

<http://www.EmbeddedDataSystems.com>

FEATURES

- Wireless communication over the widely accepted 2.4 GHz frequency band
- High power radio (10x Standard MN-ENV Radio)
- Buffer stores up to 1024 readings with time stamps
- Highly accurate Temperature, Humidity, and External Probe Sensors
- Discrete Input with Activity Latch
- Programmable parameters such as transmission rate
- Globally unique 64-Bit EUI (Extended Unique Identifier)
- Supports repeaters enlarging the wireless network and providing additional transmission routes for the sensor data
- Transmission strength reported on all devices, allowing troubled areas to be identified and addressed proactively (e.g. adding Repeaters)
- Robust Communication protocol includes acknowledgements and retries
- Energy efficient design optimizes battery life
- Applications include thermostatic controls, industrial systems, consumer products, thermometers, or any temperature/humidity sensitive system
- Auto adjusts to comply with EU & USA/CA controllers
- *Complies with FCC, Industry Canada and CE Marking requirements*



DESCRIPTION

The **MeshNet External Probe Sensor Line**, MN-ENV-H-THX, offers an innovative way to monitor temperature, humidity, and up to 3 temperature probes. The wall mount sensor features high accuracy temperature and humidity sensors. The product also contains a memory buffer capable of holding 1024 sensor readings, a high power radio with 10x the transmission range of the standard model, and a screw-down terminal which allows up to 3 DS18B20/DS18S20 sensors to be connected as well as a discrete input with an activity latch. Together these features offer an efficient and flexible system for monitoring the humidity and temperature at multiple locations within a facility.

Part Numbers:

TEMPERATURE

TEMPERATURE/EXTERNAL PROBES

TEMPERATURE/HUMIDITY

TEMPERATURE/HUMIDITY/ EXTERNAL PROBES

MN-ENV-H-T (Special Order)

MN-ENV-H-TX (Special Order)

MN-ENV-H-TH (Special Order)

MN-ENV-H-THX

LINKING INSTRUCTIONS

1. Remove the Lid of Enclosure - Lightly depress against the two small (0.5"x 0.625") vented sections on the sides of the enclosure and pull the rear of the enclosure away from the front.
2. Inside will be a screw, which will later be used to secure the enclosure together. Set the screw aside until required.
3. Go to MeshNet Controller's homepage and select System Configuration>Devices.
4. Insert battery into sensor's battery holder.
5. Select the sensor when it appears on the "Unlinked Devices" section of the MeshNet Controllers page.
6. Click "OK" on the popup to link the sensor to the Controller.

7. Confirm sensor moves to “Linked Devices” section. This may take up to 1 minute or longer¹.

MOUNTING SENSOR & WIRING SENSORS/INPUT

1. Remove the battery.
2. Draw the wires through the circular hole in the rear of the enclosure for sensors and discrete input.
3. Mount the rear of the enclosure on the wall using the diagonal slots reserved for the screws.
4. If sensor connections are to be made:
 - a. Strip 3/8” of the wires.
 - b. Securely attach wires to the corresponding screw-down terminals on the terminal block.
 - c. Wiring an OW-TEMP or other DS18B20/DS18S20 based sensor.
 - i. Connect Data (Blue on OW-TEMP) to “OW” Terminal.
 - ii. Connect Ground (White on OW-TEMP) to “GND” Terminal.
 - iii. Connect VDD² (Orange on OW-TEMP) to “3.3V” Terminal.
 - d. Wiring the discrete input – The 2 connections to the discrete input, “GND” and “IN”.
5. Reinsert the battery.
6. Replace the Lid of the Enclosure.
7. Insert the screw into the single screw hole found in the upper left corner of the enclosure.



SYSTEM DESCRIPTION

The MeshNet Environmental Sensor is part of the MeshNet Wireless Sensor System, designed to wirelessly monitor and control real world environmental conditions. The system is completed with the Embedded Data Systems MeshNet Controller (MN-CTRL). The controller communicates directly with the Environmental Sensor and presents all data via Ethernet. The Sensor and Controller communicate with each other using a proprietary protocol and are not compatible with other wireless networks. An optional system component is Embedded Data Systems' MeshNet Repeater (MN-RPT) which is used to extend the range of communication between the Controller and Environmental Sensor.

Controller: Each wireless system contains a MeshNet Controller. The Controller interfaces the wireless system to a local area network (LAN) or the Internet via Ethernet. It manages, reads/writes to the wireless devices, presents the data in easy to use formats such as HTTP and XML, and optionally pushes the data on a timed basis to a HTTP Post server.

Repeater: Repeaters are used to extend the distance a Sensor can be located from the Controller. Many Sensors can communicate with the Controller through a single Repeater. Each Controller can manage up to 7 Repeaters, and there can be 1 Repeater between a Controller and Sensor.

Sensor: The MeshNet Environmental Sensors provide the means to monitor and control real world environmental conditions. They are typically battery-powered devices that wake on a timed basis, take readings, send the readings to the controller, confirm successful transmission, and check to see if any data is waiting for them.

OPERATION

All data from the MeshNet Environmental Sensor is read using a MeshNet Controller. This can be done through HTTP GET, SNMP, and through receiving data pushed via HTTP POST. All data that is retrieved from the Controller programmatically is in XML form. See *the MeshNet Controller Users Manual for more information*. Buffered data is only made available through the HTTP POST interface.

Temperature

¹ The sensor will respond when its next transmission is made. Upon applying power to the sensor, it will transmit every 10 seconds for the first minute then slow to the configured or default rate (1 minute).

² Sensor must have the VDD connected. Units without the VDD connected will read 127.50°C (261.50°F).

Current reading, displayed in °C.

Humidity

Current reading, displayed in percent with a resolution of 0.01% RH.

OW1Value, OW2Value, and OW3Value

This reports the current temperature³ reading with up to 0.0625°C resolution.

Battery

Displays voltage of the battery. **NOTE: In order to conserve power, the battery voltage is read only every 10th time.**

Input 1

Input 1 provides a means of reading a discrete state; this parameter displays the most recent input state.

Activity Latch 1

Changes in the input state are detected by hardware, even when the sensor is sleeping. An Activity Latch State of 1 indicates the state has changed at least once since it was last reset. Sending the Activity Latch reset command will reset the Activity Latch. See *Discrete Input* for more details on using this input.

Input Send

If INPUT SEND is set to 0, input changes are sent every time the sensor wakes up to send other sensor information. If set to 1, all sensor data is sent every time the input changes state (rising or falling edge) and when a timed transmission is due. For example, if the device is programmed to send data every minute, but the input changed after 20 seconds and Input Send is set to 1, then the data will be sent immediately. Then, 40 seconds later the timed send will occur.

OPERATIONAL PARAMETERS

EUI

The EUI, or Extended Unique Identifier, is a globally unique 64-bit number, represented by 16 hexadecimal digits. This number can be used by software to uniquely identify every MeshNet wireless device.

Controller RSSI

This indicates the strength of the radio signal at the Controller; higher numbers equate to stronger signals. Due to hardware limitations, the highest number that can be displayed is -34 dBm. However, the actual signal strength may be much higher.

Device RSSI

This indicates the strength of the radio signal at the Sensor. Due to hardware limitations, the highest number that can be displayed is -34 dBm, however the actual signal strength may be much higher.

Address

This is the address of the sensor, which was assigned by the controller.

Repeater

When the repeater joins the controller, it is assigned a repeater number, which is displayed here. A zero indicates there is no repeater in the communication path.

Health

This is a number ranging from 0 to 7; 0 is not connected and 7 is healthy. The number is incremented when a packet is received from the repeater and decremented when two packets are not received after a predetermined period of time. Numbers less than 7 indicate a weak wireless link or other problem.

OW1Health, OW2Health, and OW3Health

This is a number from 0 to 3; 0 is not connected and 3 is healthy. The number is incremented when a sensor is read.

³ As of firmware version 1.04, only temperature data is reported in the OWxVALUE field.

OW1DataType, OW2DataType, and OW3DataType

This identifies the type of sensor data reported in OWxVALUE field. Only temperature data was supported upon release.

OW1ROMID, OW2ROMID, and OW3ROMID

The unique ROM ID is reported for each attached temperature probe. Note the ROM ID is not cleared when the device is not present (unless a 4th temperature sensor has been connected).

Version

This indicates the firmware version of the sensor.

User Name

The user programmable string used to identify any given Sensor; it may be up to 29 characters long. It is saved in non-volatile memory and so is retained even when power is cycled. The string is best used as a human readable label, which can uniquely identify each MeshNet Environmental Sensor.

Read Counter

Counts the number of times a packet has been sent to the controller. This number has a maximum of 4294967296.

Read / Send Data

Used to define frequency the current sensor readings are transmitted. Larger periods between transmissions will conserve battery power.

At power up, the device sends data packets every 10 seconds for the first 6 packets. After the first 6 packets are sent, the device reverts to sending packets at the Read / Sens Data setting (1 minute by default). This is to facilitate programming in cases where a long read period is desired. Even with very long read periods, simply cycling the power will cause parameters to be written without having to wait for the sensor read period to time out.

Setting	Period
0	5 seconds
1	10 seconds
2	15 seconds
3	30 seconds
4	1 minute
5	2 minutes
6	5 minutes
7	10 minutes
8	15 minutes
9	30 minutes
10	1 hour

Factory Reset

Web (soft reset)

Writing anything to the <FactoryReset> location will return all parameters except for the <UserName> and the Network Key to factory defaults. The sensor read counter must be below 20 or the command is ignored. This parameter is not sent from the sensor to the controller so no data is presented.

Short (hard reset)

All parameters can be reset by shorting the two pads labeled "RST" together. The sensor will detect the short when it wakes up for the next transmission. To speed this up, it is suggested to remove the batteries, wait 30 seconds (to drain capacitors), and then reinsert the batteries before shorting the pads. The LED will blink rapidly once the reset is triggered. Please note the factory reset will move the sensor to its Unlinked state.



WRITE PARAMETERS

In order to conserve power, MeshNet sensors sleep when not reading the sensors or sending data. When sleeping, they cannot receive wireless data. Because of this, writes are queued by the MeshNet Controller and sent when the Sensors are awake.

Writes Pending

The number of writes waiting to be sent to the sensor.

Writes Succeeded

The number of writes that have been receive and acknowledged by the sensor.

Writes Failed

The number of writes that were not able to be sent to the sensor or were not acknowledged.

WIRELESS COMMUNICATIONS

The device communicates at 2.4 GHz via an industry standard 802.15.4 wireless link. Wireless packets are acknowledged, all data is checked for errors using CRC and corrupted data is resent.

DIAGNOSTIC PARAMETERS

The following parameters are provided for diagnostic purposes. Wireless communications are acknowledged and retried if no acknowledgment is received. The parameters below can be used to determine link quality. Wireless performance can be improved with the introduction of MeshNet Repeaters within the wireless network. The repeaters provide sensors additional paths to the controller. Sensors will continue to use an established path until a failed transmission.

Connection Counter

Counts the number of connections to the controller. When a device is first powered, it connects to a controller, obtaining an address and thus belonging to the network. If the signal strength is good and power is not lost at the controller, this number will stay low. A high number could be due to low signal strength, periodic interference or power problems. The maximum is 65535.

Message Attempts

The number of packets attempted to have of been sent. It can be reset and has a maximum of 65535.

Message Packet Retries

The number of times wireless packets had to be resent due to no acknowledgment being received. The maximum is 65535.

Message Failures

When no acknowledgment is received, the packet is resent. After 4 retries, the message has failed. The counter increments when a failure has occurred. The maximum is 65535.

Message Counter Reset

It is used to reset the 3 message counters above to zero.

BUFFERED DATA

The MN-ENV-H-THX includes a 32K byte EEPROM which is capable of storing up to 1024 complete sets of the sensor readings. This memory is used to buffer sensor data when a sensor transmission is not acknowledged. The sets of readings are stored at every send period, but attempts to contact the controller may not happen every send period after a failed transmission. This saves battery power when a short send period is selected. Once a connection with the controller is reestablished, the buffer is emptied. To receive the buffered data from the controller, the POST Client and the "Use Buffer" option must be enabled.

PROGRAMMABLE/WRITEABLE PARAMETER SUMMARY

Parameter	Description	Limitations
UserName	User friendly name for the sensor	29 characters 0-9, A-z, and special characters (space and ".")
ActivityLatchReset	Clears activity latch which allows the next change in discrete input state to be detected	
SensorReadPeriod	Selects the transmission rate (see selectable transmission rates on page 4)	11 transmission rate options
ResetMessageCounters	Resets MessageAttempts, MessagePacketRetries, and MessageFailures to 0.	
InputSend	Enabling (set to 1) configures sensor to transmit when scheduled and when the input state changes.	0 to 1
FactoryReset	Resets all programmable settings except UserName and Network Key.	Only occurs if ReadCounter is below 20.

BATTERY LIFE

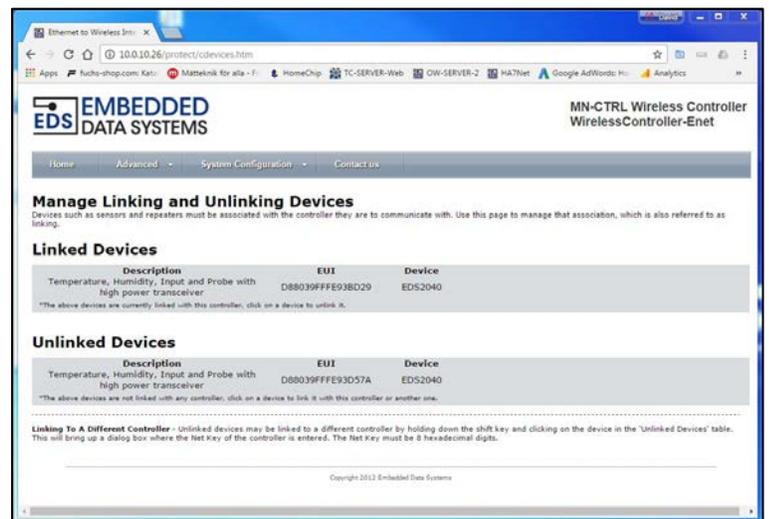
The MeshNet Environmental Sensor spends most of its time in sleep mode; it wakes up to take readings, send data and see if any packets are in the queue to be received. Battery life can be maximized by reading/sending the sensor data as infrequently as possible. Battery life is highly variable on a number of parameters.

1. How often data is read/sent.
2. Number of external sensors connected. Reading the 2nd and/or 3rd external sensor is more energy efficient through the use of the 'Skip ROM' function.
3. Extreme temperatures reduce the useful life of the battery.
4. If the sensor is sending data through a repeater, battery life will be reduced because the sensor has to wait longer for the acknowledgment.
5. If the sensor has to reconnect to the controller frequently, battery life will be reduced. This happens when the signal is low or there is interference.
6. The battery chemistry will affect the performance. Lithium batteries will provide substantially better performance especially in cold environments.
7. Discrete input should be open (high) in its normal state when battery powered. Connecting the input to ground introduces 15.8 microAmps of flow which is approximately 10x sleep current.

In internal testing, Duracell AA batteries were able to power a MN-ENV-H-THX for 6 months at room temperature with a 5 second transmission rate. A transmission rate of 1 minute would increase the expected battery life to 2+ years.

LINKING PROCEDURE (CABLE FREE)

1. **Apply power to the MeshNet Controller.** 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.
2. **Connect the MeshNet Controller 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.
3. **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 and <http://short.eds.bz/apps-edsscanner>. 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.
4. **Navigate to the MeshNet Controller.** Type the IP address of the MeshNet Controller into your web browser (e.g., <http://192.168.1.27>) and press enter. Go to System Configuration>Devices. When the name and password is requested, enter “admin” for the name and “eds” for the password. A page similar to below will appear:
5. **Insert AA batteries into sensor.** Once this is done the sensor will appear⁴ in the “Unlinked Devices” section.
6. **Click the unlinked sensor.** A window will pop up confirming you want to link the sensor. Click “OK”. The sensor will move to the “Linked Devices” section upon its next transmission. (Sensors at power up transmit every 10 seconds for the first minute then they move to the configured transmission rate which is 1 minute by default.)
7. **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.***

EDS ENVIRONMENTAL SENSOR IDS

ID	Features
EDS1064	Temperature
EDS1065	Temperature & humidity
EDS1066	Temperature & barometric pressure
EDS1067	Temperature & light
EDS1068	Temperature, humidity, barometric pressure, & light
EDS2040	Temperature, humidity, external probe support, memory buffer, & high power radio

⁴ Previously linked MeshNet sensors (which were not unlinked) will not appear. A hard reset (page 4) should be performed to move the sensor into an unlinked state.

EDS REPEATER DEVICE IDS

ID	Features
EDS2101	MeshNet Repeater with high power radio

SPECIFICATIONS

PARAMETER	MIN	TYP	MAX	UNITS
Operating Temperature Range	-40	-	85	°C
Internal Sensor Temperature Accuracy -10 to +85°C	-0.4	±0.3	+0.4	°C
Internal Sensor Temperature Accuracy -40 to +85°C	-0.9	±0.7	+0.9	°C
Internal Sensor Temperature Resolution	-	0.01	-	°C
Long Term Stability (Internal Temperature)	-	≤ 0.01	-	°C/Year
External DS18B20 Temperature Accuracy -10 to +85°C	-0.5	-	0.5	°C
External DS18B20 Temperature Accuracy -55 to +125°C	-2.0	-	+2.0	°C
External DS18B20 Temperature Resolution	-	0.0625	-	°C
Operating Humidity Range (note 2)	0	-	100 (Non-Condensing)	%RH
RH Accuracy: 0% RH to 80% RH (note 2, 4, 5) at 30°C	-3	±2	+3	%RH
RH Accuracy: 80-100% RH	-4.5	±3	+4.5	%RH
RH Resolution	-	0.01	-	%RH
Humidity Drift vs Temperature	-	±0.05	-	%RH/°C
Long Term Stability (Humidity)	-	≤0.05	-	%RH/Year
Supply Voltage (battery in series)	2.2	-	3.1	Volts
Sleep Current	-	1.17	-	uA
Battery voltage reading accuracy (note 1)	-1.2	-	+1.2	%
Discrete input voltage (note 7)	-48	-	+48	Volts
Discrete input low threshold (note 3)	0.435	-	0.54	Volts
Discrete input high threshold (note 3)	1.525	-	1.7	Volts
Enclosure Dimensions (L x W x H)	80	80	21	Mm

Notes:

1. The battery voltage varies depending on how much current is flowing. When the sensor is sleeping, the voltage is higher than when it is awake. The reading is taken when the sensor is awake.
2. Recommended humidity operating range is 20% to 80% RH (non-condensing) over -10 °C to 60 °C. Prolonged operation beyond these ranges may result in a shift of sensor reading, with slow recovery time.
3. Discrete input voltages are ratiometric, based on the battery voltage. The input low voltage maximum equation is $0.15 * V_{bat}$, the input high voltage minimum equation is $0.25 * V_{bat} + 0.8$.
4. Excludes hysteresis, long term drift, and certain other factors and is applicable to non-condensing environments only.
5. Drift due to aging effects at typical room conditions of 30 °C and 30% to 50% RH. May be impacted by dust, vaporized solvents or other contaminants, e.g., out-gassing tapes, adhesives, packaging materials, etc.
6. The sensors are designed to monitor a dry contact. R11 must be removed if power is on the discrete input.

Discrete Input

The discrete input circuit can have additional components to suit the intended application. If it is used to monitor contact closure, then it may require a pull up or pull down resistor and capacitor to remove contact bounce. If it is used to count pulses (such as from a flow meter) a capacitor may not be required to remove contact bounce, or if one is required, the value can be modified so the pulses are still present at maximum frequency.

Regulatory 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	(Emissions)
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.*