Embedded Data Systems
MeshNet Controller
MN-CTRL

MeshNet Controller Operation Manual

Rev 1.0

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Introduction

Thank you for purchasing the Embedded Data Systems' MeshNet Controller. The MeshNet Controller provides an easy and robust method for the continuous monitoring of wireless Sensors that you might install in such places as computer server rooms or manufacturing facilities.

The Embedded Data Systems' MeshNet Controller features a lightweight, low-power space saving design coupled with powerful on-board, web-based monitoring software. Data from connected MeshNet Sensors is provided in open, industry-standard formats (e.g., XML, SNMP) making it easy to integrate with existing business automation and monitoring systems.

How this manual is organized:

- **Quick Start Guide**—provides simple and easy steps to get up and running quickly with your MeshNet Controller

- **Interface**—describes the three interfaces (physical, web, and programmatic) to the MeshNet Controller

- **Configuration**—provides information on how to setup a MeshNet Controller with your existing network and/or business systems as well as how to configure wireless devices

- **Proper Placement**—provides suggestions on how to place and position your MeshNet System components for optimum performance.

- **Web Access**—describes how to utilize the on-board web application to access real-time monitoring of your MeshNet Sensors

- **Integration**—provides details on how to integrate the MeshNet Controller with existing systems and applications. This section is aimed at software programmers and engineers who want to interface directly to the MeshNet Controller

- **Maintenance**—covers various activities related to maintaining or upgrading the MeshNet Controller

- **Additional Resources**—provides product and power supply specifications as well as support information

Quick Start Guide

Getting started with the MeshNet Controller is simple. Just follow a few easy steps:

1. **Link a MeshNet Sensor to the MeshNet Controller.** Using the custom "Linking Cable" provided, insert the straight 3.5mm connector end into the jack located on the front of the MeshNet Controller. Insert the right angle 3.5mm connector into the jack located inside the MeshNet Sensor (or Repeater). *(Use only the custom "Linking Cable" provided by EDS or linking will not occur.)* If power is not already applied to all devices, do so now. The internal "linking" process takes under 2 seconds; the LED on the face of the MeshNet Sensor will flash at a 1/2 second rate when complete. Once the LED signals success, power and the "Linking Cable" should be removed. (If after 5 seconds the LED does not flash at the 1/2 second rate, repeat the process)

2. **Apply power to the MeshNet Controller a second time.** The green PWR/ACT LED located on the front of the Controller will begin to flash at one-second intervals, indicating that the product is operating normally. Power must be 5 volts +/- 10% at 400 milliamp.

3. *Connect it to your Network*. Connect a live network cable to the Ethernet Port on the device. The green LED on the Ethernet connector will light, indicating a valid network connection. The yellow LED on the Ethernet connector blinks only when there is network traffic.

4. **Determine the IP address of the MeshNet Controller** by checking your DHCP server logs or using EDS Appliance Scanner Software available from the EDS website. If the MeshNet Controller does not find a DHCP server running on your network, it will default to the following IP address: 169.254.1.1.

5. **Configure your device**. Type the IP address of the MeshNet Controller into your web browser (e.g., http://192.168.1.27) and press enter. Select the menu item "Network" under "System Configuration". When the name and password is requested, enter "**admin**" for the name and "**eds**" for the password. A webpage similar to the one shown to the right will enable you to configure and monitor various aspects of your MeshNet Controller.

   CONGRATULATIONS! You have successfully installed a MeshNet Wireless Sensor System. *Please refer to the Web Access section of the Operation Manual to obtain an understanding of the function of each of the web pages served by the MeshNet Controller.*
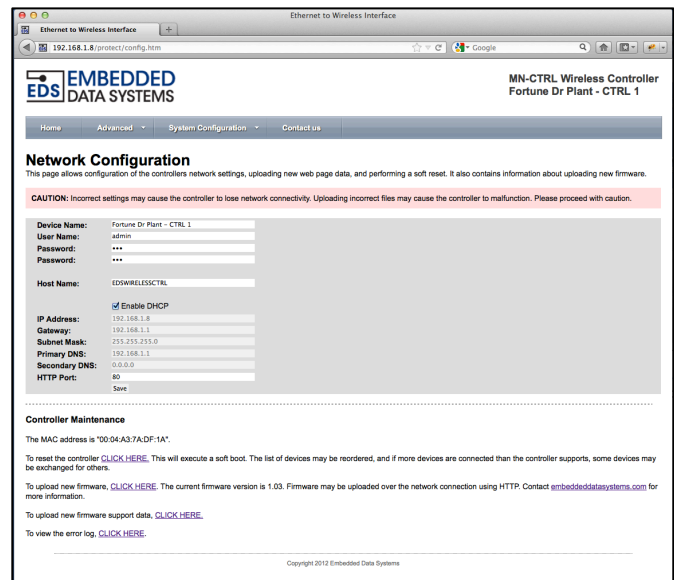
Some things to keep in mind:

- Support is provided for MeshNet Controller IP address identification only when utilizing the EDS Appliance Scanner Software (http://short.eds.bz/apps-edsscanner). Please consult your network administrator if you cannot locate the DHCP address.

- *For instructions on appropriate placement of the components of the MeshNet Wireless Sensor System, please refer to Proper Placement section of the Operation Manual.*

Interface

The MeshNet Controller has 3 types of interfaces:
- Physical—the ports, buttons, and other elements on the unit itself
- Web—the on-board web application that provides real-time access of monitoring data
- Programmatic—the methods by which to interface directly with monitoring data

Physical

The physical interface of the MeshNet Controller consists of these parts:
- Power: a single micro USB connector. This connector is used for power only; USB functions are disabled.
- Ethernet: connects the device to an existing 10/100-baseT network via a standard RJ45 Ethernet connector
- Status Indicator: flashes green to indicate the unit is receiving power and operating correctly, flashes yellow to indicate data activity
- Link: Used to make a MeshNet Sensor or Repeater "link" to this MeshNet Controller. This is accomplished by connecting the MeshNet Controller to the Sensor/Repeater with the "Linking Cable" and then applying power to the MeshNet Controller and Sensor/Repeater. A rapidly flashing LED on the face of the Sensor/Repeater indicates the process is complete.

Web

Each MeshNet Controller includes an integrated web-server that provides access to monitored data from any[1] Internet connected device, such as a web-browser on your PC, smartphone, or even an iPad®!

The Web interface provides you an easy way to configure the network settings for the MeshNet Controller and is accessible by navigating to its IP address. When you connect the MeshNet Controller to your network it will automatically request an IP address from an available DHCP server if the feature is turned on (default), otherwise it will use an IP address assigned by you. *See configuration section below.*

Simply open a web browser and enter that IP address to access the web monitoring application.

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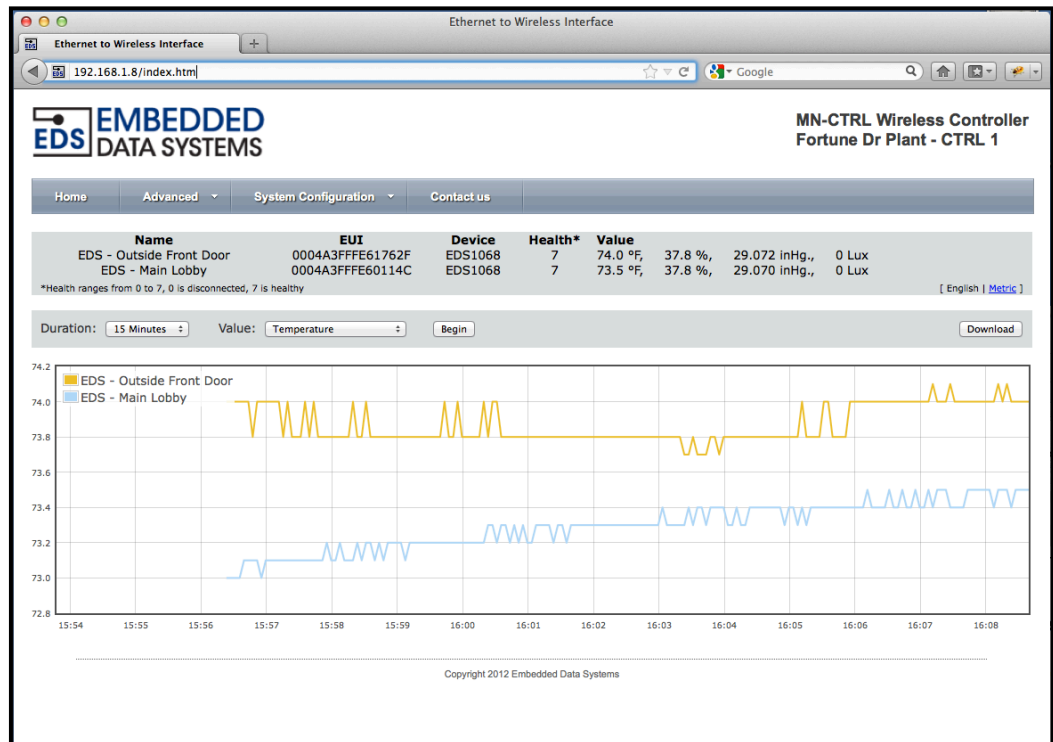
[1] Controllers limited to LAN connections may not be reachable from Mobile devices.

The web interface provides the following menu items:
- **Home**—the default opening screen which provides a list of all connected devices including their user definable name, EUI, device type and associated sensor values, a graph allowing one value to be graphed for all connected Sensors, a download option for the data from the graph, and MeshNet Controller basic information
- **Advanced**—displays information about each device connected to the MeshNet Controller.
    - Details—displays detailed information about each device as well as allows access to configurable parameters
    - Details XML File—displays all data in the .xml file
- **System Configuration**—provides access to security and network configuration information including:
    - Network—provides access to security and network configuration information
    - Wireless—provides access to configuration fields for the wireless network
    - POST Client—provides access to configuration fields for HTTP Post and Proxy Server features
- **Contact us**—displays physical address, Phone / Fax Number, email address and website link for Embedded Data Systems

In addition to the 4 menu items, highlighting and selecting a specific device accesses an Individual Device Web Page. The page allows users to view current sensor data, graph three separate sensor values, and modify writable parameters.

Note 1: If you don't know the IP address being assigned to the MeshNet Controller by your network, access your DHCP's assignment or download the EDS Appliance Scanner Software that will automatically find and display the IP address for any MeshNet Controller on the network. For more information about the EDS Application Scanner software, see section *Additional Resources.*

Note 2: If your network does not have a DHCP server, the MeshNet Controller will default to a self-assigned address of 169.254.1.1. In the event of this situation, you will need to temporarily re-configure your computer's network settings to be on the same network as the MeshNet Controller in order to talk to the device for the first time. Only when the MeshNet Controller is in the same address space as your other computers can you access it using a web browser.

Programmatic
Through a number of different channels, you can access the MeshNet Controller programmatically to create integration with existing systems and network services:

- **HTTP**—service provides delivery of HTML and XML data files via http *GET* command, and firmware upload via http post

- **SNMP**—provides access to data from all connected Sensors, and pushes SNMP traps to remote listeners for alarming capabilities

- **Telnet**—service provides ability to monitor the internal activities of the MeshNet Controller for diagnostic purposes

- **UDP Broadcast**—listener on port number 30303 will respond to properly formatted packets broadcast to this port number, allowing other devices and applications to discover any MeshNet Controller that exists on the same network. For assistance in determining the units IP address, see the section *Additional Resources* regarding EDS Appliance Scanner Software.

- **(HTTP) POST Client**—provides a method of pushing XML data about connected devices to a server; ideal for circumventing firewall issues.

System Setup

System Configuration

Configuration of your MeshNet Controller can be carried out through the integrated web application. The on-board, web-based tools provide a method to configure both the unit itself as well as any attached supported devices.

To access all configuration elements,
- Using your personal computer, navigate to the IP Address your network has assigned to the MeshNet Controller. This will open the web interface.

To access the Main System Configuration, please select *System Configuration* from the scroll-down navigation menu.
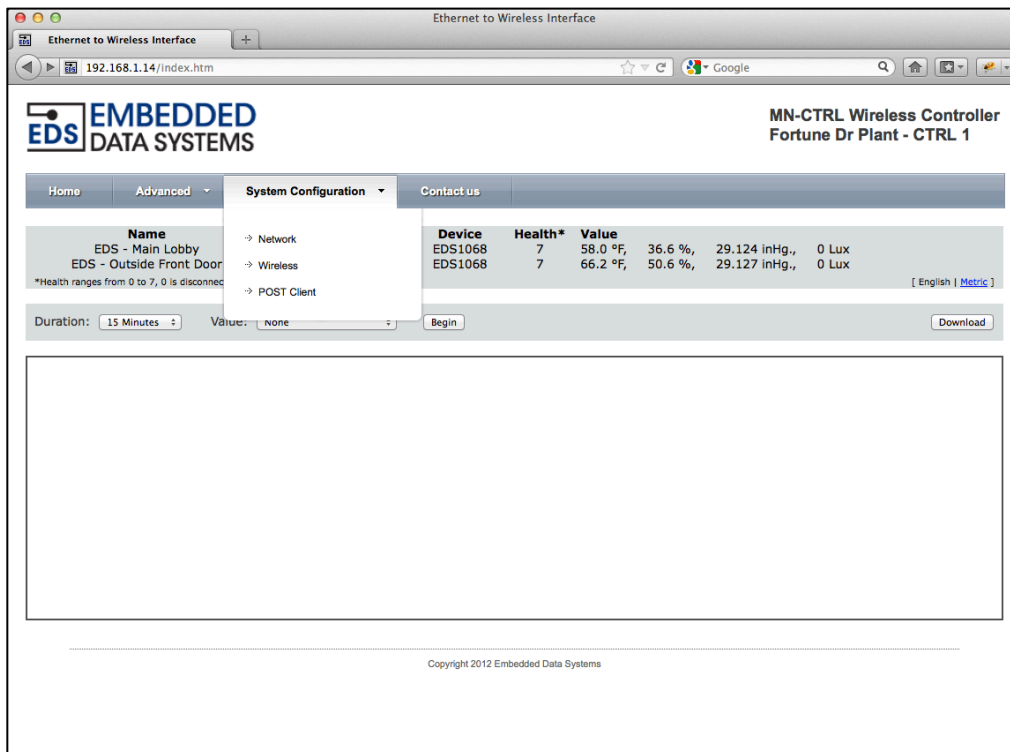
Network Configuration

The Network Configuration provides a number of fields to configure the MeshNet Controller operations within your network.

Note: In order to access this portion of the web tool, you will need a username and password. If you have not set it previously, you can use the factory default user name of "admin", and password of "eds" (all in lower case.)

You can configure the following aspects of the MeshNet Controller:

- **Device name**—the factory default is "*WirelessController-Enet".* However this is a user definable name, maximum 24 characters. Alphanumeric characters, dashes, periods, spaces and under-scores are permitted. This flexibility allows you to distinguish a device by its location or function for clarity. This field is included in the XML file. This name is displayed on each web page in the upper right.

- **User name**—this is the user name, case-sensitive maximum 12 characters, used to access the configuration sections of the on-board web tool and the Telnet interface. Uppercase and lowercase Alphanumeric Characters permitted. The factory default is "*admin*".

- **Password**—this is the password used to access the configuration sections of the on-board web tool and the Telnet interface. Uppercase and lowercase Alphanumeric Characters permitted. The factory default is "*eds*".

- **Password**—confirm the password entered in the previous password field.

- **Host Name**—the factory default name for the MeshNet Controller is *EDSWIRELESSCTRL*. You can change the name but it is limited to 16 UPPERCASE characters. This field is also printed in the XML file.

- **Enable DHCP**—check this box to automatically enable the MeshNet Controller to receive an IP address and other network configuration information (such as gateway and subnet mask) from a DHCP provider on your network. Note: this is the factory default setting of the device. If you elect NOT to enable DHCP, you must manually provide network adapter settings for the device:

  - o **IP Address**—a standard IPV4 address. Note: if you configure the device with an IP Address that is NOT a part of your network IP-range or class you will be unable to access the device unless connected directly to it with a computer configured with the same IP settings (*Recoverably only via Manual Factory Reset*)

  - o **Gateway**—the IP address of your network gateway

  - o **Subnet Mask**—the Subnet mask

- o **Primary DNS**—the IP address of the primary DNS server
- o **Secondary DNS**—the IP Address of a secondary DNS server. Note: this is optional
- o **HTTP Port**—the port through which the MeshNet Controller will listen for incoming HTTP requests. Normally programmed to 80
- **Save**—when you have finished making settings, click the "Save" button to commit the settings to the device. This will cause the device to reboot

Note: At the time of initial boot-up, the device will look for a DHCP server. If one cannot be found, the following default configuration settings will be applied:

- IP Address: 169.254.1.1
- Gateway: 169.254.1.1
- Subnet Mask: 255.255.0.0
- DNS: 169.254.1.1

Wireless Interface Configuration
The Wireless Setup feature of the web-tool allows you to configure the wireless network parameters.

The first two parameters, *Network Key* and *Pan ID* uniquely identify this controller to the Sensors. This is the information that is exchanged during the link process (see link section below). The primary reason to change these parameters is if the MeshNet Controller needed to be replaced, and there were many Sensors in the system, it would be quicker to change these parameters to the old settings than to go through the link process for each Sensor.

The *Channel Hop* parameter, when set to anything but zero, causes the Wireless Controller to periodically scan the available channels to find the quietest one, then switch to that channel. When this happens, the Sensors, which are on the previous channel, have to discover that the MeshNet Controller has changed channels; they then have to scan all the channels to find where the MeshNet Controller has moved. The *Channel Hop* number is programmed in hours.
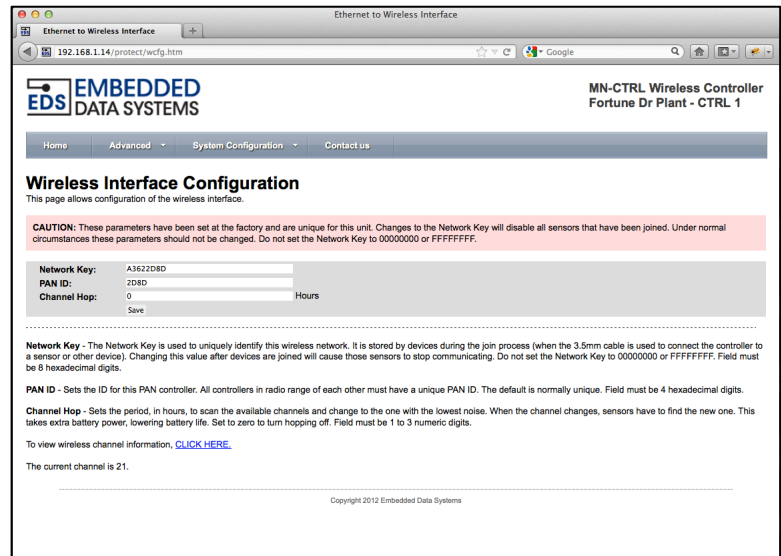
The advantage of channel hopping is that is assures the controller will be operating on the quietest channel. This can be an issue in some areas because the 2.4 GHz band, where the MeshNet Controller operates, is shared with other wireless devices such as WiFi, ZigBee, some cordless phones, etc. When the MeshNet Controller first powers up, it performs a channel scan and uses the quietest one, so channel hop only helps if the environment changes over time, as would be the case if WiFi modems were turned on / off or moved, etc.

The disadvantage of channel hopping is that it uses up battery power in the Sensors when they have to discover the MeshNet Controller has moved channels, then find which channel it has moved to. Because of this, if channel hopping is used, it should be set to as long as possible, perhaps once a week or month.

(HTTP) POST Client Setup

The POST Client Setup page of the web-tool allows you to configure the POST Client and Proxy features of the MeshNet Controller.

To configure POST Client:

- Enable the feature by clicking the check box
- Enter the URL of the HTTP POST server. This field requires a fully qualified URL and may include an alternate port number. This example sets the port to 12391:
http://www.embeddeddatasystems.com:12391/files/myfile.htm"
- Select how often to send the "details.xml" file
- Proxy server may be enabled by clicking the check box
- Set the Proxy URL to the appropriate address, which is typically obtained from the network administrator. For example, if the proxy server is at 192.168.1.230, port number 8080, then the Proxy URL field would be programmed to http://192.168.1.230:8080. These proxy parameters only apply to the POST Client feature, they have no effect on any of the other features.
- Save Changes

Linking

Linking is the process of connecting the MeshNet Controller with a MeshNet Sensor or MeshNet Repeater in order to make the Sensor or Repeater communicate with the MeshNet Controller. During the linking process, the MeshNet Sensor or Repeater retrieves the Network Key and Pan ID from the controller (see Wireless Setup section above), which are then used to select which MeshNet Controller to join.

To perform a link, follow these steps:

1. Apply power to the MeshNet Controller, Sensor or Repeater.
2. Using the EDS supplied Linking Cable; insert the straight 3.5mm connector into the jack on the front of the MeshNet Controller and right angle 3.5mm connector into the jack inside the Sensor or on the face of the Repeater. *(NOTE: the Linking Cable has a custom pin out and must be purchased from EDS)*
3. In a few seconds, the LED on the Sensor or Repeater should flash rapidly, indicating the process is complete. If, after 5 seconds the LED is not flashing rapidly, unplug the Linking Cable connector and plug it in again.
4. After the LED is flashing rapidly, remove power from the MeshNet Sensor or Repeater, wait 10 seconds and apply power again.
5. The process is complete, the new MeshNet Sensor or Repeater should appear on the web page of the MeshNet Controller.

Proper Device Placement

Implementing proper device placement can maximize the range and robustness of the wireless network. Use the following principles when deciding where to locate the MeshNet Controller, Repeater and Sensors.

- Place the Controller as close to the geographic middle of the sensors as possible. Usually this optimizes the distance to all the Sensors.
- Place the Controller up high, not on the floor.
- Mount the Controller vertically, with the connectors pointing down; this is the optimal orientation for the internal antenna.
- Mount Sensors and Repeaters as high up as possible.
- Remove all metal or stone objects between the Controller and Repeaters / Sensors.
- Monitor the RSSI levels for each Sensor, if they are below approximately -85, try moving the Sensors and Controller around to see if that number can be improved.

Web Access

The MeshNet Controller provides a robust, on-board, web-based tool to access connected devices from any web browser—whether on a PC or a smartphone.

To access the connected devices:
Navigate to the IP Address your network has assigned to the MeshNet Controller. This will open the web interface.

*NOTE: Since the web browser actually does all graphing, if the web page is closed, the data is lost. Opening multiple web pages will allow individual devices to be monitored and additional parameters to be graphed and logged. However **the limit on the number of web pages that may operate effectively is subjective;** factors include the number of sensors on the system, the number of different types of browsers being used (i.e. Chrome™, Safari®, Firefox®, etc), the number of different web pages open and the quality of the Ethernet connection. If you find the data is not being received and displayed consistently, reduce the number of web pages open.*

From the default "Home" page you can view the following:

- Connected Devices, along with overview information
- One graph that will display the same value for up to 12 connected devices
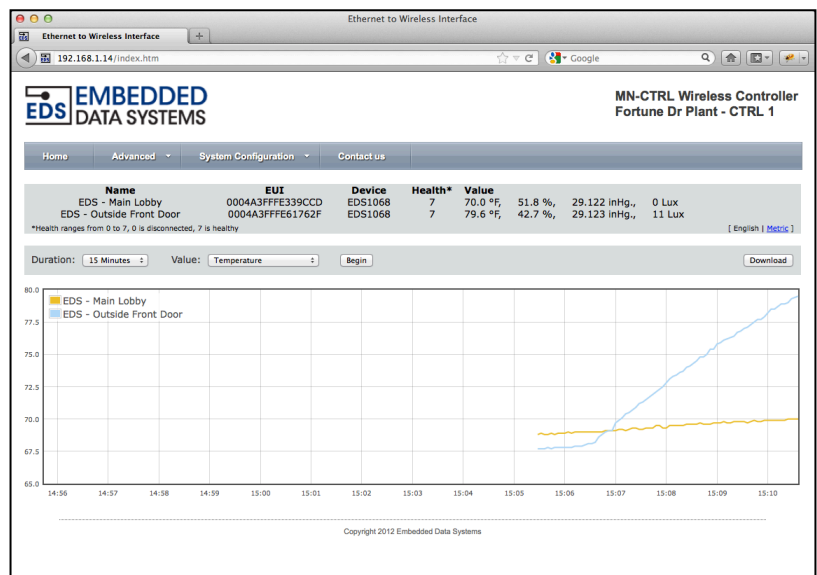
Connected Devices

The default "Home" page has a list of devices that are currently communicating with the controller with overview information. Click on a device to view a new web page showing additional details of that device.

Name	EUI	Device	Health*	Value			
EDS - Outside Front Door	0004A3FFFE61762F	EDS1068	7	9.5 °F,	98.5 %,	29.032 inHg.,	0 Lux
EDS - Main Lobby	0004A3FFFE339CCD	EDS1068	7	43.3 °F,	28.5 %,	29.030 inHg.,	0 Lux

*Health ranges from 0 to 7, 0 is disconnected, 7 is healthy   [English | Metric]

The MeshNet Controller device summary data provides the following points:

- **Name**—each device has a name that can be changed by the user (called "UserName" in the XML file).
- **EUI**—serial number of the sensor or repeater.
- **Device**—controller identification of the device.
- **Health –** health of the device. This number is decremented if the sensor is not heard from within for a while. Maximum is 7, which indicates a good connection.
- **Value –** custom string of data for each device, showing the most used parameters.

Graph

When the page is first loaded, the graph is turned off. To graph a single value, select the Value and Duration using the associated drop down boxes, then click "Begin". The graph will show all the possible parameters from the connected devices as the data is read, but **only one value may be graphed from this page**. In the example below, 2 devices are connected that have a Temperature field in the XML file, so there are 2 separate graphing lines, one for each device. New data is inserted on the right.
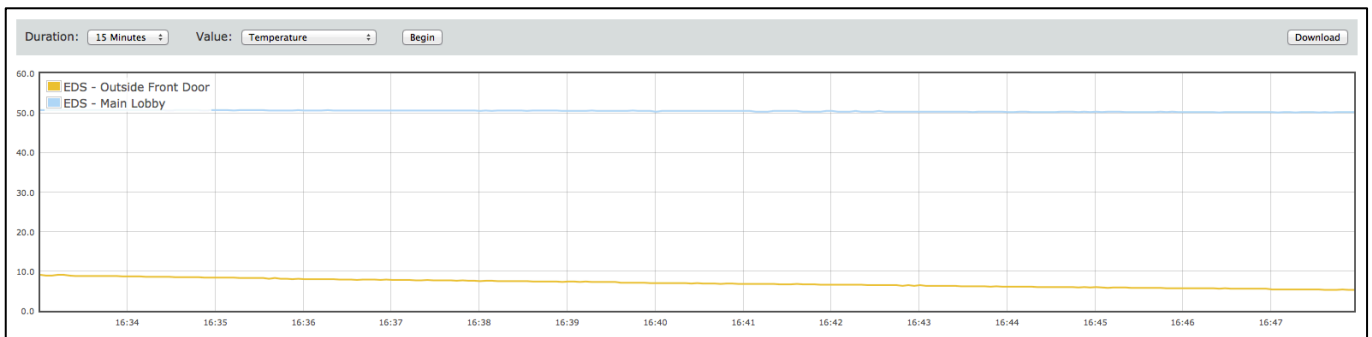
Download

Clicking the "Download" button to the upper right of the graph may download data from the graph. The file will be in comma-separated format with headers.

Individual Device Details

Each device has it's own web page that *allows users to modify writable parameters and view current Sensor data.*

To access a device page, highlight and click on the line of the device to view, found within the listing of connected devices.
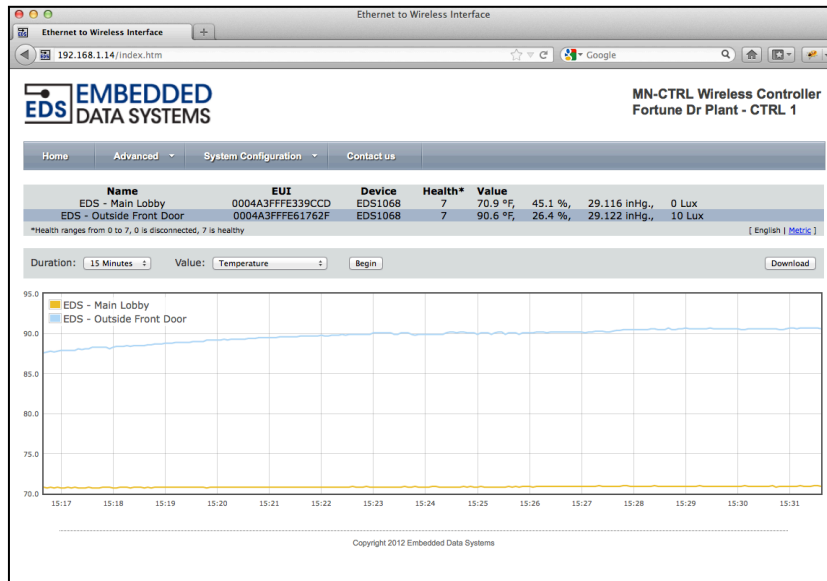
The device page for the EDS1068 is shown here. This sensor measures temperature, humidity, barometric pressure and light, has a discrete input with pulse counter and activity latch, plus an optional relay output. Similar display features apply to all device pages.

Note that all information on these pages is taken from the XML file.

The page consists of the following sections:

- Current sensor data
- Additional sensor data
- Graph of up to 3 different parameters
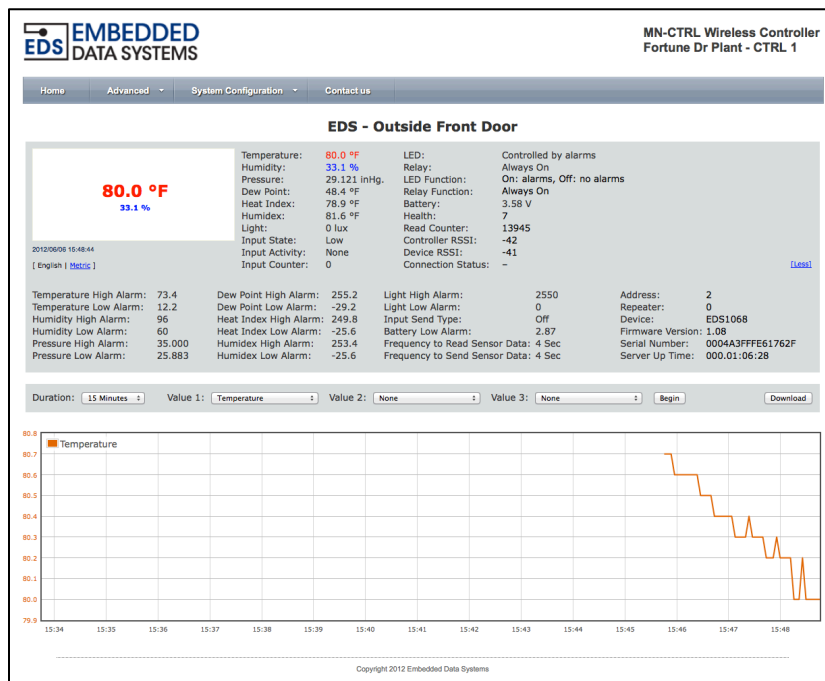
Current Sensor Data

This section shows the current readings from any given Sensor. All data will be presented in black text unless the unit is in alarm state. If the unit is in alarm state, the corresponding data will be presented in red for high alarm and blue for low alarm. The white box on the left displays the most pertinent information, in this case the temperature and humidity. Below the white box is the date and time of the last reading received from the sensor. Below that is a browser wide selection of the units to display, English or Metric. This selection is saved as a cookie in the browser and will apply to all windows from the same browser. On the lower right is a "more" selection, which displays more information about the device.

	Temperature:	52.0 °F	LED:	Off
52.0 °F	Humidity:	100.0 %	Relay:	Always On
100.0 %	Pressure:	29.019 inHg.	LED Function:	On/Off under command
	Dew Point:	51.9 °F	Relay Function:	Always On
	Heat Index:	52.0 °F	Battery:	3.58 V
	Humidex:	52.0 °F	Health:	7
	Light:	0 lux	Read Counter:	5171
2012/06/05 15:29:08	Input State:	Low	Controller RSSI:	-60
	Input Activity:	None	Device RSSI:	-56
[English	Metric]	Input Counter:	0	Connection Status:	–	[More]

- **Parameters that cannot be written, and do not have alarms, such as Health** – These items are displayed in black and NOT highlighted when the cursor is moved over them.
- **Parameters with alarms, such as Temperature and Humidity**—If the item is in high alarm, it will be displayed in red, if it is in low alarm it will be displayed in blue. Clicking the value will clear the alarm if it is not active. At the bottom center of the box below is a message display area where status of write data is shown in pink.
- **Writable Parameters, such as LED and LED Function –** *Writable items highlight when the cursor moves over them*. When these writable items are clicked, a dialog box is displayed requesting the data to write or displaying an error message if the item cannot be written. Additionally the dialog box may contain item specific information. For example, clicking the "Off" text to the right of the LED label will bring up a dialog box that defaults to turning the LED on (since it is already off). If the LED Function parameter is not set to "On/Off under command" it cannot be written, so the message display area shows text indicating such.

Additional Sensor Data

Clicking the "More" text on the bottom right of the Sensor Data box brings up additional sensor data.

This data typically consists of items that do not need to be viewed regularly, such as alarm settings.

	Temperature:	39.3 °F	LED:	Off
39.3 °F	Humidity:	100.0 %	Relay:	Always On
100.0 %	Pressure:	29.013 inHg.	LED Function:	On/Off under command
	Dew Point:	39.3 °F	Relay Function:	Always On
	Heat Index:	39.3 °F	Battery:	3.47 V
	Humidex:	39.3 °F	Health:	7
	Light:	0 lux	Read Counter:	5397
2012/06/05 15:43:09	Input State:	Low	Controller RSSI:	-57
	Input Activity:	None	Device RSSI:	-54
[English	Metric]	Input Counter:	0	Connection Status:			[Less]

Temperature High Alarm:	89.6	Dew Point High Alarm:	255.2	Light High Alarm:	2550	Address:	1
Temperature Low Alarm:	12.2	Dew Point Low Alarm:	-29.2	Light Low Alarm:	0	Repeater:	0
Humidity High Alarm:	96	Heat Index High Alarm:	249.8	Input Send Type:	Off	Device:	EDS1068
Humidity Low Alarm:	33	Heat Index Low Alarm:	-25.6	Battery Low Alarm:	2.87	Firmware Version:	1.08
Pressure High Alarm:	35.000	Humidex High Alarm:	253.4	Frequency to Read Sensor Data: 4 Sec		Serial Number:	0004A3FFFE61762F
Pressure Low Alarm:	25.883	Humidex Low Alarm:	-25.6	Frequency to Send Sensor Data: 4 Sec		Server Up Time:	000.01:54:29

Graph

The bottom part of the screen displays a real-time graph of up to 3 different parameters from the sensor. When the page is first loaded, the graph is started with one parameter. For the EDS0068, like most sensors, that parameter is Temperature.
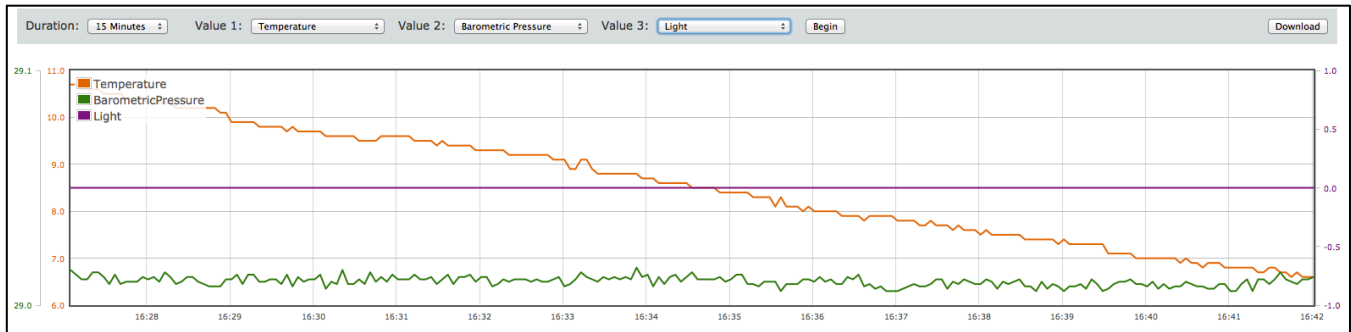
To change the graph, select the desired value or values and duration using the drop down boxes, then press Begin. To save the current graph data, click the Download button to the upper right of the graph. This saves the graph data in comma-separated format, with headers and other identifying information.

*NOTE: Since the web browser actually does all graphing, if the web page is closed, the data is lost. Opening multiple web pages will allow individual devices to be monitored and additional parameters to be graphed and logged. However **the limit on the number of web pages that may operate effectively is subjective;** factors include the number of sensors on the system, the number of different types of browsers being used (i.e. Chrome™, Safari®, Firefox®, etc), the number of different web pages open and the quality of the Ethernet connection. If you find the data is not being received and displayed consistently, reduce the number of web pages open.*

Advanced

Under the advanced menu are 2 options: Details and Details XML File.

Details

This page shows information about the Controller, followed by all the XML parameters for each sensor, in one long list. Writable parameters can be written here by clicking on the write button on the right of the line of interest.

The top of the screen shows information about the communication status of the Wireless Controller, the devices as a group, and the web browser:

- **Firmware Version** – the version of the controller firmware.
- **Devices Connected**—the total # of devices connected
- **Up Time** – how long the Wireless Controller has been turned on. Displayed as days.hours:minutes:seconds (ddd.hh:mm:ss).
- **Device Name** – name of the device, as programmed in the Web Setup page.
- **Host Name –** host name, as programmed in the Web Setup page.

- **Mac Address –** this is the Ethernet MAC address, which is globally unique and can be used to identify this Wireless Controller from others in a system.
- **Connection status**—the connection status between the Wireless Controller and the web browser that is accessing the Wireless Controller web configuration page. An error will be displayed here in the event there is an issue.
- **Data activity**—this light will toggle between white and green every time the browser receives a data push of new values from the Wireless Controller. This is useful to know that the data feed is alive, even if the values are not changing.
- **Enable auto update**—check this box to enable the browser to update the webpage as new data is received from the Wireless Controller. Uncheck the box if you would like to pause the automatic refresh between browser and the Wireless Controller to analyze information on the screen. Note: if you leave this box unchecked, the web page will not update with new values automatically but the Wireless Controller will continue to communicate with attached devices.

The bottom part of the screen displays information about each connected device. Because each supported device may have different elements, they are not covered in detail in this manual.

Name	EDS1068	
Description	Temperature, Humidity, Barometric Pressure and Light Sensor	
EUI	0004A3FFFE61762F	
ControllerRSSI	-66	
Address	1	
Repeater	0	
Health	7	
PrimaryValue	18.48 %RH	
UserName	EDS - Outside Front Door	Write
Temperature	-15.9375	
Humidity	18.48	
DewPoint	-34.4375	
Humidex	-15.9375	
HeatIndex	-15.9375	
BarometricPressure	982.300	
Light	0	
Battery	3.37	
LED	1	
Relay	0	
Input1	0	
ActivityLatch1	0	
PulseCounter1	0	
ActivityLatchReset	-	Write
ReadCounter	6640	
ConnectionCounter	8	
MessageAttempts	6647	
MessagePacketRetries	220	
MessageFailures	7	
ResetMessageCounters	-	Write
DeviceRSSI	-63	
TemperatureHighAlarmState	0	
TemperatureLowAlarmState	1	
HumidityHighAlarmState	1	
HumidityLowAlarmState	1	
DewPointHighAlarmState	0	
DewPointLowAlarmState	1	
HumidexHighAlarmState	0	
HumidexLowAlarmState	0	
HeatIndexHighAlarmState	0	
HeatIndexLowAlarmState	0	
BarometricPressureHighAlarmState	0	
BarometricPressureLowAlarmState	0	
LightHighAlarmState	0	

For those devices that have "programmable" elements (parameters that can be changed in a Sensor), you can click the "Write" button to specify a value.

All of the current sensor data is available for download at the details.xml link on the bottom of the page, or through the Advanced, Details XML File menu item.

Details XML File
This page shows the XML file. It is not updated continuously and contains no page formatting.

Integration

The MeshNet Controller provides a powerful set of tools to enable developers and network administrators the ability to integrate the device (and data from connected devices) with existing management and/or monitoring systems. The following are the network services supported by MeshNet Controller, accessible via TCP/IP:

- HTTP—service provides delivery of HTML and XML data files via HTTP GET, a method of writing data to wireless devices, the web browser interface previously discussed and firmware upgrading

- SNMP—provides access to data from all connected Sensors, and pushes SNMP traps to remote listeners for alarming capabilities

- Telnet—service provides login to monitor some of the MeshNet Controller's communication activities for diagnostic purposes

- UDP Broadcast—listener on port number 30303 will respond to properly formatted packets broadcast to this port number, allowing other devices and applications to discover MeshNet Controllers that exist on the same network

- **POST Client**—provides a method of pushing XML data about connected devices to a server

HTTP
The HTTP mechanism enables programmers to utilize a GET command to retrieve various data elements that are contained in an XML file as well as write data to wireless devices that support control functions.

The MeshNet Controller provides the following XML file for data retrieval:
- details.xml—this file provides detailed information on the MeshNet Controller and all connected devices.

Retrieving XML File
To retrieve the XML file, simply access it by corresponding URL.
For example: "http://192.254.1.1/details.xml"

Once the file has been retrieved, it can be parsed according to the methods available to the developer in whatever programming language they are using.

Details.xml

The following is an example of the details.xml file:

```
<Devices-Detail-Response xmlns="http://www.embeddeddatasystems.com/schema/wirelesscontroller"xmlns:xsi="http://www.w3.org/2001/
        XMLSchemainstance">
<UpTime>000.04:35:26</UpTime>
<DevicesConnected>1</DevicesConnected>
<ProductName>WirelessController-Enet</ProductName>
<FWVersion>1.03</FWVersion>
<DeviceName>Fortune Dr Plant - CTRL 1</DeviceName>
<HostName>EDSWIRELESSCTRL</HostName>
<MACAddress>00:04:A3:7A:DF:1A</MACAddress>
<Channel>24</Channel>
<owd_EDS1068 Description="Temperature, Humidity, Barometric Pressure and Light Sensor">
<Name>EDS1068</Name>
<EUI>0004A3FFFE339CCD</EUI>
<ControllerRSSI Units="dBm">-45</ControllerRSSI>
<Address>2</Address>
<Repeater>0</Repeater>
<Health>7</Health>
<PrimaryValue>60.86 %RH</PrimaryValue>
<UserName Writable="True">EDS - Main Lobby</UserName>
```

```
<Temperature Units="Centigrade">21.7500</Temperature>
<Humidity Units="Percent">60.86</Humidity>
<DewPoint Units="Centigrade">13.8125</DewPoint>
<Humidex>25.0000</Humidex>
<HeatIndex Units="Centigrade">24.5000</HeatIndex>
<BarometricPressure Units="Millibars">990.960</BarometricPressure>
<Light Units="Lux">1</Light>
<Battery Units="Volts">3.56</Battery>
<LED>0</LED>
<Relay>0</Relay>
<Input1>0</Input1>
<ActivityLatch1>0</ActivityLatch1>
<PulseCounter1>0</PulseCounter1>
<ActivityLatchReset Writable="True">-</ActivityLatchReset>
<ReadCounter>966</ReadCounter>
<ConnectionCounter>2</ConnectionCounter>
<MessageAttempts>967</MessageAttempts>
<MessagePacketRetries>4</MessagePacketRetries>
<MessageFailures>0</MessageFailures>
<ResetMessageCounters Writable="True">-</ResetMessageCounters>
<DeviceRSSI Units="dBm">-46</DeviceRSSI>
<TemperatureHighAlarmState>0</TemperatureHighAlarmState>
<TemperatureLowAlarmState>0</TemperatureLowAlarmState>
<HumidityHighAlarmState>0</HumidityHighAlarmState>
<HumidityLowAlarmState>0</HumidityLowAlarmState>
<DewPointHighAlarmState>0</DewPointHighAlarmState>
<DewPointLowAlarmState>0</DewPointLowAlarmState>
<HumidexHighAlarmState>0</HumidexHighAlarmState>
<HumidexLowAlarmState>0</HumidexLowAlarmState>
<HeatIndexHighAlarmState>0</HeatIndexHighAlarmState>
<HeatIndexLowAlarmState>0</HeatIndexLowAlarmState>
<BarometricPressureHighAlarmState>0</BarometricPressureHighAlarmState>
<BarometricPressureLowAlarmState>0</BarometricPressureLowAlarmState>
<LightHighAlarmState>0</LightHighAlarmState>
<LightLowAlarmState>0</LightLowAlarmState>
<BatteryLowAlarmState>0</BatteryLowAlarmState>
<ClearAlarms Writable="True">-</ClearAlarms>
<TemperatureHighAlarmValue Writable="True" Units="Centigrade">35</TemperatureHighAlarmValue>
<TemperatureLowAlarmValue Writable="True" Units="Centigrade">-40</TemperatureLowAlarmValue>
<HumidityHighAlarmValue Writable="True" Units="Percent">100</HumidityHighAlarmValue>
<HumidityLowAlarmValue Writable="True" Units="Percent">0</HumidityLowAlarmValue>
<DewPointHighAlarmValue Writable="True" Units="Centigrade">125</DewPointHighAlarmValue>
<DewPointLowAlarmValue Writable="True" Units="Centigrade">-40</DewPointLowAlarmValue>
<HumidexHighAlarmValue Writable="True">125</HumidexHighAlarmValue>
<HumidexLowAlarmValue Writable="True">-40</HumidexLowAlarmValue>
<HeatIndexHighAlarmValue Writable="True" Units="Centigrade">125</HeatIndexHighAlarmValue>
<HeatIndexLowAlarmValue Writable="True" Units="Centigrade">-40</HeatIndexLowAlarmValue>
<BarometricPressureHighAlarmValue Writable="True" Units="Millibars">2000.000</BarometricPressureHighAlarmValue>
<BarometricPressureLowAlarmValue Writable="True" Units="Millibars">0.000</BarometricPressureLowAlarmValue>
<LightHighAlarmValue Writable="True" Units="Lux">100000</LightHighAlarmValue>
<LightLowAlarmValue Writable="True" Units="Lux">0</LightLowAlarmValue>
<BatteryLowAlarmValue Writable="True" Units="Volts">3.40</BatteryLowAlarmValue>
<ReportCount Writable="True">0</ReportCount>
<SensorReadPeriod Writable="True" Units="Minutes">0</SensorReadPeriod>
<LEDFunction Writable="True">2</LEDFunction>
<RelayFunction Writable="True">4</RelayFunction>
<InputSend Writable="True">0</InputSend>
<LEDState Writable="True">0</LEDState>
<RelayState Writable="True">0</RelayState>
<FactoryReset Writable="True">-</FactoryReset>
<Version>1.07</Version>
<WritesPending>0</WritesPending>
<WritesSucceeded>0</WritesSucceeded>
<WritesFailed>0</WritesFailed>
</owd_EDS1068>
</Devices-Detail-Response>
```

Each "owd_xxx" element contains the device name (Name), family code (Family), ROM ID (ROMId), health (Health), raw data used to obtain the data fields (RawData) displayed in hex format, and a list of the data fields where the name of the data field provides the description.

Writing Data to Wireless Devices

To write data to a connected device that supports control commands simply make a request of **devices.htm** with the appropriate URL parameters. Below is an example:

devices.htm?rom= 0004A3FFFE61762F&variable=UserName&value=Office1

The URL parameters in the example are as follows:

- **rom**—the ROM ID of the device to modify, alpha characters must be upper case

- **variable**—the name of the variable to modify. The name is the same as the XML field name, only XML fields with attributes of '**Writable="True"**'' may be written, (e.g., <ClearAlarms....)

- **value**—the new decimal value to write to the device

Firmware Upgrading

Firmware may be upgraded using the link on the "Network" page, under the System Configuration menu item. At the bottom, under the heading "Controller Maintenance" is a link to upload new firmware. Follow the instructions to complete the process.

Once firmware has been upgraded, the firmware support data must be updated. This link is directly below the firmware link on the same page. For more information, see the MAINTENANCE section of this manual.

SNMP (Simple Network Management Protocol)

Simple Network Management Protocol (SNMP) is a protocol commonly used to maintain network equipment. Every piece of equipment in a network is described in its .mib file (Machine Information Base file); Using an SNMP application, network administrators can monitor and interact with equipment throughout the network.

The EDS_MIB file can be loaded into your SNMP program, making it available for management and machine-to-machine communication. This file is available from the EDS MeshNet Controller product page under the _DOWNLOADS_ tab. It defines all available SNMP nodes available, complete with a text description.

The file also contains text descriptions and explanations of the various OIDs.

This screenshot of the iReasoning MIB Browser[1] shows the MeshNet Controller .mib file loaded into the SNMP interface and expanded to display the 3 nodes of interest to the MeshNet Controller—edsEnterprise, wTrap and wDevices, as shown below.

---
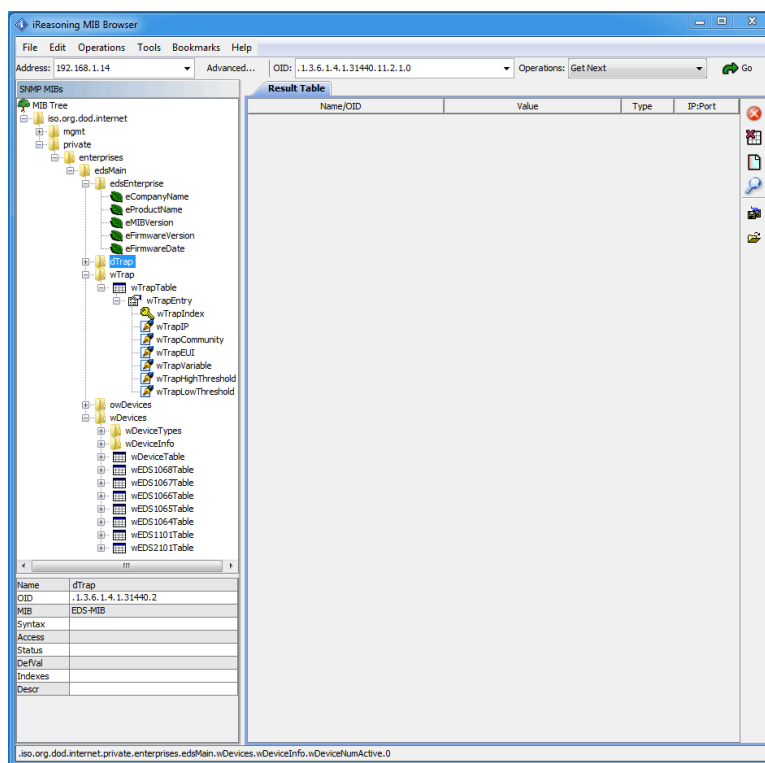
[1] This application is available from the iReasoning website and is only used as an example. There is no affiliation of any kind between Embedded Data Systems and the creator of iReasoning.

edsEnterprise Branch

The edsEnterprise branch presents basic information such as name and version.

wTrap Branch

The wTrap contains a table used to send traps based on preset conditions. The table, entitled wTrapTable, is depicted in the diagram below.

- o wTrapIP – IP address of where to send the trap.
- o wTrapCommunity – typically set to "private".
- o wTrapEUI – Stores the EUI of the device to base sending traps on. To be valid, this value must not be zero and must match an EUI of a currently connected wireless device.
- o wTrapVariable – Defines which variable of the wireless device to base calculation on. The value must refer to a valid variable or no trap will be sent. Set this to the name of the XML item to send. For example, if the XML item is Temperature, write the string "Temperature" to this value.
- o The items wTrapDeviceHighThreshold and wTrapDeviceLowThreshold work together to define 3 windows.
    - The variable is in the high window when it is greater than the high threshold
    - The variable is in the middle window when it becomes less than or equal to the high, or greater than or equal to the low threshold
    - It is in the low window when it is less than the low threshold
    - When a variable is read from a wireless device, it is compared to these values. If the new value from the device causes a change in the windows, this generates a trap message with this information:
        - OID of wTrapDeviceIndex.x where x is the number of wTrapDeviceTable row that caused the trap.
        - The data type integer indicates which transition occurred:
            - o 1 – middle to high window transition
            - o 2 – high to middle window transition
            - o 3 – middle to low transition
            - o 4 – low to middle transition
        - If the high threshold is less than the low threshold, no traps will be generated.
        - The high threshold and low threshold are stored as float in the MeshNet Controller, but are written as strings. This is because the SNMP V1 protocol makes no provision for a float. Because of this, some numbers may be rounded, and are displayed with 3 digits of precision after the decimal point regardless of what the number actually is in the MeshNet Controller.

- The wDevices has the following branches:
    - o wDeviceTypes lists each device type supported. This branch is read only.
    - o wDeviceInfo branch lists the number of devices connected
    - o wDeviceTable shows basic information about each device connected
    - o The specific device tables, for example *wEDS1068Table* defines the EDS1068. See the latest version of the EDS_MIB file for a list and description of the devices supported and their associated parameters.
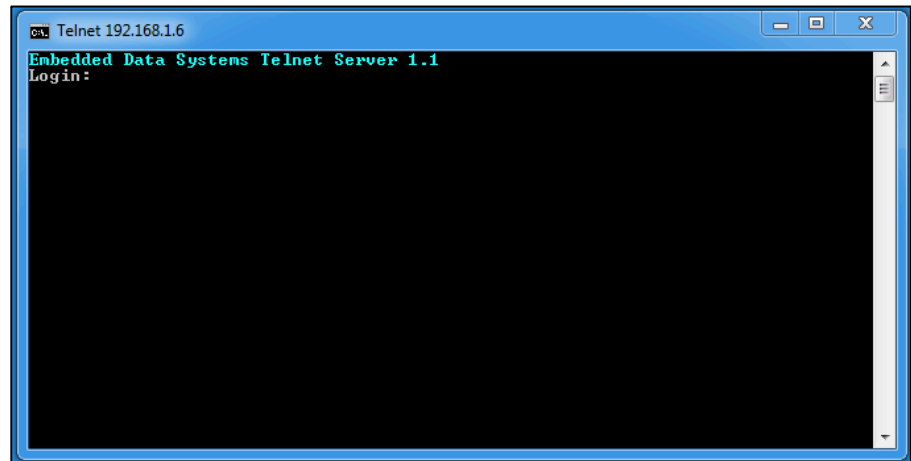
Telnet

Telnet is a network protocol used on the Internet or local area networks to provide a bidirectional interactive text-oriented communications facility using a virtual terminal connection. User data is interspersed in-band with Telnet control information in an 8-bit byte oriented data connection over the Transmission Control Protocol (TCP).
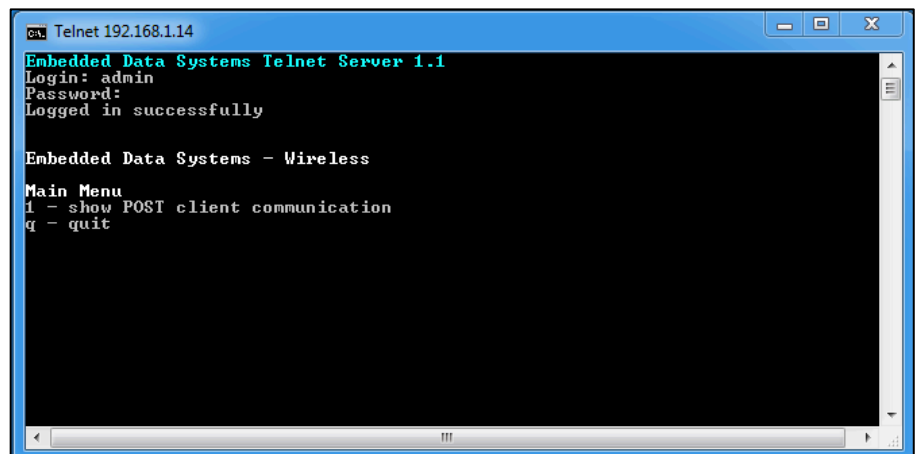
In most operating systems, Telnet connections are enabled through the Telnet Client program, which is run in a terminal window (as illustrated above). To start a Telnet connection with the MeshNet Controller,

- Open the Telnet program. This is accomplished by typing "Telnet" into the search box (of a computer using the Windows Operating System) or "Telnet" in a terminal window of a Mac or Linux computer.

- Once the Telnet program has opened, type "open {IP address}" where {IP address} represents the IP address of your MeshNet Controller (e.g., open 192.168.1.14). This will open a connection between your Telnet program and the MeshNet Controller. In order to complete the connection, you must enter the username[1] and word.[2]

Once the connection has been successfully authenticated, the MeshNet Controller will present you with a textual menu through which you can show basic information.

---

[1] Factory default "admin"
[2] Factory default "eds"

UDP

The MeshNet Controller can interact with UDP requests on port 30303 and provide basic information in return. The primary use for this is discovering any MeshNet Controller on the network, such as with the EDS Appliance Scanner Software. You can download a copy of this free discovery application (available for Windows, Apple OS X, and Linux) from the EDS website. A link to the software is provided in the EDS Appliance Scanner section of this manual.

The MeshNet Controller sends a UDP broadcast packet to port 30303 when:
- First powered up

- IP address changes due to a new DHCP server lease

- When the letter '**D**' is received on UDP port 30303, either directly or via a UDP broadcast.

The following is an example of the UDP packet:

```
{"NETBios": "EDSWIRELESSCTRL",
"MAC": "00-04-A3-7A-DF-1A",
"IP": "192.168.1.14",
"Product": "WirelessController-Enet",
"FWVer": "1.03",
"Name": "WirelessController-Enet",
"HTTPPort": "80",
"Bootloader": "POST",
"TCPIntfPort": "0",
}
```

The packet is formatted using JSON (Javascript Object Notation). The fields have the following information
- **NETBios**—This is the text string programmed in the "Host Name" field of the "Web Setup" web page

- **MAC**—This is the globally unique MAC address of the MeshNet Controller

- **IP**—The current IP address

- **Product**—A text description of the product. It cannot be changed

- **FWVer**—Firmware version of the MeshNet Controller

- **Name**—This is the text string programmed in the "Device Name" field of the "Web Setup" web page

- **HTTPPort**—The HTTP port number as programmed in the "HTTP Port" field of the "Web Setup" web page. The standard HTTP port is 80.

- **Bootloader**—Specifies the boot-loader type. For the MeshNet Controller the bootloader is always POST.

POST Client

This feature automatically, on a timed basis, sends the XML file "details.xml" to a HTTP server. Its primary purpose is to get data that's behind a firewall to a server residing on the Internet. By using the standard HTTP POST originating from behind the firewall, firewalls and other Internet filters see the communication as a standard browser request and typically will not block it.

An HTTP proxy server has been included for the POST Client.

The HTTP POST feature requires a properly configured server to receive the file. Download the MeshNet Controller PHP Script from the EDS website to perform this function.

Maintenance

The activities you can carry out to maintain and/or upgrade your MeshNet Controller include:
- Firmware and support files upgrade
- Factory reset

Firmware and Support Files Upgrade

The MeshNet Controller features the ability to upload firmware and support files over the network.

Update of support files must always be done in conjunction with a firmware upgrade.

To locate your current installed firmware version, access the Details Web Page, from the "Advanced" menu. The version of firmware installed in your device is listed at the top. To determine if there is a more recent version available, contact EDS.

If EDS has provided you new firmware and support files, you can upload it to your MeshNet Controller via the WEB using the following procedure:
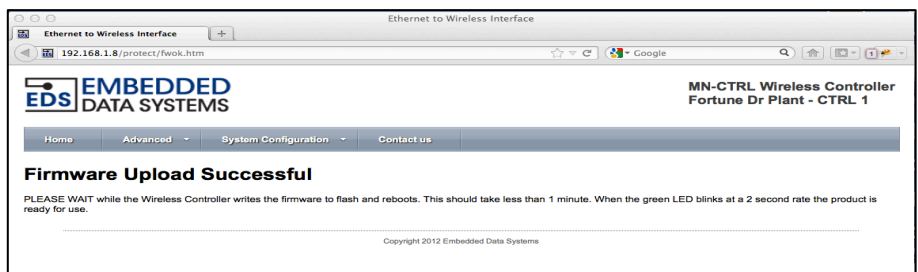
1) **Update the firmware files**:

- Open the web-based configuration tool and select the "Network" screen from the "System Configuration" menu.

- Scroll to the paragraph near the bottom of the page, beginning with "To upload new firmware, CLICK HERE". Click the link to begin the procedure.

- Click the "Browse" button to locate and select the *.hex file provided to you by EDS.

- Once the file is located, click the "Upload" button.
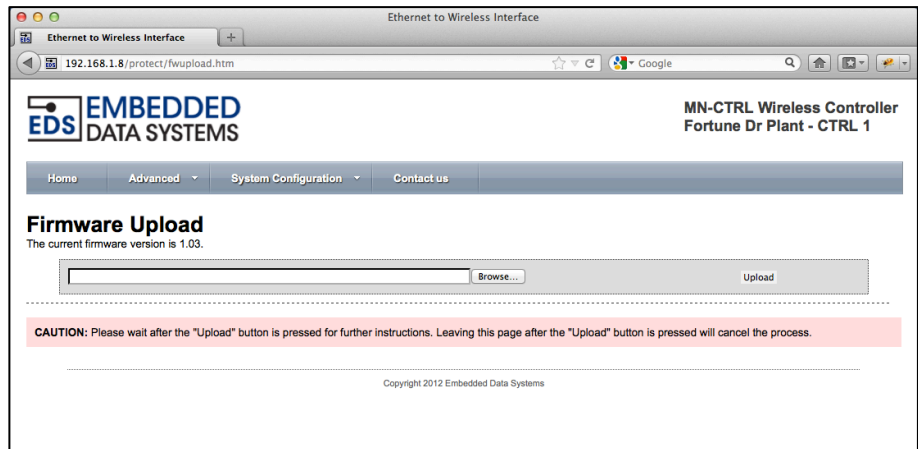
- It can take over 30 seconds to upload the firmware, if successful the following page will display and the MeshNet Controller will automatically write and begin using the new firmware.

- Approximately 10 seconds after the "successful" web page is displayed, the green LED will flash at a 1 second rate, indicating completion.

- Verify the upload was successful by viewing the new version of firmware on the Overview page.

2) **Update the Support files**:

- Open the web-based configuration tool and select the "Network" page from the "System Configuration" menu.

- Scroll to the paragraph near the bottom of the page, beginning with "To upload new firmware *support* data, CLICK HERE". Click the link to begin the procedure

- Click the "Choose File" button to locate and select the *.bin file provided to you by EDS

- Once the file is located, click the "Upload" button

- Once complete, the MeshNet Controller will apply the new file and return the message "Update Successful"

- Select "Site main page" to return to "OVERVIEW" screen

- *NOTE:* Be certain to clear the cache in your web browser; otherwise the new web pages may not be displayed.

Manual Factory Reset

To reset the MeshNet Controller to factory defaults:

1. Be certain power has been removed from the MeshNet Controller

2. Remove the lid of the MeshNet Controller by unscrewing the four corner screws

3. Once lid is removed, with connector panel positioned towards you, locate the two plated drill holes in the lower middle section of the PC board (P3). *See drawing below.*

4. Apply power to the MeshNet Controller

5. Using an appropriate tool (tweezers, paper clip, etc.) short these two pads together until the green LED stops flashing and stays on solidly.

6. Remove the short and replace the top cover. Once you have removed the short from P3, the reset will take less than four seconds to complete.
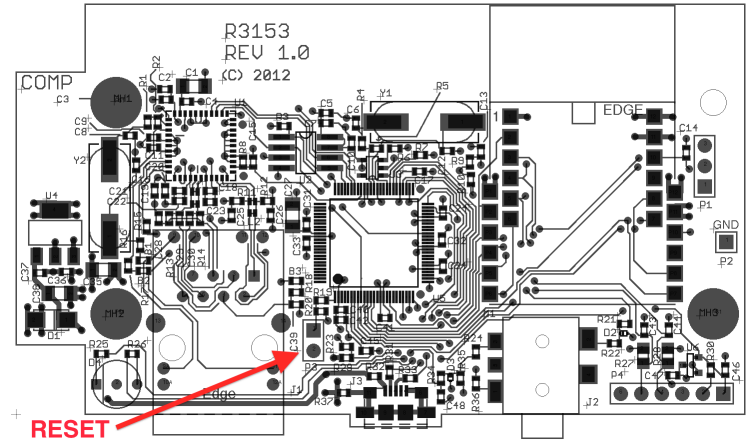
Once reset, the following configuration elements will be returned to their factory settings:

- Device Name: WirelessController-Enet

- Host Name: EDSWIRELESSCTRL

- DHCP Enabled. In the event that a DHCP server is available on the network, the following will be provided automatic configuration data:

    - IP Address: DHCP assigned
    - Gateway: DHCP assigned
    - Subnet Mask: DHCP assigned
    - Primary DNS: DHCP assigned
    - Secondary DNS: DHCP assigned
    - If there is no DHCP server, an internal IP address will be provided. More information about this process can be found in the Setup section of this manual.

- User Name: admin

- Password: eds

Additional Resources

Below is a list of additional resources:
- Supported wireless devices
- EDS Appliance Scanner Software
- Power Supply Requirements
- Ethernet Interface
- Specifications
- Support

Supported Devices

The MeshNet Controller supports the following devices:

- EDS1064 - MN-ENV-T(R) — Temperature Sensor (w/relay)
- EDS1065 - MN-ENV-TH(R) — Temperature and humidity Sensor (w/relay)
- EDS1066 - MN-ENV-TP(R) — Temperature and barometric pressure Sensor (w/relay)
- EDS1067 - MN-ENV-TL(R) — Temperature and light Sensor (w/relay)
- EDS1068 - MN-ENV-THPL(R) — Temperature, humidity, barometric pressure and light Sensor (w/relay)
- EDS2101 - MN-RPTR — Repeater

EDS Appliance Scanner Software

In some instances, it may not be easy to obtain the IP address of a MeshNet Controller via DHCP router tables. Therefore, EDS offers a Java application that will utilize the UDP communication method available on any MeshNet Controller to retrieve the IP address of the MeshNet Controller connected to the network.

This application software can be downloaded at **http://short.eds.bz/apps-edsscanner**. If you have difficulty downloading the software from this link, contact EDS.

Ethernet Interface

The MeshNet Controller is equipped with a standard RJ45 Ethernet jack for 10/100 BASE-T. The half duplex mode of operation is supported on the Ethernet interface. If you are connecting to a hub or switch, a straight through cable should be used. If connecting directly to a PC, then a crossover cable should be used. The Ethernet connector has 2 LEDs; the green indicates connection to the network and the yellow indicates network traffic.

Note: The traffic indicator LED indicates any traffic on the network, not just traffic addressed to the MeshNet Controller. This is a hardware function.

Power Supply Requirements

The MeshNet Controller is fitted with a USB micro-B receptacle suitable for connection to any 5 Volt DC power supply having a USB micro-B plug. The MeshNet Controller has a typical current draw of 245ma with no devices connected; however a power supply with at least 400ma capacity is required for correct operation. The input is reversed voltage protected, although use of a standard micro USB wall transformer such as used to charge cellular phones should avoid any reverse or over voltage issues. The voltage must be 5 Volts +/- 10%. The MeshNet Controller was tested to meet FCC, CSA, CE, and C-check using the Emerson DCH3-050EU-0006 wall power supply. The power input schematic is shown below.
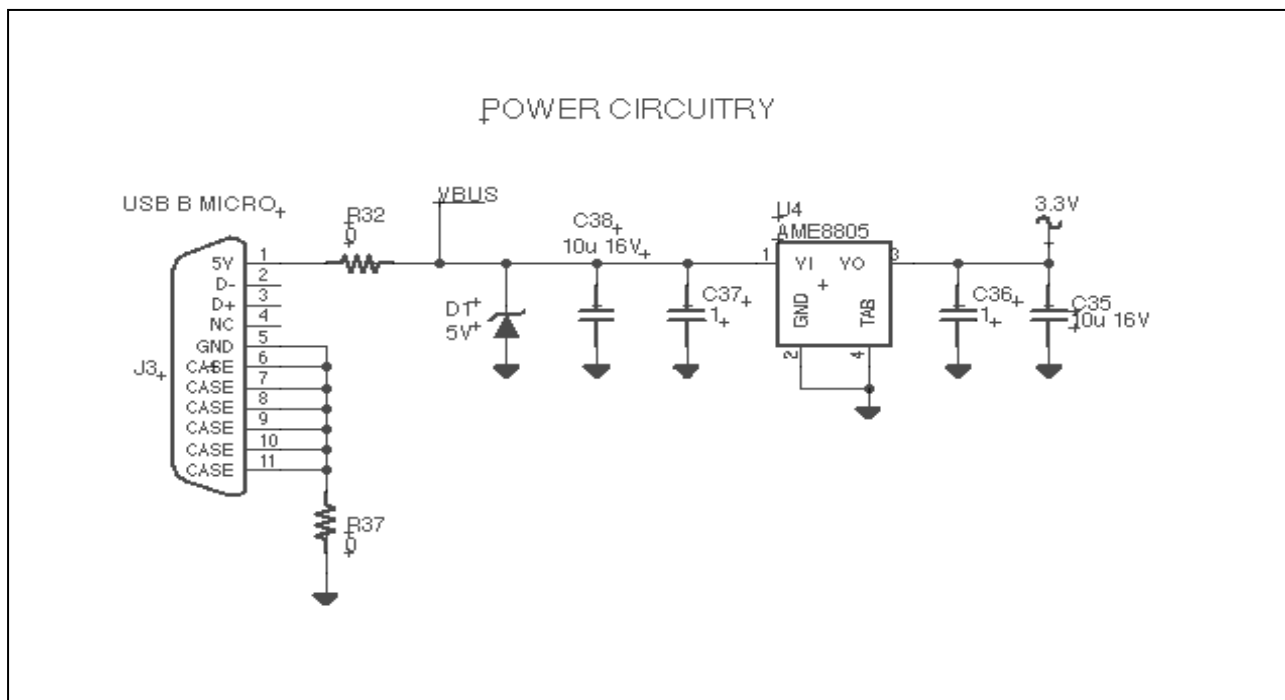
Specifications

PARAMETER	MIN	TYP	MAX	UNITS
Operating Temperature	-40	-	85	°C
Storing Temperature	-40	-	85	°C
Operating Humidity (non-condensing)	0	-	90	%
Storing Humidity (non-condensing)	0	-	90	%
Supply Voltage DC +/-10%	-	5	-	Volts
Rated Current (average)	-	245	-	mA
Communication	10/100Base-T Ethernet			
Enclosure Dimensions (L x W x H)	4.109	2.233	1.594	Inches

Support

Embedded Data Systems provides a comprehensive online support system accessible from their website. This support system includes the most up-to-date information about the MeshNet Wireless Sensor System product family.

Compliance

FEDERAL COMMUNICATIONS COMMISSION (FCC) COMPLIANCE STATEMENT

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

INDUSTRY CANADA (IC) COMPLIANCE STATEMENT

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

EUROPEAN COMMUNITY (EC) DIRECTIVES CONFORMITY

APPLICATION OF COUNCIL DIRECTIVE 2004/108/EC Standard to which Conformity is Declared:

EN 61326-1:2006	(Emmissions)
EN 61326-2-3:2006	(Immunity)
EN 61000-3-2:2006+A1:2009+A2:2009	(Harmonics)
EN 61000-3-3:2008	(Flicker)

Caution: *The manufacturer is not responsible for any radio or television interference caused by using other than recommended cables or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate this equipment.*

Acknowledgements

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Firefox is a registered trademark of Mozilla.