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LEAP WIRELESS SENSOR SYSTEM

ACTIVITY MONITOR

QUICK START AND USER MANUAL

Revision 1.1

Contents

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1. About this Manual

This user manual will explain the special features of the Leap Activity Monitor Device Node. Please consult the main Leap User Manual for the complete system functionality.

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.

1.2 Background

The LEAP Activity Monitor is for sensing and tracking situations that are on/off, open/closed, blocked/unblocked, empty/full, running/down, true/false, etc. where a sensor reads a single discrete state and uses edge logic to track the amount of time in each state, plus time each active and inactive event, and the percentage of time active. It also counts inactive events (stops, failures, etc.)

2. Set up of the Physical Sensor

Depending on the application, the Activity Sensor can use one of several sensors to detect activity. Photoeyes and proximity sensors are often used to detect presence of product. Electrical Current Switches are often used to detect when a machine is running vs. down. These are our most common sensors used with our Activity Monitor, but others are possible as well. If you have questions about your sensor, reach out to Phase IV or your sensor provider for more information.

2.1 Photoeyes and Proximity Sensors

Photoeyes and Proximity switches need to be powered, and also provide back an output to the Leap Activity node. Simply mount the sensor to point at the product being monitored. In most cases, users can just attach the sensor to the Leap node using the M12 connector that is part of the sensor cable. Often, the default sensitivity settings will work fine. Test the sensor by placing product where it will be during normal operation and removing it. The light on the sensor should light up when the product is present and turn off when it is absent. If this is not the case, you can adjust the sensitivity as needed, often using a miniature screwdriver.

2.2 Adjustable Amp Switches

When monitoring Electrical Activity, we often use an adjustable amp switch to detect electrical current. The amp switches we typically use are "split core," and can be opened and then closed around a wire. Generally, users will want to connect around a single conductor to a motor inside an electrical enclosure like a motor control cabinet or electrical disconnect.

2.2.1 Safety Notice

Electrical enclosures contain high voltage which can be hazardous. Only properly trained and authorized personnel that are familiar with the hazards and precautions required should enter electrical cabinets to install these amp switches. It is recommended that the amp switches be installed with power disconnected while wearing appropriate personal protective equipment.

2.2.2 Choosing the wire to monitor

All amp clamps and amp switches work by sensing the magnetic field created by the flow of electricity through a wire. Our amp switch can only detect AC current, not DC. The amp clamp requires access to a single conductor as multiconductor wires with both hot and neutral or three phase wiring will have current flowing through the internal conductors in opposite directions, cancelling each other out. Generally, the only place where single conductors are exposed are inside electrical enclosures where the wires feeding the equipment are split apart to go through disconnects, fuses, starters, and drives. This is where the amp clamp will need to be located.

Determine what wiring best aligns with the part of the operation you want to monitor. For example, if you want to monitor the main motor of a machine, find the starter or variable drive for that motor and clamp to a wire feeding it. Try to avoid monitoring the main feed to a piece of equipment with many different electrical components, although sometimes there is no choice.

Also avoid DC (direct current) wiring as our standard amp switch cannot detect DC current. If you need to monitor a DC motor, consider whether there is an AC voltage feed to the DC drive that you can monitor. This may allow you to still monitor the motor without clamping to a DC conductor wire.

2.2.3 Installing the Amp Switch

Our standard adjustable Amp Switch is split core, meaning that it has a hinged opening to allow the switch to be opened and place around a wire and then closed. There is a small tab that can be pulled to open the switch, and small fingers to hold the clamp around the wires. Slide the clamp around the single conductor wire and close the

switch, making sure it is securely fastened. Rotate the switch so that the adjustable dial and LED lights face out where they can be seen and adjusted if needed.

2.2.4 Troubleshooting and adjusting the Amp Switch

The Amp Switch is wired to the Leap Activity node with two wires. These wires are monitoring the state of a on/off contact in the switch. The contact is “normal open,” or not connected when it is not powered. It switches on or closes the contact when high current flow is detected and remains open or off when there is no current or low current.

Our standard amp switch has three different potential states, unpowered, low current, and high current. The LED lights on the front or top of the switch indicate which state the switch is in. The switch requires no power to operate as it is powered by the magnetic field of the conductor it is monitoring. In other words, it is an energy harvesting switch, utilizing energy from the current flowing in the conductor. It is not powered by the Leap Activity node, so users can determine the function of the switch regardless of whether the Leap Activity node is powered on or not.

1. No Lights- not powered. If there is no current flowing at all, there is no power to energize the switch, so the switch contact will remain off or “open.”
2. Lo Light On- Low current flowing. There is current flowing but less than the adjustable trip point, so the switch contact remains off or “open.”
3. Hi Light On- High current flowing. There is current flowing at a level higher than the adjustable trip point. When this occurs, the contact closes providing a positive signal back to the Leap Activity node.

In most cases, the switch can simply be placed on the conductor wire and it will immediately work as expected, but if not follow these instructions.

The reason for the adjustable dial is because some customer machines and motors pull significant current when not producing product, but pull much more when running. The adjustable dial allows users to set the threshold where the sensor switches from LO to HI, or not running to running. For most situations, turning the dial all the way down to 0.5 Amps, the minimum will be best. The only reason to adjust higher is if the machine or motor being monitored has a current higher than 0.5 Amps when not running.

Adjust the dial to a point where the HI light always comes on when the machine is running and the HI light is off when the machine is not running. When the machine is not running either no light should be on or the LO light- in either case the switch will signal that the machine is not running.

When adjusting, move in small increments and give the switch 3-5 seconds to trigger after adjusting. Generally, you want to be set just slightly above the idle current, so the LO light is on, and it switches to HI when production starts.

3. Operating the Wireless Sensor System

3.1 Special Power Switch and Power to the Sensor Node

Because the Activity Monitor Sensor Node utilizes break-beam sensors that must be powered-on at all times, this device node is not battery powered. Power is supplied to the Sensor Node (and the break-beam sensors) using the wall transformer that plugs into the Sensor Node. Use the wall transformer labeled, "Sensor" to power the Sensor Node.

3.1.1 Power Switch – No LEDs

Because this Sensor Device Node is wall powered, the power switch does not have the red and green LEDs integrated like other Leap Sensors.

3.1.2 Wall Transformer to Sensor Node

Connect the wall transformer labeled "Sensor" to the Activity Monitor Device Node prior to turning it on.

3.2 Time Reset Button

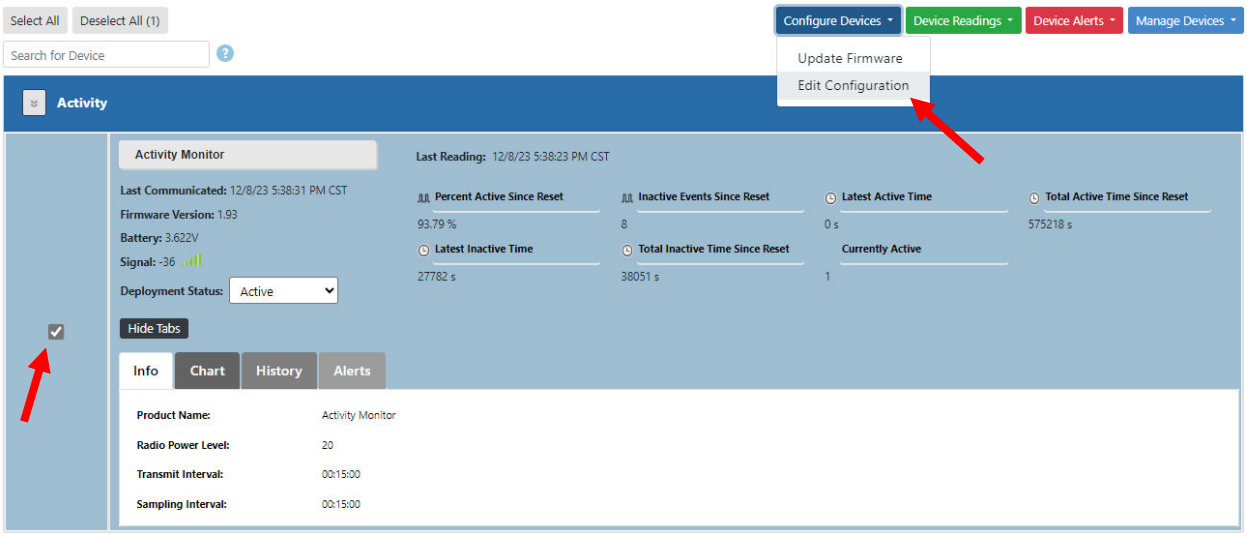
The silver push-button on the top of the enclosure will zero-out the time after and other values it is pushed. Times and other values can also be reset remotely from the software interface. The count reset button is one of several ways to reset the count. See count reset configuration options for more details.

3.3 Understanding the Data –Timing, Counting, Transmitting

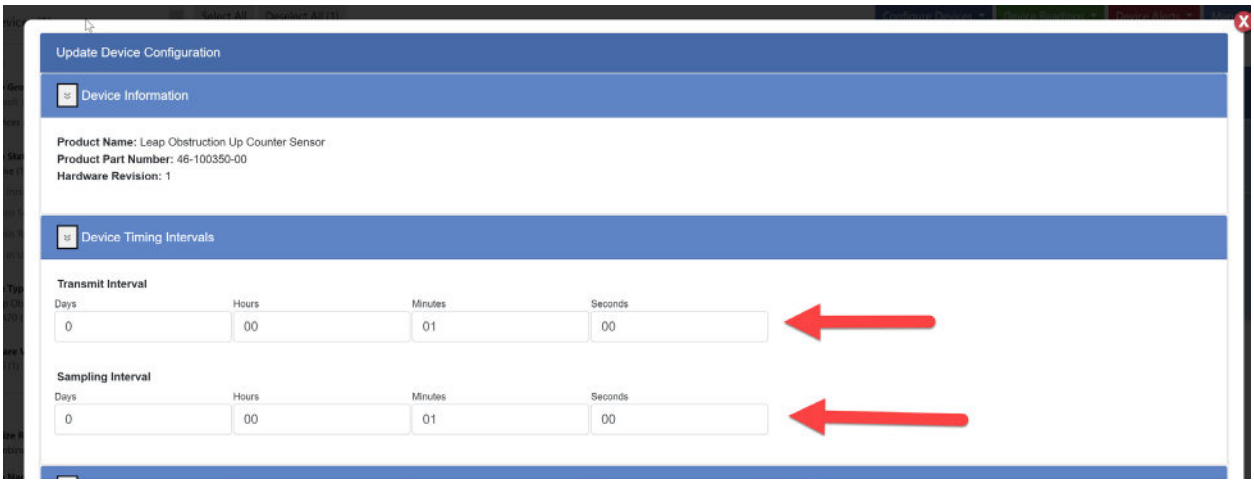
3.3.1 Transmit Interval – How Often Data Is Updated

The Activity Monitor Device Node will transmit the latest data at the "Transmit Interval" that is set for the device. Typically, this is set to 10 or 15 minutes. The transmit interval works with the "Sampling Interval" and "Transmit Mode" settings to manage what triggers the device node to sample and transmit data. Before changing the transmit or sample intervals, make sure to understand the impact of the "Transmit Mode" setting. To change the transmit interval, do the following:

- Click on the check box to the left of the sensor device to select it.
- Click on "Configure Devices" button

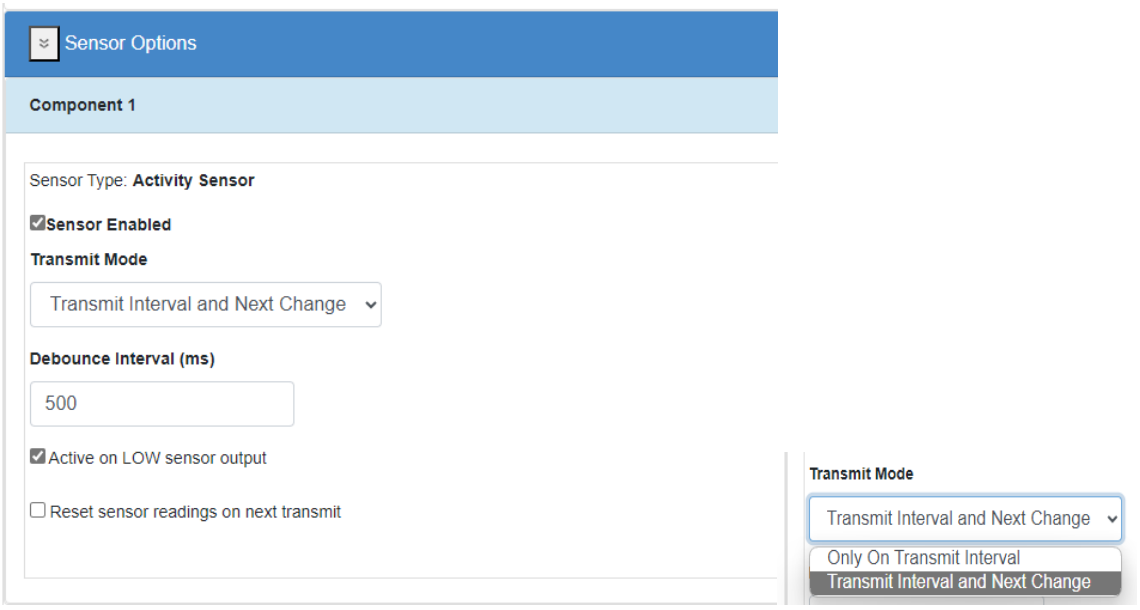


- Click on “Edit Configuration”
- Edit the Transmit Time. Set Sample Time to the same value. CLICK SAVE at the bottom of the screen



3.3.2 Transmit Mode – When Data Is Updated

While the Activity Monitor Device Node will transmit the latest count data at the “Transmit Interval” that is set for the device, it can transmit based on events that occur as well. The transmit and sampling interval works with the “Transmit Mode” settings to manage which triggers the device node uses to sample and transmit data. Before changing the transmit or sample intervals, make sure to understand the impact of the “Transmit Mode” setting. To view or change the transmit mode, view “Sensor Options” further down the configuration screen:



There are two transmit modes to choose from: the default is to only transmit on the time interval plus the next change for the counter (default interval is 10 minutes). The two choices are:

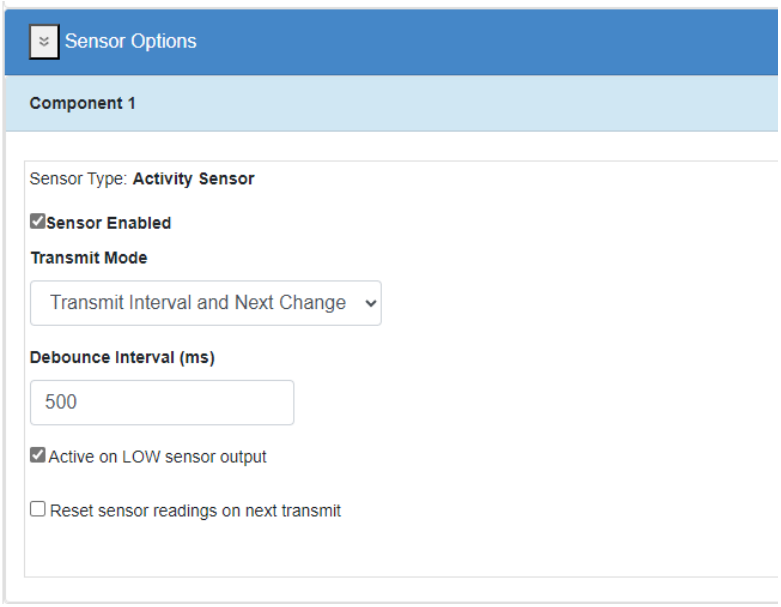
a. "Only On Transmit Interval" - Only transmits on the configured transmit interval. You’ll get a timing update and data update on each interval and only then. This is a good option if the status changes very

frequently and getting every event would be too much data. If a large number of the events being tracked are less than a minute, this is the better setting option.

b. "Transmit Interval and Next Change" - On the normal interval and each time a change in state happens between detecting start/stop conditions. This is the best option for most applications where the activity status doesn't change more than once a minute. (There is a limit to the number of transitions that can be detected, typically the node will stop transmitting after 50 transitions in a transmission interval. This is to avoid too much data flooding the Leap Server and gateway.)

3.3.3 Adjusting Sensor Sensitivity with Debounce Time

Debounce time is the amount of time that a sensor can flicker on or off before the node transitions between active and not active. If your sensor flickers when products pass by or as the equipment starts or stops, you may want to increase this time substantially. If your rates are extremely fast, this time may need to be small. If your stop counts from the sensor data aren't matching what you physically see and count, adjust your sensor settings and adjust the de-bounce rate.



3.3.4 Setting the active state

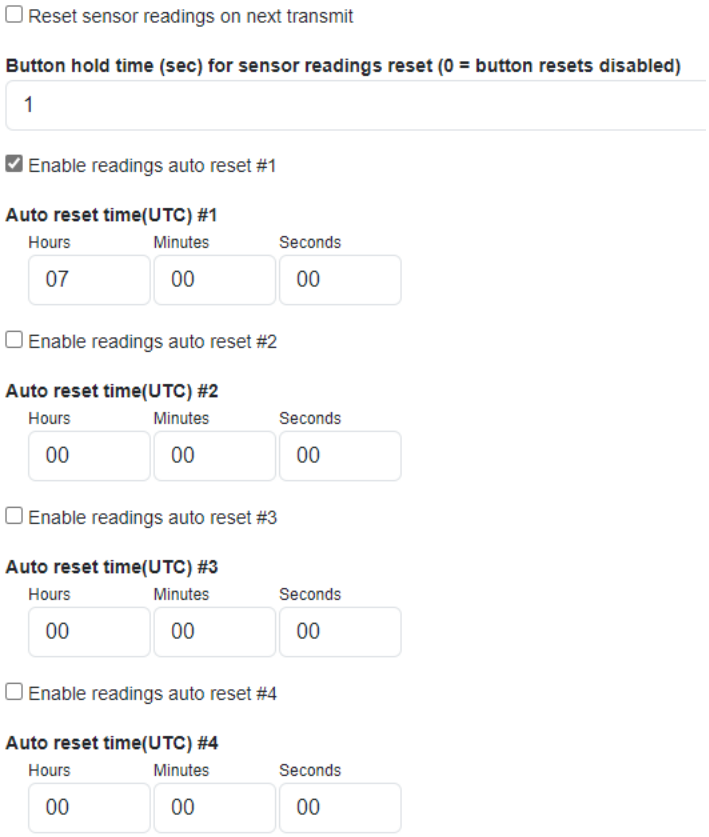
You can switch the active state between a low and hi sensor output. Select or deselect the check box in the sensor configuration to choose which state is "active."

For amp switches, this box should be unchecked. When the amp switch lights up HI, the output to the node is also hi as the contact in the switch closes to allow voltage to return to the node input.

For photoeye and proximity sensors, this setting just depends on the setup of the sensor compared to the condition being monitored. It could be either way. Adjust this setting if the active state shown is backward from actual behavior.

3.3.5 Reset Options

The configuration screen allows you to determine how the counts are reset, either manually or automatically. From these choices, you can influence resetting the count three ways.



1. Check the box to reset reading on next transmit. Once you check this option and save it, the software will send a message to the production count node to reset its count during the next transmit sequence. This is a helpful option when you need to reset the count, but are not physically near the sensor to manually reset it.

2. Hold down the reset button on the production count node to reset it. Some customers in environments with lots of vibration have found that counts can accidentally reset from motion from the surrounding environment. Because of this we default the setting of the reset button that it be held down one second for the count to reset. Once the button is released, the node will update the count and all calculations and send them to the Leap Server and then reset all values back to zero. No data is lost, and counts start over when the button is pushed.

   For operations that don't want the push button used for resets for what ever reason, set the hold time to zero, and the reset button will be disabled. The hold time can be made longer as well.

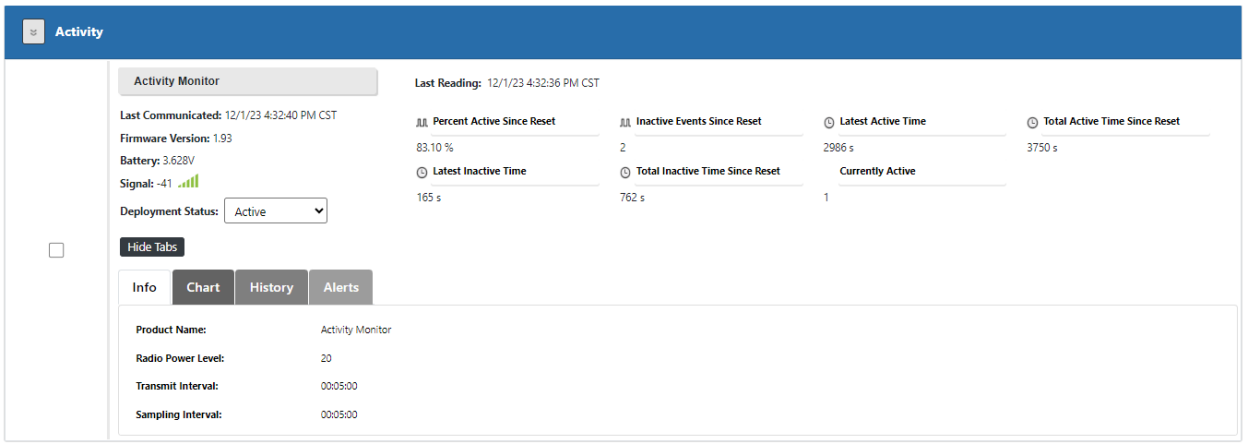
3. You can set up to four different automatic resets per day. Simply check the box for each reset you want to use and enter the hour, minute and second for the reset to occur.

   For example, some customers want to reset the count at the beginning of every shift as well as at midnight. Others may want to reset the count just once a day at a specific time. Others never want to reset the count.

   Note that the reset time is based on the UTC time. In the US, time zones vary from UTC-4 for EDT to UTC-9 for Hawaii. Daylight savings time causes a need to change this setting. For example, if you are on Pacific time and want the reset to occur at midnight every day, you would pick 7 (see above) for daylight savings time, and 8 for standard time. If you happen to be in Indiana, Arizona, or Hawaii, then you don't have to worry about changing settings twice a year.

4. Understanding the data

The main display screen will show these seven data points.

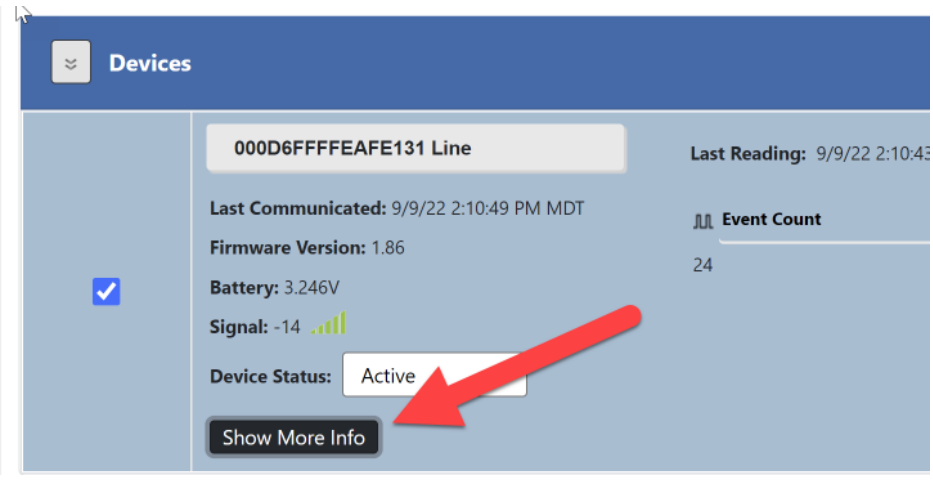


4.1 Defining the 7 data values

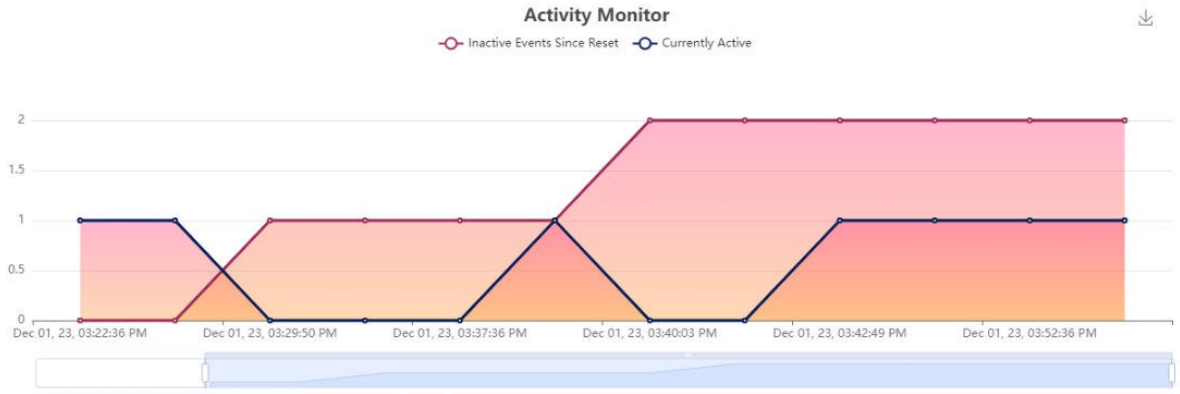
1. Percent Active Since Reset- This is a calculation based solely on time active and inactive since the last reset. For production operations, this might be considered a measure of reliability or OEE.
2. Inactive events since reset. How many times has the activity stopped since the last reset?
3. Latest Active Time- From the last start of activity, how long has or was the system active before it stopped?
4. Total Active Time Since Reset- This is a tally of the total time the sensor has determined that the system has been active since the last reset.
5. Latest Inactive Time - From the last stop in activity, how long was the activity stopped before it re-started?
6. Total Inactive Time Since Reset- This is a tally of the total time the sensor has determined that the system has been inactive since the last reset.
7. Currently Active: This is 1 if the system is active and 0 if the system is inactive.

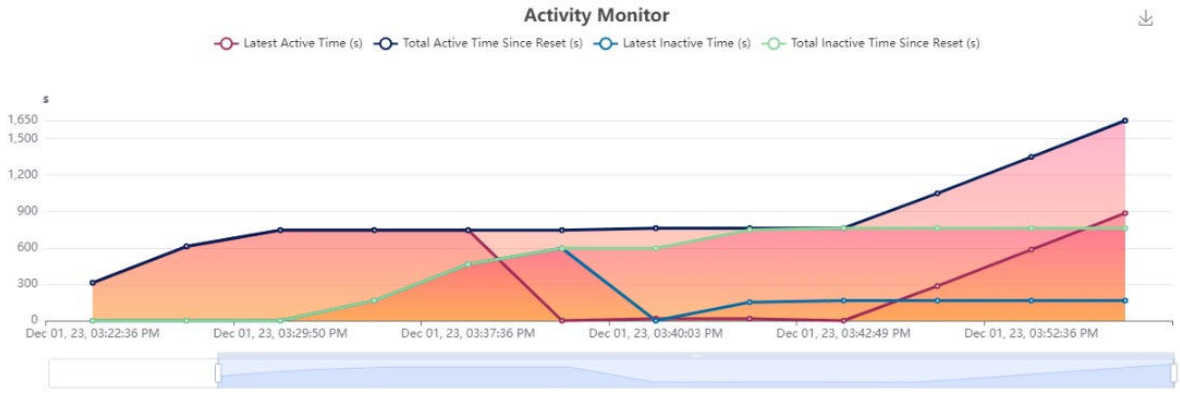
4.2 Graphing the Data

To graph the data click on “Show More Info”, then the Chart Tab.



There are two graphs that appear, a graph with the count of events and the currently active status, and a graph with all the times and percent active.





4.3 Viewing historical data

By clicking on the History tab, recent data points can be viewed in the web interface.

Info | Chart | History | Alerts

Timezone

CST (UTC-6) UTC

mm/dd/yyyy Start Date | mm/dd/yyyy End Date | Show Range

Readings Displayed: 14

Reading Timestamp	Received Timestamp	Percent Active Since Reset (%)	Inactive Events Since Reset	Latest Active Time (s)	Total Active Time Since Reset (s)	Latest Inactive Time (s)	Total Inactive Time Since Reset (s)	Currently Active
Dec 01, 23, 03:47:36 PM	Dec 01, 23, 03:47:38 PM	57.93	2	286	1050	165	762	1
Dec 01, 23, 03:42:49 PM	Dec 01, 23, 03:42:51 PM	50.03	2	0	763	165	762	1
Dec 01, 23, 03:42:36 PM	Dec 01, 23, 03:42:38 PM	50.46	2	16	763	152	749	0
Dec 01, 23, 03:40:03 PM	Dec 01, 23, 03:40:05 PM	56.13	2	16	763	0	596	0
Dec 01, 23, 03:39:47 PM	Dec 01, 23, 03:39:48 PM	55.60	1	0	747	596	596	1

4.3.1 Downloading Readings

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

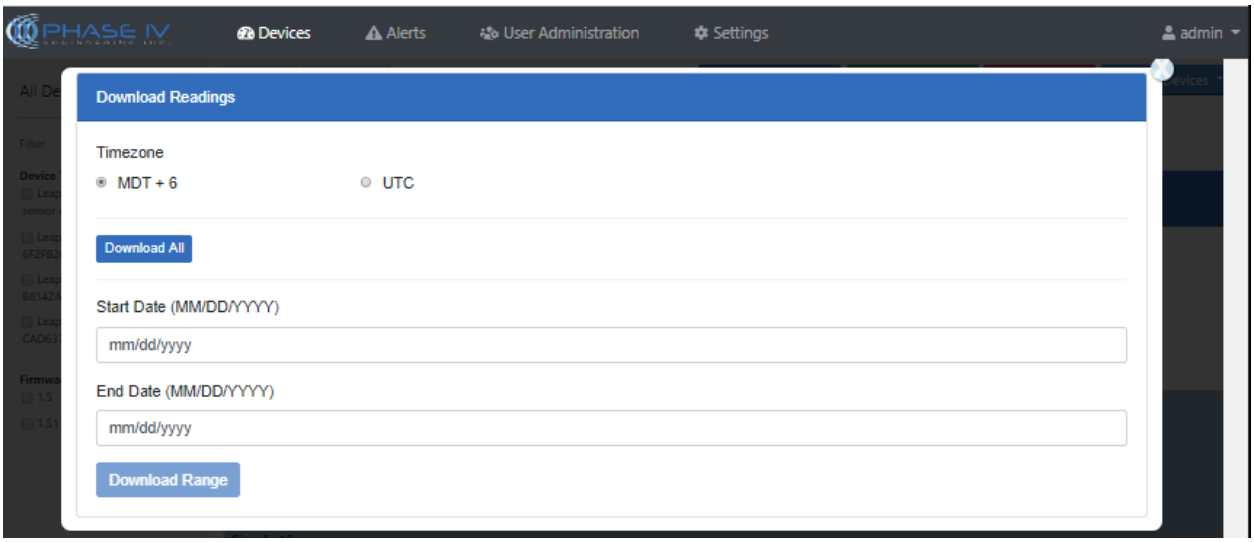


Figure 1: Download Readings Window

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 (your local time zone by default, or optionally UTC time).

4.3.2 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 3.
4. Finally, use the Format Painter tool to apply this to each column with a time stamp.

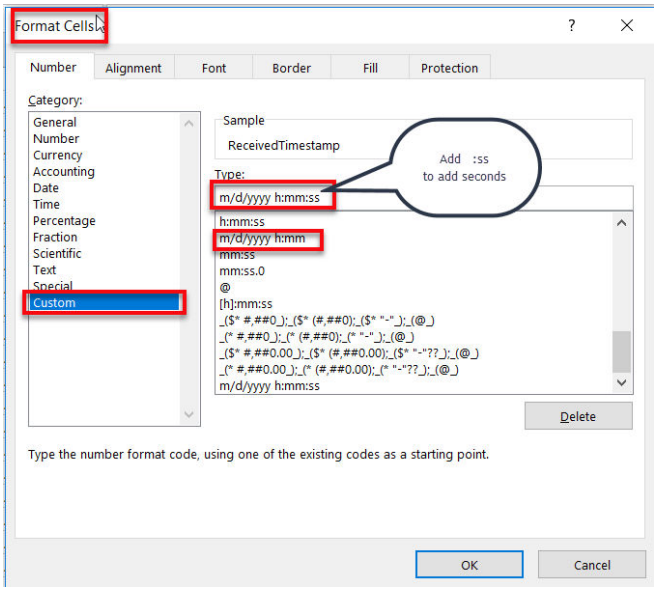
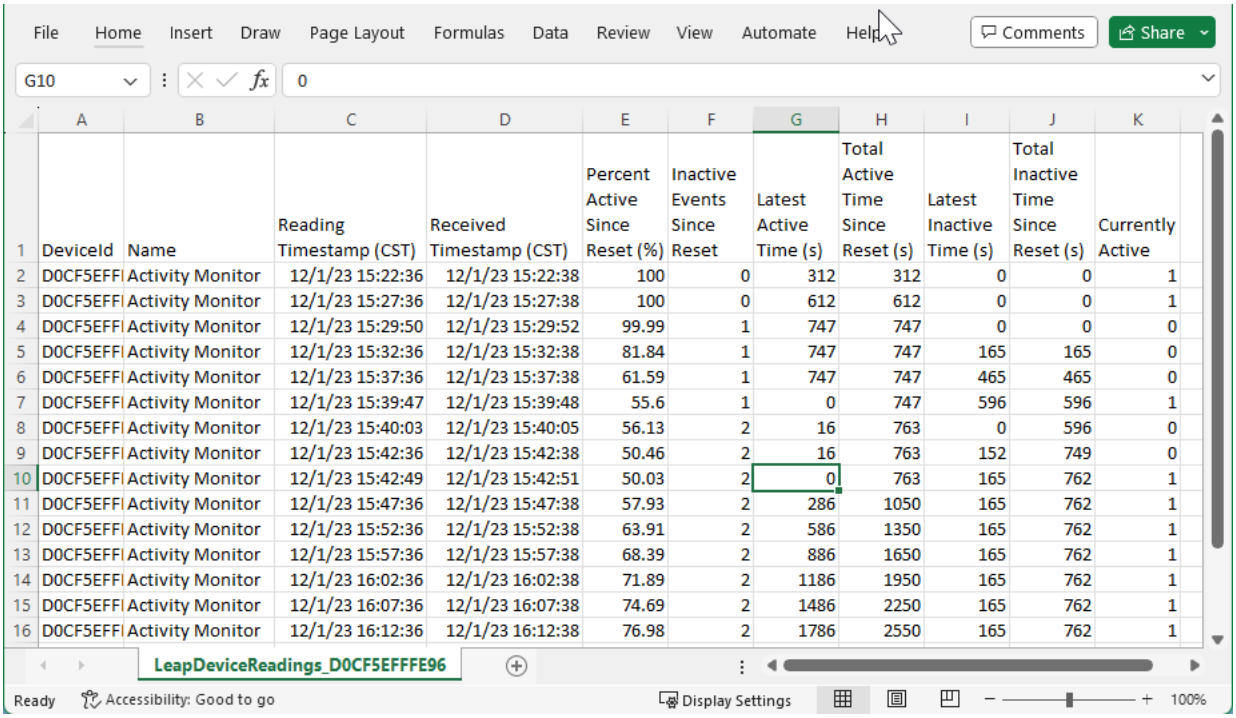


Figure 2: How to Display Seconds with Timestamps within Excel

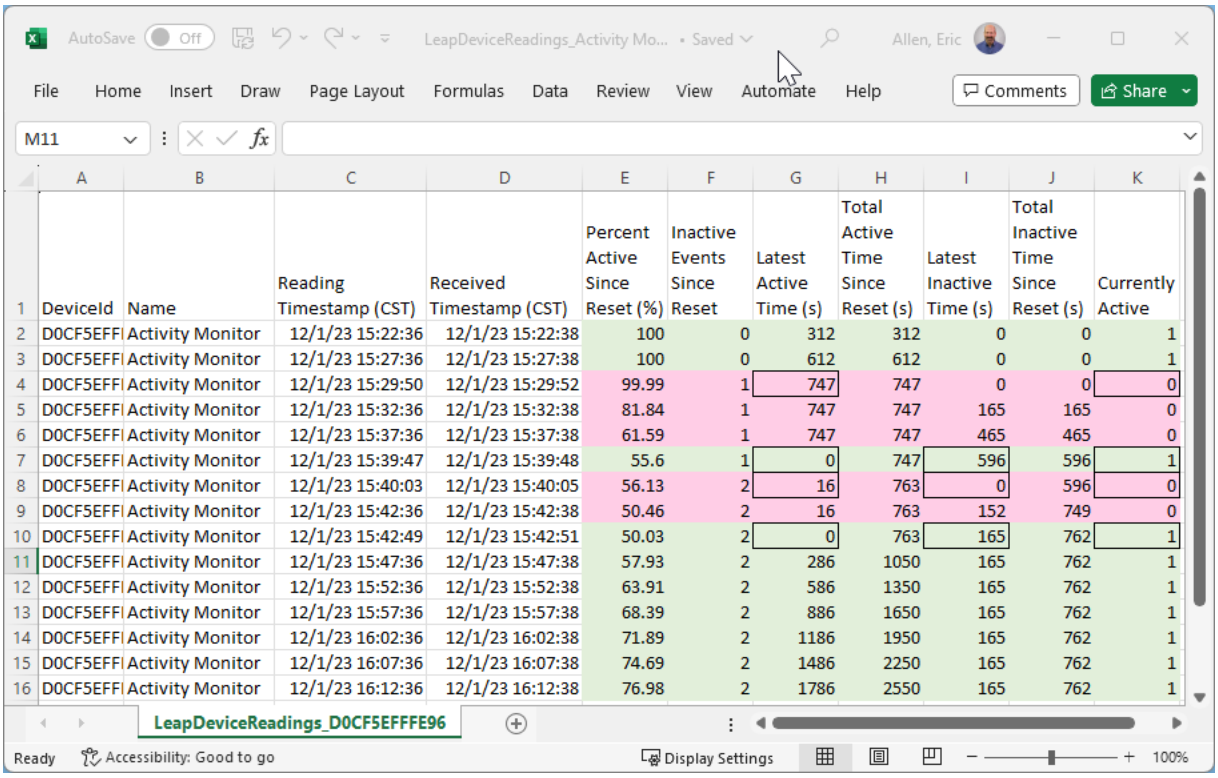
4.3.3 Interpreting the Activity Data

Using the Method shown above, the data can be downloaded and analyzed with a program such as Excel.



	A	B	C	D	E	F	G	H	I	J	K
1	DeviceId	Name	Reading Timestamp (CST)	Received Timestamp (CST)	Percent Active Since Reset (%)	Inactive Events Since Reset	Latest Active Time (s)	Total Active Time Since Reset (s)	Latest Inactive Time (s)	Total Inactive Time Since Reset (s)	Currently Active
2	D0CF5EFFI	Activity Monitor	12/1/23 15:22:36	12/1/23 15:22:38	100	0	312	312	0	0	1
3	D0CF5EFFI	Activity Monitor	12/1/23 15:27:36	12/1/23 15:27:38	100	0	612	612	0	0	1
4	D0CF5EFFI	Activity Monitor	12/1/23 15:29:50	12/1/23 15:29:52	99.99	1	747	747	0	0	0
5	D0CF5EFFI	Activity Monitor	12/1/23 15:32:36	12/1/23 15:32:38	81.84	1	747	747	165	165	0
6	D0CF5EFFI	Activity Monitor	12/1/23 15:37:36	12/1/23 15:37:38	61.59	1	747	747	465	465	0
7	D0CF5EFFI	Activity Monitor	12/1/23 15:39:47	12/1/23 15:39:48	55.6	1	0	747	596	596	1
8	D0CF5EFFI	Activity Monitor	12/1/23 15:40:03	12/1/23 15:40:05	56.13	2	16	763	0	596	0
9	D0CF5EFFI	Activity Monitor	12/1/23 15:42:36	12/1/23 15:42:38	50.46	2	16	763	152	749	0
10	D0CF5EFFI	Activity Monitor	12/1/23 15:42:49	12/1/23 15:42:51	50.03	2	0	763	165	762	1
11	D0CF5EFFI	Activity Monitor	12/1/23 15:47:36	12/1/23 15:47:38	57.93	2	286	1050	165	762	1
12	D0CF5EFFI	Activity Monitor	12/1/23 15:52:36	12/1/23 15:52:38	63.91	2	586	1350	165	762	1
13	D0CF5EFFI	Activity Monitor	12/1/23 15:57:36	12/1/23 15:57:38	68.39	2	886	1650	165	762	1
14	D0CF5EFFI	Activity Monitor	12/1/23 16:02:36	12/1/23 16:02:38	71.89	2	1186	1950	165	762	1
15	D0CF5EFFI	Activity Monitor	12/1/23 16:07:36	12/1/23 16:07:38	74.69	2	1486	2250	165	762	1
16	D0CF5EFFI	Activity Monitor	12/1/23 16:12:36	12/1/23 16:12:38	76.98	2	1786	2550	165	762	1

In the following version, active readings are highlighted in green and inactive readings are highlighted in pink. Notice that the first data point of the new state will show the total time of previous state and show zero for the current state. This is true for Activity Monitors set to transmit on "Transmit Interval and Next Change." Data from sensors set to transmit on "Transmit Interval Only" will show times of the current state and final times of the last state event.

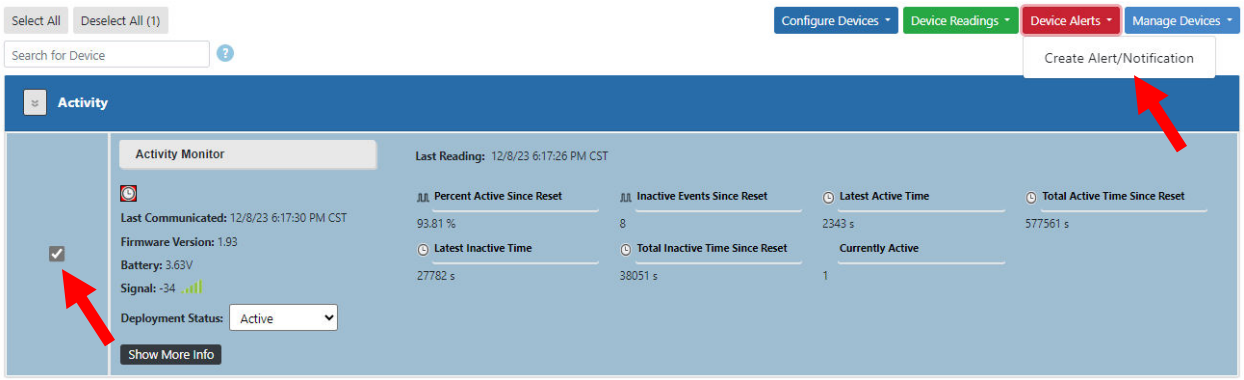


	A	B	C	D	E	F	G	H	I	J	K
1	DeviceId	Name	Reading Timestamp (CST)	Received Timestamp (CST)	Percent Active Since Reset (%)	Inactive Events Since Reset	Latest Active Time (s)	Total Active Time Since Reset (s)	Latest Inactive Time (s)	Total Inactive Time Since Reset (s)	Currently Active
2	D0CF5EFFI	Activity Monitor	12/1/23 15:22:36	12/1/23 15:22:38	100	0	312	312	0	0	1
3	D0CF5EFFI	Activity Monitor	12/1/23 15:27:36	12/1/23 15:27:38	100	0	612	612	0	0	1
4	D0CF5EFFI	Activity Monitor	12/1/23 15:29:50	12/1/23 15:29:52	99.99	1	747	747	0	0	0
5	D0CF5EFFI	Activity Monitor	12/1/23 15:32:36	12/1/23 15:32:38	81.84	1	747	747	165	165	0
6	D0CF5EFFI	Activity Monitor	12/1/23 15:37:36	12/1/23 15:37:38	61.59	1	747	747	465	465	0
7	D0CF5EFFI	Activity Monitor	12/1/23 15:39:47	12/1/23 15:39:48	55.6	1	0	747	596	596	1
8	D0CF5EFFI	Activity Monitor	12/1/23 15:40:03	12/1/23 15:40:05	56.13	2	16	763	0	596	0
9	D0CF5EFFI	Activity Monitor	12/1/23 15:42:36	12/1/23 15:42:38	50.46	2	16	763	152	749	0
10	D0CF5EFFI	Activity Monitor	12/1/23 15:42:49	12/1/23 15:42:51	50.03	2	0	763	165	762	1
11	D0CF5EFFI	Activity Monitor	12/1/23 15:47:36	12/1/23 15:47:38	57.93	2	286	1050	165	762	1
12	D0CF5EFFI	Activity Monitor	12/1/23 15:52:36	12/1/23 15:52:38	63.91	2	586	1350	165	762	1
13	D0CF5EFFI	Activity Monitor	12/1/23 15:57:36	12/1/23 15:57:38	68.39	2	886	1650	165	762	1
14	D0CF5EFFI	Activity Monitor	12/1/23 16:02:36	12/1/23 16:02:38	71.89	2	1186	1950	165	762	1
15	D0CF5EFFI	Activity Monitor	12/1/23 16:07:36	12/1/23 16:07:38	74.69	2	1486	2250	165	762	1
16	D0CF5EFFI	Activity Monitor	12/1/23 16:12:36	12/1/23 16:12:38	76.98	2	1786	2550	165	762	1

Seeing the data organized into events like this, many customers build reports using formulas to identify and calculate key times and additional metrics. Simply copy and downloaded data into a sheet with formulas for reports on the latest data each day or week.

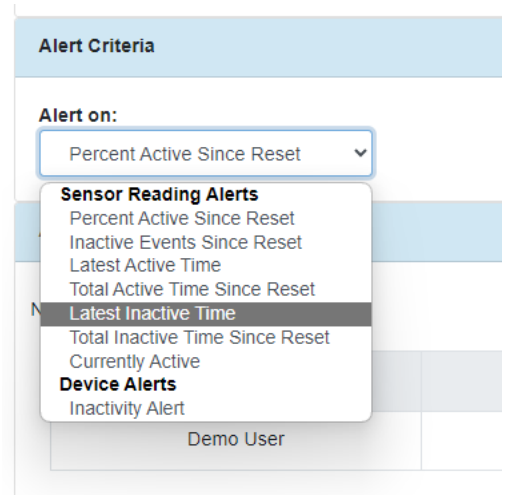
4.4 Setting Alerts

- Click on the check box to the left of the sensor device to select it.
- Click on “Device Alerts” button

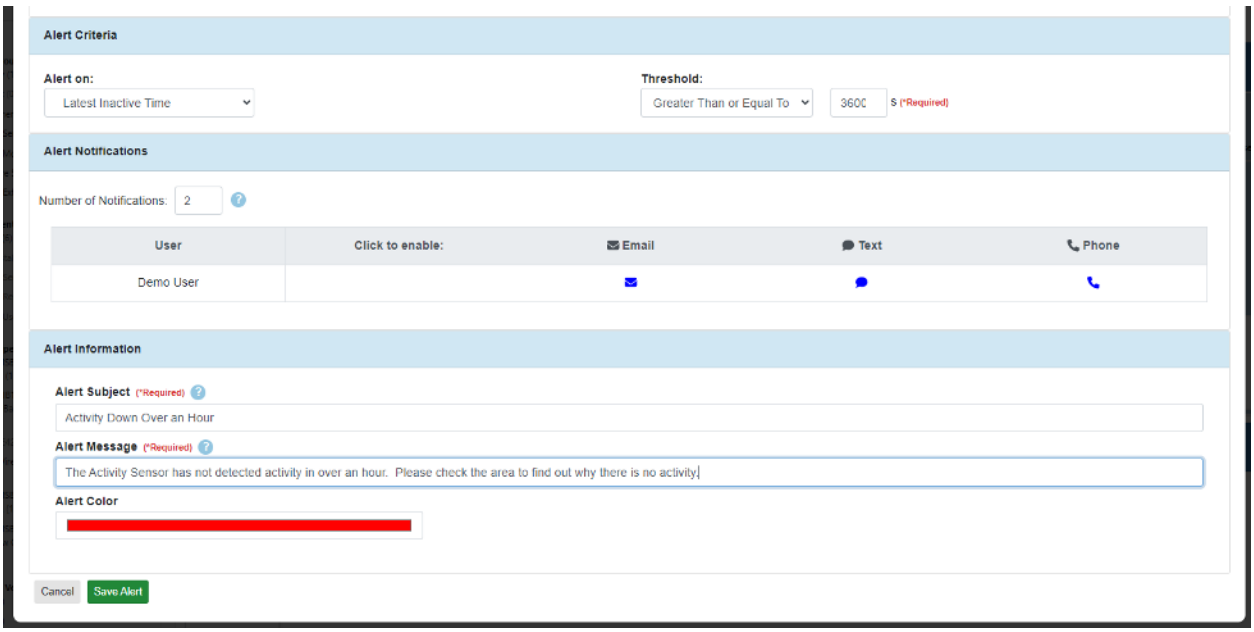


- Click on “Create Alert/Notification”

The Alert system allow you to alert on either Sensor Readings or Device issues.



After choosing the criteria to alert on, choose the Threshold and other settings for the alert. To send notifications on alerts, your account must be set up with at least one of the optional notification services.



5. Optional Add On Features

The LEAP Activity Monitor has many features that customers can use to better understand the performance of production lines. The built-in features are sufficient for most situations. However, Phase IV does offer some additional features and services that can make the experience even better.

5.1 Text, Phone, or Email Notifications

With the purchase of Alert notifications to your users, you can set alerts based on any of the seven sensor values that are part of your activity monitor sensor. You can notify users when a value gets too high like total inactive time, or when an inactive event has gone too long, or when an event count is too high. You can notify users if a value is too low, like Percentage of active time. You can determine how many times to alert users when these situations occur, and can set up different users with different alerts and have different alerts on different devices. You can also set device alerts to let users know if a node has stopped sending data, which may be for a variety of reasons that need to be investigated.

5.2 Sharing Data through Modbus TCP

With the purchase of a LEAP Modbus TCP Server extension, your system can provide data to other data systems, like data historians, PLCs, or operator interfaces. Modbus TCP is an extremely common protocol used often in factory automation for sharing data between different types of hardware and software using only Ethernet.

5.3 Build Custom Dashboards for displaying data

With the purpose of our configurable dashboards, you can make dashboards that look the way you want them to look. You can make different dashboards for different audiences or departments. You could make a dashboard to display on a monitor in the production area with event counts and percentage active with an up/down chart. You could make a dashboard with key metrics for several lines to be used by supervisors on their tablets or phones. Dashboards are configured how you want them, built from multiple available configurable widgets, so it's up to your creativity to make exactly what you want. If the feature you isn't currently available with an existing widget, just ask and we'll quote what it will take to make the feature available.

6. 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.