synetica enLink

enLink OAQ

LoRaWAN Wireless Outdoor Air Quality Monitor

Specifications

Frequency range	868 / 915 MHz*
Protocol	LoRaWAN®
Receiver sensitivity	-135dBm @ 980bps
RF Transmit power	Up to +18dBm
Antenna	Integrated
Certifications	Pre-certified radio regulatory approvals: 868 & 915 MHz spectrum CE, FCC RoHS
Batteries	4 x AA sized 3.6V Lithium Thionyl Chloride. LS14500
External Power	12-24V Volts DC. 0.15 Amp (max)
Processor	ARM® Cortex® M0+
Dimensions	180mm x 120mm x 51mm
Weight	300g Including batteries (depending on sensor options)
IP Rating	IP42 (conformally coated electronics)
Orientation	Vertical wall mounting, North facing, in sheltered, shaded conditions
Operating	-10 – 40°C, 0 – 95%RH, Non-Condensing
Case materials	Nylon PA12

Temperature | Humidity | VOC's | Pressure | CO_2 | O_3 | Sound | Particles | EPA AQI | Plus 1 Gas

The enLink OAQ Indoor Air Quality Monitor is a precision instrument which accurately measures up to ten key environmental parameters including Temperature, Relative Humidity, VOC's, Carbon Dioxide, Particulate Matter (PM1, PM 2.5, PM4 & PM10), Sound Level, Barometric Pressure, EPA Air Quality Index (AQI), Ozone, Formaldehyde, Carbon Monoxide, Nitrogen Dioxide, Hydrogen Sulphide, Sulphur Dioxide and Oxygen.

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 / FCC compliant
- RoHS compliant
- Made in the UK

*Model dependent

OAQ Sensor Characteristics

Temperature	Accuracy: ±0.2°C (typical) Repeatability: ±0.1°C Conversion time: 6.35ms
Humidity	Accuracy: ±2% (typical) Repeatability: ±0.1% Response time: 15s
VOC's	IAQ Index 0 to 500 (see below) TVOC level (ppm) Variability ±15% (typical) Response time: (ττ33-63%) 1 s
Pressure	Accuracy: ±0.12hPa (equivalent to ±1m in altitude) Range (with full accuracy): 300 – 1100hPa Resolution: 0.18Pa
Particulate Matter	MCERTS Certified (PM2.5) Particles measured: PM0.5, PM1, PM2.5, PM4 & PM10 Sensing method: Laser-based light scattering particle sensing Concentration range: 0 – 1,000 µg/m^3 PM1, PM2.5 Accuracy: 0 µg/m^3 to 100 µg/m^3 ± 10 µg/m^3 100 µg/m^3 to 1000 µg/m3 ±10% m.v. PM4, PM10 Accuracy: 0 µg/m^3 to 100 µg/m^3 ± 25 µg/m^3 100 µg/m^3 to 1000 µg/m^3 ±25% m.v. Mass concentration resolution: 1 µg/m^3 Lower limit of detection: 0.3 µm Response Time: < 6s (t90) Sensor life expectancy: > 3 years Maintenance Interval: Keep vents clean. No additional maintenance required.
EPA Air Quality Index (AQI)	AQI Index 0 to 500 (see below) Ozone detection 20 – 500 ppb Nitrogen Dioxide Detection 20 – 500 ppb Variability ±50 AQI
CO_2 - Optional	Sensing method: Optical. Non-dispersive infrared (NDIR) Accuracy: ±(30, +3%) ppm (typ.) Range: 0 – 5,000 ppm Extended range 0 – 10,000 ppm Response time: 3 minutes (t90) Sensor life expectancy: >15 years Maintenance Interval: No maintenance required Built in Automatic Baseline Correction
Sound - Optional	Sensitivity: -26dB FS ±1dB SNR: 65dBA Dynamic Range: 91dBA Acoustic Overload Point: 120dB SPL Total Harmonic Distortion: 0.2% (Typ.) @ 105dB SPL

Part Number	Temperature	Relative Humidity	VOC's	Barometric Pressure	EPA AQI	Particulates PM1, 2.5, 4, 10
ENL-OAQ	●	●	●	●	●	●

Order part number **ENL-OAQ** for base enLink OAQ model with the sensors listed in the table above.

The base enLink OAQ model can be enhanced with CO_2 (-C option), plus up to two additional gas sensors, if two sensors are fitted, one of these must be Ozone. Units may be specified with one additional gas sensor plus Ozone from the selection guide in the section below.

Example 1, to order the unit with an Ozone (0-2ppm) sensor the part number is:

ENL-OAQ, AQS-O3-2

Example 2, to order the unit with, CO2, Ozone (0-2ppm) and Nitrogen Dioxide (0-5ppm) sensors the part number is:

ENL-OAQ-C, AQS-O3-2, AQS-NO2-5

Example 3, to order the unit with Nitrogen Dioxide (0-5ppm) sensor the part number is:

ENL-OAQ, AQS-NO2-5

Sensor Selection Guide							
Parameter	Type	Range	Units	Part Number	Calibration Certificate	Specific Gravity (SG) NTP*	Distribution
°C	Temperature	-40 - 85	°C	Fitted as standard	Factory Calibrated		
%RH	Humidity	0 - 100	%	Fitted as standard	Factory Calibrated		
Pa	Pressure	300 - 1100	hPa	Fitted as standard	Factory Calibrated		
PM	Particulate Matter	0 - 1,000	µg/m3	Fitted as standard	Factory Calibrated		
Sound	Decibels, A Weighted	91dBa	dB(A)	Option -S	--		
VOC	Volatile Organic Compounds	0 - 500	IAQ	Fitted as standard	Factory Calibrated	1	Evenly Distributed
CO_2	Carbon Dioxide	0 - 5000	ppm	Option -C	Factory Calibrated	1.5189	Floor to Middle
NH_3	Ammonia	0 - 100	ppm	AQS-NH3-100	✓	0.59	Ceiling / roof
NH_3	Ammonia	0 - 1000	ppm	AQS-NH3-1000	✓	0.59	Ceiling / roof
CO	Carbon Monoxide	0 - 10	ppm	AQS-CO-10	✓	0.9667	Evenly Distributed
HCHO	Formaldehyde	0 - 5	ppm	AQS-HCHO-5	✓	1.067	Evenly Distributed
H_2S	Hydrogen Sulphide	0 - 50	ppm	AQS-H2S-50	✓	1.1763	Floor to Middle
NO_2	Nitrogen Dioxide	0 - 5	ppm	AQS-NO2-5	✓	1.58	Floor to Middle
O_3	Ozone	0 - 2	ppm	AQS-O3-2	✓	1.66	Floor to Middle
SO_2	Sulphur Dioxide	0 - 5	ppm	AQS-SO2-5	✓	2.264	Floor
O_2	Oxygen	0 - 25	%	AQS-O2-25	✓	2.264	Floor

*NTP - Normal Temperature and Pressure - is defined as 20°C (293.15K, 68°F) and 1 atm. (101.325 kN/m^2, 101.325 kPa, 14.7 psia, 0 psig, 30 in Hg, 760 torr)

Sensors are grouped according to Specific Gravity (SG). Gas sensors should be used on the same enLink OAQ unit when the gases are Evenly Distributed and from the same SG band.

Examples:
Oxygen + Carbon Dioxide (Oxygen is evenly distributed and Carbon Dioxide is heavier than air.)
Oxygen + ~~*Carbon Dioxide*~~ + ~~*Ammonia*~~. (Ammonia and Carbon Dioxide have different SG and therefore need to be in separate enLink Air units.)
Oxygen + Ammonia. (Oxygen is evenly distributed and Ammonia is lighter than air.)

(enLink OAQ must be mounted at the correct height for the gases to be measured).

Performance Data

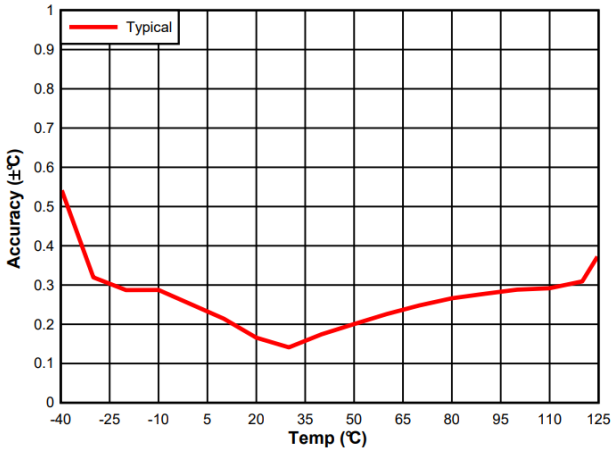
Temperature (°C)

Features

- Factory calibrated
- High accuracy digital sensor
- Excellent stability at high humidity

Specifications

Measurement:	Temperature °C
Operating Principle:	Digital
Measurement Range (full accuracy):	5°C to +60°C
Expected Operating Life:	> 10 years
Long Term Sensitivity Drift:	< 2% per month
Calibration:	Factory Calibrated
Resolution:	0.1°C
Accuracy (full range):	± 0.2°C
Temperature Range:	-20°C to +50°C
Humidity Range (non-condensing):	0 – 100 %RH
Response Time:	< 1 seconds
Storage Temperature:	-65°C to +150°C
Orientation Sensitivity:	None
Part Number:	Fitted as standard to enLink OAQ



Temperature Accuracy vs. Temperature

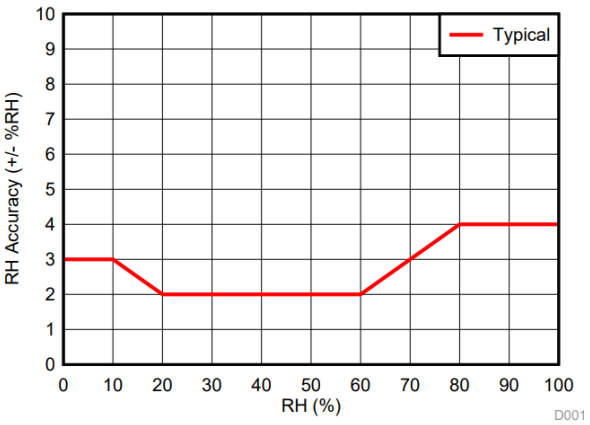
Relative Humidity (%RH)

Features

- Factory calibrated
- High accuracy digital sensor
- Excellent stability at high humidity

Specifications

Measurement:	Relative Humidity %RH
Operating Principle:	Digital
Measurement Range (full accuracy):	0 – 100 %RH
Expected Operating Life:	> 10 years
Long Term Sensitivity Drift:	0.25 %RH per year
Calibration:	Factory Calibrated
Resolution:	0.1 %RH
Accuracy (full range):	± 2 %RH
Temperature Range:	-20°C to +70°C
Response Time:	< 1 seconds
Storage Temperature:	-65°C to +150°C
Orientation Sensitivity:	None
Part Number:	Fitted as standard to enLink OAQ



RH Accuracy vs. RH

Barometric Pressure (Pa)

Features

- Factory calibrated
- High accuracy digital sensor

Specifications

Measurement:	Barometric Pressure
Operating Principle:	Digital
Measurement Range (full accuracy):	300 – 1100 hPa
Expected Operating Life:	> 5 years
Long Term stability:	1 hPa per year
Calibration:	Factory Calibrated
Resolution:	0.18 hPa
Accuracy (full range):	± 0.6 hPa
Relative Accuracy	± 0.12 hPa (equivalent to ±1m difference in altitude)
Temperature Range:	0°C to +65°C
Response Time:	< 10 seconds
Storage Temperature:	-45°C to +85°C
Orientation Sensitivity:	None
Part Number:	Fitted as standard to enLink OAQ

Particulate Matter PM0.5 to PM10

Features

- MCERTS Certified
- Laser-based light scattering particle sensing
- Concentration range: 0 µg/m3 to 1,000 µg/m3
- Fully calibrated
- Long life
- High reliability
- High resolution

Specifications

Measurement:	Particulate Matter
Operating Principle:	Laser-based light scattering particle sensing
Measurement Range (full accuracy):	0 – 1000 µg/m3
Expected Operating Life:	> 3 years
Calibration:	NA
Resolution:	1 µg/m3
Accuracy:	PM1, PM 2.5 0 µg/m3 to 100 µg/m^3 ± 10 µg/m^3 100 µg/m3 to 1000 µg/m^3 ± 10 % m.v. PM4, PM 10 0 µg/m3 to 100 µg/m^3 ± 25 µg/m^3 100 µg/m^3 to 1000 µg/m^3 ± 25 % m.v.
Number concentration size range	PM 0.5 0.3 - 0.5 µm PM 1.0 0.3 – 1.0 µm PM 2.5 0.3 – 2.5 µm PM 4 0.3 – 4 µm PM 10 0.3 - 10 µm
Temperature Range:	-10°C to +60°C
Humidity Range (non-condensing):	0 – 95% RH
Response Time (T90):	< 6 seconds
Storage Temperature:	-40°C to +70°C
Orientation Sensitivity:	As per mounting instructions
Part Number:	Fitted as standard to enLink OAQ

The TPS reading from the sensor is the Typical Particle Size of the particulate matter in µm. It provides an indication on the average particle diameter in the sample aerosol. The output correlates with the weighted average of the number concentration bins measured with a TSI 3330 optical particle sizer. Lighter aerosols will have smaller TPS values than heavier aerosols. The reactiveness of this output increases with the particle statistics: a larger number of particles in the environment will generate more rapidly meaningful TPS values than a smaller number of particles (i.e., clean air).

Volatile Organic Compounds VOC's (IAQ)

Features

- Factory calibrated
- Digital Indoor Air Quality sensor
- Tested to ISO16000-29 "Test methods for VOC detectors".

Specifications

Measurement:	Volatile Organic Compounds VOC's
Operating Principle:	Metal Oxide Adsorption
Measurement Range (full accuracy):	0 – 500 IAQ
Expected Operating Life:	>5 years
Calibration:	Factory Calibrated
Resolution:	1 IAQ
Accuracy:	± 15% (typ.)
Temperature Range:	-40°C to +85°C
Humidity Range (non-condensing):	10 – 95% RH
Response Time:	< 2 seconds
Storage Temperature:	-45°C to +85°C
Orientation Sensitivity:	None
Part Number:	Fitted as standard to enLink OAQ

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

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

[1] According to the guidelines issued by the German Federal Environmental Agency, exceeding 25 mg/m^3 of total VOC leads to headaches and further neurotoxic impact on health.

[2]Software auto-calibrates the low and high concentrations applied during testing to IAQ of 25 and 250, respectively

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

bVOC mixture with Nitrogen as carrier gas

Molar fraction	Compound	Certified accuracy
5 ppm	Ethane	5 %
10 ppm	Isoprene /2-methyl-1,3 Butadiene	5 %
10 ppm	Ethanol	5 %
50 ppm	Acetone	5 %
15 ppm	Carbon Monoxide	2 %

EPA Air Quality Index (AQI)

Features

- Factory calibrated
- Digital Indoor Air Quality sensor
- Tested to ISO16000-29 “Test methods for VOC detectors”.

Specifications

Measurement:	Ozone and Nitrogen Dioxide to determine AQI
Operating Principle:	Metal Oxide Adsorption
Measurement Range (full accuracy):	0 – 500 AQI
Expected Operating Life:	>5 years
Calibration:	Factory Calibrated
Resolution:	1 AQI
Accuracy:	± 50 AQI
Temperature Range:	-40°C to +65°C
Humidity Range (non-condensing):	5 – 90% RH
Response Time:	< 2 seconds
Storage Temperature:	-50°C to +125°C
Orientation Sensitivity:	None
Part Number:	Fitted as standard to enLink OAQ

Outdoor air quality (AQI) classification and colour coding [1]

AQI Index	Levels of Concern	Description of Air Quality
0 – 50	Good	Air quality is satisfactory, and air pollution poses little or no risk.
51 – 100	Moderate	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
101 – 150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
151-200	Unhealthy	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
201 – 300	Very Unhealthy	Health alert: The risk of health effects is increased for everyone.
301 and higher	Hazardous	Health warning of emergency conditions: everyone is more likely to be affected.

What is the EPA Air Quality Index (AQI)?

The AQI is the United States of America Environmental Protection Agency's (EPA) index for reporting air quality.

How does the AQI work?

Think of the AQI as a yardstick that runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 or below represents good air quality, while an AQI value over 300 represents hazardous air quality.

For each pollutant an AQI value of 100 generally corresponds to an ambient air concentration that equals the level of the short-term national ambient air quality standard for protection of public health. AQI values at or below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is unhealthy: at first for certain sensitive groups of people, then for everyone as AQI values get higher.

The AQI is divided into six categories. Each category corresponds to a different level of health concern. Each category also has a specific colour. The colour makes it easy for people to quickly determine whether air quality is reaching unhealthy levels in their communities.

Carbon Dioxide (CO_2)

Features

- Advanced optical NDIR technology
- Long life due to non-depleting sensing principle
- Self-correcting for pressure and altitude variations
- High reliability
- High resolution
- Automatic Baseline Correction

Specifications

Gas Detected:	Carbon Dioxide CO_2
Operating Principle:	Non-dispersive infrared (NDIR)
Measurement Range (full accuracy):	0 – 5000 ppm
Expected Operating Life:	> 15 years
Calibration:	Automatic baseline correction
Resolution:	0.1 ppm
Accuracy:	+/- (30, +3%) of reading, ppm
Temperature Range:	0°C to +50°C
Humidity Range (non-condensing):	0 – 95% RH
Response Time (T90):	< 60 seconds
Storage Temperature:	0°C to +20°C
Orientation Sensitivity:	None
Part Number:	-C (Optional sensor for enLink OAQ)

Ammonia (NH_3)

Features

- Liquid electrolyte
- Highly sensitive
  Combined with intelligent algorithms, has stronger adaptability to the environment, more accurate detection, and stable zero point

Specifications

Gas Detected:	Ammonia NH_3
Operating Principle:	Liquid electrochemical sensing technology
Measurement Range (full accuracy):	AQS-NH3-100 100 ppm AQS-NH3-500 500 ppm AQS-NH3-1000 1000 ppm
Expected Operating Life:	> 18 months
Calibration:	Manufacturer Calibration Certificate
Resolution:	AQS-NH3-100 0.1 ppm AQS-NH3-500 0.1 ppm AQS-NH3-1000 0.1 ppm
Accuracy:	± 5% Full Scale
Repeatability:	≤ 2%
Temperature Range:	-20°C to +40°C
Pressure Range:	900 – 1100 mbar
Humidity Range (non-condensing):	15 – 95% RH
Response Time (T90):	< 50 seconds
Storage Temperature:	0°C to +20°C
Orientation Sensitivity:	None
Part Number:	AQS-NH3-100 AQS-NH3-500 AQS-NH3-1000

Carbon Monoxide (CO)

Features

- Long life
- High reliability
- High resolution
- Combined with intelligent algorithms, has stronger adaptability to the environment, more accurate detection, and stable zero point

Specifications

Gas Detected:	Carbon Monoxide CO
Operating Principle:	Solid polymer electrochemical technology
Measurement Range (full accuracy):	0 – 10 ppm
Lower Detection Limit:	0.01 ppm
Expected Operating Life:	> 3 years
Calibration:	Manufacturer Calibration Certificate
Resolution:	0.001 ppm
Accuracy:	±5% Full Scale
Repeatability:	≤ 2%
Temperature Range:	-40°C to +50°C
Pressure Range:	Atm. ± 10%
Humidity Range (non-condensing):	15 – 95% RH
Response Time (T90):	< 30 seconds
Storage Temperature:	0°C to +20°C
Orientation Sensitivity:	None
Part Number:	AQS-CO-10

Formaldehyde ($HCHO/CH_2O$)

Features

- Long life
- High reliability
- High resolution
- Combined with intelligent algorithms, has stronger adaptability to the environment, more accurate detection, and stable zero point

Specifications

Gas Detected:	Formaldehyde CH2O
Operating Principle:	Solid polymer electrochemical technology
Measurement Range (full accuracy):	0 – 5 ppm
Expected Operating Life:	2 years
Calibration:	Manufacturer Calibration Certificate
Resolution:	0.01 ppm
Accuracy:	±5% Full Scale
Repeatability:	≤ 2%
Temperature Range:	-40°C to +50°C
Humidity Range (non-condensing):	15 – 90% RH
Response Time (T50):	< 40 seconds
Storage Temperature:	5°C to +20°C
Orientation Sensitivity:	None
Part Number:	AQS-HCHO-5

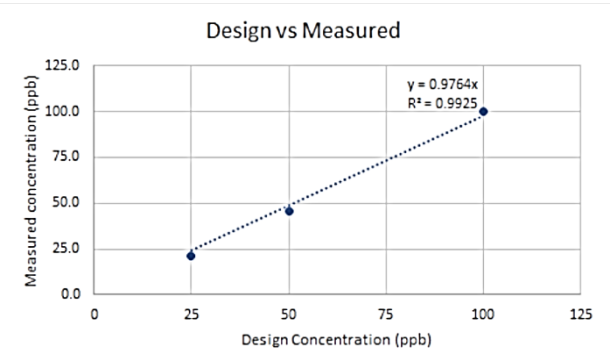
Ozone (O_3)

Features

- Nano gas Sensor
- Long life
- High reliability
- High Sensitivity to single digit ppb

Specifications

Gas Detected:	Ozone O3
Operating Principle:	Nano Gas Sensor
Measurement Range:	0 – 2ppm
Expected Operating Life:	> 2 years
Calibration:	Factory calibrated
Resolution:	1ppb
Accuracy (@100ppb):	±10% of reading
Temperature Range:	5o°C to +65°C
Humidity Range (non-condensing):	5 – 99% RH
Response Time (T90):	< 10 seconds
Storage Temperature:	0°C to +50°C
Orientation Sensitivity:	None
Part Number:	AQS-O3-1



Ozone Sensor percent error for Design versus Measured in laboratory environments show a 14.9% variance at 25 ppb; 8.5% variance at 50ppb and 0.1% variance at 100 ppb exposure.

Nitrogen Dioxide (NO_2)

Features

- Long life
- High reliability
- High resolution
- PPB level high-precision environmental monitoring
- Combined with intelligent algorithms, has stronger adaptability to the environment, more accurate detection, and stable zero point

Specifications

Gas Detected:	Nitrogen Dioxide NO2
Operating Principle:	Solid Polymer Electrochemical Sensing Technology
Measurement Range (full accuracy):	0 – 5 ppm
Expected Operating Life:	2 years
Calibration:	Manufacturer Calibration Certificate
Resolution:	0.001 ppm
Accuracy:	±5% Full Scale
Lower Detection Limit:	0.05ppm
Temperature Range:	-40°C to +50°C
Humidity Range (non-condensing):	15 – 90% RH
Response Time (T90):	< 50 seconds
Storage Temperature:	5°C to +20°C
Orientation Sensitivity:	None
Part Number:	AQS-NO2-5

Oxygen (O_2)

Features

- Long life
- High reliability
- High resolution
- Combined with intelligent algorithms, has stronger adaptability to the environment, more accurate detection, and stable zero point

Specifications

Gas Detected:	Oxygen O_2
Operating Principle:	Solid polymer electrochemical technology
Measurement Range:	0 – 25% O_2
Expected Operating Life:	> 2 years
Calibration:	Factory calibrated
Resolution:	0.01%
Accuracy:	±5% Full Scale
Lower Detection Limit:	0.5% Vol.
Temperature Range:	-40°C to +50°C
Pressure Range:	Atm. ±10%
Humidity Range (non-condensing):	15 – 95% RH
Response Time (T90):	< 10 seconds
Storage Temperature:	0°C to +40°C
Orientation Sensitivity:	None
Part Number:	AQS-O2-25

Battery Installation / Replacement

enLink OAQ devices use 4 x EVE ER14505 AA 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: SAFT LS14500 Lithium Thionyl Chloride AA 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.

Specifications are subject to change without notice