

USER MANUAL

ONGUARD® SMART



Preface

Airborne gaseous contaminants, as well as fluctuations in temperature and relative humidity, have always posed a threat to everything from modern electronic equipment to centuries-old artwork and archives. In recent years attention has been focused on how we can monitor and control these variables in our environment, creating a new key term: Indoor Air Quality (IAQ).

Purafil, Inc., the industry leader in air filtration systems, anticipated the need to merge technology with IAQ and created the OnGuard atmospheric corrosion monitor. After thorough testing and development, Purafil introduced the patented OnGuard Atmospheric Corrosion Monitor. For OnGuard's development, Purafil received the R&D 100 Award, recognizing the top 100 technologically significant products of the year.

Today, OnGuard is monitoring and protecting the environment in worldwide facilities such as: Santa Maria delle Grazie (housing da Vinci's Last Supper), Italy; the English Channel Tunnel, U.K. and France; Haindl Papier, Germany; British Nuclear Fuels, U.K.; Honeywell, Yokogawa, and Georgia Pacific, USA.

Purafil thanks you for your purchase and we know you will be as pleased with your OnGuard unit as we are with its development. For additional information or questions on the product contact:

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The OnGuard Technology

Introduction

Metal strips have been used to quantify the effects of the atmosphere on similar metal surfaces for decades. Originally, the analysis of the reactive metal strips relied on simply determining the weight gain due to atmospheric gases reacting with the base metal. Later, more involved laboratory analyses gave some additional information on what compounds made up the resulting corrosion film that collected on the metal strips.

While this is a good technique, it requires that the metal strips be placed in the environment from 30 to 90 days and can only report the total corrosion that has occurred during the test period. Corrosion, however, is most often an isolated event, and seldom occurs at an equal rate over the 30-to-90-day testing period. The method allows no way to pinpoint when any of the corrosion occurred, or to determine the severity of any particular corrosion event. Likewise, it cannot detect what dramatic atmospheric changes, such as wind, temperature and humidity, have had on the corrosive activity within indoor environments.

It is important to take corrective action at the time these dangerous atmospheric shifts occur instead of after damage from corrosion has taken place. Getting information “real-time” gives users this advantage.

The OnGuard 1000 was the first instrument to provide real-time monitoring of environmental corrosion that can affect the reliability of industrial electronics, computers, and control equipment. The OnGuard 1000 has also been used extensively in museums and archives to monitor the environmental conditions that could irreparably damage precious artwork, artifacts and archives. The OnGuard 2000 and related models are patented, second-generation instruments that provide the same basic capabilities as the OnGuard 1000, with significant improvements in user interface, accuracy, and application flexibility. The OnGuard Smart implements the most desired features of the OnGuard 2000, 3000, 4000 adding pressure measurements and Wi-Fi Ethernet communications. In addition, the OnGuard Smart is housed in an attractive enclosure that can address a variety of markets.

The OnGuard provides real-time measurements of the amount of corrosion forming on copper and silver surfaces by corrosive gases present in the local environment. It also measures the temperature and relative humidity of the environment, both of which can affect the corrosion rate of these metals.

All of the OnGuard measurements for corrosion rates, temperature, and relative humidity can be related to the International Society for Measurement and Control (ISA) Standard S71.04-2013: Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants and ISA S71.01-1986: Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity. The silver corrosion rate measured by the OnGuard is reported in an environmental classification of the newly issued ISA Standard S71.04-2013. Similarly, the OnGuard measurements can be related to various archive and museum standards being utilized around the world.

OnGuard Smart units are equipped with the standard sensor set (temperature/relative humidity, copper corrosion, silver corrosion and pressure). The OnGuard is capable of logging the sensor measurements in internal memory at user-selectable intervals, and this information is downloadable to a personal computer for viewing, graphing or archiving.

How the OnGuard Works

Technology

Corrosion on electronic components and contacts and on precious and semiprecious metal artifacts is characterized by the buildup of various chemical reaction products (films) which form when corrosive gases come into contact with the base metal. The sources of these gases often result from the types of processes being operated at the industrial site, chemicals in use and/or general atmospheric contamination. They may also be transported from an adjacent facility so careful attention should be given to potential sources of atmospheric corrosion outside the facility boundaries as well.

Typical corrosive gases are: hydrogen sulfide (H_2S), chlorine (Cl_2), oxides of sulfur and nitrogen (SO_2 , SO_3 , NO , NO_2 , etc.), ozone (O_3), ammonia (NH_3), and hydrogen fluoride (HF). Therefore, corrosion films may be composed of reaction products such as copper sulfide and oxide (Cu_2S and Cu_2O) on copper and silver sulfide and chloride (Ag_2S and AgCl) on silver. These reaction products cause an associated mass gain which can be directly correlated to the average corrosion film thickness, in angstroms (\AA), on the metal surface.

Measuring atmospheric corrosion on metallic surfaces has been done with a variety of techniques. The simplest and most reliable is the measurement of the mass gain on a metal sample strip (often referred to as a "coupon"). The OnGuard uses a patented technology to measure the corrosion that will occur on copper and silver surfaces using quartz crystal microbalance sensors plated with either copper or silver. The plated crystal has a natural resonance frequency based upon its mass. As corrosion films are formed, the sensor mass increases by the mass of the contaminant gases that have reacted with the base metal plating. As a result, the crystal's resonance frequency decreases.

By applying the proper conversion factors contained in the software of the OnGuard, the corrosion buildup that occurs over the life of the corrosion sensor can be determined. This is referred to as *Cumulative Corrosion*. The rate of corrosion buildup over a given time period can also be determined. This is termed *Incremental Corrosion*.

Cumulative Corrosion

Cumulative Corrosion is the total amount of corrosion that has accumulated on a metal surface. Corrosion is an ongoing process, occurring when the conditions are correct for additional reaction of the contaminant gases with the base metal. For surfaces like copper and silver, the onset of corrosion is evidenced by the appearance of a slight tarnish, which is the actual corrosion film. Progressively, this tarnish gets darker and thicker. Cumulative Corrosion is reported to the OnGuard in terms of angstroms (\AA), which is 10^{-10} meters.

The OnGuard corrosion sensors have the capability to accumulate 4000 \AA of Cumulative Corrosion. At this stage of Cumulative Corrosion, the base metal copper and silver corrosion sensors will be completely black. If the OnGuard is being used to monitor the effects gases have on other metallic surfaces, whether they are precious artifacts or electrical circuit contacts, either visual tarnishing or electrical failures will have occurred prior to the OnGuard's corrosion sensors reaching their 4000 \AA limit.

Incremental Corrosion

Incremental Corrosion is the amount of corrosion that has accumulated on a metal surface over a specific time period. Incremental Corrosion can also be referred to as the rate of corrosion buildup. The OnGuard reports Incremental Corrosion in terms of angstroms per twenty-four hours ($\text{\AA}/24$ hours). The Incremental Corrosion is an indication of the severity, or lack of severity, of a corrosion-causing event. In the OnGuard, the Incremental Corrosion is recalculated every 15 minutes for the previous 24-hour period. Because Incremental Corrosion is updated every 15 minutes, significant changes in the rate of corrosion can often be determined within a 15-minute time period. Less significant changes in the rate of corrosion may take longer to detect.

Temperature Effects on Corrosion

Increases in Temperature can accelerate the rate of corrosion by increasing chemical reactions. Using the OnGuard to monitor and record Temperature, increases or decreases in Cumulative Corrosion and Incremental Corrosion can be correlated to Temperature effects. The Temperature sensor is read continuously, and the data is averaged over a one-minute time period.

Relative Humidity Effects on Corrosion

Varying levels of Relative Humidity can significantly affect the rate of corrosion. Changes in the Relative Humidity can result in condensation on surfaces within a space, and should corrosive gases be present, they can dissolve into this water layer. Many corrosive gases are often referred to as “acid gases” in that when they are dissolved in water, the resulting mixture is an acid. For instance, chlorine (Cl₂) gas dissolved in water creates hydrochloric acid (HCl). Therefore, Relative Humidity often needs to be carefully monitored and controlled in computer control rooms. The OnGuard monitors and records Relative Humidity for correlation to events that are associated with increased rates of Cumulative Corrosion and Incremental Corrosion. The Relative Humidity sensor is read continuously and the data are averaged over a one-minute time period.

Standards

Standards can be used to define the limits of acceptable performance. These limits may be formally set by a committee acting on behalf of an organization or informally set by an individual based upon a particular application.

Initially, the OnGuard has been set up with industrial standards for corrosion written by the Instrument Society of America (ISA). These standards are ISA S71.04-2013: *Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants* and ISA S71.01-1985: *Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity*. They were written by a panel of experts in the corrosion field, ranging from manufacturers of sophisticated electronics and gas-phase filtration to professional engineers and end users in the industrial marketplace. The standards have been globally accepted and used in areas where sensitive electronics are housed in industrial complexes.

Unpacking and Inspection

DO NOT REMOVE THE ONGUARD UNIT FROM THE SEALED PLASTIC BAG UNTIL TIME OF INSTALLATION

1. Verify that the following items are included in the shipping box. If any item is missing, notify Purafil, Inc. immediately at (770) 662-8545 or 800-222-6367.
 - OnGuard
 - Terminal Block (Transmitter)
 - USB Flash Drive
 - o User manual
 - o Warranty form
 - o EC letter
 - o Terminal block drawing
2. Make a visual inspection of the OnGuard. *Do not remove it from the sealed plastic bag for extended periods until the time of installation.* This insures that the corrosion sensors are not exposed to air contaminants prematurely, which may shorten sensor life.
3. Examine the OnGuard for any damage that may have occurred during shipment. If any obvious damage is found *notify the carrier immediately* and call Purafil.
4. Fill out the Warranty Registration Card and return it to Purafil immediately. Failure to send in the Warranty Registration Card may result in delayed receipt of future updates to OnGuard and may limit technical support.
5. Check the packaging for any additional documentation that may have been included.

READ THIS BEFORE YOU CONTINUE

When setting up the OnGuard, after [powering it](#) and [initializing the sensors](#), please contact your IT department to help with connecting the OnGuard to a network and setup.

Installing and Powering the OnGuard

Although the OnGuard is designed to withstand corrosive industrial environments, the unit contains sensitive electronic circuitry. Therefore, care should be taken to ensure that it is not dropped or handled roughly during installation.

Mechanical Mounting of the OnGuard

The OnGuard is designed to be mounted on a secure flat vertical surface. Use the screws provided and install in a level orientation. There are two “keyhole-shaped” mounting holes on the rear of the OnGuard. The two mounting screws can be positioned and installed using the mounting template provided in the appendix, which should be photocopied and used for installation. The screws should be driven into the mounting surface until the bottom surface of the head of the screw is approximately 0.1 inches (2mm) from the wall. The OnGuard’s mounting holes are then placed over the screws and lowered into place. Adjust the screws for a firm fit.

External Power

There are two ways to provide external power to the OnGuard.

External DC Power Supply

The OnGuard can be powered by an externally supplied DC voltage between 12VDC and 36VDC. The power source should be able to supply at least 500 mA of current. This voltage is applied to pins 11 and 12 of the 12-pin terminal block on the bottom of the OnGuard (see the terminal block drawing on USB flash drive). Pin 1 of the terminal block is on the left when viewed from the front, pin 12 on the right. The negative lead of the power source is connected to pin 11, and the positive lead is connected to pin 12.

When operating from an external power supply the OnGuard will operate continuously and will not power down into “sleep mode” as it does when powered from the batteries.

Power Over Ethernet (POE)

The OnGuard can also be powered by connecting the OnGuard to the Ethernet through the Ethernet port on the bottom of the unit. All functions are available and the OnGuard will operate the same as if it is powered from an external power supply.

Battery Operation

Opening the OnGuard for Battery Installation

Remove the OnGuard from the protective bag it was shipped in. Remove the two screws that hold the front half and the back half of the case together. These are located in the middle on each side of the unit. With these screws removed the case will come apart, providing access to the battery holders.

Installing the Main Batteries

The OnGuard is designed to operate on four standard “AA” alkaline batteries. The unit will begin operation when the last of the four batteries is installed. For longest operating life, use “high capacity” batteries like the Duracell Ultra or Energizer Max.

When the batteries are installed reassemble the case by installing the two screws that were removed to open the case.

Initializing Sensors

When the OnGuard is shipped from the factory, it is enclosed in a protective bag designed to minimize contaminant access to the corrosion sensors. **When batteries are installed or power is supplied and the unit begins to operate, the first function the OnGuard performs is the initialization of the copper and silver corrosion sensors. This process is initiated automatically, takes two hours and should not be interrupted until it is completed. Please make sure the logger is off when initializing takes place.** This process establishes the initial state of the sensors and sets the reference for future operation. During this period the LCD display will turn off and the green LED will flash on and off at about a 1 second rate.

Communication via Ethernet

The OnGuard is designed to communicate through an internal web interface, via the Ethernet, for setup and logging purposes. **Remember to power the OnGuard in one of the two external ways before trying to connect.**

Password Protection

Below are the procedures to establish [communication](#) between the OnGuard and the computer via Ethernet. However, once connected to the OnGuard, a password is required for the user to access the Network page and setup [email notifications](#) or [manually set the IP address](#). Once accessed, the user can click between any of the pages and return to the Network page without having to re-enter the password. However, once the user closes the browser and tries to re-access the page, a password is again required.

The default password is as follows:

- User Name: admin
- Password: password

User Name cannot be changed and is always “admin”. *Password* can be changed on the Network Page. It is limited to 10 characters in length.

In the event *Password* is lost or forgotten, it can be reset to “password” by holding down the OnGuard Down-Arrow key (button 4) as power is applied. The key can be released as soon as the boot screen appears (about 2 seconds). The boot screen will also display the text “PASSWORD RESET”.

The following page shows the Password entry field in the lower left corner of the Network Page.

Network

CAUTION: Incorrect settings may cause the board to lose network connectivity. Recovery options will be provided on the next page.

Network MAC Address: <input type="text" value="54:10:EC:15:37:B9"/> Host Name: <input type="text" value="PURAFIL_OG5"/> <input checked="" type="checkbox"/> Enable DHCP IP Address: <input type="text"/> Gateway: <input type="text"/> Subnet Mask: <input type="text" value="255.255.255.0"/> Primary DNS: <input type="text"/> Secondary DNS: <input type="text"/> <input type="button" value="Save Config"/> (Device will reboot)	E-Mail <input type="checkbox"/> Enable E-mails SMTP Server: <input type="text"/> Port: <input type="text"/> <input type="checkbox"/> Use SSL User Name: <input type="text"/> Password: <input type="text"/> From: <input type="text"/> To: <input type="text"/> Triggers: <input type="checkbox"/> ISA Class <input type="checkbox"/> Temperature <input type="checkbox"/> Humidity Test: <input type="checkbox"/> Send Now <input type="button" value="Save Changes"/>
Password User Name: <input type="text" value="admin"/> Password: <input type="password" value="*****"/> <input type="button" value="Save Changes"/>	

Local Area Network Connection

By default, DHCP is enabled on the OnGuard. This means that it will acquire an address (dynamically) from the local network router as soon as it is plugged into a network.


The new address is displayed on the OnGuard's LCD screen for about 10 seconds whenever the Ethernet connection is made or disconnected. Below is the OnGuard's Network menu that appears to show a change in status of network connectivity:

```
NETWORK MENU
-----
DHCP -ENABLED-
IP ADDRESS:
192.168.2.103
ROUTER:
192.168.2.1
MAC 001EC0BB2B6C
```

```
NETWORK MENU
-----
DHCP -ENABLED-
IP ADDRESS:
192.168.2.103
ROUTER:
192.168.2.1
MAC 001EC0BB2B6C
```

In this case, to connect to this OnGuard's web interface, type "192.168.2.103" into your browser's address bar. Below shows the home page of this OnGuard at address 192.168.2.103:

Data

Power: Over Ethernet 

Sensor	Cumulative (Å)	Incremental (Å)	ISA Class	Alarm
Copper	2495	10	G2	INC ALARM
Silver	2446	0		OK

Sensor	Reading	24 Hr Low	24 Hr High	Alarm
Temperature	72.1 °F	72 °F	80 °F	OK
Humidity	21 %	21 %	22 %	OK
Pressure	0.0467 IWG	0.0000	0.0803	OK

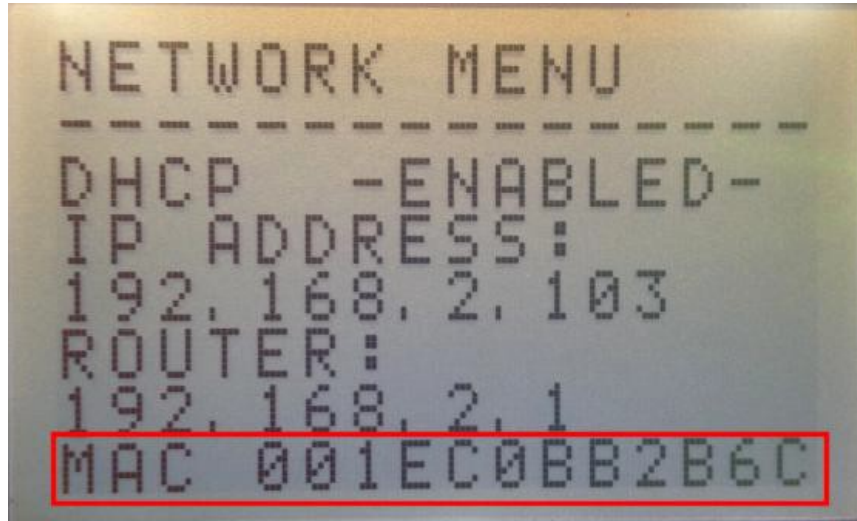
Note that the dynamic address may change. If the OnGuard or the network router is power-cycled, the OnGuard may be assigned a different address. Exact behavior will depend on the network router's (or local DHCP server's) configuration.

Static Address

There are two methods to set a static address for an OnGuard device. The preferred method is to configure the local router (or DHCP server) to assign the same address to the device every time it registers on the network. The other method is to disable DHCP and set a fixed address in the OnGuard. This is not preferred because address conflicts may occur due to setting multiple devices to the same address.

Preferred method

To define an address in the router (or DHCP server), the server must know the unique hardware address of the OnGuard – the MAC address. The MAC address is displayed on the OnGuard's network menu as shown below:



Enter this address in your router DHCP configuration with a desired address in order to specify a fixed address for the OnGuard. Exact method will depend on the router's make and model, but this is typically found in its settings page under Configuration->Advance->DHCP. Consult your router's manual.

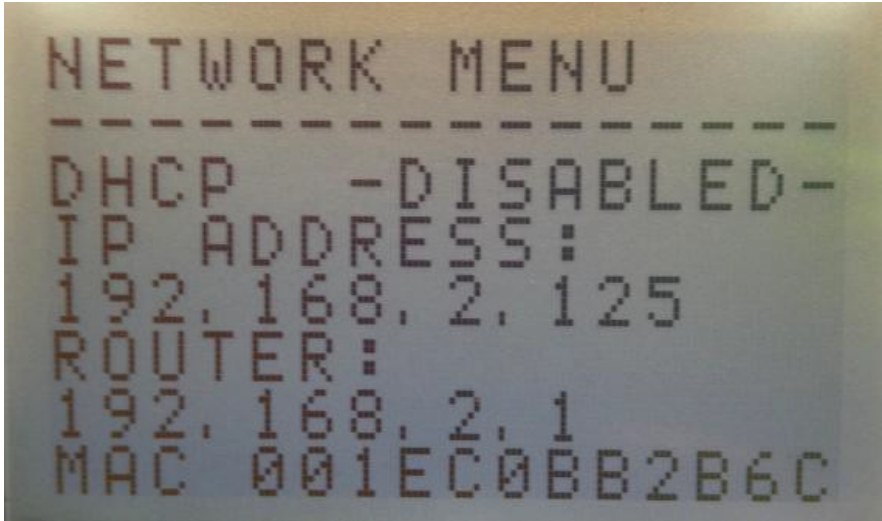
Non-preferred method

The non-preferred method of setting a static address involves disabling DHCP and setting a fixed address in the OnGuard. To do this, you must first gain access to the OnGuard web interface and select the network page as shown below. Additionally, the numbers in red indicate the maximum text length of each text field.

<p>Network</p> <p>MAC Address: <input type="text" value="00:1E:C0:C4:A8:AE"/></p> <p>Host Name: 16 <input type="text" value="PURAFIL_OG4"/></p> <p><input checked="" type="checkbox"/> Enable DHCP</p> <p>IP Address: <input type="text" value="192.168.2.100"/></p> <p>Gateway: <input type="text" value="192.168.2.1"/></p> <p>Subnet Mask: <input type="text" value="255.255.255.0"/></p> <p>Primary DNS: <input type="text" value="192.168.2.1"/></p> <p>Secondary DNS: <input type="text" value="0.0.0.0"/></p> <p><input type="button" value="Save Config"/> (Device will reboot)</p>	<p>E-Mail</p> <p><input checked="" type="checkbox"/> Enable E-mails</p> <p>SMTP Server: 40 <input type="text" value="smtp-auth.no-ip.com"/></p> <p>Port: <input type="text" value="3325"/></p> <p><input type="checkbox"/> Use SSL</p> <p>User Name: 40 <input type="text" value="og4test.com@noip-smtp"/></p> <p>Password: 20 <input type="password" value="....."/></p> <p>From: 30 <input type="text" value="og4test@gmail.com"/></p> <p>To: 30 <input type="text" value="mvmoore@bellsouth.net"/></p> <p>Triggers:</p> <p><input checked="" type="checkbox"/> ISA Class</p> <p><input checked="" type="checkbox"/> Temperature</p> <p><input type="checkbox"/> Humidity</p> <p>Test: <input type="checkbox"/> Send Now</p> <p><input type="button" value="Save Changes"/></p>
<p>Password</p> <p>User Name: <input type="text" value="admin"/></p> <p>Password: 10 <input type="password" value="....."/></p> <p><input type="button" value="Save Changes"/></p>	

Click "Enable DHCP" so that it is not checked, then enter the desired address in the "IP Address" field. Click "Save Config" to save the settings. The device will reboot and then you must point your browser to the newly assigned address.

The device's address is displayed on the OnGuard's network menu as shown below and may be accessed by scrolling through the menus using the devices "Menu" key on the front panel.



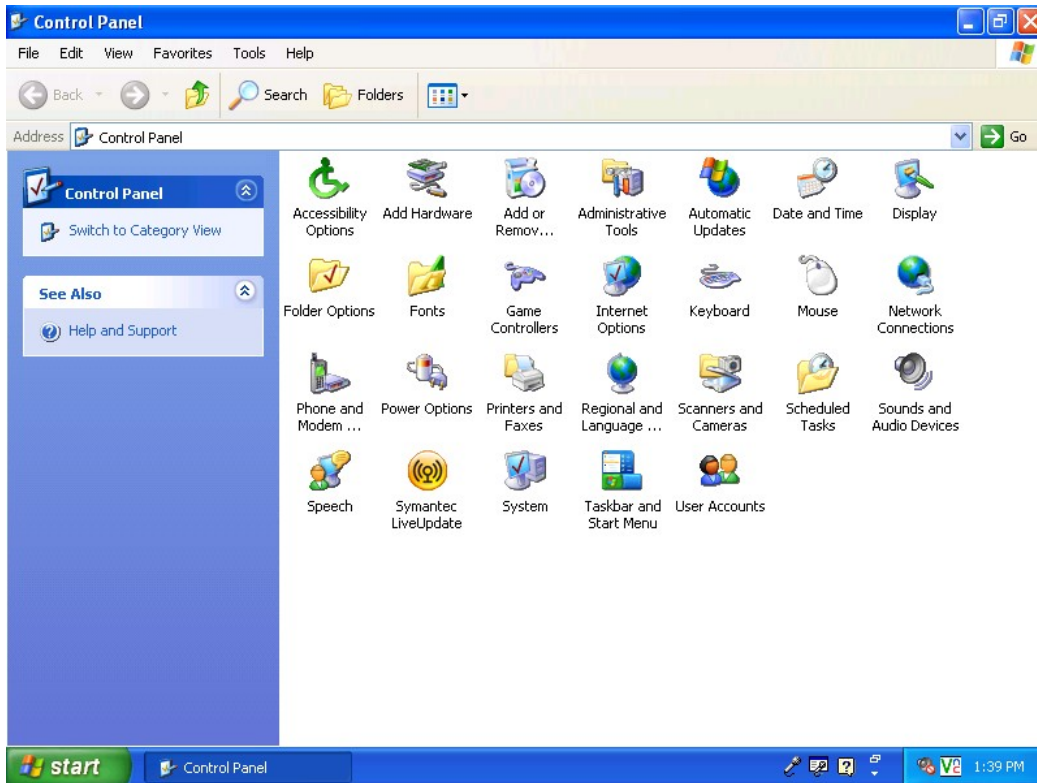
Direct Connection (no Network)

Finally, the device may be accessed directly from a PC/MAC without a proper network. This is accomplished by setting your computer's network adapter to a fixed address on the 192.168.2.x network; for example, 192.168.2.99.

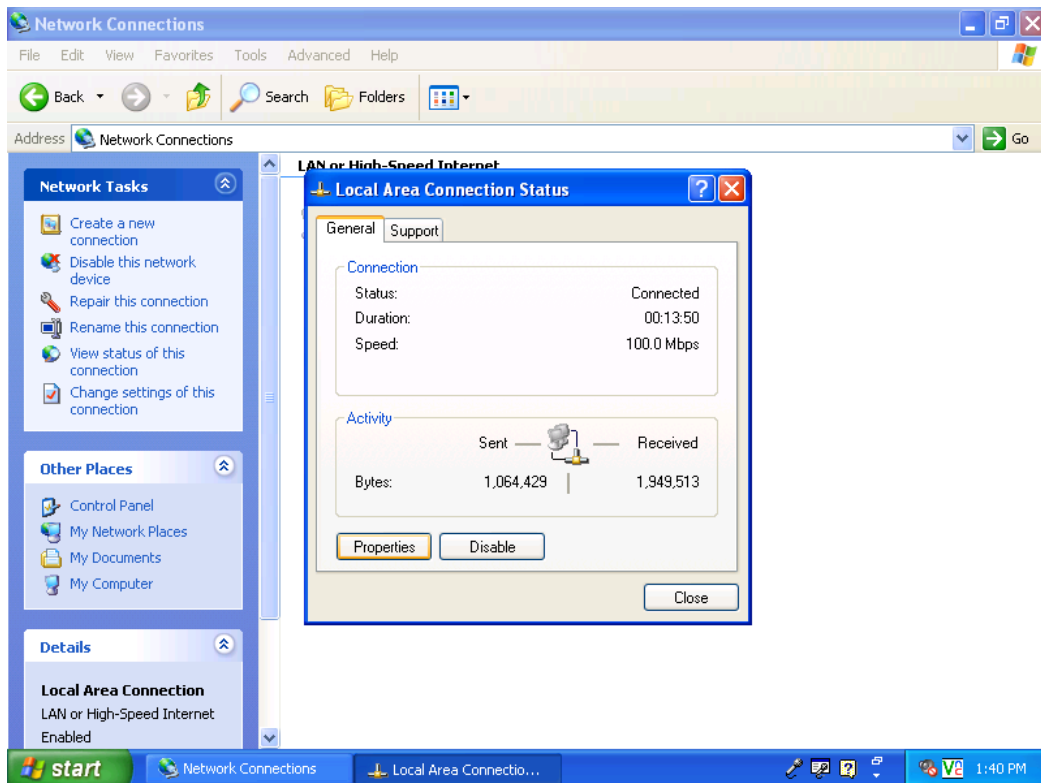
From the Start menu, click Control Panel.



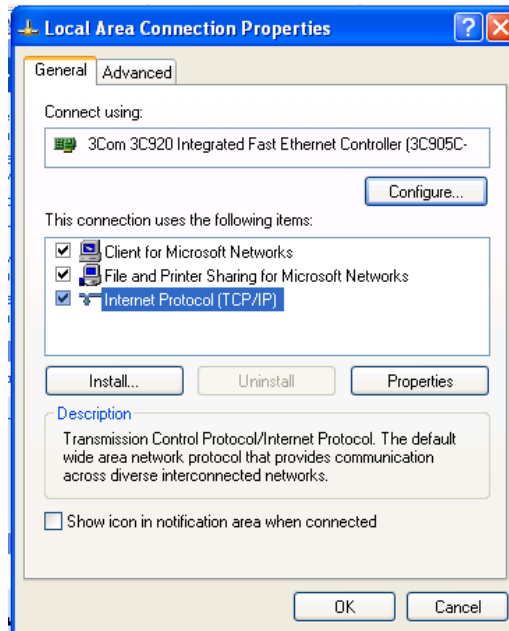
Double-click Network Connections.



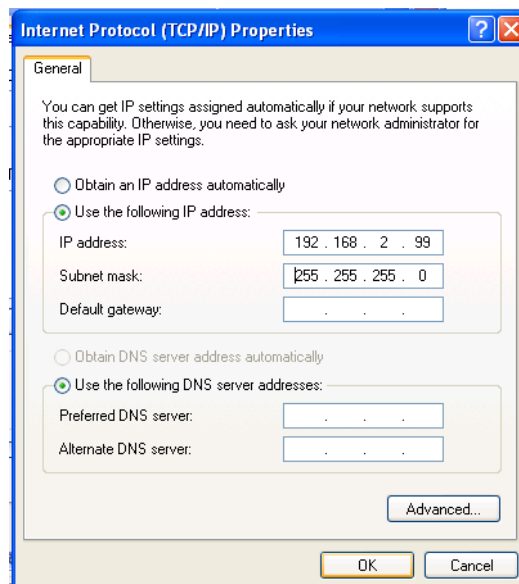
Right-click the Local Area Connection icon, and then choose Properties.



On the General tab, highlight Internet Protocol (TCP/IP), and then click Properties.



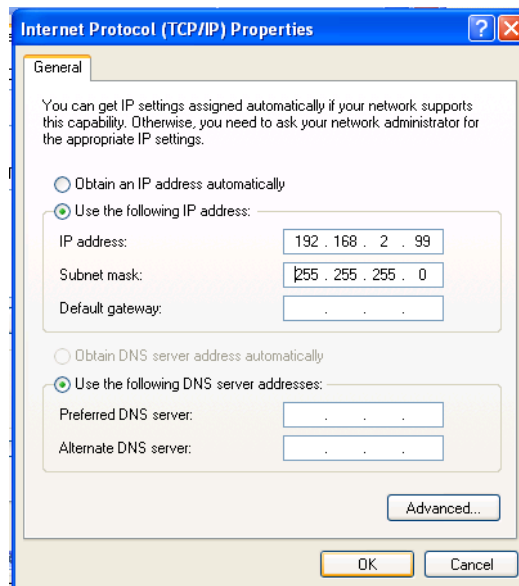
Click “Use the following IP address:” button and enter 192.168.2.99. Click “OK”. A message asking for the “subnet mask” will pop-up. Click “OK” and the subnet mask should populate itself. Pressing the Tab button on your keyboard should also auto fill the subnet mask field. Click “OK” again to save the changes.



Then connect the OnGuard to the computer using a standard Ethernet cable. The OnGuard is programmed to default to 192.168.2.77 when no DHCP server is found. Point your browser to 192.168.2.77 to access its web interface.



Once the [configuration](#) is complete, you will need to return the local area connection to the default settings. Return to the local area Ethernet connection that was changed, open its properties and select "Obtain an IP address automatically." Click "OK" to save changes.



Wireless Settings

The OnGuard is designed to communicate through an internal web interface, via Wi-Fi, for setup and logging purposes. **Remember to power the OnGuard in [one of the two external ways](#) before trying to connect.** The OnGuard will display the available networks. Clicking on one of the networks will establish a connection.



Smart Version: SW Rev: 4.0
Build Date: Feb 7 2017
Device Time: 2-12-17, 20:13:53

Purafil OnGuard® Smart

Data

Settings

Logger

Network

Wireless

Network

CAUTION: Incorrect settings may cause the board to lose network connectivity. Recovery options will be provided on the next page.

Network

Connected:

Available Networks:

- ProductionWiFi_2_4
- IncGuest
- Lab7
- MyCharterWiFi270
- Netgear23
- CISCO_9371E77
- Att645_abg

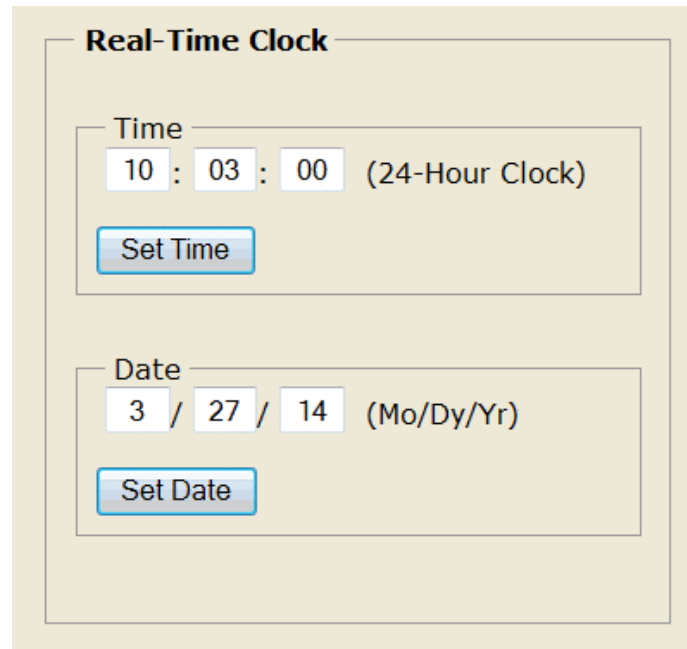
Configuration

The OnGuard may need to be configured to operate properly in your location, and provide the data desired. The configuration includes setting up the date and time and temperature and relative humidity limits. The OnGuard internal web interface is used for configuration. To connect with the OnGuard for configuration please see the [communication via](#)

[Ethernet](#) section. A summary of the available functions is listed below:

Clock/Calendar Tab

The date and time must be set. Make sure the OnGuard is powered and connected to the Ethernet and [communication](#) is established. Once the web interface is accessed, click on the “Settings” tab. Enter the time and date in the spaces provided and click the “Set” buttons.



The image shows a web interface for setting the Real-Time Clock. It is titled "Real-Time Clock" and contains two main sections: "Time" and "Date".

Time Section:
The "Time" section has a label "Time" above a row of three input boxes containing "10", "03", and "00", followed by the text "(24-Hour Clock)". Below this row is a blue button labeled "Set Time".

Date Section:
The "Date" section has a label "Date" above a row of three input boxes containing "3", "27", and "14", followed by the text "(Mo/Dy/Yr)". Below this row is a blue button labeled "Set Date".

Temperature & Humidity

The OnGuard allows you to set high limit, low limit, and rate-of-change limits for temperature and relative humidity. When limits are exceeded, the red LED will flash on the OnGuard as well as an indication of alarm on the web interface. To access alarm settings for temperature and humidity click on the Settings tab and changes can be made in the environment box.

Environment

Alarm Thresholds

Temperature	Humidity
Low <input type="text" value="10"/>	Low <input type="text" value="20"/>
High <input type="text" value="35"/>	High <input type="text" value="60"/>
Rate <input type="text" value="10"/> deg/Hour	Rate <input type="text" value="10"/> %/Hour
Scale <input type="text" value="Celsius"/> ▾	
Calibrate	Calibrate

Sensors

The OnGuard is shipped with copper and silver sensors installed. Copper is on top and silver is on the bottom. By default the classification level will correspond to the ISA standards. See the appendix for additional information on the Classification Levels.

Calibrate Temperature & Humidity

The temperature and relative humidity sensors can be calibrated from the OnGuard website. Under the "Settings" tab, there are selections for calibrating temperature and calibrating humidity. A reference instrument is required to provide a point to calibrate to. The temperature can be calibrated in Celsius or Fahrenheit.

Environment

Alarm Thresholds

Temperature	Humidity
Low <input type="text" value="10"/>	Low <input type="text" value="20"/>
High <input type="text" value="35"/>	High <input type="text" value="60"/>
Rate <input type="text" value="10"/> deg/Hour	Rate <input type="text" value="10"/> %/Hour
Scale <input type="text" value="Celsius"/> ▼	
Calibrate	Calibrate

To calibrate temperature, click on the link "Calibrate" within the temperature box. A window will pop-up with instructions and field for input.

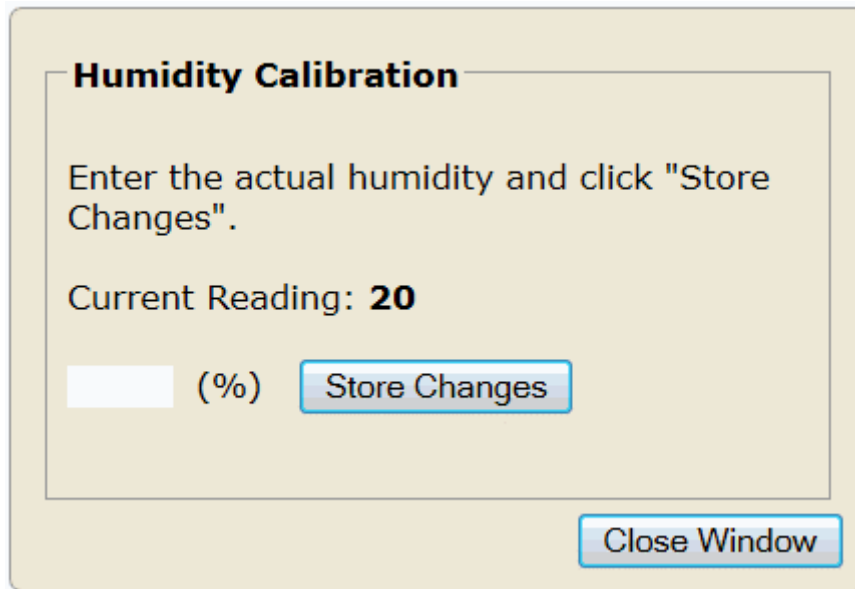
Temperature Calibration

Enter the actual temperature and click "Store Changes".

Current Reading: **23°C**

(°Celsius)

To calibrate humidity, click on the link “Calibrate” within the humidity box. A window will pop-up with instructions and field for input.



Calibrate Pressure

The pressure sensor can be calibrated from the OnGuard website. Under the “Settings” tab, there are selections for calibrating pressure. To calibrate pressure, click on the link “Calibrate” within the pressure box. A window will pop-up with instructions and field for input.

Normal Operation

Once the OnGuard has been installed, configured, and the sensors initialized, it is ready for normal operation. Most of the time the unit will be in “sleep” mode with no visible sign of activity except a flash from one of the LEDs once a minute. If the green LED flashes it means the unit is operating properly and no limits have been exceeded. When the unit is taking a reading, the green LED will flash once per second for about a minute. If there is an alarm condition, the red LED will flash at a one second “on”, one second “off” rate. At any time, the user can press the ENTER key to wake the unit and view the current readings or any alarm conditions.

Data Logger

The data logger can be enabled and disabled from the logger tab (screen below).

Setup

The logger interval can be set from 2 to 120 minutes. When the OnGuard is battery operated, you can maximize battery life by setting the logger interval to a higher value (15+ minutes) as the OnGuard uses more power during readings than between readings, when it “sleeps”. The most power is used when interfacing with an operator via the keypad and LCD display. Batteries can be made to last several months with proper setup and minimal operator intervention. When using batteries, the fields “Remaining” and “Days” refers to life left in the batteries. **Remember: do not power the OnGuard with batteries and leave it connected to the Ethernet as battery life will be significantly shortened.**



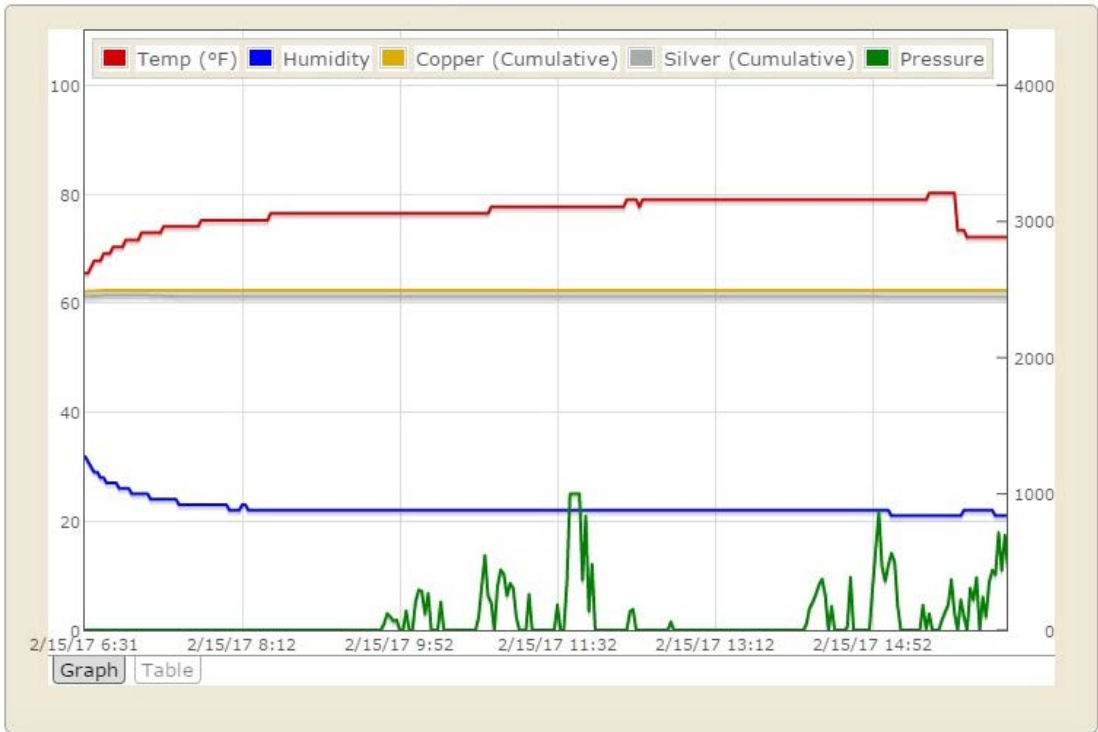
Smart Version: SW Rev: 4.0
Build Date: Feb 14 2017
Device Time: 2-15-17, 16:19:02

Purafil OnGuard® Smart

[Data](#) | [Settings](#) | [Logger](#) | [Network](#) | [Wireless](#)

Logger

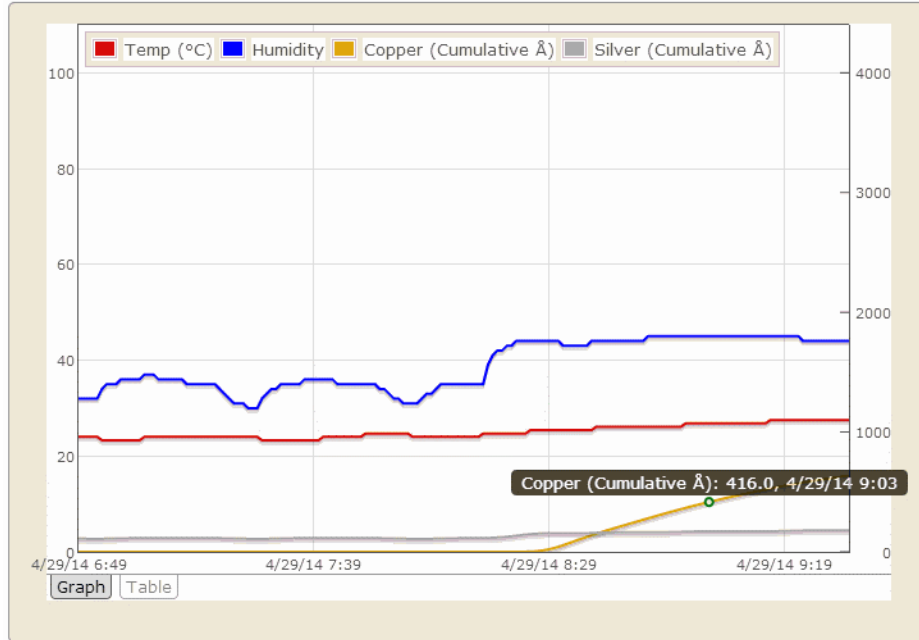
Remaining	Days	Interval:
98%	21	2 min
<input type="button" value="Erase"/>		<input type="button" value="Set"/>



Read 294 records

Pop-Up Data Feature

Placing your cursor over specific points along the copper, silver, temperature and relative humidity lines will display data point values.



Data Table

A table with the raw data from the graph can be accessed by pressing the “Table” tab in the bottom left corner of the window. The data can then be exported (“Download CSV” button) as a comma-separated value (CSV) file or copied (Select all button) and pasted into Excel (or similar program.)

Download CSV Select all

	Temp (°C)	Humidity	Copper (Cumulative Å)	Silver (Cumulative Å)
4/29/14 6:49	24	32	1	110
4/29/14 6:50	24	32	1	109
4/29/14 6:51	24	32	1	108
4/29/14 6:52	24	32	1	107
4/29/14 6:53	24	32	1	107
4/29/14 6:54	23.3	34	1	108
4/29/14 6:55	23.3	35	1	109
4/29/14 6:56	23.3	35	1	110
4/29/14 6:57	23.3	35	1	111
4/29/14 6:58	23.3	36	1	112
4/29/14 6:59	23.3	36	1	113
4/29/14 7:00	23.3	36	1	114
4/29/14 7:01	23.3	36	1	115
4/29/14 7:02	23.3	36	1	115
4/29/14 7:03	24	37	1	115
4/29/14 7:04	24	37	1	115
4/29/14 7:05	24	37	1	115
4/29/14 7:06	24	36	1	115
4/29/14 7:07	24	36	1	115

Graph Table

Logger Memory

The OnGuard can store over 21,000 readings in its logger memory. Data can be erased using the “Erase” button at the top of the logger window. Below is the logger memory capacity given different log intervals.

Log Interval	Hours	Days
2 Minutes	700	29
5 Minutes	1750	72
15 Minutes	5250	218
30 Minutes	10500	432
60 Minutes	21000	864
120 Minutes	42000	1728

Please note: If power is lost on the OnGuard while logging data, then the logger will shut off. When power is reestablished, download the data before resetting the logger as resetting the logger will erase previous data.

Alarm Conditions

There are two LED indicators on the OnGuard just to the right of the LCD display. The green LED will light if there are no “Alarm Conditions”. If an alarm condition is detected, the red LED will flash. The conditions that can cause an alarm condition are:

- One or both sensors in the two-hour initialization mode Sensor 1 (copper) or Sensor 2 (silver) failure
- Sensor 1 (copper) rate-of-change above limit
- Sensor 2 (silver) rate-of-change above limit
- Temperature above or below user-set limits
- Temperature rate-of-change above limit
- Relative Humidity above or below user-set limits
- Relative Humidity rate-of-change above limit
- Battery level below 10%

If there is an alarm condition active, and the unit is in “sleep” mode, the red LED will flash once per minute. If the unit is awake (during reading), the red LED will flash one second on, one second off. If there is no alarm condition the green LED will flash on the one minute interval and will flash at one second intervals during the reading period. To disable the red LED from lighting due to temperature or relative humidity limits being exceeded, set those limits to values the unit will not experience.

Email Settings

Basic Settings

- Enable E-Mails – Unchecking this will disable emails from being sent by this device
- To – The intended email recipient
- Test – Check “Send Now” and save changes to send a test email

Server Settings

The following email settings are required by your email service (gmail, yahoo, Exchange, etc):

- SMTP Server – address of the mail server
- Port – Port required by the server (usually 25 or 465 for secure)
- Use SSL – May be required by your email server
- User Name – A valid email address on the given SMTP Server
- Password – The login password associated with the above user name

Triggers

“Triggers” selects the alarm conditions by which an email to be generated and sent. For example, if Humidity is selected, an alarm email will be sent when any of the humidity limits are crossed (RATE, LO, HI). ISA alarms will be sent when ISA crosses higher than G1. Any combination of triggers may be selected. Only one alarm email is sent for a given condition until the alarm state returns to normal.

E-Mail

Enable E-mails

SMTP Server:

Port:

Use SSL

User Name:

Password:

From:

To:

Triggers: ISA Class
 Temperature
 Humidity

Test: Send Now

Email Information

The alarm email will contain the following information:

Device: **OG_ROOM185**

CURRENT READINGS

Local Time: 4/23/14, 15:05:13 ISA
Class: G1
Temperature: 27 *C Rel
Humidity: 34 %RH Power:
External


----- ALARM

DETAILS

0: SENSOR_1	<i>Sensor 1 not initialized or Sensor expired</i>
0: SENSOR_2	<i>Sensor 1 not initialized or Sensor expired</i>
0: BATTERY	<i>Battery is low</i>
0: TEMP_LO	<i>Low Temperature</i>
0: TEMP_HI	<i>High Temperature</i>
0: TEMP_RATE	<i>Temperature Rate</i>
0: HUM_LO	<i>Low Humidity</i>
0: HUM_HI	<i>High Humidity</i>
0: HUM_RATE	<i>Humidity Rate</i>
0: TEMP_READ	<i>Faulty Temp/Hum Sensor</i>
0: INCR_1	<i>Sensor 1 Incremental > G1</i>
0: INCR_2	<i>Sensor 2 Incremental > G1</i>
0: SENSINT_1	<i>Sensor 1 is initializing</i>
0: SENSINT_2	<i>Sensor 1 is initializing</i>
0: FLASH_FILESYS	<i>WEB Pages not present or could not read FLASH</i>
0: APP_SETTINGS	<i>cannot read saved settings from FLASH</i>

Device label is derived from the "Host Name" on the Network page.

Network

MAC Address: 00:1E:C0:C4:A8:5B 

Host Name: OG4_ROOM185

Enable DHCP

IP Address: 192.168.2.114

Gateway: 192.168.2.1

Subnet Mask: 255.255.255.0

Primary DNS: 192.168.2.1

Secondary DNS: 0.0.0.0

(Device will reboot)

Replacing Corrosion Sensors

When a corrosion sensor reaches its end of life, which happens when it reaches 4000 Angstroms of corrosion accumulation, it will cease to function and must be replaced. When a replacement sensor is obtained, install it on the OnGuard in the same place as the sensor that failed. The upper sensor location is for Copper sensors and the lower position is for Silver sensors. The OnGuard will recognize that a new sensor has been installed and will begin the [initialization procedure](#). The LCD will display a message indicating that the initialization sequence is in process. This process takes two hours, and during this time the information received from the OnGuard for that sensor is not valid. When the initialization sequence is complete the LCD message will be replaced with valid sensor readings.

Current Outputs from Channels

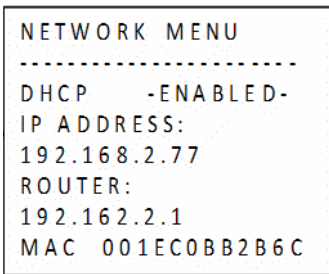
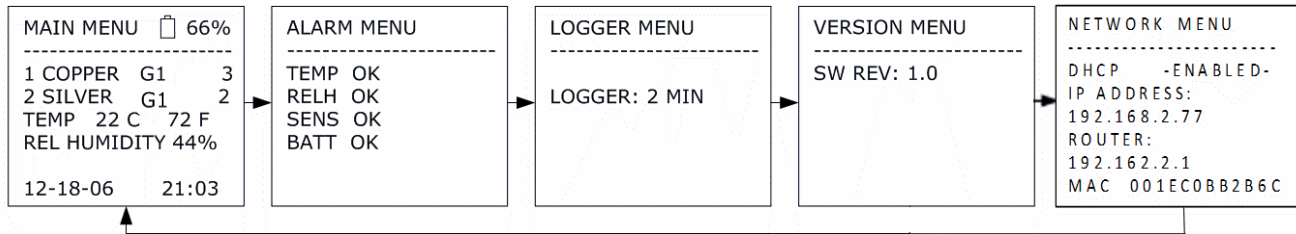
The OnGuard has five 4-20mA current outputs that correspond to Copper Cumulative, Silver Cumulative, Temperature, Relative Humidity and Pressure. The current outputs are accessible in the large 12-pin terminal block on the bottom of the OnGuard. Pin 1 and Channel 1 is located on the left end of the terminal block as viewed from the front. There is no LCD screen on the OnGuard that deals with the Current Outputs. These outputs are disabled when the OnGuard is battery operated.

Channel 1, Copper Cumulative, Pin 1 (-), Pin 2 (+), 4-20mA = 0-4000 Angstroms Channel
 2, Silver Cumulative, Pin 3 (-), Pin 4 (+), 4-20mA = 0-4000 Angstroms Channel 3,
 Temperature, Pin 5 (-), Pin 6 (+), 4-20mA = 0-100C
 Channel 4, Relative Humidity, Pin 7 (-), Pin 8 (+), 4-20mA = 0-100%
 Channel 5, Pressure, Pin 9(-), Pin 10 (+), 4-20 mA = 0-0.4 IWG
 OnGuard External Power, Negative Input, Pin 11
 OnGuard External Power (+12-36VDC), Positive Input, Pin 12

Appendix

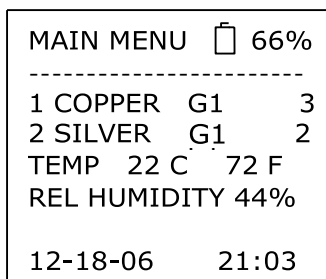
OnGuard LCD Menus

The OnGuard contains a backlit graphic LCD Display. The primary information screens are the “Network Menu” and the “Main Menu”. Additional screens are available to display alarm conditions, data logger settings and the OnGuard’s firmware revision. These are the “Alarm Menu”, the “Logger Menu”, and the “Version Menu”. The user can sequentially cycle through all these screens by pressing the “Menu” key.



Network Menu

When the OnGuard is powered up, the Network Menu Screen appears as shown above. After a few seconds, the LCD defaults to the MAIN MENU. The first line shows if DHCP has been enabled. The IP address is shown as well as the router address and the MAC address.



Main Menu

This screen displays the measured results from the on-board sensors, which include copper and silver corrosion sensors, temperature, and relative humidity.

The first line shows the screen title and the remaining battery life.

The second line shows the copper sensor “classification” (G1) and the current cumulative value (3). The third

line shows the silver sensor “classification” (G1) and the current cumulative value (2).

The fourth line shows the current temperature in Celsius and Fahrenheit. The

fifth line shows the current value for Relative Humidity.

The sixth line shows the date and time in 24 hour format.

```
ALARM MENU
-----
TEMP OK
RELH OK
SENS OK
BATT OK
```

Alarm Menu

The Alarm Menu shows the status of the OnGuard sensors and the main power batteries. The status of each will be shown as “OK” unless there is a problem with one of them. When an alarm condition occurs the red LED will light. The temperature (TEMP) and relative humidity (RELH) sensors will show an “L” for “low”, “H” for “high”, or “R” for “rate of change” limit exceeded. The SENS will show a “1” for copper, a “2” for silver, or “1/2” for both if any sensor has failed or reached end-of-life. The BATT entry shows “FAULT” when the battery level falls below 10%.

```
LOGGER MENU
-----
LOGGER: 2 MIN
```

Logger Menu

The Logger Menu shows the log interval. The value may be changed by pressing the UP or DOWN arrows on the keypad. Cycling through the interval values will present options for enabling and disabling the logger, and clearing the logger memory. When the desired option is displayed, pressing the ENTER key will implement that option.

```
VERSION MENU
-----
SW REV: 1.0
```

Version Menu

The Version Menu displays the current revision of the software in the OnGuard.

OnGuard® Smart 4-20 mA Calibration

Introduction

The OnGuard is capable of 4-20 circuit calibration through the [internal web interface](#). The 4-20 circuits are set by firmware default values such that the current loop levels will be very close to 4 and 20 milliamps on average. However, due to slight performance differences in electronic components, the firmware default levels may not be close enough for a particular application. Each of the four circuits may be individually calibrated by the end-user. It should be noted that even though the calibration adjustments can set the levels to within 0.005 mA, the circuits may drift slightly after calibration due to temperature change or other external forces.

Preparation

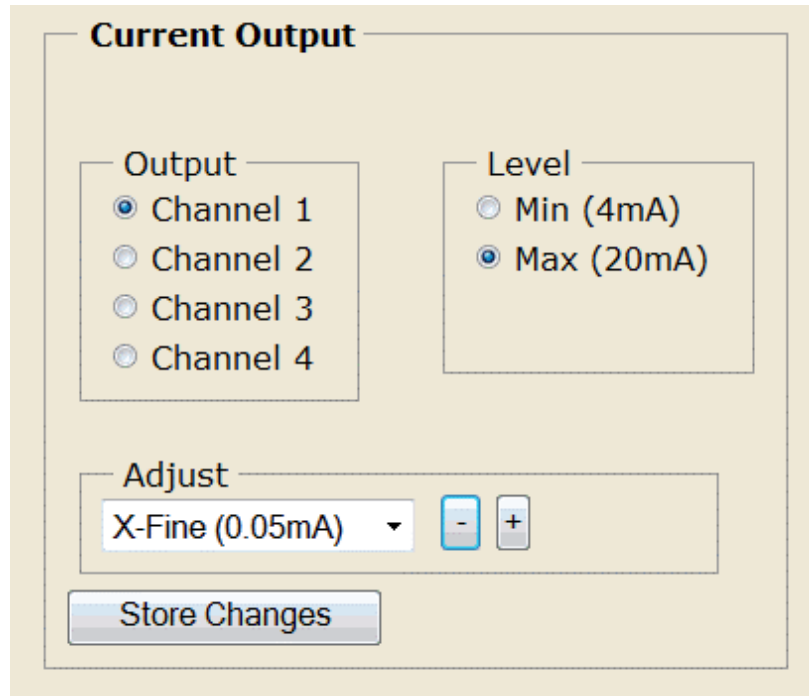
1. Connect the OnGuard to [external power \(12-36 vDC, pin 11 negative pin 12 positive\)](#). The OnGuard's 4-20 circuits will not operate under battery and will operate only when external power is applied.
2. Connect a suitable ammeter to a selected channel on the OnGuard. Refer to the images below for output information. At this point, the current displayed on the ammeter will represent the selected channel's output (e.g. humidity on channel 4).

Signal	Positive	GND/Common
Chan 1 (Copper)	2	1
Chan 2 (Silver)	4	3
Chan 3 (Temperature)	6	5
Chan 4 (Humidity)	8	7
Chan 5 (Pressure)	10	9

Table 1: Connector Pin Assignments

3. [Connect the OnGuard to the PC/MAC with an Ethernet cable and access the web interface.](#)
4. The current output is located on the web interface in the "Settings" tab. At this point, the current displayed on the ammeter will represent the output channel (1-4) and level (min or max) as selected on the 4-20 calibration window.

The OnGuard will hold the selected level, bypassing normal 4-20 functionality, for a period of 60 seconds every time an adjustment selection from this window is chosen.



Output

Selecting any of the outputs (Channel 1 through Channel 4) will force the currently selected level (Minimum or Maximum) to be output on the selected channel.

Level

Selecting either option (Minimum or Maximum) will force the currently selected channel to its minimum or maximum level.

Plus and Minus Keys

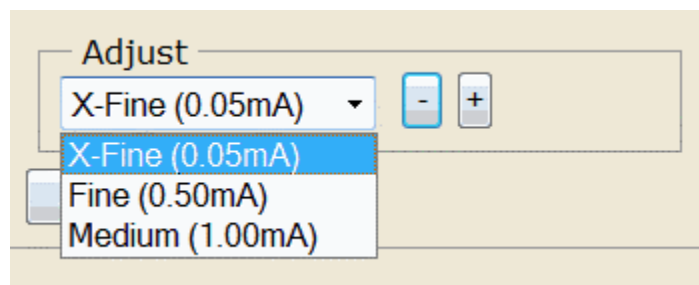
Selecting these will adjust the current on the selected channel up or down by an amount corresponding to the level shown in the drop-box immediately below.



Step Amount

This defines the step size affected by the arrow keys. The steps are roughly as follows: X-

Fine	0.05 mA
Fine	0.50 mA
Medium	1.00 mA



Store Changes

This stores the changes for the currently selected channel and level. For example, if *Channel 1* and *Maximum* are selected, clicking *Store Changes* will store changes made to the maximum level of channel 1, channel one's minimum level and the other channel calibrations will not be stored. This allows the user to change any single attribute of each channel's minimum and maximum levels; however, *Store Changes* and the intended calibration level must be selected for each channel to be calibrated before exiting the calibration window.

Procedure

1. Follow the setup steps listed in the *Preparation* section above.
2. Familiarize yourself with the operation of the calibration window controls as shown above.
3. For each channel:
 - a. Connect a suitable ammeter to the channel's output pins
 - b. Select Minimum (4 mA)
 - c. Verify that the ammeter reads 4.00 mA. Adjust up or down using the plus and minus keys until the desired level is obtained while using the step amount control to achieve an appropriate adjustment size.
 - d. Select Maximum (20 mA)
 - e. Verify that the ammeter reads 20.00 mA. Adjust up or down using the plus and minus keys until the desired level is obtained while using the step amount control to achieve an appropriate adjustment size.
4. After all the channels have been adjusted, select the "Store Changes" button to store the calibration adjustment.
5. Disconnect the ammeter. The OnGuard will continue normal 4-20 circuit operation 60 seconds after the most recent (calibration window) button-press.

General Questions:

Q. What is new with the OnGuard Smart?

Room pressure measurements and Wi-Fi communications to a network.

Q. Why do I need a corrosion monitor?

To monitor an environment for potential reliability issues.

Q. Will the OnGuard 3000 and OnGuard 4000 still be available for purchase?

The 3000 is no longer available and the 4000 will be not be available after January 2018.

Q. How many days of data can be logged in the unit?

Depending on the logger setting form 2 weeks to 6 months.

Q. What is the value of having a pressure sensor?

Positive pressure is a key to a room's ability to deter corrosion and avoid reliability issues.

Q. To which ISA Standard is the device calibrated?

IAS-S71.2013

Q. Can I get alerts when a measurement gets to a certain threshold?

The OnGuard Smart has set able alarms for Copper, Silver, Temperature, Relative Humidity and Pressure.

Q. What are the different methods by which the unit can be powered?

The OnGuard Smart can be powered by batteries (4 AAs), POE (power over Ethernet) and 25v DC.

Q. What are the different methods by which I can view the data?

Data can be viewed locally with the LCD, on a network with a computer or through a DCS (distributed control system) or BMS (building management system).

Q. How many OnGuard Smart devices do I need per facility?

One OnGuard Smart is suggested for each AHU (air handling unit).

Installation and Operation:

Q. [How do I connect to Wi-Fi?](#)

Detailed instructions are available on Page 19 of the Manual or the OnGuard Smart Tutorial Video.

Q. [Does the unit use battery power when connected to Wi-Fi?](#)

Battery power is not suggested when the OnGuard Smart is connected to a network by Wi-Fi or cable due to power consumption. Power Over Ethernet (POE) is suggested for directed connections and 24v DC is suggested when Wi-Fi is used.

Q. [How do I connect to the facility Distributed Control System \(DCS\)?](#)

Detailed instructions are available on Page 28 of the Manual or the OnGuard Smart Tutorial Video.

Q. [Is this unit compatible with standard building systems protocols \(BACNet, Modbus, etc.\)?](#)

Communication with the OnGuard Smart is currently only available through a Distributed Control System using analog (4-20 mA) connection.

Q. [How do I view the data in the logger?](#)

Connect to the OnGuard Smart and go to the Logger Tab. Detailed instructions are available on page 23 of the manual.

Q. [How do I set up email alerts?](#)

Connect to the OnGuard Smart and go to the Network Tap. Detailed instructions are available on page 25 of the manual.

Q. [What is the ideal location to place the monitor?](#)

The OnGuard Smart should be located near the most critical equipment in the control room.

Q. [Can I export the data in the logger? If so, how?](#)

Connect to the OnGuard Smart and go to the Logger Tab. Detailed instructions are available on page 23 of the manual.

Troubleshooting:

Q. The battery gets exhausted very quickly.

Logger is set for 1 minute, increase logger interval for longer battery life.

Q. How do I get spare parts for the OnGuard?

Contact Purafil at Purafil.com/contact or +1 770.662.8545

Q. What is the calibration process for the silver and copper sensor?

The copper or silver sensors do not require calibration, they are factory calibrated.

Q. The email alert feature is not working.

Connect to the OnGuard Smart and go to the Email Settings Tap (see manual page 26) and check address settings.

Q. How do I modify the ISA Standard set for the device?

The ISA Standard settings are factory set and cannot be modified.

Q. Which web browsers are compatible with the OnGuard Smart?

The OnGuard Smart is compatible with IE, Google Chrome or Fox Fire. However the OnGuard Smart is optimized for Google Chrome.

Q. How do I know when I need to replace the sensor?

The OnGuard Smart will alarm locally when a sensor has failed.

Q. What if the installation requires a loop-powered transmitter?

The OnGuard Smart is not a loop-powered transmitter. The OnGuard Smart requires a standalone 24 VDC power supply.

Q. What if there are four AA batteries installed in the OnGuard Smart.

Remove the batteries; the OnGuard Smart will only transmit analog data if powered by a 24 VDC power supply.

Q. What if after wiring for power the lights do not come on?

Check the DC power supply for the proper voltage level, 12 to 36 VDC. Verify that the positive and ground leads are secured to the terminal block.

Troubleshooting (Continued):

Q. What if there is no analog output?

Verify that the signal and ground wires are secured to the terminal block.

Q. What if the OnGuard Smart is hooked up to a DCS that is reporting unexpected values?

If the output channels are hooked up, eight wires must be secured in the proper positions on the terminal block. Verify the reading at the terminal block and compare them to the reported values on the DCS or BMS. If a discrepancy exists, the wiring is not correct.

Q. What if the cumulative corrosion fluctuates instead of continually increasing?

This occurrence is normal for the corrosion sensors. The sensors are extremely sensitive and even water vapor or microscopic dust particles will cause minor fluctuations in the readings.

Control of temperature, relative humidity and vibrations will help minimize fluctuations. The scale selected to graphically display the data, if a narrow range, can also accentuate the fluctuations.

Q. What if the cumulative readings don't match the results of coupons in the same environment?

Be sure the coupons are placed as close to the OnGuard Smart as possible. The OnGuard Smart zeros out any existing corrosion on the sensors during initial power-up. Coupons as prepared per the ISA Standard (S71.04) generally have background reading from 50 to 150 angstroms. The coupon value should be corrected for background corrosion before making any comparisons.

Q. What if the OnGuard Smart has been moved to a new location and the corrosion values seem to have changed?

The OnGuard Smart is designed to be permanently mounted. Any shaking or jostling may affect the corrosion sensors. If the OnGuard Smart is moved, remount, wire and install new sensors.

Q. What if the unit is in a continuous alarm state?

Check the high and low levels for the temperature and relative humidity. The units are shipped with factory defaults, but these defaults are often changed when the owner has become familiar with the operation of the unit.

Also, check the incremental limits for copper and silver corrosion