WORKS WITH WELL

enLink IAQ Radon

USER GUIDE

LoRaWAN IAQ and Continuous Radon Monitoring

synetica

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LoRaWAN IAQ and Continuous Radon Monitoring

Synetica's enLink IAQ Radon monitor provides continuous, real-time monitoring of radon, a naturally occurring radioactive gas that can enter buildings unnoticed and accumulate in enclosed spaces, where it poses a serious long-term health risk. As radon is invisible, odourless, and tasteless, reliable and specialised measurement is essential

Designed and manufactured in the UK, the IAQ Radon allows for easy visualization and analysis of air quality data including temperature, relative humidity, volatile organic compounds, barometric pressure and optionally particulate matter and CO_2,

The IAQ Radon can be battery or externally powered ensuring flexible installation options. Data is transmitted up to 16km using LoRaWAN long-range wireless with building, interior penetration of 1-2km without repeaters.

enLink IAQ Radon:

- Satisfies the accuracy and range requirements for IWBI WELL v2 standard
- Battery or externally powered
- Built in sensors and options for:
  - Temperature (°C)
  - Humidity (%RH)
  - Radon (Rn)
  - Barometric Pressure (Pa)
  - Volatile Organic Compounds (VOC's)
  - Carbon Dioxide (CO_2) *
  - Particles PM 1, 2.5, 4, 10 *

Features

- Multiple sensor options*
- LoRa long range wireless
- Frequency range 863-870MHz*
- Frequency range 902-928MHz*
- Up to +18dBm Tx power
- Built in USB port for configuration
- Battery or externally powered
- UKCA, CE, FCC, RoHS compliant
- Made in the UK
- Works with WELL licensed

Option / model dependent

1. Introduction

What is Radon?

Radon is a naturally occurring radioactive gas formed from the breakdown of uranium in soil and rock. It is colourless, odourless, and tasteless, and therefore cannot be detected without specialised equipment. Radon can enter buildings through cracks in floors and walls, construction joints, service penetrations, and other openings in contact with the ground. It can accumulate indoors, particularly in basements and poorly ventilated areas.

Health Risks of Radon

When radon gas is inhaled, it decays and releases alpha radiation inside the lungs. This radiation can damage lung tissue over time. Long-term exposure to elevated radon levels significantly increases the risk of developing lung cancer. Radon is recognised as the second leading cause of lung cancer after smoking, and the leading cause among non-smokers. The risk is higher for smokers and increases with both concentration level and duration of exposure.

Regular monitoring and maintaining adequate ventilation are effective measures for reducing radon-related health risks.

enLink IAQ Radon accurately measures up to seven key indoor air quality parameters.

The device can monitor temperature, relative humidity, radon, VOC's, barometric pressure and optionally particulate matter and CO_2.

The sensor meets all of the requirements for WELL® and RESET® air quality monitoring. Data is transmitted via long range LoRaWAN wireless for remote analysis.

The units can be either battery or externally powered allowing for flexible installation options.

IAQ Radon is available in three models:

Model	Parameters
ENL-IAQ-R	Temperature, Humidity, VOCs, Pressure, Radon
ENL-IAQ-RC	Temperature, Relative Humidity, VOCs, Pressure, CO2, Radon
ENL-IAQ-RCP	Temperature, Humidity, VOCs, Pressure, CO2, Particulate Matter, Radon

2. Configuration

LoRa devices can be configured using Over The Air Activation (OTAA) or Activation By Personalization (ABP).

OTAA is the most secure way to connect a device to the LoRa network. In OTAA, the device performs a join-procedure with the network, during which a Dynamic Device Address (DevAddr) is assigned and security keys are negotiated with the device.

ABP allows you to set the DevAddr as well as the security keys in the module. This is simpler than OTAA as there is no join procedure, however, it is less secure than OTAA.

This guide will illustrate using OTAA as it is the most secure and flexible method. The OTAA configuration requires the following parameters to be correctly set:

- DevEUI: End-device Identifier. It is unique for every device and is set at device manufacture.
- AppEUI / JoinEUI*: Application Identifier. Used to identify the end application.
- AppKey: Application Key. Used to create the session keys.

**Note: In LoRaWAN 1.1, AppEUI was renamed to JoinEUI.*

The DevEUI is always set at device manufacture and is unique. The device AppEUI and AppKey can easily be set via the USB connection if required and the process is detailed later in this document.

3. Join enLink Devices to the LoRa Network

enLink devices in wireless range and with the correct AppEUI and AppKey settings will automatically join the LoRa network when they are first powered up.

enLink IAQ Radon Unit Label

The unique DevEUI is printed on all enLink devices and is also present in the QR code. The DevEUI can be used to identify the device once joined to the network.

4. Powering the Unit

IAQ-R can be powered via 1 x onboard Lithium D Cell battery, or via external power 12-24V DC (200mA max).

The battery part number is EVE ER34615EHR2. The battery is fitted with flying leads and a polarised JST EHR-2 female connector.

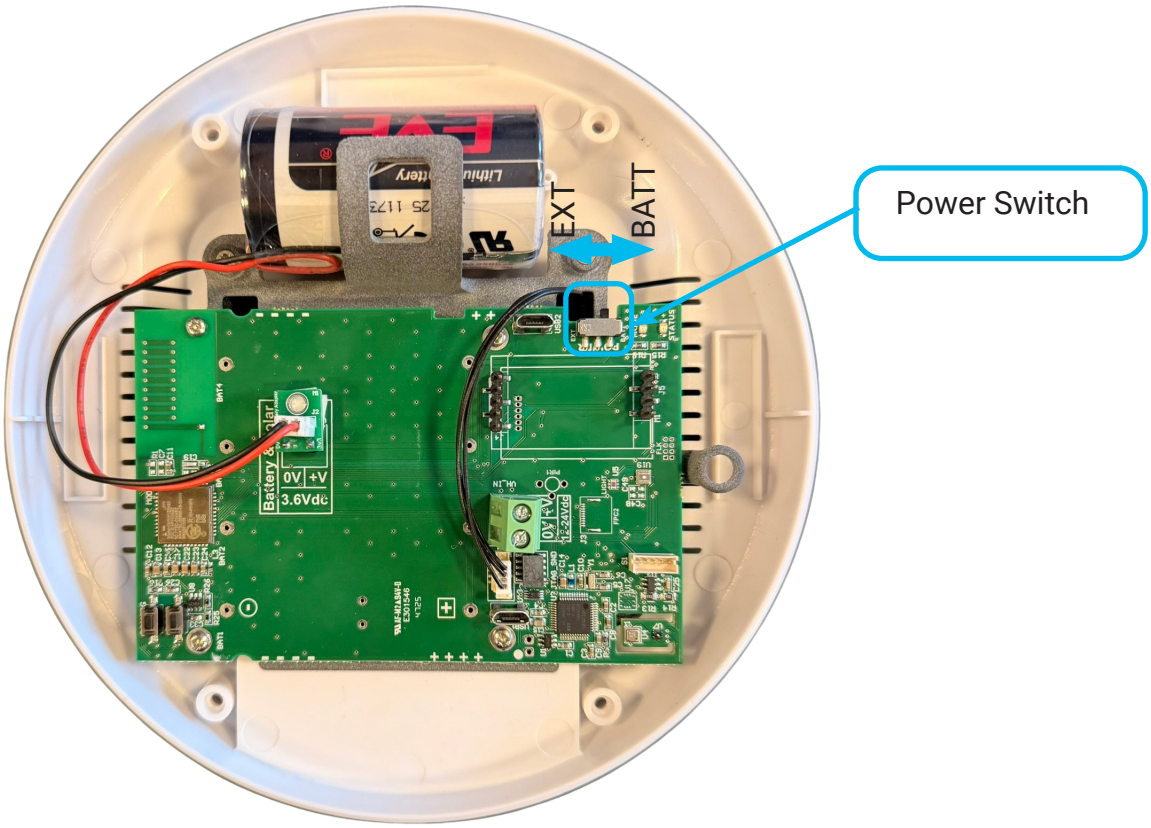
4a. Powering the unit via the on-board battery

To power the device **ON**, first slide the power switch to the **EXT** position, to disconnect the battery power input. Insert the 1 x D sized Lithium 3.6V battery taking great care to insert it the correct way around. The IAQ battery connector is keyed to ensure the correct polarity.

Lithium batteries have very high energy capacity and a great degree of care should be exercised to ensure that all batteries are new, from the same manufacturer, installed the correct way around and are not in any way damaged. Refer to Section 15 for more details.

Check that the batteries are correctly inserted and then slide the power switch to **BATT** to connect the battery power to the unit.

Note that the unit can only be battery-powered or externally powered. When the switch is in the **BATT position**, any external power source is automatically disconnected. When in the **EXT position**, the batteries are automatically disconnected.



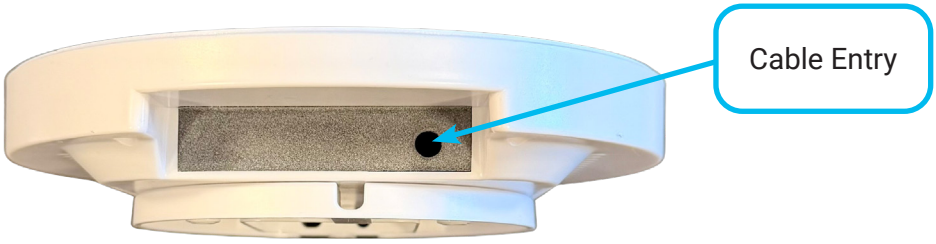
Once powered ON, the enLink device will send a join request message to the LoRa network server. The status LED will blink RED whilst the join process is taking place. Depending on factors such as signal strength, RF interference etc. the join process may take several seconds to complete.

When the device has successfully joined the network the **mode LED** will blink **GREEN** for several seconds to show that the join has been completed. The LED's will then switch off to conserve the batteries.

4b. Powering the unit with external power

The IAQ-R may be powered from an external power source if required.

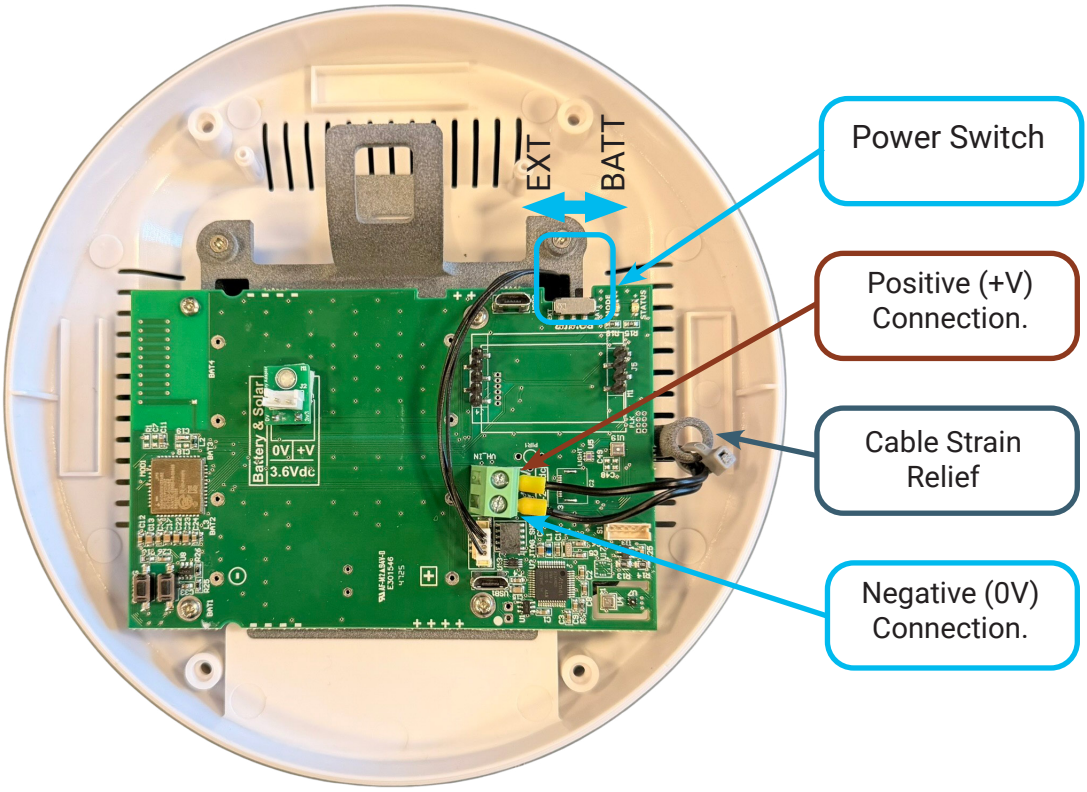
The unit requires a power supply 12 – 24V DC at 200mA (max).



enLink IAQ-R Cable Entry Point

The enclosure moulding will guide the cable through the enclosure. Route the cable through to the screw connector as shown below. Move the power switch to the **BATT** position, then connect the power cable to the unit, carefully observing the polarity shown.

Power is supplied to the unit via a 2 pole screw connector as shown below. The conductor size should be 12-22 AWG (2mm – 0.6mm diameter, 3.3mm^2 CSA – 0.32mm^2 CSA). Strip the cable to expose 5mm of conductor.



IAQ-R External Power Connector

Push the stripped end of the power cable into the connector taking great care to observe the correct polarity. The positive cable should connect to the terminal marked (+V) and the negative cable to the terminal marked (0V).

Gently pull on the cable to ensure that it is correctly inserted. Ensure that no uninsulated cable is showing.

Once complete, move the power switch to the **EXT** position for external power as shown below. The unit will power up and attempt to join the LoRaWAN network.

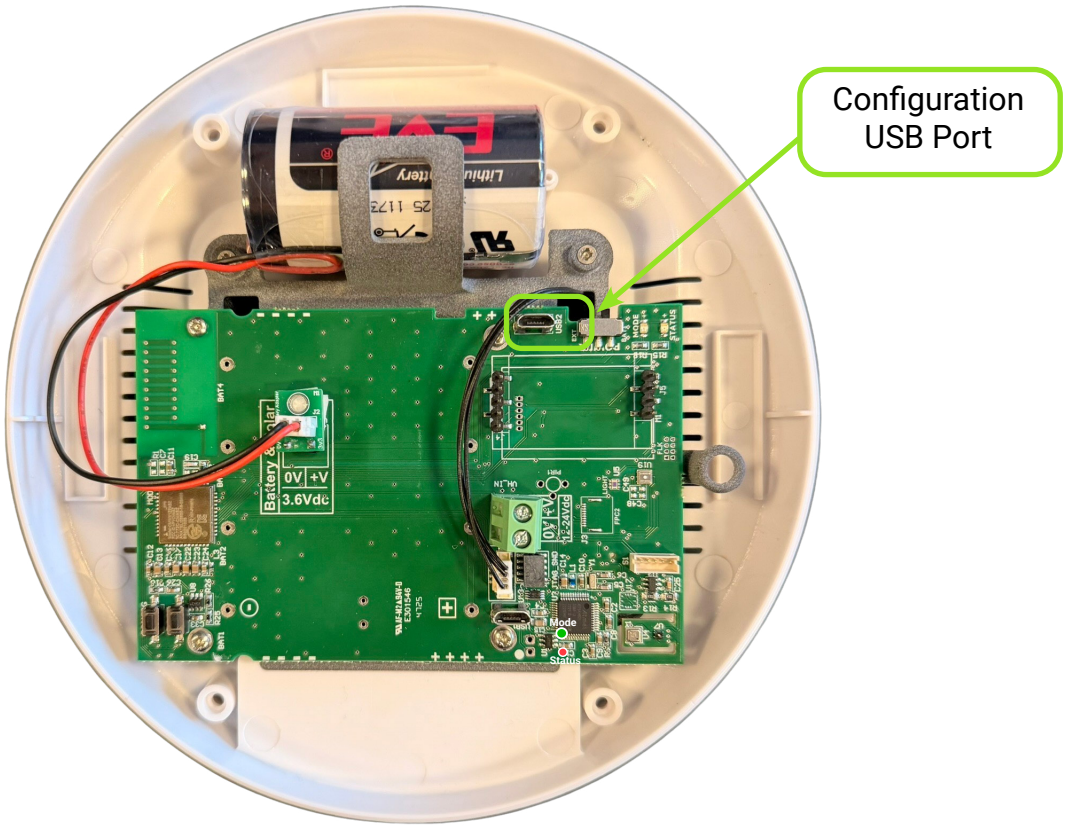
5. Setting / Changing the enLink LoRa Keys

The LoRaWAN keys will be supplied in a separate file for bulk upload to your LoRa Network Server such as Chirpstack, Loriot TTN etc.

For some applications, Synetica can supply enLink IAQ units with the LoRa **AppEUI** and **AppKey** parameters pre-configured to your requirements, whereby if the LoRa gateway has matching keys the join process will happen automatically once the enLink IAQ unit is in wireless range and powered on.

The DevEUI is always set at device manufacture and is unique. The device **AppEUI** and **AppKey** can easily be set via the USB connection as detailed below.

Once the cover is removed, connect a micro USB cable to the enLink unit. There are two USB connectors on the enLink IAQ-R, so be sure to connect to the correct USB port as shown in the image below. The device will attach to a COM port on your PC.

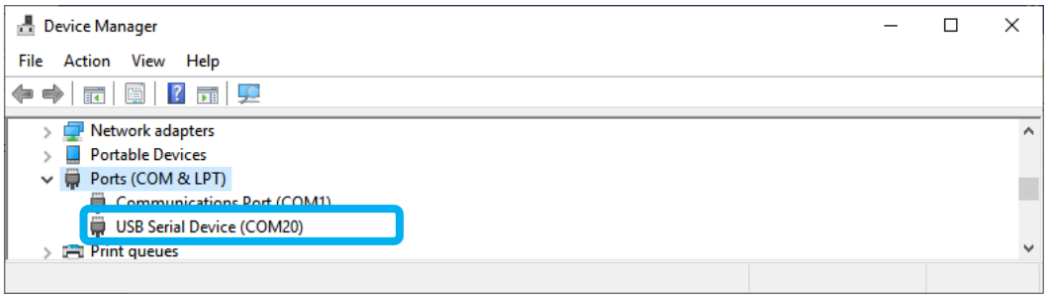


Configuration USB Port

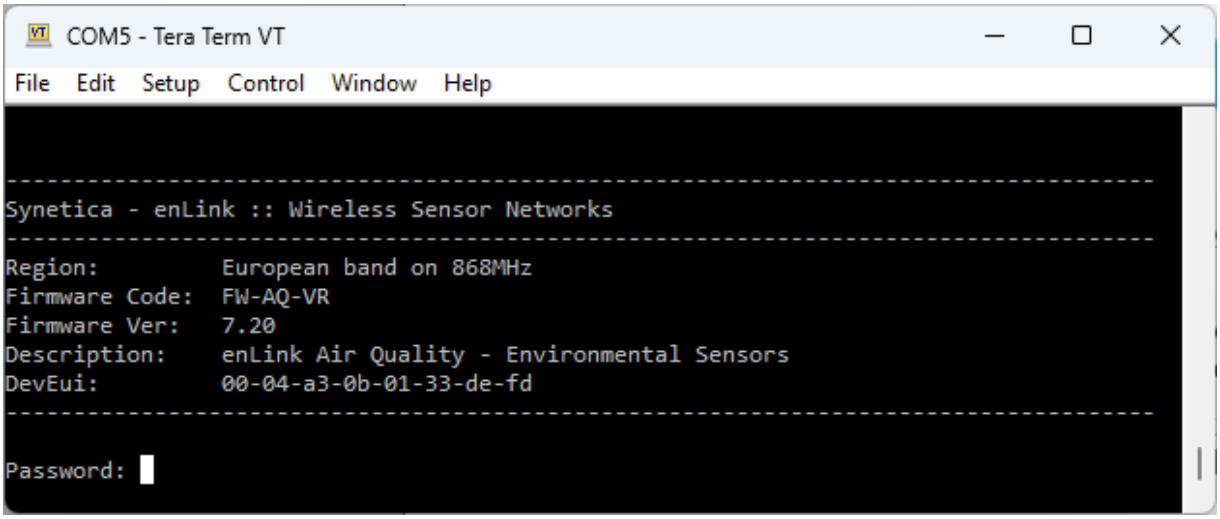
Using a terminal program (e.g. Teraterm https://github.com/TeraTermProject/teraterm/releases) connect to the COM Port used by the enLink device.

See Synetica document “Configuring enLink Devices Using Serial Terminal Applications” for more details including using PuTTY and serial applications that will operate on Apple and Linux computers.

To verify which COM port is being used, check the Windows™ **Device Manager** (in Windows - click the start button, type **Device Manager** into the search box and click **Device Manager** on the menu.) Expand the **Ports (Com & LPT)** menu as shown below.

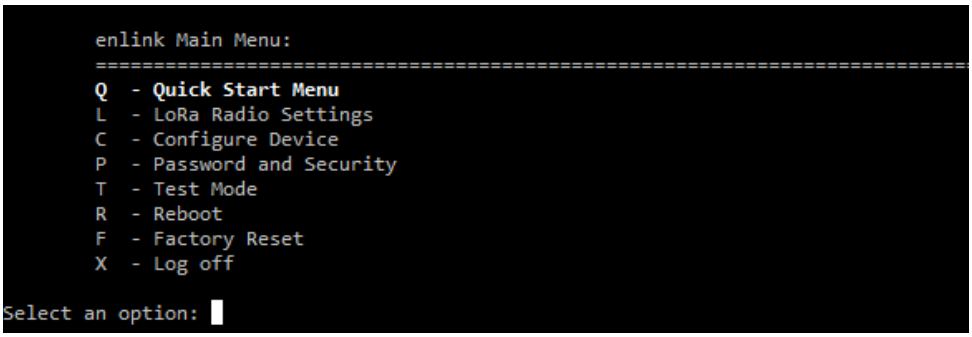


In your terminal program press the **Enter** key. An enLink summary screen will appear as shown below. The default password is the last four digits of the displayed **DevEUI**, in the screen below this is defd.

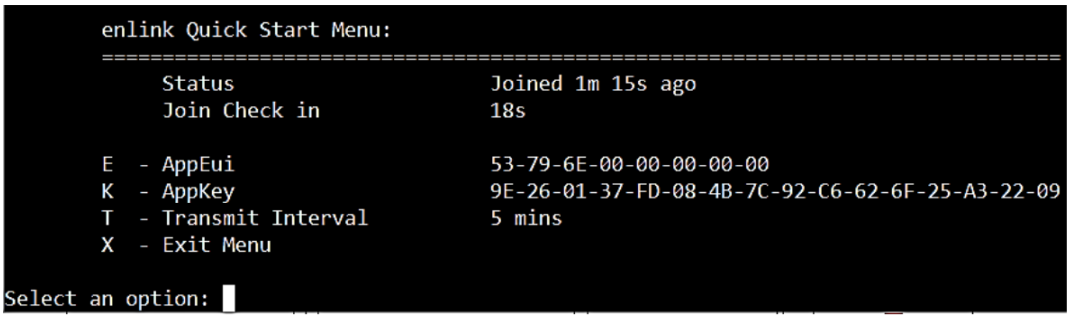


enLink Logon Screen

The screen below will show with the enLink Main Menu options. Enter **Q** to enter the **Quick Start Menu.**

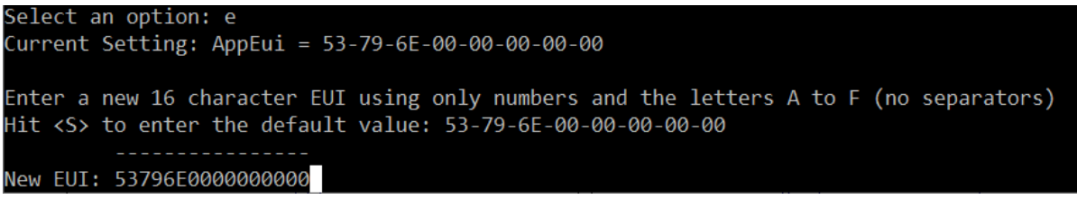


The **Quick Start Menu** contains only the parameters that normally need to be configured to setup the device and join the LoRa network. From the Quick Start Menu you can change the **AppEUI** and **AppKey.**



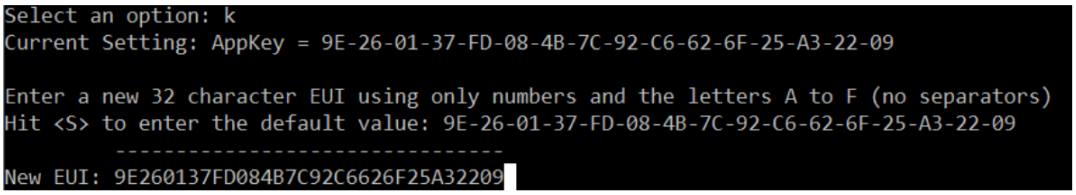
Quick Start Settings Menu

From the **Quick Start Settings Menu,** access the **AppEUI** setting by entering **E.** Enter the 16 character **AppEUI** using numbers and letters A to F. Do not include spaces or any other characters. Pressing **S** will enter the default **AppEUI** which you can then edit. Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu.**



AppEUI Setting

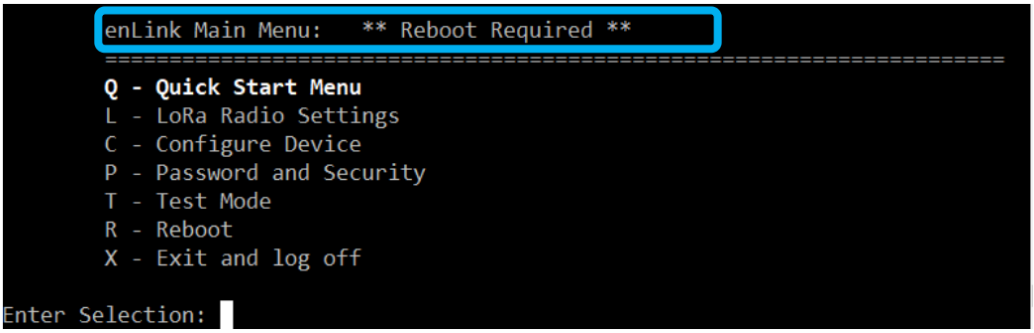
From the **Quick Start Settings Menu** access the AppKey setting by entering **K**. Enter the 32 character **Appkey** using numbers and letters A to F. Do not include spaces or any other characters. Pressing **S** will enter the default **AppKey** which you can then edit. Press **Enter** when the key is correctly entered to return to the **Quick Start Settings Menu**.



AppKey Setting

Press **X** from the **Quick Start Settings Menu** to return to the **enLink Main Menu**.

The header will show **** Reboot Required **** as shown below. The new key settings will not take effect until the enLink device is restarted. Enter **R** to reboot followed by **OK.** The device will restart with the entered **AppEUI** and **AppKey** and attempt to join the LoRa network.



Reboot Required Notification

6. Setting / Changing the Transmit Interval

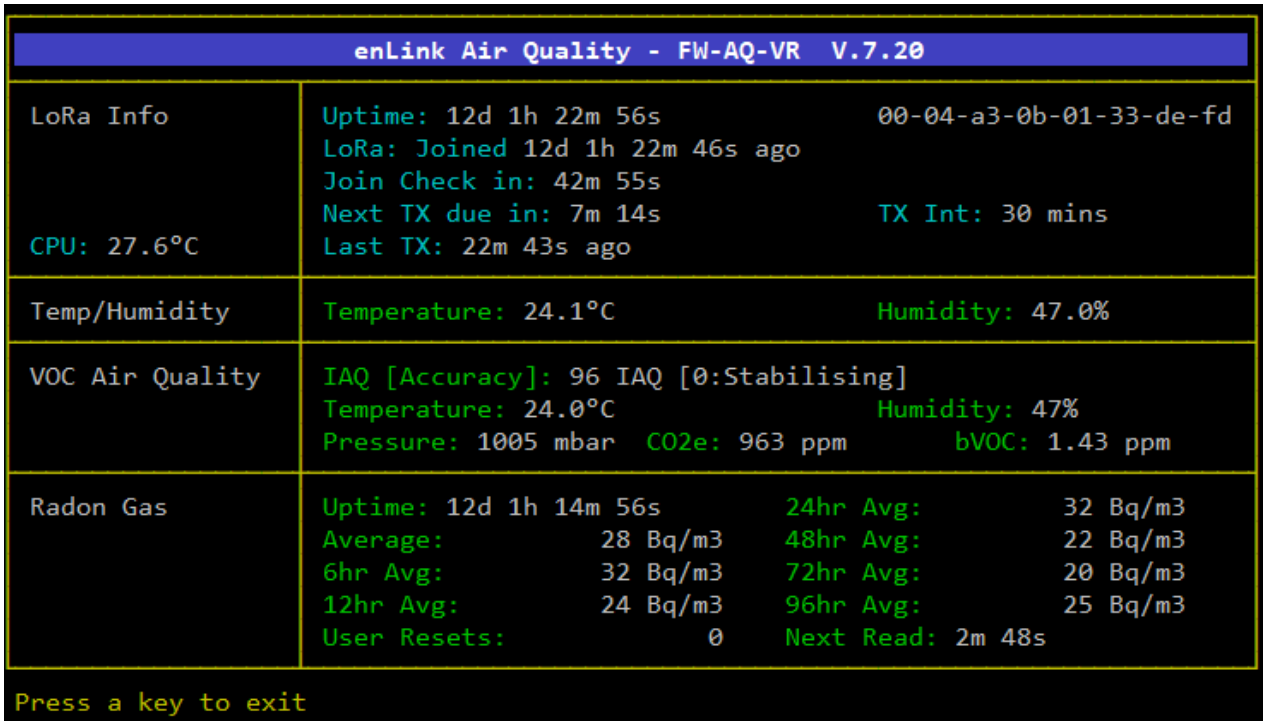
Access the Transmit Interval setting by entering T from the quick start menu.

Transmit Interval Settings

Select a fixed transmit interval from the menu options. The Transmission Interval may also be changed by using a LoRaWAN downlink message. See: https://github.com/synetica/enlink-decoder?tab=readme-ov-file#downlink-message-index-tables for more details and example downlink messages. **Press Enter** when the interval is correctly set to return to the **Quick Start Settings Menu.**

7. Live Menu

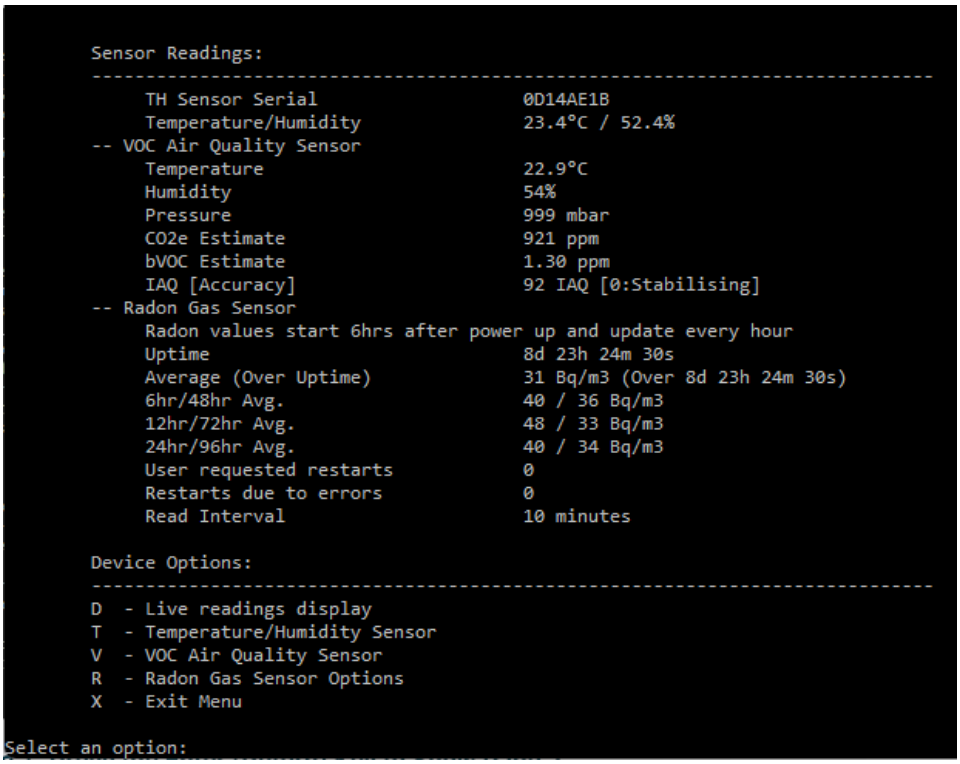
enLink IAQ incorporates a live data screen which shows all readings and device status for easy data validation. To enter the Live status screen, from the **Main Menu** enter **C** for Configure Device followed by **D** for Live readings display. A screen similar to the one below will show. The sensors will vary according to the enLink IAQ model and the installed sensors.



Live Display

8. Configuration Menu

The enLink IAQ-R Configuration Menu allows you to view current sensor readings and also to change various functions of their behaviour such as calibration data. To enter the Configure Device Menu press **C** from the **Main Menu.** A screen similar to the one below will show. The exact parameters shown will vary according to the IAQ-R model and sensors fitted.



Configuration Screen

9. Radon Sensor

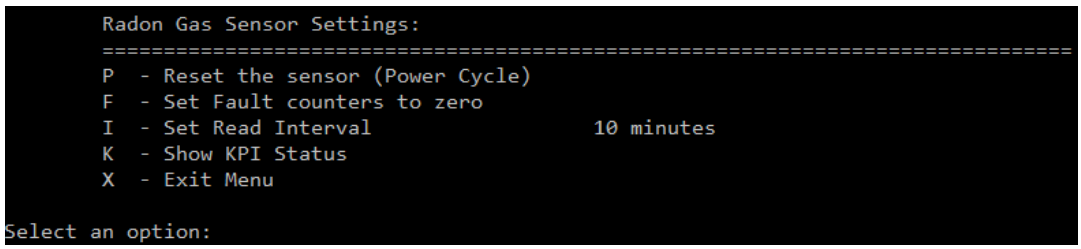
The radon sensor utilises a semiconductor alpha particle detector to measure ionizing radiation generated by radon decay, converting detected alpha events into a calculated radon concentration. To ensure statistically reliable measurement, the first validated concentration reading is available approximately 6 hours after power-up or reset.

The sensor provides the following radon measurements:

Type Hex	Type Dec	Sensor	Sensor Range	Units	Num Bytes	Format
0x75	117	Radon Sensor Uptime	0 to 2^32	Seconds	4	U32
0x76	118	Radon Gas average over uptime	0 to 2^16	Bq/m³	4	U16
0x77	119	Radon Gas average over 6 hours	0 to 2^16	Bq/m³	4	U16
0x78	120	Radon Gas average over 12 hours	0 to 2^16	Bq/m³	4	U16
0x79	121	Radon Gas average over 24 hours	0 to 2^16	Bq/m³	4	U16
0x7A	122	Radon Gas average over 48 hours	0 to 2^16	Bq/m³	4	U16
0x7B	123	Radon Gas average over 72 hours	0 to 2^16	Bq/m³	4	U16
0x7C	124	Radon Gas average over 96 hours	0 to 2^16	Bq/m³	4	U16

For additional technical details and implementation guidance, please refer to the Synetica enLink decoder on GitHub: https://github.com/synetica/enlink-decoder

To view and set the Radon Sensor settings, select **R** and the screen below will show.

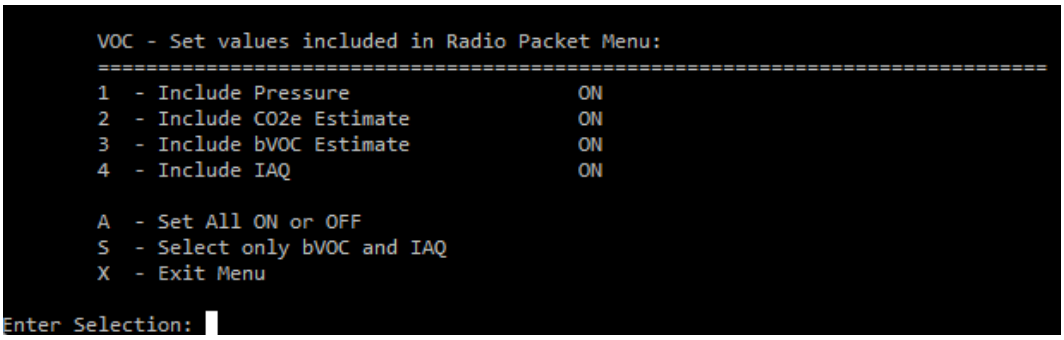


Please see the table below for information on each menu item.

Menu Item	Description Details
P - Reset the sensor (Power Cycle)	Reset the radon sensor. All averaged radon readings will be lost and all readings will revert to zero.
F - Set Fault counters to zero	Reset the internal radon sensor fault counters.
I - Set Read Interval	Set the radon sensor read frequency. Do not change this without consulting Synetica.
K - Show KPI Status	Show the radon sensor key performance indicator values. This information may be required for support purposes.

10. VOC Sensor Configuration

To view and set the VOC sensor configuration, enter **V** from the Configuration menu and the screen below will show.



The VOC configuration settings allow you to select which VOC sensor values are included in the LoRa data packet. By default, all parameters are transmitted, these can be turned off to reduce the amount of information transmitted or to avoid sending data which is not required by the application. All parameters can be toggled on or off from the menu.

The above parameters can also be set via LoRaWAN downlink message.

See https://github.com/synetica/enlink-decoder?tab=readme-ov-file#voc-sensor-downlinks for more details.

Menu Item	Description Details
Include Pressure	The VOC sensor includes an accurate barometric pressure sensor. Barometric pressure data can be integrated into HVAC (heating, ventilation, and air conditioning) systems to optimize air flow and pressure, improving energy efficiency and indoor air quality.
Include CO2e Estimate	The VOC sensor can provide a CO2 estimate. By using the IAQ index and other environmental data (like temperature, humidity, and pressure), the sensor estimates the equivalent CO2 (eCO2) levels. The estimation algorithm is designed to approximate the indoor CO2 levels that would be expected given the measured VOCs. Note that CO2e is not a CO2 measurement and should not be used where the unit is fitted with a CO2 sensor.
Include bVOC estimate	bVOC refers to the concentration of VOCs detected by the sensor, providing a baseline measure of indoor air quality. It represents the aggregated level of VOCs present in the environment, which is used to assess overall air quality. The bVOC reading is the same as the IAQ value expressed as parts per million (ppm) instead of as an Index.
Include IAQ	The VOC sensor provides an Indoor Air Quality (IAQ) index, which is a numerical value representing the overall quality of the indoor air. This index is calculated based on the concentrations of volatile organic compounds (VOCs) detected by the sensor, along with other environmental factors such as temperature, humidity, and pressure. The IAQ index ranges from 0 to 500, with lower values indicating better air quality and higher values indicating poorer air quality. Here's a general interpretation of the IAQ index values: 0-50: Excellent air quality 51-100: Good air quality 101-150: Lightly polluted (acceptable) 151-200: Moderately polluted (somewhat unhealthy) 201-300: Heavily polluted (unhealthy) 301-500: Severely polluted (very unhealthy to hazardous)

11. VOC Monitoring

In both indoor and outdoor environments, poor air quality can greatly impact our health and well-being. Volatile Organic Compounds (VOCs) concentration in an indoor space is a key indicator for air pollution measurement

Official air quality monitoring stations provide only consolidated or averaged data for the outdoor environment without the corresponding indoor air data. They do not generate personalised information.

The enLink IAQ unit incorporates a highly sensitive VOC sensor for air pollution measurement. Gases that can be detected by the VOC sensor include: Volatile Organic Compounds (VOCs) from paints (such as formaldehyde), lacquers, paint strippers, cleaning supplies, furnishings, office equipment, glues, adhesives and alcohol.

The table below illustrates the IAQ Index parameter with a description of the air quality, its impact and suggested action for that level / banding. The unit also outputs a bVOC parameter which is the total VOCs expressed as a parts per million (PPM) value instead of an index (see section 16 below for more details).

IAQ Index	Air Quality	Impact (long-term exposure)	Suggested action
0 – 50	Excellent	Pure air; best for wellbeing	No measures needed
51 – 100	Good	No irritation or impact on wellbeing	No measures needed
101 – 150	Lightly polluted	Reduction of wellbeing possible	Ventilation suggested
151 – 200	Moderately polluted	More significant irritation possible	Increase ventilation with clean air
201 – 250[1]	Heavily polluted	Exposition might lead to effects like headache depending on type of VOC	Optimise ventilation
251 – 350	Severely polluted	More severe health issue possible if harmful VOC present	Contamination should be identified if level is reached even without the presence of people; maximise ventilation and reduce attendance
> 351	Extremely polluted	Headaches, additional neurotoxic effects possible	Contamination needs to be identified; avoid presence in room and maximise ventilation

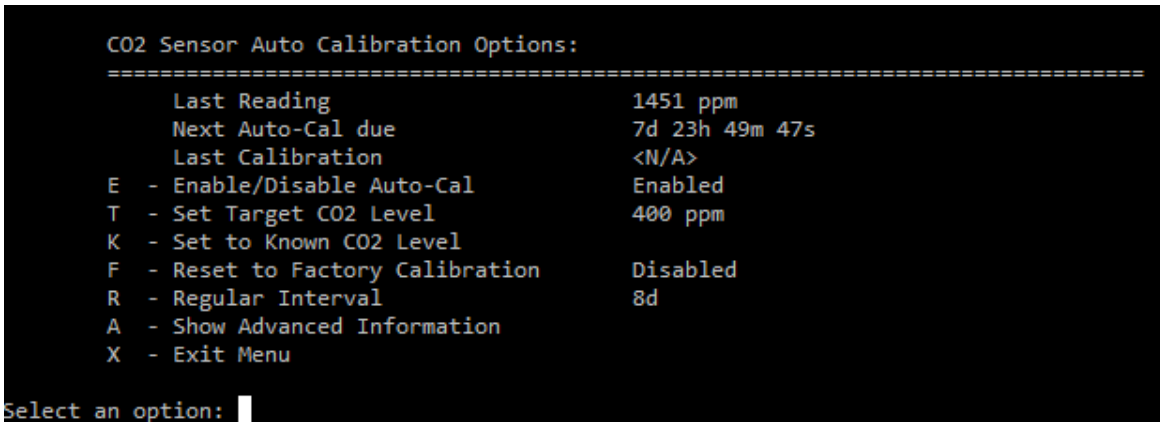
Indoor air quality (IAQ) classification and colour coding [1]

[1] According to the guidelines issued by the German Federal Environmental Agency, exceeding 25 mg/m3 of total VOC leads to headaches and further neurotoxic impact on health.

Compliant to the ISO16000-29 standard “Test methods for VOC detectors”.

12. CO_2 Sensor Auto Calibration Configuration

This section refers to models with CO_2 sensor option fitted. To view and set CO_2 sensor calibration information, enter **C** and the screen below will show.



Please see the table below for information on each menu item.

Menu Item	Description Details
Last/Minimum Reading	Shows the last CO_2 value read and the minimum CO_2 value read since the last auto calibration.
Next Auto-Cal due	Shows when the next auto-calibration routine will occur
Last Auto-Cal result	Shows the value of the last auto calibration result. Used internally by the sensor.
Calibration Success	This shows the total number of successful auto calibrations since the device was powered up.
Out-of-bounds Ignored	Shows the number of times that auto calibration did not run due to the Out Of Bounds setting.
E - Enable/Disable Auto-Cal	Enables or disables the auto calibration routine.
T - Set Target CO_2 Level	This is the known CO_2 corresponding to the minimum value the sensor has read since power-up or last calibration. It is normally 'fresh air' or the lowest level when the building is unoccupied overnight or at weekends. Typically this is 400 ~ 450 ppm.
K - Set to Known CO_2 Level	This will re-calibrate the zero point of the sensor to a known gas concentration. The sensor should be placed in this gas concentration and allowed to stabilise. This command runs in the background and will take 8 to 10 seconds to complete. As an example, fresh air is typically around 400 ~ 450 ppm.
F- Reset to Factory Calibration	This resets the sensor to the factory calibration settings.
R - Regular Interval	This is the standard calibration interval, it is set to 8 days by default to accommodate a week long period where the minimum sensed CO_2 level should have fallen to background levels..
A-Show Advanced Information	Shows more advanced sensor information, such as, temperature, total reads, calibration target/ period, calibration success/fail and error count.

Many of the above parameters can also be set via LoRaWAN downlink message. See https://github.com/synetica/enlink-decoder?tab=readme-ov-file#carbon-dioxide-sensor-downlinks for more details.

The CO_2 sensor needs to be exposed to fresh, clean air periodically for the auto calibration to be successful. Most occupied areas are unoccupied for some time during a week-long period, typically at night, or at the weekend and therefore the auto calibration runs every 8 days by default. Background CO_2 levels are typically around 400-450 ppm, if the background CO_2 level is known to be a different value then this can be set in the “Set Target CO_2 Level” parameter

If a unit is placed in an area where the CO_2 level may not fall below a certain level, e.g. 450ppm, during the calibration interval then the “Out-of-bounds check” parameter can be set so that the auto calibration routine does not run. As an example, if an area is continuously occupied for a long period and the minimum CO_2 reading does not fall below, say 450ppm, then it is undesirable to run the auto-calibration routine based on a target of 400ppm. In this case, if the “Set Target CO_2 Level” is set to 400ppm and the “Out-of-bounds check” value is set to +/-50 ppm then the auto-calibration routine will not run unless the minimum read value falls below 451ppm in the interval.

13. CO_2 Monitoring

Measuring CO_2 levels can serve as a good indicator of the indoor air quality. CO_2 concentrations within a building are often used to indicate whether adequate fresh air is being supplied to the space. Indoor CO_2 concentration is directly proportional to the number of people in a building and the ability of the ventilation system to dilute the CO_2 generated by occupants.

Moderate to high levels of carbon dioxide can cause headaches and fatigue, and higher concentrations can produce nausea, dizziness, and vomiting. Elevated levels of CO_2 can also affect performance and productivity. In one study 3 out of 24 employees cognitive scores were 50% lower when the participants were exposed to 1,400ppm of CO_2 compared with 550ppm during a working day.

CO2 concentration	Remarks / Effect
400ppm	Normal CO_2 concentration in outdoor ambient air
400-1,000ppm	Concentrations typical of occupied indoor spaces with good ventilation
1,000-2,000ppm	Complaints of drowsiness and poor air
2,000-5,000 ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Lack of concentration, loss of attention, increased heart rate and slight nausea may also be present
5,000ppm +	Workplace exposure limit (as 8-hour TWA)

14. Particulate Matter Sensor Configuration

This section refers to models with the Particulate matter sensor option fitted. To view and set Particulate Sensor Information, enter **P** and the screen below will show.

```
        Particulate Sensor:
        ================================================================================
        F   - Fan run period                    8s (per sample)
        C   - Cleaning interval                 7d
        R   - Set values included in Radio Packet
        X   - Exit Menu

Enter Selection:
```

Menu item **F** sets the particulate sensor fan run time. The default is 8 seconds and is the recommended setting for most applications. The fan run time may be extended to increase accuracy, however this will have an impact on the battery life.

The particulate sensor has a self-cleaning function which runs the fan at high speed to clean away any dust build up in the measurement chamber. By default, this cleaning cycle operates every 7 days but may be changed if required.

Reducing the cleaning interval will have a detrimental effect on battery life.

The Particulate Matter configuration settings, menu item **R**, allow you to select which PM sensor values are included in the LoRa data packet. By default, all parameters are transmitted, these can be turned off to reduce the amount of information transmitted or to avoid sending data which is not required by the application. All parameters can be toggled on or off from the menu.

```
        PM: Set values included in Radio Packet Menu:
        ================================================================================
        1  - Include PM 1.0                     OFF
        2  - Include PM 2.5                     ON
        3  - Include PM 4.0                     OFF
        4  - Include PM 10.0                    ON
        5  - Include PC 0.5                     OFF
        6  - Include PC 1.0                     OFF
        7  - Include PC 2.5                     OFF
        8  - Include PC 4.0                     OFF
        9  - Include PC 10.0                    OFF
        10 - Include TPS                        OFF

        A  - Set All ON or OFF
        S  - Select only PM 2.5 and PM 10.0
        X  - Exit Menu

Enter Selection:
```

The above parameters can also be set via LoRaWAN downlink message. See:
https://github.com/synetica/enlink-decoder?tab=readme-ov-file#particulate-sensor-downlinks for more details.

15. Installation Guidance

Correct installation of the IAQ Radon monitor is essential to ensure accurate and representative radon measurements. Radon concentration can vary significantly within a building depending on ventilation, building structure, and proximity to the ground.

The monitor should therefore be installed in a location that reflects the typical breathing zone of occupants and where airflow conditions represent the general indoor environment.

Recommended Installation Locations

The monitor should be installed in areas where people spend significant time.

Typical recommended locations include:

- Living rooms or family rooms
- Bedrooms
- Offices
- Classrooms
- Basements or ground-floor rooms
- Communal areas in residential buildings

Where multiple floors exist, radon monitoring should ideally be carried out on the lowest occupied level of the building.

Mounting Height

Install the monitor within the typical breathing zone:

- 0.8 m to 2.0 m above the floor

The device may be:

- wall mounted, or
- placed on a shelf, desk, or stable surface.

Avoid placing the monitor directly on the floor.

Locations to Avoid

To ensure accurate measurement, do not install the monitor in locations that may distort the radon reading.

Avoid locations:

- Within 1 metre of windows or exterior doors
- Close to ventilation outlets or air conditioning units
- Near heat sources (radiators, heaters, direct sunlight)
- In bathrooms, kitchens, or laundry rooms
- In areas with excessive humidity or condensation
- Inside cupboards, cabinets, or enclosed spaces
- Directly above the ground floor slab or crawlspace openings

Strong airflow or unusual air circulation can dilute or concentrate radon and may affect the measurement.

Installation Environment

The monitor is designed for indoor environmental monitoring.

Ensure the installation environment meets the following conditions:

Parameter	Recommended Range
Temperature	0 °C to 40 °C
Relative Humidity	0–90% RH (non-condensing)
Airflow	Normal indoor air movement

Avoid installation in areas exposed to water ingress, dust accumulation, or chemical vapours.

Initial Stabilisation Period

Following power-up or reset, the radon sensor requires an initial stabilisation period.

Typical behaviour:

- The first radon reading is available approximately 6 hours after power-up
- Measurement accuracy improves as the monitor collects more data
- Long-term average values provide the most reliable indication of radon exposure

Users should allow the monitor to operate continuously for at least 24–48 hours before interpreting the readings.

Installation in Multi-Room Buildings

Radon levels can vary significantly between rooms.

For large buildings or buildings with multiple floors:

- Install one monitor per frequently occupied area
- Prioritise ground-floor or basement rooms
- Consider additional monitors in:
  - poorly ventilated areas
  - rooms with ground contact
  - older buildings with porous foundations

Power and Communication Considerations

Ensure the device is installed where reliable power supply and communication coverage are available.

- Verify adequate LoRaWAN / cellular signal strength
- Avoid installation inside metal cabinets or enclosures
- Maintain reasonable distance from large metal structures

Installation Checklist

Before completing installation confirm that:

- ☑ The device is located in a representative occupied space
- ☑ The monitor is 0.8–2 m above floor level
- ☑ The location is away from windows, vents, and heat sources
- ☑ The environment is dry and free from condensation
- ☑ The device has adequate wireless connectivity
- ☑ The monitor has been powered for at least 6 hours before evaluating readings

Important Notes

- Radon concentrations can fluctuate throughout the day due to ventilation, weather, and pressure changes.
- Short-term readings should not be used alone to assess long-term exposure risk.
- Continuous monitoring provides the most accurate assessment of indoor radon levels.

General Safety

IAQ Radon is designed for indoor environmental monitoring of radon gas concentrations. It must be installed and operated in accordance with the instructions provided in this manual.

Failure to follow installation and operating instructions may result in inaccurate measurements or device malfunction.

The device contains sensitive electronic components and should not be opened, modified, or serviced by unauthorized personnel.

Intended Use

The radon monitor is intended for:

- Continuous monitoring of indoor radon concentrations
- Use in residential, commercial, or public buildings
- Integration into building environmental monitoring systems

The device is not intended for use as a life-safety alarm or for environments requiring certified radiation detection equipment.

Environmental Safety

The device should only be operated within the specified environmental limits.

Avoid:

- Exposure to water or condensation
- Operation in explosive atmospheres
- Exposure to corrosive chemicals or vapours
- Direct contact with dust or debris

Operating the device outside of its specified conditions may affect performance and measurement accuracy.

16. Radon Overview and Health Risks

What is Radon?

Radon is a naturally occurring radioactive gas produced by the decay of uranium in soil, rock, and groundwater.

Radon is:

- Colourless
- Odourless
- Tasteless
- Invisible

Because radon gas cannot be detected by human senses, monitoring equipment is required to measure its concentration in indoor environments.

Radon can enter buildings through:

- Cracks in concrete floors and foundations
- Construction joints
- Service pipe penetrations
- Gaps around drains or cables
- Porous building materials

Once inside a building, radon can accumulate, particularly in poorly ventilated areas or rooms in contact with the ground.

Health Risks

When radon decays, it produces radioactive particles that can be inhaled. These particles can deposit in the lungs where they emit alpha radiation, which may damage lung tissue.

Long-term exposure to elevated radon concentrations increases the risk of lung cancer.

Radon is widely recognised as:

- The second leading cause of lung cancer after smoking
- The leading cause of lung cancer among non-smokers

The risk from radon exposure increases:

- with higher concentrations
- with longer exposure durations
- significantly for smokers

Health authorities therefore recommend monitoring indoor radon levels and taking action if concentrations exceed recommended limits.

17. Typical Guideline Levels

Radon concentrations are commonly expressed in:

- Becquerels per cubic metre (Bq/m³)

Typical guideline values:

Organisation	Reference Level
World Health Organization (WHO)	100 Bq/m³ recommended
UK Health Security Agency (UKHSA)	200 Bq/m³ action level
European Union Basic Safety Standards	300 Bq/m³ reference level

Continuous monitoring allows building occupants to identify elevated radon levels and assess exposure over time.

Interpreting Radon Readings

Short-Term vs Long-Term Measurements

Radon levels naturally fluctuate due to:

- ventilation
- atmospheric pressure
- weather conditions
- building occupancy

For this reason, short-term readings may vary significantly.

The most reliable indicator of radon exposure is the long-term average concentration, typically calculated over days, weeks, or months.

Understanding the Displayed Values

Radon Level	Interpretation
< 100 Bq/m³	Low radon concentration
100 – 200 Bq/m³	Moderate level – continued monitoring recommended
200 – 300 Bq/m³	Elevated – consider investigation or mitigation
> 300 Bq/m³	High – mitigation measures recommended

These values are indicative guidance and may vary depending on local regulatory recommendations.

Fluctuating Readings

It is normal for radon readings to change throughout the day. Users should focus on long-term trends rather than individual measurements.

18. Maintenance and Calibration

Routine Maintenance

IAQ Radon requires minimal routine maintenance.

Recommended actions:

- Periodically inspect the device for dust accumulation
- Ensure ventilation openings remain unobstructed
- Verify power and communication connections remain secure

The device should remain powered continuously for optimal measurement stability.

Cleaning

If necessary, the external surfaces may be cleaned using:

- a soft dry cloth, or
- a slightly damp cloth

Do not use:

- solvents
- aerosol cleaners
- abrasive materials

Avoid allowing moisture to enter the device.

Sensor Calibration

The radon sensor is factory calibrated to ensure accurate measurement. Under normal operating conditions no routine user calibration is required.

19. Troubleshooting

No Radon Reading

Possible causes:

Cause	Action
Device recently powered on	Allow up to 6 hours for first measurement
Communication interruption	Check LoRaWAN network connectivity
Device not powered	Verify battery level / power supply

Unexpectedly High Readings

Possible causes:

- building ventilation changes
- ground pressure changes
- closed windows and doors
- temporary environmental conditions

Recommended actions:

- allow readings to stabilise over 24–48 hours
- verify installation location
- confirm that the device is not located near cracks or openings in the floor

Unstable or Fluctuating Readings

Short-term fluctuations are normal.

Check for:

- airflow from vents or HVAC systems
- open windows or doors
- rapid environmental changes

Relocate the device if it is exposed to direct airflow.

Device Not Communicating

If the device fails to report data:

- verify LoRaWAN network coverage
- check device power, including battery (if using)
- confirm device configuration

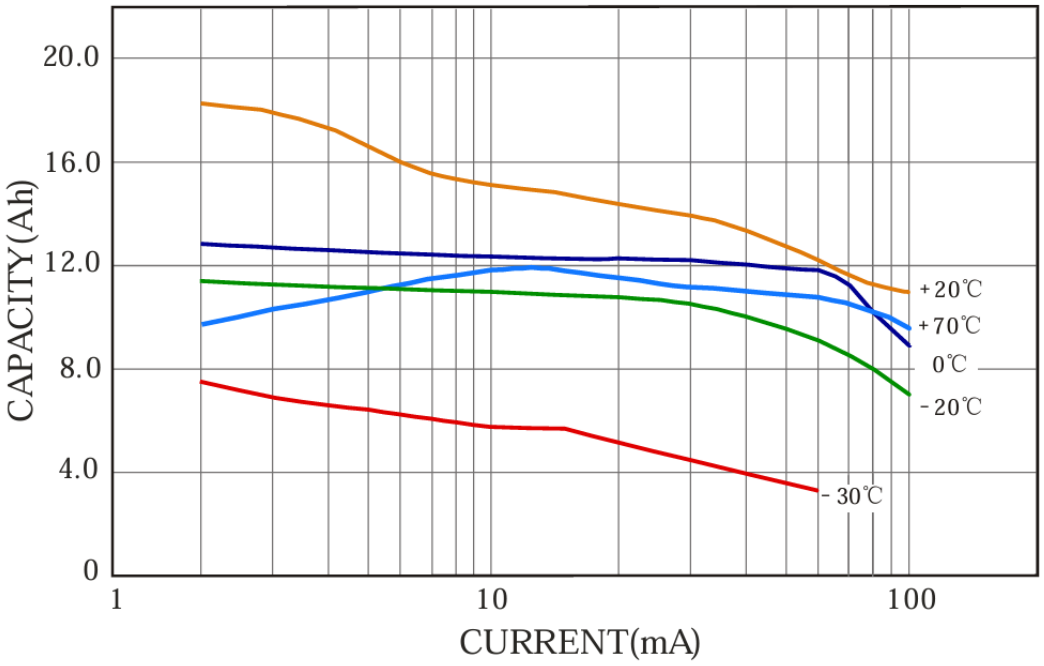
Consult the system administrator or network operator if the issue persists.

20. Power Considerations

The enLink IAQ-R can be powered with 1 x 3.6V lithium-thionyl chloride (Li-SOCl2) D sized battery or via external power (12 - 24V DC @ 200mA or greater).

enLink IAQ-R can be specified with many environmental sensor options including laser scattering particle matter sensor and a variety of gas sensors. These sensors consume considerable power while actively sensing and therefore, to prolong battery life, the sampling interval should be set to the longest period practical for the application. Sampling / transmission intervals of less than 30 minutes place strain on the batteries, limiting their capacity and should be avoided when operating on battery power. If more frequent sampling is required then external power should be applied to the unit.

Battery capacity is dependent on ambient temperatures and this should be considered when estimating battery life. Low temperatures slow down electrochemical reactions significantly and increase the internal resistance of the batteries. High temperatures increase the battery self-discharge. The chart below illustrates the effect of temperature on the av



Battery capacity vs current at various temperatures for EVE ER34615 batteries

Battery life is also highly dependent on the LoRa spreading factor used. Higher spreading factors result in longer active times for the radio transceivers and shorter battery life. Positioning devices in closer proximity to a gateway will generally result in lower spreading factors, shorter time on air and much lower transmit power.

21. Battery Installation / Replacement

enLink IAQ devices use 1 x EVE ER34615EHR2 D size 3.6 volt lithium-thionyl chloride (Li-SOCl2) batteries (non-rechargeable) or direct equivalent.

No other batteries are approved for use in the device.

Lithium-thionyl chloride batteries have very high energy capacity and must be used and handled with care observing the guidance below.

WARNING!

Risk of death or serious injury from explosion or fire

- Keep out of sight and reach of children.
- Fire, explosion and burn hazard - do not recharge, short circuit, crush, disassemble, incinerate.
- Due to the high terminal voltage (3.6V), they are not suitable as direct replacements for other battery technologies in the same can sizes.
- When not in use the Batteries must be stored in a non-hazardous area.
- Do not change batteries in an explosive gas atmosphere.
- When installing batteries, do not snag the battery terminal on the clip or the battery may be damaged. Do not apply excessive force.
- Do not drop. Dropping the battery may cause damage. If a battery is dropped, do not install the dropped battery into the unit
- Dispose of dropped battery promptly per local regulations or per the battery manufacturer's recommendations.

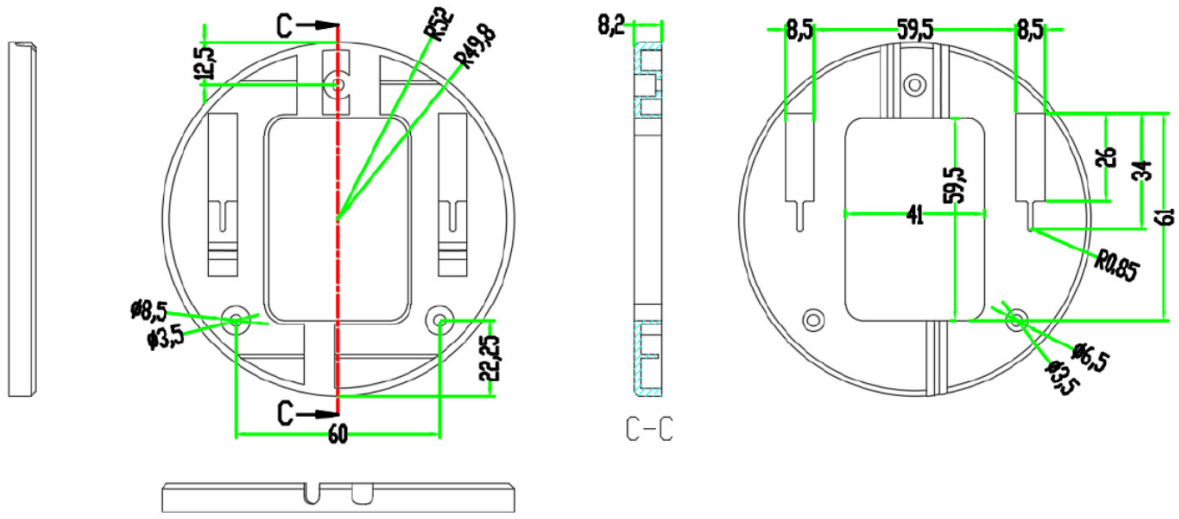
Guidance

- Always install the batteries correctly as per instructions taking great care to observe the battery polarity.
- Ensure that the contact points are clean and conductive.
- All batteries must be the same model from the same manufacturer.
- Do not mix old and new batteries or batteries from different manufacturers.
- Do not heat or attempt to recharge the battery.
- Do not dispose of in a fire.
- Only install approved batteries: EVE-ER34615EHR2 Lithium-thionyl chloride D battery 3.6 volt, or direct equivalent.

Safe Disposal

- Please recycle responsibly, a wide range of schemes are available.
- Do not dispose of in normal waste or in a fire.

22. Enclosure Mounting Details



The IAQ-R can be wall or ceiling mounted. A mounting bracket is provided with three mounting screw locations, the hole diameter is 3.5mm with a 6.5mm recess.

Fix the mounting bracket to the wall or ceiling using suitable fixings and then slide the IAQ onto the bracket.

When wall mounted, it is important that the unit has the recessed vent pointing down towards the floor to prevent dust build-up in the particle sensor. When the bracket is mounted with the orientation shown above the vent will be positioned correctly facing towards the floor.

23. LoRaWAN Payload Decoder

The latest LoRaWAN payload decoders and guides are available on the Synetica GitHub repository:

https://github.com/synetica/enlink-decoder

A live payload decoder which allows you to paste LoRa payloads in Hexadecimal or Base 64 and see the correctly decoded results can be found at the link below:

https://synetica.github.io/enlink-decoder/

24. Technical Support

For technical assistance, please visit the downloads section of our web site at www.synetica.net or email us at support@synetica.net

25. Revsion History

Revision	Date	Description
1.00	2nd March 2026	Initial release.
1.01	4th March 2026	Added installation guidance and data interpretation guidance.

About us

Synetica was established in 2008 with the simple idea to revolutionise air quality monitoring, energy usage and remote asset monitoring. Our global customer base relies on our expertise to help them reduce emissions and clean up the air they breathe by allowing them to monitor their energy usage and key environmental parameters via the touch of a button.

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Rev 1.01