



Quick Start Guide

enLink IAQ

Wireless Indoor Air Quality Monitor

- LoRa long range wireless
- Satisfies the accuracy and range requirements for IWBI WELL v2 standard.
- Battery or externally powered
- Built in sensor options for:
 - Temperature (°C)
 - Carbon Dioxide (CO₂)*
 - Barometric Pressure (Pa)*
 - Particles PM 1, 2.5, 4, 10*
 - Humidity (%RH)
 - Sound (dB)*
 - Volatile Organic Compounds (VOC's)*
 - Ozone*



Temperature



Humidity



VOC's



Pressure



CO₂



Sound



Particles



Ozone

The enLink IAQ wireless Air Quality Monitor is a precision instrument which accurately measures up to 8 key environmental parameters including Temperature, Humidity, VOC's, Carbon Dioxide, Particulate Matter (PM1, PM 2.5, PM4 & PM10), Sound Level, Barometric Pressure and Ozone.

enLink IAQ is a precision instrument and satisfies the accuracy and range requirements for IWBI WELL v2 certification.

Readings are transmitted to the cloud using long range LoRa wireless, where the data can be displayed and analysed.

A built in USB port allows all parameters including air quality data, wireless signal strength and wireless network configuration to be viewed and set using simple menus via any USB enabled host such as a PC or Mac.

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
- CE compliant
- RoHS compliant
- Made in the UK

**Model dependent*



Introduction

LoRa devices can be configured using OTAA (Over-the-Air-Activation) or ABP (Activation-by-Personalisation).

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 DevAddr (device address) 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.

For many applications Synetica can supply enLink AQ units with the above parameters pre-configured, so providing the LoRa gateway has the matching keys the join process will happen automatically once the enLink AQ unit is in wireless range and switched 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 if required and the process is detailed later in this document.



To get started with enLink IAQ wireless sensor, follow these steps:

1. Setup using Multitech Conduit® AEP

Multitech's Conduit is a leading configurable, manageable, and scalable LoRa gateway and can be quickly and easily configured to create a LoRaWAN network with enLink LoRa devices.



To enable LoRa devices to connect to the Conduit the **AppEUI** and **AppKey** must be changed to match those of the enLink devices.

For Multitech Conduit units running V1.6.4/1.7.0, follow the process below. Detailed instructions can be found on the Multitech Web Site (www.multitech.net).

Logon to the Conduit and select **LoRaWAN** -> **Network Settings**

Set the **Mode** to **Network Server**, then set the **Channel Plan** required and set the **Mask** to **00FF** as shown below.

The screenshot displays the Multitech Conduit web interface. The left sidebar contains navigation links: Home, Save and Restart, Setup, LoRaWAN™, Network Settings (selected), Key Management, Gateways, Devices, Device Groups, Profiles, Packets, Downlink Queue, and Operations. The main content area is titled 'LoRaWAN Networking' and includes a 'Reset To Default' button. Under 'LoRa Mode', the 'Mode' is set to 'NETWORK SERVER'. Below this, there are fields for 'Packet Forwarder' (4.0.1-r12.0), 'Network Server' (2.1.5), 'Lens Server' (2.1.5), 'FPGA Version' (31), and 'Frequency Band' (868). The 'Status' for 'Network Server' is 'RUNNING'. A 'Restart LoRa Services' button is present. The 'LoRaWAN Network Server Configuration' section is expanded, showing 'Channel Plan' set to 'EU868' and 'Channel Mask' set to '00FF'. The 'Network' section shows 'Network Mode' set to 'Public LoRaWAN'. The 'Settings' section shows 'Tx Power' at 26 dBm, 'Antenna Gain' at 3 dBi, 'Rx 1 DR Offset' at 0, 'Rx 2 Datarate' at 0 - SF12BW125, 'ADR Step' at 30 cBm, 'Min Datarate' at 0 - SF12BW125, 'Max Datarate' at 3 - SF9BW125, and 'ACK Timeout' at 5000.

Next, select the Key Management menu and set the **AppEUI** and **AppKey**. Ensure that these match the enLink devices you want to join the LoRa network.



MultiConnect® Conduit - Application Execution Platform
MTCDT-LEU1-246A Firmware 1.6.4

Logged In: admin Logout
Search:

Home
Save and Restart
Setup
LoRaWAN™

Network Settings
Key Management
Gateways
Devices
Device Groups
Profiles
Packets
Downlink Queue
Operations

Cellular
Firewall
SMS
Tunnels
Administration
Status & Logs

Key Management ? [Reset To Default](#)

Join Server
Location Local Keys

Local End-Device Credentials [Add New](#)

Device EUI	App EUI	App Key	Class	Device Profile	Network Profile	Options
-	-	-	-	-	-	-

Settings

Local Network Settings

Enabled ☒

Network ID (AppEUI) EUI

EUI 53:79:6E:00:00:00:00:00

Network Key (AppKey) Key

Key 9e:26:01:37:fd:08:4b:7c:92:c6:62:6f:25:a3:22:09

Default Profile DEFAULT-CLASS-A

[Submit](#)

Once the keys are set, select **Submit**. The Conduit will prompt to **Save and Restart**. The settings will not take effect until the Conduit has restarted. Once the unit has restarted you are ready to join enLink devices to the network.

MultiConnect® Conduit - Application Execution Platform
MTCDT-LEU1-246A Firmware 1.6.4

Logged In: admin Logout
Search:

Home
Save and Restart
Setup
LoRaWAN™

Network Settings
Key Management
Gateways
Devices
Device Groups
Profiles
Packets
Downlink Queue
Operations

Cellular
Firewall
SMS
Tunnels
Administration
Status & Logs

Key Management ? [Reset To Default](#)

Join Server
Location Local Keys

Local End-Device Credentials [Add New](#)

Device EUI	App EUI	App Key	Class	Device Profile	Network Profile	Options
-	-	-	-	-	-	-

Settings

Local Network Settings

Enabled ☒

Network ID (AppEUI) EUI

EUI 53:79:6E:00:00:00:00:00

Network Key (AppKey) Key

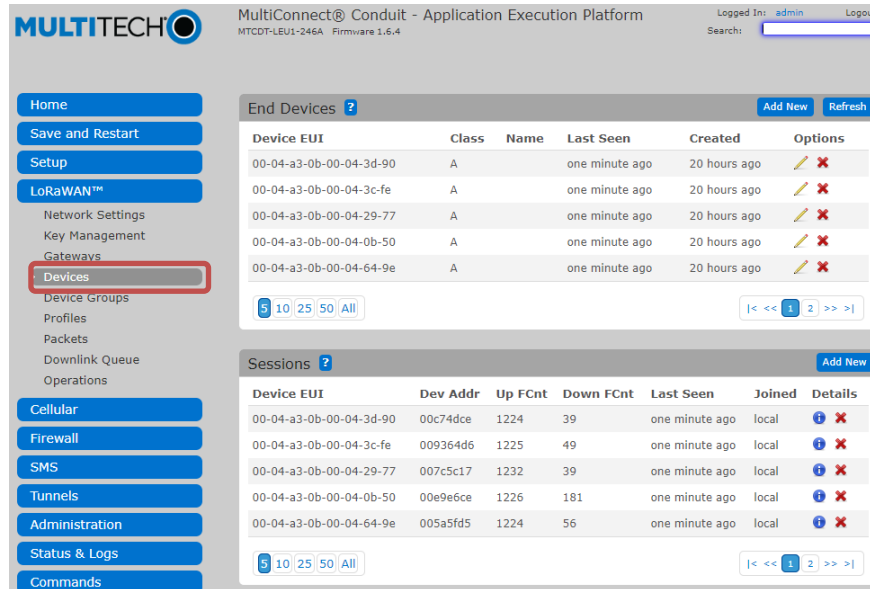
Key 9e:26:01:37:fd:08:4b:7c:92:c6:62:6f:25:a3:22:09

Default Profile DEFAULT-CLASS-A

[Submit](#)

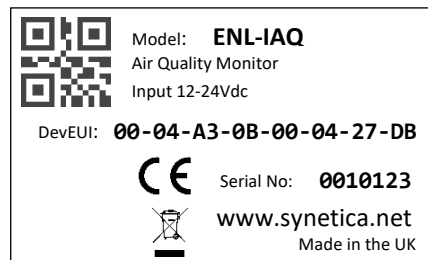
The Conduit gateway is now ready to receive devices onto the network. On the Conduit, select **LoRaWAN -> Devices** as shown below. This screen shows details of devices which have joined the network, when they joined and when the last message was received from them. As you add devices to the network, this is where they will appear.





2. Join enLink devices to the LoRa network

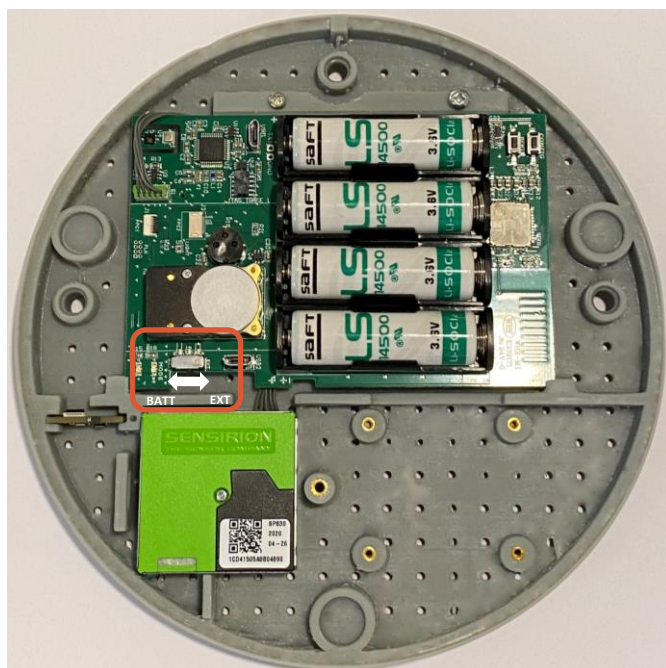
enLink devices in wireless range and with the correct AppEUI and AppKey settings will automatically join the LoRa network when they are first powered up.



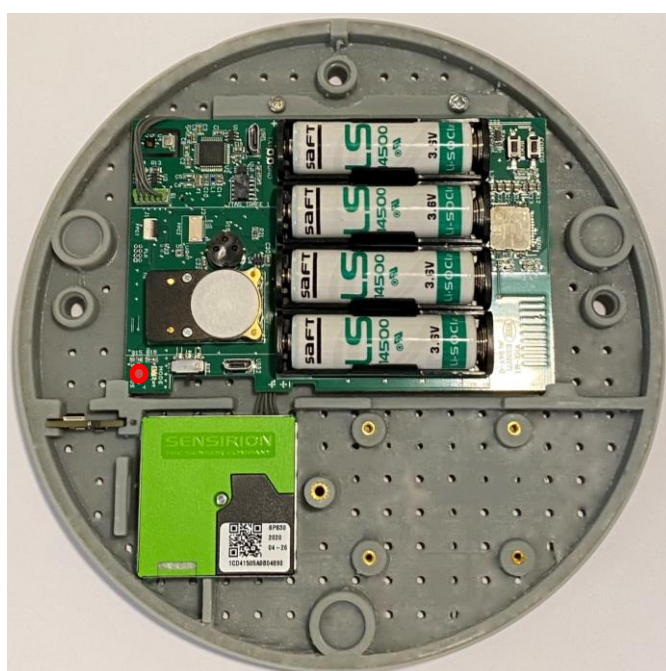
enLink IAQ Unit Label

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.

To power the device ON, install batteries and slide the power switch to BATT or apply external power (12V-24V DC) to the unit and slide the power switch to EXT.

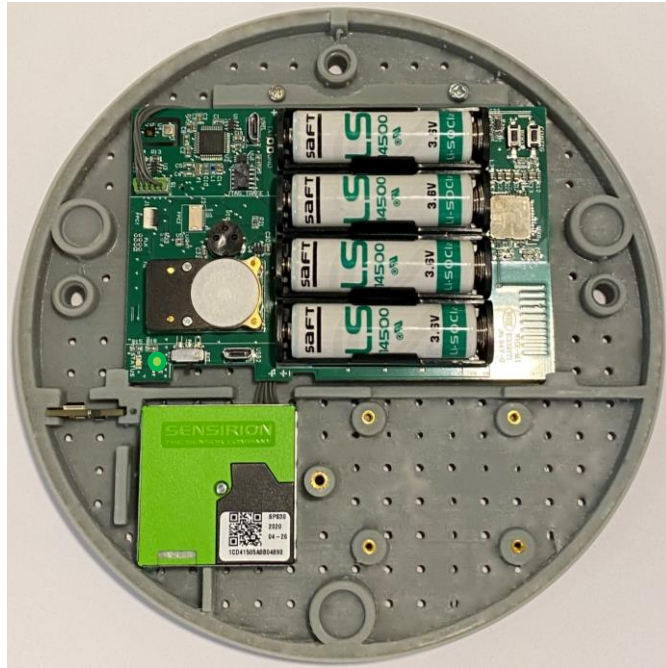


Once powered ON, the enLink device will send a Join request message to the Conduit. The Status LED will blink RED as shown below whilst the Join process is taking place. Depending on factors such as signal strength, RF interference etc the Join process may take several seconds to complete.



Blinking Red LED – Attempting Join

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.



Blinking Green LED – Device Successfully Joined

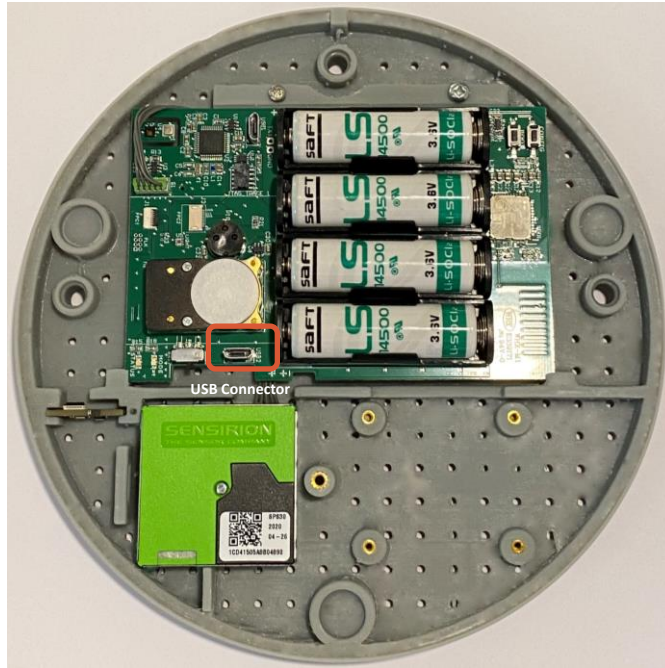
Devices which have Joined the network appear in the Conduit **LoRaWAN** - > **Devices** menu as shown previously.

3. Setting / changing the enLink LoRa keys

For many 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.

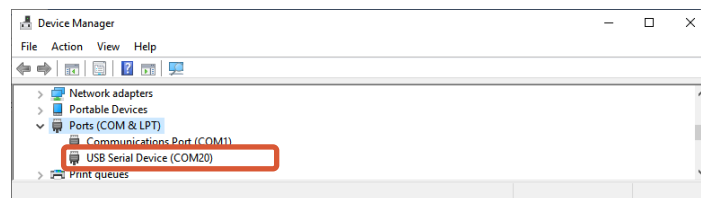
Once the cover is removed, connect a micro USB cable to the enLink unit. There are two USB connectors on the enLink IAQ, so be sure to connect to the correct USB port as shown in the image below. The device will attach to a COM port on your PC.



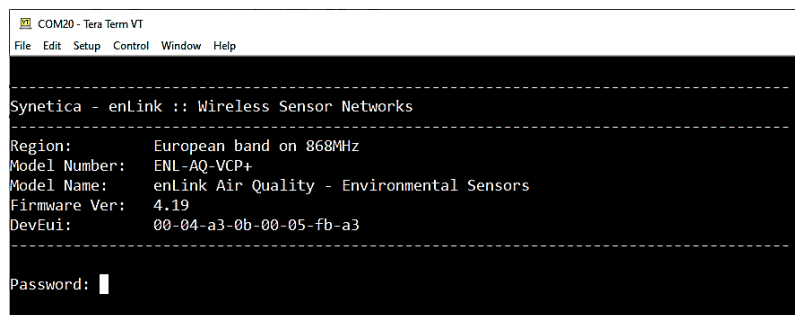
Configuration USB Port

Using a terminal program (e.g. TeraTerm <https://ttssh2.osdn.jp/>) connect to the COM port used by the enLink device.

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 tap **Device Manager** on the menu.) Expand the **Ports (Com & LPT)** menu as shown below.

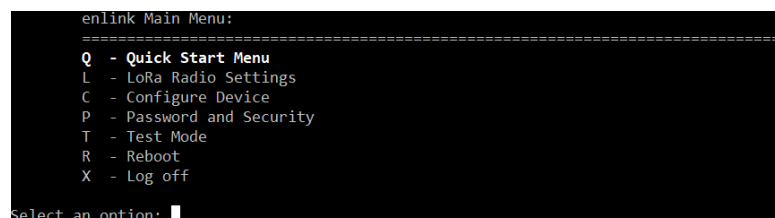


In your terminal program press the **Enter** key. An enLink summary screen will appear as shown below. The default password is the last four digits of the displayed **DevEui**, in the screen below this is fba3.



enLink logon screen

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



enLink Main 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**.

```
enlink Quick Start Menu:
=====
      Status                Joined 1m 15s ago
      Join Check in        18s

E - AppEui                 53-79-6E-00-00-00-00
K - AppKey                 9E-26-01-37-FD-08-4B-7C-92-C6-62-6F-25-A3-22-09
T - Transmit Interval      5 mins
X - Exit Menu

Select an option: █
```

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**.

```
Select an option: e
Current Setting: AppEui = 53-79-6E-00-00-00-00

Enter a new 16 character EUI using only numbers and the letters A to F (no separators)
Hit <S> to enter the default value: 53-79-6E-00-00-00-00
-----
New EUI: 53796E0000000000 █ S
```

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**.

```
Select an option: k
Current Setting: AppKey = 9E-26-01-37-FD-08-4B-7C-92-C6-62-6F-25-A3-22-09

Enter a new 32 character EUI using only numbers and the letters A to F (no separators)
Hit <S> to enter the default value: 9E-26-01-37-FD-08-4B-7C-92-C6-62-6F-25-A3-22-09
-----
New EUI: 9E260137FD084B7C92C6626F25A32209 █
```

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.

```
enLink Main Menu: ** Reboot Required **
=====
Q - Quick Start Menu
L - LoRa Radio Settings
C - Configure Device
P - Password and Security
T - Test Mode
R - Reboot
X - Exit and log off

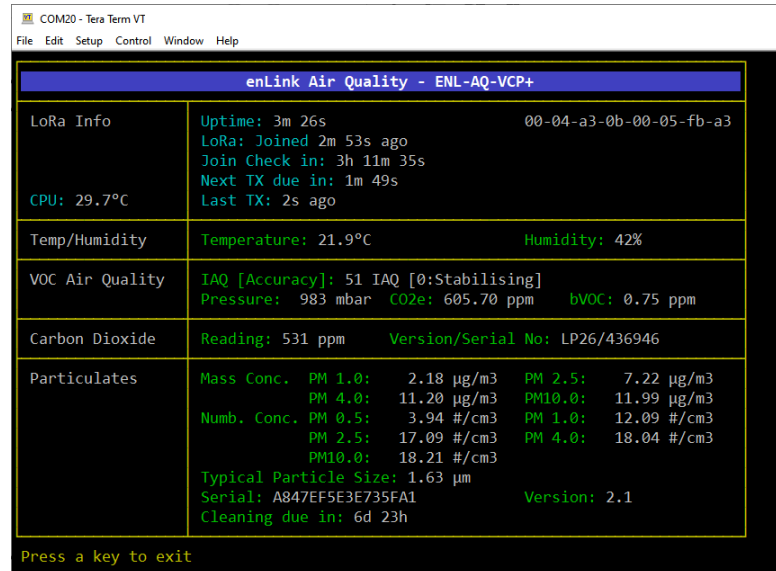
Enter Selection: █
```

Reboot Required notification

Check the Conduit **LoRaWAN** -> **Devices** menu detailed previously to verify that the enLink device has joined successfully.

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.



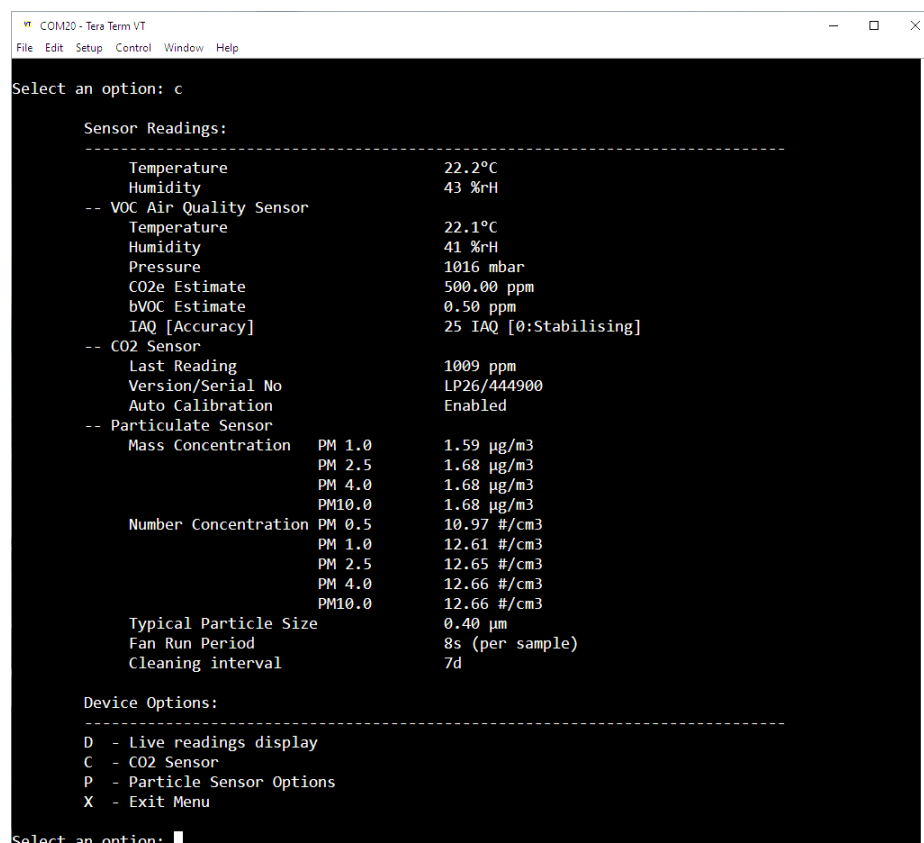
enLink Air Quality - ENL-AQ-VCP+	
LoRa Info	Uptime: 3m 26s 00-04-a3-0b-00-05-fb-a3 LoRa: Joined 2m 53s ago Join Check in: 3h 11m 35s Next TX due in: 1m 49s Last TX: 2s ago
CPU: 29.7°C	
Temp/Humidity	Temperature: 21.9°C Humidity: 42%
VOC Air Quality	IAQ [Accuracy]: 51 IAQ [0:Stabilising] Pressure: 983 mbar CO2e: 605.70 ppm bVOC: 0.75 ppm
Carbon Dioxide	Reading: 531 ppm Version/Serial No: LP26/436946
Particulates	Mass Conc. PM 1.0: 2.18 µg/m3 PM 2.5: 7.22 µg/m3 PM 4.0: 11.20 µg/m3 PM10.0: 11.99 µg/m3 Numb. Conc. PM 0.5: 3.94 #/cm3 PM 1.0: 12.09 #/cm3 PM 2.5: 17.09 #/cm3 PM 4.0: 18.04 #/cm3 PM10.0: 18.21 #/cm3 Typical Particle Size: 1.63 µm Serial: A847EF5E3E735FA1 Version: 2.1 Cleaning due in: 6d 23h

Press a key to exit

Live Display

Configuration Menu

The enLink IAQ 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 model and sensors fitted.

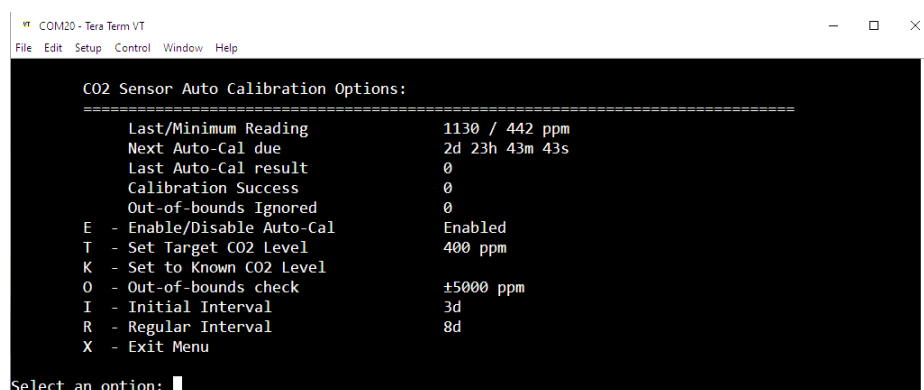


Sensor Readings:	
Temperature	22.2°C
Humidity	43 %rH
-- VOC Air Quality Sensor	
Temperature	22.1°C
Humidity	41 %rH
Pressure	1016 mbar
CO2e Estimate	500.00 ppm
bVOC Estimate	0.50 ppm
IAQ [Accuracy]	25 IAQ [0:Stabilising]
-- CO2 Sensor	
Last Reading	1009 ppm
Version/Serial No	LP26/444900
Auto Calibration	Enabled
-- Particulate Sensor	
Mass Concentration	PM 1.0 1.59 µg/m3 PM 2.5 1.68 µg/m3 PM 4.0 1.68 µg/m3 PM10.0 1.68 µg/m3
Number Concentration	PM 0.5 10.97 #/cm3 PM 1.0 12.61 #/cm3 PM 2.5 12.65 #/cm3 PM 4.0 12.66 #/cm3 PM10.0 12.66 #/cm3
Typical Particle Size	0.40 µm
Fan Run Period	8s (per sample)
Cleaning interval	7d
Device Options:	
D - Live readings display C - CO2 Sensor P - Particle Sensor Options X - Exit Menu	

Select an option: **D**

CO₂ Sensor Auto Calibration Configuration

To view and set CO₂ sensor calibration information, enter **c** and the screen below will show.



```
COM20 - Tera Term VT
File Edit Setup Control Window Help

CO2 Sensor Auto Calibration Options:
=====
Last/Minimum Reading      1130 / 442 ppm
Next Auto-Cal due        2d 23h 43m 43s
Last Auto-Cal result      0
Calibration Success       0
Out-of-bounds Ignored    0
E - Enable/Disable Auto-Cal  Enabled
T - Set Target CO2 Level  400 ppm
K - Set to Known CO2 Level
O - Out-of-bounds check   ±5000 ppm
I - Initial Interval      3d
R - Regular Interval      8d
X - Exit Menu

Select an option: 
```

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

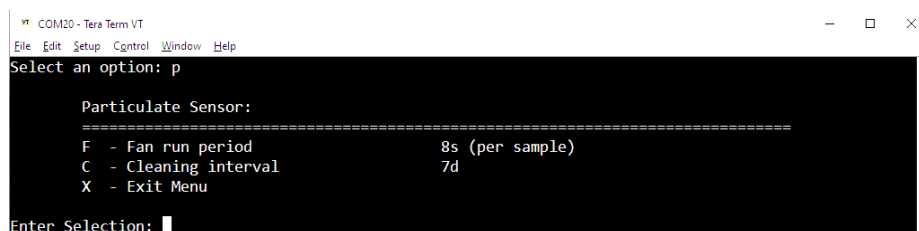
Menu Item	Description / details
Last/Minimum Reading	Shows the last CO ₂ value read and the minimum CO ₂ value read since the last auto calibration.
Next Auto-Cal due	Shows when the next autocalibration routine will occur
Last Auto-Cal result	Shows the value of the last auto calibration result. Used 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.
O - Out-of-bounds check	The Out-of-bounds value is used to ignore the calibration if the minimum value the sensor has read is not within a sensible range of the target concentration level. So, if the target concentration level is 400, the Out-of-bounds value is ±50 and the minimum reading is 451 (or more), the calibration routine is ignored.
I - Initial Interval	It is possible for the first auto-calibration to take place more quickly than the regular auto-calibration events. This can be useful to stabilise the readings quickly after installation.
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.

The CO₂ 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 CO₂ levels are typically around 400-450 ppm, if the background CO₂ level is known to be a different value then this can be set in the “Set Target CO₂ Level” parameter

If a unit is placed in an area where the CO₂ 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 CO₂ reading does not fall below, say 450ppm, then it is undesirable to run the autocalibration routine based on a target of 400ppm. In this case, if the “Set Target CO₂ Level” is set to 400ppm and the “Out-of-bounds check” value is set to +/-50 ppm then the autocalibration routine will not run unless the minimum read value falls below 451ppm in the interval.

Particulate Sensor Configuration

To view and set Particulate sensor information, enter **p** and the screen below will show.



```
COM20 - Tera Term VT
File Edit Setup Control Window Help
Select an option: p

Particulate Sensor:
=====
F - Fan run period          8s (per sample)
C - Cleaning interval       7d
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 for certain applications, however this will have an impact on the battery life of the unit.

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.

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

