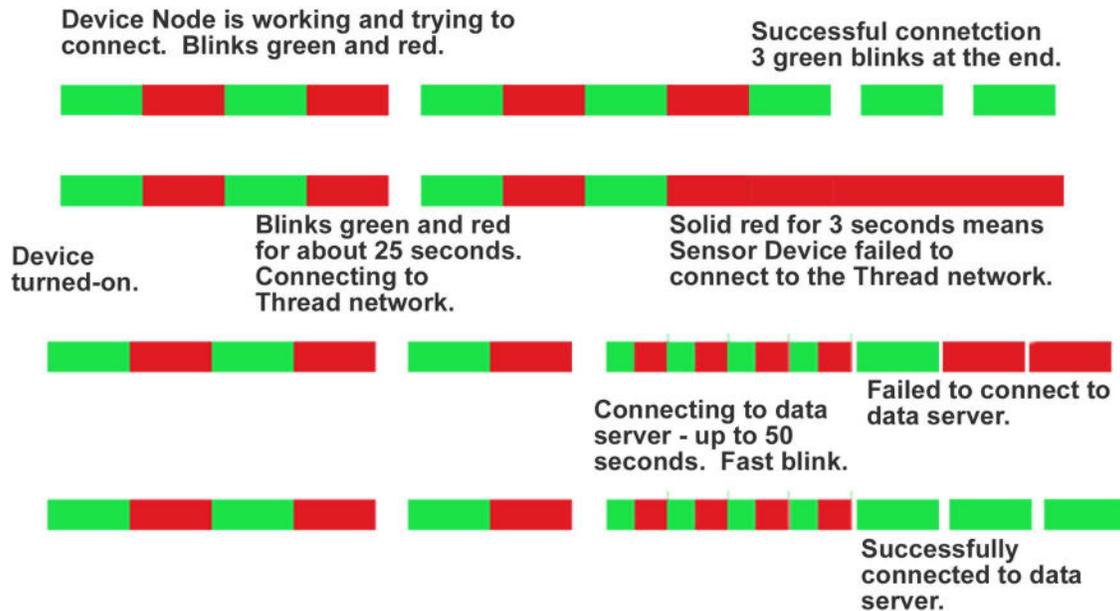


Figure 5: Sensor Device Node Power-On LED Sequence

2.2.4.1 Troubleshooting Device Node to Gateway Connection

- LED does not turn-on at all when the power switch is depressed.
 - Check batteries.
- Fails to connect to the Thread Network.
 - Check antennas on gateway are attached properly and are tight.
 - Verify 2 green LEDs on gateway – indicating that it is running. Check power connection if there are not 2 green LEDs.
- Fails to connect to the data server.
 - Cellular gateways – move the gateway to a location where it will get a better cellular signal.
 - Check ethernet connections on Ethernet connected gateways.

2.2.5 Forcing a Transmit from Sensor Device Node to Gateway

- On each device, turn-off the power switch – then turn it back on. This will force the device to transmit to the gateway.
- To verify that the gateway and software received the transmission from the device, check the “Last Communicated” time to verify that a message was just received. See the graphic below.

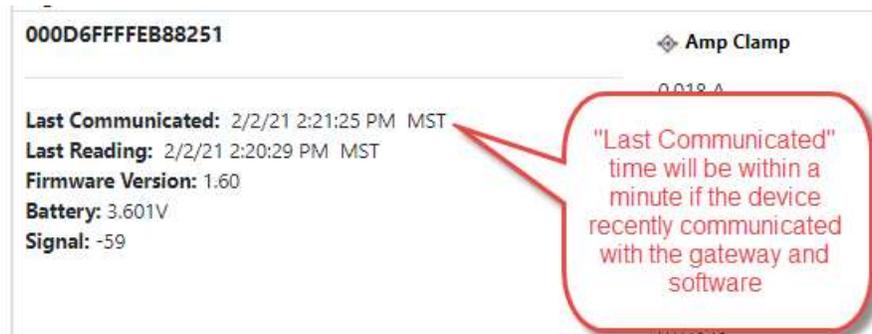


Figure 6: Last Communicated Timestamp

2.2.6 Getting Started – User Administration - Set User Rights

- Use the information from the included log-in sheet to log into the Leap Web Interface as the default administrative user.
 - **Recommended Action:** Change the admin password to a new one by using the “User Administration” tab.
 - New users may also be added using this screen.
 - Only Administrators will have full rights to change all settings.

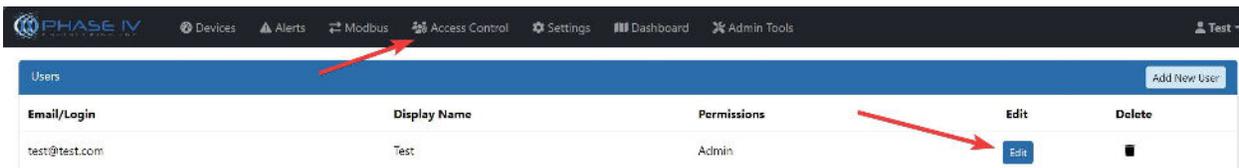


Figure 7: The Access Control Tab

- Once logged in, click on “Devices” to go to the main screen.
- Turn the power switches on the sensor device ON to have the sensor start communicating with the Gateway and software.
 - Verify that the sensor is communicating with the Gateway by looking at the “Last Communicated” time.



Figure 8: The time Sensor 50325FFFFEE6C024 Last Communicated with its Gateway

2.2.7 When “Last Communicated” Time is Different from “Last Reading” Time

Leap Sensors have the feature of “data logging” time-stamped readings to memory when the wireless communication to the gateway is not established.

If a sensor has a “backlog” of data stored in memory, then when the sensor first connects to the gateway, the oldest data will be sent to the gateway first. In this situation, the “Last Reading” will have an older time and date from the “Last Communicated” reading. It should only take a few minutes for the sensor to send all its logged data to the gateway so that the “Last Communicated” and “Last Reading” times are the same.

2.3 Forcing a Sensor to Sample and Transmit

At any time, you may force a sensor to transmit by turning the power off, waiting 30 seconds, then turning the sensor back on. A new reading should be communicated to the connected Gateway within one minute.

2.4 Setting Sample Time Interval and Transmit Time Interval

Sensors may be configured individually, or as a group. Below we will demonstrate how to adjust how often a sensor takes a sample and how often the sensor sends these samples to its connected Gateway.

To begin, click on the sensors that you want to configure. The sensor will have a blue background when it is selected.

Use the buttons shown below to select or deselect all the sensors for configuration.

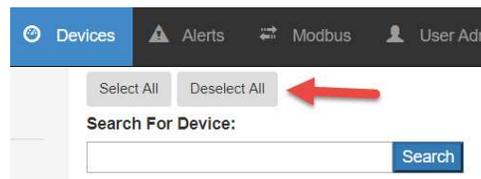


Figure 9: The "Select All" and "Deselect All" buttons

- After selecting the sensor(s) you wish to configure, click on the “**Configure Devices**” button, then click on “**Device Settings**” from the resulting dropdown menu.
 - *Note: Configuring sensors is restricted solely to Administrator users. Non-Administrator users will only be able to view sensor readings and receive sensor notifications.*

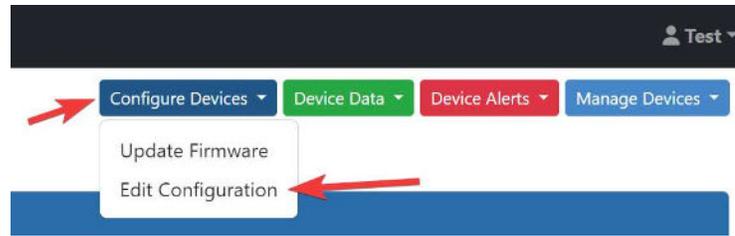


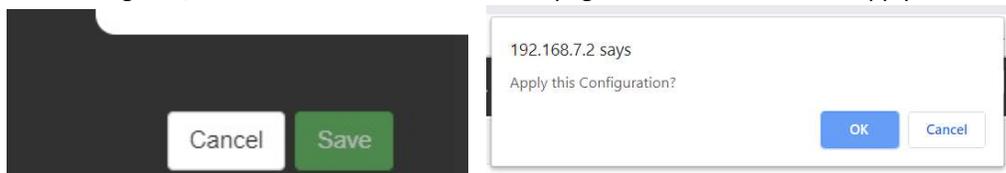
Figure 10: How to Navigate to Device Configuration screen

- Scroll down to the “**Device Timing Intervals**” Section. *Do not change settings in the other sections.*
- Set the Sampling Interval to how often you want the sensor to take a sample.
- Set the Transmit interval to how often you want the sensor to transmit its samples to the Gateway.
 - If the Sample interval is shorter than the Transmit interval, the samples will be stored in the sensors memory and transmitted normally at the next Transmit interval. Only the latest reading from the device will be shown on the Leap Web Interface, but all sensor readings will be stored and available on the Gateway.



Figure 11: The "Device Timing Intervals" section of our Device Settings. Allows you to configure how often the Sensor takes new samples and transmits them back to the Gateway

- Once configured, scroll down to the bottom of the page and click on “**Save**” to apply the new settings.



- Click “**OK**” when asked if you want to apply this configuration.

- The new settings will be applied the next time the sensor communicates with the Gateway. On the “**Devices**” screen, the sensor will show “**Configuration Pending**” while the new configuration is waiting to be applied.



Figure 12: "Configuration Pending" message appears after changes pushed to the Sensor

- Typically new configurations will be applied during the next Transmit interval. However, to force the sensor to “update now”, you can turn the sensor off, wait 30 seconds, then turn it back on to force the sensor to transmit. The sensor will always transmit when first turned-on.

2.5 Changing Sensor Names

To change a sensor name, click in the name field of the sensor you which to change in the “**Devices**” tab. This will allow you to enter a new name in this field. When complete, click the green “Check Mark” button to save your entry. It is recommended to leave the serial number of the device in the name, however the default sensor name can always be restored by pressing the Blue “Reset” button.

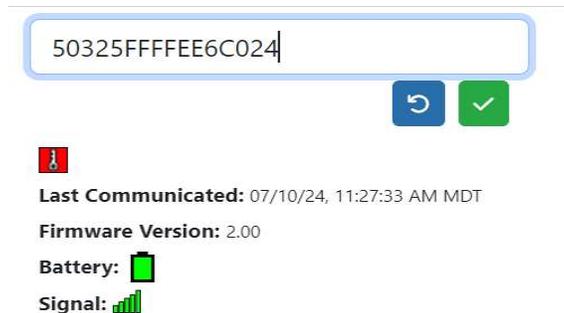


Figure 13: Text Field allowing modification of Sensor name

Note: When the sensor name is changed, the Name and device ID will be included in the data that is downloaded to a CSV file. (See section 5 for details on downloading data.) See the example below:



Figure 14: Name Change on Device Group

Sensor name will be in column “B” when the data is downloaded. The Device ID will always be remembered by the sensor and will be displayed in Column “A”.

| | A | B | C | D | E | F |
|----|------------------|------------------|-------------------------|--------------------------|-------------|--------------|
| 1 | DeviceId | Name | Reading Timestamp (MDT) | Received Timestamp (MDT) | Temperature | Humidity (%) |
| 2 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:00 | 4/22/2020 0:05 | 21.87 | 25 |
| 3 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:05 | 4/22/2020 0:20 | 21.85 | 25 |
| 4 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:10 | 4/22/2020 0:20 | 21.86 | 25 |
| 5 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:15 | 4/22/2020 0:20 | 21.85 | 25 |
| 6 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:20 | 4/22/2020 0:35 | 21.82 | 25 |
| 7 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:25 | 4/22/2020 0:35 | 21.82 | 25 |
| 8 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:30 | 4/22/2020 0:35 | 21.8 | 24 |
| 9 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:35 | 4/22/2020 0:50 | 21.79 | 24 |
| 10 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:40 | 4/22/2020 0:50 | 21.8 | 24 |
| 11 | 90FD9FFFFEADAC5D | Storage Room 321 | 4/22/2020 0:45 | 4/22/2020 0:50 | 21.78 | 24 |

Figure 15: Name Change in Excel Data Download File

2.6 Sensor Data Time Stamp Displayed in the User Software

All the times from sensor readings are stored in the database in UTC Time. When displayed on the User Interface software, the browser gets the time zone from your computer and displays the times in the time zone that is set on your computer.

3. System Overview

3.1 System Components

The following sections give a brief description of each component of the system.

3.1.1 Hardware Components

The following hardware components make up the system.

| Component | Description |
|-----------|---|
| Device | Wireless transmitter node with leads extending from housing. Used to take samples. |
| Gateway | Contains database with sensor information and sensor readings. It hosts Leap Sensor Manager interface for data access and system configuration. |

Table 1 – Hardware Components in the Leap Wireless Sensor System

3.2 System Memory – Sensor Data Log and Gateway Database

The Gateway database will hold approximately 1 million individual sensor readings.

A single sensor will hold at least 15,000 data log entries, each containing 1-2 sensor readings.

Both the sensor and the database will over-write the oldest readings with the newest readings when the memory is filled.

3.3 Software Components

Instead of installing software on the PC, the system uses a web interface accessible by Mozilla Firefox, Microsoft Edge, and Google Chrome. In general, the Leap Web Interface described in this document is used to install, configure, and view all data within a Leap Wireless Sensor System.

4. Detailed System Information

4.1 *Resetting the Gateway to Defaults*

Please contact Phase IV Engineering Customer Service before resetting the Gateway.

Reset Gateway to Factory Defaults – This option is only displayed when connecting to the Gateway through a USB cable and not available when connecting through Ethernet or Wi-Fi. The “Reset Gateway to Factory Defaults” action will perform the following actions and should only be performed if there is a problem.

1. Permanently delete all device information and sensor readings.
2. Delete all configured ‘notifications’ and ‘alerts’.
3. Delete all users except for ‘admin’.
4. Reset the ‘admin’ password back to the factory default value.



Figure 16: "Reset Gateway to Factory Defaults" button on Initial Gateway Login Page

4.2 *Device Data Logging – When out of Range of the Gateway*

The device will continue to operate when out of range of the Gateway. When out of range of the Gateway, the device will store time-stamped sensor data to memory. When the device gets back in-range of the Gateway, the data will automatically be downloaded once communication is established.

4.3 *Devices Tab*

The “**Devices**” tab will display information about each sensor device as well as the last sensor value received. If a device sends new data to the Gateway, the screen will automatically display the latest reading from the device, there is no need to ‘refresh’ the page. Devices that have a high sampling rate (less than 15 seconds) may have a slight delay in updating the latest values.

The “Devices” screen has the controls and data items shown in

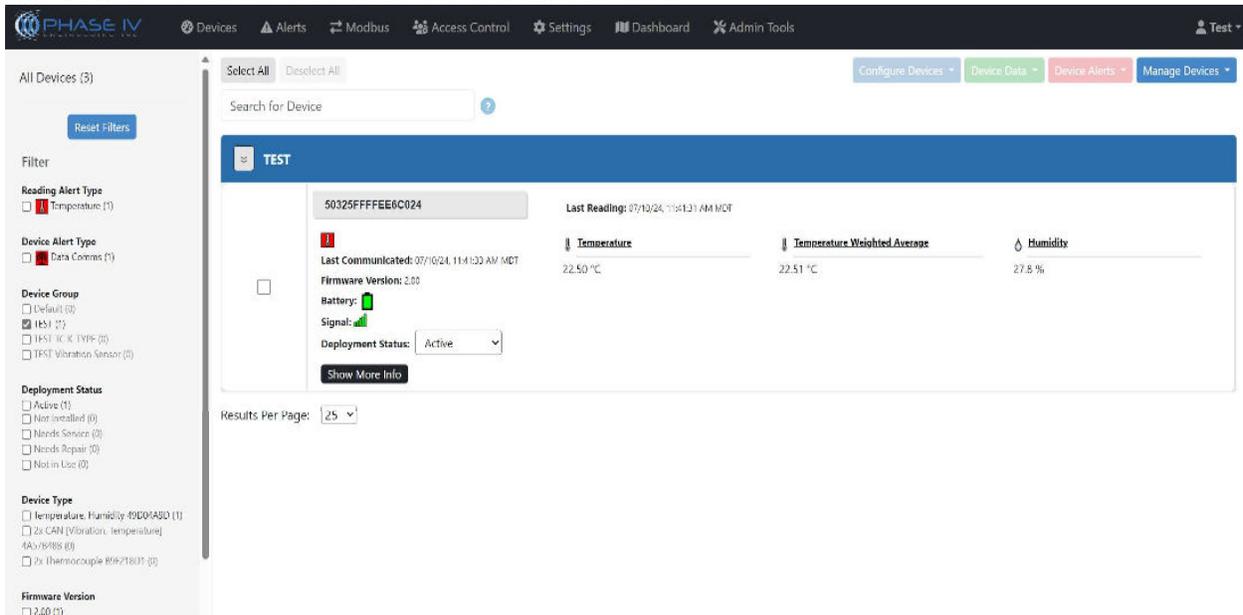


FIGURE 17: EACH COMPONENT of the Device Data Display

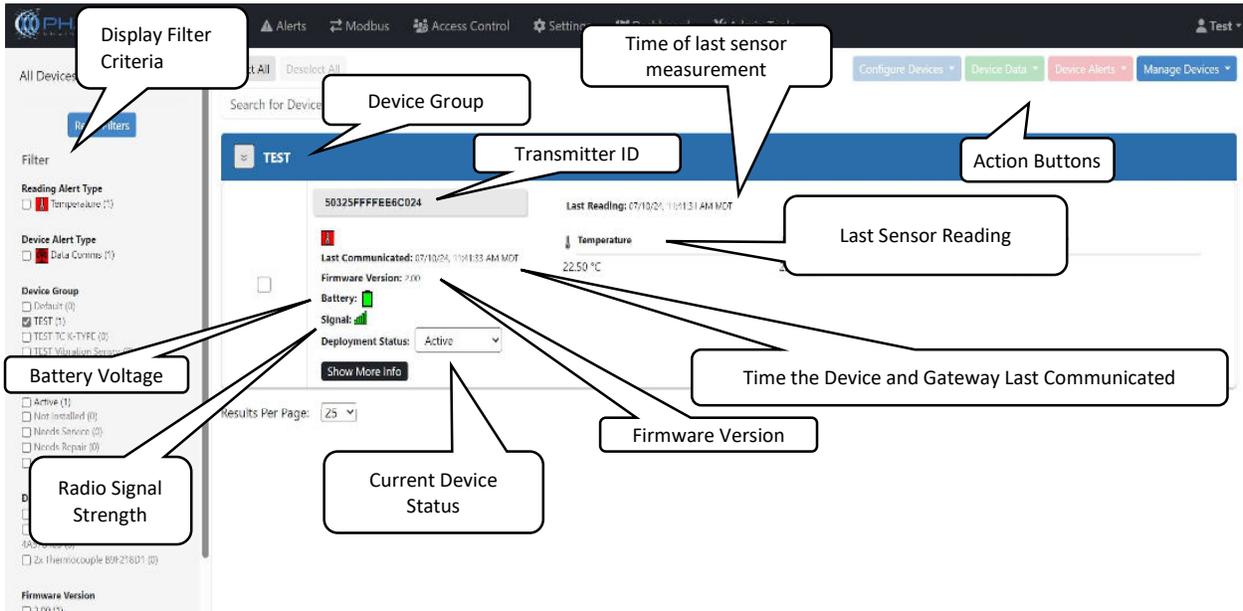


Figure 17: Each Component of the Device Data Display

4.3.1 Sort by Display Filter

This area allows you to ‘filter’ the list of displayed sensors based on what you would like to see. Many systems can contain hundreds of sensor devices, so being able to filter what is shown in the “Devices” tab can be useful. The criteria list is updated automatically depending on the sensors connected to the Gateway and what filters have already been applied.

Reading Alert Type – Allows viewing of multiple devices that have the same type of Active Sensor Reading Alerts configured, even if devices are within different groups. These alerts include Inactivity Alert, and Low Battery Alert

Device Alert Type – Lets you view all devices with the same active sensor specific device alerts configured, regardless of which “Group” the sensor lives in

Device Group – Devices can be arranged logically by the user into “Groups”, where all members of a group share some common trait defined by the user. For more info on Groups, see section 5.4 DEVICE GROUP.

Device Type – There are a large variety of device types in the Leap product family. Each device has its own definition of settings and sensor interfaces. This filter allows you to select only the types of devices you wish to see now.

Deployment Status – Every node has a deployment status which can be set depending on the status on-site. This status can be changed at will, and devices with the same status can be filtered and shown together.

Firmware Version – Allows you to sort by the current firmware version of each device. This can be helpful when deciding which devices to upgrade during a firmware upgrade (see 4.3.6 - UPDATE DEVICE FIRMWARE)

4.3.2 Device Information and Re-Naming Devices

Each device in the system will display the following information fields:

Transmitter ID – The unique ID of the device. By “clicking” on the unique ID, you can assign your own “display name” for the device that will be displayed rather than the unique ID. After editing the ID, click the  button to save the new value. You can revert the name back to the original unique ID again by starting to edit the field, then clicking the  button.

- **Last Communicated** - This value shows the last time that the device had radio communication with the Gateway.
- **Last Sensor Reading** – The value of each sensor interface of the sensor at the time the last measurement was recorded.
- **Firmware Version** – The current firmware version running on the device. To upgrade to a newer firmware version, see the section 4.3.6 UPDATE DEVICE FIRMWARE.
- **Battery** – The latest recorded battery voltage of the device. The battery voltage is measured at the same time the sensor takes a sample.
- **Signal** – Gives a relative signal quality indicator between the device and the gateway. Values closer to “0” are stronger (i.e. -34 is better than -94).

4.3.2.1 Time Differences between Last Sensor Reading and Last Communicated Times

Because the software allows the transmit interval and the sampling interval to be different, the sampled readings are stored in memory – and then transmitted at the next transmit interval. In the user display, there may be a time difference between the “Last Communicated” and “Last Reading” times.

4.3.2.2 Good Signal Level

A good wireless signal level can be affected may many factors.

A general guideline is that the signal is typically lost when it is below -85 to -90.

In most environments, a signal strength higher than -70 is considered good.

To determine if each sensor has a reliable signal strength, the data from a sensor can be downloaded and the “Reading Timestamp” can be compared to the “Received Timestamp”. Assuming the sample and transmit settings are the same for the sensor, then a sensor with a good signal strength should have the same times for every reading – indicating that every transmission is being received.

4.3.3 Action Buttons

The action buttons are a group of buttons that allow the user to execute tasks that affect the functioning of the devices and gateway, as well as manage the data for each sensor device.

4.3.4 Selecting Devices to Perform Actions On

To execute any of the action buttons relating to the sensor devices, you must first ‘**Select**’ the device you wish to perform the action on. To select a device, you just ‘click’ on the containing square showing the information for the desired device. When selected, the containing box will change its background color to a light blue. You can select multiple devices at a time by simply clicking more devices. shows an example of a selected and unselected device. To unselect a device, just click the selected device again, and the background will turn white.

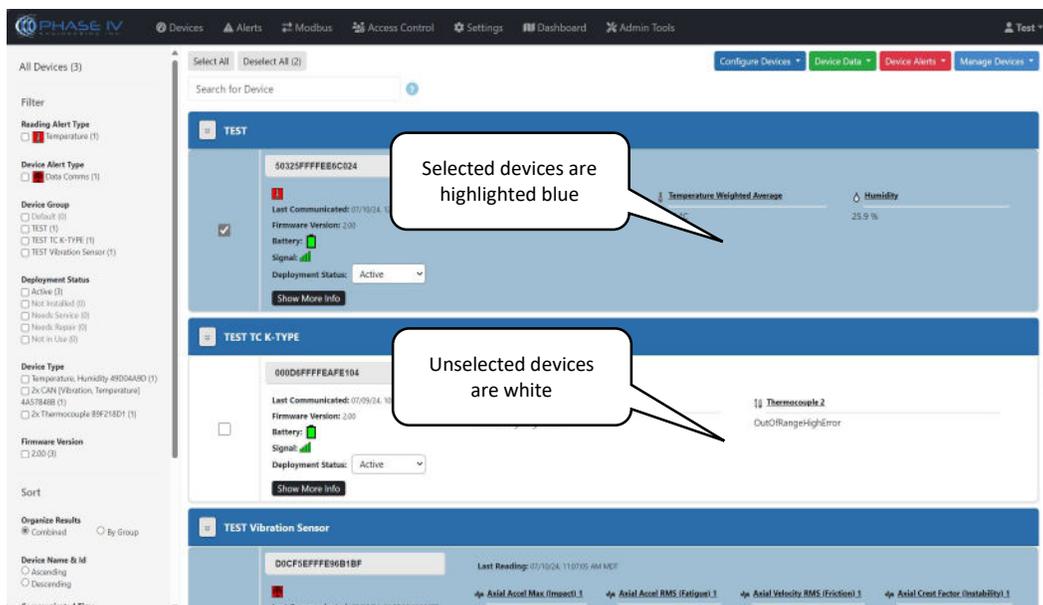
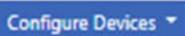


Figure 18: Device Selection

To select all devices at one time within the filtered list, click the “**Select All**” button ().

To deselect all devices, click the “**Deselect All**” button () (Note: this button is only enabled if at least one device is currently selected).

4.3.5 Configure Devices Button



All operations in the “**Configure Devices**” action apply to any device that is currently selected. The two operations available are “**Update Firmware**” and “**Edit Configuration**”.

4.3.6 Update Device Firmware

From time to time, new firmware packages are released for devices that add functionality or fix bugs for a Leap device. These firmware upgrades will be delivered by Phase IV Engineering in the form of a zip file. Firmware

packages are specific to the sensor devices they are designed for, so please take care to follow the instructions from Phase IV on what firmware should be sent to a specific device.

NOTE: Do not open or try to un-zip the zipped file. The zipped firmware update file will be loaded into the software as a zip file.

Before using the “**Update Device Firmware**” action, only select devices that share a common “**Device Type**”. This allows upgrading devices in ‘bulk’ in one easy step, rather than individually upgrading them.

You can ensure you only select devices of a common type by using the “**Sort By**” filter on the left sidebar of the Leap Web Interface. It is also not necessary to upgrade devices that are already at the current version you are upgrading to, as it is just a waste of battery power. The “**Sort By**” filters can help in ensuring this when used in conjunction with the “**Firmware Version**” filter.

Select the “**Update Firmware**” option from the “**Configure Devices**” button to display the “**Update Device Firmware**” window (ERROR! REFERENCE SOURCE NOT FOUND.). The firmware upgrade will apply to all currently selected devices (assuming they are all the type “**Device Type**”).

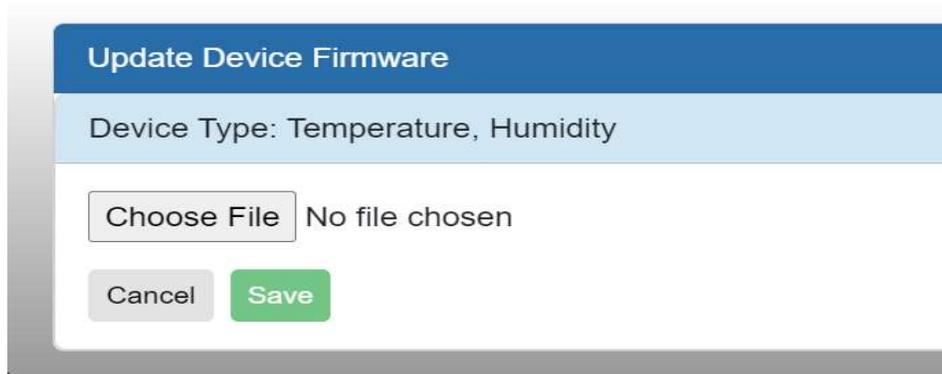


Figure 18: Firmware Upgrade Window

Use the “**Choose File**” button to browse on your computer to the appropriate zip file provided by the manufacturer, then click the “**Save**” button to start the upgrade process.

After processing the file, the gateway will set a flag within the database that will tell the device to download the firmware from the gateway upon the next communication. The device information window will then show a “**Firmware Pending**” message until the upgrade has been successful, as shown below. When the upgrade is complete, the “**Firmware Pending**” message will disappear, and the “**Firmware Version**” field will be updated.

| Lab Demo | | | | |
|--|------------|--------------------|------------------|----------|
| 000D6FFFEB88313 | Gate Angle | Bell Max Amplitude | Bell Strike Rate | 1 ON |
| Firmware Pending | 77 ° | 0 dB | 0 /min | 644 ms |
| Last Communicated: 5/14/19 11:35:33 AM | 1 OFF | 2 ON | 2 OFF | 3 ON |
| Last Reading: 5/14/19 11:13:58 AM | 686 ms | 0 ms | 16974 ms | 0 ms |
| Firmware Version: 0.04 | 3 OFF | 4 ON | 4 OFF | 5 ON |
| Battery: 0V | 16974 ms | 0 ms | 16974 ms | 16974 ms |
| Signal: -50 | | | | |

Figure 19: Firmware Pending Message

When attempting to update firmware, the application may populate the window “**Invalid firmware uploaded for devices**”. Please verify that the file you are attempting to upload matches the expected node Device Type, as uploading the incorrect firmware can cause issues with your equipment. If the Device Type and Firmware match, go to: **Settings > General Settings > Safe Firmware Upgrades > Change Settings**. Deselect “**Safe Firmware Upgrades Enabled**” and hit **Save**. Attempt the firmware update once more, and this should allow the file to upload properly, regardless of the failsafe in place.

NOTE!

Depending on how often the device is configured to communicate and how good the communication path is to the Gateway, the firmware upgrade to the device may take several minutes to complete. In some cases, it can take over an hour. If the “**Firmware Pending**” is still displayed after several hours, it may be necessary to power cycle the device to force it to communicate to the Gateway.

4.3.7 Configure Device Settings

Before using the “**Configure Devices**” item, only select devices that share a common “**Device Type**”. This allows configuration of devices in ‘bulk’ with the same configuration in one easy step, rather than individually configuring them. You can easily ensure this by using the “**Sort By**” filter located in the left sidebar of the web interface on the main “**Devices**” tab.

Each Device Type will define its own specific set of device settings, but all devices have a group of common configuration categories.

Device Information – Displays the Product Name, Product Part Number and Hardware Revision.

Device Timing Intervals – Used for configuring how often data is taken and transmitted.

- **Transmit Interval** - How often the device will communicate to the Gateway to transfer samples, download new configuration, and download new firmware. If communication is not successful on the transmit interval, the device will use the slower “Gateway Search Interval” (Thread networks only) until communication is re-established.
- **Sampling Interval** - How often the sensor device will measure each of its attached interfaces and store the result to the sensors local storage.

Device Operation (Typically not changed) – Shows configuration related to the device operation.

- **Storage Mode** – Determines what the device should do if the stored sensor readings fill up the data log of the device. The two options are:
 - **Overwrite** – Writes over the oldest reading in the log and replaces it with the newest sample (default).
 - **Stop when full** – No more data samples are taken until space becomes available in the data log via communication with the gateway.
- **Device Mode** – Determines what mode the device is current operating in. The options are:
 - **Run** – The device will take sensor measurements on the designated “Sampling Interval”, then transfer those samples on the “Transmit Interval” (default).

- Idle – No sensor measurements are taken, but the device will still communicate on the “Transmit Interval” to the gateway.

Sensor Options – This section allows the user to set specific offsets to sensor specific values depending on device on-site configuration and conditions.

System Options –

Communication Options (Factory Configured – Do not Change!) – Determines the radio communication parameters that the device will use to communicate to a Gateway. There are currently two supported communication modes and these modes come pre-configured in a device and cannot be changed.

Option 1- Cellular Communication – Cellular communication is used for devices where there is no ‘local’ Gateway, but instead will communicate over a cellular network and upload readings to a cloud server running the same software as a Gateway.

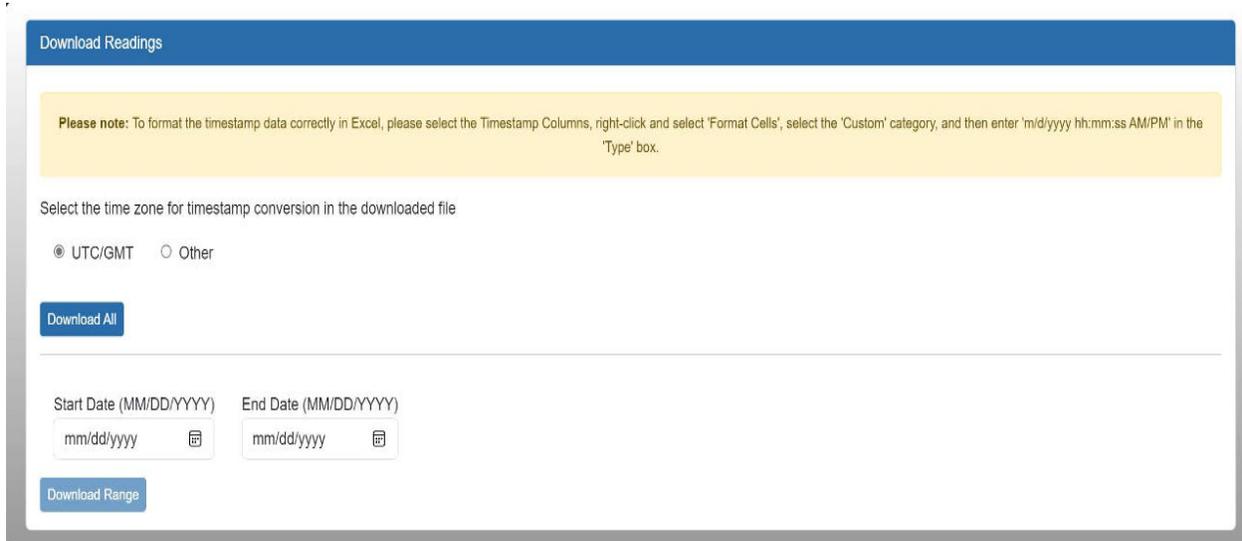
Option 2 – Thread Network – A Thread network is a short range (less than 1 mile) wireless communication protocol for 2.4GHz radios. Most Leap sensors use the Thread Network option. The following parameters are available for Thread:

- Gateway Search Interval – Determines how often the sensor should attempt communication if radio contact has been lost. For example, if a sensor is unable to communicate with a Gateway on the normal “Transmit Interval” (see Intervals section below), it will wait for the Gateway Search Interval before communication is attempted again. This is a power saving feature so that a device will not try and frequently communicate with a Gateway that is not there. Once communication is re-established, the sensor will then communicate on the “Transmit Interval” time as normal.
- Thread Network Parameters – These settings include Radio Channel, Network ID, Pan ID, ULA Prefix, Extended Pan ID, Network Key, Fallback Channel Mask and Radio Power Level. In general, these setting should not be modified from the user interface, as they are all automatically configured when the sensor joins the Thread network. If any of these settings are changed, the sensor may stop communicating on the network and will have to re-join.

5. Operating the Wireless Sensor System

5.1 Download Readings

Exporting data from the Gateway or server to a local PC is possible with the “**Download Readings**” action under the “**Device Data**” button. First, select the list of devices you wish to download data from. Then, click “**Download Readings**” from the “**Device Data**” button. The Download Readings window will appear as shown below ([ERROR! REFERENCE SOURCE NOT FOUND.](#)).



Download Readings

Please note: To format the timestamp data correctly in Excel, please select the Timestamp Columns, right-click and select 'Format Cells', select the 'Custom' category, and then enter 'm/d/yyyy hh:mm:ss AM/PM' in the 'Type' box.

Select the time zone for timestamp conversion in the downloaded file

UTC/GMT Other

Download All

Start Date (MM/DD/YYYY) End Date (MM/DD/YYYY)

mm/dd/yyyy mm/dd/yyyy

Download Range

Figure 20: Download Readings Window

Edit the date range you want to download data from, then click the “**Download Range**” button, or select “**Download All**” to download all the data available for the selected device(s). A Comma Separated Values file (csv) file will be generated and will be saved by the web browser (like downloading any file on the internet) to the default ‘downloads’ folder of your web browser.

If you wish to view the downloaded CSV file in Microsoft Excel, just double click on the file from your filesystem. Excel will open the file.

NOTE: Times and dates in the spreadsheet are displayed in the time zone specified when downloading the data (UTC is default, or you can choose “Other” and specify a time zone).

| DeviceId | Reading Timestamp (UTC) | Received Timestamp (UTC) | Temperature (°C) |
|------------------|-------------------------|--------------------------|------------------|
| 90FD9FFFFEADAC58 | 3/1/2019 17:19 | 3/1/2019 23:24 | 23.43 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:24 | 3/1/2019 23:24 | 23.34 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:29 | 3/1/2019 23:24 | 23.13 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:34 | 3/1/2019 23:24 | 23.53 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:39 | 3/1/2019 23:24 | 23.01 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:44 | 3/1/2019 23:24 | 23.97 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:49 | 3/1/2019 23:24 | 24.53 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:54 | 3/1/2019 23:24 | 24.78 |
| 90FD9FFFFEADAC58 | 3/1/2019 17:59 | 3/1/2019 23:24 | 24.83 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:04 | 3/1/2019 23:24 | 24.57 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:09 | 3/1/2019 23:24 | 24.3 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:14 | 3/1/2019 23:24 | 24 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:19 | 3/1/2019 23:24 | 24.16 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:24 | 3/1/2019 23:24 | 24.48 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:29 | 3/1/2019 23:24 | 24.89 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:34 | 3/1/2019 23:24 | 25.25 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:39 | 3/1/2019 23:24 | 25.67 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:44 | 3/1/2019 23:24 | 26.1 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:49 | 3/1/2019 23:24 | 26.46 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:54 | 3/1/2019 23:24 | 26.82 |
| 90FD9FFFFEADAC58 | 3/1/2019 18:59 | 3/1/2019 23:25 | 27.18 |

Figure 21: Dates and Times are displayed in the time zone specified when downloading the data. The time zone used for the data is also present at the end of the "Reading Timestamp" and "Received Timestamp" columns in the spreadsheet.

5.1.1 Steps to Display Seconds with Time Stamp Data in Excel Spreadsheets

By default, Excel does not display the seconds in the time stamps in the "Reading Timestamp" and "Received Timestamp" columns. To force Excel to show the seconds, follow these steps:

1. Right-click on a cell with a time stamp – such as cell B2 above.
2. Click on "Format Cells", then "Custom" under the "Category" area.
3. Modify the fields as shown in [FIGURE 17](#).

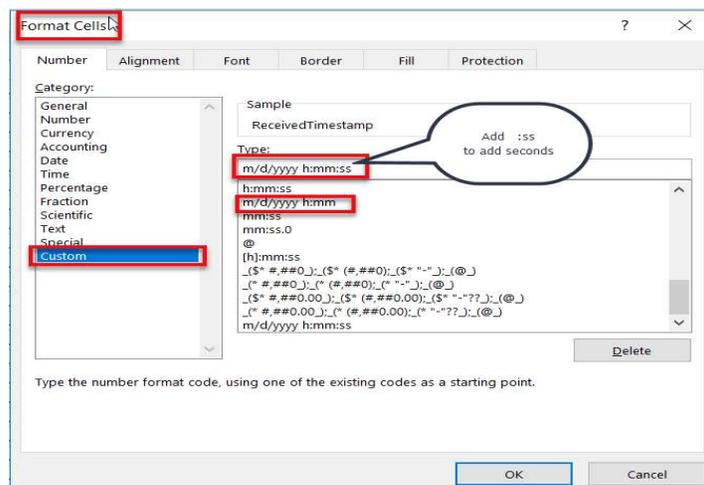


Figure 22: How to Display Seconds with Timestamps within Excel

4. Finally, use the  **Format Painter** tool to apply this to each column with a time stamp.

5.2 Clear Readings

To remove sensor measurements from the database in the Gateway, first select the devices you wish to clear (delete) data from, then click **Device Data** → **Delete Data**. The “**Clear Data**” window will appear.

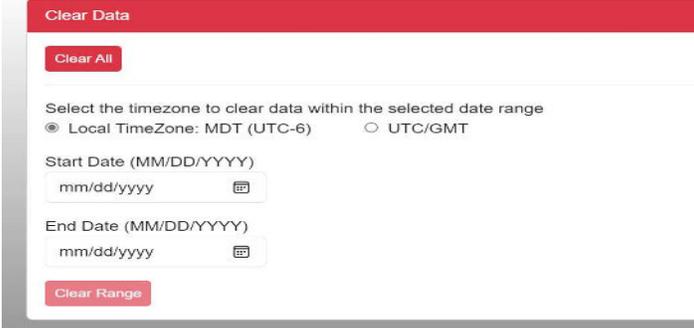


Figure 23: Clear Data Window

Select a date range of data you wish to clear, then click “**Clear Range**”, or delete all readings by clicking the “**Clear All**” button. When prompted to verify you want to clear the readings **permanently**, click “**OK**”.

5.3 Alerts Button

 Device Alerts ▾

5.3.1 Create Alert

Alerts are used to tell users that a sensor measurement was outside of a defined threshold by showing an indicator in the interface. The Leap System also can proactively notify the user if a reading is outside threshold via text/SMS, email, and telephone. Notifications are only available with systems that are purchased with those options activated.

To create an alert condition for a device, or group of devices, select the devices you wish the alert to apply to, then click the “**Device Alerts**” button (**not** the Alerts tab), and select the “**Create Alert/Notification**” option. To edit an existing alert, refer to section (5.4 – MODIFYING AN EXISTING ALERT CONFIGURATION) below.

The “**Device Alerts**” window will appear ([ERROR! REFERENCE SOURCE NOT FOUND. ON FOLLOWING PAGE](#))

Create Alert/Notification

Alert Devices

Product Name: Temperature, Humidity
Device Group: TEST
 Apply to all Temperature, Humidity devices that are assigned to TEST ?

Alert on Devices

50325FFFFEE6C024

List of Available Devices in Group

Alert Criteria

Alert on: Temperature **Threshold:** Equal To °C (*Required)

Trigger alert after a single reading matches alert criteria.
 Trigger alert after a selected number of consecutive readings match alert criteria.
 Trigger alert after a percent of readings match alert criteria over a selected time period.
 Also trigger alert on sensor error.

Time Settings

Time Zone
(UTC-07:00) Mountain Time (Denver)

Alert will only be active between:
 Start Time: --:--:-- ⌵ End Time: --:--:-- ⌵ Clear
Leaving these blank means alert is always active.

Alert Notifications

Number of Notifications: 10 ?

| User | Click to enable: | ✉ Email | 📱 Text | 📞 Phone |
|------|------------------|---------|--------|---------|
| Test | | ✉ | | |

Alert Information

Alert Subject (*Required) ?

Alert Message (*Required) ?

Alert Color

Timestamps in Alert Notifications will be in the America/Denver Time Zone.

Cancel
Save Alert

Figure 24: Device Alerts Window

Fill in the appropriate fields, then click **“Save Alert”** at the bottom of the screen. You can apply the alert to every sensor device within a Device Group by selecting the **“Apply to all devices that are assigned to this group”** option. To notify users of a triggered alert, click on the Email/Text/Phone symbol next to the user you want to enable notifications for. If the symbol is blue, the notification is active. You can simply toggle the notifications on/off by selecting and deselecting the notification symbols. (See next page for Create Alert/Notification Interface)

Include customization of max number of alerts per device here

You can input the text you would like to see when the notification is sent. The Alert Subject allows for configuration of the subject line of the message and the Alert Message fields allows you to configure the body of the message.

NOTE!

You will need to define a group for the device you want to setup an alert on. To setup a Device Group, select the device(s) that you want to include and click **Manage Devices → Group Devices**. Specify a name for the new Device Group and click **“Add to New Group”**. When you return to the Devices tab, you will be able to select the sensor and apply an alert as described above. See the section 5.4 DEVICE GROUP for more information.

After an alert notification has been assigned, each new incoming measurement will be compared against the alert threshold. If the value exceeds the threshold, an alert notification will be displayed on the main **“Devices”** page, as shown below in **FIGURE 20** and if enabled, the previously configured text/email/voice notifications will be sent out to the designated users. The criteria in which an alert will trigger can be configured in multiple ways.

- Trigger alert after a single reading matches alert criteria.
- Trigger alert after a selected number of consecutive readings match alert criteria.
- Trigger alert after a percent of readings match alert criteria over a selected time period.
- Also trigger alert on sensor error.

Figure 25: Alert Trigger Selection

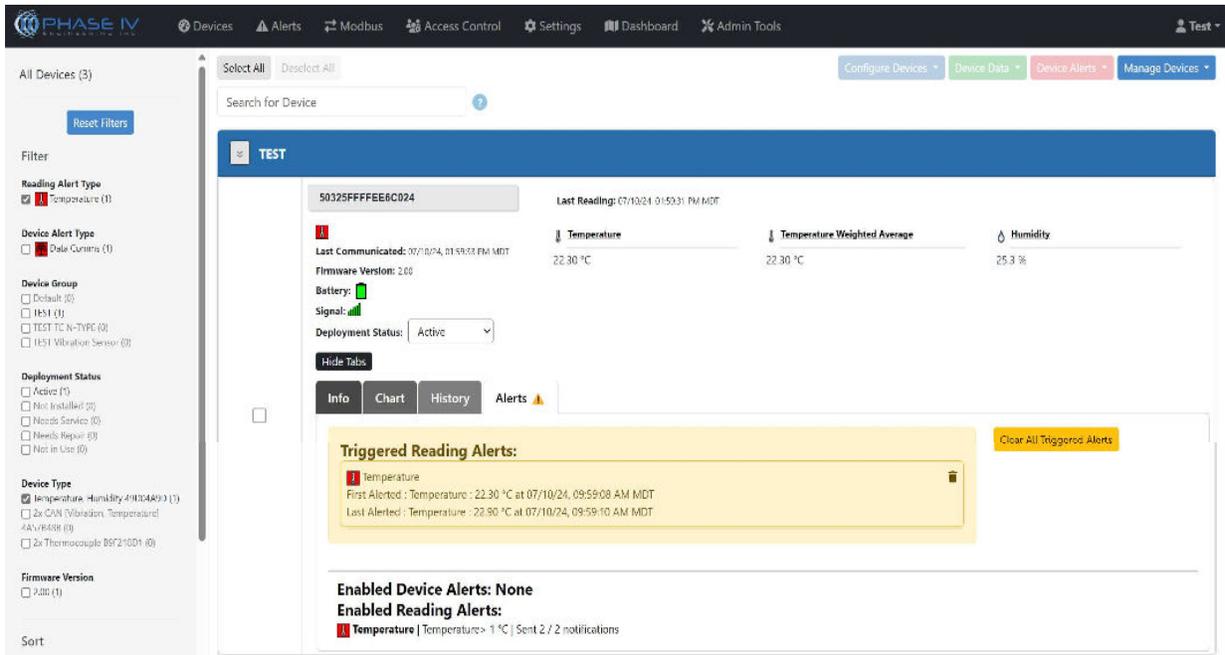


Figure 26: A Temperature Sensor with an "Out of Range Temperature" Alert

To acknowledge that a user has seen the alert condition, click on the **"Show More Info"** link in the device information area, and selecting the devices **"Alerts"** tab. You can click the **"Clear All Triggered Alerts"** button to dismiss the alerts for that device (ERROR! REFERENCE SOURCE NOT FOUND.).

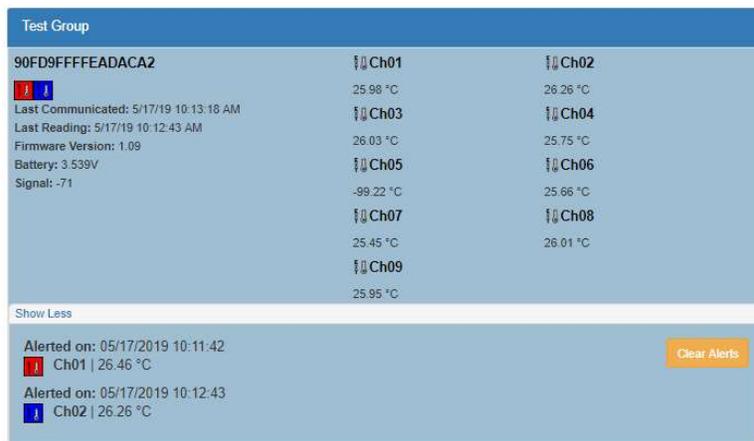


Figure 27: "Show More" Dialog Box

5.3.2 Modifying an Existing Alert Configuration

To modify or delete an existing alert, click the **"Alerts"** tab at the top of the screen. A list of active alerts will be displayed (FIGURE 27 BELOW). Clicking the **"Show More"** link for each alert will display the current alert parameters. To create a new alert, see section 5.3.1 CREATE ALERT.

| Sensor Reading Alerts | | | | |
|---------------------------|-------------------|---------------|------|--------|
| Type | Criteria | Alert Subject | Edit | Delete |
| Temperature | Greater Than 1 °C | Temperature | | |
| Show More | | | | |

| Device Alerts | | | | |
|---------------------------|--|---------------|------|--------|
| Type | Criteria | Alert Subject | Edit | Delete |
| Inactivity Alert | Device misses a transmit for 1 minute. | Data Comms | | |
| Show More | | | | |

Figure 28: Active Alert Configurations

Click the “**Edit**” icon to modify the existing parameters, or the “**Delete**” icon to entirely remove the notification from the system.

5.3.3 Adding Email, Text, and Telephone Notifications

5.3.3.1 Verify Email, Text, and Telephone Notifications are Activated and Working

Alerts can trigger email, text, and telephone notifications if this service is turned-on for your Leap Sensor system. These notifications are sent through the Twilio service. To see if your system has notifications activated, click on “Settings” – then see if the “Twilio Settings” section has account information. If it is not activated and you wish to have this service, please contact the Phase IV sales department.

Always test the email, text, and telephone notifications after they are set. The Twilio service may not work with some phone and email services – especially outside the USA (at this time).

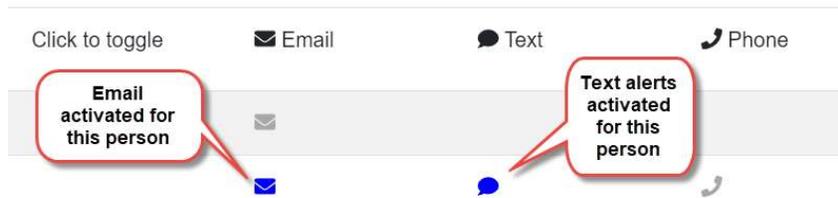
5.3.3.2 Creating an Email, Text, or Telephone Alert – Set-Up People to Receive Alerts

Email, text, and telephone alerts can be sent to Users in the Leap Software. To add a new user or add an email or phone information to an existing user, click on “User Administration”.

5.3.3.3 Creating an Email, Text, or Telephone Alert

Create or edit an alert as described in the previous section.

In the notifications section, click on the email, text, or phone icon to activate the alert. The icon will turn from light grey to blue when it is activated.



In the “Alert” section, type-in the “Alert Subject” Line and “Alert Message”.

NOTE for Telephone Alerts: For telephone alerts, a computer will read the message in the “Alert Message” section.

IMPORTANT: Always test email, text, and telephone messages to assure the message is properly getting to the end user.

5.4 Device Group

Many times, it is useful to organize devices into logical groups. This can be helpful to identify multiple devices location, building name, what they are monitoring, or any other characteristic a device shares with another device. To create a group for one or more devices, select all the devices you want in the group, then click the “**Manage Devices**” button and select “**Group Devices**”. The “**Device Group**” window appears (FIGURE 23).

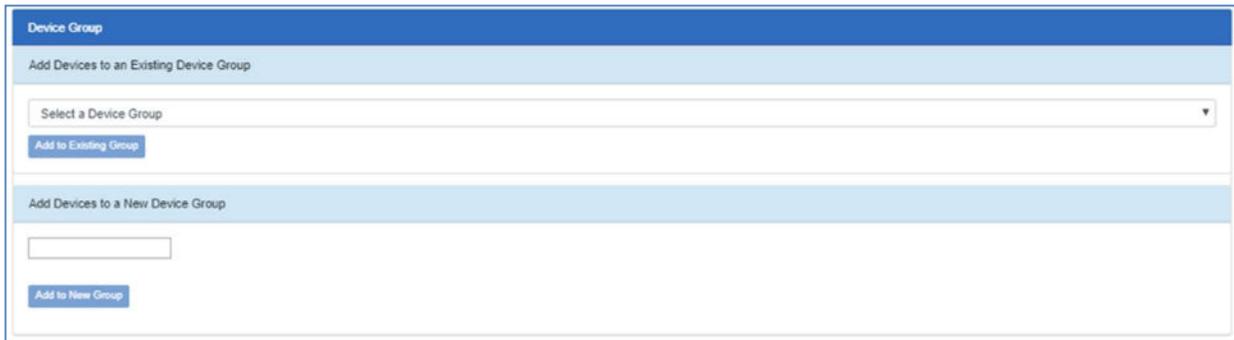


Figure 29: Device Group Window

If you wish to add selected devices to an existing group, click the drop-down menu arrow and select the group you want to add the devices to. Press the “**Add to Existing Group**” button to complete the process.

If you want to create a new group for the selected devices, type a new name into the text entry field, then click the “**Add to New Group**” button. The button will only be enabled if text is entered in the entry field.

When the screen returns to the “**Devices**” page, the devices will be surrounded by a larger box with the group name (SEE FIGURE 29).

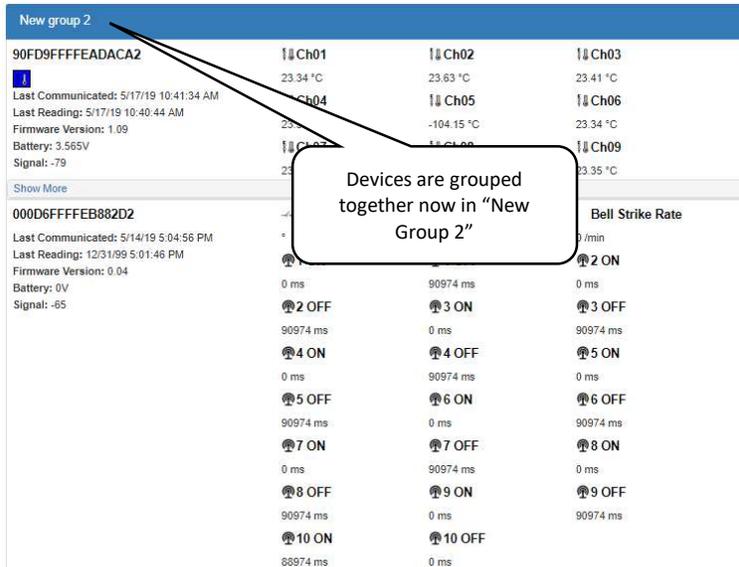


Figure 30: Grouped Devices

5.5 Remove Device

Sometimes you need to replace a device or want to delete all the associated data of a device. Select all the devices you wish to 'batch' delete on the "Devices" tab, then click the "Manage Device" button and select "Remove Device". You will be prompted with a warning that all the data and sensor readings associated with the devices will be **permanently** deleted if you continue. Press "OK" to delete the devices or "Cancel" if you changed your mind.

6. Settings Tab

This tab can be used by an administrator user to configure the Gateway settings and upgrade the system software running on the Gateway. If required, a software upgrade package will be provided by the manufacturer. After starting the upgrade, you may be prompted that the gateway will restart, click “OK”. You should wait several minutes after completion before logging back into the web interface, as this process may take up to 10 minutes.

NOTE!

Upon your next login after an upgrade, push the Ctrl-F5 button to flush your web browsers cache, this will ensure that your web browser gets the most recent version of the web interface from the Gateway.

6.1 Info: Disk Usage

This tells the user how much available disk space is left on the Gateway. As the gateway memory fills with data, the bar will change colors, eventually turning red when critical. If it becomes full, the latest data will over-write the oldest data.

6.2 Info: Current Gateway Time

This display shows the current time set on the Gateway. The Gateway will automatically synchronize its time when connecting to the internet. If no internet connection is available, the Gateway time can be set manually by pushing the “Update Gateway Time” button.

6.3 Networking

The networking page can be used to get and set configuration information about network interfaces such as Ethernet, Wi-Fi (if equipped) or any other configuration that allows the Gateway to communicate with the outside world. Only interfaces that are available in your version of Gateway will be displayed.

6.4 Networking: Ethernet

The Leap Gateway can be configured to be used on almost any Ethernet network in the world. Leap System administrators may need to work with IT professionals to configure the Ethernet settings to be compatible with corporate networks, but for most home and small office setups, the “DHCP” option is likely to work. To enable editing of the Network Settings, click the “**Change Settings**” button in the Ethernet area. Then follow the direction below for the type of configuration you wish to use.

DHCP Configuration

To enable DHCP (Dynamic Host Configuration Protocol), just check the “DHCP” check box, and click “**Save**”. Once enabled, the currently assigned IP Address from the DHCP server will be displayed in the Settings area as shown in {FIGURE 31}

The screenshot shows a web interface for configuring network settings. On the left is a sidebar with a menu containing 'Info', 'Networking' (highlighted), 'Notification Settings', and 'General Settings'. The main content area is titled 'Ethernet' and has a sub-section 'Current Settings'. At the top of this section are two radio buttons: 'DHCP' (which is selected) and 'Static'. Below these are five input fields, each with a label and a text box: 'IP Address:', 'Subnet Mask:', 'Default Gateway:', 'Preferred DNS Server:', and 'Alternate DNS Server:'.

Figure 31: Current DHCP Settings

Static IP Configuration

Select the “Static” check box, then, modify the appropriate network parameters to match the desired network settings, then click the “Save” button to apply the settings to the Gateway.

6.5 Networking: Thread Wireless

Thread settings allow the wireless sensor devices to communicate securely with the Gateway on a private local radio network. In most cases, normal users do not need to modify, or even be aware of these settings. Each Gateway comes pre-configured from the manufacturer with a unique Thread network configuration. This ensures that only sensors that are authorized for that Gateway can communicate on the Thread network.

If a wireless sensor device must travel from one building to another, both Gateways may be configured with the same Thread settings, which will allow the wireless device to communicate with either Gateway (note that the data will only be stored on the Gateway the device is currently communicating with).

To edit the **Thread Settings**, push the “Change Settings” button in the Thread Wireless configuration area as shown below.

The screenshot shows a configuration window titled "Thread Wireless". At the top right of the window is a "Change Settings" button. Below this is a section labeled "Current Settings" which contains five rows of settings, each with a text input field and a question mark icon to its right:

- Radio Channel: 21
- Network ID: p4_74E1828C5EA1
- Pan ID: 0x49E2
- Extended Pan ID: EEF5C247BA2EF7DB
- Network Key: 4EFD7EFA3E777F1DAAE98FC23F3E7BE!

Figure 32: Thread Wireless Settings

NOTE!

If you modify the thread settings of your gateway, existing sensors in the network will not be able to communicate with the Gateway until you 'join' the sensor to the Gateway again.

6.6 Networking: Data Server Location

This section allows you to set the location of a remote data server. These setting will be configured by Phase IV Engineering at system commission and should not need to be altered. To edit the **Data Server Connection String**, press the "Change Settings" button to update the settings and select Save.

6.7 Networking: Cellular Modem Configuration

This section allows you to enable and select your cellular carrier for your Gateway. These setting will be configured by Phase IV Engineering at system commission and should not need to be altered. To edit the **Cellular Modem Configuration**, press the "Change Settings" button and select the desired service. Click Save to update the setting as shown below.

6.8 License & Info - Settings

6.8.1 Updating the Gateway Software

After receiving a “Phase IVApps X.X.X.X gateway XX.upgrade” file from Phase IV Engineering, save the file to a local computer.

Connect the USB cable from your computer to the gateway. Verify the gateway has been powered-on for 3+ minutes.

Login to the software on the gateway by using a web browser and going to the URL address: 192.168.7.2.

User name = admin

Password = <use password printed on the sticker on the underside of the gateway>

Once the software opens...

Click on Setting (on the top black bar)

Click on “License and Info” on the left side-bar.

Click on the “Update Gateway Software” button.

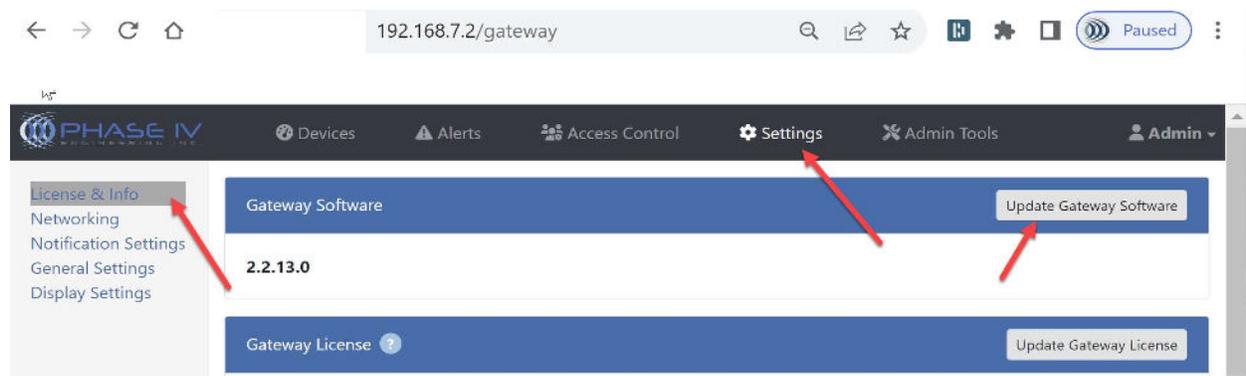


Figure 33: Gateway Software Update Initiation

Load the new “Phase IVApps X.X.X.X gateway XX.upgrade” file as shown below.

Click Save.

You will get a message saying, “The Gateway is updating – this may take a moment...”

Click OK on this message.

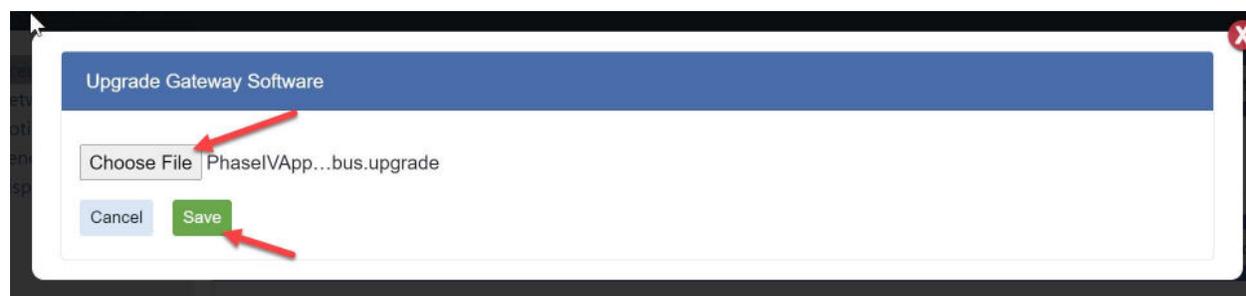


Figure 34: Upgrade Gateway Software Window

You will get a pop-up window saying that the software was uploaded and that you will be returned to the login screen.

Refresh the web browser.

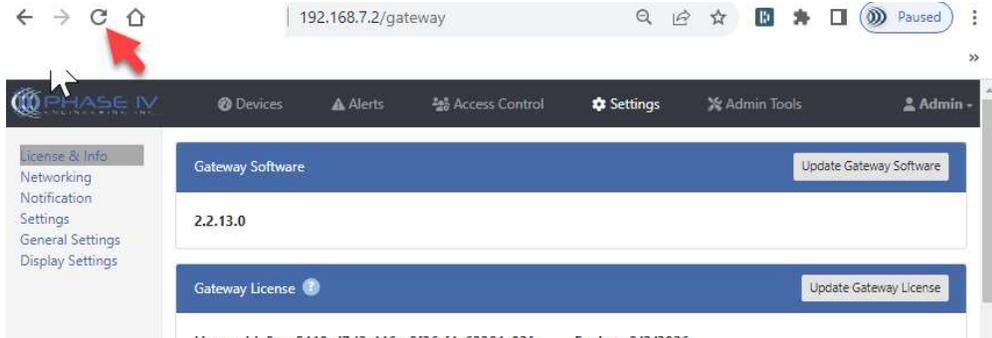


Figure 35: Web Browser Refresh Button

The software may re-start and may require that you login again.

Verify the software has updated by checking that the software revision matches the revision in the “.upgrade” file that was loaded.

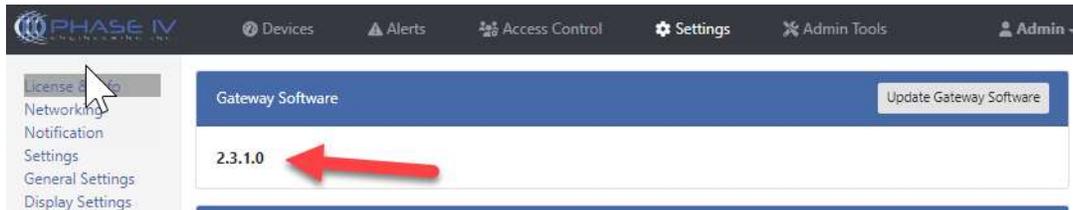


Figure 36: Current Gateway Software Version after Update

6.9 Updating the License File

Connect the USB cable from your computer to the gateway. Verify the gateway has been powered-on for 3+ minutes.

Login to the software on the gateway by using a web browser and going to the URL address: 192.168.7.2.

User name = admin

Password = <use password printed on the sticker on the underside of the gateway>

Once the software opens...

Click on Setting (on the top black bar)

Click on “License and Info” on the left side-bar.

Click on the “Update Gateway Software” button.

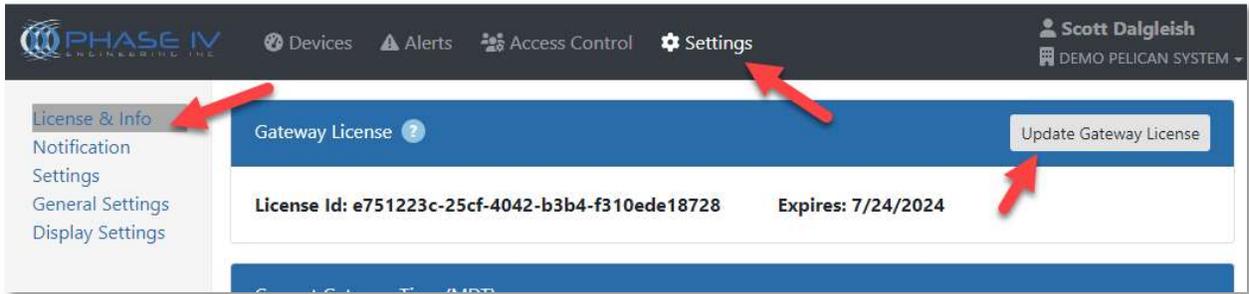


Figure 37: Updating Gateway License

Click on the “Choose File” button and then double click on the new license file that you saved to your computer.

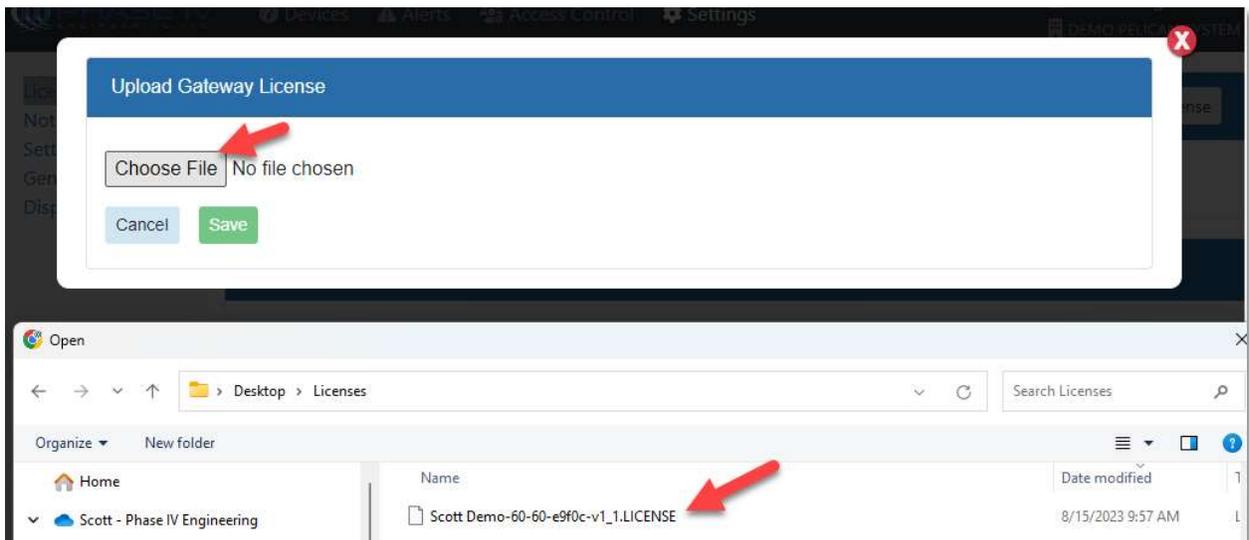


Figure 38: "Upload Gateway License" Window

Click on Save to load the file.



Figure 39: Select "Save" to Upload New License

When asked, “Upload New License?” click on OK.

Close the “Upload Gateway License” window.

Refresh the web page and verify that the expiration data is correct.

7. Battery Replacement

Most Device Nodes use either one 3.6V D-cell battery or two AA alkaline batteries. (A few device nodes use 3.6V C-cell batteries). We recommend purchasing guaranteed-fresh 3.6V batteries from Phase IV Engineering. Tadiran TL-5930/F 3.6V D-cell and C-cell replacement batteries can be purchased on-line.

To open the enclosure, insert a #2 flat blade screwdriver as shown. Press down on the screwdriver, then rotate to the side.

Do not release left side hinge in this manner during battery replacement. Doing so can cause unnecessary strain on internal wiring.



Figure 40: Opening the Enclosure For Battery Replacement

For D-cells:

- Remove the battery cable from the circuit board by pressing the locking tab and removing the connector.
- Remove the battery from the holder and replace the battery.
- Install the battery cable to the board. The connector is polarized and cannot be installed incorrectly.
- Properly dispose of the battery. Never short-out the battery.

8. Dashboard Tab

8.1 Creating New Dashboard

The Dashboard is a modular interface allowing users to view multiple points of data on a single, highly customizable page. The Dashboard is a powerful tool for viewing multiple points of data easily via Charts, Graphs, Tables, and Sensor Specific Widgets.

To create a new dashboard, from the main page, select the **“Dashboard”** tab, click on the Drop Down Menu under **“Viewing”**, and Select **“Create New...”** from the Drop-Down Menu.

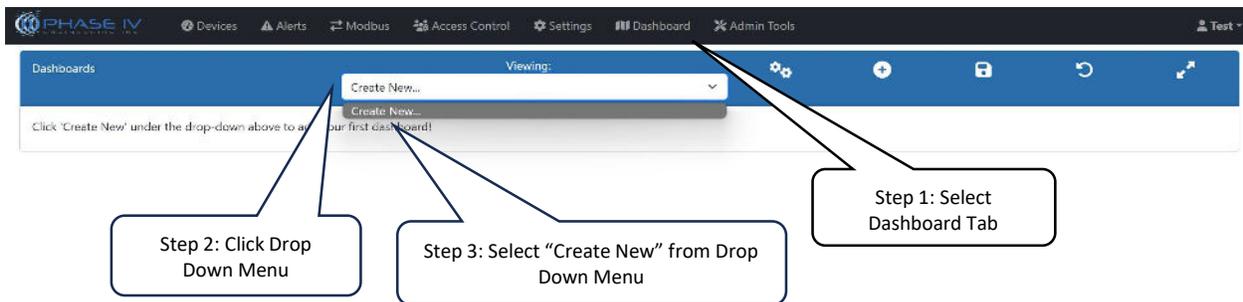


Figure 41: Selecting a New Dashboard

After making the selections to Create New Dashboard, the **“Create New Dashboard”** window will populate.

This window allows you to set the Name and Row/Column size for your Dashboard. After making these selections, hit **“Save”**. This will return you to the main Dashboard page, with your new dashboard automatically selected in the Drop-Down Menu.

8.2 Adding Widgets

Once your dashboard has been created, you can now add multiple custom widgets. The dashboard features six styles of widgets, all of which can be further configured to meet your specified needs. Select the **“+”** icon to **“Add Widget”**



Figure 42: "Add Widget" Icon

8.2.1 Types of Widgets

- **Custom Text:** The custom text widget is a text only addition. This can be used to add a heading to the Dashboard with information on what is being viewed, or to add notes throughout. This is the only widget that allows only text.
- **Single Device Panel:** Shows all data points across a single node. This includes sensor readings, and both last communications and last reading timestamps.
- **Single Device Graph:** Shows all sensor readings over the last 24 hours in graph form for a single node.
- **Single Sensor Graph:** Same visual configuration as a “Single Device Graph” but allows isolation of a single sensor attachment. Useful when a node has multiple sensors with different capabilities.
- **Multiple Device Table:** Capable of showing multiple sensor values across multiple nodes in a single widget.
- **Customizable Sensor Widget:** Highest level of customization of the six styles of widget.

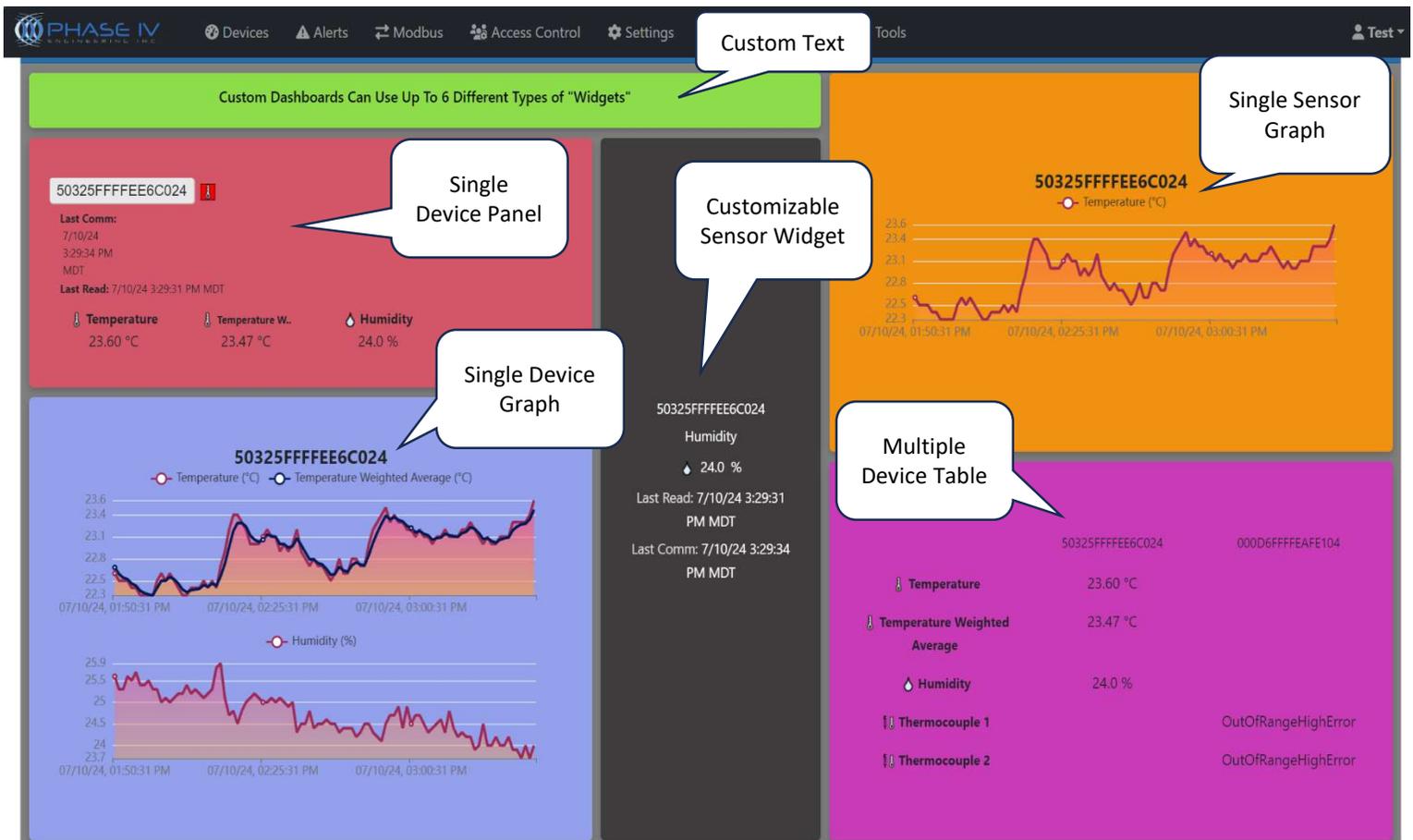


Figure 43: All Widget Types Within a Dashboard

9. Technical Support

For more information about our products and services, or for technical assistance:

Visit us at: www.phaseivengr.com
Tel: +(303) 443 6611 (USA – MST 8:00 a.m. to 5:00 p.m., Mon.-Fri.)
E-Mail: support@phaseivengr.com

If you need assistance, please provide the product part number, product serial number, and product version.