

SensHub Wireless EnOcean Interface

Version 1.0
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LEhigh

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TECHNICAL INQUIRY

The dimming system consists of electrical and electronic components which could cause electrical shock if tampered with. Only individuals experienced with electrical and electronic equipment should remove the panels or attempt to service this system.

All questions regarding this equipment should be referred to:

Lehigh Electric Products Company
6265 Hamilton Boulevard
Allentown, PA. 18106-9789
Phone 610 395-3386
Fax 610 395-7735

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1 Introduction

SensHub is an EnOcean sensor gateway into Lehigh's control systems: EFlex and Solitaire/DTM. After EnOcean sensors are 'linked' to SensHub, sensor data is passed on to the control system.

There are three variants of SensHub

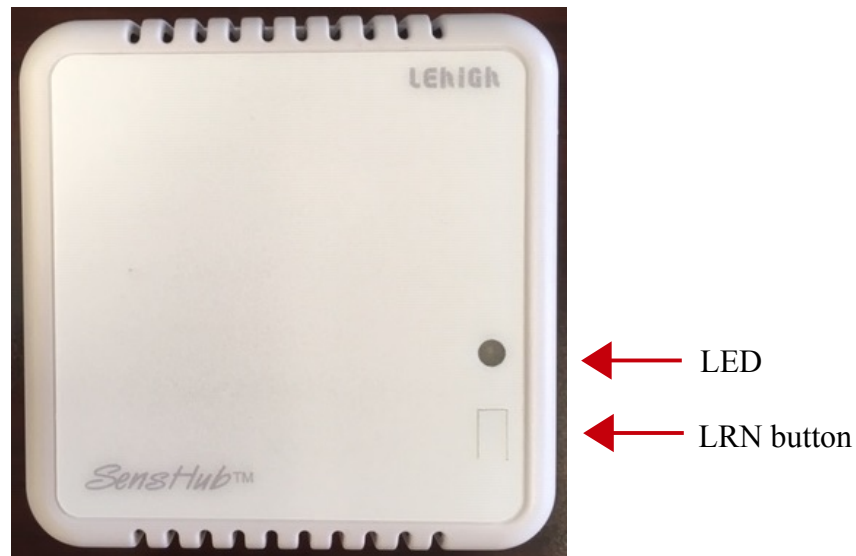
1. SensHub for EFlex – this is an EnOcean sensor gateway into the EFlex control system.
2. SensHub for Solitaire/DTM – this is an EnOcean sensor gateway into the Solitaire/DTM control system.
3. SensHub Repeater – this extends the range of sensors for EFlex and Solitaire/DTM.

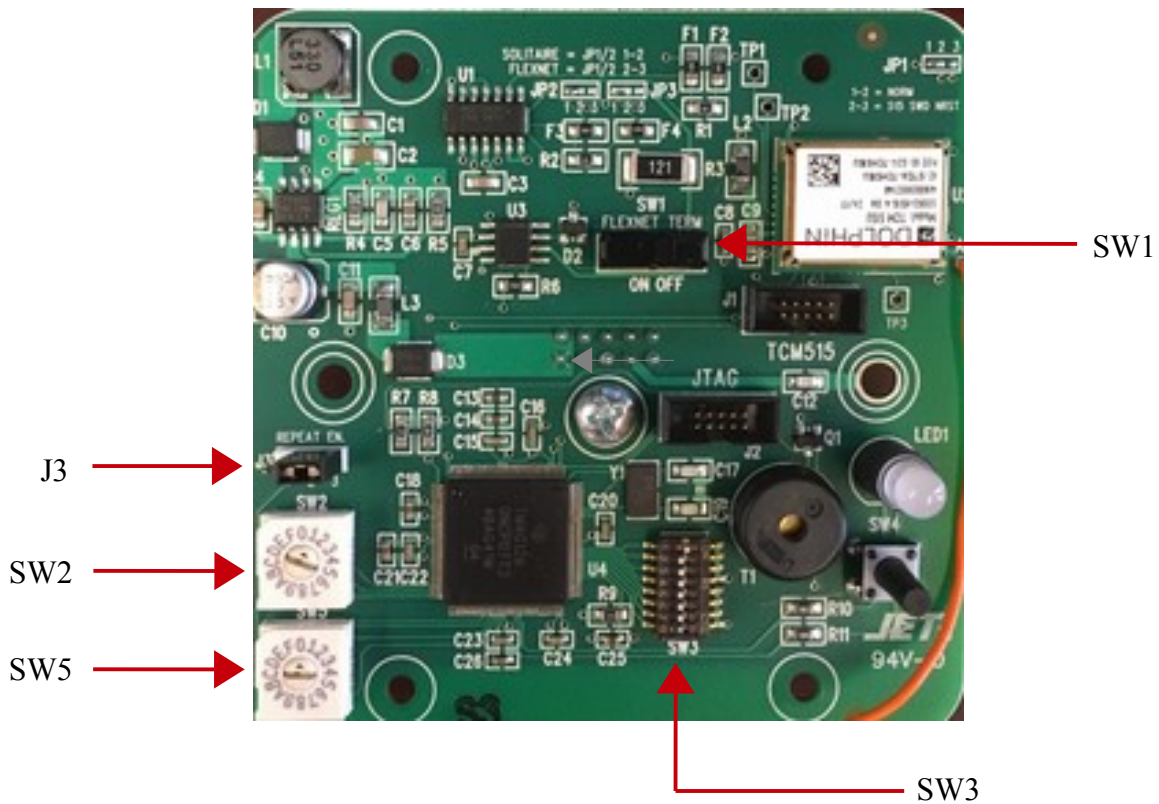
SensHub works with EnOcean occupancy sensors with EnOcean Equipment Profile (EEP) A5-07-01, and with light level sensors with EEP A5-06-02. Up to 10 occupancy sensors and 10 light level sensors (8 and 8 for Solitaire/DTM) can be linked to SensHub.

Linking is the process of assigning sensors to SensHub. Linking can be done manually, using buttons and LEDs at SensHub and the sensors. Sensors can also be easily linked and set up remotely using Lehigh's EOConfig Windows application with an EnOcean USB gateway (USB300U).

2 How to use

2.1 Buttons and switches





- LED – indicator for Link Mode (section 2.2), Test Mode (section 2.5)
- LRN button – press to start/stop Link Mode (section 2.2) for 'learning' sensors
- SW1 – slider switch for terminating EFlex (section 5.1.3)
- J3 – mode selection jumper
 - across 1-2 Test Mode (section 2.5)
 - across 2-3 normal operation
- SW2 – assignment rotary switch
 - for EFlex (section 5.1.2)
 - for Solitaire/DTM (section 5.2.1)
- SW5 – parameter rotary switch (section 4)
- SW3 – DIP switches (1 = ON/up, 0 = OFF/down)
 - DIPs 1-7 for EFlex (section 5.1.1)
 - DIPs 1-8 for Solitaire/DTM (section 5.2.2)
 - DIP switch #1 for Repeater setup (section 3.3)

2.2 Link a sensor

- Ensure that the parameter rotary is set as required (section 4).
- Ensure that the DIP switches and assignment rotary are set as required (section 5).
- Press the LRN button. The LED will blink, alternating red and green, while SensHub is in Link Mode. Link Mode will end automatically after 30 seconds if no sensors are linked or unlinked.
- Press the Link or Menu button on an unlinked sensor (the button without the line on it). SensHub will short-beep and its LED will be solid green for 4 seconds. When the LED goes off, another sensor can be linked/unlinked.
- Press the LRN button again to end Link Mode. The LED will be off.
- If linking fails, SensHub will long-beep and its LED will fast-blink red a few times. Linking will fail if:
 - the assignment rotary setting is invalid
 - the assignment rotary is set for an assignment that is already in use.
 - the maximum number of sensors of this type have been linked.
- If the LED is solid red instead of green, that means the sensor was already linked and you have just unlinked it. Press the Link or Menu button on the sensor again to link it.

2.3 Unlink a sensor

- Press the LRN button, it will blink, alternating red and green, while SensHub is in Link Mode. Link Mode will end automatically after 30 seconds if no sensors are linked or unlinked.
- Press the Link or Menu button on a linked sensor (the button without the line on it). SensHub will short-beep and its LED will be solid red for 4 seconds. When the LED goes off, another sensor can be linked/unlinked.
- Press the LRN button again to end Link Mode. The LED will be off.
- If the LED is solid green instead of red, that means the sensor was already unlinked and you have just linked it. Press the Link or Menu button on the sensor again to unlink it.

2.4 Unlink all sensors, set to factory defaults

- Press and hold the LRN button for 10 seconds. After that, SensHub will short-beep and its LED will be solid red for 10 seconds. No sensors can be linked or unlinked during this time.

2.5 Test Mode

In Test Mode, SensHub will short-beep and transmit an EnOcean message every time the LRN button is pressed. Input from sensors is ignored. To begin Test Mode, position jumper J3 across pins 1 and 2. The LED will be red. To end Test Mode, put the jumper across pins 2 and 3.

Use Test Mode with Lehigh's EOSniffer Windows application to see the name and EnOcean ID of SensHub, and read the strength of all received signals. EOSniffer is part of Lehigh's EnOcean Sensors software package and can be downloaded from www.lehighdim.com. A Windows 7 or later computer with an EnOcean USB gateway (USB300U) is required.

3 Functional behavior

3.1 *With occupancy sensors*

SensHub receives information from linked occupancy sensors and reports this to the control system (EFlex or Solitaire/DTM). When there is motion, 'occupied' is reported right away to the control system so that lights may be turned on. 'Vacancy' is reported after a period of time when there is no motion – this is called 'vacancy delay' and is determined by the occupancy sensor parameters (section 4.1). A report of 'vacancy' typically causes the control system to turn off lights.

When an occupancy sensor is linked (section 2.2), it is assigned to an identifier in the control system (section 5). This assignment associates a physical sensor with a sensor in the control system configuration. For example, an occupancy sensor could be assigned to:

- Eflex: device #5, offset #0
- Solitaire/DTM: port occ2

EFlex only: Multiple occupancy sensors may have the same assignment. These are handled as a group. Grouped occupancy sensors report 'occupied' to EFlex when any one of them detects motion, and report 'vacant' when all of them detect no motion.

Refer to the sensor installation instructions for details on sensor placement and usage.

3.2 *With light level sensors*

SensHub receives information from linked light level sensors and reports this to the control system (EFlex or Solitaire/DTM) according to the light level parameters set for the sensor (section 4.2).

SensHub dims lights at the control system based on the 'dimming mode' of the sensor parameters:

- Continuous dimming – Uses a five-point dimming curve, as explained in section 4.2.1.
- Two-level dimming – Lights are turned on or off based on the light level reported from the sensor, as explained in section 4.2.2.

When a light level sensor is linked (section 2.2), it is assigned to an identifier in the control system (section 5). This assignment associates a physical sensor with a sensor in the control system configuration. For example, a light level sensor could be assigned to:

- Eflex: device #5, offset #1
- Solitaire/DTM: port day2

Light level sensors should be located facing a window or skylight, with minimal influence from artificial light. Refer to the sensor installation instructions for more details on sensor placement and usage.

3.3 *As a repeater*

The repeater variant of SensHub is used to extend the radio range of sensors for EFlex and Solitaire/DTM. Place a SensHub Repeater between the control system's SensHub and the out-of-range sensors. SensHub Repeater does first level (level 1) repeating – repeating only original telegrams.

SensHub Repeater can be setup to repeat all telegrams or to only repeat telegrams from linked sensors. Typically, SensHub Repeater is used to repeat only linked sensors, the ones that are out of range from the control system's SensHub. The link and unlink process is the same as the control system's SensHub (sections 2.2, 2.3) except that the sensor assignment and parameter settings (SW2, SW5) do not matter.

SW3 DIP switch #1*	Repeat action
0	Repeat all telegrams
1	Only repeat telegrams from linked sensors (recommended)

* Power up after changing the switch position.

4 Sensor Parameter Setup

When a sensor is linked to SensHub it is assigned a set of parameters determined by the parameter rotary switch, SW5. This switch can be set each time a sensor is linked. Sensor parameters can be viewed and easily changed in the EOConfig Windows application (section 6). EOConfig also allows for more choices in parameter settings.

Sensor parameters do not apply to the SensHub Repeater.

4.1 Occupancy sensor parameters

Vacancy delay – when there is no motion, this is how long to wait before reporting vacancy. Rotary switch options are:

- Short: 2.5 minutes
- Medium: 5 minutes
- Long: 15 minutes

Use rotary switch SW5 to select the vacancy delay before linking a sensor (section 4.3). Use EOConfig Windows application (section 6) to view and change the vacancy delay of linked sensors, an exact value can be set with EOConfig.

4.2 Light level parameters

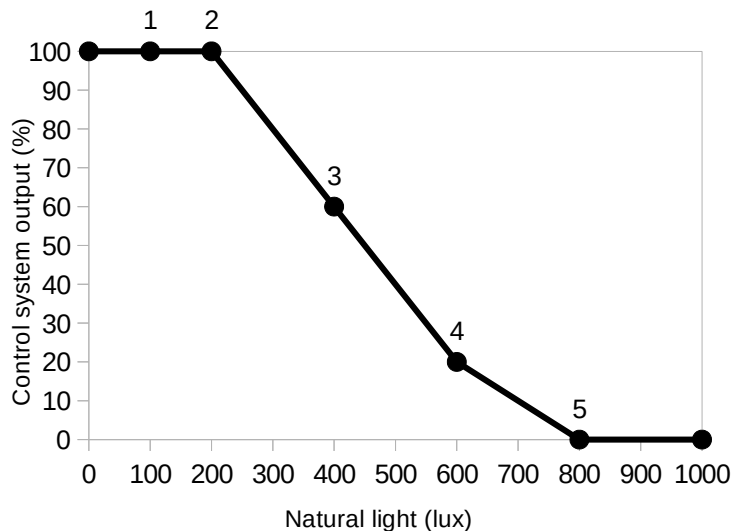
Dimming mode – Determines how SensHub reports light level changes from the sensor to the control system. Options are:

- Continuous dimming – SensHub reports changes based on a five-point dimming curve. This results in smooth dimming by the control system.
- Two-level dimming – SensHub will cause the control system to turn lights on or off based on two set points.

Use rotary switch SW5 to set the light level parameters before linking a sensor (section 4.3). Use EOConfig Windows application (section 6) to view and change these parameters.

4.2.1 Continuous dimming parameters

Each of the five points in the dimming curve defines the percentage of output from the control system based on how much light the sensor receives. More natural light reported from a sensor results in less artificial light being output by the control system. The default dimming curve (normal dimming) is shown below.



Output percentage beyond the first and last point is an extension of those points. Linear interpolation is used to determine the output percentage between points. Ramp speed determines how quickly output percentage changes.

Curve points – map the lux level received from the sensor to the light output percentage from the control system. Rotary switch options:

- Normal dimming
 - Lux level = 100, 200, 400, 600, 800
 - Output % = 100, 100, 60, 20, 0
- Less dimming
 - Lux level = 200, 300, 500, 700, 900
 - Output % = 100, 100, 60, 20, 0

Ramp speed between points – Rotary switch options:

- Normal: 1% per second
- Fast: 3% per second

The above parameters are set with rotary switch SW5 before linking a sensor (section 4.3). Use EOConfig Windows application (section 6) to create a custom dimming curve and to vary the ramp speed between points.

4.2.2 Two-level dimming parameters

Two-level dimming is based on thresholds. The control system will turn on lights when the natural light drops below the On threshold. Lights will turn off when the natural light reaches the Off threshold. There should be a hysteresis between the 2 thresholds to avoid too much switching. The ramp speed determines how quickly lights will fade up or down.

On & Off thresholds – Rotary switch options:

- Medium: On: 200 lux, Off: 400 lux
- High: On: 300 lux, Off: 500 lux

Ramp up & down speeds – Rotary switch options:

- Normal: 20% per second
- Slow: 10% per second

The above parameters are set with rotary switch SW5 before linking a sensor (section 4.3). Use EOConfig Windows application (section 6) to set these parameters to exact values.

4.3 Rotary SW5 parameter settings

Rotary SW5	Occ sensor	Light level sensor	
	Vacancy delay (4.1)	Continuous dimming: (4.2.1) Dimming/Ramp speed	Two-level dimming: (4.2.2) On & Off thresholds/Up & Down speed
0	Medium	Normal/Normal	
1	Long	Normal/Fast	
2	Short	Less/Normal	
3	Medium	Less/Fast	
4	Medium		Medium/Normal
5	Medium		Medium/Slow
6	Medium		High/Normal
7	Medium		High/Slow
8-F	Medium	Normal/Normal	

5 Sensor Assignment Setup

When a sensor is linked to SensHub it is assigned to an identifier in the control system. The assignment is set with rotary switch SW2 and the DIP switches. Assignment can be automatic (recommended) or it can be explicit, as described below for each control system. Most sensor assignments can be viewed and easily changed in the EOConfig Windows application (section 6).

Sensor assignment does not apply to the SensHub Repeater.

5.1 For EFlex

Sensors are identified to EFlex by the device ID of SensHub and the sensor offset number. The device ID must be set with DIP switches 1 through 7. The offset is set with the assignment rotary. The offset can be viewed and changed in the EOConfig Windows application (section 6).

5.1.1 Set the device ID with DIP switches 1-7

Device number	DIPs 1234 567
1	1000 000
2	0100 000
3	1100 000
4	0010 000
5	1010 000
6	0110 000
7	1110 000
8	0001 000
9	1001 000
10	0101 000
11	1101 000
12	0011 000
13	1011 000
14	0111 000
15	1111 000
16	0000 100
17	1000 100
18	0100 100
19	1100 100
20	0010 100
21	1010 100
22	0110 100
23	1110 100
24	0001 100
25	1001 100
26	0101 100
27	1101 100
28	0011 100
29	1011 100
30	0111 100
31	1111 100
32	0000 010
33	1000 010
34	0100 010

Device number	DIPs 1234 567
35	1100 010
36	0010 010
37	1010 010
38	0110 010
39	1110 010
40	0001 010
41	1001 010
42	0101 010
43	1101 010
44	0011 010
45	1011 010
46	0111 010
47	1111 010
48	0000 110
49	1000 110
50	0100 110
51	1100 110
52	0010 110
53	1010 110
54	0110 110
55	1110 110
56	0001 110
57	1001 110
58	0101 110
59	1101 110
60	0011 110
61	1011 110
62	0111 110
63	1111 110
64	0000 001
65	1000 001
66	0100 001
67	1100 001
68	0010 001

Device number	DIPs 1234 567
69	1010 001
70	0110 001
71	1110 001
72	0001 001
73	1001 001
74	0101 001
75	1101 001
76	0011 001
77	1011 001
78	0111 001
79	1111 001
80	0000 101
81	1000 101
82	0100 101
83	1100 101
84	0010 101
85	1010 101
86	0110 101
87	1110 101
88	0001 101
89	1001 101
90	0101 101
91	1101 101
92	0011 101
93	1011 101
94	0111 101
95	1111 101
96	0000 011
97	1000 011
98	0100 011
99	1100 011
100	0010 011

5.1.2 Set the sensor offset with assignment rotary SW2

Use SW2 to assign an offset number to the next linked sensor. The Automatic setting means that sensors are assigned an offset number in the order in which they are linked, per sensor type. For example, the first linked occupancy sensor will be offset 0, the next one will be offset 1. If a sensor is unlinked, its offset number is free and will be reused the next time a sensor is linked.

Multiple occupancy sensors with the same offsets will be handled as a group. Grouped occupancy sensors report 'occupied' when any one of them detects motion and report 'vacant' when all of them detect no motion. Light level sensors must have unique offsets.

Rotary SW2	Offset
0 - 9	0 - 9
A	Automatic
B - F	invalid

5.1.3 Set as terminator with SW1

Set SW1 to 'ON' if this device is the terminating device.

5.2 For Solitaire/DTM

Sensors are identified to Solitaire/DTM by a 'port '. Occupancy sensors require an additional area number. The port is set with the assignment rotary. Area numbers are set with DIP switches. Port numbers and area numbers can be viewed and changed in the EOConfig Windows application (section 6).

5.2.1 Set the port with assignment rotary SW2

Use SW2 to assign a port to the next linked sensor. The Automatic setting means that ports (and occupancy sensor areas) are assigned in the order in which they are linked, per sensor type. For example, the first linked occupancy sensor will be occ1 in area 1, the next one will be occ2 in area 2. The first linked light level sensor will be day1, the next one will be day2. If a sensor is unlinked, its port is free and will be reused the next time a sensor is linked. Every sensor must have a unique port assignment.

Rotary SW2	Occupancy sensor port	Light level sensor port
0	occ1	day1
1 - 8	occ1 - occ8	day1 - day8
9	invalid	invalid
A	Automatic	Automatic
B - F	invalid	invalid

5.2.2 Set the occupancy sensor area number with DIP switches 1-8

Only occupancy sensors have an area number. If the port assignment is not Automatic, use DIP switches 1-8 to set the area assignment of the next occupancy sensor to be linked. The area assignment corresponds to the DIP switch number, as shown below. Only 1 DIP switch can be in the ON position.

DIPs 1234 5678*	Occ Area number*
1000 0000	1
0100 0000	2
0010 0000	3
0001 0000	4
0000 1000	5
0000 0100	6
0000 0010	7
0000 0001	8

*Only when port assignment is not Automatic

6 EOConfig Windows application

The EOConfig Windows application lets you create, modify, and store a sensor configuration for SensHub. The sensor configuration consists of linked sensors and their parameters and assignments. Sensors can be added or removed from the list of linked sensors. Linked sensors can be named and assigned to a control system identifier. Sensor parameters can be set explicitly and copied to other sensors. SensHub itself can be named as part of the configuration – making it easier to manage more than one SensHub.

A new sensor configuration can be created entirely in EOConfig. Sensors can be linked by pressing the 'link' button on the sensors. Linking can also be done manually, by entering the sensor ID directly into the configuration.

An EnOcean USB gateway (USB300U) is required to transfer the sensor configuration to and from SensHub. EOConfig is part of Lehigh's EnOcean Sensors software package and can be downloaded from www.lehighdim.com. Also included is EOSniffer, used to 'see' EnOcean messages and measure their received signal strengths. All EnOcean applications run on a Windows 7 or later computer.

To simplify sensor installation:

Use EOConfig before installing the sensors. Ensure that the sensor's batteries are charged (a green LED will blink when you press the Link button, the one without the line on it), and have them nearby. Run EOConfig and add each sensor, pressing the sensor Link button to get its ID into the configuration. Name the sensor so it is easy to identify later. Assign the sensor to the control system and adjust its parameters if necessary, then send the configuration to SensHub. Keep the

configuration file as a record of your work. Use this to make future adjustments. Even if sensors are linked manually, you can read the current configuration from SensHub and store that for safe keeping.

7 Installation

7.1 Planning

Refer to Application Note AN001 from EnOcean GmbH for details on wireless range planning (available at www.enocean.com). SensHub receives telegrams from the sensors. Refer to the sensor's installation instructions for details on sensor placement and installation. The following is a summary of guidelines to follow.

- When installing SensHub, take care not to damage the radio antenna, the wire that runs along the outside of the circuit board.
- Install SensHub at least 20 inches away from another transmitter (e.g., wireless LAN) or high-frequency source of interference (e.g., computer, A/V equipment).
- Install SensHub at least 4 inches away from a wall corner or concrete ceiling.
- Do not install SensHub on the same plane (wall or ceiling) as the sensors.
- The wireless range varies depending on construction materials and obstacles. SensHub should be no more than 80 feet away from the sensors. Use a SensHub Repeater as needed.
- To check the received signal strength of sensors at various locations, use a portable Windows computer with a USB300U EnOcean gateway and Lehigh's EOSniffer application, part of Lehigh's EnOcean Sensors software package (section 6). Run EOSniffer and connect to the USB gateway, then press any button on the sensor to force it to transmit. Read the received signal strength in EOSniffer. It should be between -23 dBm and -98 dBm. Received signal strength approaches 0 as it gets stronger.