



**ESENSORS**

Specializing in Network Sensors

# **Instruction Manual**

*Air Quality Monitor (Ethernet)*

*with Email ALERTs*

**Version 2.0**

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# Introduction

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## Introduction

The Esensors, Inc. Wi-Fi Air Quality Monitor (AQM) is an electronic device *classified* as a *Smart Sensor*. AQM is designed to utilize the Internet to transmit Gas concentration, temperature, and relative humidity data from a remote acquisition point to a host computer or hosted database.

The AQM offers built-in signal conditioning and an embedded mini-webserver. Users are able to access the sensor using Hypertext Transfer Protocol (HTTP) based commands.

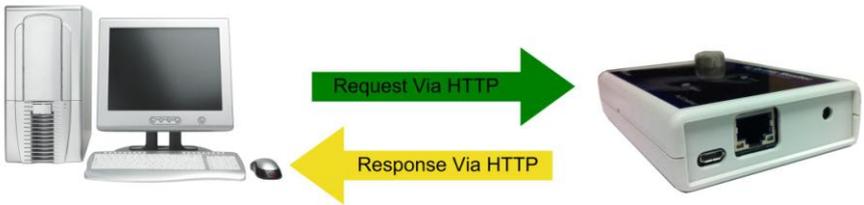


Figure 1 - AQM HTTP: Request/Response

Figure 1 (above) shows the AQM returning data via a HTTP: response.

Simply, AQM's function is to send a response (by a HTTP: message) upon request from a central website or the User's PC.

The AQM supports DHCP and a user configurable IP address. It's IP address gives it uniqueness on the network which it is attached to. It is through the IP address, that AQM is able to take its' place on the Internet, becoming fully accessible to query by the user

## Introduction

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AQM consists of a base unit with one communication port. Within the base unit are microcomputers, which handle the Internet protocol, the communication port, sensors and sensor signal conditioning. The AQM has no switches, keyboard or display because it functions as a sensor, not as a computer.

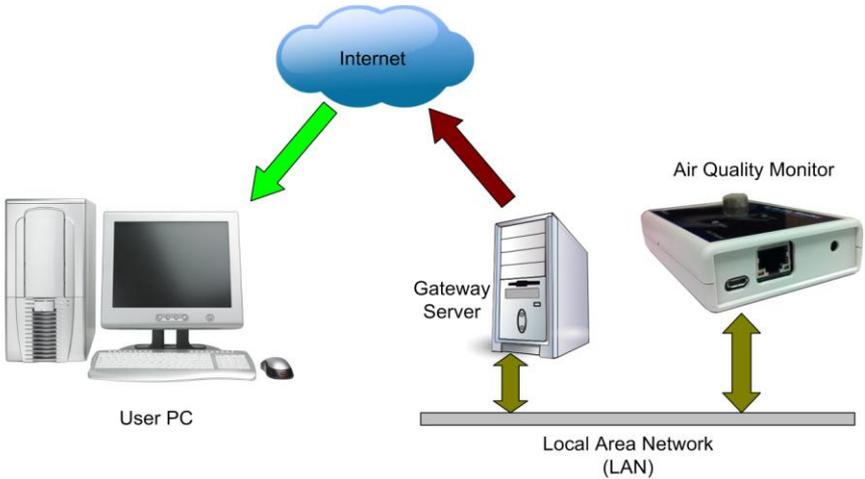


Figure 2 – How AQM works.

## Technical specifications

- High sensitivity, long life gas sensors
- Built-in HTTP interface
- Standard XML data output & Text output
- Temperature accurate to +/- 0.2 Celsius with range from -40 to +123.8 Celsius
- Fahrenheit and Celsius temperature scales.
- Humidity accurate to +/- 3% RH with range from 1% to 99% Relative Humidity

## AQM Hook up

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### AQM Hook-up

#### a. Powering up the AQM

The AQM is powered by the 9V adaptor included with the unit. Remove the adaptor from the pack, and plug the power jack to the wall supply connector of AQM shown in figure 3. Plug the adaptor brick to a standard 120V wall socket.

LED status: the AQM has 2 LEDs. Power, and activity. When powered up, The Power LED and Activity LED blinks thrice, and the power LED remains on. The Activity LED blinks when there is communication between the device and the host computer.



Figure 3 – Location of Wall Supply connector.

### Configuring the AQM

To configure and use a AQM, it must be connected to a PC via an Ethernet cable as shown in either figure below. You can connect

## AQM Hook up

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the AQM directly to a PC, or through a hub.

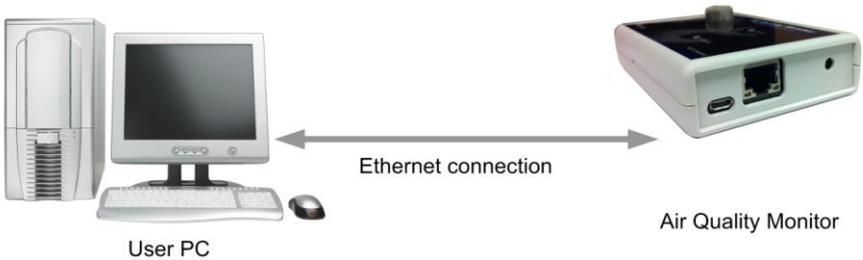


Figure 4 - AQM connected directly to the NIC in a PC

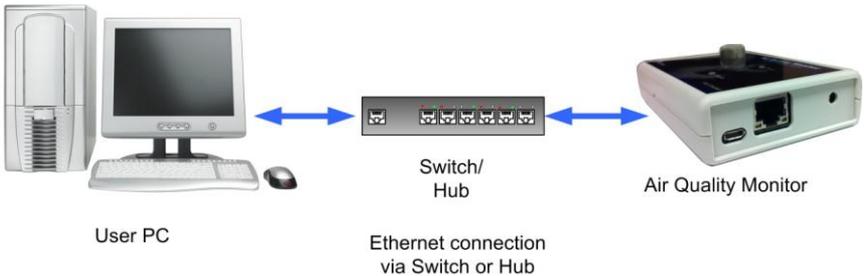


Figure 5 - AQM connected through a HUB to the NIC in a PC.

Once the AQM is connected to a PC and powered via the supplied USB/ DC Wall Supply, it can be queried by typing the following command into the address line of the browser.

**<http://192.168.254.102>**

## User Interface

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**Note:** The default address for the AQM is 192.168.254.102. This requires that the PC being used to program the AQM have its “network interface card” (NIC) set with the same subnet address: 192.168.254.\*\*\*

Note: Please do not power up multiple AQM devices with default settings at the same time since they have same IP address.

### AQM User interface

#### Overview

The overview page shows the product information specific to the AQM. This includes the device version, build, serial number, network info and technical specifications of the device.

#### Sensor Status

The SENSOR STATUS screen depicts the same information as the MAIN (HOME) page. From the Sensor Status screen it is possible to alter the temperature units by clicking on the “Change Temperature Unit” button. If your Device comes with an internal temperature sensor, heater type gas sensors may cause a higher temperature reading.

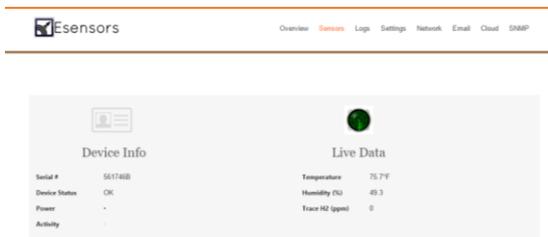


Figure 6 – Sensor Status screen

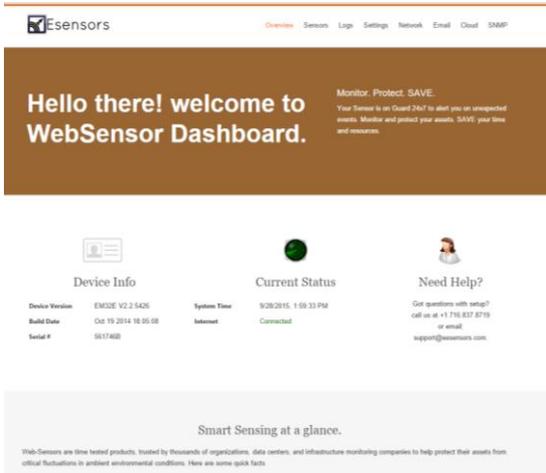


Figure 7 – The OVERVIEW Screen

## Visualizing outputs

The AQM has a simple, yet useful graphing feature available on the webpage. Under 'visualizing outputs' tab, you can select any two of the available sensors and plot them on a time based graph.

## Sensor Calibration:

The AQM comes with an online calibration feature. This tab is not provided on the web, but rather should be accessed through a direct command.

**Eg: [192.168.254.102/calib.htm](http://192.168.254.102/calib.htm)**

so that the page is not invoked other than when calibration is needed. On the calibration tab, the sensors available on the device will be displayed. The key parameters of the sensor are

## Calibration

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**$R_{base}$ :** The base resistance of the sensor when no gas is present.

**$R_{load}$ :** The load resistance for the sensor

**$R_{limit}$ :** The sensor element resistance when the upper limit gas concentration is introduced.

**Slope:** The gain of the system. For the same gas concentration, a higher gain will output a higher 'ppm' value.

**$R_{sensor}$ :** The resistance of the sensor element at any given point.

**Gas(ppm):** The gas concentration expressed as a ppm value.

Understanding sensor operation.

The solid state sensors used in the AQMs often have a logarithmic response curve.  $V_h$  represents the heater voltage and  $V_c$  the sensor voltage. When a target gas is exposed to the sensor element, the sensor resistance goes down. The  $R_{sensor}$  in series with  $R_{load}$  forms a divider network, and  $V_{load}$  (Voltage across load resistance) increases. The Analog to digital converter digitizes the data after filtering and conditioning, and it is this data that is converted to a ppm value.

With  $R_{sensor} \geq R_{base}$ , Gas (ppm) gives a zero Reading.

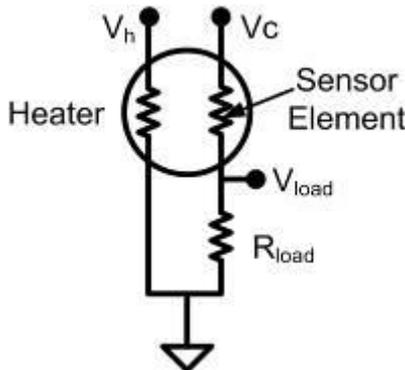


Figure 8 – Sensor Operation basics.

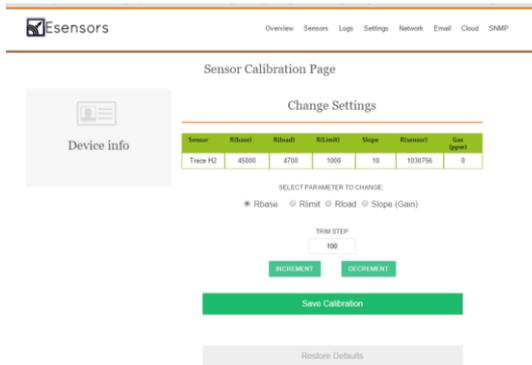


Figure 9 – Calibration screen.

## Making Changes on the Calibration:

Before making changes on the calibration, please read carefully the different parameters mentioned in the Sensor Calibration section.

To Change a particular parameter, Select the sensor for which you want to make the changes (If your device supports a single gas sensor, this will be selected by default). Now select the parameter you want to change. Input the value you want to Add or subtract in the 'Trim Step' field, and click the increment / decrement button as you may want. You will notice the changes immediately in the table.

## How to set the reading to zero:

## Calibration

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Verify the  $R_{\text{sensor}}$  value under a stable neutral gas in a controlled environment. This value is the base line resistance. Change the  $R_{\text{base}}$  to this value, and the new base line will take effect, giving a zero reading at this point.

### **IMPORTANT!**

After calibration, remember to Save Calibration by clicking on the button.

Restore factory default:

If you want to get the settings back to the factory default, click the 'Restore factory settings' button.

### Sensor Warm-up time

Please note that after power on, the sensor has a warm up time before the base line values stabilize. This may take anywhere from 3 to 15 minutes depending on the sensor. During warm-up time, the sensor readings may show High Gas concentration which should come down to zero, given no gas is present. To check if the sensor is working fine, you should be able to see the  $R_{\text{sensor}}$  value increasing (under no gas condition) on the Calibration page (calib.htm).

## Sensor Threshold Settings

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### Network Configuration

The network configuration page is password protected. The default username and password for the device is *admin* & *password*. The NETWORK CONFIGURATION page enables the user to set up the device IP & host name using the web interface.

When the NETWORK CONFIGURATION button is clicked the NETWORK CONFIGURATION page appears; see Figure 10.

From the NETWORK CONFIGURATION screen it is possible to change the various network settings involved in any IP addressable device, port number for the webpage, DNS, gateway, admin ID and password. The device requires an internet connection if you want to set the device time. The device uses Network time protocol to log sensor data for maximum & minimum measurement. In case of power loss the device automatically corrects the time upon the next webpage access by the user. Once changes are made it is necessary to “left click” on the “Save Config” button to have the changes take effect.

When you change the IP address though the webpage interface, the next page displayed is the “Reboot in Progress” page depicted in Figure 11.

*Note: If you get the message “Error: Connection to AQM device was lost” is because the browser still points to the former IP address. When the new IP address is entered into the address bar the screen will correctly display the AQM MAIN (Home) Page.*

# Sensor Threshold Settings

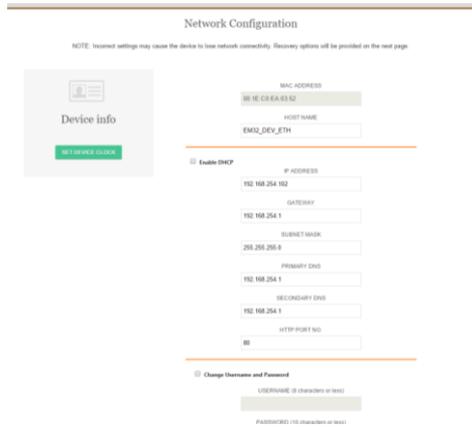


Figure 10 – Network Configuration screen

Refer to the Quick Reference section for some “keyboard short-cut” commands.

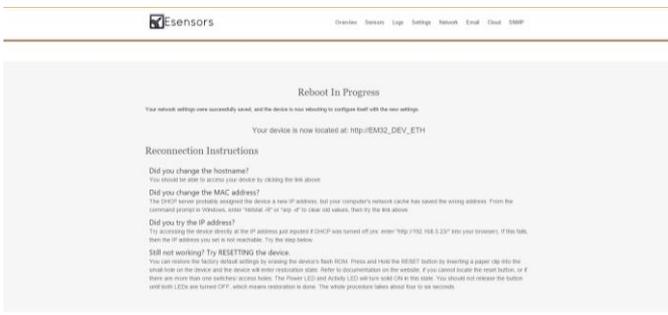


Figure 11 – “Reboot in Progress” screen

## Sensor threshold settings

This page holds the sensor thresholds for email alerts sent by device. The trip time is the time for which the sensor data has to violate the threshold to be considered as an alert. The Return time

## Sensor Threshold Settings

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is the time interval after which the alert status returns back to normal if the measured a data returns back within the specified threshold. Alarm interval is the minimum interval after which the send alert for the sensor will be reported if the threshold conditions still remain violated. However if an alert occurs for a different sensor within the time interval would be reporter.

### Understanding the thresholds and alarms

Each of the available sensors can trigger an alarm condition and sent alert messages. An alarm is triggered when the sensor measurement crosses the lower or upper threshold limits, both being user settable. Just make sure that these values do not exceed the permitted range of the sensor.

### Time Interval between alarm and report emails.

The AQM allows setting an interval between alert/ report emails so that repeated emails are not sent for same trigger event. This feature is available on the sensor settings page as well.

The screenshot displays the configuration interface for a gas sensor. It includes several input fields for setting thresholds and time intervals, along with checkboxes for email notification options.

Gas Sensor<sup>™</sup> - Send Alarm When  
CONCENTRATION IS LESS THAN (value in ppm)

OR CONCENTRATION IS GREATER THAN (value in ppm)

AND STAYS THERE FOR (value in Seconds)

ALARM RESET TIME (value in Seconds)

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General Settings

SEND ALARM EMAILS SEE NOTE 1

INCLUDE PREVIOUS ALARM LOGS IN EMAIL

ALARM INTERVAL (in Minutes. Min. value: 1000)

EMAIL DAILY PEAK VALUES

SEND DAILY PEAK EMAILS AT (between: 18:00:00)

Figure 12. Sensor settings

# Email Settings

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## Email Configurations

The Email Configuration is selected by clicking on the “email Configuration” button displayed in the menu as shown in Figure 13 below.

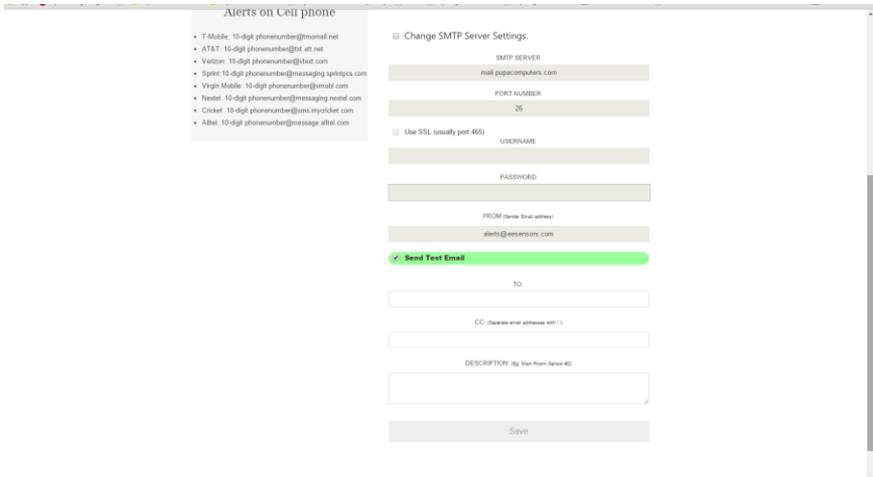


Figure 13: Email settings

## Sensor outputs in xml format

The AQM can output the sensor data as an xml file. This simple approach enables end users to develop their own application to

## XML and CGI Interface

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monitor data. The data format is supported in all the plug-in's provided on the CD.

The xml file can be obtained by typing the following command in the address bar of the browser.

<http://192.168.254.102/status.xml>

The content of the file is shown below

```
<response>
  <sid>702240B</sid>      // Device ID
  <stu>OK</stu>           // Device Status
  <tm>32.0</tm>           // Temperature sensor reading
  <hu>.0</hu>             // Humidity reading
  <tun>F</tun>            // Temperature Unit
  <Gsn>0</Gsn>           // Gas Sensor ID
  <Gpn>0</Gpn>           // Gas concentration (ppm)
  <led>1</led>           // Power LED status
  <led1>0</led1>         // Activity LED status
  <btn>up</btn>          // Button status
</response>
```



Figure 14 – Error Message – CONNECTION LOST.

After an IP change, you may get an Error on the webpage. The reason for the “Error: Connection to AQM device was lost” message is because the browser still points to the former IP address. When the new IP address is entered into the address bar the screen will correctly display the AQM MAIN (Home) Page.

## Basic Troubleshooting Instructions

### 1. Did you change the IP address?

The DHCP server probably assigned the device a new IP address, but your computer's network cache has saved the old MAC address for the new IP. From the command prompt in Windows, enter "nbtstat -R" or "arp -d" to clear old values and try again. Make sure you launch the command prompt as administrator.

### 2. Did you try the IP address?

Try accessing the device directly at the IP address just inputted if DHCP was turned off. (Example: enter "http://192.168.5.23/" into your browser). If this fails, then the IP address you set is not reachable. Accessing device via IP address is more reliable than using host name since some networks may have troubles dealing with host name. If you forgot the IP address and the host name of your AQM device, try Step 3 below.

## Trouble Shooting

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### 3. Use Ethernet Discoverer to find AQM devices

Microchip's Ethernet Discoverer is a very nice tool to list all AQM devices on the same subnet. Double click *Microchip Ethernet Discoverer.exe*, Click "Discover Devices" button, the IP address, Host name and MAC address of all AQM devices will be listed. It is also helpful to check AQM's IP address when it is automatically assigned by DHCP server. *Microchip Ethernet Discoverer.exe* do not need to be installed, it can be copied to and executed from any location. (This utility program can be found on the supplied CD in the "Manual" Folder within the "AQM" Folder.

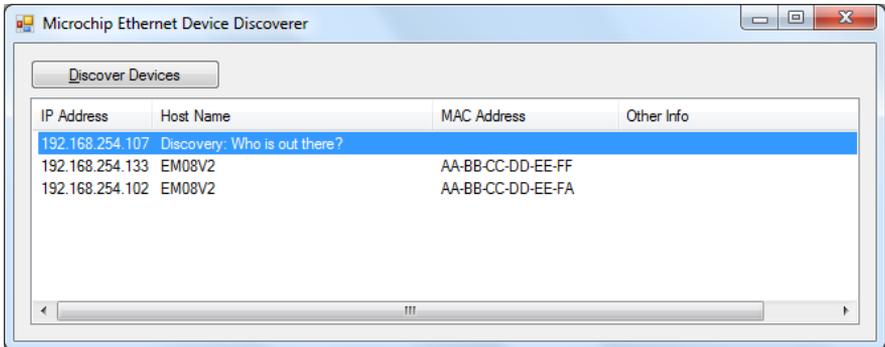


Figure 15 – Microchip Ethernet Device Discover screen

### Still not working? Device Reset

You can restore the factory default settings by erasing the device's flash ROM.

# Resetting the AQM

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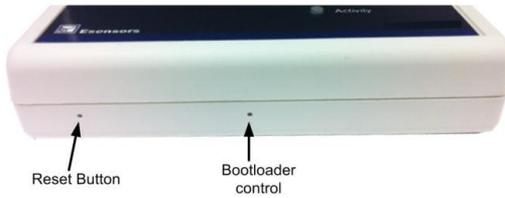


Figure 16 – Location of the RESET SWITCH

## Resetting the AQM

- Hold the button by inserting a paper clip into the small hole on the left side panel of the device. Both the LEDs should turn solid ON now.
- The device waits for 4-5 seconds, after which the LEDs will turn OFF.
- Release the button. The device is now reset to factory default settings.

## Quick Reference

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- Hold the button pressed until both LEDs are OFF, which means restoration is done.
- The whole procedure takes about eight to ten seconds. The factory default IP address is “192.168.254.102”.
- 

## AQM Factory Settings

The factory default settings for the AQM are:

IP Address: 192.168.254.102

Subnet: 255.255.255.0

Gateway:192.168.254.1

Password lock:

User name: admin

Password: password

## Quick Reference

### AQM Keyboard Short-cuts:

#### Change Temp unit to C:

*<http://192.168.254.102/index.htm?etpC>*

#### Change Temp unit to F:

*<http://192.168.254.102/index.htm?etpF>*

#### Change Temp unit from C to F or F to C:

*<http://192.168.254.102/index.htm?etpX>*



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