Sensedge

SE-100

Professional Indoor Air Quality Monitor

Getting Started


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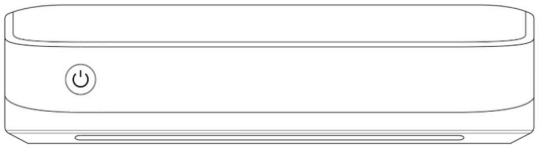
Introduction to Sensedge

The Sensedge is a building-grade air quality monitor, designed to measure a range of pollutants and air quality parameters. The Sensedge supports multiple methods of data communication and has a wide range of features for data collection, analysis and export. Up to 50 million air quality readings can be stored on the device, and can be viewed using the embedded touchscreen, or exported for further analysis.

This user manual will provide a basic guide to the first use, installation, and basic troubleshooting of the Sensedge.

Further information, tutorials and trouble-shooting can be found on the Kaiterra Support Portal, at http://www.kaiterra.com/support



Externals and air flow

Air is drawn into the Sensedge from both the modules on the lower side, as well as the air intake on the upper side. It is vital that neither side of the device is covered, or the airflow blocked. Any changes in airflow may affect the readings and accuracy of the Sensedge.

Connection ports

The Sensedge has four ports for connectivity:
Micro-USB: Used to supply power to the Sensedge. Only use the cable and charger/adapter supplied with the device.
USB (type A): For use with external accessories that require a standard USB connection. For a list of compatible accessories, visit the Kaiterra website.
Micro-SD Card slot: The Sensedge supports SD cards for data export. Only use [type] micro-SD cards (under 64GB).
Ethernet: Used for data transfer via Ethernet. The Sensedge does not support PoE - the micro-USB port must be used for power.

Accessories

The Sensedge may be shipped with the following accessories (dependent upon region and order details):
Power cable and 2.4A, 5V adapter: Used to provide power to the Sensedge. Never use an adapter or cable other than that shipped with the device.
Ethernet cable: The cable supplied with the device is optimised to fit inside within the Sensedge's wall mount and allow cables to run directly into the wall.
Ethernet extension: Used to extend the Ethernet port outside of the device. This may be necessary depending on the Ethernet cable used and the method of installation.
Mini screw driver: Used to remove and attach the Sensedge wall mount from the Sensedge body. The mini screw driver is not for use with the wall screws, and should not be used to mount the device on a wall.
Wall screws (x3): Used to mount the Sensedge on a wall or vertical surface.
Miniature screws: Used to keep the outer case connected to the body of the Sensedge.
Sensor modules: Used to measure a variety of pollutants and other parameters, these sensors are interchangeable and modular.

Sensor modules

The Sensedge utilises a modular design to allow for easy control and replacement of sensors. A CO2 sensor is built into the core of the device, and a variety of other sensors may be inserted using the two sensor bays on the lower side of the device.

To insert a sensor module, simply slide it into the bay, ensuring the Kaiterra logo on the aluminium casing is facing upwards. When inserted correctly, the module will click into place, and an LED light on the module's front will briefly flash green.

To remove a module, gently push on the left side of it. The module will slide further into the bay, before popping out. Do not push on the air intake/output of a module to remove it.

Sensors may be inserted in either sensor bay, and in any order. They may be swapped both when the Sensedge is powered on and operational, and when the device is turned off.

By default, the Sensedge is shipped with the KM-100 and KM-102 sensor modules, which together measure PM2.5, TVOC, temperature, and relative humidity.

About the measurement

The following methods are used for measurement of pollutants and parameters:

CO2: Non-dispersive infrared (NDIR)
KM-100 module, PM2.5: Laser-based light scattering (mie principle)
KM-102 module, TVOC: Metal-oxide-semiconductor (MOS)
KM-102 module, temperature and relative humidity: CMOSens® technology

The Sensedge provides realtime measurements, thus it important to consider other factors that may influence sensor measurement when taking a reading of air quality. Human breath within several metres of the device will impact both CO2 and TVOC measurements, and physically touching and interacting with the Sensedge can have a measurable impact on temperature.

Changes in airflow or currents in an indoor space can all have a measurable impact on the readings of the Sensedge, and correct usage is vital for accurate and reliable readings.

Data buffer

The Sensedge takes readings of pollutants and measured parameters every second, and calculates a minute-by-minute average, which is recorded in the Sensedge's onboard memory. When connected to the Internet, these readings are uploaded once per minute. Should the data connection be lost for a period of time, all readings will be stored in the data buffer, and automatically uploaded to the cloud when the Sensedge reconnects. There is no maximum to the number of historical readings that can be stored in the data buffer and uploaded upon reconnection.

Sensedge First Use

Charging the device

The Sensedge contains a 5200mAh Lithium Ion battery, which can be charged via the micro-USB port. When turned on and charging, the Sensedge will display a charging icon in the status bar.

If the Sensedge is turned off, upon connection to power, the current battery level will be displayed on the screen for several seconds, before disappearing.

Powering up the device

Before turning the Sensedge on for the first time, connect it to a power source using the Micro-USB cable and adapter supplied. Upon connection to power, a battery level will be displayed on the screen. Ensure that the battery level is above 50% before powering on for the first time.

Power on the device by holding down the power button for 10 seconds, until the Kaiterra logo appears on the screen.

Setting the language

Upon first use, the Sensedge will prompt users to select a language. Scroll through the options using the touchscreen, and confirm using the “next” arrow on the screen. The language can be changed in the settings menu at any time. The screen may briefly flash once the language has been selected.

Connecting to Wi-Fi

On first use, a Wi-Fi network can be selected for the device to use. Internet connectivity allows the Sensedge to store data in the cloud for monitoring, analysis and alerting purposes, and provides the Sensedge with vital information such as new software updates, and automated calibrations. For accurate results, it is highly recommended to connect the Sensedge to the Internet.

Setting a PIN code

To prevent unauthorised use, the Sensedge can be locked using a PIN code. On first setup, the PIN code can be enabled or disabled. If enabled, users may select either the “Always” or “Only settings” mode.

By enabling a PIN code for “Always”, the device will not display any information when powered on, and a PIN code must be entered before any interaction may take place. This mode is suited to situations where all device access must be restricted to authorised users only.

By setting the PIN code to “Only settings”, the settings menu will be unavailable without entering the PIN code. This mode is suited to environments where multiple users may want to view data and readings on the device, but only a limited number of authorised users have access to the device settings.

Note: the only way to reset a forgotten PIN code is by factory resetting the device. For more details, see the factory reset section of this guide.

Views

The Sensedge has three main views available: My Air, Data, and Settings. Views are switched between using the menu on the left side of the screen.

Views: My Air

This is the default view displayed when the Sensedge is powered on, and provides an overview of realtime air quality. Realtime pollutants in their raw format are displayed on the right side of the screen, while an air quality index or other standard is used to display an overall reading in the centre of the view.

By default the Kaiterra Overall Index is used, but this may be modified in the settings menu, to utilise a variety of air quality standards and indices.

The unit of measurement for each raw pollutant may also be modified in the general settings menu.

Views: Data

This view is used to display historical air quality readings stored on the device. Readings can be viewed by the index selected in the settings menu, as well as by individual pollutants. The colour of the data bars reflects the selected index or air quality standard, which can be changed in the settings menu.

When the device is first powered on, no data has yet been collected, and the

historical data view will display “No Data”. After one minute of data has been collected, readings will begin to appear on the screen.

Data is available in three different frequencies: daily, hourly, and per-minute. Cycle through the frequencies by tapping the selected frequency on the right menu, and navigate through the historical data by swiping left and right on the chart.

Views: Settings

General

Used to adjust basic settings of the device, such as the standards used for each pollutant, and basic user interaction settings.

General > PIN

Used to enabled or disable a security PIN code, and adjust the relevant settings.

Enable: Toggle is used to enable or disable the use of the PIN code on the device. When disabled, no PIN code will be requested from users at any point in time, and anyone with access to the device may interact with it.

Require PIN: Select “Always” to require the security PIN for all interaction with the device - this should be chosen for maximum security available. Selecting “Settings” will require a PIN code to interact with the settings page, but not with the My Air or Data views.

Auto Lock: The auto lock is used to define the duration of user inactivity after which the PIN code is required to interact with the device.

General > Pair Device

Used to display a unique QR code for the device. This may be scanned by supported mobile apps to add the device or remotely view readings from the device. For details, see the guide for the app being used.

Sensors

Modular sensors currently inserted into the two bays of the Sensedge will be displayed on this page. The model number of the module is displayed, alongside the current readings of the sensor, and the module’s health.

The health of a module refers to the lifespan of the module. Hours of usage, and the pollutant concentrations during this usage are recorded by each module, and used to calculate lifespan, and current health levels.

When the health of a sensor drops below 10%, the potential for drift in accuracy or module failure increases, and it is necessary to change the sensor module. For instructions, see the "Introduction to Sensedge" in this booklet.

Note: when a sensor is inserted, it may take several seconds to appear on this view.

Data Export

Used to export historical data contained within the device or in the cloud. Three methods of data export are supported: e-mail, USB and SD card.

E-mail Export: Used to send readings directly from the cloud to your e-mail. This is an easy way to receive historical air quality readings on your computer for analysis. Files are exported in .csv format, and can be directly opened in Microsoft Excel and other spreadsheet software. Data export via e-mail will only transfer readings that are stored in the cloud, and not readings that are stored locally on the device and unavailable in the cloud. If the Sensedge is connected to the Internet most of the time, this is the recommended method of data export.

USB & SD Card Export: Used to export readings stored locally on the Sensedge to a USB device or SD card inserted into the Sensedge. Historical readings are exported in .csv format. Data export via USB and SD card will only transfer readings that are stored on the device, and not readings in the cloud. If the Sensedge is primarily used offline, this is the preferred method for data export.

Wi-Fi

The Sensedge supports 2.4G Wi-Fi connectivity, which can be enabled in the Wi-Fi settings view. Simply select the Wi-Fi network by tapping once, and enter the password by tapping on the password input.

The Sensedge will store previous Wi-Fi connections and connect automatically to a network, if available. To remove, or "forget" a Wi-Fi network, simply tap the "Forget" button next to the network name.

Wi-Fi > Add Network (Hidden SSID)

Hidden networks (hidden SSIDs) are supported by the Sensedge. To connect, tap on the "Additional Settings" button at the bottom of the list of available networks, to enter the Add Network view. Enter the SSID, password, and select the encryption used to connect.

Ethernet

When an Ethernet cable with an active internet connection is plugged into the Sensedge, the device will automatically switch from Wi-Fi to Ethernet.

Screen

Used to adjust brightness of the screen, as well as the orientation. Orientation may be set to face either up, down, or adjust automatically with the orientation of the device (recommended).

Language

Used to change the language of the device. A number of languages are supported, and may be modified at any point in time. Upon change of language the device's screen may briefly dim as the interface is reloaded.

Time

By default, the Sensedge is configured to automatically set the date and time when connected to the Internet. For seamless capture and storage of air quality data, it is important to ensure the date, time, and timezone are set correctly on the device.

If the Sensedge is used offline, without an Internet connection, please ensure that the date and time settings have been manually configured to the correct time.

Both 12h and 24h clocks are supported, and may be configured in this view.

Device Details

Used to display details including the unique ID of the device, the serial number, and other manufacturing details.

Device Details > Firmware Version

The current firmware version of the Sensedge can be seen in the device details page, as well as several settings regarding firmware updates.

The Sensedge supports over-the-air (OTA) updates, so that the firmware running on the device may be updated. Firmware updaters make both new features as well as security upgrades available.

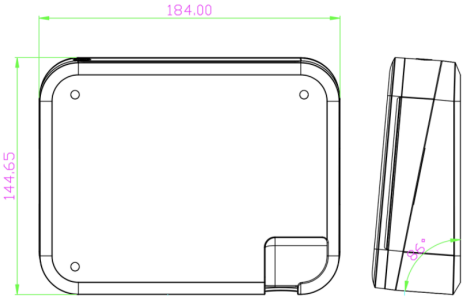
By default, auto-update is enabled, so that upgrades will be automatically installed when they become available online. It is highly recommended to keep this setting enabled.

Tapping on the "check" button located next to the current firmware version will manually check for available updates, and if available, allow them to be manually installed.

It is highly recommended to keep the Sensedge up to date at all times.

Mounting the Sensedge

The Sensedge may be used as a portable device, or mounted on a wall. Mounting the Sensedge is done by first mounting the backplate to the wall, using three screws. Once mounted, the main device may be inserted, by first inserting the upper side, and then the lower side. ***Always remember to insert and tighten the screw that holds the Sensedge closed when using the device, and when wall mounting it.***



Cables may be run down the wall, or run directly into the wall, through the backplate.

Maintenance

The Sensedge contains no customer serviceable components, other than the modules inserted in the two module bays. Neither the modules, nor the Sensedge should never be opened, or unscrewed. ***Opening the Sensedge or any of the modules immediately voids the warranty and may result in exposure to laser radiation, which can cause eye injury.***

The modular design of the Sensedge allows sensors with a limited lifespan, or sensors requiring regular calibration and maintenance, to be easily replaced, without the entire device being replaced.

Annual calibration of the device is not required, as each sensor module is individually calibrated and tested at production.

Technical Specifications [1]

CO_2 Sensor

Sensor type
Non-dispersive infrared

Accuracy [2] [3]
±3% ±50ppm

Resolution
1ppm

Range [4]
400-2000ppm

KM-102 Module [5]
TVOC

Sensor Type
MOS

Precision [6] [7]
±15%

Resolution
1ppb

Sensitivity
125ppb

Temperature

Range
-20 - 100°C

Accuracy
±1°C

Resolution
1°C

Relative Humidity

Range
0-99%

Accuracy
±5%

Resolution
1%

KM-100 Module [8]
$PM_{2.5}$

Sensor Type
Light scattering (350nm)

Precision [9] [10]
±10% (<30µg/m^3: ±3µg/m^3)

Resolution
1µg/m3

Range
1-1000µg/m^3

Measurable particle size
0.3-2.5µm

Connection
Wi-Fi (2.4Ghz), Ethernet
Support for hidden SSIDs, CaptivePortal and proxy servers

Data logging
8GB of on-board memory
(>50,000,000 data points)
>100 years at 1 minute interval

External storage
Cloud-based, Micro-SD card, USB

Log interval
1 minute, 1 hour, 1 day

Screen
7" full colour touchscreen

Battery
5200mAh (5 hours with screen powered on, 11 hours with screen powered off)

Input voltage
DC - 5V

Input current
1.8A

Operational temperature [11]
0 - 50°C

Storage temperature
-20 - 50°C

Operational humidity
5 to 95% RH, non-condensing

Physical size
184 x 146 x 48mm
(7.2 x 5.7 x 1.9in.)

Product weight
800g
(1.76lb)

Endnotes

1. All specifications are at *2σ* significance.
2. Accuracy is specified over operating temperature range. For accuracy in relation to absolute measurements, uncertainty of calibration gas mixtures (+/-1% currently) is to be added to the specified accuracy.
3. Accuracy is defined both at exit from factory, and also after 3 weeks of continuous operation in normal IAQ applications, utilising ABC function. Rough handling and transportation might result in a reduction of sensor accuracy. With time, the ABC function will tune the readings back to the correct numbers.
4. Sensor is designed to measure in the range 400 to 2000ppm with specified accuracy. Exposure to concentrations below 400ppm may result in incorrect readings. Readings above 2000ppm will be displayed.
5. Included with Sensedge standard package.
6. Precision is defined upon all devices being powered on at the same instant, in the same environment.
7. TVOC measurement is relative, and defined in the range of 125 to 600ppb with specified accuracy. Exposure to extremely high concentrations of VOCs may result in incorrect readings.
8. Included with Sensedge standard package.
9. Accuracy is defined upon fifteen-minute averages. Due to non-uniform distribution of particulate matter, fluctuations may occur at higher measurement frequency.
10. The Sensedge is calibrated during the manufacturing process using a standardised aerosol mix. The default calibration is appropriate for most applications, as it simulates the wide variety of ambient aerosols found in urban locations. When connected to the Kaiterra cloud, by default, the Sensedge's calibration factor will automatically be adjusted according to the geographic location of the device, using cloud based calibration. Calibrations are updated in real time to ensure high accuracy as the composition and photometric response of the ambient aerosols changes. Because optical mass measurements are dependent upon particle size and material properties, there may be times in which a custom correction factor would improve your accuracy for a specific aerosol. When more accurate measurement data regarding specific aerosols is required, custom correction factors must be developed for said aerosol. A custom correction factor is a multiplier applied to raw data to more closely represent the desired results. Custom correction factors are linear and are good only for a specific aerosol and a specific application or work area. A custom correction factor can be developed by comparing a statistically valid number of side-by-side gravimetric and photometric samples.
11. When moving from a cold to a warm environment there is a risk of condensation. To avoid influence on the accuracy of the instrument, it is important to allow it to adjust to the environment for a few minutes before usage.

FCC Warning

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. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note 1: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

Note 2: 1.Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

2. The minimum separation generally be used is at least 20 cm.