Environment Sensor

Installation Manual



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1. Environment Sensor Features

Cascoda's KNX IoT Environment Sensor provides environment measurements compliant to the Indoor Environmental Quality (IEQ) provisions of the EU Energy Performance of Buildings Directive (EPBD).

It is battery powered and includes a high-resolution E-Paper display and GUI users, installers, configuration settings & QR Code, and to show current environment values.

Measures the following environmental variables:

- Temperature
- Relative Humidity
- Atmospheric Pressure
- Carbon Dioxide (CO2)
- Volatile Organic Compound (VOC) Index

Other features:

- Wireless Thread, sleepy end device, using Chili2S with Industry leading receive sensitivity
- Immediate wake on button press
- Battery charge status indicator for any chemistry
- 10 minute measurement cycle (configurable with ETS)
- Menu options for showing overview, Temperature, Relative humidity, Atmospheric Pressure, Carbon Dioxide (CO2) and Air Quality Index
- Language options for English, French, German, Italian and Spanish
- Configurable with ETS6.3 or later

Specification:

- High-resolution E-Paper display
- Wall or panel mount options
- Dimensions 135 x 75 x 23mm
- Battery powered (3 AA)
- 5-year battery life on Alkaline (LR6)
- 6-year battery life on Lithium (FR6)

2. General information

2.1. Document Version information

This manual is amended periodically and will be brought into line with new software releases. The change status (date) can be found in the contents header. If you have a device with a later software version, please check <u>www.cascoda.com</u> to find out whether a more up-to date version of the manual is available.

2.2. Used Terms

Sign	Description
DANGER!	Indicates an immediately hazardous situation which will lead to death or severe injuries if it is not avoided.
CAUTION!	Indicates a potentially hazardous situation which may lead to trivial or minor injuries if it is not avoided.
WARNING!	Indicates a situation which may lead to damage to property if it is not avoided.
NOTE!	Indicates a situation which may lead to possible (known) side effects.

2.3. Safety instructions

CAUTION! Risk of explosion if an incorrect battery is installed. Use consumer grade, non-rechargeable alkaline, zinc-carbon or lithium batteries.

CAUTION! The product is only suitable for mounting at heights of less or equal than 2 meters.

2.4. Issues

Questions about the product?

You can reach the technical service of Cascoda under Tel. +44 (0)2380 638 111 or <u>support@cascoda.com</u>.

We need the following information to process your service request:

- Type of appliance (model name or item number)
- Description of the problem
- Serial number or software version
- Source of supply (dealer/installer who bought the device from Cascoda)

For questions about KNX functions:

• Version of the device application

• ETS version used for the project

2.5. Contact information

info@cascoda.com Threefield House, Threefield Lane, Southampton, SO14 3LP, UK

3. Technical Information

3.1. Storage Conditions

Parameter	Min	Тур	Max	Unit
Storage Temperature	-25		70	°C
Storage Humidity	0		65	%RH

3.2. Operating Conditions

Parameter	Min	Тур	Мах	Unit
Operating Temperature	0		50	°C
Supply Voltage	3.1	4.5	5.5	۷

The device is supplied by 3x 1.5V AA Batteries (LR6 or FR6), non-rechargeable.

Parameter Condition		Min	Тур	Мах	Unit
Wakeup Interval			10		Minutes
Battery Life	LR6 Alkaline			5	Years
	FR6 Lithium			6	Years

3.3. Sensor information

3.3.1. Sensor Measurement Ranges

Parameter	Min	Тур	Max	Unit
Temperature	0		50	°C
Humidity	0		100	%RH
Atmospheric Pressure	300		1250	hPa
CO2	400		5000	ppm
VOC Index	1		500	Index Points

3.3.2. Sensor Accuracy

Parameter Condition Absolute Accuracy RMS Noise U	Unit
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Parameter	Condition	Absolute Accuracy	RMS Noise	Unit
Temperature Over entire Range		±0.2	0.03	°C
Humidity Over entire Range		±1.8	0.08	%RH
Atmospheric Pressure	Over entire Range	±0.5	0.08	hPa
CO2	@400 ppm	±62	28	ppm
	@1000 ppm	±80	37	ppm
	@2000 ppm	±110	48	ppm
	@5000 ppm	±500	98	ppm
VOC Index	Over entire Range	±15	2	Index Points

Note: The VOC Index measurement requires 24 hours of initialisation time for calibration. However, events will be detected during this period.

3.4. Radio Specification

Protocol: KNX-IoT over Thread

MAC Protocol: IEEE 802.15.4

Configuration: 2.4 GHz, O-QPSK, 250 kbps, Channels 11-26

Parameter	Min	Тур	Max	Unit
Frequency Range	2405		2480	MHz
Transmit Power	0		9	dBm

4. Physical placement of the Environment Sensor

The Environment sensor can measure the environment in a specific place/room. Although the device is designed to be non stationary, e.g. can be moved around. The placement of the device is still important, since it can influence the measurements.

Selection for a spot:

- Not in place having direct sunlight.
- Not in a place that has draft.
- Not in a place that is obscured.

For example do not place the device:

- Next to a door.
- Next to a window that can be opened.
- Next to or above a heat source (radiator).
- Behind a curtain.

Since the device is a radio based device, the device should not be put in a metal surrounding. For example a metal filing cabinet. The device should be in range of its parent (router) node, so that it is able to send the measurements over the Thread network. For the best reliability and battery life, please use the Connectivity page to ensure that the environment sensor has an average received RSSI value of at least -85dBm, or ideally - 80dBm.

4.1. Wall mounting

To install the environment sensor on a wall the following bracket is supplied:





The sizes are in [mm]. When the bracket is installed the environment sensor can be clicked on the device.

Attach to the wall using four self-tapping flat-headed M3 screws with head not larger than 6mm in diameter & 3mm in height. The ideal length of the screw varies depending on the type of wall it is being installed into, but it must be at least 6mm long. A wall anchor may also be required depending on the wall material.

4.2. Device size

The following diagram is showing the size of the device. The sizes are in [mm].



Fig 2: Device sizes

Note that the 23.5 mm is without the wall bracket.

5. Configuration

5.1. Device Startup

The device is start up when the batteries are inserted. The batteries can be inserted when the battery cover is removed at the back of the device. The size of batteries are **AA**.



Fig 3: Battery Cover

5.2. System Menu

The Environment Sensor has a build in Graphical User interface (GUI). The Buttons are used to navigate between the different pages of the GUI. The relevant part of the GUI is **System Menu**.

The navigation in the **System Menu** is depicted as follows:





Fig 4: System Menu

NOTE! A,B,C,D are referring to the buttons on the device.

For the commissioning the following pages are important:

• QR codes

This page shows the QR code as explained above

• Connection

All the information in the Connection page is updated in real time. The Connection page shows whether the Environment Sensor is connected to the Thread network. When connected to the Thread network then the Environment Sensor pings its parent in the © Cascoda Ltd. 2025, All Rights Reserved.

network. Hence this information can be used to see where the device is located in the network. The information shown is the following:

- Serial number
 - This is KNX terminology. This number is assigned to each device before leaving the factory. It allows writing or reading the individual address of a device without having to press the programming button of the device. This is supported in ETS 6 versions.
- Individual Address (15.15.255 means not configured)
 - Described in section about the Connection screen.
- EUI-64 of the device
 - This is Thread terminology. It stands for 64-bit Extended Unique Identifier, and it uniquely identifies a device's Thread interface.
- RLOC16 of the device
 - This is Thread terminology. It is a 16-bit encoding for the Routing Locator (RLOC), which identifies the location of a Thread interface within a Thread Network Partition. For example, if a "Child" becomes a "Router", its RLOC16 will change. Or, if a "Child" changes parents, then its RLOC16 might change as well.
- Individual Address (15.15.255 means not configured)
 - This is KNX terminology. The individual address is assigned to a device upon downloading a configuration with ETS. It uniquely identifies the device in a KNX installation.
- Role of the device
 - This is Thread terminology. The role indicates whether the device is a Child, a Router, or a Leader.
- Information about how many ping requests were sent, and how many replies were received. Note that the number of replies received may be greater than the number of requests sent. This is because the ping requests are multicast to all nodes on the network. If the number of replies is less than the number of requests, it means that the device is not well connected to the Thread network.
- RSSI of the last received message from the parent, and LQI
 - RSSI stands for Received Signal Strength Indicator, and it is a measure of the power present in the received radio signal. So by looking at this value, you are able to determine how good the signal strength is between the device and its parent. The higher the number (closer to 0) the better, and as a rule of thumb, see the table below for an indication of how to interpret the values.
 - LQI stands for Link Quality Indicator. It is a number between 0 and 3 that indicates how good the link is between a device and its parent. 0 is the worst, and 3 is the best. In practice, any link quality below 3 is an indicator of a bad and unreliable link.



Fig 5: Network diagram with RLOC information

- Individual Address (15.15.255 means not configured)
 - This is KNX terminology. The individual address is assigned to a device upon downloading a configuration with ETS. It uniquely identifies the device in a KNX installation.
 - The value 15.15.255 means not configured.
- Role of the device
 - This is Thread terminology. The role indicates whether the device is a "child", a "router", or a "leader".
- Information about how many ping requests were sent, and how many replies were received. Note that the number of replies received may be greater than the number of requests sent. This is because the ping requests are multicast to all nodes on the network. If the number of replies is less than the number of requests, it means that the device is not well connected to the Thread network.
- RSSI of the last received message from the parent
 - RSSI stands for Received Signal Strength Indicator, and it is a measure of the power present in the received radio signal. By looking at the RSSI value, you are able to determine how good the signal strength is between the device and its parent. The higher the number (closer to 0) the better, as a rule of thumb, see the table below for an indication of how to interpret the values.

RSSI	Signal Strength
> -70 dBm	Excellent
-70 dBm to -85 dBm	Good
-86 dBm to -100 dBm	Fair
< -100 dBm	Poor
-110 dBm	No signal

Fig 6: RSSI classification

WARNING! Prolonged staying on this page will drain the battery life.

• KNX Tables

The KNX Tables page shows the following KNX information: - Load status

• Device Info

The **Device Info** page shows the following KNX information:

- Serial number
 - This is KNX terminology. This number is assigned to each device before leaving the factory. It allows writing or reading the individual address of a device without having to press the programming button of the device. This is supported in ETS 6 versions.
- **IA** Individual Address (15.15.255 means not configured)
 - Described in section about the Connection screen.
- **HW** Hardware version
- **SW** Software version, will change with software updates
- **HWT** hardware type
- Model the model name
- **RLOC16** the RLOC16 of the device
 - Described in the section about the Connection screen.

5.3. Commissioning

Configuration is made using the KNX software as of ETS 6.3 or later. The product file can be downloaded from the ETS online catalogue and the <u>Cascoda website</u>. After the batteries has been applied, the device will enter a commissioning phase. In this phase the QR code will be shown on screen.



Fig 7: QR information

The QR code can be used to for Thread commissioning and KNX commissioning.

NOTE! Thread commissioning needs to be done before KNX commissioning, since this enables the IPV6 communication.

5.3.1. Thread Commissioning

Thread commissioning is adding the device to the thread network. To be able to do so, one needs to have a Thread Border router. Cascoda recommends using the <u>KNX-IOT-HUB</u>

Check out the youtube video <u>here</u>, demonstrating the process of doing Thread and KNX Commissioning using a QR code scanner.

More information about Thread commissioning can be found <u>Here</u>.

5.3.2. KNX Commissioning

KNX commissioning is adding the device to an ETS project. Since KNX IoT is a secure KNX protocol, one needs to have the security credentials and the serial number of the device. This information is contained in the QR code.

The device can only be added to an KNX IoT Area or Line. When the device is added to a KNX IoT area or Line, the credentials can be supplied. ETS can scan the QR code with the camera (or 2D bar code scanner).

Check out the youtube video <u>here</u>, demonstrating the process of doing Thread and KNX Commissioning using a QR code scanner.

5.3.2.1. Downloading the ETS configuration

The downloading of the configuration can happen when the ETS data for the data is created, e.g.:

- The parameters are set
- The communication objects are connected

Since the device is a "Thread Sleepy" device, one can go in the menu to the **Connection** page or use the **PROG** button. This will cause that the sleepiness of the device is temporary halted. Hence the download will commence immediately, without waiting for the duration of the sleep period.

NOTE! go to the **overview** (or other presentation page) after downloading, since the power consumption in **Connection** Page will be larger than normal.

The download can be started in ETS, and one can use either:

- download by serial number
- download per programming mode

The download by serial number does not require any interaction with the device, but one has to be on the **Connection** Page to avoid the sleep period.

The download per programming button requires pressing the programming button. The **PROG** button is on the back of the device and needs to be pressed for 1 second. While the **PROG** button is pressed, the LED is on. When the **PROG** button is released and the device is in programming mode the LED above will start flashing. Disabling the programming mode can achieved by pressing again the **PROG** button.

NOTE! Please disable programming mode when not in use, since it consumes extra power.

5.3.2.1.1. Reset of the Environment Sensor

The device allows resetting of KNX and Thread in separate steps. This allows that the KNX configuration can be reset to factory default, without resetting the connectivity part.

• Reset KNX

Reset of KNX is achieve by pressing the **PROG** button for 5 seconds. While the **PROG** button is pressed, the LED is on.

When the **PROG** button is released (after 5 sec), the LED will quickly flash 2 times.

NOTE! KNX Reset: this means that also the security credentials are removed. Hence ETS will download newly created device keys. • Reset Thread

Reset of Thread is achieve by pressing the **PROG** button for 10 seconds. While the **PROG** button is pressed, the LED is on. When the **PROG** button is released (after 10 sec), the LED will slowly flash 3 times.

NOTE! Thread Reset: This means that the device needs to be added to the thread network again.

6. Software Bill of Materials

This paragraph contains the list of used open source software in this product.

Name	Version	License
Cascoda SDK	0.25	BSD-3-Clause
tinycbor	v0.6.0	MIT
mbedtls	2.16.2	Apache-2.0
Openthread	knx-v1.0.0	BSD-3-Clause

6.1. Cascoda SDK

- Description: Cascoda development
- License: BSD-3-Clause
- Version: 0.25
- URL: <u>https://github.com/Cascoda/cascoda-sdk</u>
- Notes: Chili2D/S SDK, various drivers

6.2. tinycbor

- Description: CBOR implementation
- License: MIT
- Version: v0.6.0
- URL: https://github.com/intel/tinycbor
- Notes: used for CBOR encoding/decoding

6.3. mbedtls

- Description: security constructs
- License: Apache-2.0
- Version: 2.16.2
- URL: <u>https://github.com/ARMmbed/mbedtls</u>
- Notes: used for encryption/decryption

6.4. Openthread

- Description: OpenThread, IPv6
- License: BSD-3-Clause
- Version: knx-v1.0.0
- URL: <u>https://github.com/Cascoda/openthread</u>

• Notes: Cascoda's port of OpenThread

7. KNX device information

Info Field	Value
Manufacturer	Cascoda
Model	Environment Sensor
Order_number	0004
Hardware_type	00000000004
Hardware version	[0, 0, 1]
Firmware version	[1, 2, 5]
Sleepy Device	yes
Sleep time (default)	600

7.1. Data points

url	name	instance	resource type	interface type	data type
"/p/1"	Temperature	1	321.51	if.s	DPT_Value_Temp
"/p/2"	Humidity	1	337.51	if.s	DPT_Value_Humidity
"/p/3"	CO2 AirQuality	1	65534.51	if.s	DPT_Value_AirQuality
"/p/4"	Pressure	1	1013.51	if.s	DPT_Value_Pres
"/p/5"	Battery Information	1	246.51	if.s	DPT_Battery_Info
"/p/6"	VOC Index	1	50002.51	if.s	DPT_Value_VOC_Index
"/p/7"	Temp_Lower_Alarm	1	321.3073	if.o	DPT_Switch
"/p/8"	Temp_Upper_Alarm	1	321.3072	if.o	DPT_Switch
"/p/9"	Humidity_Lower_Alarm	1	337.3073	if.o	DPT_Switch
"/p/10"	Humidity_Upper_Alarm	1	337.3072	if.o	DPT_Switch
"/p/11"	CO2_Upper_Alarm	1	65534.3072	if.o	DPT_Switch
"/p/12"	VOC_Index_Upper_Alarm	1	50002.3072	if.o	DPT_Switch

7.2. Parameters

url	name	param type
"/p/p1"	Sleep Period	int
"/p/p2"	Battery Curve	int
"/p/p3"	Language	int
"/p/p4"	Temperature Lower Limit Alarm	DPT_Value_Temp
"/p/p5"	Temperature Upper Limit Alarm	DPT_Value_Temp
"/p/p6"	Humidity Lower Limit Alarm	DPT_Value_Humidity
"/p/p7"	Humidity Upper Limit Alarm	DPT_Value_Humidity
"/p/p8"	CO2 Upper Limit Alarm	DPT_Value_AirQuality
"/p/p9"	VOC Index Upper Limit Alarm	DPT_Value_VOC_Index

7.2.1. Parameter Sleep Period

Sleep period in Seconds, after each period the device wakes up and creates and sends the measurement.

Values:

- 20 seconds : value 20
- 1 minute : value 60
- 5 minutes : value 300
- 10 minutes : value 600 [Default]
- 15 minutes : value 900 Example: 600

7.2.2. Parameter Battery Curve

Curve selection, so that the battery percentage can be calculated according the used battery type.

Values:

- Zinc-Carbon (R6) : value 1
- Alkaline (LR6) : value 2 [Default]
- Li-FeS2 (FR6) : value 3 Example: 2

7.2.3. Parameter Language

Language selection of the Menu. Values:

- English : value 1 [Default]
- German : value 2
- French : value 3
- Italian : value 4
- Spanish : value 5 Example: 1

7.2.4. Parameter Temperature Lower Limit Alarm

lower limit threshold, when passed the Alarm will be triggered. Example: 1.99000000000000E+001

7.2.5. Parameter Temperature Upper Limit Alarm

upper limit threshold, when passed the Alarm will be triggered. Example: 2.70000000000000E+001

7.2.6. Parameter Humidity Lower Limit Alarm

lower limit threshold, when passed the Alarm will be triggered. Example: 1.99000000000000E+001

7.2.7. Parameter Humidity Upper Limit Alarm

upper limit threshold, when passed the Alarm will be triggered. Example: 7.00000000000000E+001

7.2.8. Parameter CO2 Upper Limit Alarm

upper limit threshold, when passed the Alarm will be triggered. Example: 1.20000000000000E+003

7.2.9. Parameter VOC Index Upper Limit Alarm

upper limit threshold, when passed the Alarm will be triggered. Example: 3.50000000000000E+002