

OPERATING & INSTRUCTION MANUAL

Renew™ Air Treatment Solution | Version 1.0

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1 INTRODUCTION

1.1 OVERVIEW

This version of Luminator Technology Group's Renew™ Air Treatment System is manufactured and designed for installation and use in transit, rail and vehicle applications.

This guide has basic product information such as mounting information, connections, and startup procedures for the system – including the Atomizer, Controller and Sensor.

1.2 DISCLAIMER

The information and specifications contained in this guide are subject to change without notice.

1.3 WARRANTY, SERVICE AND SUPPORT INFORMATION

For warranty, service and additional information including technical support, please visit: www.luminator.com or contact technical support by email: support.na@luminator.com.

1.4 SAFETY NOTES

- Do not submerge any components
- Always disconnect components from power before manual cleaning
- Do not operate the Atomizer if the housing, fluid tank, or cables appear damaged
- In the event of a serious operating problem, stop using immediately
- The system is designed for use only with Grignard PURE™
 - Grignard PURE should not be diluted - do not add anything to the fluid
 - Do not drink the fluid
 - Avoid direct contact with skin or eyes
- Only connect electrical components to a grounded and protected circuit

1.5 SYSTEM COMPONENTS AND ACCESSORIES

- Operating and Instruction Manual (this guide)
- Renew Atomizer
- Renew Controller
- Renew Sensor
- Atomizer Power Cord
- Remote Reservoir
- Sensor to Controller Cable
- Controller to Atomizer Cable

2 SYSTEM ATOMIZER

2.1 INTRODUCTION

The Renew System Atomizer includes a fluid pump, air pump, heating element, power supply, and microcontroller. The Atomizer is designed to disperse Grignard Pure and is designed to be controlled autonomously using the Renew Controller and Renew Sensor.

2.2 POWER

This product is designed to operate from a 120VAC power source.

NOTE: THE ATOMIZER MAXIMUM POWER DRAW IS 365 WATTS @ 120VAC

2.3 MOUNTING

NOTE: BEFORE MOUNTING THIS PRODUCT, REFER TO THE SAFETY NOTES.

1. The Atomizer can mount to a side wall of a structure or bolted to a platform (for example luggage rack in a train/bus). $\frac{1}{4}$ " -20 bolts are recommended fasteners.
2. The Atomizer has been designed to allow for remote mounting directly into an HVAC plenum or duct to maximize dispersion characteristics of Grignard Pure in large spaces.
3. For best results, HVAC plenum or duct mounting should be located after the HVAC filter, blower fan, and evaporator coil.
4. When mounting outside of the HVAC duct or plenum but still using the HVAC system as a dispersion mechanism, a 4" O.D. duct (not included) can be attached to the outlet of the machine and piped to the HVAC duct or plenum.

NOTE: IF PLENUM PRESSURE IS TOO HIGH FOR THE ATOMIZER FAN, THE ATOMIZER CAN BE CONNECTED IN BYPASS MODE. BYPASS MODE UTILIZES A 4" DUCT ATTACHED FROM THE HVAC PLENUM TO THE INLET OF THE ATOMIZER AND A SECOND 4" DUCT OF EQUAL LENGTH ATTACHED TO THE OUTLET OF THE ATOMIZER BACK TO THE HVAC PLENUM.

2.4 MOUNTING ILLUSTRATIONS

FIGURE 1: ANCHOR TO SURFACE

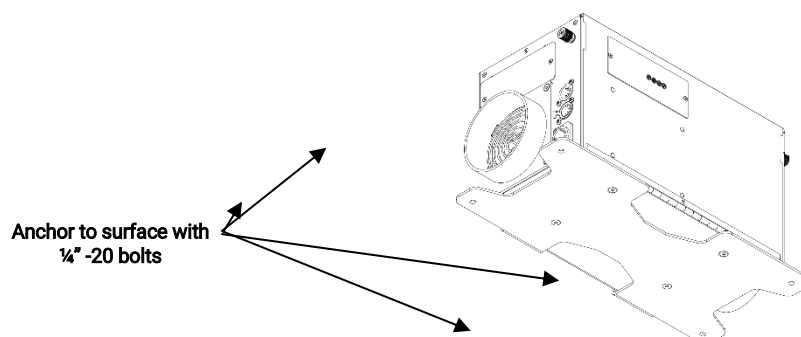


FIGURE 2: BRACKET POSITION FOR FLOOR MOUNT

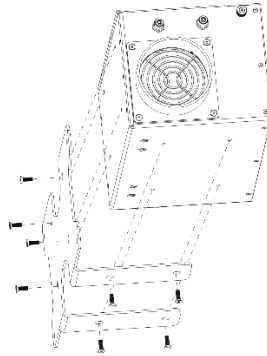
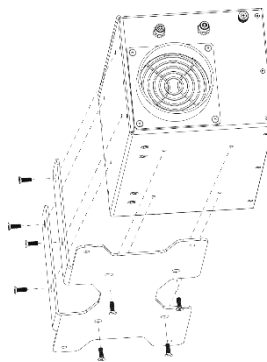


FIGURE 3: BRACKET POSITION FOR WALL MOUNT



2.5 CONNECTIONS

5 pin XLR Pin Receptacle connector

- Used to control the Atomizer
- Half duplex RS485
- DMX Protocol
- RDM protocol (Future)
- Data +/-, GND

3 Pin Twist Lock Receptacle connector

- Used to power the Atomizer
- 120VAC

3 SYSTEM CONTROLLER

3.1 INTRODUCTION

The Renew System Controller obtains data from the Sensor, to monitor levels of Grignard Pure in the air and continuously adapts the amount of product to be dispersed by the Atomizer. This enables the system to maintain the pre-determined effective concentration at all times.

The Controller monitors a PM2.5 laser diffraction particle Sensor, once per second.

As with any closed loop control, there are several configuration settings that can be changed to maximize the performance of the control loop. For example, a small volume area with little fresh air replenishment will detect the presence of atomized solution much faster than a large volume area with high fresh air replenishment rates. The initial settings for the small volume space would be lower than for the large volume space.

This knowledge of the environment and preset parameters is known as “feed-forward” or “open loop” control. These feed-forward values can account for the major portion of the controller output while allowing the automatic adaptive feedback control to account for the smaller deviations above the desired set point.

3.2 POWER

This product is designed to operate from a 120VAC power source.

NOTE: THE CONTROLLER MAXIMUM POWER DRAW IS LESS THAN 6 WATTS

3.3 MOUNTING

NOTE: BEFORE MOUNTING THIS PRODUCT, REFER TO THE SAFETY NOTES.

The controller can be mounted virtually anywhere within the limits of the sensor cable length and the Atomizer cable length..

The controller provides an Ethernet access port for configuration and system status which makes it beneficial to mount it in a location where a laptop can be connected directly to it.

It is also possible to connect it to a Local Area Network but does require a fixed IP address.

3.4 CONNECTIONS

Sensor Connector: 6 pin receptacle universal mini mate

- Used to communicate with the sensor and supply power to the sensor
- Full duplex RS485 plus 5VDC power

Atomizer Connector: 5 pin XLR Pin Receptacle connector

- Used to control the atomizer
- Half duplex RS485
- DMX Protocol
- RDM protocol (Future)

10/100 Ethernet: RJ45 Standard Ethernet Connector

- Used for configuration and monitoring of the system
- Hosted webpage for configuration at IP address 192.168.123.10

USB: Standard USB Host Mode A Connector

- Utilized for data logging by installing a USB thumb drive

3.5 CONFIGURATION SETTINGS

DMX Channel – The DMX protocol allows for multiple channels for communicating to different items or functions that reside on the DMX communication bus. The values for the current Atomizer are shown in the following table.

TABLE 1: DMX CHANNEL CONTROL FUNCTIONS

Channel	Function	Value	Percent/Setting
1	Fan Speed	000 ⇔ 010	No function
		011 ⇔ 255	1–100%
2	Haze Output	000 ⇔ 010	No function
		011 ⇔ 255	1–100%
3	Remote Clean Function	000 ⇔ 151	No function
		152 ⇔ 159	Remote clean function
		160 ⇔ 255	Standby mode

Fan Speed: The fan speed setting.

The higher the setting, the faster the atomized solution is dispersed in the space. This value is typically fixed for a specific environment.

Max Atomizer Power: The maximum Atomizer output setting.

This setting directly correlates to how much Grignard Pure is being dispensed at any given time.

NOTE: HIGHER SETTINGS ARE NOT NECESSARILY BETTER, AS THEY WOULD CAUSE THE CONCENTRATION TO “OVERSHOOT” THE DESIRED LEVEL.

Atomizer On Time (seconds): Indicates the amount of time the Atomizer is ON (dispensing Grignard Pure).

This allows for fine adjustments to the amount of Grignard Pure that is dispensed.

NOTE: THE CONTROLLER CONSTANTLY ADJUSTS OFF TIME BASED ON THE SENSOR READINGS. IF THE LEVEL IS TOO HIGH THEN THE OFF TIME IS GRADUALLY INCREASED. IF THE LEVEL IS TOO LOW THE OFF TIME IS GRADUALLY DECREASED.

Hysteresis: Adjusts the maximum level before a change is made to change the Atomizer output.

This is often referred to as “dead band”. Example: If the desired set point is 4000 and the hysteresis is 1000, the Controller will allow the concentration level to fluctuate between 4000 and 5000 before taking any action.

PM Threshold (#/cm³): The set point (or the desired concentration) of Grignard Pure.

This value represents the total number of detected vapor droplets between .3 micron and 2.5 microns in size per cubic centimeter. At publication of this document, current efficacy testing concluded this level should be approx 4000 detected particals/cm³.

4 SYSTEM SENSOR

4.1 INTRODUCTION

The Renew System Sensor features a PM2.5 Laser Diffraction Sensor with RS485 Full Duplex Isolated Interface. The Sensor detects levels of Grignard Pure in the air and transmits this data to the Controller.

4.2 POWER

The Sensor is powered from the Controller with 5V DC power source.

4.3 MOUNTING

The Sensor should be mounted on a ceiling or wall that is free from direct air flow. E.g. Do not mount directly next to a HVAC air vent, HVAC return air vent, or ceiling fan.

The Sensor grating should be positioned parallel to the floor or pointing downward to prevent accumulation of dust and debris in the Sensor housing.

4.4 CONNECTIONS

The Sensor features a RS485 interface has the ability to include termination resistors via dip switch settings. Termination resistors improve the signal integrity and help support longer cable runs which theoretically can reach up to 4000 feet.

Sensor Connector: 6 pin connector

Used to communicate with the Sensor and supply power to the Sensor
Full duplex RS485 plus power

5 INITIAL SYSTEM SETUP

5.1 INSTALL THE ATOMIZER

1. Mount the Atomizer and securely fasten according to the instructions in section 2.
2. Attach the power cable to the Atomizer and connect to a 120VAC power source.
3. Ensure the reservoir has adequate levels of Grignard Pure.

5.2 INSTALL THE CONTROLLER

1. Securely mount the Controller according to the instructions in section 3.
NOTE: THE CONTROLLER DOES NOT NEED TO BE LOCATED NEAR THE ATOMIZER OR THE SENSOR.
2. Connect the 5 Pin DMX cable from the Controller to the Atomizer.
3. Plug the Controller into an available 120VAC outlet.

5.3 INSTALL THE SENSOR

1. Securely mount the Sensor according to the instructions in section 4. A ceiling or high on a wall is ideal. The Sensor grate should be located parallel to the ground, or pointing downward to avoid dust accumulation inside the Sensor.
NOTE: THE SENSOR DOES NOT NEED TO BE LOCATED NEAR THE CONTROLLER.
NOTE: FOR BEST RESULTS LOCATE THE SENSOR A FAR DISTANCE FROM THE ATOMIZER
2. Route the Sensor cable and connect the Sensor to the Controller.

5.4 ACTIVATE THE ATOMIZER

1. Ensure the tubing connecting the reservoir to the Atomizer is free of air bubbles.
NOTE: REFER TO STEP 4 AFTER APPLYING POWER IF THE FLUID TUBE IS EMPTY OR AIR BUBBLES ARE PRESENT.
2. If the Atomizer is equipped with an on/off switch, depress the switch to the ON position.
3. If the Atomizer is NOT equipped with a switch, plug in the Atomizer to connect to power.
4. Wait a few minutes for the Atomizer to warm up before proceeding to step **Error! Reference source not found.**
NOTE: SOME VERSIONS OF THE ATOMIZER DO NOT FEATURE A SELF-PRIMING PUMP. IF THE ATOMIZER FEATURES A MANUAL PUSH BUTTON SWITCH, FOLLOW THESE INSTRUCTIONS FOR FIRST-TIME SETUP, OR IF THE RESERVOIR HAS RUN DRY.
5. Press the Prime Button located behind the panel with LED indicators.
NOTE: THIS STEP IS ONLY NECESSARY IF THE FLUID TUBE IS EMPTY OR LARGE AIR BUBBLES ARE PRESENT.

NOTE: THIS ACTION CAN GENERATE A VERY THICK BURST OF ATOMIZED GRIGNARD PURE WHICH GREATLY EXCEEDS THE EFFICACY LEVEL NEEDED. THIS INITIAL BURST WOULD NEED TO DISSIPATE TO LOWER LEVELS BEFORE THE SYSTEM WILL TURN BACK ON.

NOTE: THE FLUID IN THE TUBING IS DETECTED BY A SENSOR. IF AN AIR BUBBLE OR NO FLUID IS PRESENT, THE SYSTEM WILL NOT OPERATE.

5.5 ACTIVATE THE CONTROLLER

1. If the Controller has already been configured for the installed space, the system will automatically begin operation as follows:
 - a. The system automatically detects the Sensor
 - b. The system automatically cleans the Sensor Fan
 - c. The system automatically calibrates based upon the background particulate matter (PM) levels

NOTE: BACKGROUND PM LEVELS ARE TYPICALLY 1% OF THE TOTAL PM THRESHOLD.

NOTE: WITH EARLY SOFTWARE VERSIONS THIS CALIBRATION STEP COULD TAKE SEVERAL MINUTES E.G. 8 MINUTES.

NOTE: EFFECTIVE ATOMIZED LEVELS OF GRIGNARD PURE MAY BE TOO SMALL TO BE VISIBLE.

NOTE: THE STATUS OF THE SYSTEM CAN BE VIEWED BY CONNECTING A LAPTOP PER THE INSTRUCTIONS IN SECTION 0.

6 RENEW SYSTEM APPLICATION

6.1 INTRODUCTION

The Controller features a web application to provide the following functions:

- System status
- System configuration
- Date and time setting
- Firmware upgrades

Accessing this site is not necessary for the system to operate. However, it can be used to change system parameters. Once ideal values are determined for an environment, they are stored in non-volatile memory and should not require on-going changes.

The system does not need to be connected to a network in order to configure parameter settings on the Controller. As the Controller is a fixed end point in a network, it can not implement DHCP to assign an IP address to a laptop that is connected to the Controller. Therefore, a static IP address must be assigned to the laptop.

The default static IP address for the Controller is 192.168.123.10.

In order to connect a laptop directly to the Controller, it must also have an IP address that is fixed and on the same subnet. It can be any address on the same subnet, for example: 192.168.123.20.

For more information about setting a static IP address on a laptop computer, refer to Appendix A.

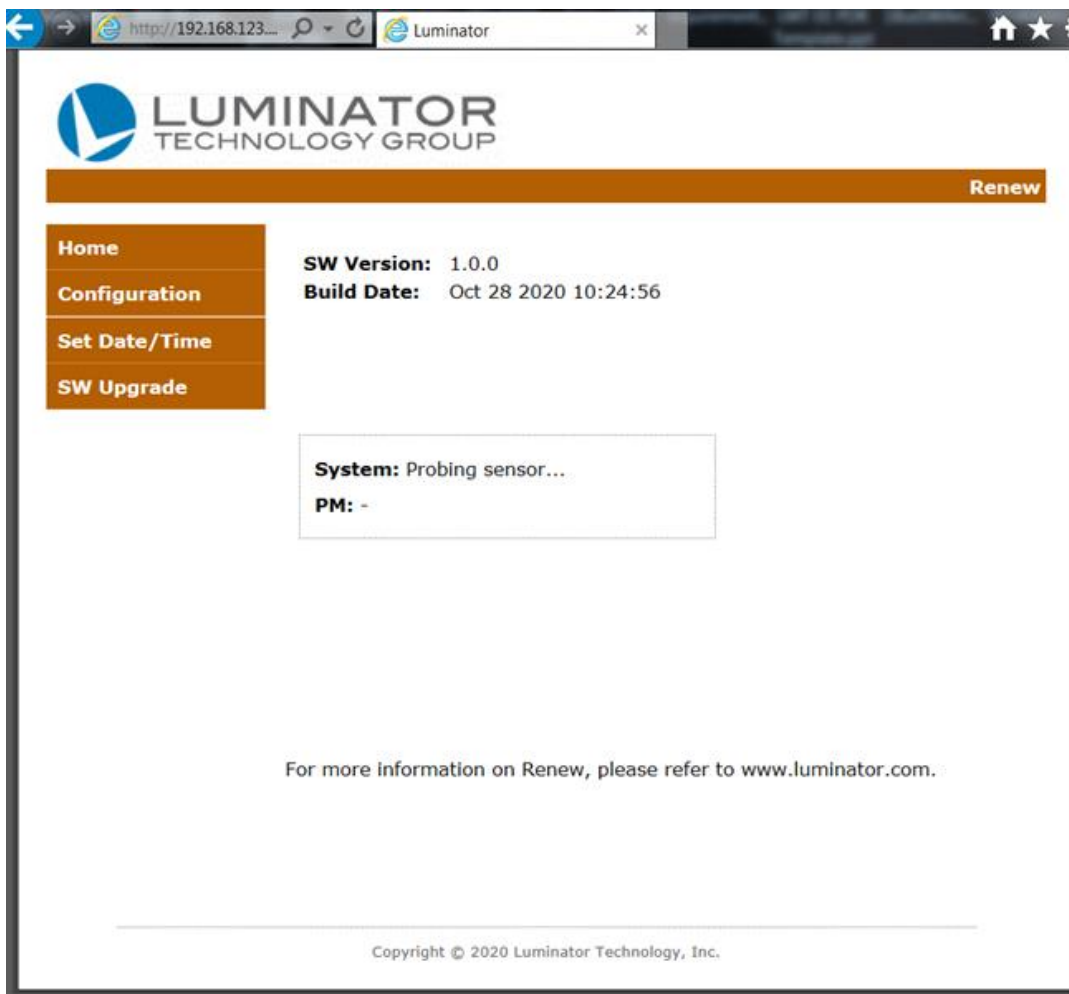
6.2 ACCESSING THE APPLICATION

Required items:

- A laptop computer that is NOT connected to a network and has a static IP address configured as 192.168.123.20
- Standard Ethernet patch cable

1. Connect the Ethernet cable to the laptop and the Controller.
2. Once the static IP address is configured on the computer, open a web browser (e.g. Firefox, Google Chrome, or Internet Explorer) and enter the fixed IP address. 192.168.123.10 into the browser search bar.
3. The status page titled Figure 4 : Renew Controller Web Page will appear.

FIGURE 4 : RENEW CONTROLLER WEB PAGE



6.3 CONTROLLER STATUS

The system status displays the various system states such as:

- Connection to the Sensor
- Automatic Sensor cleaning
- Automatic Sensor calibration
- Currently dispensing Grignard Pure

- Atomizer is inactive
- Current PM (particulate matter) Sensor reading

6.4 CONTROLLER CONFIGURATION

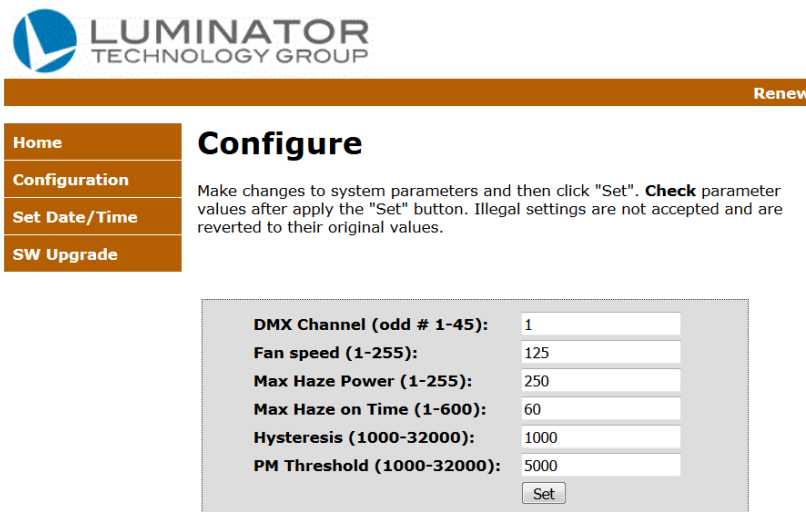
The Controller configuration allows the user to set the various parameters that impact the control loop and are dependent on the installed environment.

Each environment is different depending upon HVAC systems, Fresh Air Replenishment, etc. Some suggested starting values are provided in the following table.

FIGURE 5: EXAMPLE CONTROL SETTINGS

Setting	Default Value	Small Office	Rail Car	Gymnasium	Comments
DMX Channel	1	1	1	1	Should not change, dependent on the Atomizer
Fan Speed	125	255	125	255	Spaces with minimal air movement should use higher settings
Max Atomizer Power	90	12	30	125	This number controls how many ml/min are being utilized when the Atomizer is on
On Time (Seconds)	90	10	75	120	This controls how long the Atomizer stays on, the off time between on times is constantly adapting to the Sensor readings
Hysteresis	1000	1000	1000	1000	This is the band above the PM threshold where no action is taken by the Controller
PM Threshold (#/cm ³)	3500	3500	3500	3500	This is based on live virus efficacy testing, higher numbers are not necessarily more effective

FIGURE 6: CONTROLLER CONFIGURATION



The screenshot shows the LUMINATOR TECHNOLOGY GROUP logo at the top left. Below it is a navigation menu with options: Home, Configuration (selected), Set Date/Time, and SW Upgrade. To the right of the menu is a 'Renew' button. The main content area is titled 'Configure' and contains the following text: 'Make changes to system parameters and then click "Set". Check parameter values after apply the "Set" button. Illegal settings are not accepted and are reverted to their original values.'

The configuration parameters are listed in a table:

DMX Channel (odd # 1-45):	1
Fan speed (1-255):	125
Max Haze Power (1-255):	250
Max Haze on Time (1-600):	60
Hysteresis (1000-32000):	1000
PM Threshold (1000-32000):	5000

At the bottom right of the configuration area is a 'Set' button.

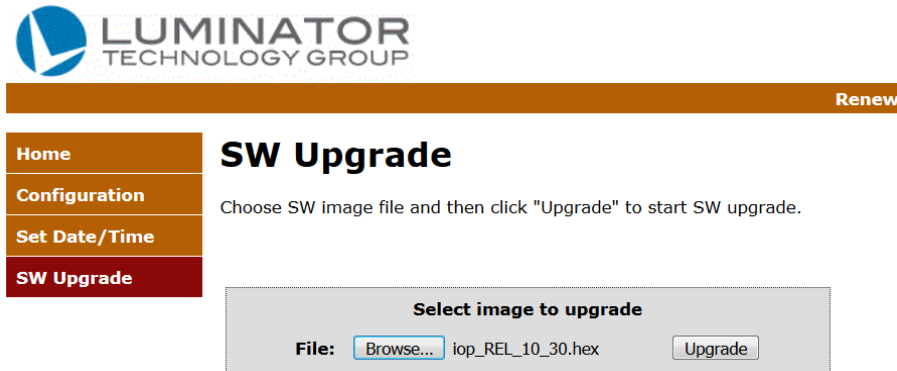
6.5 CONTROLLER SOFTWARE UPGRADE

The Controller application interface supports easy software upgrades.

Required items:

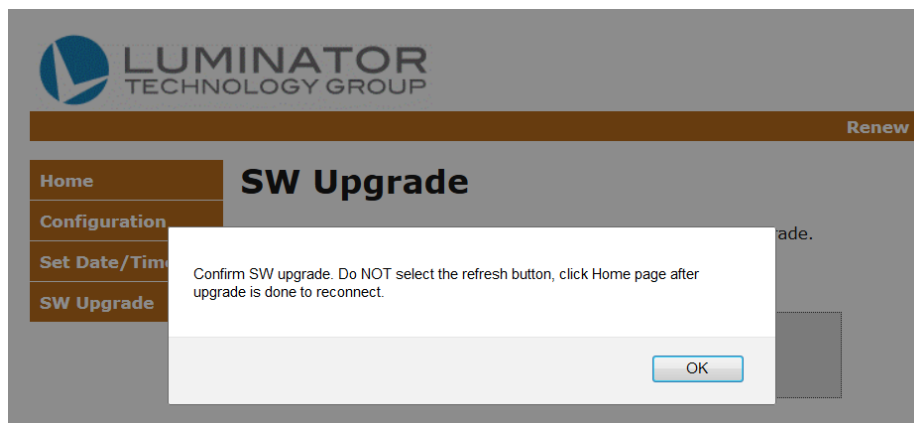
- A .hex file supplied by Luminator
1. Using a browser, select the file as shown in the following figure.

FIGURE 7: CONTROLLER SOFTWARE UPGRADE



2. The application will ask you to confirm the upgrade, as shown in the following figure.

FIGURE 8: CONTROLLER SOFTWARE UPGRADE



3. Once the upgrade is complete, the Controller will reboot with the new software.
4. Reconnect to the application by either clicking on the home tab, or restarting the browser and reentering in the IP address: 192.168.123.10.

6.6 CONTROLLER DATE AND TIME SETTINGS

The Controller application interface supports easy date and time setting adjustments. Time and data information is recorded in the system log files.

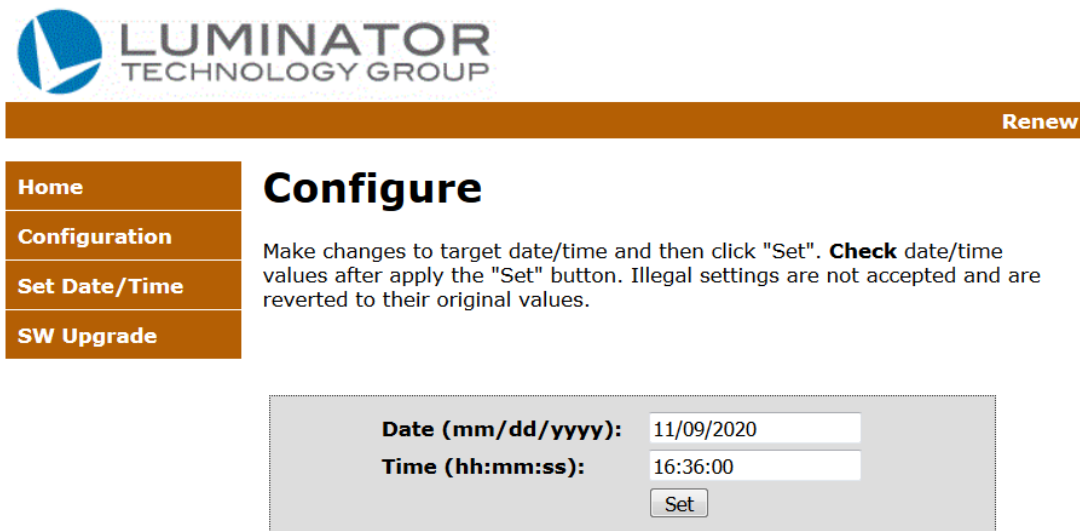
If the system is connected to a network switch that supports Simple Network Timing Protocol (SNTP), then the Date and Time will automatically adjust. If the system is NOT connected to a network switch, then the date and time can be adjusted manually.

NOTE: EARLY VERSIONS OF THE CONTROLLER DO NOT FEATURE A BATTERY BACKUP REAL-TIME CLOCK FOR MAINTAINING TIME AND DATE INFORMATION.

NOTE: THE LOG FILES WILL CONTINUALLY UPDATE WITH A SEQUENTIAL TIME, BUT IF POWER IS TURNED OFF, THE NEXT TIME POWER IS APPLIED, THE DATE AND TIME WILL RESUME WHERE IT LEFT OFF.

1. Select "Set Date/Time" from the menu.
2. Enter the desired settings.
3. Select "Set" to save the settings.

FIGURE 9: RENEW CONTROLLER DATE AND TIME



The screenshot shows the Luminator Technology Group interface. At the top right is a 'Renew' button. On the left is a navigation menu with 'Home', 'Configuration', 'Set Date/Time', and 'SW Upgrade'. The main area is titled 'Configure' and contains the following text: 'Make changes to target date/time and then click "Set". **Check** date/time values after apply the "Set" button. Illegal settings are not accepted and are reverted to their original values.'

The date and time settings are displayed in a form:

Date (mm/dd/yyyy):	<input type="text" value="11/09/2020"/>
Time (hh:mm:ss):	<input type="text" value="16:36:00"/>
	<input type="button" value="Set"/>

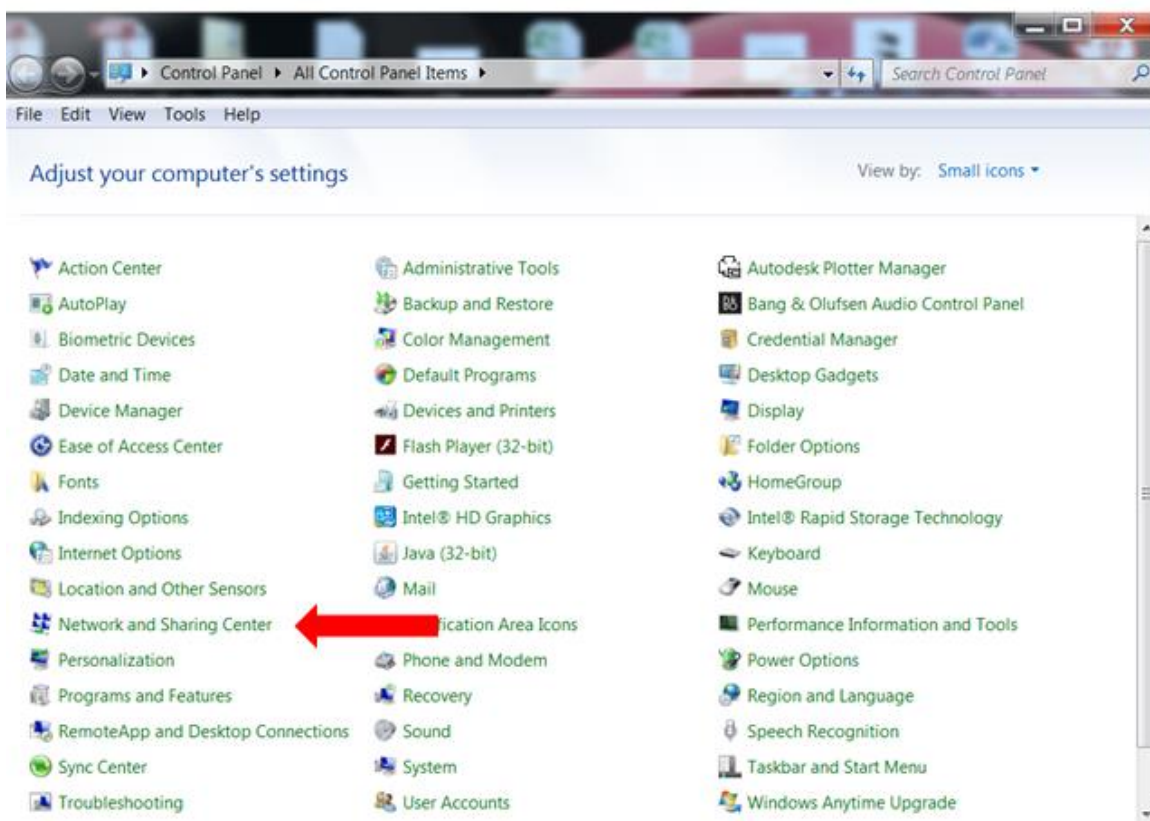
APPENDIX

CONFIGURE A STATIC IP ADDRESS

These instructions are provided to setup a connection between a laptop and the Controller. This procedure is not required in order for the system to operate, it is only needed to change initial configurations settings on the Controller or to monitor system status.

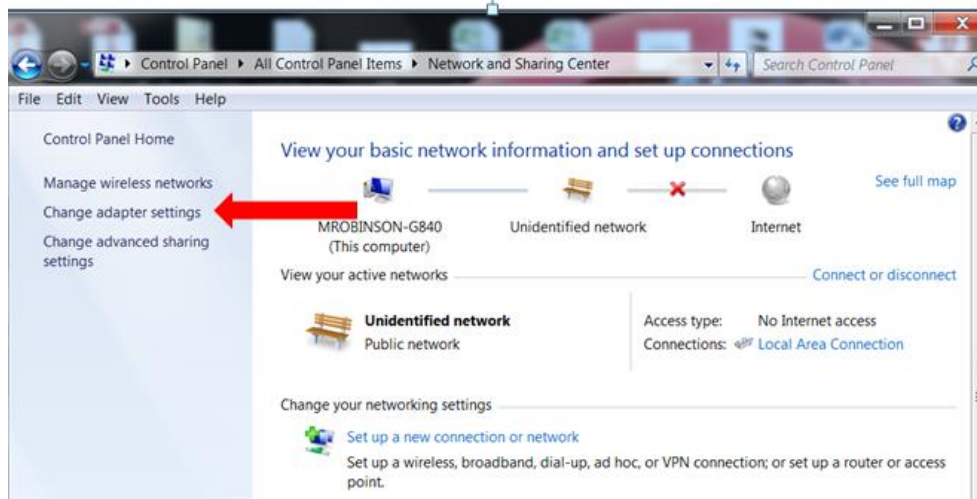
1. Navigate to the “Control Panel” of the computer and select “Network and Sharing Center”

FIGURE 10: ACCESSING THE NETWORK SHARING CENTER



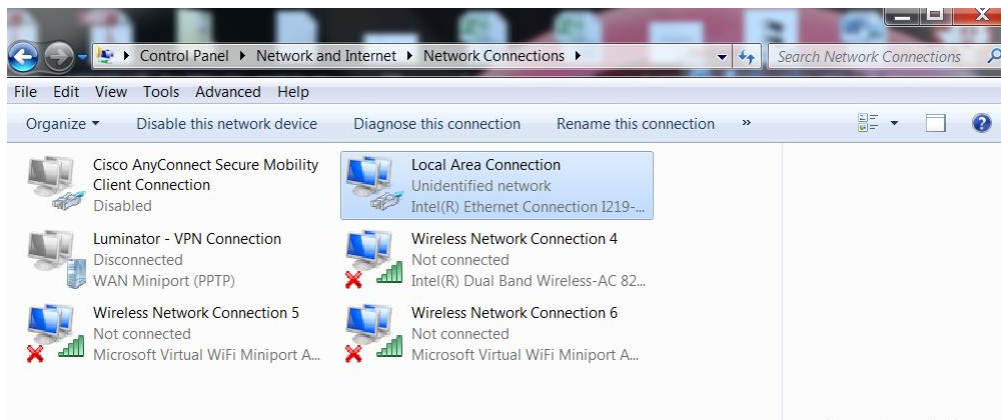
2. Select “Change Adapter Settings”

FIGURE 11: ACCESSING NETWORK ADAPTER SETTINGS



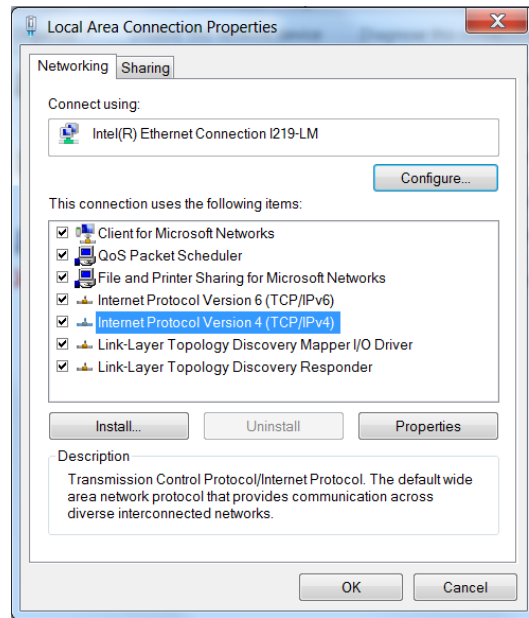
3. Select the “Local Area Connection”, right click and select “Properties”

FIGURE 12: MODIFY LAN CONNECTION SETTINGS



4. Select "Internet Protocol Version 4 (TCP/IPv4)" and click "Properties"

FIGURE 13: CHANGE LOCAL AREA NETWORK SETTINGS



5. Select "Use the Following Address" and set the static IP Address and Subnet mask on the same subnet as the Controller. Example: 192.168.123.20 and 255.255.255.0

FIGURE 14: SETTING STATIC IP ADDRESS

