User Manual

OnGuard® Smart with Modbus

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Preface

Thank you for your purchase of the OnGuard Smart with Modbus. We are confident your unit will provide the same level of reliability and performance that has made the OnGuard platform a trusted solution for environmental corrosion monitoring. For additional product information or support, please contact:

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OnGuard Technology

Introduction

The Purafil OnGuard Smart Atmospheric Corrosion Monitor, now with Modbus communications, is an advanced environmental monitoring solution designed to protect critical electronics and infrastructure from the damaging effects of corrosive airborne contaminants. Using highly sensitive copper and silver Quartz Crystal Microbalance (QCM) sensors, the OnGuard Smart with Modbus continuously measures corrosion rates in real time while also monitoring temperature, relative humidity, and room pressure. By providing instant visibility into environmental conditions, the system helps facility operators identify harmful trends before corrosion leads to costly equipment failures, downtime, or maintenance issues.

Engineered for industrial facilities, data centers, control rooms, museums, archives, and other mission-critical environments, the OnGuard Smart with Modbus combines precise monitoring with modern connectivity and remote access capabilities. Its built-in data logging, Ethernet and Modbus communications, and compatibility with facility management systems make it easy to integrate into existing operations and proactively manage air quality risks. Designed to align with ISA Standard 71.04-2013 corrosion classifications, the OnGuard Smart with Modbus gives operators actionable data to maintain reliable environments, extend equipment life, preserve critical artifacts, and support continuous operational performance.

Corrosion

Cumulative Corrosion is the total amount of corrosion that has accumulated on a metal surface over time. Corrosion occurs continuously when contaminant gases react with the base metal. On copper and silver, it first appears as a light tarnish that gradually darkens and thickens as corrosion increases.

The OnGuard Smart with Modbus reports Cumulative Corrosion in angstroms (Å), where 1 Å equals 10^{-10} meters. OnGuard corrosion sensors can measure up to 4,000 Å of cumulative corrosion. By this point, the copper and silver sensors will appear completely black, while visible tarnishing or equipment performance issues will typically occur well before the 4,000 Å limit is reached.

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 (Å/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 (Cl_2) 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.

Corrosion Standards

Standards establish the acceptable limits for performance and environmental conditions. These limits may be defined by industry organizations through formal committees or developed internally to meet the specific requirements of a particular application. The OnGuard system is preconfigured with industry-recognized corrosion, temperature, and humidity standards established by the International Society of Automation (ISA). These include ISA 71.04-2013, *Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants*, and ISA 71.01-1985, *Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity*.

Developed by a panel of experts including electronics manufacturers, gas-phase filtration specialists, professional engineers, and industrial end users, these standards provide a trusted framework for evaluating environmental conditions. They are widely accepted and used around the world to help protect sensitive electronic equipment in industrial and mission-critical environments.

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
        - User manual
        - Warranty form
        - EMC letter
        - 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 ensures 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 will 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 Smart with Modbus

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.

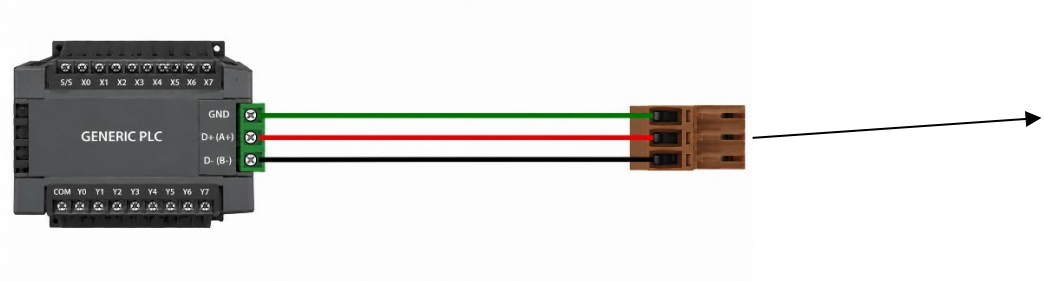
Initializing Sensors

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 and takes approximately two hours. It 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.

Modbus Setup and Settings

Basic Setup and Connection

The OnGuard has an RS-485 half duplex (A(D+)/B(D-)/GND) serial connection at the left side of the device. This port allows for Modbus-RTU/ASCII communication. Proper wiring of the device is below. This is a view from the top down of the device when connected:



For wiring:

- Green wire = GND
- Red wire = A(D+)
- Black wire = B(D-)

Note: the colors used are only for illustration purposes only. Any color wire can be used, just ensure they are consistent to the connection points.

The serial settings for the device are as follows (displayed on the Modbus Menu):

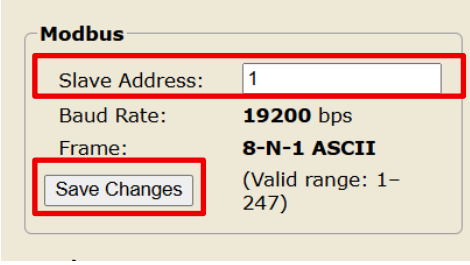
- Baud Rate: 19,200 (fixed)
- Data Bits: 8 (fixed)
- Parity: None (fixed)
- Stop Bits: 1 (fixed)
- Protocol: Modbus ASCII over RS-485 (fixed) **DO NOT SELECT RTU on Master device**.
- Slave ID: 01 (default; This is configurable via the holding register (FC 03), or via direct Ethernet connection).
- Supported function codes (FC)
- 03 (Read Holding)
- 04 (Read Input)
- 06 (Write Single Holding)
- 16 (Write Multiple Holding)

The connection is always available if the OnGuard is powered externally. Using Modbus with battery operation is not recommended.

To change the slave ID with direct connection, connect the OnGuard via Ethernet cable instructed in the Communication via Ethernet section of the manual.

Go to the communication tab. Change the slave address to the ID number desired (1-247).

Click the “Save Changes” button.



Quick Reference – Common Master Operations

Operation	FC	Address	Quantity / Value
Read all live readings	04	0	13 (regs 0–12)
Read RTC date/time	04	13	6 (regs 13–18)
Read all settings	03	0	13 (regs 0–12)
Read current slave address	03	19	1
Set logger ON	06	1	1
Set measurement interval	06	0	30
Set RTC (atomic)	16	13	6 regs: 26, 5, 7, 14, 30, 0
Change slave address	06	19	5

Full Register Tables

Input Registers (FC 04, read-only) — 19 registers, addresses 0–18

Reg	Description	Firmware Variable	Valid Range
0	Temperature, units = 0.1 °C signed (e.g. 235 = 23.5 °C)	DataRecord.Temp	sensor-driven
1	Relative humidity, units = %	DataRecord.Humid	0–100
2	Differential pressure (units depend on AppSettings.Pressure.Display_ Scale: 'P' = Pa, 'I' = IWG ×1000)	DataRecord.Pressure	sensor-driven
3	Sensor 1 (copper) cumulative corrosion	DataRecord.Crystal_1_Cumulative	sensor-driven
4	Sensor 1 (copper) incremental corrosion	DataRecord.Crystal_1_Incremental	sensor-driven
5	Sensor 2 (silver) cumulative corrosion	DataRecord.Crystal_2_Cumulative	sensor-driven
6	Sensor 2 (silver) incremental corrosion	DataRecord.Crystal_2_Incremental	sensor-driven
7	Battery voltage, units = mV	batteryVoltage	0–~5000
8	Battery level, units = %	batteryPercent	0–100
9	Alarm word 1 (16 bitflags — see Alarm Bitfields table)	Main_GetAlarms()	bitfield
10	Alarm word 2 (16 bitflags)	Main_GetAlarms2()	bitfield
11	Reserved. Op flags suppressed in v5.5e — always reads 0		
12	Logger sample number (incremented on each entry)	DataRecord.SampleNum	0–65535
13	RTC year (decimal, 2-digit; e.g. 26 = 2026)	Current_Time.YR	0–99
14	RTC month (decimal)	Current_Time.MO	1–12
15	RTC day-of-month (decimal)	Current_Time.DT	1–31
16	RTC hour (decimal, 24-hour)	Current_Time.HR	0–23
17	RTC minute (decimal)	Current_Time.MN	0–59
18	RTC second (decimal)	Current_Time.SC	0–59

Holding Registers (FC 03 / 06 / 16, read-write) — 20 registers, addresses 0–19

Reg	Description	Firmware Variable	Valid Range
0	Measurement interval, units = minutes	AppSettings.Meas_Inc_Min	2–120
1	Logger enable	AppSettings.Logger_ON	0 or 1
2	Temperature low alarm threshold, units = 0.1 °C signed	AppSettings.TempHum_Limits.Temp_LO	int — no firmware bounds check
3	Temperature high alarm threshold, units = 0.1 °C signed	AppSettings.TempHum_Limits.Temp_HI	int — no firmware bounds check
4	Humidity low alarm threshold, units = %	AppSettings.TempHum_Limits.Hum_LO	0–255 (cast to BYTE)
5	Humidity high alarm threshold, units = %	AppSettings.TempHum_Limits.Hum_HI	0–255 (cast to BYTE)
6	Temperature rate-of-change alarm, units = degrees/hour	AppSettings.TempHum_Limits.Temp_Rate	0–255 (cast to BYTE)
7	Humidity rate-of-change alarm, units = %/hour	AppSettings.TempHum_Limits.Hum_Rate	0–255 (cast to BYTE)
8	Pressure low alarm threshold (units per Pressure.Display_Scale)	AppSettings.Pressure.Press_LO	uint16 — no firmware bounds check
9	Pressure high alarm threshold (units per Pressure.Display_Scale)	AppSettings.Pressure.Press_HI	uint16 — no firmware bounds check
10	Temperature calibration offset, units = 0.1 °C signed	AppSettings.TempHum_Offsets.Temp_Offset	uint16 — no firmware bounds check
11	Humidity calibration offset, units = %	AppSettings.TempHum_Offsets.Humi_Offset	uint16 — no firmware bounds check
12	Pressure calibration offset (units per Pressure.Display_Scale)	AppSettings.Pressure.Press_Offset	uint16 — no firmware bounds check
13	RTC year (decimal). Write is staged — see note below	mb_dtPending.YR (staged) → RTC	0–99
14	RTC month (decimal)	mb_dtPending.MO (staged) → RTC	1–12
15	RTC day-of-month (decimal)	mb_dtPending.DT (staged) → RTC	1–31
16	RTC hour (decimal, 24-hour)	mb_dtPending.HR (staged) → RTC	0–23
17	RTC minute (decimal)	mb_dtPending.MN (staged) → RTC	0–59
18	RTC second (decimal)	mb_dtPending.SC (staged) → RTC	0-59
19	Modbus slave address	AppSettings.Modbus_SlaveAddr	1-247

Notes:

1) RTC = Real Time Clock. Registers 13-18 return the live RTC value immediately after the moment of the request.

2) Uint16 = 16-bit unassigned integer

Alarm Bitfields (Reference for input regs 9 and 10)

Bit	Name	Description
0	SENSOR_1	Sensor 1 failure (init not complete or expired)
1	SENSOR_2	Sensor 2 failure (init not complete or expired)
2	BATTERY	Battery low
3	TEMP_LO	Temperature below low threshold
4	TEMP_HI	Temperature above high threshold
5	TEMP_RATE	Temperature rate-of-change exceeded
6	HUM_LO	Humidity below low threshold
7	HUM_HI	Humidity above high threshold
8	HUM_RATE	Humidity rate-of-change exceeded
9	TEMP_READ	Failed to read/communicate with temp/humidity sensor
10	INCR_1	Sensor 1 incremental value exceeds P1/G1 threshold
11	INCR_2	Sensor 2 incremental value exceeds P1/G1 threshold
12	SENSINT_1	Sensor 1 is initializing
13	SENSINT_2	Sensor 2 is initializing
14	FLASH_FILESYS	Flash file-system error
15	APP_SETTINGS	Could not read application settings from non-volatile memory

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 to 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.

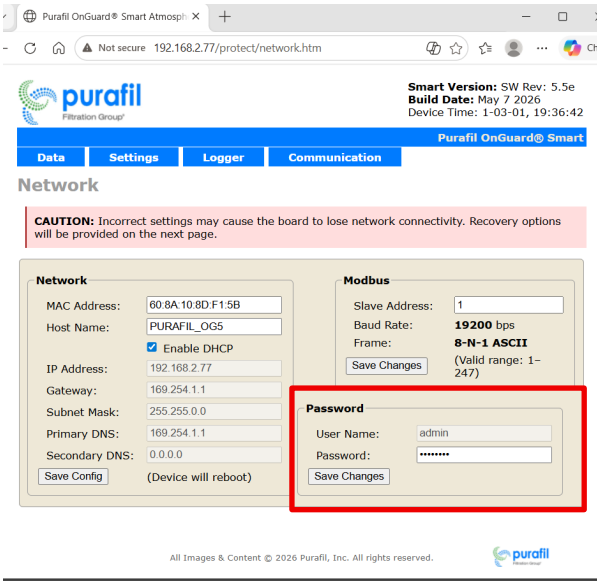
The default password is as follows:

- User Name: admin
- Password: password

User Name cannot be changed and is always “admin”. *Password* can be changed on the Communication 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”.

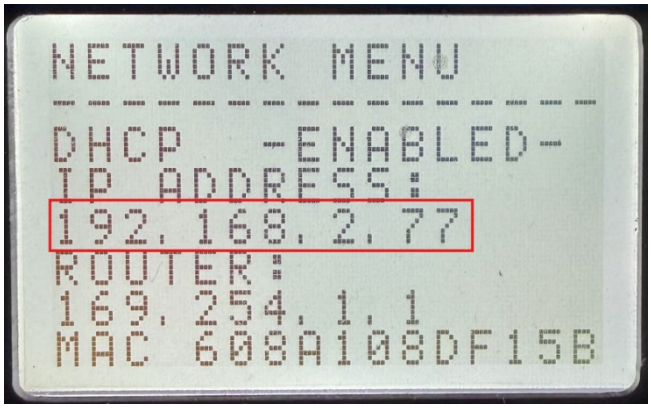
The following page shows the Password entry field in the lower left corner of the Communication Page.



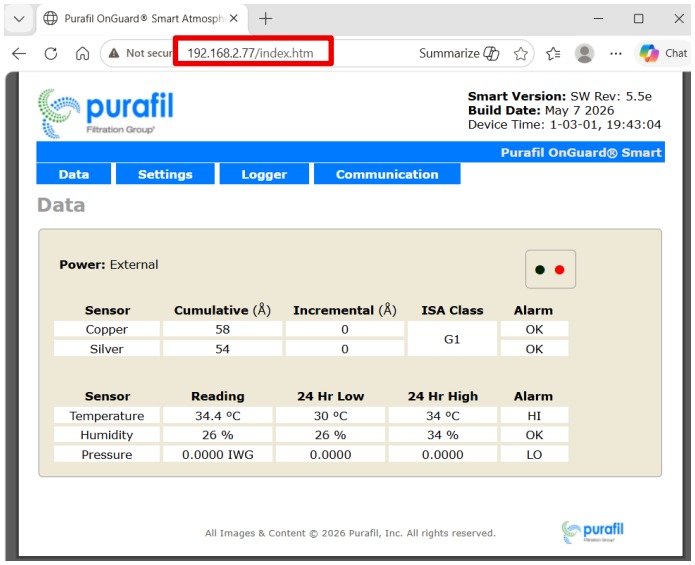
Local Area Network Connection

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.



In this case, to connect to this OnGuard's web interface, type "192.168.2.77" into your browser's address bar. Below shows the home page of this OnGuard at address 192.168.2.77:



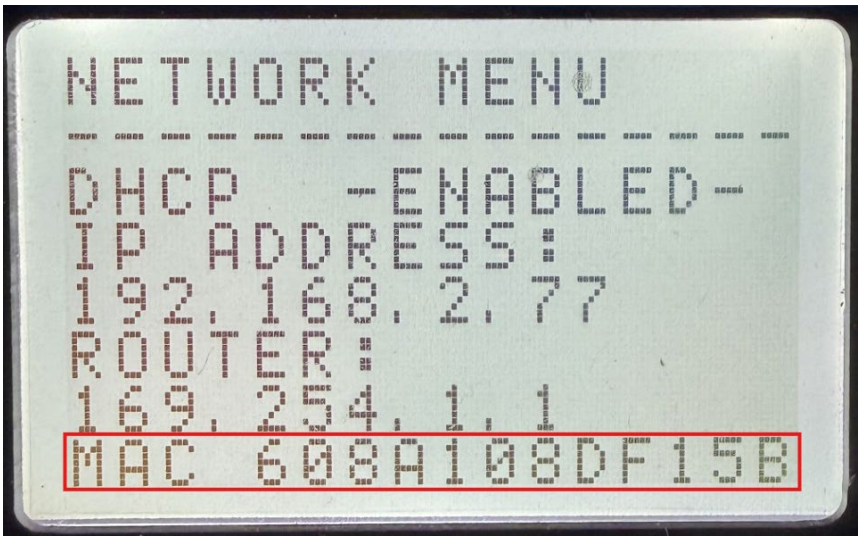
Note that the dynamic address may change. If the OnGuard or the network router is power-cycled, the OnGuard may be assigned a different address. Exact behavior will depend on the network router's (or local DHCP server's) configuration.

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

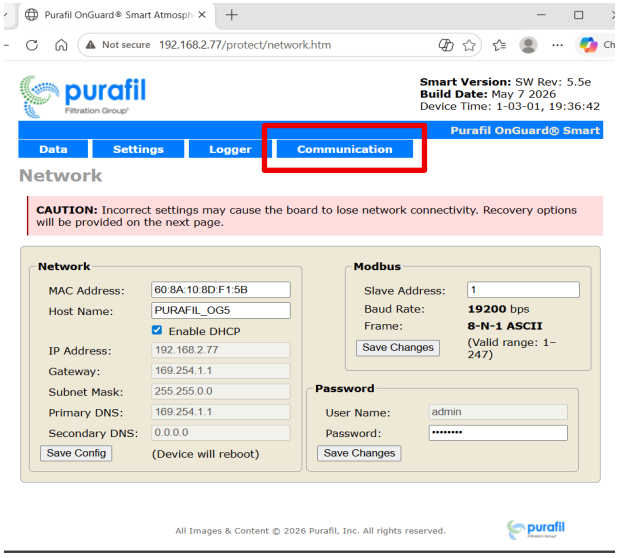
To define an address in the router (or DHCP server), the server must know the unique hardware address of the OnGuard – the MAC address. The MAC address is displayed on the OnGuard's network menu as shown below:



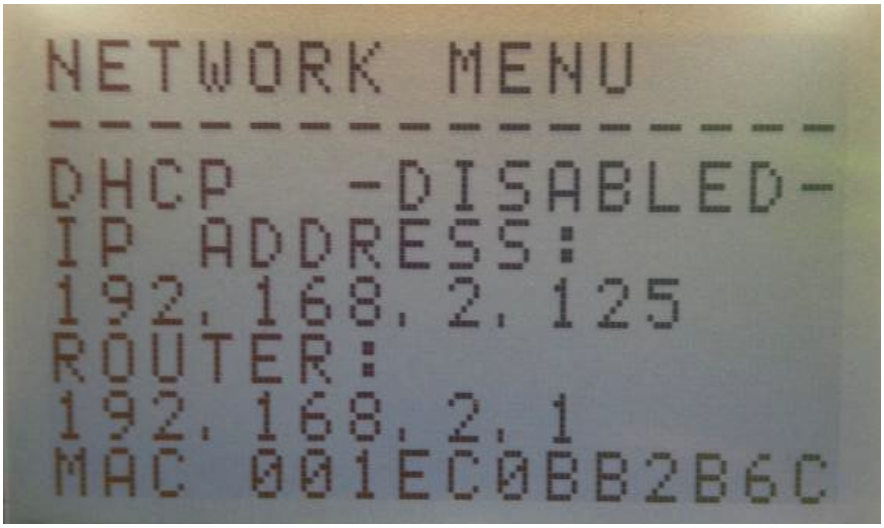
Enter this address in your router DHCP configuration with a desired address in order to specify a fixed address for the OnGuard. Exact method will depend on the router's make and model, but this is typically found in its settings page under Configuration->Advance->DHCP. Consult your router's manual.

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 Communication page as shown below.



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.



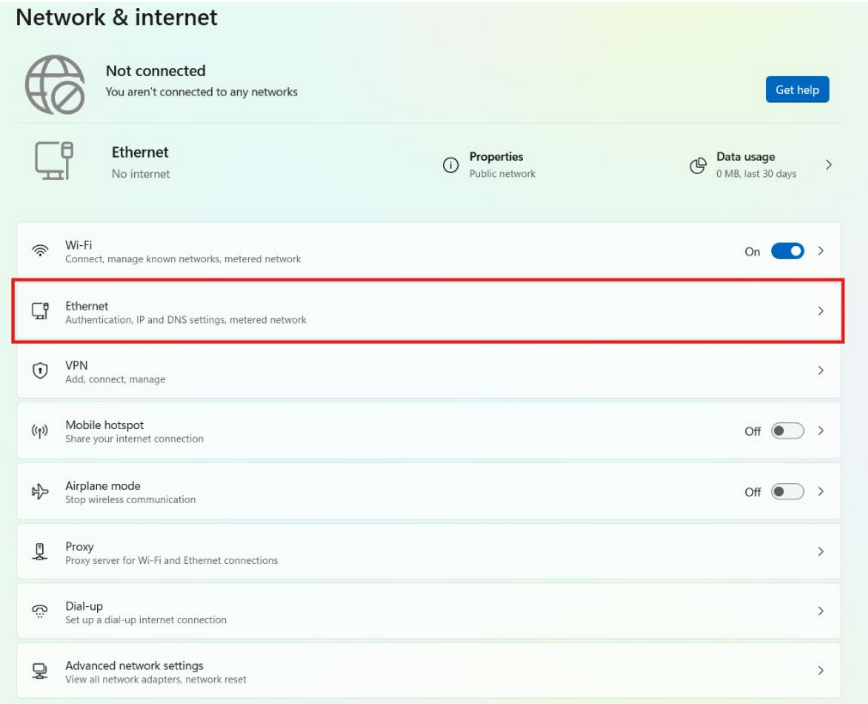
Direct Connection (no Network)

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.

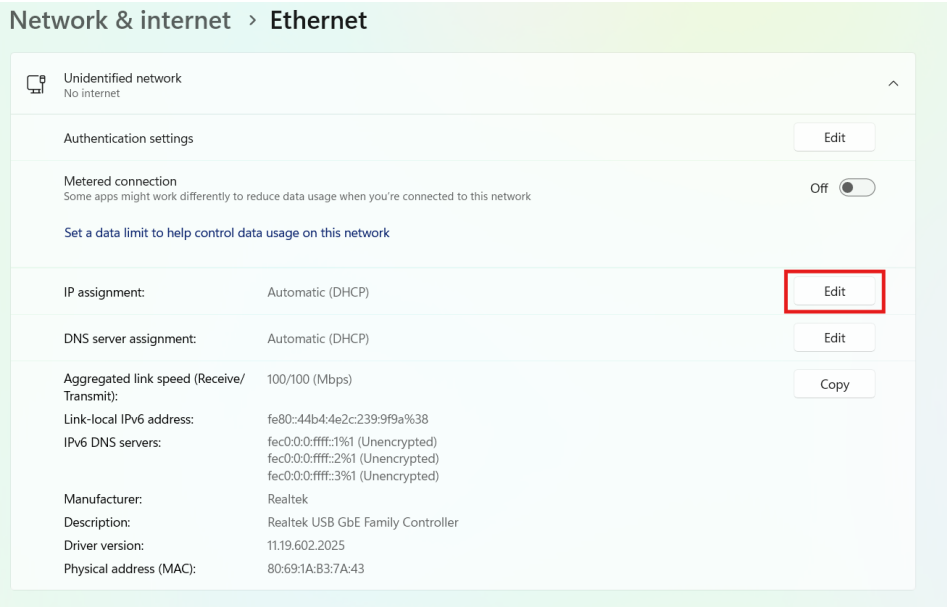
Note: Ensure that the user has administrative rights on the computer.

Click Microsoft Menu > Settings > Network & Internet

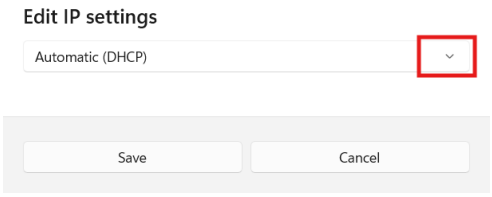
Double-click Ethernet.



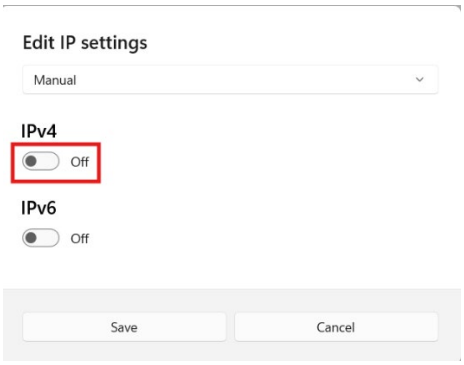
Under the Ethernet menu, click Edit for IP assignment.



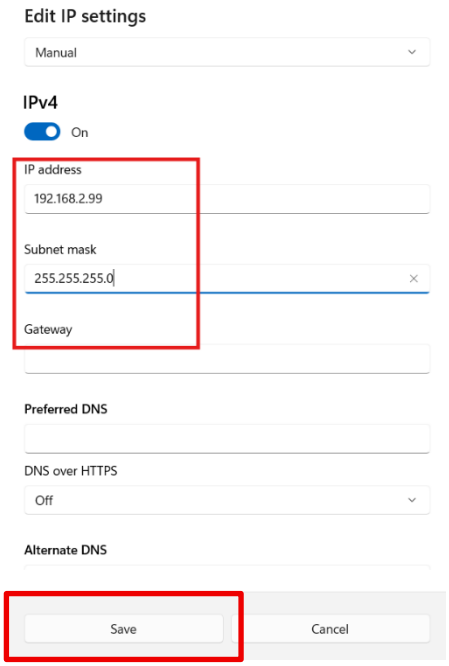
A pop-up window will appear for Edit IP settings. Click on the drop-down menu and select “Manual”.



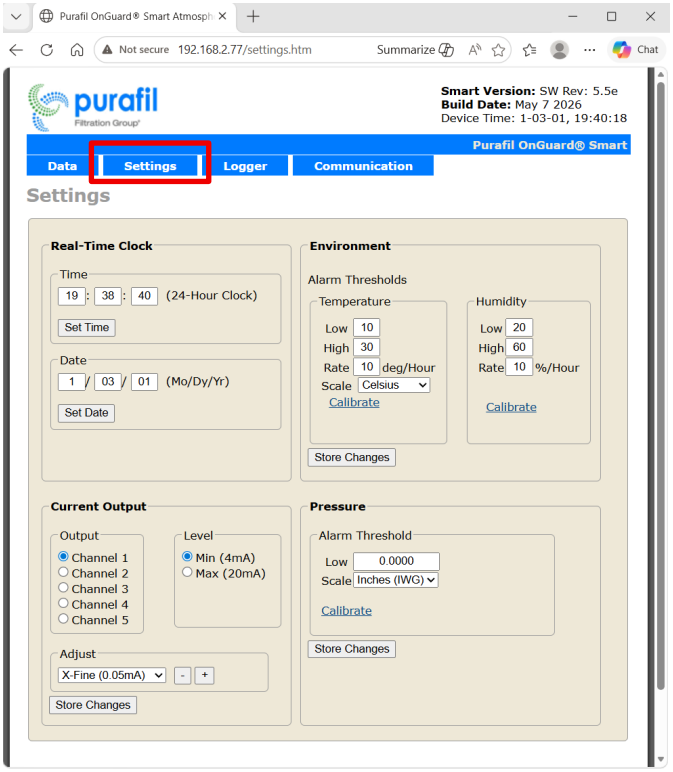
Select IPv4 to “On”.



Under “IP address”, enter 192.168.2.99. Under “Subnet mask”, enter 255.255.255.0. Leave all other fields blank and click “save”.



After saving, 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. Open a browser and enter 192.168.2.77 into the address bar. From there click onto the settings tab.



Once the configuration is complete, you will need to return Network and Internet back to the default settings. Return to the Ethernet menu and undo changes made to IPv4. Click “Save” to save changes.

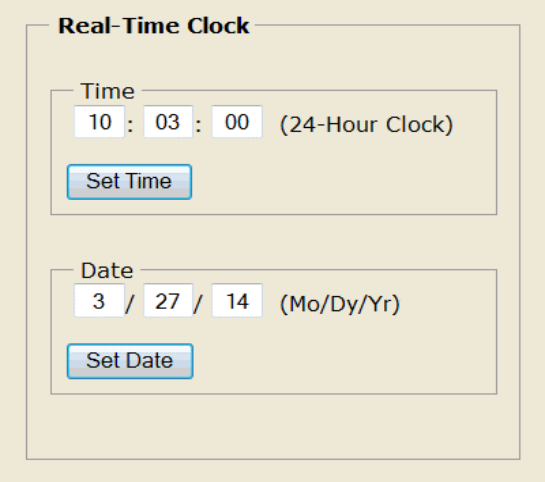
Configuration

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, time, 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:

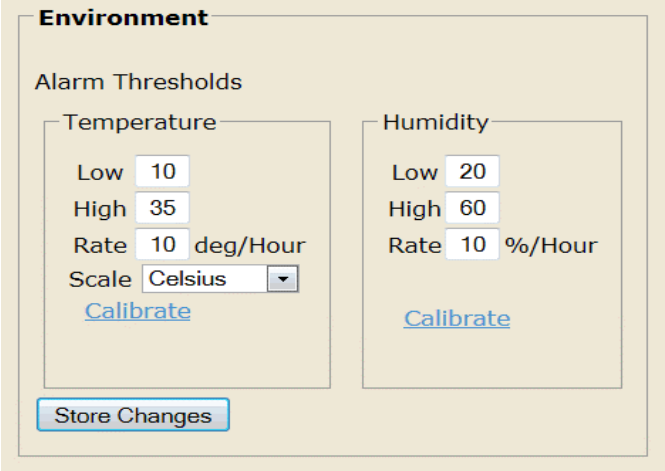
Clock/Calendar Tab

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.



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 relative humidity click on the Settings tab and changes can be made in the environment box.

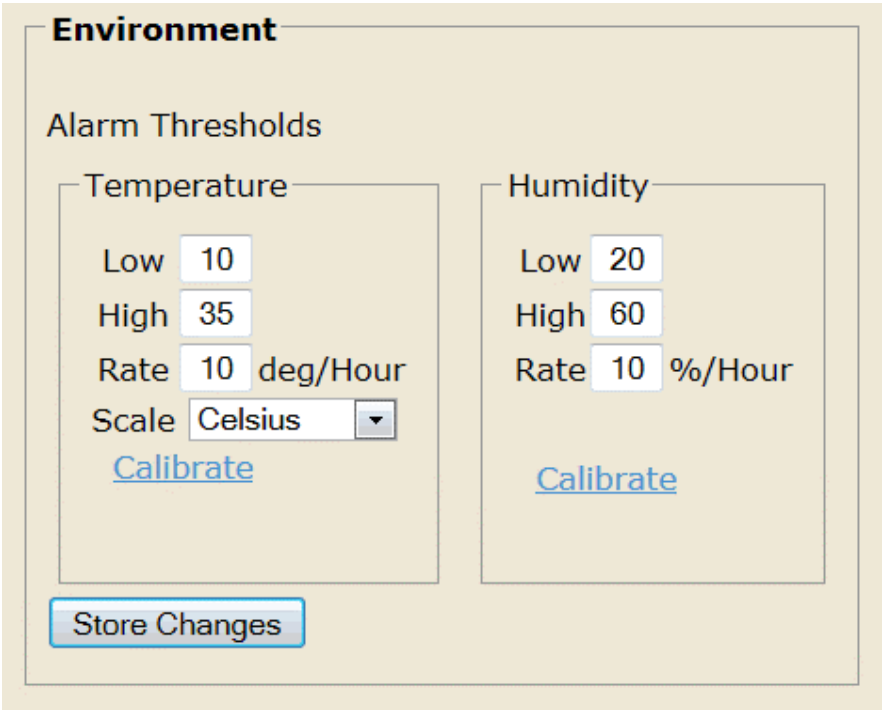


Sensors

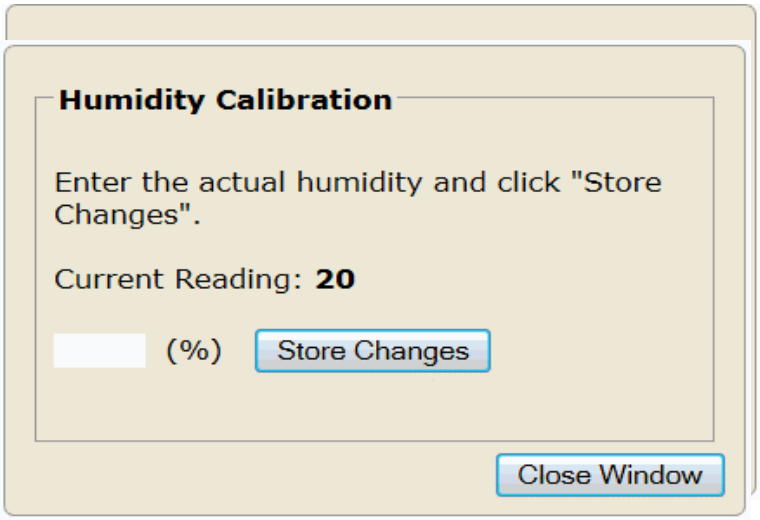
The OnGuard is shipped with copper and silver sensors installed. Copper is on top and silver is on the bottom. By default the classification level will correspond to the ISA standards. See the appendix for additional information on the Classification Levels.

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.



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



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

Normal Operation

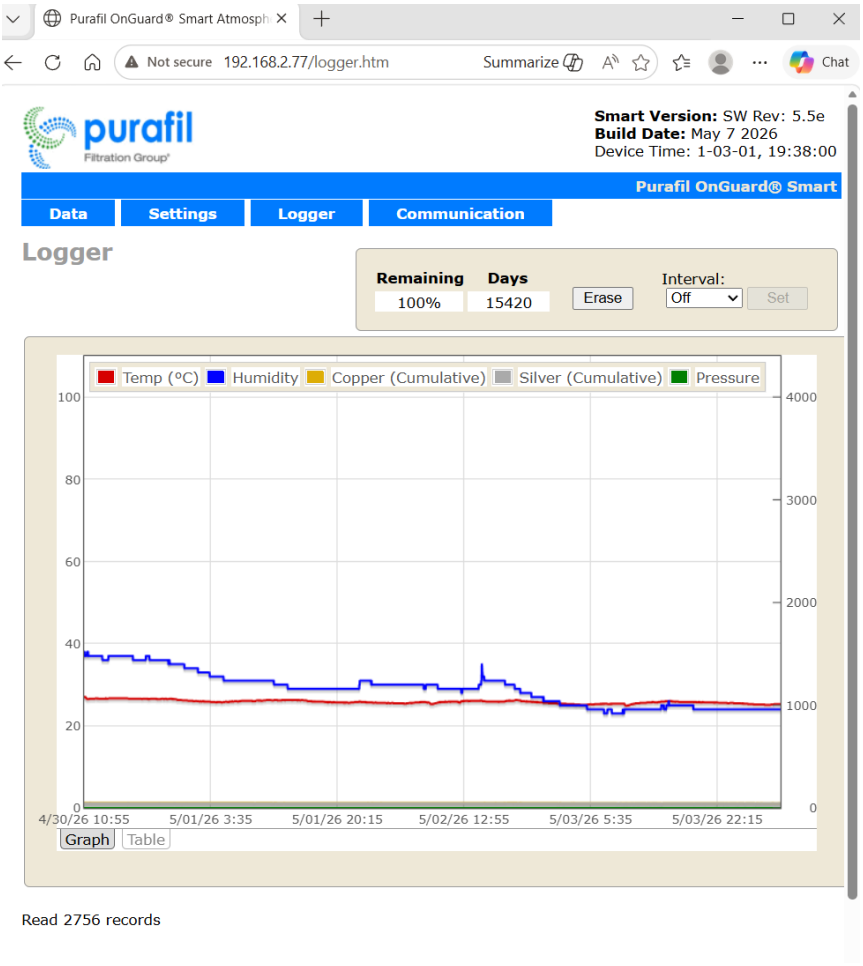
Once the OnGuard has been installed, configured, and the sensors initialized, it is ready for normal operation. Most of the time the unit will be in “sleep” mode with no visible sign of activity except a flash from one of the LEDs once a minute. If the green LED flashes it means the unit is operating 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.

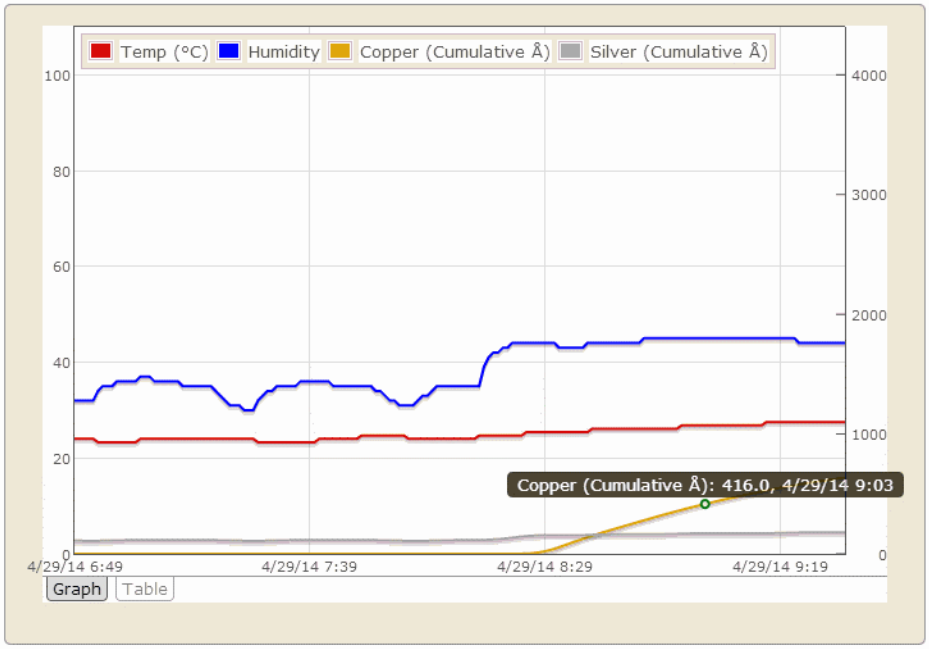
Setup

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.**



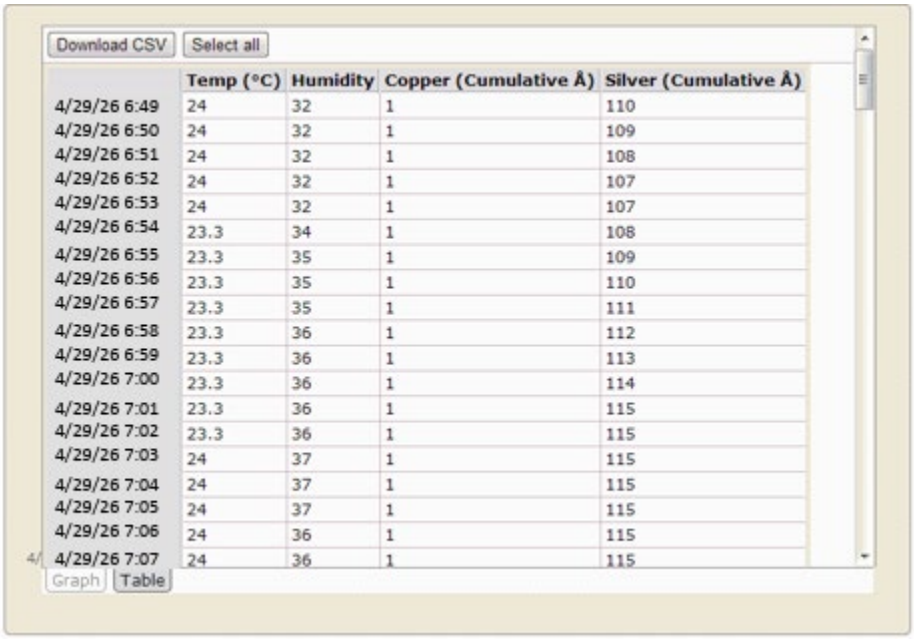
Pop-Up Data Feature

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.)



	Temp (°C)	Humidity	Copper (Cumulative Å)	Silver (Cumulative Å)
4/29/26 6:49	24	32	1	110
4/29/26 6:50	24	32	1	109
4/29/26 6:51	24	32	1	108
4/29/26 6:52	24	32	1	107
4/29/26 6:53	24	32	1	107
4/29/26 6:54	23.3	34	1	108
4/29/26 6:55	23.3	35	1	109
4/29/26 6:56	23.3	35	1	110
4/29/26 6:57	23.3	35	1	111
4/29/26 6:58	23.3	36	1	112
4/29/26 6:59	23.3	36	1	113
4/29/26 7:00	23.3	36	1	114
4/29/26 7:01	23.3	36	1	115
4/29/26 7:02	23.3	36	1	115
4/29/26 7:03	24	37	1	115
4/29/26 7:04	24	37	1	115
4/29/26 7:05	24	37	1	115
4/29/26 7:06	24	36	1	115
4/29/26 7:07	24	36	1	115

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 or Relative Humidity above or below user-set limits
- Temperature or 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, update those limits to values the unit will not experience.

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 the copper sensor and the lower position is for the silver sensor. 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.

To order replacement sensors, please contact your sales representative, or visit corrosionmonitor.com.

Current Outputs from Analog Channels

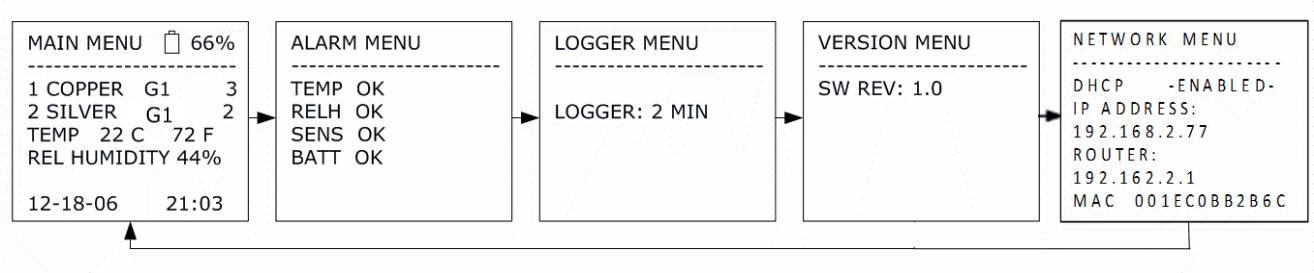
The OnGuard has five 4-20mA current outputs that correspond to Copper Cumulative, Silver Cumulative, Temperature, Relative Humidity, and Pressure. The current outputs are accessible in the large 12-pin terminal block on the bottom of the OnGuard. Pin 1 and Channel 1 is located on the left end of the 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

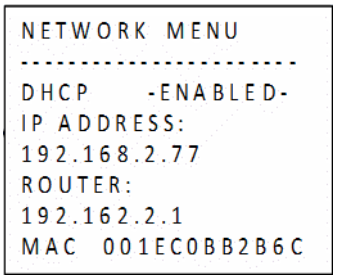
Appendix

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.

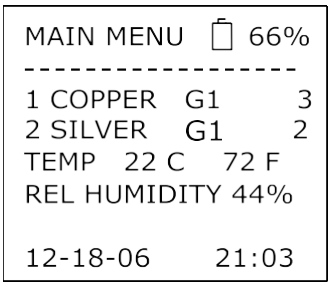


Network Menu



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.

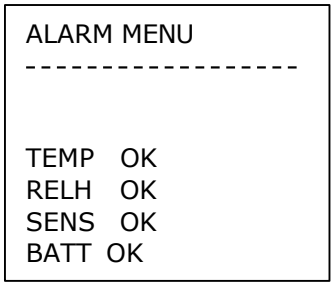
The second line shows the copper sensor classification (G1) and the current cumulative value (3). The third line shows the silver sensor classification (G1) and the current cumulative value (2).

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

The fifth line shows the current value for Relative Humidity.

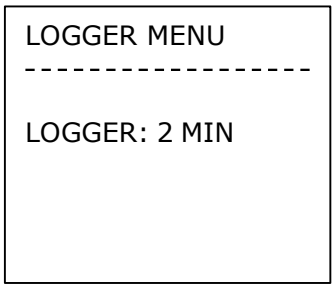
The sixth line shows the date and time in 24-hour format.

Alarm Menu



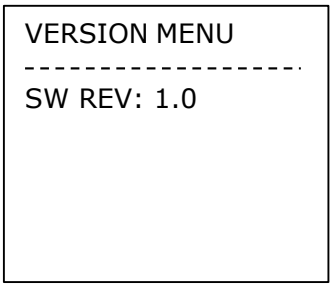
The Alarm Menu shows the status of the OnGuard sensors and the main power batteries. The status of each will be shown as OK unless there is a problem with one of them. When an alarm condition occurs, the red LED will light. The temperature (TEMP) and relative humidity (RELH) sensors will show an L for 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



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



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

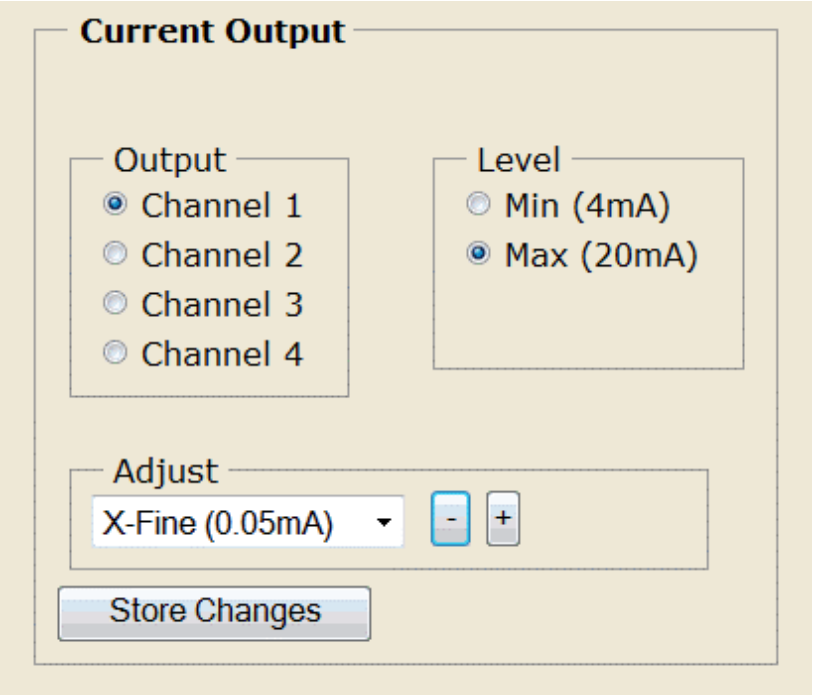
3. Connect the OnGuard to the PC/MAC with an Ethernet cable and access the web interface.

4. The current output is located on the web interface in the "Settings" tab. At this point, the current displayed on the OnGuard 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.

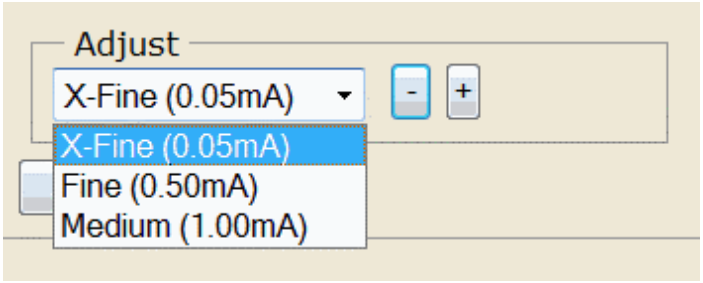
Plus and Minus Keys

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.

External converter for Modbus TCP/IP

Some PLCs will not directly accept the RS-485 Modbus ASCII connection. For this, an external converter is available on the market. For this example, we will use a device manufactured by ICP DAS.

This converter is readily available through distributors such as Digi-Key, RS, Radwell, Amazon, and other controls suppliers. Alternative manufacturers are also available for this type of conversion (e.g., Moxa, Phoenix Contact); however, the appendix in the user manual will reference configuration instructions based on the ICP DAS device.

Connect the converter using the D+/D- screw terminal connection along with ground. Initial setup requires installation of the vendor configuration software on a computer without firewall restrictions or corporate security limitations to allow assignment of static IP settings and device configuration.

Once configured, the converter can be accessed through its assigned IP address. Screenshots of the required settings are included below.

After configuration changes are made, a full power cycle of both the OnGuard and the converter is recommended to ensure the device operates correctly in pass-through mode. The recommended sequence is:

1. Power down both devices
2. Power up the OnGuard
3. Allow the OnGuard to fully initialize
4. Power up the converter

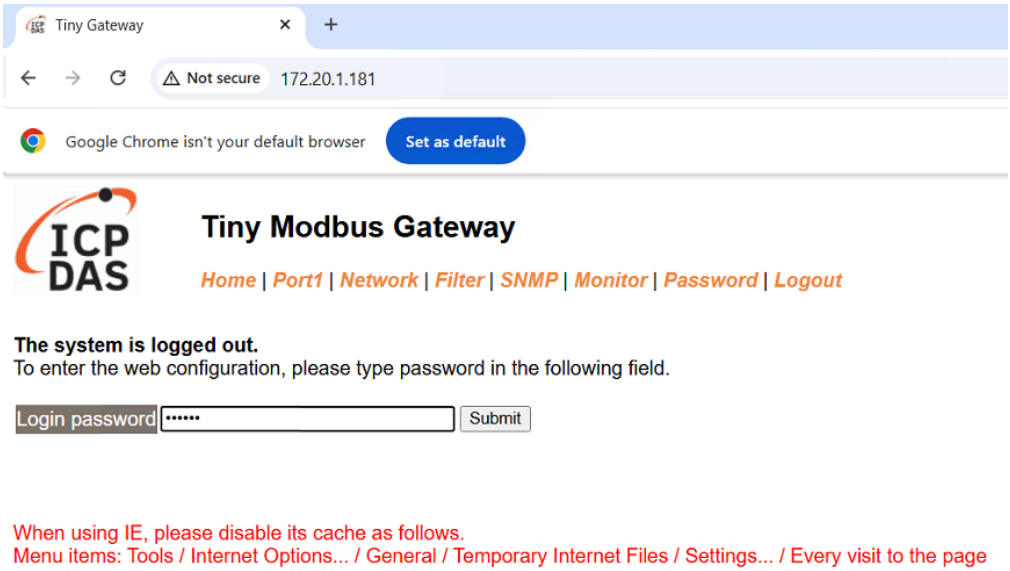
Converter Login

After the IP address is assigned, access the device through a web browser.

Initial login credentials:

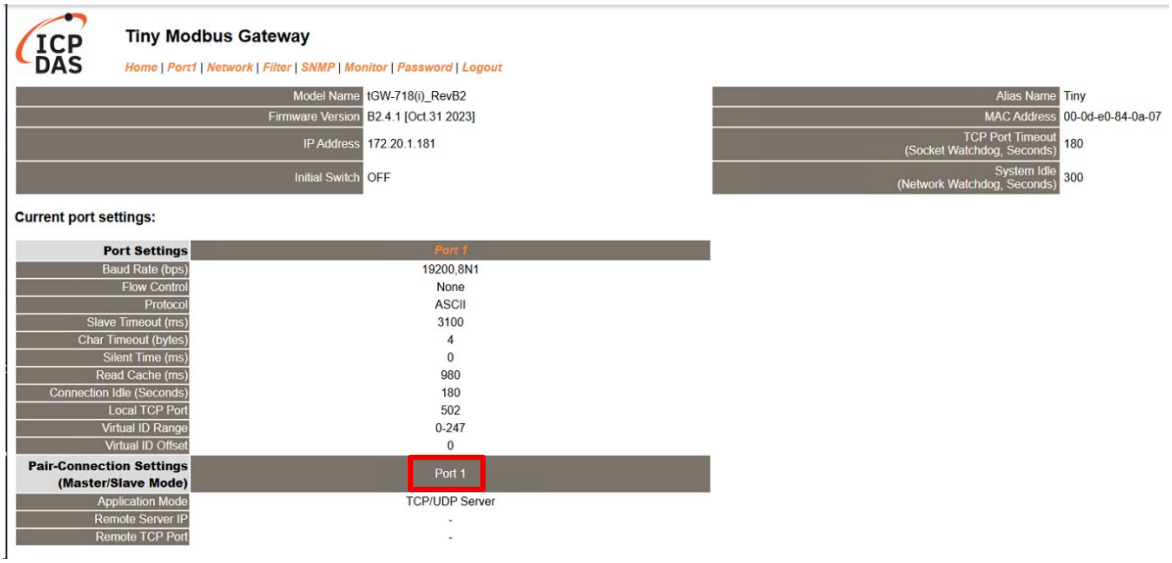
- Username: admin
- Password: admin

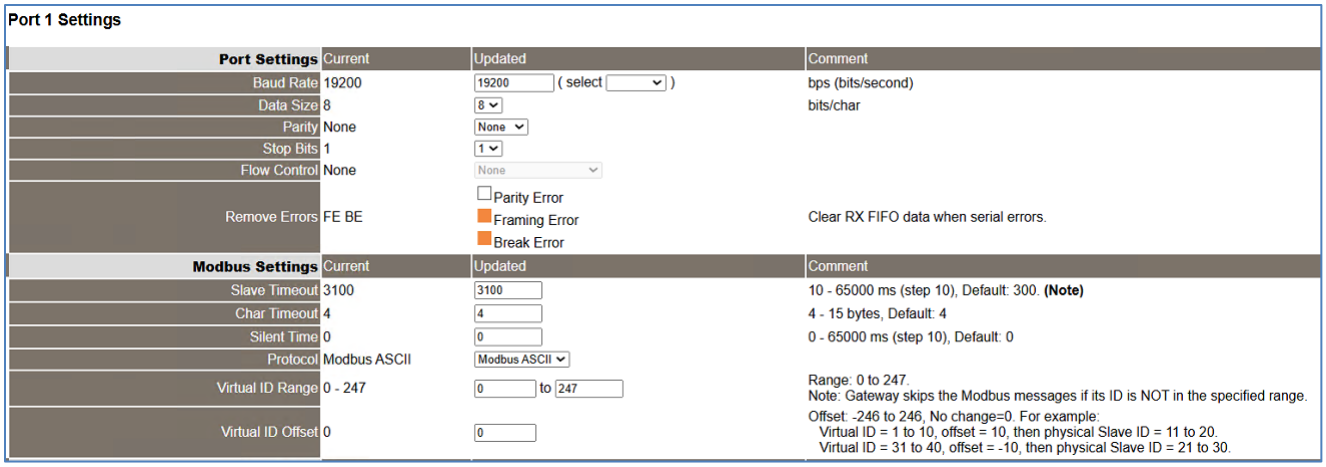
The password must be changed upon first login.



Port 1 Settings (under the Port 1 menu):

Using the settings listed above, ensure the baud rate, data bits, parity, and stop bits match the communication parameters of the connected device. Set the Slave Timeout to greater than 3000 ms and verify that the protocol is set to MODBUS ASCII. Screenshots are provided below. Be sure to save or hit Update settings when completed.





Port 1 Settings

Port Settings	Current	Updated	Comment
Baud Rate	19200	19200 (select)	bps (bits/second)
Data Size	8	8	bits/char
Parity	None	None	
Stop Bits	1	1	
Flow Control	None	None	
Remove Errors	FE BE	Parity Error Framing Error Break Error	Clear RX FIFO data when serial errors.
Modbus Settings	Current	Updated	Comment
Slave Timeout	3100	3100	10 - 65000 ms (step 10), Default: 300. **(Note)**
Char Timeout	4	4	4 - 15 bytes, Default: 4
Silent Time	0	0	0 - 65000 ms (step 10), Default: 0
Protocol	Modbus ASCII	Modbus ASCII	
Virtual ID Range	0 - 247	0 to 247	Range: 0 to 247. Note: Gateway skips the Modbus messages if its ID is NOT in the specified range.
Virtual ID Offset	0	0	Offset: -246 to 246, No change=0. For example: Virtual ID = 1 to 10, offset = 10, then physical Slave ID = 11 to 20. Virtual ID = 31 to 40, offset = -10, then physical Slave ID = 21 to 30.

Network Settings (under network menu):

This is where the IP address can be changed if needed. If there are connection issues, disable then enable Auto DNS Configuration.

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

Questions and Answers:

General Questions:

Q. What is new with the OnGuard Smart?

Modbus connectivity

Q. Why do I need a corrosion monitor?

To monitor an environment for potential reliability issues.

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

Depending on the logger setting from 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 with Modbus devices do I need per facility?

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

Installation and Operation:

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

Communication with the OnGuard Smart with Modbus can communicate through a Distributed Control System using analog (4-20 mA) and Modbus-ASCII directly. Modbus RTU or TCP/IP communication can occur with an external converter. See appendix for more information on an external converter.

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 28 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 25 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, on the phone at +1 770.662.8545, or email at info@purafil.com

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. 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 with Modbus?

The OnGuard Smart with Modbus is compatible with Edge and Google Chrome. However, the OnGuard 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 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.

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 is connected via analog output channels to a DCS that is reporting unexpected values?

If the analog output channels are connected, ten analog 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 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 as possible. The OnGuard 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 has been moved to a new location and the corrosion values seem to have changed?

The OnGuard is designed to be permanently mounted. Any shaking or jostling may affect the corrosion sensors. If the OnGuard 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.

Q. What if the unit is not communicating through Modbus?

1. Check the wire connections:
    a. Ensure that the Ground, A(D+), and B(D-) wires are connected to the OnGuard and the Master device.
    b. Ensure there are no connection issues with the wiring (broken or exposed wires, etc).
2. Check the Slave ID number. Ensure it matches what is displayed on the Modbus Menu.
    a. If slave ID must be changed, see Modbus section of user manual.
3. Double check the serial settings on the Master device and ensure the baud rate, parity, data bits, and stop bits are correct.
4. Ensure the protocol on the Master device is selected for Modbus-ASCII protocol.
    a. Do not select RTU or Modbus-RTU as the protocol.
5. Use an external polling program like Modbus Poll to determine if device is communicating.
6. If there is no communication, open the device on the back side, ensure the RS-485 card is connected to the recipient pins.
7. If all the above has been completed, switch the A(D+) and B(D-) wires. This will not damage the OnGuard or the other connected device. Repeat steps 1-6.
8. Ensure power at the other connected device.
9. If none of the above are successful, contact Purafil for assistance.