

# VIBE $\odot$ SIGHT

## Vibe-Sight<sub>Lt</sub> Multi-hop User Manual



VS700LTM

2/10/23

# Contents

1.0 <a href="#">Introduction</a>	1
2.0 <a href="#">What's New with Multi-Hop</a>	2
3.0 <a href="#">Vibe-Sight Components</a>	2
4.0 <a href="#">Getting Started</a>	3
4.1 <a href="#">Sensor Nodes</a>	4
4.2 <a href="#">Sensor Installation</a>	5
5.0 <a href="#">Using the Screens</a>	6
5.1 <a href="#">Main Screen</a>	6
5.1.1 Real Time Monitoring	6
5.1.2 Vibration and Temp Display	7
5.1.3 Health Halo (Predictive Health Display)	7
5.1.4 Visualization of Data	7
5.1.5 System Date and Time	7
5.1.6 System Operation Information	8
5.1.7 Navigation Buttons	8
5.1.8 Calling Node Display Screens	9
5.2 <a href="#">Node / Device Status Screen</a>	9
5.2.1 Alarm Display	9
5.2.2 Real Time Visualization	10
5.2.3 Device Configuration	11
5.2.4 Real Time Trend Charts	12
5.2.5 Node Number and Name	13
5.2.6 Navigation Buttons	13
5.3 <a href="#">Node / Device Configuration Screen</a>	14
5.3.1 Node Setpoints	14
5.3.2 Vibration Class Setup	17
5.3.3 Auto Calc. Sample Time	18
5.3.4 Sensor Selection	18
5.3.5 Dynamic Tracking	18
5.3.6 Reset Tracking Data	19
5.3.7 Temp. In Health Calculation	19
5.3.8 Return to Node / Device Status	19
5.4 <a href="#">Alarms Screen</a>	20
5.5 <a href="#">System Configuration Screen</a>	21
5.5.1 LAN Connection Display	21
5.5.2 Global Vibration Setpoints	22
5.5.3 Summary Report Time	22
5.5.4 Dynamic Tracking	22
5.5.5 Return to Main Screen	22
5.6 <a href="#">Radio Setup Screen</a>	24
5.6.1 Bind	24
5.6.2 Survey	24
5.6.3 Close Popup	24
5.6.4 Setup Tips Icon	24
5.6.4.1 Battery Installation	25
5.6.4.2 Dip Switch Setting	25
5.6.4.3 Cables and Flex Power	26

5.6.4.4	Wiring	26
5.7	<a href="#">Summary Screen</a>	27
5.8	<a href="#">System Validation Code</a>	27
6.0	<a href="#">Binding</a>	29
6.1	<a href="#">Binding the H10 Radio</a>	30
7.0	Adding in a Sensor	30
8.0	<a href="#">Site Survey</a>	30
9.0	<a href="#">Determining Setpoints</a>	32
10.0	<a href="#">Using Statistics for Auto Setpoints and Health</a>	32
11.0	<a href="#">Dynamic Tracking</a>	33
12.0	<a href="#">Remote Viewing of Vibe-Sight Screens</a>	34
12.1	cMT Viewer	35
12.2	Built in WebView	35
13.0	<a href="#">Remote Connection to Vibe-Sight Via Tosibox</a>	36
13.1	Default Connections	36
13.1.1	Connect Directly to the Lock-175's LAN	36
13.1.2	Tosibox WIFI as a Client to your Guest Account	37
13.1.3	Tosibox Lock-175 with Cellular Network	37
13.2	<a href="#">How Does Tosibox Work?</a>	37
<b><a href="#">ADDENDUMS</a></b>		
1.0	<a href="#">Setting up the 2<sup>nd</sup> LAN Port on the cMT-FHD</a>	41
1.1	Vibe-Sight to MES network	41
1.2	Configure LAN Ports	41
1.2.1	Via cMT	41
1.2.2	Via Easy Web	44
2.0	<a href="#">Introduction to Tosibox</a>	45
2.1	Minimum Setup	45
2.2	Adding Additional Personnel (keys)	45
2.3	Adding additional sites (Locks)	45
2.4	What Happens if You Lose Your Master Key?	45
2.5	Types of Lock Connections	46
2.6	How does this work?	47
2.7	Excerpt from Tosibox's Security Paper	48
2.8	Simultaneous Connections	48
3.0	<a href="#">Setting Tosibox up as a WIFI Client</a>	49
4.0	<a href="#">Vibe-Sight Edge Server</a>	53
4.1	Connection Via Same LAN	53
4.2	Connection Via Tosibox VPN Tunnel	54
4.3	Parameters List	56
4.4	External Vibration / Temperature Data	56
5.0	<a href="#">EULA</a>	57
4.0	<a href="#">Important Links</a>	58

## Vibe-Sight V2 User Manual

### 1. Introduction:

The Vibe-Sight V2 Predictive maintenance appliance gives you both **Real Time Trouble Shooting** and **On-Board Predictive Maintenance**. All analytics, charts and reports are located on Vibe-Sight, not in the cloud.



The VS700LTM is set up to monitor 6 different devices, whether they are motors, bearings, or machine assemblies. The default configuration uses the Banner Wireless Gateway (900 MHz FHSS radio) along with their wireless vibration nodes. Vibe-Sight Lt can be upgraded in groups of 6 up to a total of 18 Devices.

All Data gathering, displays and charts are preconfigured. Out of the box, all you have to do is connect the Vibe-Sight to power, place your Wireless Vibration sensors and nodes on their respective sensing points and Bind the nodes (more on this later). The Vibe-Sight unit is set to start monitoring up to 6 sensor nodes with Z axis and X axis vibration along with Temperature. All you have to do once the Vibration Nodes are mounted and Bound is Set the Vibration Levels. By default Vibe-Sight is set to automatically for you.

The Big difference with Vibe-Sight and other predictive maintenance systems, is that while it combines Real Time Monitoring and Alarming for Day-to-Day Maintenance, it also has on board predictive analytics and provides you with Device Health for Maintenance planning. Additionally, Long term Trending and Regression lines help you to visually determine the condition of your systems. All this is done without additional programming or Integration. **Vibe-Sight does not require a cloud connection or cloud subscriptions or additional programming.**



#### HDMI Graphics:

All Vibe-Sights graphics are displayed on the HMI. Just tap the display to navigate the screens.

#### Remote Viewing:

Vibe-Sight also allows up to 4 simultaneous lite clients in conjunction to the HMI Screen. These remote connections are independent of each other and the main display.

#### Remote Connectivity and Edge Gateway:

While all you need to get going is a monitor or TV, you may wish to allow remote access to screens or pass data to Control or MES devices. Vibe-Sight has a Modbus Edge Gateway to directly pass pertinent data to these Devices. Via Tosibox, Vibe-Sight allows you to connect either through direct connection to its internal Ethernet LAN, or Tosibox can act as a layer 3 router and connect to your Plant Network or it can act either as a Secure WIFI Access Point or Client and connect to your Plant Wireless system. (More on this later)

**Modifications:**

While you may never want to do any modification or programming to Vibe-Sight, you are allowed to do so. We chose to use of the Quad Core Maple Systems cMT3072XH HMI as its Data Analytics Engine instead of a custom programming environment. This gives you the ability to customize the Graphical interface and Data Flow to match your needs and easily pass data to PLC's and Management Systems. The cMT HMI's are programmed via Maples "Easy Builder Pro software."

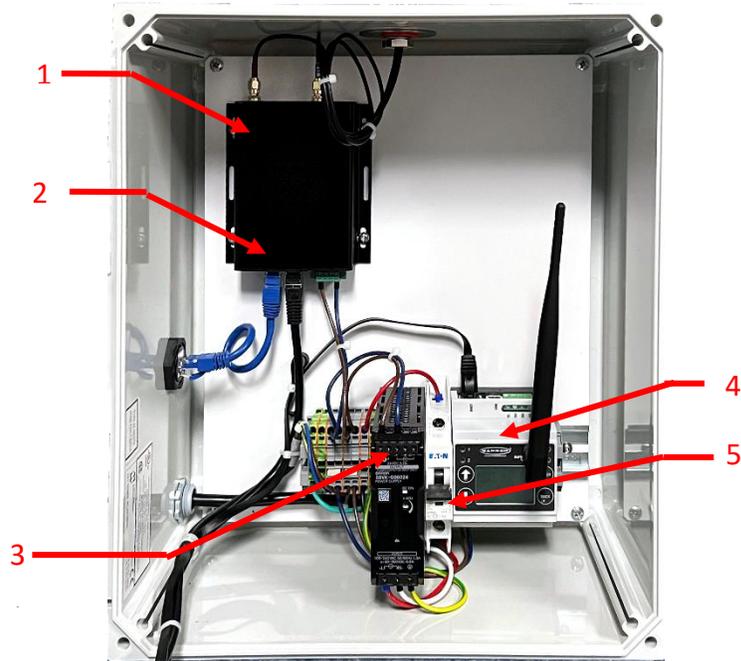
**2. What's New with Multi-hop:**

1. A Tosibox Lock-175 with Cellular Radio has replaced the old Lock-150.
2. External connectors have been upgraded to Tripp-Lite IP66 rated connectors, with available (Optional) sealed interface cables.
3. Vibe-Sight's user Interface has been modified to allow external sensing devices to be monitored in addition to the Banner nodes and sensors normally used in Vibe-Sight.
4. True predictive analytics with a Device Health Indicator.
5. Automatic calculation of Alarm Condition and Run Condition Setpoints
6. Dynamic Tracking of Event Conditions allow more accurate tracking of Bearing Failure.
7. New Easier to Read Graphics in the GUI.
8. Indication of bad radio reception and radio failure

**3. Vibe-Sight Components:**

(External View)

- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Cell and WiFi Antenna (Optional) | 3. 120 VAC Power Cord                 |
| 2. Ethernet Port                    | 4. Vibe-Sight <sub>Lt</sub> HMI / CPU |



(Internal View)

- |                     |                               |
|---------------------|-------------------------------|
| 1. Tosibox Lock 175 | 4. Banner Eng. Gateway        |
| 2. Wan Connection   | 5. Main Power Circuit Breaker |
| 3. Power Supply     |                               |

#### 4. Getting Started:

**Power:** The Vibe-Sight Lt Unit requires a 120VAC power source 3-amp minimum supply. A power cable is attached for your convenience.

**Bind Your Nodes:** You will need to Bind your Vibration Nodes. (See Section 6.0 Binding Nodes)

**Position your Radio Nodes** and preform a **Sight Survey** to assure proper signal strength

### 4.1 Sensor Nodes:

Note, there is one type of Banner Radio recommended for Vibe-Sight Multi-hop.



**1. Node Kit VS103-1** contains one the Banner Eng. **DX80DR9M-H10** (H10 Multi-Hop Radio) and one Vibration Sensor. This node is battery powered. Expect to see around 2 years of use on a set of batteries. The H10 has a 1-watt 900MHz transceiver with an internal antenna. The VS103-1 kit also contains the magnet and necessary cables and splitters to connect to 6 sensors.

#### Dip-Switch settings (you should be able to use the default settings)

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Serial line baud rate 19200 OR User defined receiver slots	OFF *	OFF *						
Serial line baud rate 38400 OR 32 receiver slots	OFF	ON						
Serial line baud rate 9600 OR 128 receiver slots	ON	OFF						
Serial line baud rate Custom OR 4 receiver slots	ON	ON						
Parity: None			OFF	OFF				
Parity: Even			OFF	ON				
Parity: Odd			ON	OFF				
Disable serial (low power mode) and enable the receiver slots select for switches 1-2			ON *	ON *				
Transmit power 900 MHz radios: 1.00 Watt (30 dBm) 2.4 GHz radios: 0.065 Watts (18 dBm) and 60 ms frame					OFF *			
Transmit power 900 MHz radios: 0.25 Watts (24 dBm) 2.4 GHz radios: 0.065 Watts (18 dBm) and 40 ms frame					ON			
Application mode: Modbus						OFF		
Application mode: Transparency						ON *		
MultiHop radio setting: Repeater							OFF	OFF
MultiHop radio setting: Master							OFF	ON
MultiHop radio setting: Slave							ON *	OFF *
MultiHop radio setting: Reserved							ON	ON



**2. Node Kit VS103-0** contains one the Banner Eng. **DX80DR9M-H10** (H10 Multi-Hop Radio) and one Vibration Sensor. This node is battery powered. Expect to see around 2 years of use on a set of batteries. The H10 has a 1-watt 900MHz

**Dip Switch Settings are the same for both Kits.**

After Binding the Radios, you need to place the Vibration Sensor on the device to be monitored.

## 4.2 Sensor Installation:

### Step 1: Install the Sensor

Mounting and installing the vibration sensors on a motor are important for getting the most accurate readings. Sensors can be mounted using magnetic brackets, thermal transfer dual-sided tape, standard brackets epoxied directly to the motor, or standard brackets bolted directly to the motor.

The vibration sensors have an X and Z axis indication on the face of the sensor. The Z axis goes in a plane through the sensor while the X goes horizontally.

1. Install the sensor so that the X axis line is aligned with the motor shaft of the motor, or axially.
2. Install the sensor's Z axis into/through the motor. These can be swapped where the X axis is going into/through the motor and the Z axis is in line with the shaft of the motor if you are placing the sensing vertically for easier installation.
3. Install the sensor as close to the bearing of the motor as possible. Using a cover shroud or location far from the bearing may result in reduced accuracy or a reduced ability to detect certain vibration characteristics.



(Copied from Banner Engineering's Vibration Monitoring Solution Guide)

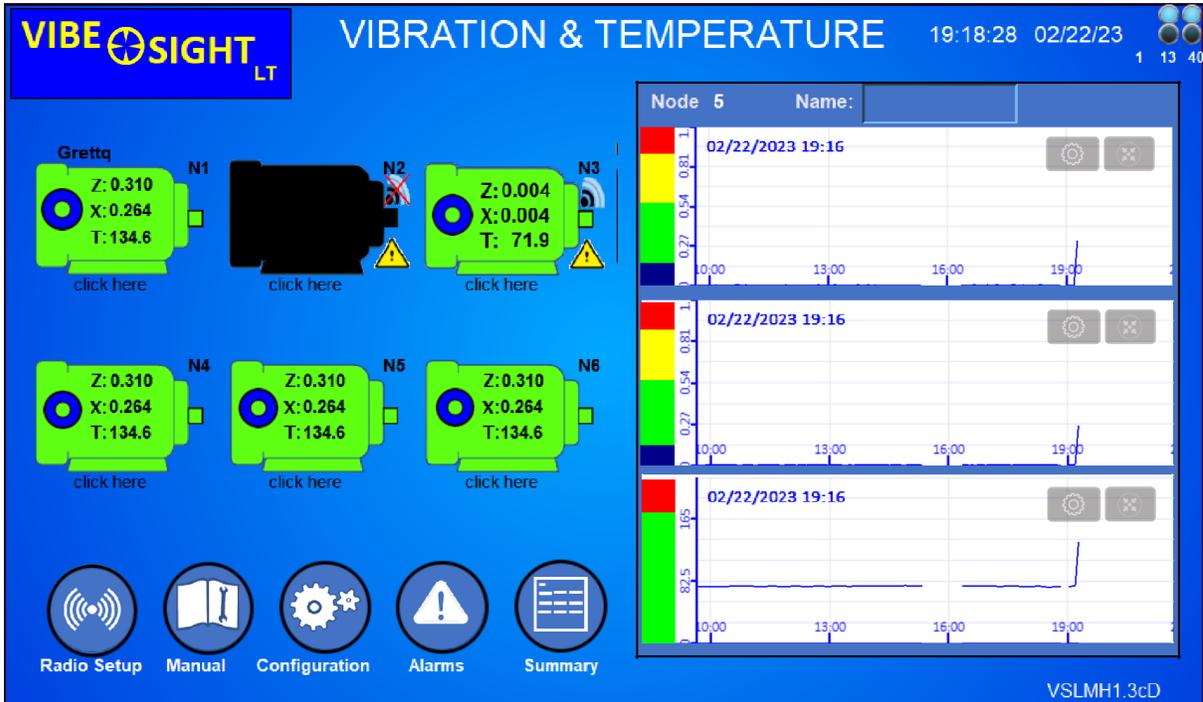
#### Mounting Brackets:

1. Vibe-Sights Sensor Kits come with one QM30VT1 Sensor and a Magnetic mount Bracket.
2. The Magnetic Mount bracket is a great way to mount the Sensor.
3. If there is too much of a Radius and the bracket rocks back and forth or a more permanent solution is required, there is a Bracket that can be epoxied into place. This bracket is included in the QM30VT1 packaging.
4. There is an additional magnetic bracket for curved surfaces this can be ordered optionally Banner Part Number BWA-BK-019. (Please see your Vibe-Sight Distributor, Integrator or VAR to order this product)

Mounting the H10 Radio should be done to maximize the signal back to Vibe-Sight. It is important that the Antenna is positioned correctly for maximum signal strength. To do this we recommend that a site survey be performed. (See Section 7. Site Surveys)

## 5. Using the Screens:

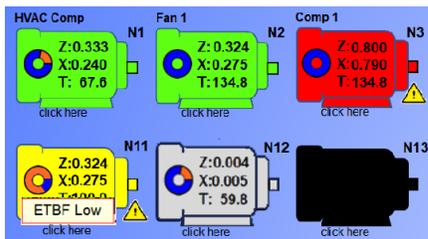
### 5.1 Main Screen:



The primary reason for the Main Screen is to provide Realtime Data for viewing the health of your plant or system.

#### 5.1.1 Real Time Monitoring:

Each Motor Icon displays the State of the Sensor Node.



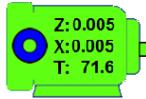
1. **Black** is an Unbound Node
2. **Grey** is a Bound device that is not Running
3. **Green** is a device that is Running
4. **Red** is a device that has exceeded its Vibration Spt.
5. **Yellow** is a device that has exceeded its Temp. Spt.
6. Alarm State Icons display for historical alarms
7. An **“ETBF Low”** (Estimated Time Before Failure) Icon displays if the **health** of the device drops below 30%
8. An **“ETBF Critical”** Icon displays if the **“Health”** of the device drops below 15%.
9. This is a new Icon that indicates Low Radio Signal. A sight survey should be done
10. This is a new icon that indicates a failed radio Signal or bad battery. Inspect and survey.
11. Each node displays the Real Time Vibration for both Z and X Axes and Temperature.
12. Each node is represented by its numerical node reference and an English Description or Nick-Name.
13. Clicking the node opens the Nodes information screen. (More on this later)

### 5.1.2 Vibration and Temp Display

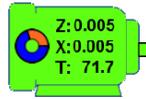


Real time Z-axis and X-Axis Vibration and Temperature are displayed on each of the devices. This will update every 1.5 minutes or less.

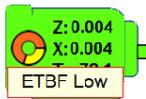
### 5.1.3 Health Halo (Predictive Health Display)



The full Blue Circle (Halo) depicts a perfectly healthy System



You will see increasingly more red on the Health Halo as the device health starts to decline. This is at 70% Health. This condition is not major but at 50% you should definitely look to see what the issues may be.



At 30% You really need to start scheduling an outage to see what is wrong. An ETBF (Estimated Time Before Failure) warning will be indicated. These show up in the alarm history and an Email will be generated



At 15% device failure is eminent. You need to service this device as soon as possible. An ETBF Critical alarm will be indicated. These show up in the alarm history and an Email will be generated.

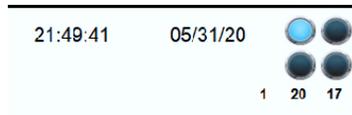
### 5.1.4 Visualization of Data:



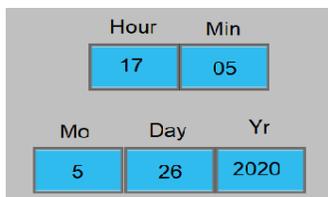
A set of Trend Charts give you a visualization of Vibration Axis and Temperature for each bound node. The charts update to a new device every 6 seconds. The indicator bar colors indicate state levels of the data, **Blue** – Noise Floor (Off), **Green** – Operating Zone, **Yellow** – Warning Zone and **Red** - Critical Zone. The Axis with the highest vibration sets the max scaling.

### 5.1.5 System Data and Time:

The top right-hand corner gives us the System Date and Time displayed in 24-hour time.

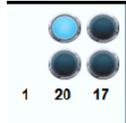


System date and time can be changed by clicking anywhere inside of the Date and Time area.



This opens up a Pop-up window which allows the setting of time and date directly from the graphical interface.

### 5.1.6 System Operation information:



The Icons at the top right give Vibe-Sight information at a glance on System Operation.

1. The top left Icon goes true (turns light blue) When there is an active connection to the Banner Gateway.
2. The Icon to its right goes true when data is being exchanged with the Gateway.
3. The Bottom two Icons display internal functions used while a node display is being generated. The sequence you will see is the Bottom left Icon goes true, then the bottom right icon goes true. When they both turn off the Node should be displayed.
4. The digits on the bottom Show system resources.  
The left most display shows active remote connections to the system  
The next display shows % of processor utilization  
The final display on the right shown the total amount of memory used.

### 5.1.7 Navigation Buttons:

The Main Screen not only provides a complete real-time view of your system health, it provides the launching point for all activities on the Vibe-Sight system.

The obvious points are the six buttons on the bottom right of the screen.



The Radio Setup Button takes you to the Radio configuration page. You will bind Radios and perform Site Surveys from this page.



The Summary Screen Button takes you to a summary screen that provides a simplified view of only the Sensors configured. This is the default Main Screen for Mobile Devices.



The Manual Button allows you to open Vibe-Sight's Web based Manual. This can be achieved by either clicking the QSR code Icon displayed or scanning with a Phone or Tablet. (See Section NN)

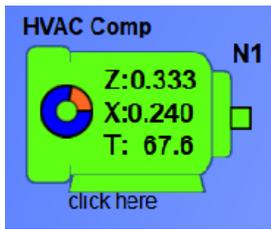


The System Config button takes you to the System configuration page. Here you can set up the Global System settings for Vibe-Sight.



Alarms takes you to the Global Alarm Page. Here you can see alarms for every node.

### 5.1.8 Calling Device Status Screens:



Clicking on any one of the Motor Icons for each Device will bring up the Device Status Screen for that device. While this screen provides real time data for each specific node, it is also the place where the Node is configured.

Real time data, Vibe Class, Running Setpoints, Dynamic Tracking, Node Binding and Site Surveys are a few of the additional functions found on the Node Screens.

### 5.2 Node / Device Status Screen:



Once you click the Motor Icon for your device of choice you will see the **Device Status Screen**.

The left of the window gives you **Real Time Visualization** of the Node's Condition.

These are detailed below:

#### 5.2.1 Alarm Display:

Alarms	
22:48	Node2 Temperature Critical levels: 181 (F)
22:48	Node2 Z Axis Vibration Critical: 0.410 (ips)
22:35	Node2 Z Axis Vibration Critical: 0.410 (ips)

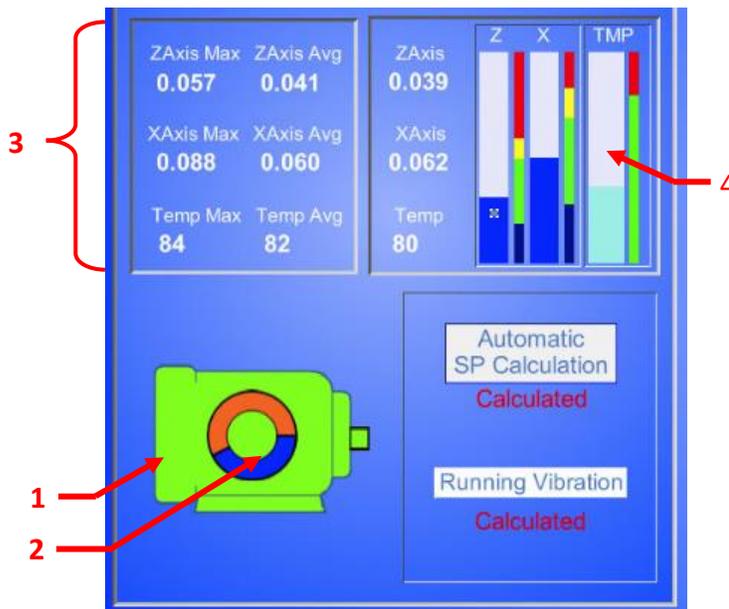
A sub-window displays the Alarms present for the selected Node.

The Alarm Conditions are color coded.

1. Red on a yellow background is an active alarm that has not been acknowledged.
2. Yellow is Acknowledged but still active.
3. Green is Acknowledged and no longer active.

You **Acknowledge** an alarm by clicking on the individual alarm condition.

### 5.2.2 Real Time Visualization:



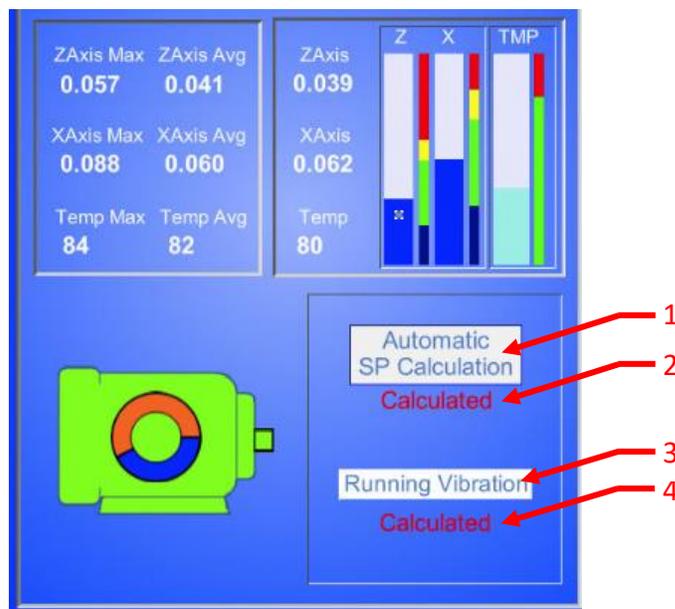
Located just below the Alarm window is a graphic that provides Visualization of the Data coming from the Node. This provides the following information:

1. The Node State Icon is color coded to give a quick indication of the Nodes health at a glance.
  - **Black** – Not Bound
  - **Grey** – Bound but not Running
  - **Green** – Running
  - **Red** – Alarm for Vibration exceeding the Node’s Vibration Set points.
  - **Yellow** – Alarm for Temperatures above the Nodes Temperature Set Points.
2. The **Health Halo** indicates the devices health.
  - **Solid Blue** is great health.
  - Increasing levels of **Red** indicates a reduced health.

3. The following Numeric Data is displayed for each Node:
  - **Daily Max Data** for both Vibration and Temperature.
  - **Daily Running Average** of the Running data only, for Vibration and Temperature. Avg and Max are reset at the end of day when the Daily Summary is calculated
  - **Realtime Data** for Vibration and Temperature.
  
4. In addition to numeric data, the real time data is visualized via Bar charts. Each Chart has a Dynamic colored axis with Running, Alarm, and Critical fault depicted in color bars. These are updated every time setpoints are changed

### 5.2.3 Device Configuration:

Located on the bottom right-hand corner of the screen is the Node Configuration pane. This gives you information on how the specific node is configured.



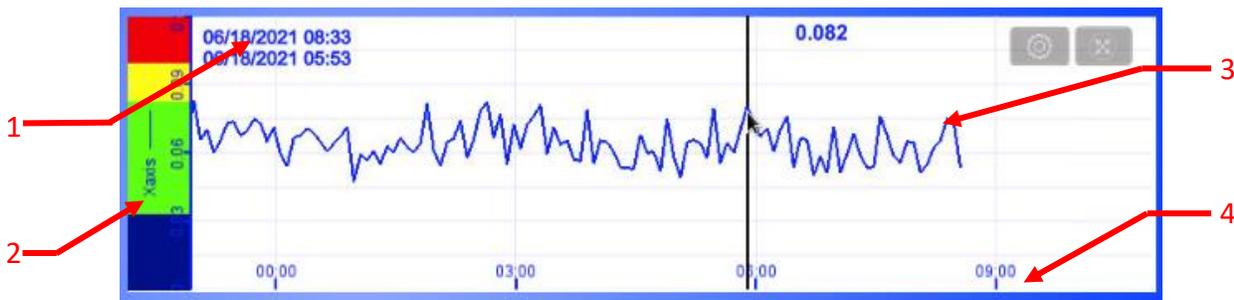
1. This Window displays which Vibration Set Points are selected. They are as follows:
  - **“Select Vibration Type”** if this is displayed the Node has never been set up.
  - **“Manual User Entry”** if this is displayed the user can enter unique data into the fields.
  - **“ISO Vibration Class 1”** (See Section 8. Determining Setpoints)
  - **“ISO Vibration Class 2”** (See Section 8. Determining Setpoints)
  - **“ISO Vibration Class 3”** (See Section 8. Determining Setpoints)
  - **“ISO Vibration Class 4”** (See Section 8. Determining Setpoints)
  - **“Automatic Setpoint Calculation”** (See Section 9. Using Statistics)

2. This indicator is displayed if “Automatic Set Point Calculation” is selected. It lets you know if the calculation is ongoing (**Calculating**) or if it is complete (**Calculated**).
3. This is the label for “Running Vibration” indication.
4. The “Running Vibration” setpoint is by default, automatically sampled and calculated. This indicator shows “Calculating” while the sampling is being gathered and “Calculated” while done. Sampling is taken over an 8-hour period of running operation.

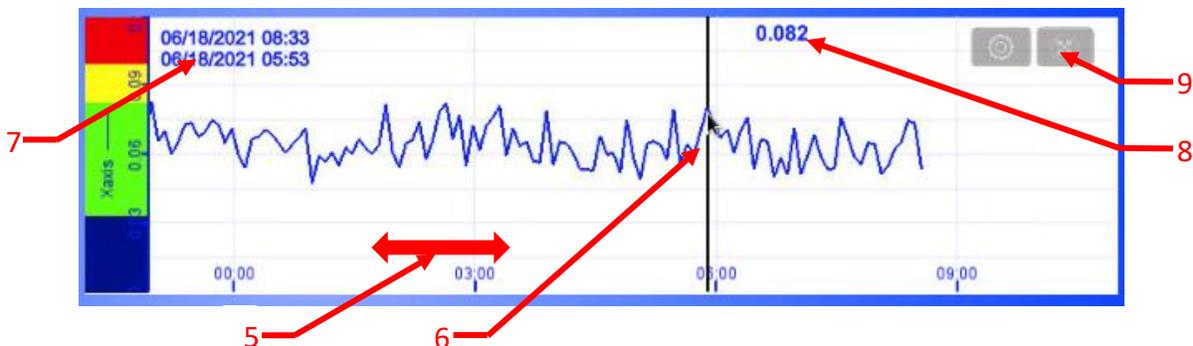
### 5.2.4 Real Time Trend Charts:

Located on the Right side of the Screen are the Trend Charts of Real time Data.

There are three charts in total with one each for Z-axis Vibration, X-axis Vibration and Temperature. Specifics of these Charts is as follows:



1. This is the Current Date and Time of the latest Sample
2. As with the Bar Charts the Y axis of the Chart has a Dynamic color bar in addition to the axis gradients. This helps you to know where the Ranges are.
  - **Off State** or the Vibration Noise floor is depicted in **Blue**
  - **Running State** depicted in **Green**
  - **Alarm State** is depicted in **Yellow**
  - **Critical Fault** is depicted in **Red**
3. The Trend Data is sampled and logged every 5 min.
4. The X Axis is demarked in 24-hour time



5. Clicking and dragging on the chart will move it backwards and forwards in time.

6. Single clicking the chart will result in a Watch Line being placed on the chart. This line captures data from the position on the chart.
7. This second time stamp registers the point in time of the Watch Line.
8. This gives the Value of the chart at the Watch Line. Note, this may have old data until you click the chart.
9. Clicking this Icon will return the chart to its home position.

### 5.2.5 Node Number and Name:

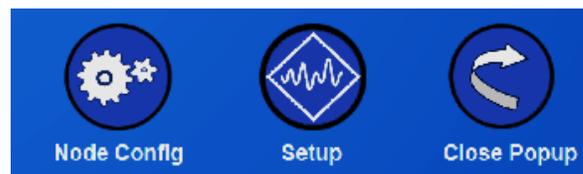
The Node status screen is also the area where you can add in or modify a unique Node name or Nick-Name. Looking at the top of the Window you will see the following:



You cannot change the Node (Device) number that is fixed. You can though, put a Nick-Name in for the Device in the Name Field. Click on the recessed area and you will be able to enter a name with up to 10 characters. **Remember to press the “Enter Key” when done.**

### 5.2.6 Navigation Buttons:

Located at the bottom right of the Node Status Screen are three Navigation Buttons.



1. **“Node Config”** will open a pop-up window enabling configuration of the Node (See section 5.3)
2. **“Setup”** will close the Node Screen and bring up the “Sensor Node Setup screen.” This needs to be done on all new unconfigured Sensor Nodes. (See Sensor Node Setup)
3. **“Close Popup”** Closes the Node Screen and returns you to the Main Display Screen.

### 5.3 Node / Device Configuration Screen:

The Node Configuration Screen Pops up when you press the “**Node Config**” button on the Node Status Screen. Note, by default the Device Nodes are set up in automatic mode and have Dynamic Tracking enabled.

**Node 1 Node Setpoints**

	$\sigma$	Z	X
Running Vib:	Auto Calc	0.120	0.102
Vib SP1 (Normal):		0.230	0.230
Vib SP2 (Warning):	3	0.570	0.570
Vib SP2 (Count):		2.0	2.0
Vib SP3 (Critical):	5	0.905	0.905
Vib Max:		1.086	1.086
Temp Alarm:		176	

**Vibration Setup**

- Auto Calc. Calculating
- User Vib Settings
- Vibration Class I
- Vibration Class II
- Vibration Class III
- Vibration Class IV

**Dynamic Tracking**

Enabled  
Trigger Pt.0.50 xSP2Δ

**Sensor Selection**

	Int	Ext
Vibration Z	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Vibration X	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Temperature	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Auto Calc. Sample Time**

8Hrs  16Hrs  24Hrs

**Temp. In Health**

Yes

Reset Tracking Data

Return

The screen can be broken down into the following sections:

#### 5.3.1 Node Setpoints

**Node 5 Node Setpoints**

	$\sigma$	Z	X
Running Vib:	Complete	0.018	0.031
Vib SP1 (Normal):		0.033	0.057
Vib SP2 (Warning):	3	0.046	0.089
Vib SP2 (Count):		20	20
Vib SP3 (Critical):	5	0.055	0.111
Vib Max:		0.133	0.133
Temp Alarm:		176	

This is where you can see or enter data for your Nodes Setpoints.

If the display is grayed out you cannot modify it. If black you can enter new data.

Please note, if you input a new value **remember to hit the “Enter Key” to complete the entry.**

## 1. Running Vib:

Running Vib is calculated for both the Z axis and the X axis Vibration Sensors. Running Vib is calculated over an 8-hour period of running conditions. **By default, it starts calculating as soon as the node is bound. Note, erroneous readings will occur if “Running Vib” is calculating the entire 8 hours while the line is not running.** If you set up a sensor during an outage or machine downtime press the “Auto-Calc / Complete” button to restart Running Vibe.

Running Vib takes into account the average running levels of the Vibration and the Noise floor of the off condition to develop / calculate a viable Running Vib set point. This set point is used to determine when the node is considered running (Green Icon) and for calculating the Run time Standard Deviation used for the Vibration Set points.

You can additionally recalculate The Running Vib setting by clicking the button marked “Complete.” It will change to Calculating and will calculate for an additional 8 hours.

You will note the display for Running Vib is not grayed out. Sometimes your running conditions are too erratic or your noise floor is too great and you cannot get a great calculation of Running Vib. If so, you can pick a value by looking at the Trend charts and manually enter that value. Just make sure to Toggle the Running Vibe button to show Calculated on this screen and on the Node Status Screen.

## 2. Vib Setpoint 1 (Normal):

Vib Setpoint 1 is the nominal running condition of the system. It is a component of the ISO data charts for vibration. (See section 8. Determining Setpoints). While in the Automatic Setpoint Calculations, Vib Setpoint 1 is the Running Average found during Setpoint calculation. It is used to develop the alarm and fault setpoint along with the Standard Deviation of the sample run.

e.g.  $SP2 = SP1 + x\sigma$ . (See section 9. Using Statistics)

This is only Editable if “Manual User Entry” is selected in Vib Class.

## 3. Vib “Setpoint 2 (Warning):

This is the warning alarm level. It is set based on the Vibe Class Selected and what is deemed to be the Top Level of Normal Operation. (See section 8. Determining Setpoints) Any levels past this are considered abnormal or alarm state conditions. This point is calculated based on SP1 and the Standard Deviation when “Automatic Setpoint Calculation” is selected.

There is one additional data column that is displayed only while in the “Automatic Setpoint Calculation” mode. It is the  $\sigma$  column. The Greek letter  $\sigma$  or Sigma is the Symbol for Standard Deviation. This column is where you select the number of Standard Deviations to be used in calculating the Setpoints. In example if 3 is entered into the  $\sigma$  column, Setpoint 2 will be calculated in the following manner.

$SP2 = SP1 + 3(\sigma)$ . This column will always be editable when in the Automatic setpoint mode. By default, this is set at 3.

**4. Vib Setpoint 2 (Count):**

Vib Setpoint 2 Count is used to determine when the alarm condition is triggered. If the Count is set to 1.0 the alarm will trigger as soon as the vibration level reaches setpoint 2. If set to 2.0 the alarm will not be triggered unless the alarm level has been recorded in two concurrent samples. This helps remove unwanted false alarms due to spurious alarm data. Default setting is 3.0.

**(Note, the decimal point is not displayed 2.0 will be displayed as 20)**

Neither the Setpoint or Count are editable unless you are in "Manual User Entry."

**5. Vib Setpoint 3 (Critical):**

This is the Critical fault level. It is set based on the Vibe Class Selected and what is deemed to be the Critical vibration fault level. (See section 8. Determining Setpoints) Running the machine at this level is expected to be the result of, or will result in damage to the system.

This point has been determined by the ISO Vibration class Chart.

This point is calculated based on SP1 and the Standard Deviation when "Automatic Setpoint Calculation" is selected.

There is one additional data column that is displayed only while in the "Automatic Setpoint Calculation" mode. It is the  $\sigma$  column (See Item 2). The Greek letter  $\sigma$  or Sigma is the Symbol for Standard Deviation. This column is where you select the number of Standard Deviations to be used in calculating the Setpoints. In example if 3 is entered into the  $\sigma$  column, Setpoint 3 will be calculated in the following manner.

$SP3 = SP1 + 3(\sigma)$ . This column will always be editable when in the "Automatic setpoint mode." By default, this is set at 5.

Vib Setpoint 3 is not editable unless you are in "Manual User Entry".

**6. Vib Max:**

Vib Max is the maximum displayed value on Charts and Graphs in Vib-Sight.

It is determined in the Vib Class ISO Setpoints. When in "Automatic Setpoint Mode" it is 120% of Setpoint 3. The Max setting will be the largest setting from both Axes.

**7. Temp Alarm:**

When the Temperature exceeds this value, the alarm will trigger. The Temp alarm is preset by default to 176 Deg F. This value is always editable. You should look at the system specifications and environmental conditions to determine the Temp alarm.

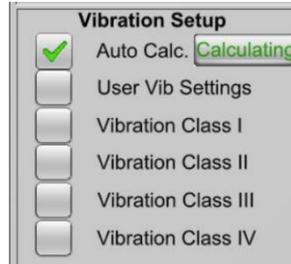
Note, Max temp is not listed but is set at 1.25% of the Temp alarm setting.

**8.  $\sigma$ :**

$\sigma$  is used as a symbol for **Standard Deviation**. The Numbers shown below  $\sigma$  represent the multipliers used to create the alarm setpoints. This is only used in the Automatic Setpoint calculations. This is not displayed unless the Automatic Setpoint Calculation is used. Note you can change these depending on your needs. A default multiplier of 3 is used for the Warning Setpoint and 5 for the Critical setpoint.

### 5.3.2 Vibration Class Setup

This is where you select the Vibration Class you wish to run. For more information on the Vibration Classes and Automatic Calculation of Vibration, (see Section 8. Determining Setpoints and Section 9. Using Statistics). The selections are as follows:



#### 1. Auto Calc:

With the Auto Calc setting Vibe-Sight will automatically calculate the Vibration Setpoints by looking at a sample runtime data selectable from 8, 16 or 24 hours of runtime. This is discussed in section 9 “Using Statistics”. The indicator shows Calculating when in process and Calculated when complete. Clicking the button will restart the calculation.

If you had to recalculate Running Vib while in Auto Calc., Click the Auto Calc button to restart.

#### 2. User Vib Settings:

When “User Vib Settings” is selected all of the Setpoint Data Points will become editable. You can configure a unique set of setpoints for a specific node. This will keep the last displayed data to be used as a starting point.

#### 3. Vibration Class 1:

When this is selected ISO Vibration Class 1 will be selected for the Node. (See section 8. Determining Setpoints)

#### 4. Vibration Class 2:

When this is selected ISO Vibration Class 2 will be selected for the Node. (See section 8. Determining Setpoints)

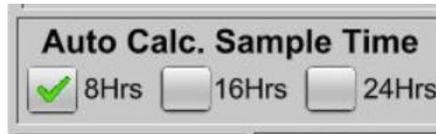
#### 5. Vibration Class 3:

When this is selected ISO Vibration Class 3 will be selected for the Node. (see section 8. Determining Setpoints)

#### 6. Vibration Class 4:

When this is selected ISO Vibration Class 4 will be selected for the Node. (See section 8. Determining Setpoints)

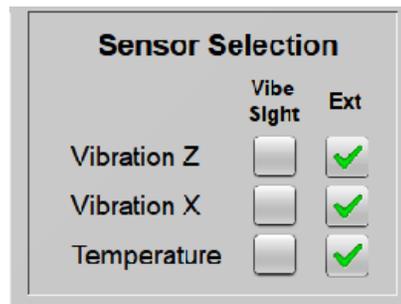
### 5.3.3 Auto Calc. Sample Time



If Auto Calc is selected a sample is taken during running conditions.

This selection box allows you to select whether you wish to sample over 8, 16 or 24 hours of sample time. Smooth systems typically require 8 hours. Very erratic systems may require a 24 hour sample.

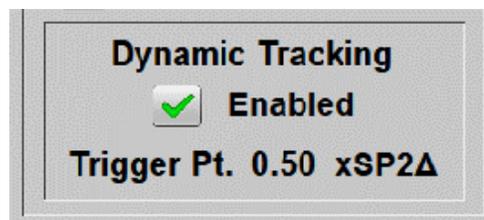
### 5.3.4 Sensor Selection



Starting with Vibe-Sight V2, you can now select whether your sensors for the device are connected via the Banner Wireless Nodes and are accessed from the Banner Gateway or come from external sources. If you Select Vibe-Sight (Int) the sensors will be the standard Banner Wireless sensors as normal.

If you select Ext or External there are a group of Tags that Vibe-Sight makes available for connecting to. These data points are exposed via the built in Edge Gateway. See the Edge Gateway manual for more information.

### 5.3.5 Dynamic Tracking



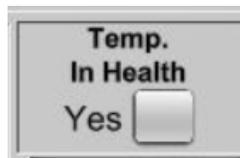
Also new in Vibe-Sight V2 is Dynamic Tracking. (See Section 10. Dynamic Tracking) for a detailed look in how this works. In a nut shell, Dynamic Tracking is used to help determine if an exponential failure or Hockey Stick failure is occurring. When Dynamic Tracking is selected and the Daily Average goes above the Trigger point, the Regression line will be reloaded so that it reacts quicker to perturbations in Vibrations. Setting a Trigger point too low will assure that Vibe-Sight reacts to the change in vibration rapidly but may result in false alarms. 50% of the alarm setpoint is used by default but may be changed.

### 5.3.6 Reset Tracking Data



Another new item in Vibe-Sight V2. If you correct a failed component in your system or move a Vibration sensor the new sensor data may become skewed and greatly affect the performance of the regression line resulting in incorrect Health results. Resetting the Tracking Data will allow the system to compensate for the new data. Effectively resetting its datum. Note, a challenge screen will pop up to assure you wish to reset the data.

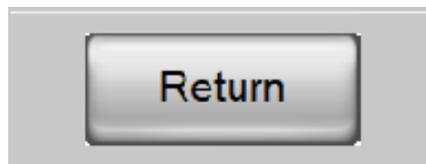
### 5.3.7 Temp. In Health Calculation



Under the proper conditions where ambient temperature is controlled Temperature may be used in the Health calculations. If Ambient temperature is not controlled the ambient temperature swings may adversely affect the Health calculation if Temperature is tracked.

Select "Yes" if ambient conditions are controlled.

### 5.3.8 Return to Node / Device Status



Pressing the Return button will close the Node Setpoints Window and return you to the Node Status Screen.

## 5.4 Alarms Screen:

ALARM LIST				
DATE	TIME	ALARM	ACK TIME	RTN TIME
05/28/2020	16:13:13	Node1 Z Axis Vibration exceeded norms: 0.385 (ips)	16:15:13	16:15:13
05/28/2020	16:15:13	Node1 Z Axis Vibration exceeded norms: 0.756 (ips)	16:15:13	
05/28/2020	16:16:13	Node1 Z Axis Vibration exceeded norms: 0.765 (ips)		

The Alarm Screen shows all Alarms on the System. Each node is represented by its Node Number, then the Alarm Condition with value are listed. Finally, the Acknowledgement time and the time the alarm returns to its normal condition are displayed. Color Code is as follows:

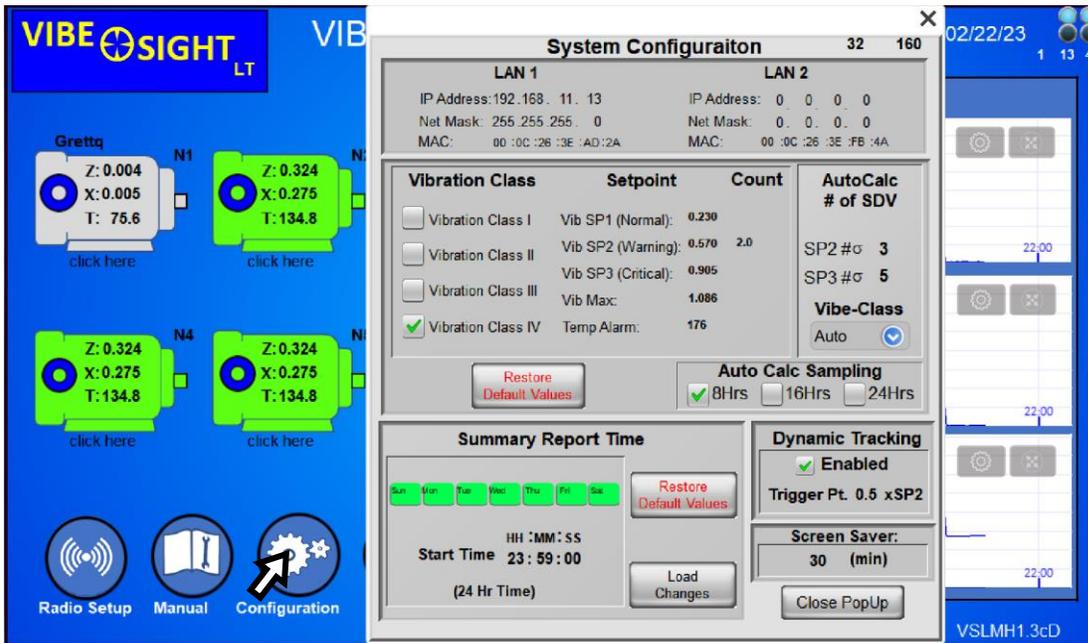
- **Active Alarm** – Red on a Yellow Background
- **Acknowledged Active Alarms** – Yellow
- **Acknowledged Inactive Alarms** - Blue

You have the ability from this screen to acknowledge the alarms all at one time with the **“Acknowledge Alarms”** button. Additionally, you can clear the alarm history stack using the **“Clear Alarms”** button.

Pressing **“Print Prep”** removes the buttons, allowing you to print just the alarms as a chart without the buttons visible. Tapping on the area of the chart around the buttons will make them visible again.

**“Return”** takes you back to the Main Screen

## 5.5 System Configuration Screen:



Clicking the “Configuration Icon” Button on the Main Screen will bring up the System Configuration Popup Screen. This screen can be broken down into key sub screens these are as follows:

### 5.5.1 LAN Connection Display

LAN 1	LAN 2
IP Address: 192.168. 11. 11	IP Address: 192.168.100. 1
Net Mask: 255.255.255. 0	Net Mask: 255.255.255. 0
MAC: 00 :0C :26 :3B :CB :63	MAC: 00 :0C :26 :3B :FA :43

The LAN Connection display section is a **read only** sub window that gives you information about the LAN setup on your cMT-FHD. (See the section on Re-configuring your cMT-FHD for information on changing your address.)

### 5.5.2 Global Vibration Setpoints

Vibration Class	Setpoint	Count	Sample Time
<input type="checkbox"/> Vibration Class I	Vib SP1 (Normal):	0.230	<b>AutoCalc SDV#</b> SP2 # $\sigma$ 3 SP3 # $\sigma$ 5 <b>Vibe-Class</b> Auto
<input type="checkbox"/> Vibration Class II	Vib SP2 (Warning):	0.570 2.0	
<input type="checkbox"/> Vibration Class III	Vib SP3 (Critical):	0.905	
<input checked="" type="checkbox"/> Vibration Class IV	Vib Max:	1.086	
	Temp Alarm:	176	

8Hrs
  16Hrs
  24Hrs

Use this section to Customize your vibration levels. Section 8. Determining Setpoints, discusses the Different Vibration Classes in depth. The setpoints are predefined by ISO standard, but you wished to make a custom class for your system you can modify “Globally” one or all Vibration Classes.

Want to revert back to factory default? Click the **"Restore Default Values"** Button.

### 5.5.3 Sample Time

If you are using the Auto Cal method for Alarm Calculation, you can change the number of Standard Deviations “SDV” used to reach each alarm. **This is a Global setting and is used on all newly attached sensors.**

### 5.5.4 Vibe-Class Function



This Vibe-Class function is a Drop Down Selection tool to select the type of Vibration monitoring you wish to use as the **Global Default** for newly selected Sensor Nodes.

“User” allows you to modify an existing baseline. Vibe-Sight uses Class 4 by default.

“Class 1 – Class 4” are the ISO standards (See Section 8)

“Auto” is the factory default setting this setting will use Statistics to calculate the necessary Vibration alarm setpoints.

### 5.5.5 Summary Calculation Time

From here, you can change the time and Days the Summary Data is Gathered .

If the Day is Green it is selected if you click it and it goes Gray it is deselected. If you don't work on Saturday and Sunday you may wish to deselect "Sat" and "Sun"

Place the Time you wish the data to be gathered in the Time Fields. Time is in 24-hour time. Each field is accessed individually. **REMEMBER hit Enter** after your entry or these will not be accepted. When you finish your changed press "Load Changes"

If you wish to go back to default (as seen above) press the "Restore Default Values" button.

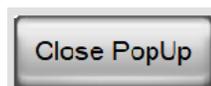
### 5.5.6 Dynamic Tracking

You can change the default setting of Dynamic tracking.

If "Enabled" is selected, all nodes will have Dynamic Tracking turned on as they are Bound. You can also change the Trigger point where Dynamic Tracking starts. By default, it is set at 50% of the Setpoint 2 delta. When the Trended Daily Average reaches 50% of the Alarm Setpoint, Dynamic tracking will kick in. (See Section 10. Dynamic Tracking for more information.)

You can also change the time before the screen saver kicks in.

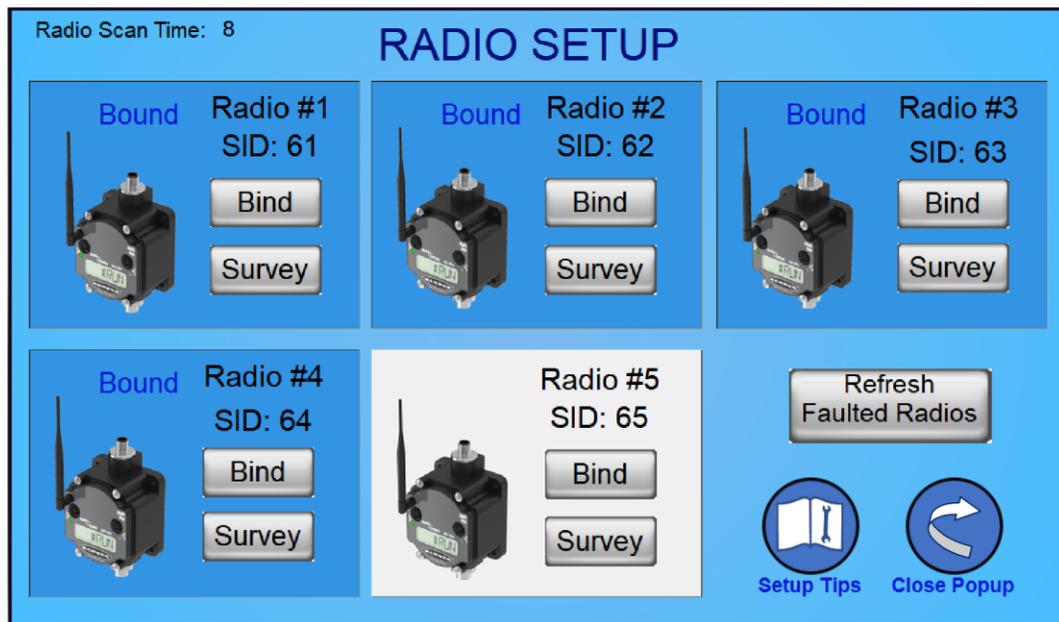
### 5.5.7 Return to Main Screen



Pressing the "Close PopUp" button will return you to the main Screen.

## 5.6 Radio Setup Screen

Clicking the Radio Setup Button on the Main Screen will bring up the Radio Setup Screen.



The Radio Setup Screen gives you a quick indication of Bound and Unbound Radios. There is also an indication of the scan time of the Master Radio for troubleshooting information.

Additionally, the Radio Screen serves as a launch page to Bind Radios and perform Site Surveys on the Radios.

The buttons on each Radio segment on the screen function as Follows:

### 5.6.1 Bind

This opens the Binding Popup and allows you to bind in the selected Radio.

(See Section 6 for more)

### 5.6.2 Survey

This opens the Site Survey Screen and allows you to perform a site survey of the selected Radio. (See Section 7 for more)

### 5.6.3 Close Popup

This Icon button closes the Radio Screen and brings you back to the Main Screen

### 5.6.4 Setup Tips ICON

Setup tips provides information on setting up the H10 Radio.

(See below for more information)

### 5.6.4.1 Battery Installation

This explains how to install batteries in the new radios if you are using battery power.

**BATTERY INSTALLATION**

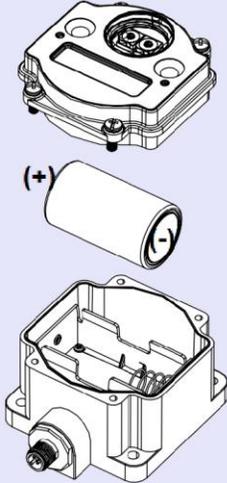
Vibe-Sight H10 radios have the option of utilizing Flex Power via an M12 connection or Battery powered via a Lithium Battery included in the box of the H10

If you are using Flex Power, you can move onto the next tip.

To install the battery, unscrew the 4 screws on the face of the H10 radio and put the battery into the holder inside the unit.

You will not need to remove the ribbon cable to do so.

Make sure the negative side of the battery is on the spring side of the holder before closing and powering the radio.





Next



Close Popup

### 5.6.4.2 Dip Switch Setting

on new radios Vibe-Sight normally uses the default configuration of the Radios but its always good to check them.

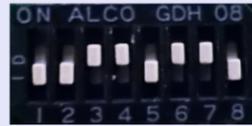
**DIP Switch Settings**

Vibe-Sight and the H10 radios have a particular manner of communicating.  
The control of that communication is managed via physical DIP switches inside the H10 radio.

To access the DIP Switches:  
You will need to unscrew the 4 screws on the face of the H10 radio.  
Once open, the 8 position DIP switch is located behind the LCD screen on the radio board.  
You will not need to remove the ribbon cable to access them.  
Reference the picture to the right.

The Position of the 8 swithes should be as follows:

1	2	3	4	5	6	7	8
OFF	OFF	ON	ON	OFF	ON	ON	OFF





Next



Close Popup

### 5.6.4.3 Cables and Flex Power

This details how to connect your cables to the Radios.

#### Cables and FlexPower

You will notice that there are two leads coming off of your H10 Radio  
Both of these Leads are M12s:  
One Female, One Male

If you are using the Lithium Battery to Power your H10"  
Ensure the provided cap is tightly on the MALE M12,  
this cable is used for FlexPower.  
Plug the QM30VT1 Vibration Sensor into the Female lead of the radio.

If you are using FlexPower:  
You will need to run a power supply to the H10 Radio via an M12 cable.  
Use Pin 1 for + VDC and Pin 3 for 0 VDC  
The radio requires a supply voltage of 10 to 30 VDC.  
Plug the M12 from the supply MALE lead for FlexPower.  
(Refer to Wiring Detail)  
Plug the QM30VT1 into the FEMALE lead.

### 5.6.4.4 Wiring Detail

#### Wiring Detail

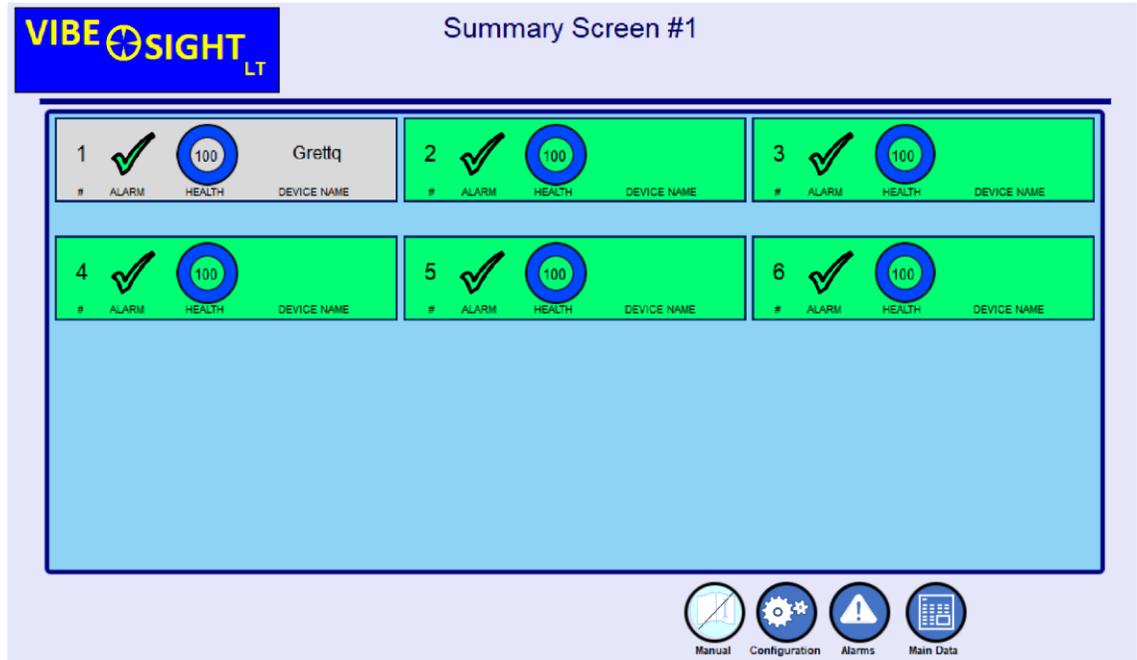
5-pin M12 Male Quick Disconnect Connector	Pin	Wire Color	Description
	1	Brown	10 V DC to 30 V DC
	2	White	
	3	Blue	DC common (GND)
	4	Black	
	5	Gray	

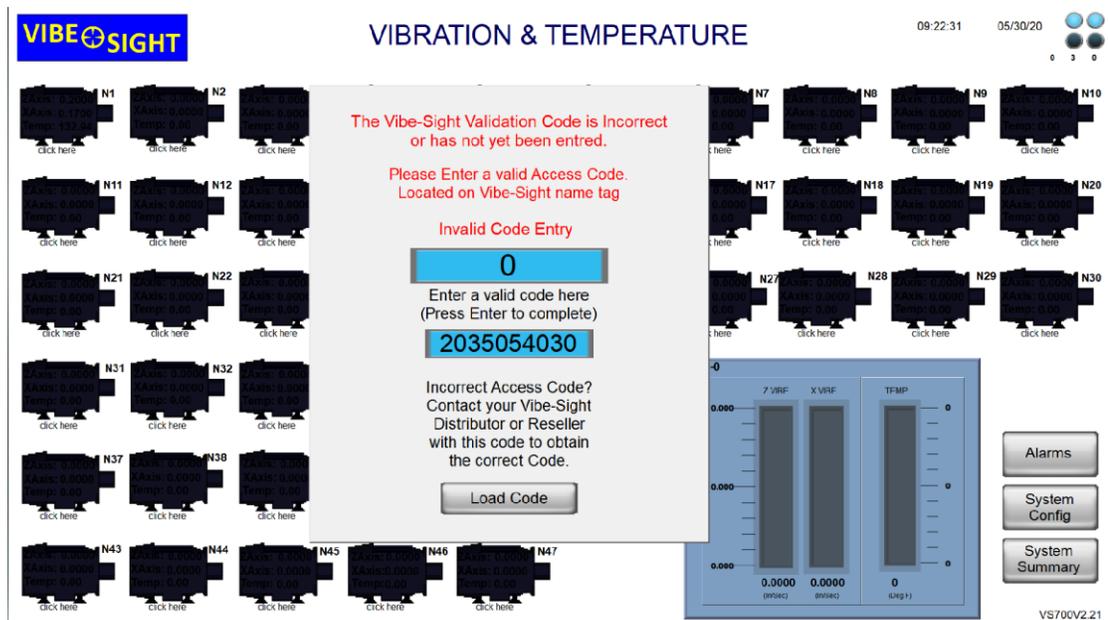
5-pin M12 Female Quick Disconnect	Pin	Wire Color	Description
	1	Brown	Power out + (to sensor)
	2	White	Device select
	3	Blue	DC common (GND)
	4	Black	Device output
	5	Gray	Serial comms

### 5.7 Summary Screen:

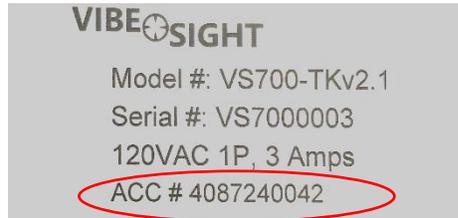
The summary Screen provides a concise way to see only the sensor nodes connected and their status. This is great way to view the sensor nodes with mobile devices. It is the default home screen for remote access.



### 5.8 System Validation Code:



If you accidentally erase the memory on a Vibe-Sight unit this window will pop up. Data logging and Analytics will not operate until the proper ACC# is entered. If you look at your Vibe-Sights Name plate you will find an ACC# located on the Label.



Enter the ACC# in the Data Field. Note, each Vibe-Sight Data Engine has a different ACC Number.

If you need to replace a cMT-FHD due to failure, it must be purchased through a Vibe-Sight Distributor or reseller. Make sure you say that the purchase is for a Vibe-Sight unit. If you purchased a replacement it should come preloaded and will have a new ACC #. If for some reason it does not, please contact your Vibe-Sight Distributor, or reseller for assistance in this manner.

**Note, by EULA, you do not purchase the software running the Data Analytics engine, you purchase the rights to use it and modify it. Copying and redistributing the software without express permission of Vibe-Sight is forbidden.**

## 6. Binding:

To add Multi-hop Radios to your Vibe-Sight System, you must first index or “Bind” then to the Radio Gateway.

Banner Engineering Nodes and Gateways communicate via Frequency Hopping Spread Spectrum (FHSS) Radios. This enables the radio transmissions to be very secure and noise immune. For the Nodes to properly communicate to the Gateway they need to be on the same frequency at the same time. To do this the Node must be “Bound” to the Gateway. Binding allows each unique node to be mapped to the Banner Engineering Gateway and allow the Nodes and Gateway to recognize each other.

Sound Complicated? It isn't. Vibe-Sight does the hard work for you.

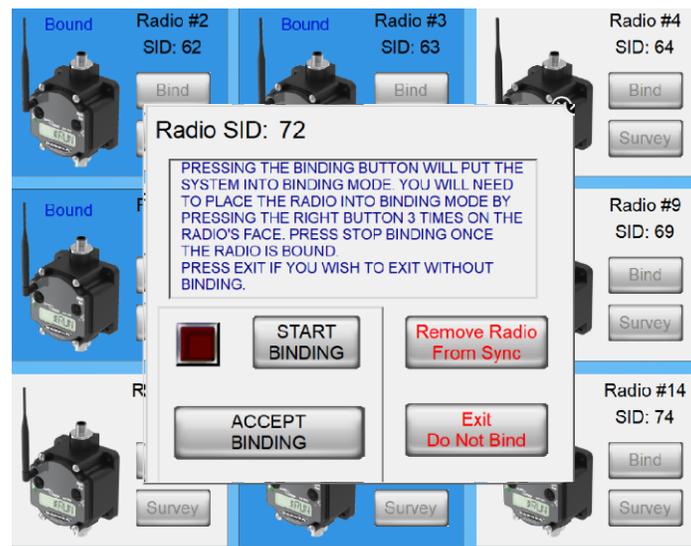
1. From the main Screen Click Radio Setup. This will open the Radio Screen.
2. From the Radio Screen select (click) “Bind” on an Unused (Unbound) Radio you wish to bind.

(Radio 4 and 9 are unbound in this image)



3. Click the Binding button one of the Radio Segments gives you a Binding Pop-up.

The following screen will Pop-up:



Press “**Start Binding**”, the Binding indicator will turn Red to indicate that Binding has started.  
**(Note, Binding is not allowed via Remote Connection)**

## 6.1 Binding the H10 Radio:

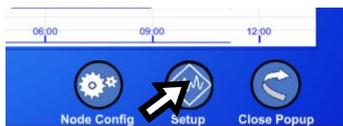
Unlike the Point to Point Radios, the H10 Multihop Radio has an LED Display. This display will inform you what the Radio is doing. The H10 Radio is woken up by the Mater during Binding and Site Survey.



1. After the binding is started from Vibe-Sight, press the 2<sup>nd</sup> button 3 times to start binding.
2. The two LED's will flash alternatively to show the unit is binding.
3. When complete both LED's will flash 4 times then go solid for a few seconds after that the unit will reset and Search for the Master and any Repeaters nearby. When this is complete the Radio will Show #Run. LED 1 will pulse show green with communication. During data transmission Led2 will flash yellow.

## 7. Adding in a Sensor:

From the Node Status Screen Select "Setup".



7.1 You need to configure the address of the Sensor manually. You can do this using one of the H10 Radios. **(Any H10 can be used for this, even Spares)**

You will see an explanation on the Setup Screen on how to do this. It is as follows:

1. Click Button 1 (left) on H10 Radio once. If nothing displays on the screen, press and hold Button 1 until the screen on the H10 radio shows "Power".
2. Screw in one QM30VT1 sensor.
3. Click Button 1 until \*DVCFG appears, then click Button 2 (right).
4. Click Button 1 until -S ADR appears and click Button 2.
5. Click Button 1 and wait for the radio to read the current sensor ID.  
A three-digit value appears with the current sensor ID with a blinking cursor.
6. Use the left button to cycle the value from 0 through 9 and the right button to accept the value and move the cursor to the next digit right.  
Each sensor must be assigned a unique SID. Use SID:
7. Click and hold button 2 until SAVING displays on the H10 Screen.

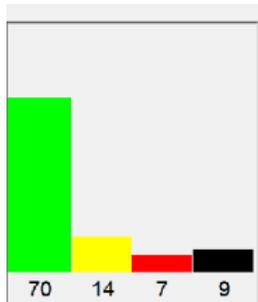
7.2 Connect this Sensor to the appropriate Radio and then do the following:

1. Fill in Sensor Name and H10 Radio SID on this Vibe-Sight Node Popup Screen
2. If you are setting up multiple sensor nodes, close this popup and go to the next node you wish to setup in Vibe-Sight.
3. Repeat Steps 7.1 to 7.2 as needed.
4. If you are setting up multiple sensors on this H10 Radio, remember to plug all back into the H10.

## 8. Site Survey:

**It is extremely important to do a Site Survey when placing your Nodes.** How well they communicate back to Vibe-Sight directly effects how well the system responds. The Good news is that Vibe-Sight has made performing the Site Surveys easy. To start a Site Survey, select the node you wish to Survey by clicking the Node on the Main Screen. This will bring up the Node Status Screen. From here, click on the **“Site Survey”** button. This will bring up the Site Survey Screen.

When the Screen is up press **“Start Survey,”** the Survey will start. It will take a few seconds for the Bar’s to normalize. When the Survey is finished all of the levels will add up to 100.



Here is what the bars mean:

1. **Green** – Excellent Signal Strength
2. **Yellow** – Okay Signal Strength
3. **Red** – Poor Signal Strength
4. **Black** – Missed Packets or # of required Repeats.

### Communication Examples:

**Very Strong Signal:** 100% Green, 0% Yellow, 0% Red, and 0% Black.

**Strong Signal:** 60% Green, 30% Yellow, 10% Red and 2% Black

**Okay Signal:** 20% Green, 60% Yellow, 10% Red and 10% Black

**Bad Signal:** 0% Green, 0% Yellow, 80% Red and 20% Black

**No Signal:** over 50% Black

The real culprit in radio transmission is the Black or missed Signals, requiring a repeated signal. On slow polling systems like Vibe-Sight, it is possible to operate with some missed packets. But it is not advisable to operate beyond 30% Missed Packets. If you are running Q45 Nodes and get a large number of missed packets or a large number of Red packets change up to a Performance node. This will allow you to move the antenna to a viable location and or move up to a larger antenna.

It is possible to have something like 70% Green, 0% Yellow, 0% Red and 30% Black. This occurs due to three main issues.

1. A significant amount of Emitted Radio Noise, as developed by some VFD's and SCR Drives
  - Move the antennas away from the area or look at filtering the noise makers.
2. Radio Signals bouncing around inside of a metal building with a significant number of machines. This causes the Radio signals to bounce back and interfere with themselves.
  - You can move the Node or antenna a bit and dramatically affect the results.
3. With **Multi-hop Radios** it is possible to get significant Radio Cross Talk So keep your Slave radios apart. A rule of thumb is 6ft apart if the radios are not directly in line with the Master or 15ft apart if in line.

If you are planning a Vibe-Sight system that is inside of a plant, has long distances or is not in direct line of sight, Vibe-Sight strongly recommends a **Site Survey** be performed prior to purchasing Nodes.

When you finish the Site Survey Click on “Stop Survey” to end the process.

## 9. Determining Setpoints:

Determining actual Vibration setpoints can be quite tedious. It is based on but not limited to the frequency of operation, Natural harmonic resonance, balance of your machines rotating components and how well the system is anchored into place.

To help with this, the International Standards Organization “ISO” came up with a chart that listed viable Vibration ranges for different types of Machinery. As seen below:

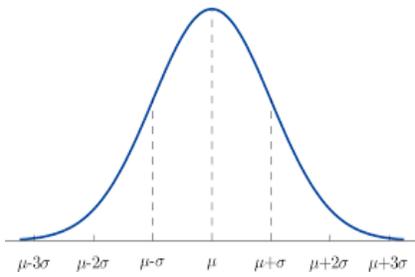
VIBRATION SEVERITY PER ISO 10816					
Machine		Class I small machines	Class II medium machines	Class III large rigid foundation	Class IV large soft foundation
in/s	mm/s				
Vibration Velocity Vrms	0.01	0.28			
	0.02	0.45			
	0.03	0.71		good	
	0.04	1.12			
	0.07	1.80			
	0.11	2.80		satisfactory	
	0.18	4.50			
	0.28	7.10		unsatisfactory	
	0.44	11.2			
	0.70	18.0			
	0.71	28.0		unacceptable	
	1.10	45.0			

Since these standards are quite often used when selecting Vibration, we have added these classes in as Setpoints.

If you need to modify these settings select the closest setting and then select “**Manual User Entry**” you can then modify the Setpoints to meet your needs.

**There is another way to look at These set points.** Since we are looking at change in Vibration as a vehicle to determine System Health, we can use statistics to determine vibration that is acceptable or out of range for a sample set of vibration data.

## 10. Using Statistics:



If “**Automatic Setpoint Calculation**” is selected we sample the data over 8, 16 or 24 hours of actual run time (8 is default). Note this does not occur until the Automatic Runtime calculation has been completed. When complete, we calculate the Standard Deviation of the Sample set. Then By default, we select 3 Standard Deviations as the Alarm Condition effectively just outside of the standard curve, and 5 Standard Deviations as the Fault condition. This can be adjusted as required.

You may also select your own count of how many samples above the alarm setpoint are required to be an Alarm.

**Health** is calculated with a proprietary algorithm that looks at Axis conditions and the Regression line of the Daily Average Trend lines.

## 11. Dynamic Tracking:

New in V2, is the ability to turn on Dynamic tracking. When Dynamic tracking is on, Vibe-Sight will track fast swings, which occur with catastrophic failure or certain bearing failures.

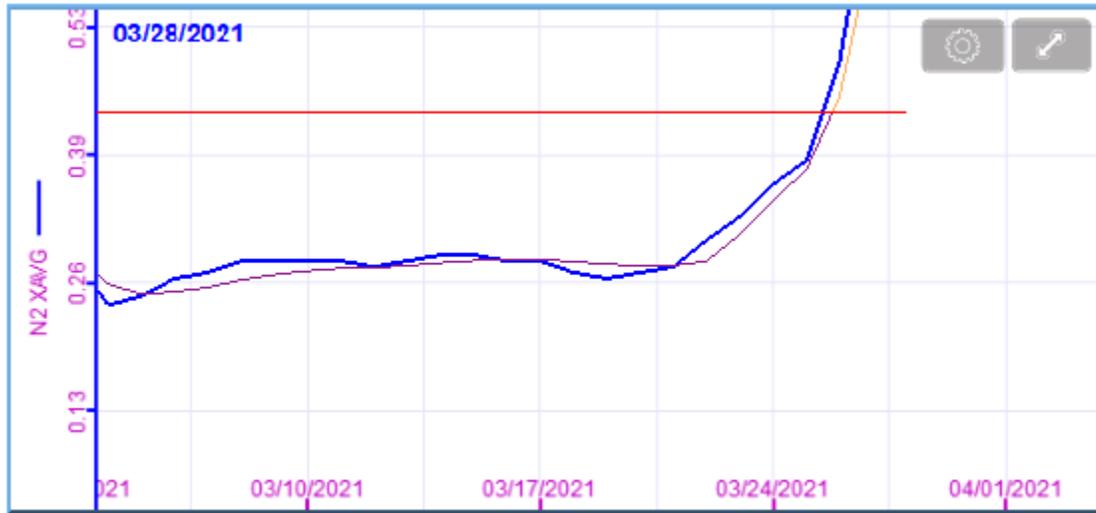
The key to making Dynamic Tracking work is setting the trigger point at a level that it can respond to the changes and not generate false alarms. By default, Vibe-Sight uses 50% of the alarm set point SP2. It is 50% of the difference between the normal operation SP1 and the alarm SP3. If you get too many false errors. Either turn off Dynamic tracking or set the default set point higher.

**Here is an example of a Bearing failure without Dynamic Tracking:**



You can see that it takes several days to respond to the failure.

Here is an example of bearing failure with Dynamic tracking turned on:



You can see the Regression line bending to track the error in near real time.

## 12. Remote Viewing of Vibe-Sight Screens

You can connect up to the cMT HMI via a number of paths.

1. You can connect to the default WIFI access point ESSDI Vibe-Sight, password Vibration1
2. You can connect via the LAN port of the cMT HMI.
3. You can connect remotely through the Tosibox Security Appliance or Easy Web

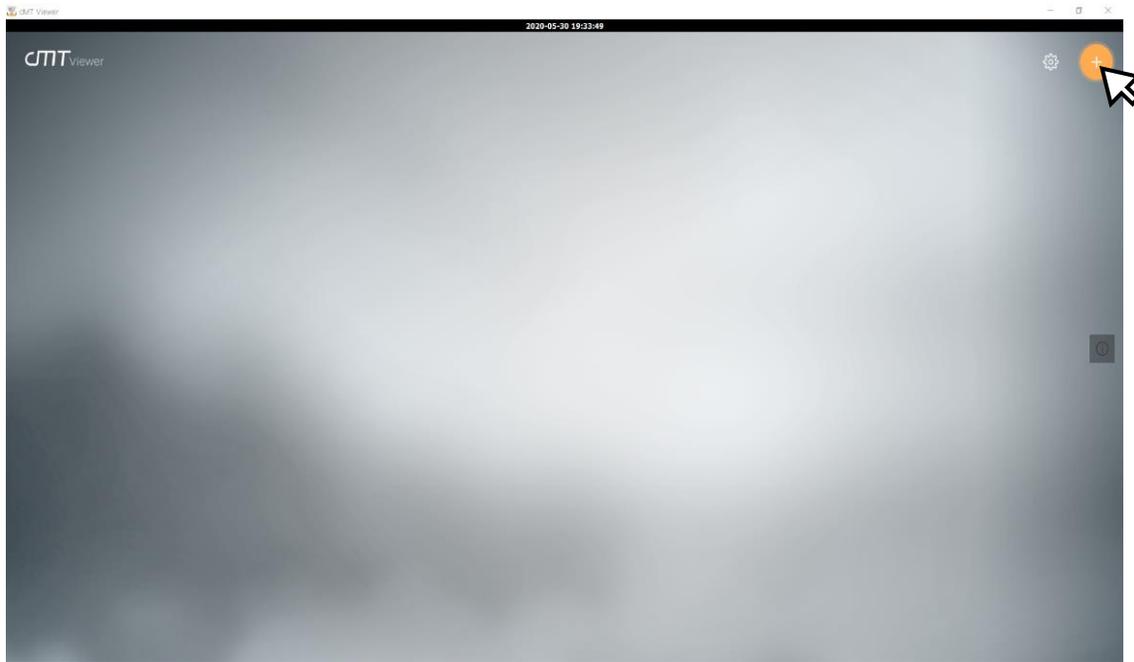
Whichever way you decide to connect you will have access to the Predictive Maintenance Appliance. The application for this is the cMT-Viewer.

If you are using a Windows Computer or Windows based Tablet to access the appliance there is a copy of cMT-Viewer for windows stored on the Tosibox Key included with your Vibe-Sight System.

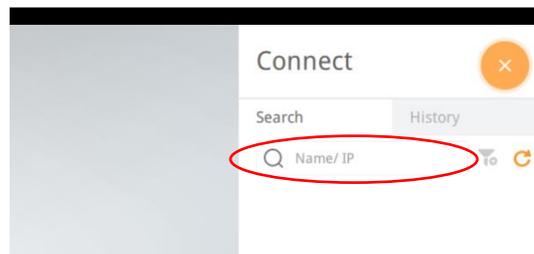
If you are using an Android or IOS Phone or Tablet you may download the app form Googles Play Store.

## 12.1 cMT Viewer

Once loaded the cMT View looks Like the following:



 Click the Orange + this will open up the connection setup.



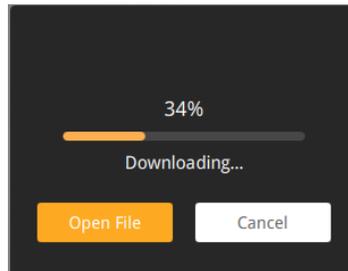
Type in the IP address of your Vibe-Sight Appliance.

The Default IP address is **192.168.11.11**. If you have changed the address and are unsure what it is connect locally and look at the System Configuration. You will see it at the top of the Window, LAN 1.

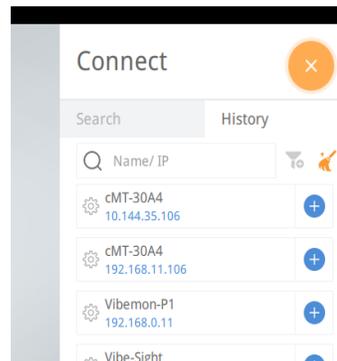
If you are connecting remotely through Tosibox the Default address is via a 1:1 Nat translation and may be different on your system. Please read the next section on Tosibox to see how to connect in and obtain Vibe-Sight's IP address.

You may be asked for a password. The default password is 111111.

If this is the first time you have connected you will see a Download window. This is Normal and it the Lite client downloading pertinent information for the connection. When Downloaded Vibe-Sight will Open.



Once you have opened cMT-Viewer on following occasions, you can use the History Tab to connect directly to your Vibe-Sight appliance. Note if you have connected locally and remotely through Tosibox you will have both IP addresses listed to pick from. Just press the + adjacent the appropriate Device.



## 12.2 WebView

Vibe-Sight also has a built in WebViewer this allows you to directly access Vibe-Sight's screens. Just enter Vibe-Sight's URL address into your browser. You will be prompted for a password. The Default password is 111111. Unlike cMT Viewer You will be sharing the screen with the main view of the system. What page you view will be viewed on the main system as well.

## 13. Remote Connection to Vibe-Sight Via Tosibox

### 13.1 Default Connections:

Vibe-Sight uses Tosibox's Lock 175 as its Layer 3 Router with 1:1 NAT and Security Appliance. This Wan port is typically passed through the Plant Network to the Internet. The Lock 175 also allows many different ways of connectivity. Our Default connections are as follows:

1. WIFI – The lock 175 is WIFI enabled. By default, we have set it up as a WIFI Access point. You can connect to it via WIFI enabled computers, Tablets and Smart Phones.

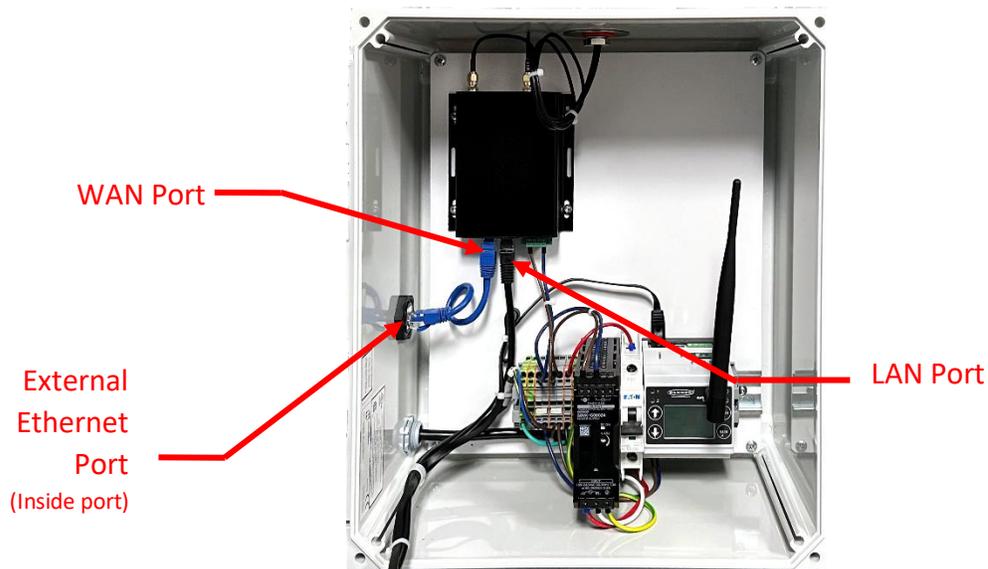
**SSID – Vibe-Sight**

**Password – Vibration1**, (We suggest you change this password to a more secure one at your facility)

2. Remote Access via the Tosibox Security System. The WAN port of the Tosibox router is setup to request an IP address via DHCP from your facilities Switch / router or security appliance that has access to the Internet. Once Internet Access is granted the Tosibox Security system will control remote access via a high-level PKI algorithm with 2-part authentication. More on this later.
3. Optional Cellular Remote access. Vibe-Sight can have an optional Cellular Router for connection to the Internet. This is now a very economical way to gain remote access and keeps the system Isolated from your network.

### 13.1.1 Connect Directly to Vibe-Sights LAN:

By default, the ethernet patch cable is connected from the RJ-45 receptacle on Vibe-Sight's enclosure to the Lock-175's WAN Port. The Cable coming from the HMI may be taken off of the Tosibox Lan to allow a plant network direct access into Vibe-Sight. The Lock-175 will be removed from the connection. This leaves you with no Security. If you wish to tie in a device with a static IP address the default subnet is 192.168.11.xxx.



### 13.1.2 Tosibox Lock-175 WIFI as a Client to You Guest Account

The Tosibox WIFI Radio can be converted to a WIFI client and allow Tosibox's WAN to connect wirelessly to your plants WIFI account or Guest WIFI account. Using Item 12.1.1 and 12.1.2 together represent the one of the most secure connection for your Vibe-Sight Echo System. Converting the WIFI to a client on your Guest account allows Tosibox to have access to the Internet without tying into your plants network, keeping everything isolated. The only access into Vibe-Sight is now controlled by the Tosibox security appliance which will only allow Tosibox Key holders access into its Echo System. A VPN Tunnel is then formed for all remote Key holder connections into Vibe-Sight. **See addendum 3.0 for information on changing the WIFI to Client mode.**

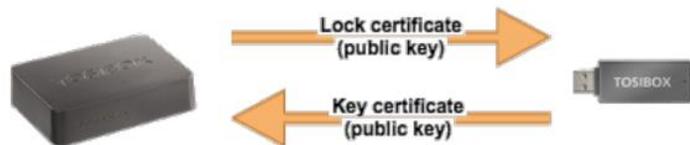
### 13.1.3 Tosibox Lock-175 with Cellular Network

The Tosibox Lock-175 has a built in Cellular Modem. Tosibox uses the “Teal” Network with an eSim card. This allows Tosibox to connect to the most favorable network. Vibe-Sight has configured the Tosibox Cellular modem but the Sim card must be activated with a monthly plan from Tosibox to be used. Using Item 12.1.1 and 12.1.3 together represents the most secure connection for your Vibe-Sight Echo System. Using the Cellular Radio allows Tosibox to have access to the Internet without tying into your plants network, keeping everything isolated. The only access into Vibe-Sight is now controlled by the Tosibox security appliance which will only allow Tosibox Key holders access into its Echo System. A VPN Tunnel is then formed for all remote Key holder connections into Vibe-Sight. **See addendum 3.0 for information on using the Cellular mode.**

### 13.2 How does Tosibox Work?

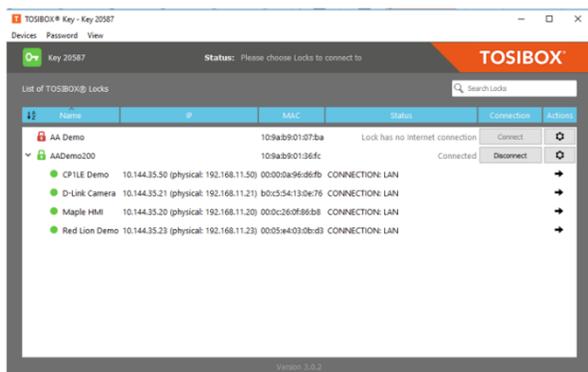
The minimum setup for Tosibox is one Tosibox Lock and one Tosibox Master Key. The Master Key shares a PKI certificate and secure password with the Tosibox lock by a patented serialization routine. When the Lock is powered up, the Master Key is inserted into the Locks USB port. This serializes the Key to the Lock. Once the Lock is serialized it can not be serialized to another Key.

**The Key provided with Vibe-Sight is pre-serialized to the Lock 150.**

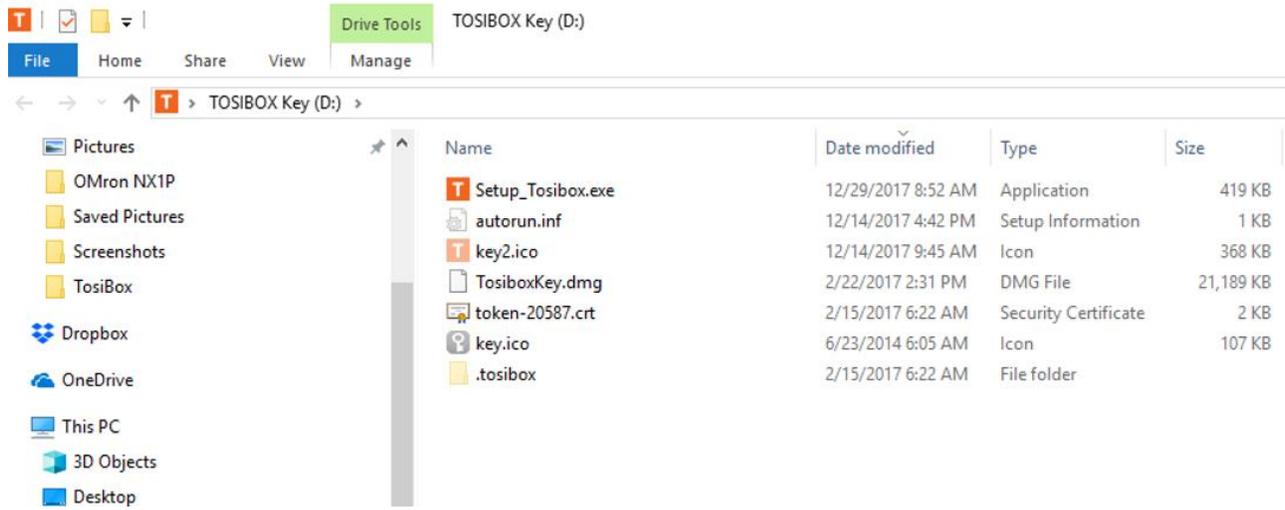


The Master Key looks like a regular USB memory stick, but in reality, has a Cybersecurity Chipset embedded in it. The security on this serialization is 2048-bit encryption.

When you first plug in the Key to your computer, it attempts to load an App on your computer.

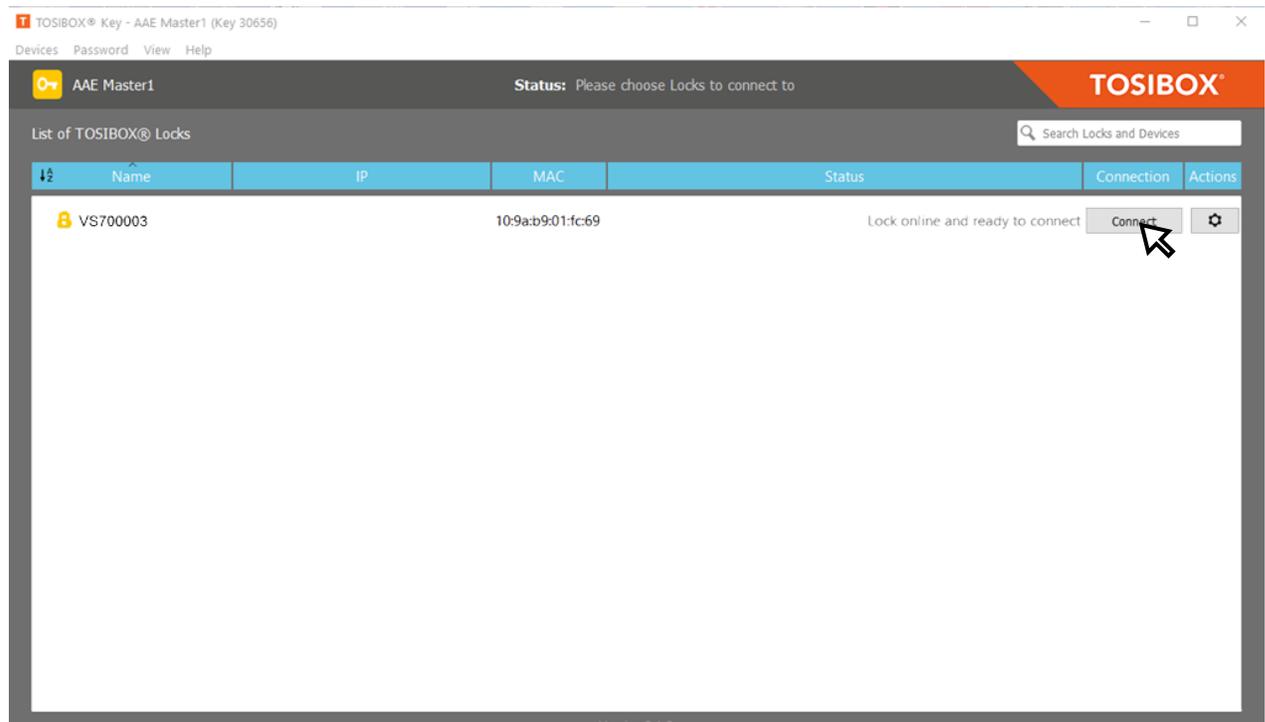


If your computer does not allow that to automatically load the File is located on the Root of the KEY. You can access this via Windows Explorer, just like a standard USB Drive.



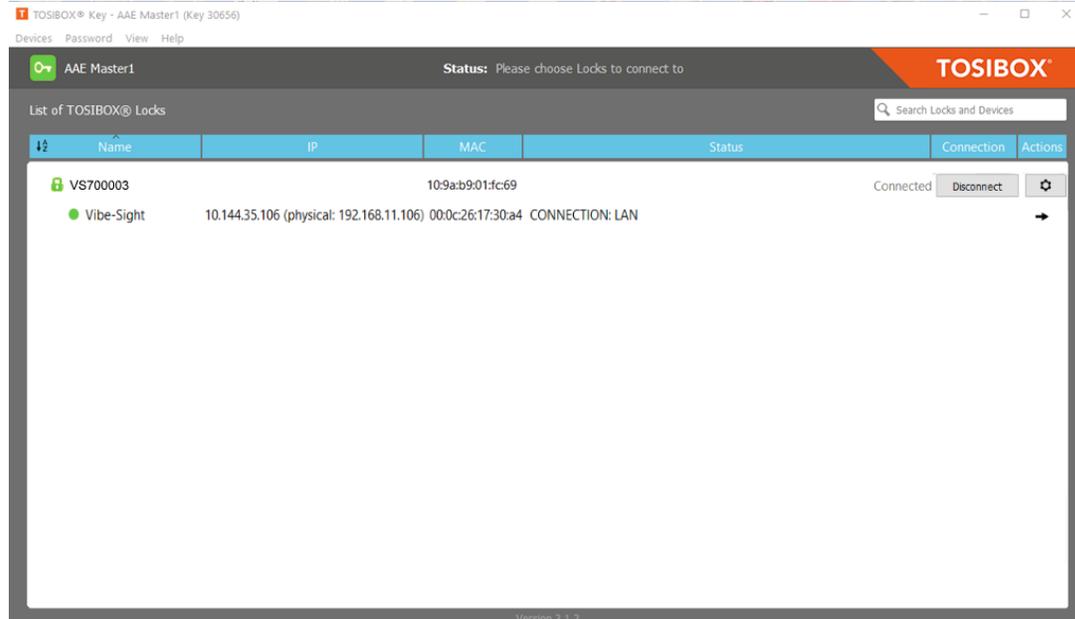
Run the file “Setup\_Tosibox.exe.”

This will load in the application. When you next put your Key in the Computer the following Window will popup.



If your Lock is connected to the Internet it will show up Yellow. If it is not yet connected it will show up Red. Once you have it connected to the internet you can continue. By clicking on the “Connect” button.

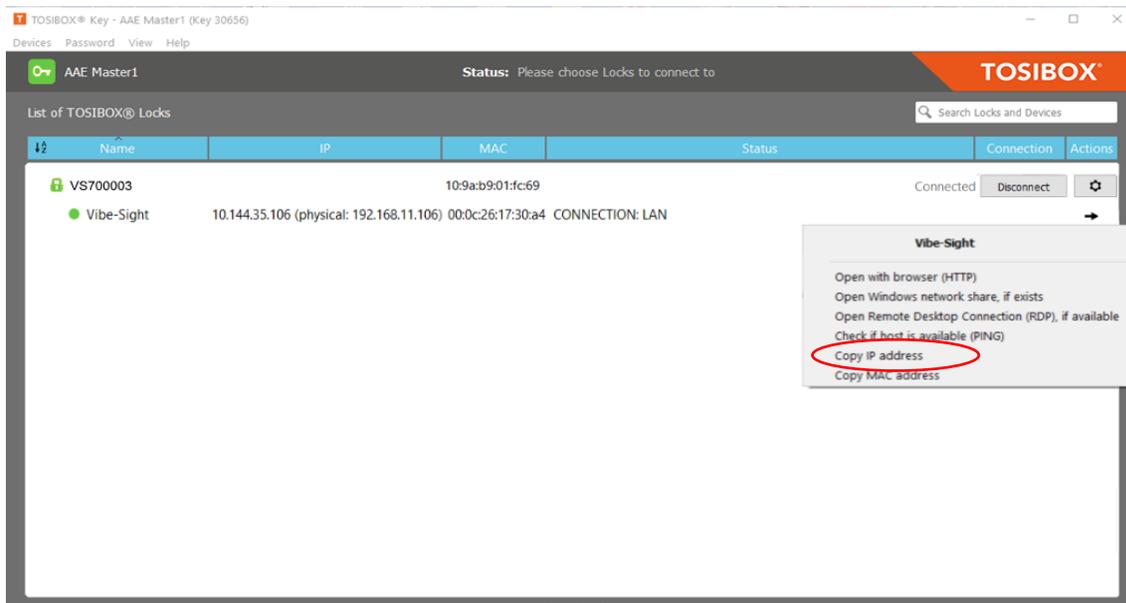
Once you are connected you will see the following window.



You will see the Lock turns Green, the Key turns Green and the Vibe-Sight shows up Green.

This lets you know you are ready to connect. To Vibe-Sight.

You will see that Vibe-Sight has two IP addresses. One is the Physical address and the other is the NAT address. The NAT address is the one you want to use. There is a quick way to copy the NAT address for use with cMT-Viewer. Click the little arrow on the right hand side of the window.



Select Copy IP Address and the address will be copied to your clipboard. When cMT-Viewer asks for an address paste this in place. See Addendum 2 for more information on Tosibox.

## ADDENDUMS:

### 1. 2<sup>nd</sup> LAN port on the cMT

The second LAN port of the cMT is connected to the Banner Gateway. Leaving only the 1<sup>st</sup> LAN port for communications. By Default this is connected to the Tosibox Security Appliance.

1.1 Want to connect Vibe-Sight to an MES network or to an existing plant network? Vibe-Sight can pass data through Tosibox to the remote system. If your MES or SCADA system cannot act as a Modbus Servant, you can connect the first LAN port on the cMT directly to your plant network.

1.2 You can access the cMT Dashboard to configure the LAN ports in two different ways.

#### 1.2.1 Via cMT

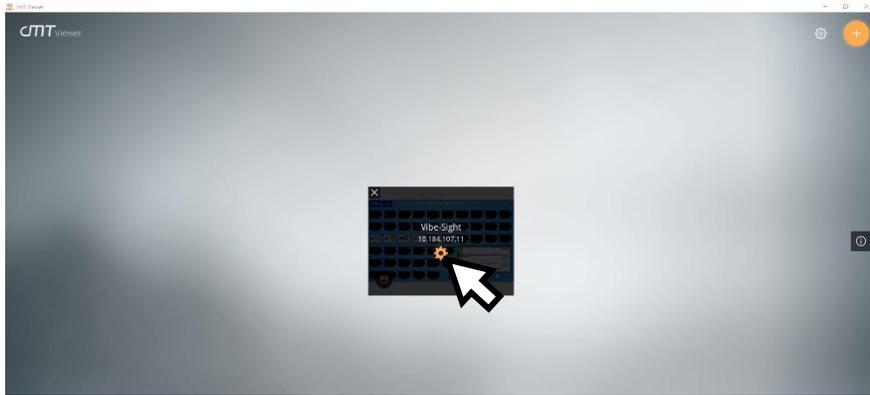
Then, click and hold the top lefthand corner of the screen



This will open up the cMT configuration page

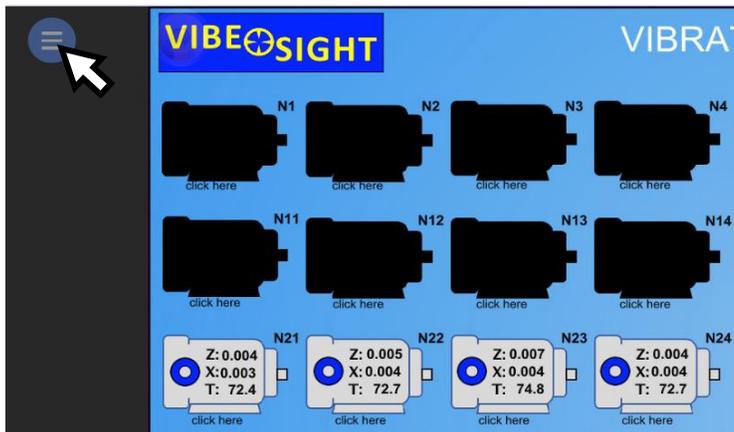


Then click on the small grey power button located on the middle right side of the screen.



This will bring up the access to the cMT Configuration page. Click the Orange Sprocket in the center of the greyed-out Vibe-Sight Screen Icon.

The cMT EasyWeb will be displayed.  
The default password is 111111.

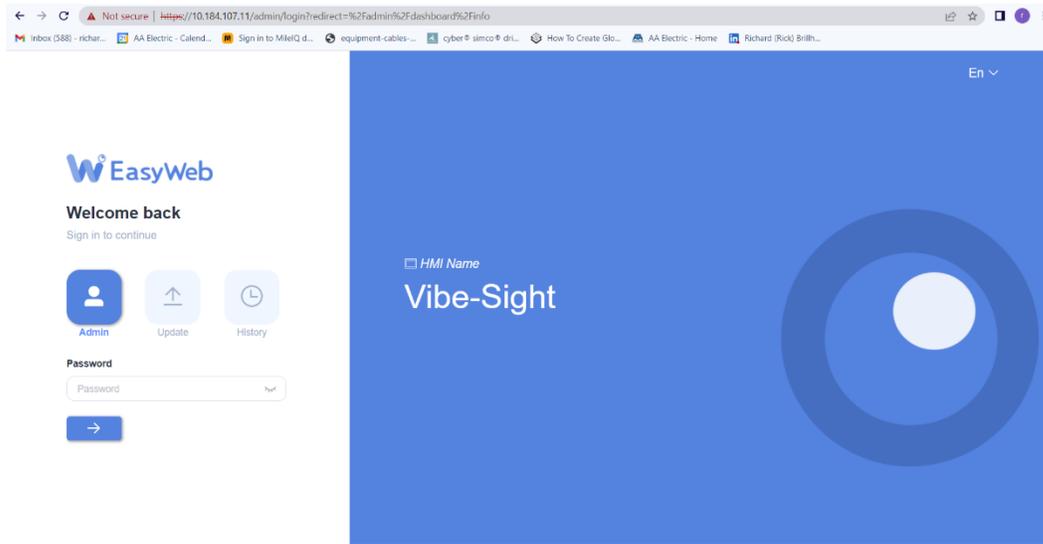


Click the blue circle with the 3 horizontal bars.

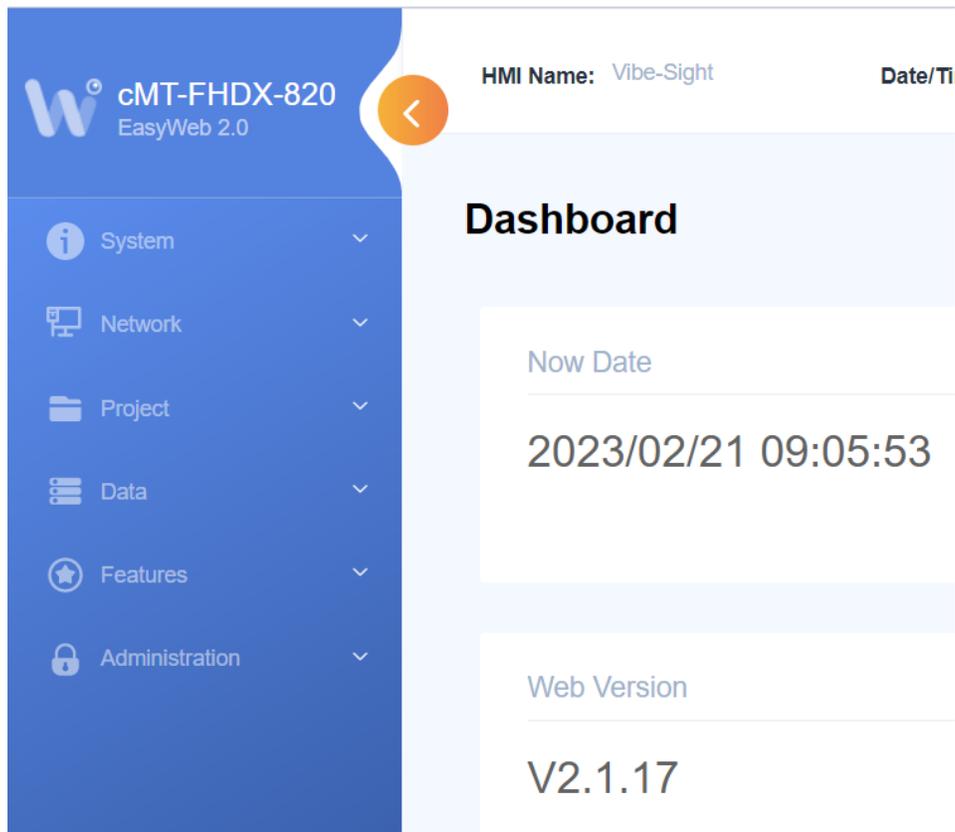


Click the white Sprocket.  
This will open the EasyWeb Portal. You want to be on the Admin Icon.

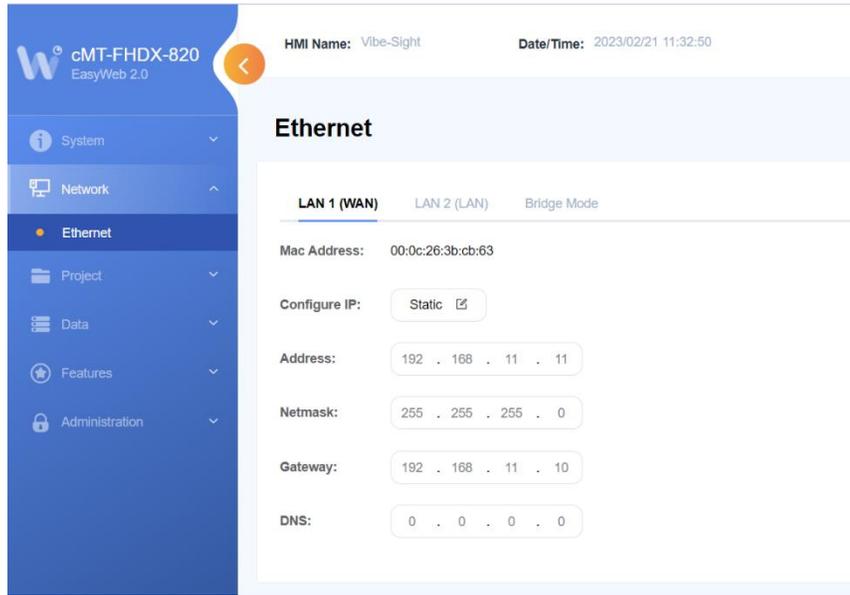
The default password is 111111.



This will open up the cMT Dashboard.



Select Network and then Ethernet



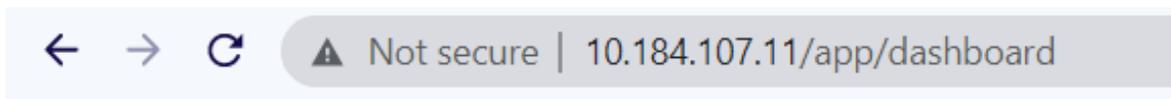
Here you can set up your IP address on the 1<sup>st</sup> or 2<sup>nd</sup> port. Do not change the 1<sup>st</sup> port unless you are changing all Vibe-Sight devices.

Click save and then Logout when you are complete.

### 1.2.2 Via EasyWeb

Alternately you can directly access the EasyWeb typing the LAN 1 IP address into a browser (use the direct IP address if you are connected via the Lan or the Nat address if connected via Tosibox. You may also double click the Vibe-Sight line on the Tosibox App.

a.



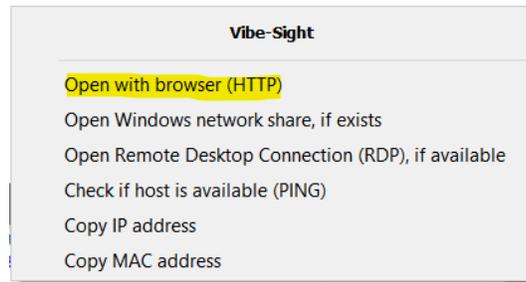
b.



Double Click

c. Or select the arrow on the right of the Vibe-Sight listing and select

## “Open with browser (HTTP)”



## 2. Introduction to Tosibox

### 2.1 Minimum Setup:

1. You need at least one Lock
  - a. Vibe-Sight uses the Lock-175.
2. You will need one Master Key.
  - a. A Pre-Serialized Key is included with each Vibe-Sight.
3. The Master Key must be linked to the Lock. These **must be serialized**, Master Key to Lock
4. Note the Lock-175 must be serialized using remote matching.
5. With this setup one individual can gain access to the lock from anywhere with a secure VPN connection.

### 2.2 Adding Additional Personnel (keys):

1. Once you have made the one “Master Key” it can make additional keys, the lock is not required for that.
2. There is a small applet that is loaded by the key when it is first inserted into a computer. Your computer may not auto load the software, but it is in the key. Look at the key as if it was a USB memory stick and manually start the setup program. “Setup\_Tosibox.exe.”
3. More on this applet later, but this is used to make “backup keys” of the Master Key and to spawn subordinate keys of the Master.
4. The Sub keys can be given to maintenance Techs, Engineers and Managers as required
5. Sub Keys can be either **Hardware Keys** or **Soft Keys** (See your Vibe-Sight Distributor or Reseller for information on additional Keys)

### 2.3 Adding additional sites (Locks):

1. The Master Key must **physically** be serialized to **each new Lock**
2. Its best to bring each lock into your office to serialize it to the Master key before sending it out.
3. You **do not** have to bring in the subordinate keys (more on this latter)
4. Each Subordinate key can be, **selectively linked** to the new Locks.
5. You pick which key goes to which lock by a checkbox selection.

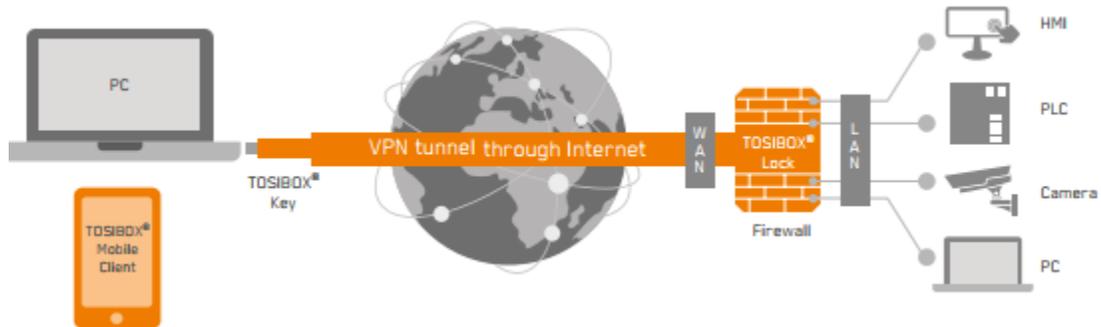
## 2.4 What happens if you lose your Master Key?

1. **That is what the backup key is for.** Make one and keep it in a safe place.
2. For security reasons, if you do not have your backup key you will need to go on site to each Lock and re-serialize each Lock to the new Master.

## 2.5 Types of Lock Connections:

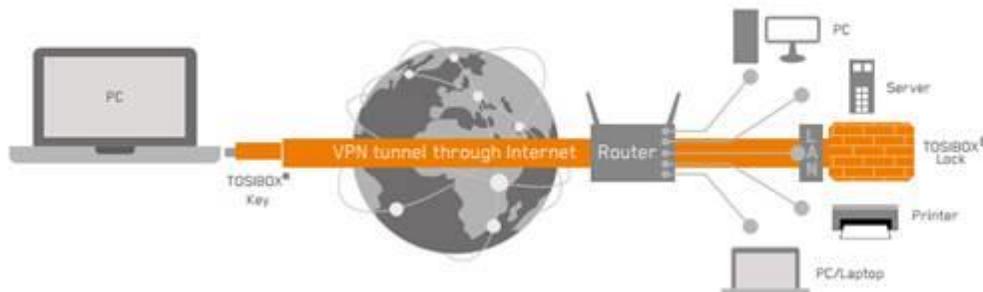
The Tosibox Lock can be set up in two modes.

1. Lock mode (Default) will act as your final Layer 3 router, firewall / VPN. The Wan port will connect to your internet connection.
  - The Wan side of the Tosibox lock can sit behind most firewalls and get out. Your Lock could actually be sitting on a guest connection and still make a full VPN connection. Devices set on the Lan side of the Tosibox Lock will be protected.



- The Lock will only allow a connection from the paired key.

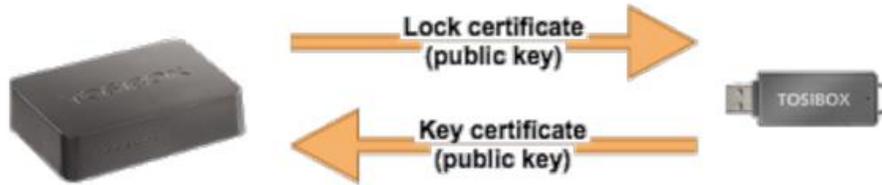
2. The second mode can connect up to your existing architecture acting as a client



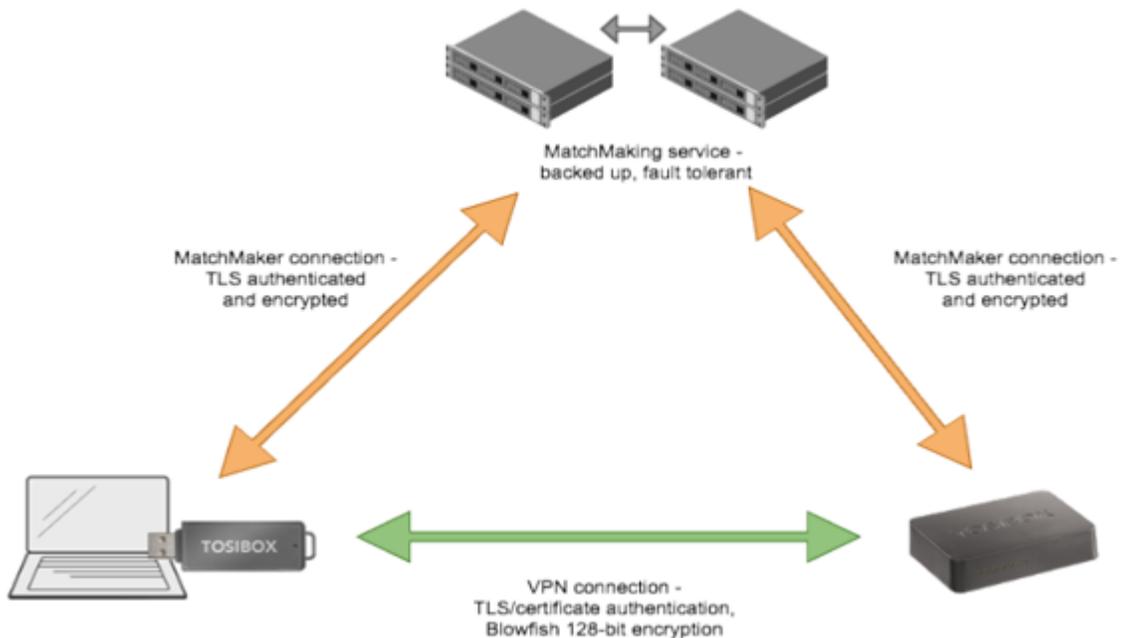
- All of the devices on the network would then be available for remote access.
- This would be beneficial if you were wanting to set up a secure remote access into your office network for remote personnel.

## 2.6 How does this work?

- The Master Key must be serialized to the Lock:



- The Tosibox Lock will make an outgoing connection to Tosibox's "Match Making Servers."



- Tosibox's server will validate the lock and check for serialized Keys.
- When you plug your Key into your computer the program will load and securely connect to the "Match Making Server" once this Key connects up, the server matches the Key to the Lock.
- The Key and the Lock have a Cryptologic chip set built in.
- Serialization encryption is via 2048-bit RSA key, physical key exchange (this is not a typo)
- Once the Match making service validates to Key to Lock you have a completed VPN connection from Key to Lock.
- At this point the match making server drops out leaving a VPN tunnel between the Lock and Key.
- Encryption on this tunnel can be as high as AES 256 CBC

- You do not need to remember any IP addresses to connect to the Key and Lock. The software will show you available locks and the devices under the locks.
- Once the connection to the lock has been made you can do anything just like you were connected locally to the device.
- Each lock also has full NAT capabilities. The Key file will show you the NAT address and the local address. (You can keep the same IP addresses at the local level on all machines without getting IP conflicts)
- **One key can connect to multiple locks.**
- **One Lock can connect to multiple Keys.**
- **You only need to have the direct connection once between your Lock and the Master Key one time to set things up.**
- You can also have a password on the Key making it truly 2-part authentication.
- The Key when first connected to your computer will download a small operational applet.
- This will allow you to select which lock to connect to and to administer the Locks and Keys, (if you have the Master Key).
- The Master Key can, through its applet make backup master Keys.
- It can also make Subkeys are what you will give to your necessary staff
- You can dictate which Subkey gets connected to which Lock
- You can change these connections on the fly with the addition of additional Locks.
- There is a Soft-Key that has all of the security but is Loaded on a computer. Configuration of the softkey is similar to a Sub-Key. Sub-Keys when terminated are returned automatically to the parent key.

### **2.7 Excerpt from Tosibox's Security Paper:**

"...TOSIBOX devices identify each other by cryptographic pairing (serialization) in which the devices must be serialized/paired with each other before use. This is achieved by connecting the TOSIBOX devices together physically. In the serialization process, the key device (Key) is inserted into the USB port of the Lock device. The Lock and Key then exchange the public key of the keypair with each other in order to create a mutual trust relationship. The encryption key is stored in a closed memory location of the crypto processor on the Key device. It cannot be copied or tampered with. Establishing a connection is impossible without the correct encryption keys. Additionally, each encrypted data stream is protected with disposable encryption keys that are exchanged with the DH method..."

### **2.8 Simultaneous Connections:**

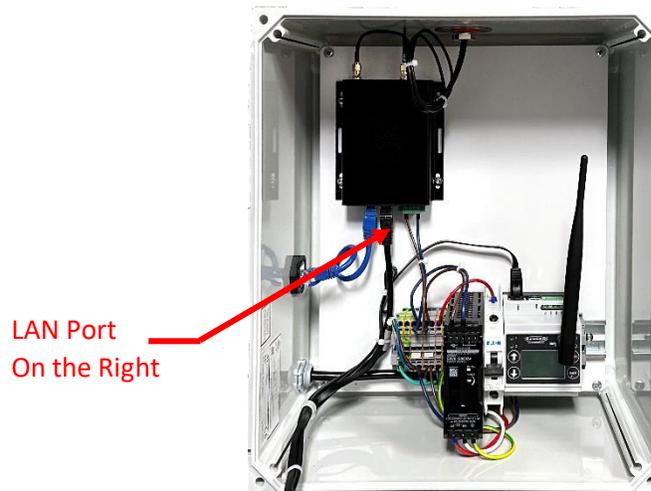
1. A Lock 175 allows 10 simultaneous connections at a speed of 10MBPS
2. Vibe-Sight will allow 4 remote connections and 1 local connection.

### 3. Setting Up Tosibox as a WIFI Client

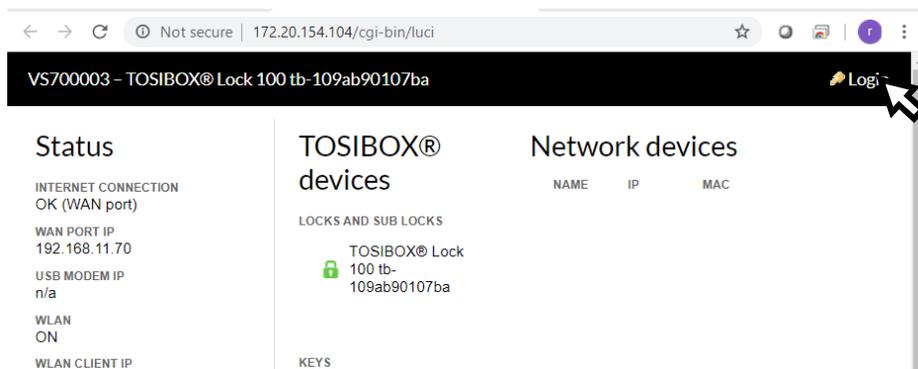
The WIFI radio on your Tosibox Lock-175 can be set up to be a WIFI Client. When that occurs, the Lock obtains its WAN port connection from its WIFI channel. This lets you connect to your plant WIFI network or Guest Account.

The following information lets you configure your Tosibox Lock-175 as a WIFI client:

You must connect to the Tosibox. This can be done via the Tosibox Applet. If you have not yet connected it into the internet you must go through the LAN-Port.



Using an Internet Browser connect to Tosibox's internal Webpage. Its IP address is 10.10.10.254. The Tosibox Password on Vibe-Sight is pre-configured to VS and the Password on the bottom. When you connect the following screen will display.



Once connected You will need to click the Login field in the top right-hand corner. The Sign-in screen will look like the following:



## Authorization Required

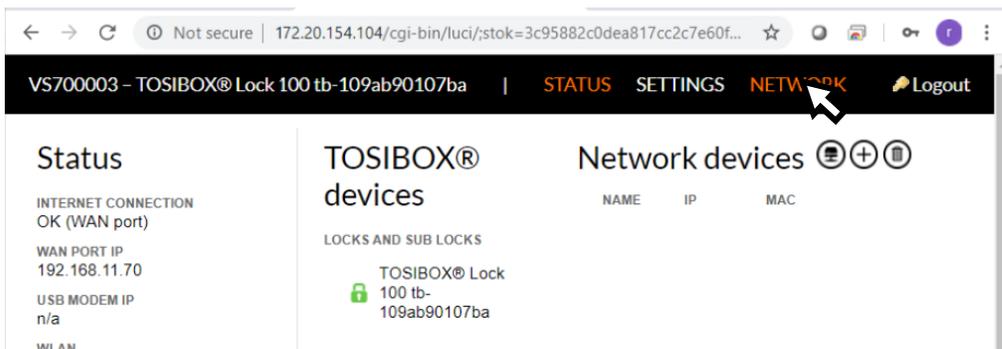
Username:

Password:

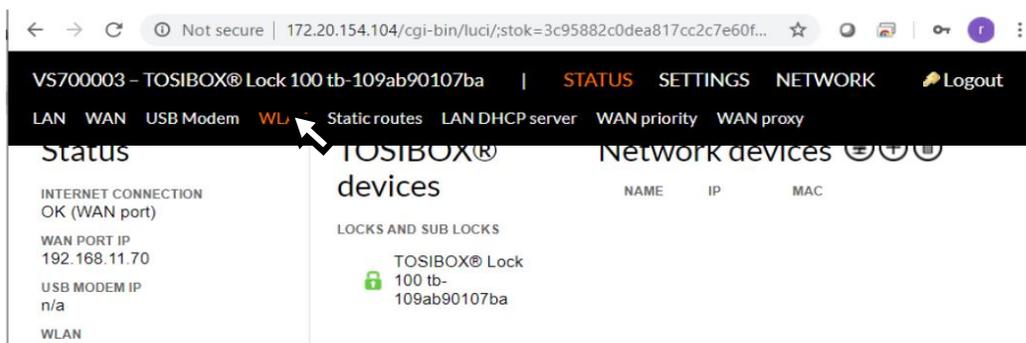
Login

If there is not a small label on the visible side of your Lock-175 you will need to look at the backside of the Lock. Each Lock has a unique password.

Once you have logged in you will need to click Network, see the following page:



Once you are in the Network Section click WLAN





## Wireless Overview

**Wireless Network Configuration**

Channel: 1 (2.412 GHz) | Bitrate: ? Mb/s

SSID: Vibe-Sight | Mode: Access Point

BSSID: 00:0F:02:75:D2:FE | Encryption: WPA2 PSK (CCMP)

Edit

Click the Edit button to change the WIFI Settings.

**Wireless Network: Access Point "Vibe-Sight"**

**Device Configuration**

General Setup
Advanced Settings

Wireless network is enabled
Disable

Channel
auto

Transmit power
27 dBm (501 mW)

**Interface Configuration**

General Setup
Wireless Security
MAC-Filter

Network name (ESSID)
Vibe-Sight

Mode
Access Point

Hide ESSID

Save

Click on the Mode field. It is displaying Access Point. You will have a choice of Access Point or Client. Pick Client.

Wireless Network: Access Point "Vibe-Sight"

Device Configuration

General Setup | Advanced Settings

Wireless network is enabled **Disable**

Channel: auto

Transmit power: 27 dBm (501 mW)

Interface Configuration

General Setup | Wireless Security

Network name (ESSID): AAEGUEST

Mode: Client

Save

You will now need to change the Network ID to the ESSID of your Plants WIFI network. For reference it is shown as AAEGUEST.

Click on the Wireless Security Tab to enter in the password for your WIFI Network.

Wireless Network: Access Point "Vibe-Sight"

Device Configuration

General Setup | Advanced Settings

Wireless network is enabled **Disable**

Channel: auto

Transmit power: 27 dBm (501 mW)

Interface Configuration

General Setup | Wireless Security

Encryption: WPA2-PSK

Key: [REDACTED]

Save

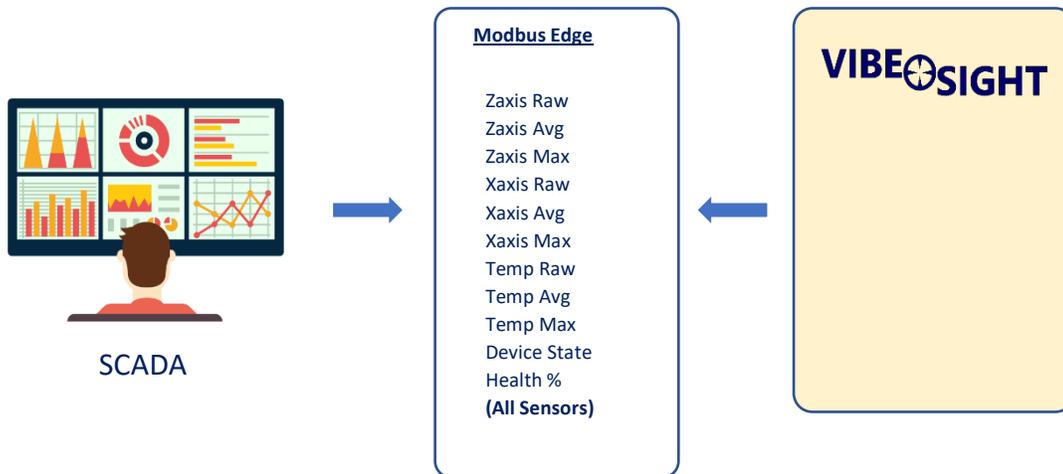
Set the Encryption type and then enter the password into the field marked Key. Hit Save. Your lock will restart and will connect to the Internet.

Connect back to the Webpage and with status see if you are connected.

#### 4. Vibe-Sight Edge Server:

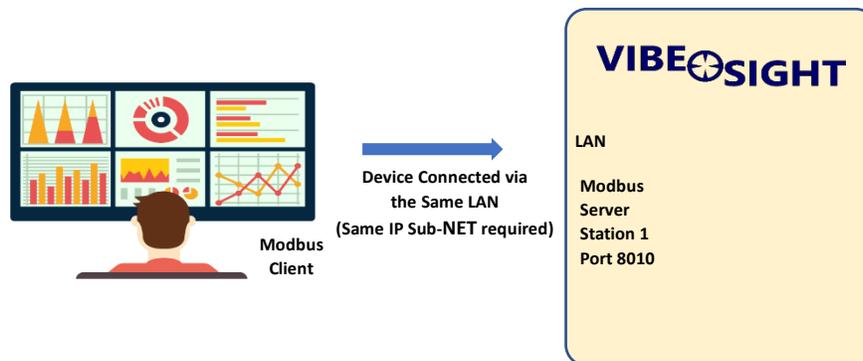
Vibe-Sight has a built in Modbus Edge Server that will provide pertinent information to External Devices such as:

- MES Systems
- Scada
- Data Historian
- Cloud Systems
- Plant information Systems



#### Data Exchange Configuration:

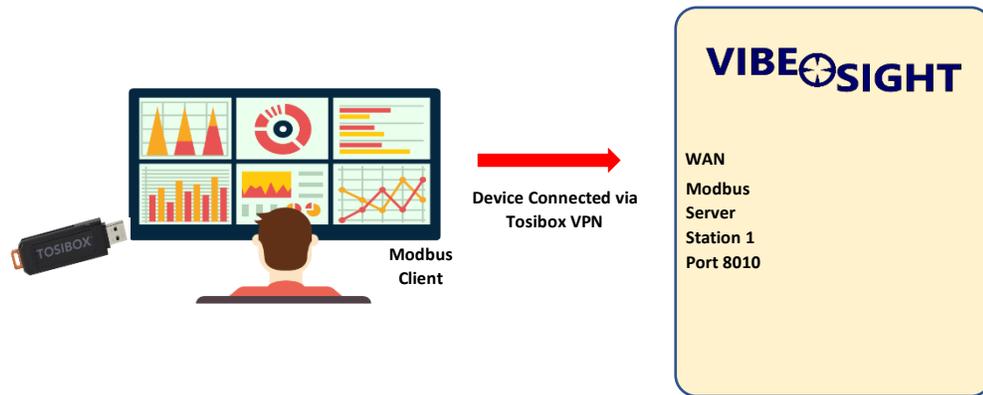
##### 4.1. Connection Via the Same LAN:



For this connection the external connection from **Vibe-Sight** needs to be the internal Lan connection from the switch, or make the second Network port on the cMT match the Plant Network Subnet and use it. **Vibe-Sight** will have to be changed to the same subnet or the second port on the cMT will need to be set up. (See Addendum 1). Note, on **Vibe-Sight<sub>Lt</sub>** you must use port 1 disconnecting it from Tosibox.

## 4.2. Remote Connection Via Tosibox VPN Tunnel:

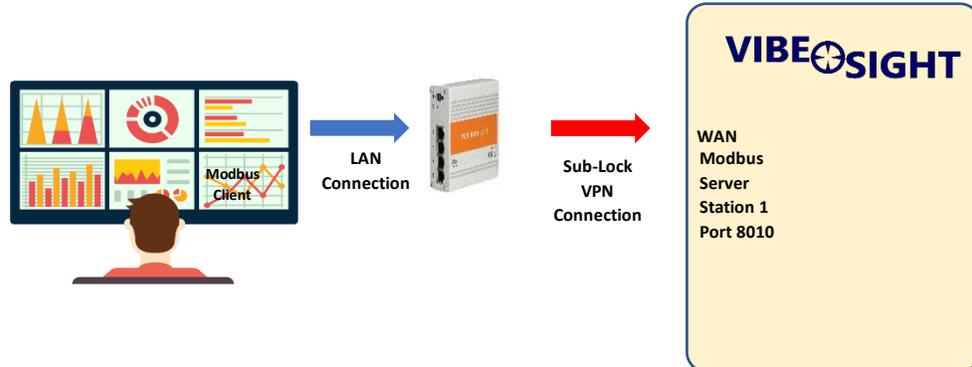
### 4.2.1. Using a Tosibox Key



For this connection the external connection from Vibe-Sight needs to be to the WAN port on the Tosibox security Device.

The SCADA or MES Computer must be connected via Tosibox. The simplest solution is to either use a Tosibox Hard Key or Soft Key. The connection will need to be reconnected on power up of the system. This works if the SCADA Computer has a connection to the Internet or both the Scada and the Vibe-Sight WAN are connected to the same Sub-Net.

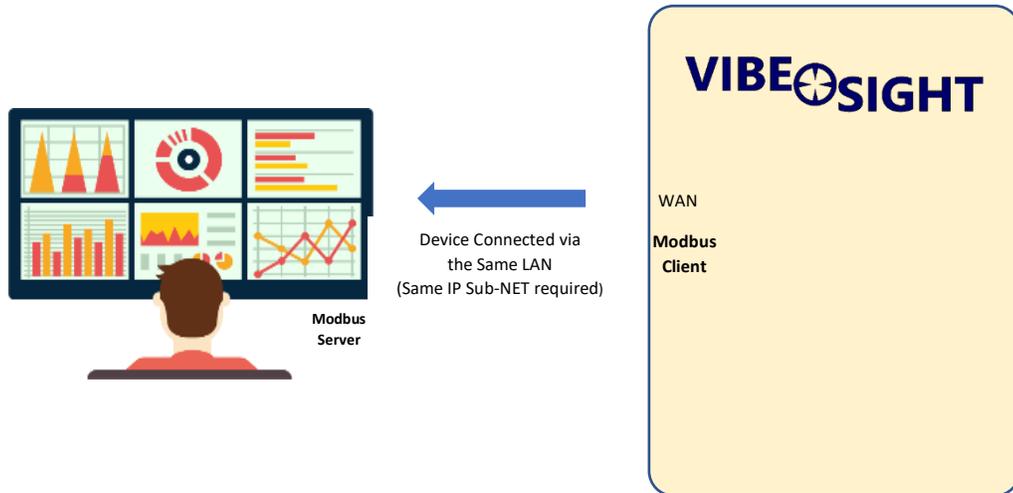
### 4.2.2. Using a Sub-Lock



For this connection the external connection from Vibe-Sight needs to be to the WAN port on the Tosibox security Device.

The SCADA or MES Computer needs to connect to a Tosibox Lock. The SCADA Lock can be a Sub-lock to Vibe-Sight or the reverse, Vibe-Sight to SCADA. (See Addendum 2 for information on Tosibox). With this connection the locks will reconnect on power up requiring no monitoring or assistance. You may also choose to connect via a full Tosibox platform. If so, please see your Vibe-Sight representative.

#### 4.2.3. Remote Connection Routed through Vibe-Sight WAN:



If your SCADA or MES Computer can be set up as a Modbus Server, the Vibe-Sight gateway can be setup as a Modbus Client. With this, the Data can be routed from the WAN port of Vibe-Sight past its firewall and through to the Server.

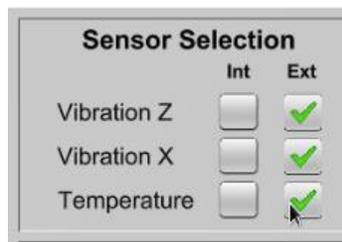
This will require Integration to set up a new device in the cMT and pass the appropriate data to the SCADA / MES compute.

### 4.3. Parameters List:

Exposed Data Modbus Server Vibe-Sight to Device								
	Definition	Data Type	Modbus Start	Modbus End	Addressing Notes	Starting Address	Access	Format
1	Z Axis Vibration (Raw)	Int	40100	40120	Node 1 starts at 40101 each successive node increments up by 1	651	Read Only	Data x 1000
2	Z Axis Avg Daily Vibration	Int	40150	40170	Node 1 starts at 40151 each successive node increments up by 1	701	Read Only	Data x 1000
3	Z Axis Max Daily Vibration	Int	40200	40220	Node 1 starts at 40201 each successive node increments up by 1	751	Read Only	Data x 1000
4	X Axis Vibration (Raw)	Int	40250	40270	Node 1 starts at 40251 each successive node increments up by 1	801	Read Only	Data x 1000
5	X Axis Avg Daily Vibration	Int	40300	40320	Node 1 starts at 40301 each successive node increments up by 1	851	Read Only	Data x 1000
6	X Axis Max Daily Vibration	Int	40350	40370	Node 1 starts at 40351 each successive node increments up by 1	901	Read Only	Data x 1000
7	Temperature (Raw)	Int	40400	40420	Node 1 starts at 40401 each successive node increments up by 1	951	Read Only	Data XXX
8	Temperature Avg Daily	Int	40450	40470	Node 1 starts at 40451 each successive node increments up by 1	1001	Read Only	Data XXX
9	Temperature Max Daily	Int	40500	40520	Node 1 starts at 40501 each successive node increments up by 1	1051	Read Only	Data XXX
10	Predictive Health	Int	40550	40570	Node 1 starts at 40551 each successive node increments up by 1	1101	Read Only	Data XXX
11	Device State	Int	40600	40620	Node 1 starts at 40601 each successive node increments up by 1	1151	Read Only	0 Not Bound, 1 Bound not Running, 2 running 3 Vib. Fault, 4 Temp. Fault

### 4.4. External Vibration / Temperature Data

If you have external devices providing Vibration or Temperature Data, you can pass them two Vibe-Sight via the following registers. Make sure to select External on the Sensor Selection section of the Node Setup page on Vibe-Sight.



Exposed Data for External Data Modbus Server Device to Vibe-Sight								
	Definition	Data Type	Modbus Start	Modbus End	Addressing Notes		Access	Format
1	Z Axis Vibration (Raw)	Int	41000	41020	Node 1 starts at 41001 each successive node increments up by 1		Read/Write	Data x 1000
4	X Axis Vibration (Raw)	Int	41050	41070	Node 1 starts at 41051 each successive node increments up by 1		Read/Write	Data x 1000
7	Temperature (Raw)	Int	41100	41120	Node 1 starts at 41101 each successive node increments up by 1		Read/Write	Data XXX

## 5. EULA

1. The End User is licensed to use the Vibe-Sight program on the one Vibe-Sight appliance purchased.
2. The End User does not Purchase the rights to own or distribute the Vibe-Sight Program
3. The End User is allowed to save copy the Vibe-Sight program to assure a backup is available.
4. Vibe-Sight may at times release an upgrade to the Vibe-Sight Program. The End User may load the new release of the Vibe-Sight program free of charge on the Vibe-Sight Analytics Engine.
5. The End User is not allowed to load the Vibe-Sight program onto any other hardware except that that is purchased through a Vibe-Sight authorized representative as a replacement part.
6. The End User or its designated agent may modify the existing display screens and add additional functions as desired.
7. Modified Screens must still retain the Vibe-Sight Logo.
8. Modifications to Vibe-Sight are the full responsibility of the End User. Vibe-Sight will though, provide Tech Support for changes.
9. The End User owns any of the Data and Logs generated by Vibe-Sight and may save and distribute at their digression.
10. While Vibe-Sight may provide free tech support by phone any on-site support visits will be on a fee plus peridium basis.
11. Operating this Vibe-Sight appliance is a acceptance of this EULA.

## 6. Important Links

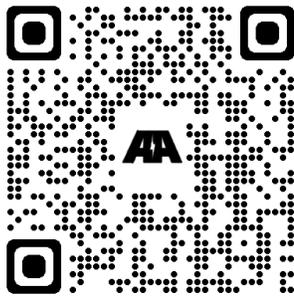
### 6.0 Manuals

#### Banner Engineering

##### H10 Data Radio

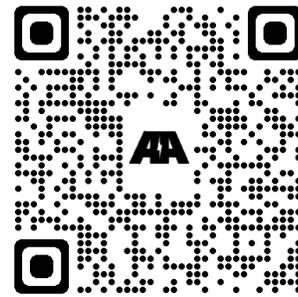
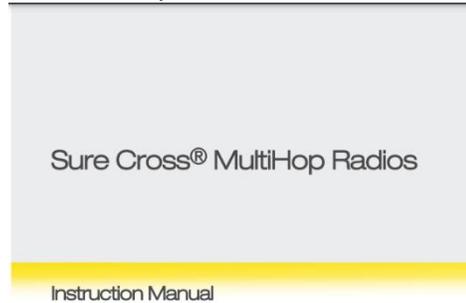


MultiHop H10 Data Radio



(Scan or click)

##### Multi-Hop Instruction Manual



(Scan or click)

##### Installing Your Sure Cross Radios

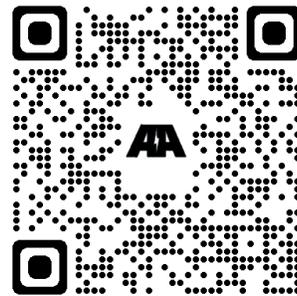


Installing Your Sure Cross® Radios



(Scan or click)

##### QM30VT1 Vibration and Temp Sensor



(Scan or click)

## Tosibox

### Lock-175 Data Sheet



**TOSIBOX**

Advantages of TOSIBOX®

- Simple**  
Build and manage secure OT infrastructure in minutes
- Secure**  
Tested & audited security
- Modular**  
Unlimited expandability and flexibility
- Timeless**  
Deals with legacy and future systems
- Unique**  
Globally patented point-to-point connection



(Scan or click)

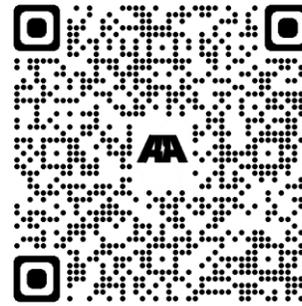
### Tosibox User Manual



**USER MANUAL**

TOSIBOX® Lock 150  
TOSIBOX® 175  
TOSIBOX® Lock 210  
TOSIBOX® Lock 250  
TOSIBOX® Lock 500  
TOSIBOX® 610  
TOSIBOX® 650  
TOSIBOX® 670  
TOSIBOX® 675  
TOSIBOX® Key

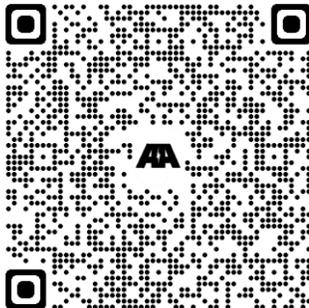
**TOSIBOX**



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### Tosibox Hard Key

**TOSIBOX**

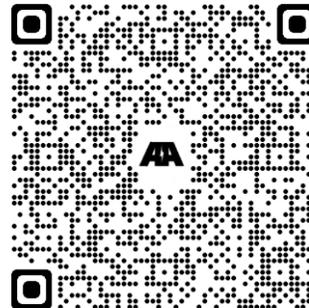


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### Tosibox Key Quick Start Guide

**TOSIBOX**

Preparing your Key  
Quick Start Guide

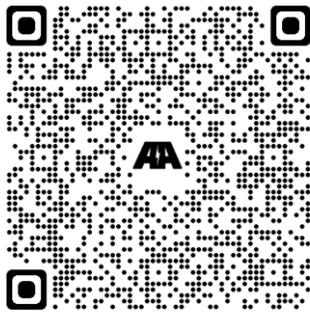


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## 6.1 White Papers

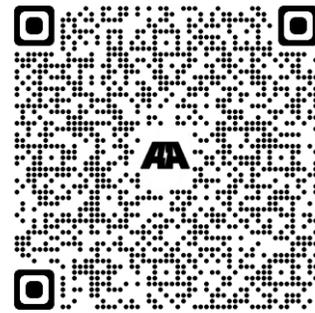
### Vibe-Sight

Predictive Maintenance Made Easy



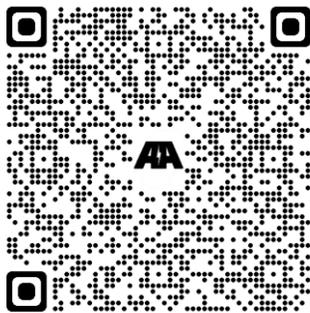
(Scan or click)

Predictive Analytics to Forecast Failure



(Scan or click)

Early Detection of Belt Failure CSA1



(Scan or click)