OIZOM™
REDEFINING RESOURCES

User Manual

Industrial Grade Single Parameter Air Quality Monitor

Dust Pollution

Emission Gases

Odourful Gases

Noise Level

Document ID : RAD22UM002

ABOUT OIZOM

Oizom is a Smart Air Quality Monitoring solutions company offering data-driven environmental solutions for better decision making. Using our sensor-based hardware, we monitor various environmental parameters related to air quality, noise, odour, weather, radiation. Our vision is to empower industries with data-driven Accurate and Affordable solutions for better decision-making while keeping the environment at our core.

ABOUT THIS DOCUMENT

Thank you for choosing AQBot™ to accurately monitor the pollutant concentration. This document is a comprehensive user manual that will help with the identification, operation, installation, and maintenance of all variants of AQBot™.

SCOPE

This document will be useful for all your AQBot™ variants listed in Table 3.3 in Section 3 Product Specifications.
This is not useful for the other Oizom products.

REVISION HISTORY

Revision	Date	Created	Approved	Comments
1.0	18/04/2022	AP	AK	User manual created

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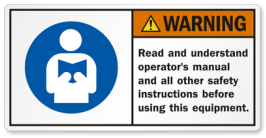
1. Definitions

Table 1.1: Definitions

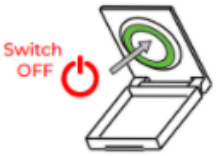
Enclosure	The outer body of the device.
NEMA 4X (National Electrical Manufacturers Association)	It is a rating for an outdoor electrical enclosure that implies it is watertight. 4X- indicates additional corrosion resistance.
OGS	Oizom Gas Sensor is a proprietary sensor used for gas monitoring.
Calibration Hood	It is an accessory for the fitment of the gas inlet to be used during onsite calibration with compressed gas cylinders.
Modbus	It is a serial communication protocol used for transmitting information over serial lines between electronic devices.
RTU	RTU is an acronym for Remote Terminal Unit. It is an electronic device that is controlled by a microprocessor.
TCP/IP	TCP/IP, in full Transmission Control Protocol/Internet Protocol, standard Internet communications protocol that allows digital computers to communicate over long distances.
CANbus(Controller Area Network bus)	A rugged, digital serial bus designed for industrial environments.
RS-485	It is an industrial specification that defines the electrical interface and physical layer for point-to-point communication of electrical devices.
RS-232	RS-232 or Recommended Standard 232 is a standard for serial communication transmission of data. It formally defines signals connecting between a DTE (data terminal equipment) such as a computer terminal, and a DCE (data circuit-terminating equipment or data communication equipment), such as a modem.
GSM	The Global System for Mobile Communications (GSM) is a standard to describe the protocols for second and third-generation (2G/3G) digital cellular networks used by mobile devices.
LTE	Long-Term Evolution (LTE), referred to as 4G LTE is a standard for wireless broadband communication for mobile devices and data terminals.
Wi-Fi	Wi-Fi is a family of wireless network protocols which are commonly used for local area networking of devices and Internet access, allowing nearby digital devices to exchange data by radio waves.
4-20mA	A point-to-point or multi-drop circuit is mainly used in the process automation field to transmit signals from instruments and sensors in the field to a controller.
LoRa	LoRa (Long Range Radio) is a proprietary low-power wide-area network modulation technique.
NB-IoT	Narrowband Internet of Things (NB-IoT) is a low-power wide-area network (LPWAN) radio technology.
Sigfox	Sigfox is a cellular style, long-range, low power, low data rate form of wireless communications that has been developed to provide wireless connectivity for devices.
Multimeter	An instrument designed to measure electric current, voltage, and usually resistance, typically over several ranges of value.
Nose plier	Commonly used to cut and bend small wires and electrical wiring. They can bend, cut, and grip where fingers and other tools are too big or clumsy.
Tester	It is used to determine the presence of electricity in a piece of equipment under test.

Cutter	A hardened metal tool that is used to cut.
Pliers	Pliers are hand tools used to hold objects firmly. They are also useful for bending and compressing a wide range of materials.
Screwdriver	A tool, manual or powered, used for driving screws.
Hammer	A tool with a heavy metal head mounted at right angles at the end of a handle, used for jobs such as breaking things and driving in nails.
Cable tie	A fastener consists of a thin, flexible nylon strap with a notched surface, one end of which is threaded through a locking mechanism at the other.
Insulation Tape	Insulation tape is used chiefly to cover exposed electric wires.
Measuring Tape	A long, thin piece of plastic or metal that is marked with units of length (such as inches or centimeters) and that is used for measuring things.
Hex nut driver	A nut driver is a tool for tightening nuts and bolts.
Drill bit	Drills are cutting tools used to remove material to create holes, almost always of circular cross-section.
Mounting Brackets	Metal structure for device mounting on pole or wall.
Hose Clamps	Metal device used for fixing the mounting bracket on the pole.
IP66	An IP66 (Ingress Protection) rated fixture is protected against multi-directional, high-pressure water jets.
Beacon	A guiding or warning light
Sounder	A thing that makes a sound or sounds
Drilling machine	Device for producing holes in hard substances.
Spirit Level	Instrument to check alignment
Spanner	A tool with a shaped opening or jaws for gripping and turning a nut or bolt.
Motherboard	The main Printed Circuit Board (PCB) placed inside the enclosure
Inlet Outlet Mesh	The filter caps placed for restricting large-sized dust particles to enter the device.
Automation	The use or introduction of automatic equipment in a manufacturing or other process or facility.
FRP	Fibre-reinforced plastic(FRP) is a composite material made of a polymer matrix reinforced with fibers.
Co-location	Correlating data by placing two devices side by side
Onsite Calibration	Calibration of the devices at the site of installation
Relay	Relays are switches that open and close circuits electromechanically or electronically
Unstable Data	Any data that is not usual or varies abruptly
ppm	Parts per million. It is a unit of measurement used when expressing a very dilute concentration level of pollutants in the air
ppb	Parts per billion. It is a unit of measurement used when expressing a very dilute concentration level of pollutants in the air
µg/m³	micrograms (one-millionth of a gram) per cubic meter. It is a unit of measurement used when expressing a very dilute concentration level of pollutants in the air.
mg/m³	Milligrams (one-thousandth of a gram) per cubic meter. It is a unit of measurement used when expressing a very dilute concentration level of pollutants in the air.

dB	Decibel. It is a unit of measurement used when expressing the level of noise
LAN	Local Area Network
WAN	Wide Area Network



Instruction to read the user manual before use.



Instruction to switch OFF the monitor for any operation.

Instruction for time interval between Switching OFF and ON the monitor.

Instruction to lock the unit after closing the enclosure.

Instruction to use Anti-static gloves for any kind of troubleshooting.

Instruction for the sim card extender.

Figure 1.1: Stickers on the monitor

2. Safety

Since the monitors are usually installed at height, certain safety precautions need to be taken before as well as during the installation/maintenance:

DOs

- Read and understand the instruction manual and all other safety instructions before using the monitor.
- All necessary personal protective equipment (PPE) such as Gloves, Goggles, Shoes, helmets, etc. must be worn at all times by the engineer.
- A well-designed and manufactured ladder to be used for working at heights. In case of difficult approaches, a boom lift may be used.
- Electrical connections must be checked before powering up the monitor.
- All necessary permissions are to be checked and met before installing the monitor.
- Personnel with prior experience of working at heights must be equipped for installing or any other kind of activity.
- Anti-static gloves must be used for any kind of troubleshooting inside the monitor.
- Always switch OFF the monitor for any cleaning or replacement activity and remove the power cable.
- After switching OFF the monitor, always wait for 1 minute before switching it ON.
- Always lock the unit after closing the enclosure.
- Make sure there are no cuts or joints, cracks, or abrasions on the cables or wires.

DON'Ts

- Don’t run cords along the floor or let cords get twisted or tangled.
- Don’t use temporary wiring.
- Don’t provide power to the monitor without any voltage stabilizer(UPS).
- Don’t install the monitor without performing the bench test.
- Don’t open the enclosure when connected to the AC power supply.

3. Product Specifications

AQBot™ is an industrial-grade single parameter air quality monitor with automation capabilities. AQBot™ Series offers a wide range of air quality parameters to choose from. The range of available parameters consists of all the important Gases, Particulates, and Noise related monitoring for Industrial Process Control, EHS monitoring, Indoor Air Quality Monitoring, Leakage detection, and much more. The AQBot™ series is designed for easy and inexpensive maintenance.

AQBot™ – fixed gas detector comes with an on-device display to check the concentration of the parameter without being dependent on a computer or any external display. It comes with an optional on-device Sounder and Strobe-light for Alarm in case of any atmospheric hazard. It provides an early warning of potentially toxic gas exposure. Thresholds for the alarm are customizable from the Oizom Air Quality Software, Envizom™ which comes with AQBot™. The device has an inbuilt feature of relays that can be triggered based on preset thresholds. Using relay output, many industrial types of equipment can be automated for quick-action and process control.

AQBot™ data is accessible via Oizom Air Quality Software, Envizom™ where various data visualization and data analytics are possible. Various alerts and notifications can be set based on this data for the industrial safety and environmental health safety (EHS) of workers. With such valuable capabilities, AQBot™ can empower multiple Industry 4.0 applications.

Based on the application, Oizom® offers solutions to monitor different essential parameters.

Table 3.1 AQBot™ Product offerings

AQBot-NH_3	AQBot-SO_2
AQBot-H_2S	AQBot-Cl_2
AQBot-CH_4	AQBot-NO
AQBot-CO	AQBot-CH_3SH
AQBot-CH_2O	AQBot-TVOC
AQBot-CO_2	AQBot-PM
AQBot-NO_2	AQBot-Noise

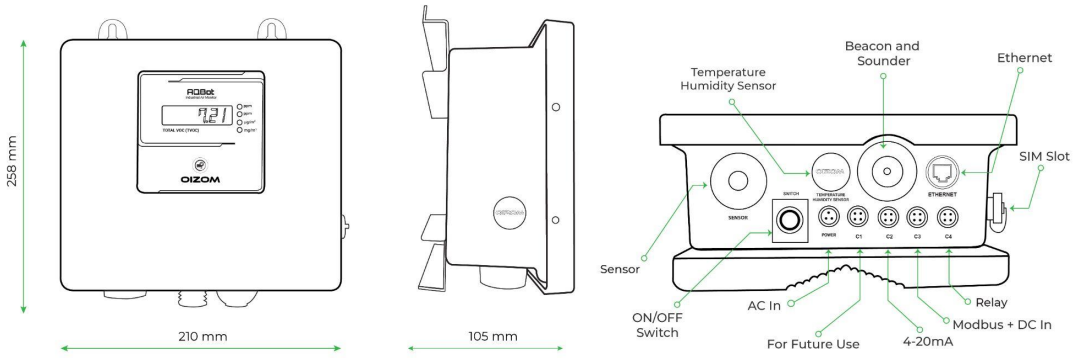


Figure 3.1 Schematic

3.1 Product features

On-Device Display
Built-in Display to check the on-site concentration of the pollutant and unit of measurement without being dependent on a computer or any external display

Ultimate Durability
NEMA 4X Certified industrial-grade enclosure made of high-grade engineering composite polymers

Wide range of parameters
Compatible with a wide range of environmental parameters for Gases such as SO_2, NO_2, NO, H_2S, TVOC, CO, Cl_2, NH_3, CH_4, CH_2O, CO_2, and CH_3SH, Particulate Matter(PM_1, $PM_{2.5}$, PM_{10}, PM_{100}) and Noise.

Temperature-Humidity Monitoring
Built-in Temperature-Humidity sensor in each AQBot™ to use in advanced data processing algorithms for compensating any effect of temperature and humidity on the sensor output.

Real-time data transfer
Continuous monitoring and real-time data transfer at configurable intervals.

Built-in Relay
Built-in relay that can be triggered ON/OFF based on preset thresholds. Various industrial types of equipment can be automated for quick-action and process control.

Wired Communications
Supports all industry-standard output signals like Modbus / Ethernet / CANbus / RS-485 / RS-232

Wireless Communications
Supports a wide range of wireless connectivity options like GSM / WiFi / LoRa / NBIoT / Sigfox

Alerts for Threshold breach
Beacon/Sounder for alerting when set thresholds are breached for automatic actions

Retrofit Design
Plug and play design for ease of implementation

Over-The-Air Update
Automatic Firmware and Calibration update from a cloud server without any onsite visit (available for wireless connectivity)

Compact
Light-weight and compact system weighing only 2.8kg, easily installed on any wall, pole, or structure.

Internal Data Storage
In case of network losses, data is stored in internal 8GB memory which can provide data backup for up to 12 months.

Data Analytics Software
Advanced software to view data, analyze, integrate and create reports for actionable insights

Identity and Configuration
Each equipment carries its unique identity with geo-tagging through wireless configuration.

Weatherproof
IP66 grade enclosure for endurance against harsh weather conditions

Tamper Proof
Comes with a security system to avoid tampering/malfunction/sabotage

Dedicated Support
Skilled support team to assist users in problem-solving

3-level Calibration
Factory calibration, Laboratory calibration in an ISO/IEC 17025 laboratory for zero and span calibration and provision of Onsite calibration.

3.2 Product identification

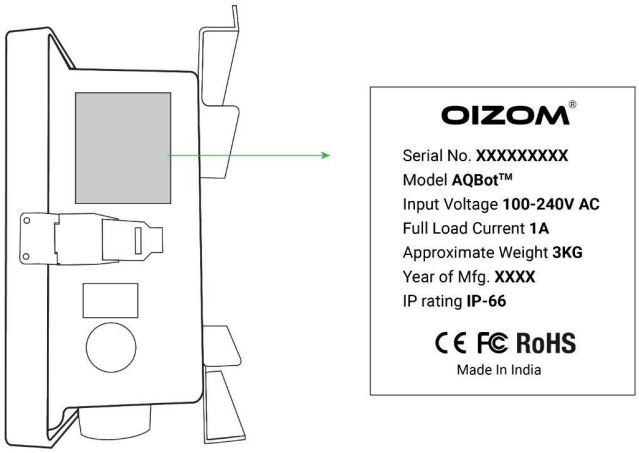
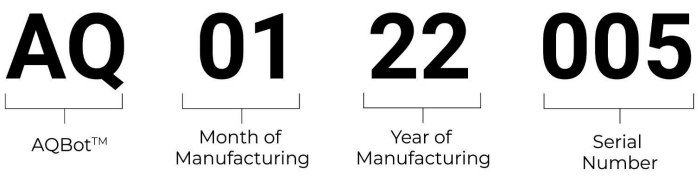


Figure 3.2 Product identification

Every product is assigned a unique serial number before it is dispatched from the facility. This unique serial number can be found on the nameplate along with information about the product name/Model, power rating, year of mfg., weight of the monitor, and certifications. The unique serial number is very important and becomes crucial while communicating for any kind of support.

Serial number: Each serial number is unique.



Model: This indicates the name of the Model.
E.g.: AQBot™.

Input Voltage: This indicates the power supply specifications for the monitor.
E.g.: 100-240 VAC(The AC power supply within the range 100-240 V should be supplied to power ON the device.)

Full Load Current: This indicates the maximum current that the device is designed to consume under particular conditions.
E.g.: 1 A (1 Ampere current is the maximum amount of current consumed.)

Approximate Weight: This indicates the approximate weight of the device which helps us to understand the exact placement of the device on a pole/wall.
E.g.: 3 kg

Year of Mfg.: This indicates the year of manufacture of the device.
E.g.: 2022

IP rating: This Ingress Protection rating indicates the defined levels of sealing effectiveness of electrical enclosures against intrusion from foreign bodies (tools, dirt, etc.) and moisture.
E.g.: IP66

CE	This AQBot™ complies with the requirements of the Low Voltage Directive 2014/35/EU and the EMC Directive 2014/30/EU and carries the CE Marking accordingly.
FC	The AQBot™ FCC marking indicates that the electromagnetic radiation from the device is below the limits specified by the Federal Communications Commission and the manufacturer has followed the requirements of the Supplier's Declaration of Conformity authorization procedures.
RoHS	This AQBot™ conforms to the European Union's Restriction of Use of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU.

Made in India: This marking on the device indicates that the device's country of origin is India.

3.3 Sensor specifications

Multiple sensors with different measurement ranges can be integrated into the monitor for different environmental parameters. Below are the AQBot™ variants which Oizom® can offer.

Table 3.2 AQBot™ Variants

ID	Parameter	Range (ppm)	Resolution (ppm)	Min. Det. (ppm)	Working Principle	Sensor Life
OZSO2_1	Sulfur dioxide (SO_2)	0-20	0.001	0.01	Electrochemical	2 Years
OZSO2_2		0-100	0.2	0.2		
OZSO2_3		0-1000	5	5		
OZNO2_1	Nitrogen Dioxide (NO_2)	0-20	0.001	0.01	Electrochemical	2 Years
OZNO2_2		0-100	0.2	0.2		
OZNO2_3		0-500	0.5	0.5		
OZH2S_1	Hydrogen Sulfide (H_2S)	0-10	0.001	0.01	Electrochemical	2 Years
OZH2S_2		0-50	0.05	0.05		
OZH2S_3		0-200	0.2	0.2		
OZH2S_4		0-2000	2	2		
OZCO_1	Carbon monoxide (CO)	0-50	0.1	0.1	Electrochemical	2 Years
OZCO_2		0-100	0.1	0.1		
OZCO_3		0-1000	0.75	0.75		
OZNO_1	Nitric Oxide (NO)	0-20	0.001	0.01	Electrochemical	2 Years
OZNO_2		0-100	0.5	0.5		
OZTVOC_1	Total Volatile Organic Compounds (VOC)	0-40	0.001	0.005	Photo Ionization Detection (PID)	5000 Hours
OZTVOC_2		0-200	0.05	0.05		
OZPM_1	Particulate Matter PM_1, $PM_{2.5}$, PM_{10}, PM_{100}	Upto 5000 µg/m³ PM_{100} : upto 30 mg/m³	0.1 µg/m³	1 µg/m³	Optical Particle Counter	5000 Hours
OZPM_2						
OZPM_3						
OZPM_4						
OZCL2_1	Chlorine (Cl_2)	0 - 20	0.05	0.05	Electrochemical	2 Years
OZCL2_2		0-50	0.1	0.1		
OZNH3_1	Ammonia (NH_3)	0-20	0.3	0.3	Electrochemical	2 Years
OZNH3_2		0-100	0.3	0.3		
OZNH3_3		0-1000	2	2		
OZCH4_1	Methane (CH_4)	500-1500	1	500	Molecular Property Spectrometer (MPS)	2 Years
OZCH2O_1	Formaldehyde (CH_2O)	0-10	0.05	0.05	Electrochemical	2 Years
OZCH2O_2		0-50	0.1	0.1		
OZCO2_1	Carbon Dioxide (CO_2)	0-5000	1	400	Non-Dispersive Infrared (NDIR)	2 Years
OZCH3SH_1	Methyl Mercaptan (CH_3SH)	0-10	0.1	0.1	Electrochemical	2 Years
OZHCL_1	Hydrochloric acid (HCL)	0-50	0.5	0.5	Electrochemical	2 Years
OZHCL_2		0-100	1	1		
OZN_1	Noise	upto 140dB	1 dB	0.5 dB	Capacitive	2 Years

Each sensor work on a different working principle. The information below will help to understand how the sensors function and provide the concentration value of the parameter after monitoring.

Electrochemical sensors exposed to the ambient air will monitor the target gas by means of the diffusion principle which results in the production of electrical signals proportional to the pollutant concentration.

The PM monitor is based on the physical principle of light scattering, also known as **optical particle counter** (OPC) which monitors dust particles illuminated by laser light at a 90° angle. The light scattered from each particle is collected at approximately 90° by a mirror and detected by a photo-diode. This signal is then fed into a multi-channel size classifier where a pulse height analyzer is used to classify each pulse that is proportional to the particle size. As a result, the counts in the channel corresponding to PM are converted to the concentration of PM_1, $PM_{2.5}$, PM_{10}, or PM_{100}.

TVOC monitor working on the principle of **PID** uses high-energy photons to detect the VOC levels. So, the air sample into the TVOC sensor is exposed to UV light of a specific output that excites the VOC molecules present in the air sample. The molecules become electrically charged as it ionizes everything that has ionization energy less than or equal to the UV lamp output. As a result, the ions produce an electric current proportional to the concentration of TVOC and are monitored by the detector.

The **Molecular Property Spectrometer (MPS)** Methane Gas Sensor's transducer is a micro-machined membrane with an embedded Joule heater and resistance thermometer. The MEMS transducer is mounted on a PCB and packaged inside a rugged enclosure open to ambient air. The presence of methane causes changes in the thermodynamic properties of the air/gas mixture that are measured by the transducer. Sensor data are processed by patent-pending algorithms to report accurate concentrations.

The noise sensor works similarly to our ears, having a diaphragm that converts vibration into signals. The sound sensor consists of an in-built **capacitive** microphone, a peak detector, and an amplifier that's highly sensitive to sound. The sound waves propagate through air molecules, such sound waves cause the diaphragm in the microphone to vibrate, resulting in capacitance change. The capacitance change is then amplified and digitalized for processing of sound intensity.

3.4 Technical Specifications

Table 3.3 Technical specifications

Processor	Quad-Core ARM Cortex A-72
Memory	2GB RAM, 8GB eMMC ROM
Internal Data Storage	Up to 12 months
Device Interface	On-device software, API, Display
Display Specification	6 digit 7 Segment Display

Table 3.4 Sensing specifications

Target Gas	Refer Table 3.2 AQBot™ Variants
Gas sample mode	Natural diffusion
Warm up time	1 hour (cold start) for gas monitoring 15 min (cold start) for Noise and PM monitoring
Response time (t90)	< 60 Seconds
Signal refresh rate	5 Seconds
Measuring Range	Refer Table 3.2 AQBot™ Variants
Accuracy	<±5%FS (at 20±5°C/ 50±20%RH)
Sensor life	Refer Table 3.2 AQBot™ Variants

Table 3.5 Electrical specifications

Power Supply	AC: 100VAC- 240VAC 50/60Hz
	DC: 18-24V DC(optional)
Average Power consumption	3.5 W
Wiring connections	Pre-wired supplied with 2m cable

Table 3.6 Device Specifications

Size (HxWxD)	210mm (W) × 258mm (H) × 105mm (D)
Weight	2.8 kg (Device weight)
Certifications	CE, FCC Certified, RoHS compliant, PTCRB Certified Communication Module

Table 3.7 Communication specifications

Wireless Communications**	Any 1 wireless communication from Global 2G/3G/4G, LoRa, LTE, NB-IoT, Sigfox, Wifi
Wired Communications**	Ethernet, Modbus TCP, Modbus RTU, CANbus(on request)
Analog Output	1 x 4~20mA Current Loop with 12-bit Resolution (on request)
Relay Outputs	2 programmable relays, volt free relay contacts (1NO, 1 NC)
Beacon and Sounder	Built-in, RED flashing light with alarm sounder 95db @ 1m

**We do not provide Modbus master or LoRa Gateway as our devices are modbus slaves and lora nodes in case of Modbus and Lora communication respectively. We are not liable for network loss in the case of GSM/Wifi Connection.

Table 3.8 General Performance Specifications

Operation temperature	-20 to +60°C
Operation humidity	0 - 90%RH, non-condensing
Storage conditions	10 - 40°C
Installation method	Wall mount / Pole mount
Housing	NEMA-4X Fire-retardant FRP enclosure
Weather Protection	Weather Resistant IP66 Enclosure

Table 3.9 Communication Protocols

Communication	Connectivity	Specification
Wireless	GSM	Global 2G/3G/4G
	LoRa	868 MHz, 915 MHz
	LTE	CAT-M1
	NB-IoT	CAT-NB1
	Sigfox	868 to 869 MHz, 902 to 928 MHz
	Wifi	802.11 b/g/n
Wired	Ethernet	10BaseT/100BaseTX
	Relay	2 Channel
	Modbus	RS485 RTU/TCP

4. Preparing AQBot™ for use

4.1 Transportation

The stickers on the packaging box helps us to make sure how AQBot™ should be taken care of while transportation to avoid any damage. Refer to the table below to understand the meaning of each symbol on the packaging box.

Figure 4.1 Packaging Stickers

If the box is tampered with or broken, contact the Oizom Support team or its representative for support.

4.2 Storage

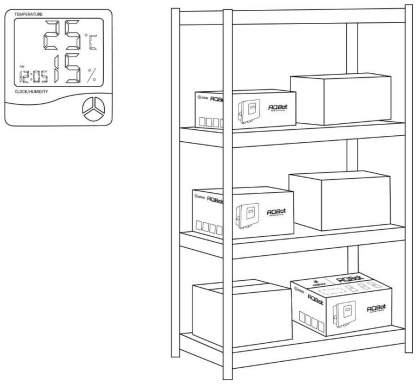


Figure 4.2 Storage conditions

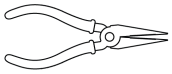
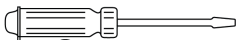
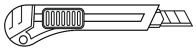
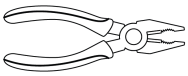
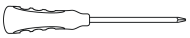
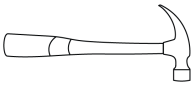
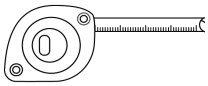
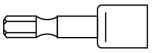
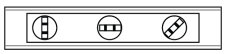
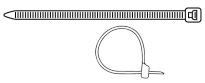
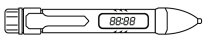
The ideal storage location for AQBotTM is a dry room where the temperature should range between 10 - 40°C and humidity in the range of 10% - 95% RH (non-condensing)
It is highly recommended to store the AQBotTM inside the packaging box in which it was delivered. It is also advisable to keep it in a safe place to avoid stepping over it. It is highly recommended to avoid stacking anything weighing more than 4 kgs on the AQBotTM packaging box.

4.3 Prerequisites for Installation

4.3.1 Tools Required

Installation of the monitor will need certain tools. Correct selection of tools is very critical to making the installation process smooth and efficient. Check the availability of these tools with your Store Supervisor. In case of unavailability of any tools, they can be purchased from any nearby or online hardware store. The table presents a list of tools required for installation (not included in the package):

Table 4.1 List of tools required

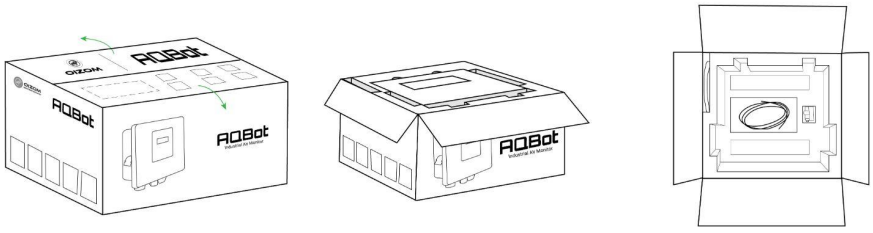
			
Multimeter - 1 no.	Nose plier - 1 no.	Tester - 1 no.	Cutter - 1 no.
			
Plier - 1 no.	PH 2 Screwdriver - 1 no.	6 mm drill bit - 1 no.	Hammer - 1 no.
			
Measuring Tape - 1 no.	Hex Nut driver 7 mm - 1 no.	1 mm x 3 core cable - 1 no	Heavy RPM drill machine - 1 no.
			
Spirit level - 1 no.	Cable tie - 1 lot.	Wall grip - 1 no.	3 pin Plug - 1 no.
			
AC wireless test probe - 1 no.	Insulation tape - 1 no.	Spanner 20/22 mm - 1 no.	Spanner 18/19 mm - 1 no.

4.3.2 Unboxing

Unbox the package and take out the monitor. During unboxing make sure the mentioned arrow on the packaging should point to the sky.
The below-listed items are present in the box:

1. AQBot™ with attached mounting bracket
2. Power cable (2 meters)
3. Modbus / Relay cable (2 meters)
4. Ethernet cable (2 meters)
5. Hose clamp + Wall Grip + Screws + Lock
6. Calibration Hood (not applicable for AQBot Noise and AQBot PM)
7. User Manual + Calibration Certificate + Warranty Certificate + Factory Acceptance Test(FAT) Report + Tax Invoice

As part of Planet Earth we aim to reduce waste and increase efficiency, Oizom advises you to keep the recyclables out of the landfill, thus recycle the packaging box. If you are unsure about where to take your packaging box for recycling, search the website for your town, city, or community regarding waste, garbage, or recycling management for your area. Contact them and follow the instructions.



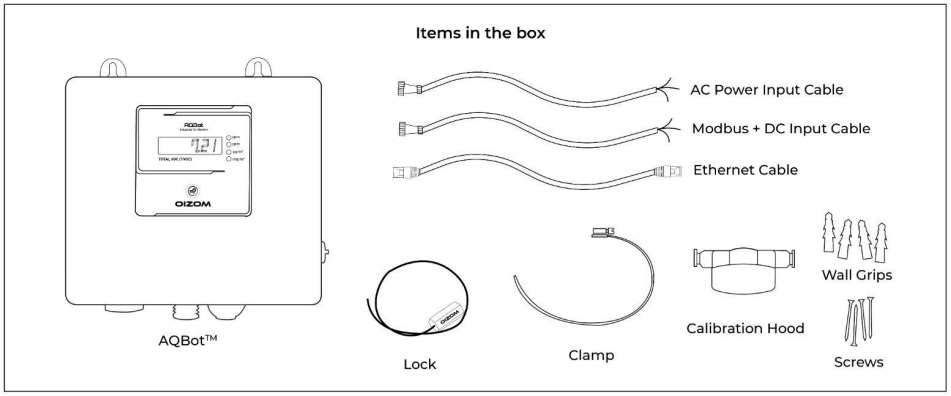


Figure 4.3 Unboxing

4.3.3 Identification of Components

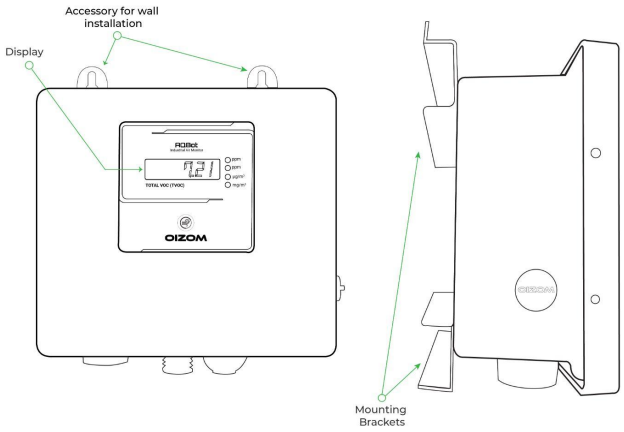


Figure 4.4 Components

Enclosure

The NEMA 4X Certified industrial-grade enclosure is fire-retardant, robust, and compact which makes it compatible with pole and wall installations. It is an industrial-grade FRP non-corrosive type enclosure.

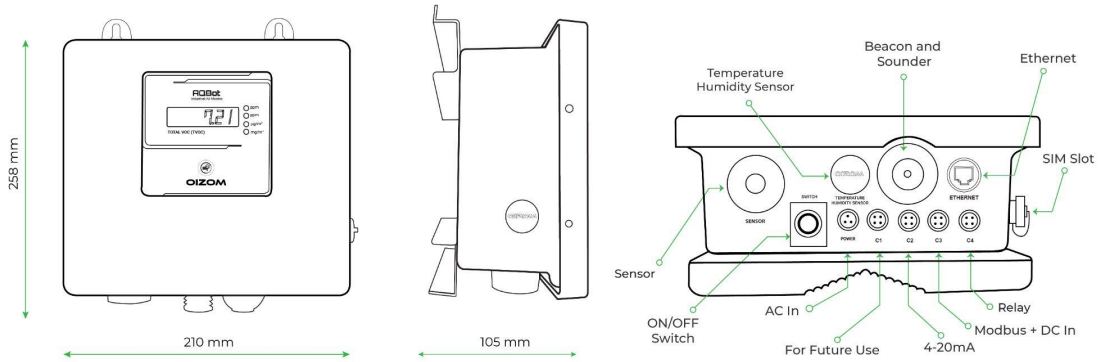


Figure 4.5 Enclosure

Connectors

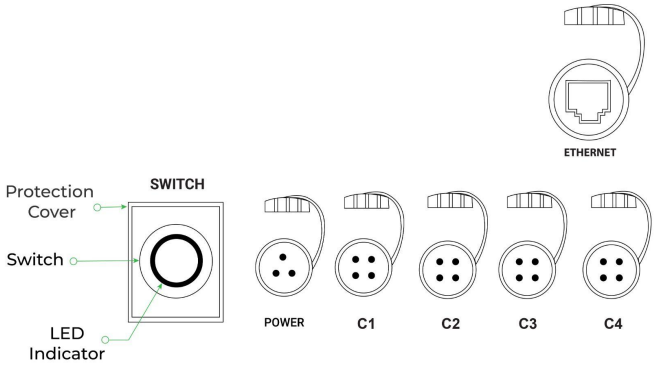


Figure 4.6 Schematic of connectors

All connectors attached to the monitor are covered with waterproof caps. There are dedicated connectors as listed below:

Table 4.2 Purpose of Connectors

Connectors	Purpose
Power	AC power cable
C1	For future use
C2	2 channel 4-20 mA output (on request)
C3	Input cables from Modbus + DC in
C4	Input cable from 2 Channel Relay
Ethernet	For Ethernet Wired connection

Cable

To connect monitor mains to AC supply, DC supply, relay automation, Modbus communication and for ethernet connectivity. Check cable tags before connecting any wires to the power source.

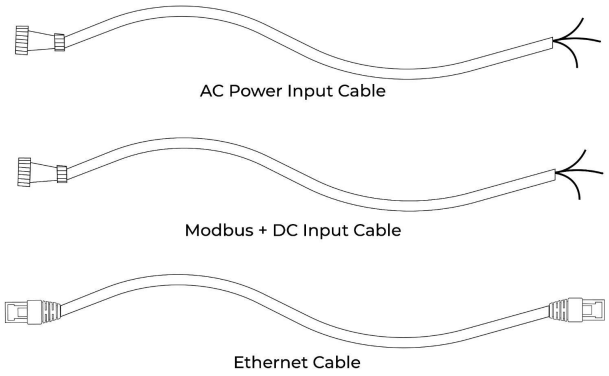


Figure 4.7 Schematic of cables

Clamp

AQBot™ can be easily installed on a pole using the provided hose clamp. In the case of wall mounting, the fastener kit provided in the box is useful.

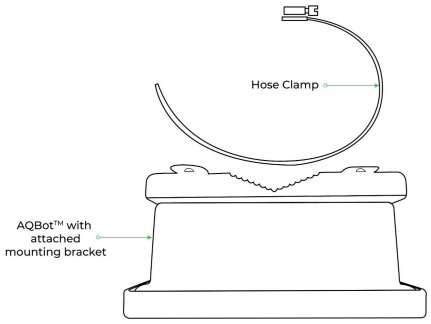


Figure 4.8 Schematic of device and hose clamp

Device mounting brackets

With the support of the attached mounting brackets on the back of the monitor, it can be installed on a pole. The holes on the top of the monitor are used for mounting on the wall.

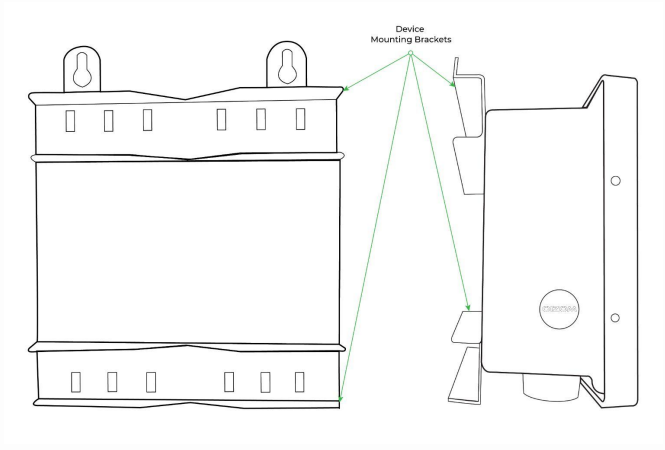


Figure 4.9 Schematic of mounting brackets on the enclosure

Display

The display will show the concentration of the pollutant and unit of measurement.

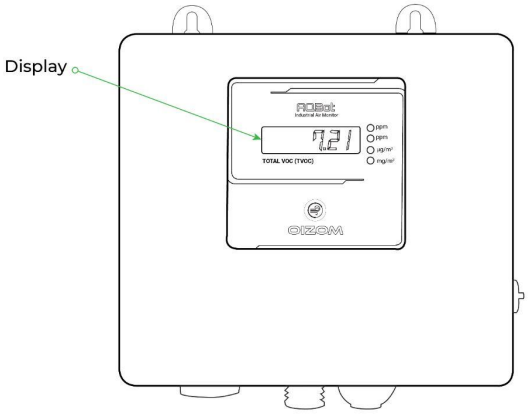


Figure 4.10 Schematic of On-device Display

Beacon and Sounder

Whenever the pollutant concentration crosses the threshold set by the user, the siren will make a loud noise of 95dB within an area of 1 meter to alert the officials to take necessary actions. The inbuilt red flashing light will also start to signal the officials.

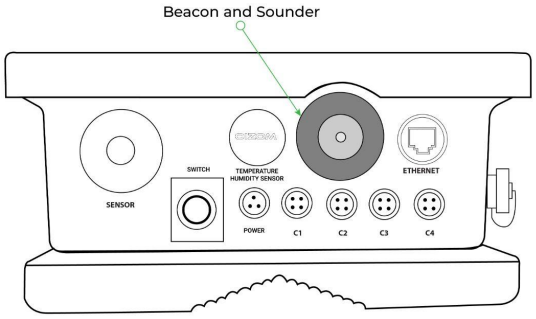


Figure 4.11 Schematic of Beacon and Sounder

Sensor

There are 3 types of sensors integrated depending on the application in AQBot™:

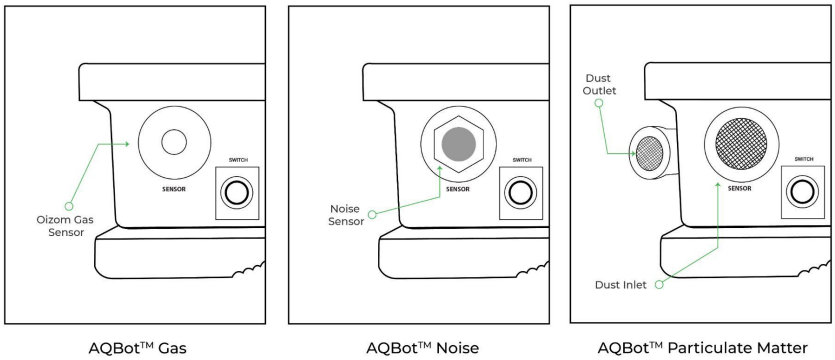


Figure 4.12 AQBot™ Variants

4.4 Initial setup

It is advisable to put AQBot™ into operation before installing it on the pole/wall. The following steps will guide you to step-wise initialization on a test bench. It is recommended to place the monitor on a flat surface devoid of any static charge. The monitor must be placed horizontally so that the display of the monitor is visible on the top and the bottom view of the device is easily accessible for power connection.

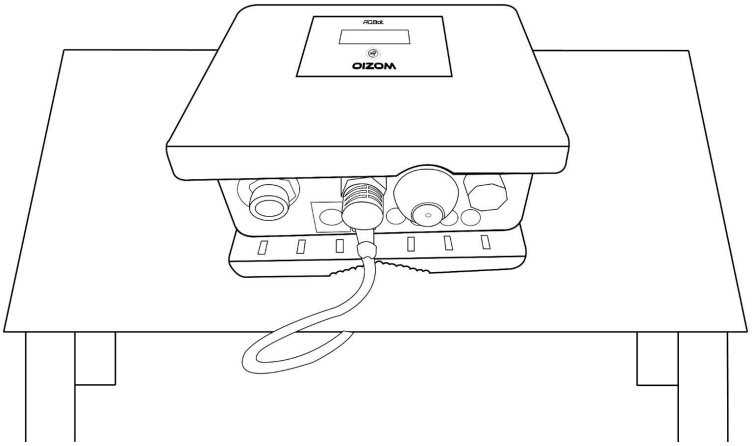


Figure 4.13 AQBot™ on test bench

4.4.1 Power Connection

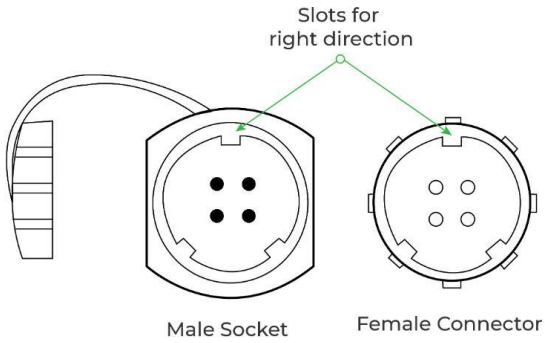


Figure 4.14 Identification of connectors

Step 1 The male connector (3 pin) of the power supply cable needs to be connected to the female connector (3 pin) on the AQBot™. Open the cap of the female connector. Before connecting, have a good look at both the connectors.

Step 2 Check for the 3 slits on both the connectors. One of the 3 slits will be wider than the other two. The widest slit on the female connector on the monitor can be seen beneath the connector labels. To insert the male connector, match this slit with the one on the female connectors and gently insert it in with a little push. The connector must not be forced into the port by any means. Do not try to force the connector into the port by adjusting it in random circular motions. Doing so will damage the connector pin as well as AQBot™.

Step 3 Once the connector is inserted, tighten the protection cover by rotating it in the clockwise direction.

The connectors provided are used for power and accessories. Users are advised to check for the connector labels and cable tags before any connection.

AC Power Supply	Red: Direct (100V-240V AC) (50-60Hz) Black: Neutral Green: Earth
DC Power Supply	Red: 18-24 V DC Yellow-Green: GND Blue: B/Data + Yellow: B/Data -

Note: Check cable tags before connecting any wires to the power source.

Now, you have connected the 3 pin power connector to the device, the other end needs to be connected to an AC power supply once an adapter plug is attached to the provided cable of the connector.

There is also a provision to supply direct DC power(18-24 V DC) to the monitor. The 4 pin male connector of the provided Modbus cable is to be inserted in the female C3 connector on AQBot™ after proper positioning of the slits.

In case you fail to power the device, check the supplied AC voltage(in case of AC power input) and DC voltage(in case of DC power input) using a Multimeter and ensure it is 100V-240V AC or 18-24 V DC respectively. Also, ensure that the connector is attached properly.

4.4.2 LED indications

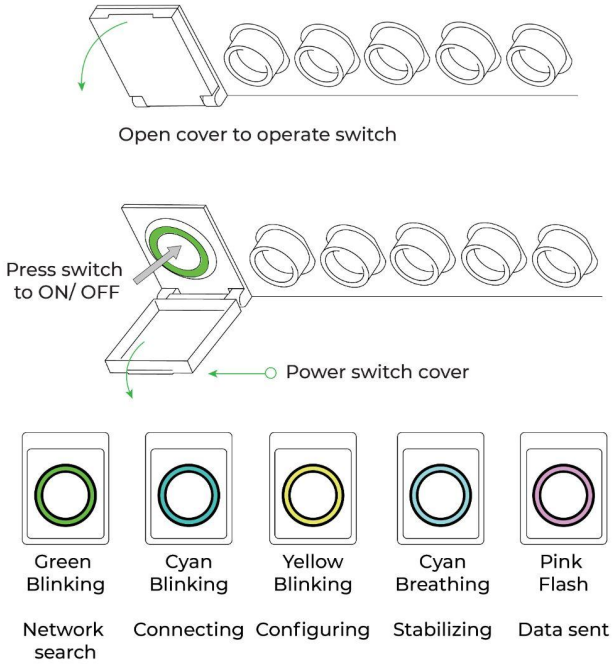


Figure 4.15 LED indications

To switch ON the monitor, push the Power switch one time. To switch OFF the monitor, push the power switch again one time. Before switching ON the monitor, recheck all power cable connections. If you are restarting the unit, wait for at least a minute before switching ON.

The Power ON/OFF switch has an LED indication feature. Five different colors signify different modes of operation. Figure 4.15 describes the LED functions and their significance.

In case there is no LED indication on the Switch, check the connectors of the switch after opening the enclosure and repress them to connect properly. It is mandatory to switch off the AC power supply before opening the enclosure.

4.4.3 Display

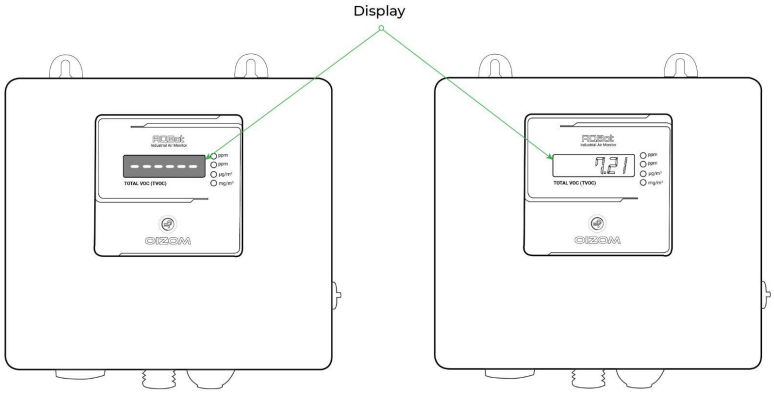


Figure 4.16 Display Initialization

Once the monitor is powered ON by pushing the switch, yellow blinking can be seen on the switch LED after 60-70 seconds. The yellow blinking will continue for about 20-30 seconds and then the display will show white horizontal dotted lines which means the display is ready. The first data point will be displayed within 2 minutes of display initialization.

If in case the display does not initialize after 15 minutes, open the enclosure by unlocking and re-press the 2 connectors, one attached to the display PCB and another on the motherboard. It is mandatory to switch off the AC power supply before opening the enclosure.

4.4.4 Connectivity

All Oizom® products are empowered with wireless and wired communication protocols. Multiple communication networks can be easily handled simultaneously. So WiFi, GSM, Ethernet, and Modbus can work together with the smart network management protocol.

The devices are compatible with fallback 2G, 3G, and 4G networks along with LTE. There are dedicated connectors for Relay Output and Modbus. Also, a Mini PCIe port is available on the device for a customized communication module. An on-device data visualization tool helps to configure the network.
To access the on-device data visualization tool, the monitor should be powered ON. There will be two conditions under which the monitor will be:

Condition A
The monitor is not connected to any existing WiFi or Ethernet network. Under this condition, the monitor will be a hotspot. Any smart device can hence be connected to the monitor. To establish connectivity, follow the steps:

Step 1 Connect the smart device (i.e. a laptop, mobile, or tablet) by selecting the hotspot network named after your Device ID*/Serial No.*

Step 2 The credentials will be:

SSID - [DEVICE ID*/Serial No.*] *Eg. if the device ID/Serial No. allotted is AQ0122003, the SSID will be AQ0122003.*
Password - 12345678

Step 3 Open any web browser on your smart device and enter the following:

[DEVICE ID*/Serial No.*].local
Eg. if the device ID/Serial No. allotted is AQ0122003, enter http://aq0122003.local Or IP address allotted to the device in the network

Step 4 Enter the user credentials for the login page:

Email address - admin@oizom.com
Password - oizom@admin

Step 5 The on-device software can now be accessed

Condition B
The Monitor is connected to an existing WiFi or Ethernet network. Under this condition, ensure that the smart device is connected to the same network.

Step 1 Open any web browser on your smart device and enter the following:

[DEVICE ID*/Serial No.*].local
Eg. if the device ID(Serial No.) allotted is AQ0122003, enter http://aq0122003.local Or IP address allotted to the device in the network

Step 2 Enter the user credentials for the login page:

Email address - admin@oizom.com
Password - oizom@admin

Step 3 The on-device software can now be accessed

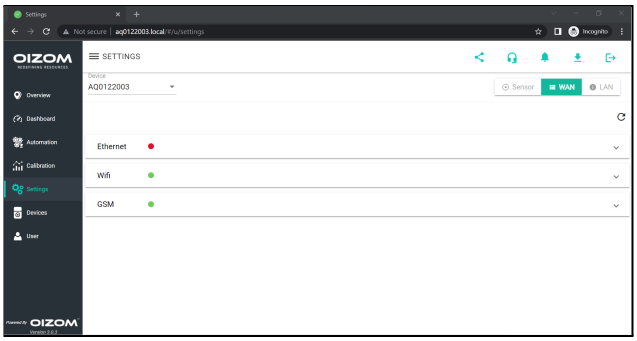


Figure 4.17 On-Device Data Visualization

Once connected, the user will have access to some basic modules. There will be 3 tabs under the **Settings** module:

1. Sensors - For enabling or disabling data of any sensor provided in the monitor. This can be done with the help of a toggle.
2. WAN - Network configuration for GSM, WiFi, Ethernet
3. LAN - Configuration for Modbus

Following are the stepwise instructions for configuring the monitor with your preferred communication protocol:

4.4.4.1 GSM

If the monitor is to be established on a GSM network, it should have a working SIM card, i.e. with an active data plan placed inside. To insert the SIM card, the user needs to follow the following instructions:

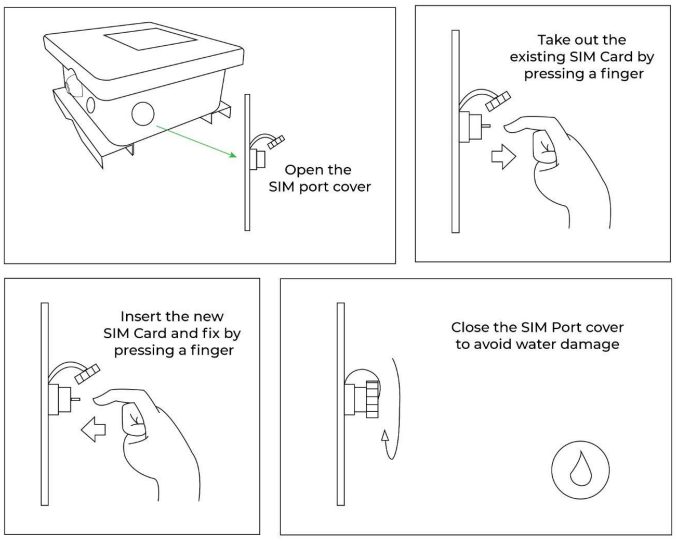


Figure 4.18 SIM card replacement

Step 1 Ensure that you have a working nano-SIM card that is activated by the carrier. Open the cap of the SIM card holder (See fig 4.18)

Step 2 For replacing an existing SIM, gently remove the SIM by pressing it using your finger and then pulling it outwards.

Step 3 Replace with a new SIM by pressing it inwards and gently pushing it using your finger.

Step 4 Put back the cap as it was placed earlier.

Step 5 Select the Settings module on the on-device software and click on GSM. The Red dot shows that there is no connection established to the internet via GSM Network. This will be shown when no SIM card is inserted or there is no or poor internet connection or APN is not set.

Step 6 Users can select from Manual or Automatic APN entries. In the case of manual APN, enter your APN of the SIM carrier.

Step 7 Select Submit. The Green dot shows the connection is established.

Step 8 Check for the latest data point in the Overview or Dashboard module

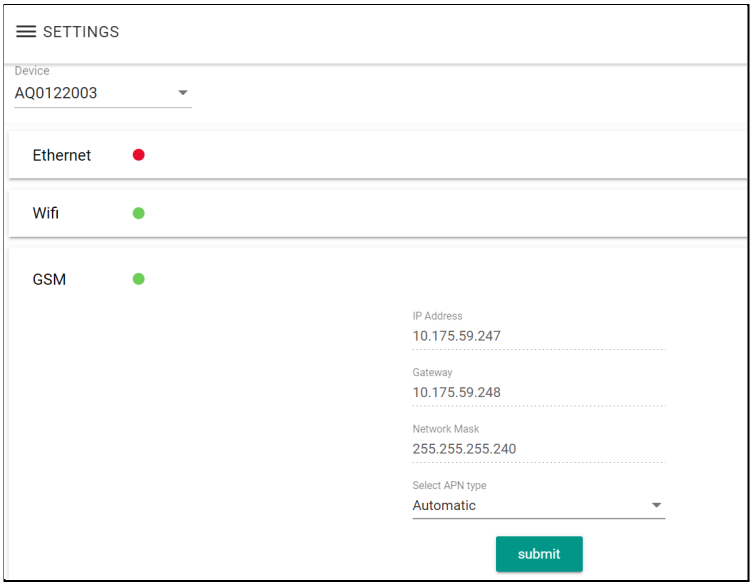


Figure 4.19 GSM configuration

4.4.4.2 WiFi

Step 1 Ensure the monitor is in a zone where the WiFi signal is optimum. (To check the WiFi signal strength, you can connect any Mac, Windows device or tablet, or phone to the WiFi that you plan to connect the monitor with and check the WiFi signal strength through online websites/command prompt or Wifi Strength checker Application)

Step 2 Select the Settings module on the on-device software and click on WiFi. The Red dot shows there is no connection established.

Step 3 From the dropdown menu, select the Wifi SSID and enter the password of the WiFi network you wish to connect your monitor with.

Step 4 Enter Submit. The Green dot shows the connection is established.

Step 5 Your monitor is now connected to the preferred WiFi network. Check for the latest data point in the Overview or Dashboard module.

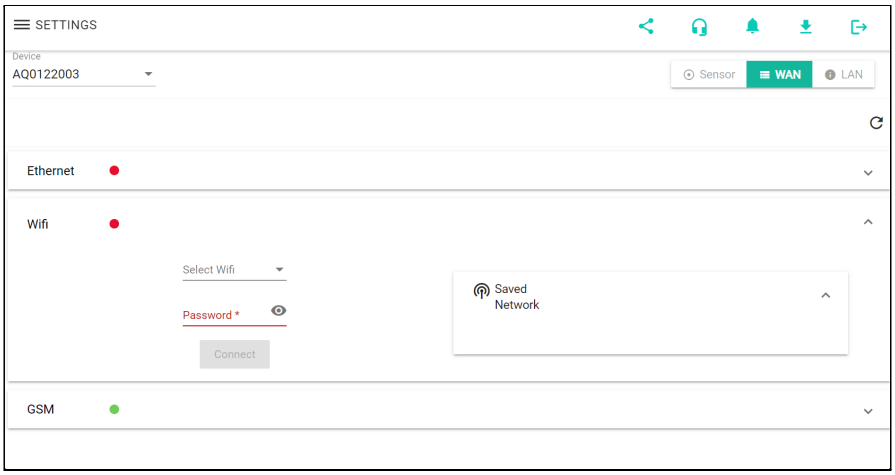


Figure 4.20 WiFi configuration

4.4.4.3 Ethernet

For ethernet connection you must ensure that there are proper accessories such as router or ethernet switch with DHCP enabled ethernet or static ethernet configuration as per requirement.

Step 1 Open the cap of the Ethernet connector.

Step 2 Insert the ethernet cable in the connector.

Step 3 Select the Settings module on the on-device software and click on Ethernet. The Red dot shows there is no connection established.

Step 4 From the dropdown menu, select DHCP or Static. In the case of Static connectivity enter the details as shown in Fig 4.21.

Step 5 Enter Submit. The Green dot shows the connection is established.

Step 6 Your monitor is now connected to the network. Check for the latest data point in the Overview or Dashboard module.

.

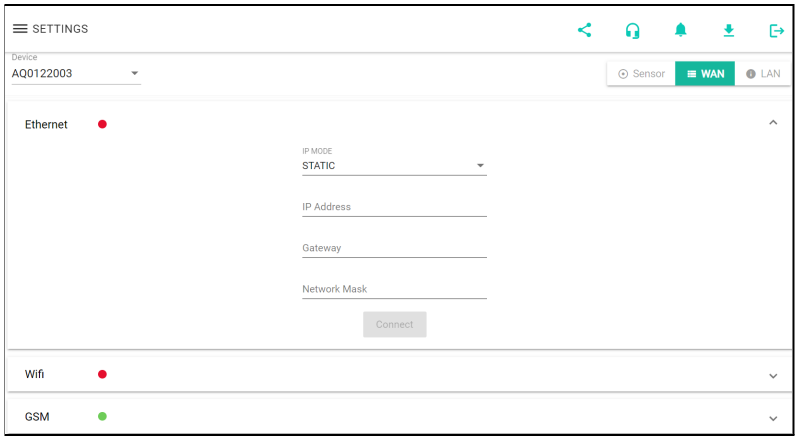


Figure 4.21 Ethernet configuration

4.4.4.4 Modbus

Modbus RTU

Step 1	Insert the Modbus cable in the C3 connector on the monitor. **The Modbus cable specification is** **Red: 18-24 V DC** **Yellow-Green: GND** **Blue: B/Data +** **Yellow: B/Data -**
Step 2	Connect the third-party device which needs to be configured
Step 3	Select the Settings module on the on-device software and click on LAN.
Step 4	Enable the Modbus using the Toggle Button.
Step 5	Select Modbus RTU from options.
Step 6	Click on Update Config.
Step 7	Your monitor is now connected to the Modbus RTU network.

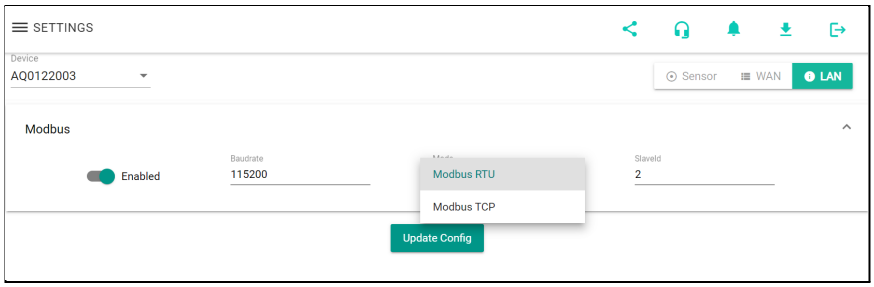


Figure 4.22 Modbus configuration

Depending upon the number of sensors selected, the number of output registers to read would vary. The sequence of output is stated in the table below.

Start Address: 40000
Slave ID: 1
Baud Rate: 115200

If Slave ID or Baud Rate change is required, please contact our support team at support@oizom.com

Modbus TCP

Step 1	Connect monitor using Ethernet Cable with Modbus TCP Supported system
Step 2	Use DEVICEID.local / Given IP address from the network as IP and 502 as Port in the connected Modbus TCP Supported system.
Step 3	Select the Settings module on-device software and click on LAN.
Step 4	Enable the Modbus using the Toggle Button.
Step 4	Select Modbus TCP from options.
Step 5	Click on Update Config.
Step 6	Your monitor is now connected to the Modbus TCP network.

After connecting devices with the local network one can access data over Modbus TCP protocol using following details. The sequence of output is stated in the table below.

Host Name: {deviceId}.local / IP address
Start Address: 40000
Slave ID: 1
PORT: 502

If Slave ID or Baud Rate change is required, please contact our support team at support@oizom.com

Table 4.3 Response Table

Key	Parameter	Position	Unit
temp	Temperature	40000 40001	Celsius
hum	Humidity	40002 40003	%
p2	PM 10	40004 40005	ug/m3
p1	PM 2.5	40006 40007	ug/m3
leq	Noise (Leq)	40008 40009	dB
light	Light	40010 40011	Lux
uv	UV	40012 40013	UV Index
g1	CO2	40014 40015	PPM
g2	CO	40016 40017	ppb
g3	NO2	40018 40019	ppb
g5	O3	40020 40021	ppb
g6	H2S	40022 40023	ppb
g7	NO	40024 40025	ppb
g8	SO2	40026 40027	ppb
g9	O2	40028 40029	%
g4	NH3	40030 40031	ppb
v2	TVOC	40032 40033	ppb

v3	CH2O	40034 40035	ppb
v4	CH4	40036 40037	ppb
v5	CL2	40038 40039	ppb
v6	CH3HS	40040 40041	ppb
pr	Pressure	40042 40043	hPa
p3	PM1	40044 40045	ug/m3
p4	PM100	40046 40047	ug/m3
wd	Wind Direction	40048 40049	degree
ws	Wind Speed	40050 40051	m/s
rain	Rain	40052 40053	mm

Float value conversion

Example to acquire gas sensor output in C language:

```
union Pun {float f; uint32_t u;};
float decodeFloat(const uint16_t *regs)
{
union Pun pun;
pun.u = ((uint32_t)regs[0] << 16) | regs[1];
return pun.f;
}
```

We are encoding Float values using the following formula:

```
void encodeFloat(uint16_t *regs, float x)
{
union Pun pun;
pun.f = x;
regs[0] = (pun.u >> 16) & 0xFFFFU;
regs[1] = pun.u & 0xFFFFU;
}
```

4.4.4.5 Relay / Automation / Buzzer

Step 1 Insert the Relay cable in the C4 connector on the monitor.

The Relay Contact Cable specification is:

Red: Common K1
Yellow-green: NO K1
Blue: Common K2
Yellow: NO K2

Step 2 Select the Automation module on the on-device software for configuring the monitor.

Step 3 Select the device from the dropdown from the left top corner for which you wish to add configuration.

Step 4 Click on the plus sign to add a new configuration.

Step 5 Select the Output 1 / Output 2 / Buzzer, Based on which parameter, Default ON or OFF, Interval, Value (greater than), Value (less than) for configuration.

Step 6 Enter Submit.

Step 7 The monitor should be restarted for establishing a connection.

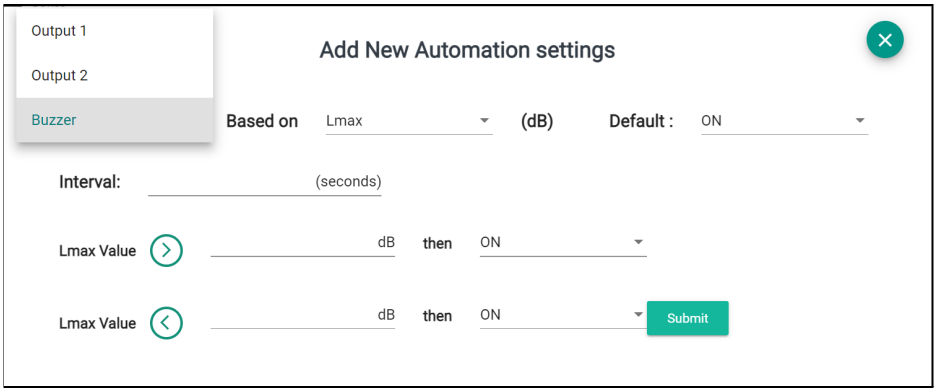


Figure 4.23 AUTOMATION configuration

4.4.5 Data visualization

Data can be visualized on the On-device Data Visualization software or Envizom™. To check the data on the On-device software select the Overview or Dashboard module.

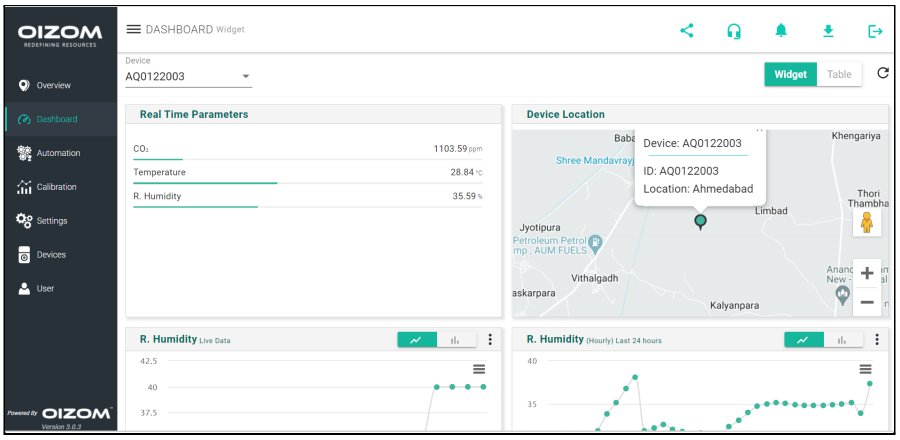


Figure 4.24 Dashboard module on On-device Software

Envizom™ is a Web application to visualize and analyze the data from the device. It can be accessed from any browser once the device is online on the internet. To go to Envizom™, type in your browser: https://terminal.oizom.com and hit Enter. Use your login credentials to access the application. The application is powered by several modules like Overview, Dashboard, Cluster, Display, Reports, Alerts, Analytics, User and Device management, etc.

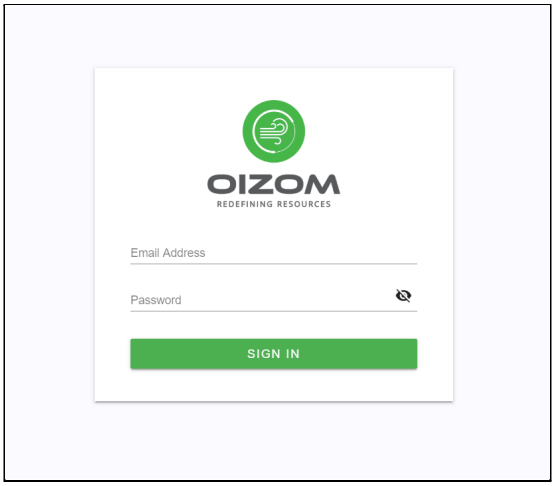


Figure 4.25 Login page-Envizom™

You can check out the **Envizom™** user guide here for ease of understanding: https://drive.google.com/file/d/1qM-WnudCBrOYTVMy0va3Tb1CoLbyIesa/view?usp=sharing

4.4.6 Sensor Configuration

Sensor can be configured on the On-device Data Visualization software.

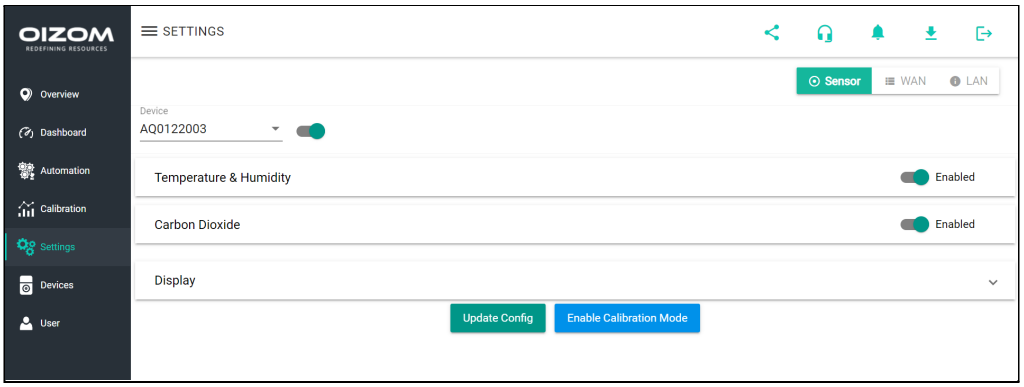


Figure 4.26 Sensor configuration

To enable or disable any sensor, click on the Settings module from the on-device data visualization tool.

Click on the toggle to enable or disable as per the preference for any sensor.
Click on Update Config to update the recent configuration. Check the next data point to validate the changes.

If there is an absence of data for any sensor during the initial setup, try re-pressing the sensor(applicable for OGS) and also press the relevant connectors properly after unlocking and opening the enclosure. It is mandatory to switch off the AC power supply before opening the enclosure.

4.4.7 Display configuration

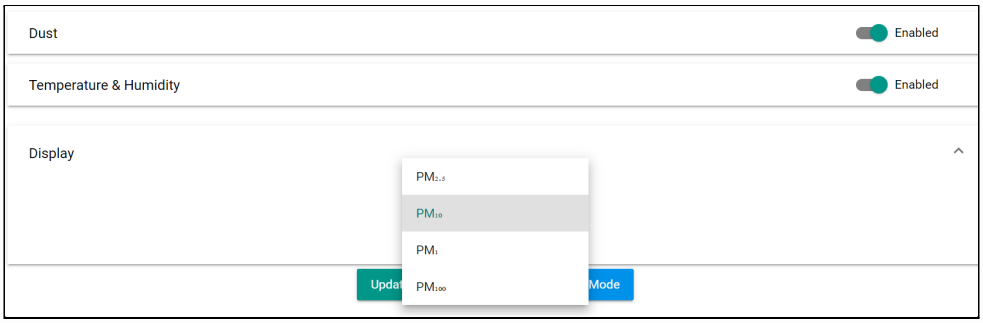


Figure 4.27 Display configuration

To change the parameter(only applicable to AQBot PM) to be displayed on the monitor, go to the settings module on the on-device software, and from the dropdown menu select the desired parameter you wish to display on the monitor. After selecting, a pop-up will appear, you need to mention config notes for eg. *to*

show PM 2.5 on display or anything else which mentions the changes made. Then click Update Config to save the changes.

4.4.8 Device configuration in Envizom™

Set location

From the Devices Module user can set the location of the device. Click on the Edit button then set the location by entering the lat long or by moving the pin on the provided map which will set the lat long accordingly and submit.

Configure device name

In the edit device section users can set Device Name/Label as per the specific requirement.

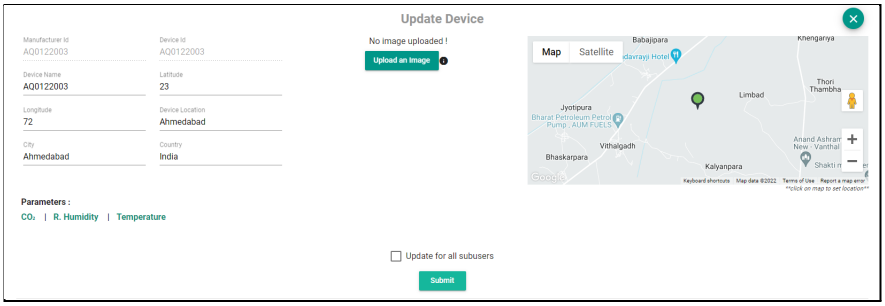


Figure 4.28 Devices Page-Envizom™

Configure units

For configuring the units go to the User module, then from the top right corner go to the Units section. It can be used to change the units of any parameter.

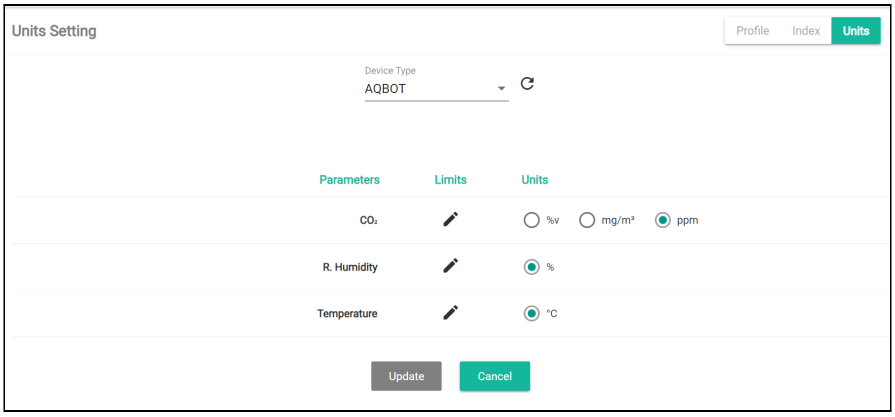


Figure 4.29 User page-Envizom™

Note: All the device configurations can be done from the On-device data visualization software as well.

5. Installation

It is advisable to check the below-mentioned Checklist before installation:

Sr No.	Activity	Yes	No
1.	Did you receive the AQBot™ package in good condition?	☐	☐
2.	Did you arrange the tools required for installation as per section 4.3.1?	☐	☐
3.	Did you unbox the AQBot™ as per section 4.3.2?	☐	☐
4.	Did you receive all the components listed in section 4.3.2?	☐	☐
5.	Did you identify all the components of AQBot™ as mentioned in section 4.3.3?	☐	☐
6.	Did you connect the power connector for AQBot™ as mentioned in section 4.4.1?	☐	☐
7.	Did you power on the monitor and observe the LED indication on the switch as per section 4.4.2?	☐	☐
8.	Did you connect the device with your preferred communication protocol as per section 4.4.4?	☐	☐
9.	Did you configure the device in Envizom™ and check the sensor data?	☐	☐
10.	Did you check if the pole has at least 2.5 inches of diameter and the height of the pole is 10ft in case of pole installation?	☐	☐
11.	Did you check that the area near the monitor is preferably 180° open for installation on Wall?	☐	☐
12.	Did you check that the area near the monitor is free from any EMF?	☐	☐
13.	Did you check if the site is approachable for O&M in the future?	☐	☐
14.	Did you check the power availability onsite(100-240 V AC)? (It is also advised to use a voltage stabilizer(UPS))	☐	☐
15.	Did you check if the site selected for installation is vandalism proof?	☐	☐
16.	Did you refer to section 2. Safety Dos and Don'ts?	☐	☐

After checking the checklist above, we are now ready to install the AQBot™ once a suitable location is chosen to install. If you have marked any point in the checklist as NO, refer to the relevant section, ensure that checkbox is checked, and then proceed further with the installation.

As the AQBot™ used for gas monitoring works on the diffusion principle, it is only able to measure the concentration of the target gas at the location where the monitor is located. Thus, locating AQBot™ is essential in Industrial and Commercial Safety applications, below are some key points to check during installation:

- The monitors should be located in positions determined by those who know gas dispersion, the process plant systems and equipment involved, and in consultation with both safety and electrical engineering personnel.
- Since the sensors are sensitive to sudden changes in external environmental conditions, locating the monitor properly is critical for optimizing data collection. Avoid placing the monitors at locations with frequent changes in temperature and humidity conditions.
- The monitor must be accessible for testing, maintenance, and recalibration.
- The location of the monitors and cables must be such that they are protected against any mechanical damage.
- The monitors may be placed at intervals around the perimeter of the site where it is necessary only to detect the escape of gas from within a given area. However, such an arrangement may not provide an early warning of a release. This arrangement should not be used alone if a release could cause a significant hazard to personnel or property within the perimeter itself.
- Monitors should be located close to any potential sources of a major release of the target gas, although to avoid nuisance alarms, detection points should generally not be located immediately adjacent to equipment which may produce inconsequential minor leakage in normal operation. In general, on open sites, minor leaks may be dispersed without causing a hazardous accumulation.
- Monitors should also be located in all areas where hazardous accumulations of gas may occur. Such areas may not necessarily be close to potential sources of release but might, for instance, be areas with restricted air movement. Heavier than air gases are particularly likely to flow like a liquid and accumulate in cellars, pits, and trenches if these are present. Similarly, lighter than air gases may accumulate in overhead cavities.
- In general, monitors should be sited above the level of ventilation openings and close to the ceiling for the detection of gases lighter than air, and below the ventilation openings and close to the floor for the detection of gases heavier than air.
- Oizom support team needs to be contacted in case the monitor is to be installed in adverse weather conditions like the presence of excess steam, driving rain, snow, ice and dust, high winds, etc.

- The monitor should be located away from any physical interferences, e.g. location should be away from overhead high-voltage cables to prevent any electrical interference with the monitor.
- The monitor should be preferably located at sites where there is an availability of existing structures to mount monitoring equipment as well as the availability of facilities such as electricity of sufficient rating, network connectivity, etc.
- The monitor should not be located at sites vulnerable to vandalism.

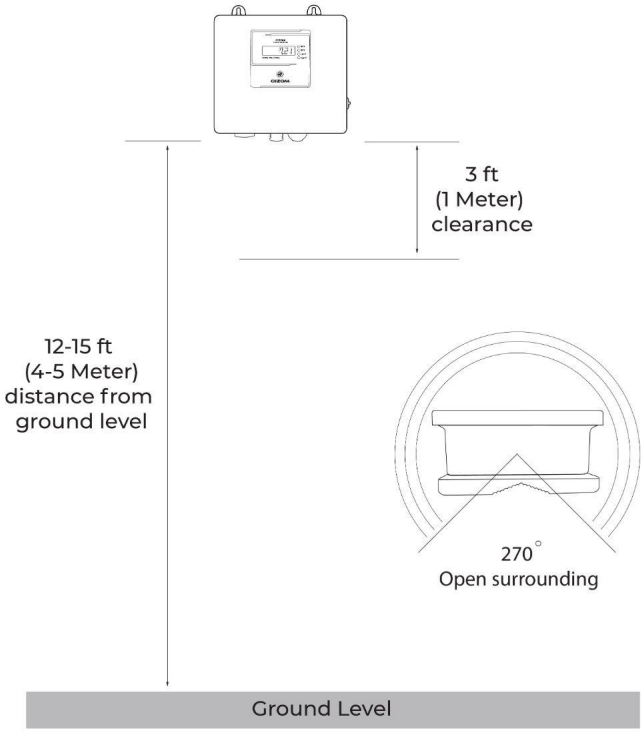


Figure 5.1 Selection criteria of monitor placement

5.1 Device with mounting bracket on pole/wall

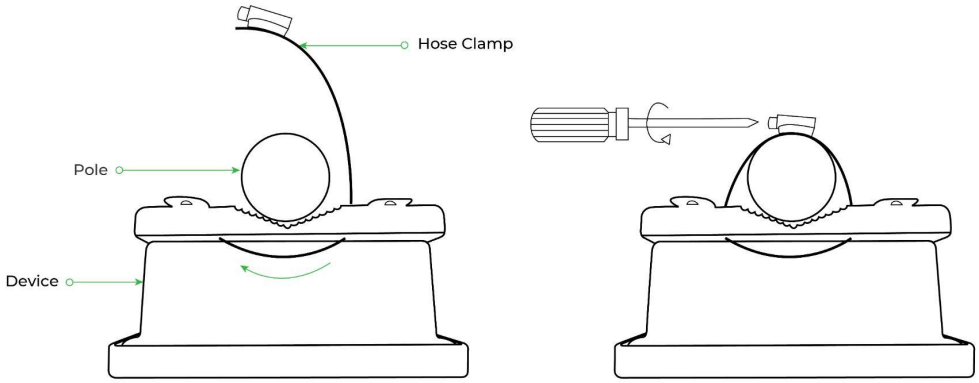


Figure 5.2 Device with mounting bracket and clamp assembly

The monitor is mounted on a pole along with the hose clamps. Alternatively, the holes on the top of the monitor are used to mount it on a wall.

First, fix the monitor on the pole using the hose clamp (refer to Fig. 5.2). Alternatively, in places with no poles, there will be no usage of clamps. The monitor has to be fixed by nailing in the wall using the 2 slots provided on the top of the monitor. Also, check the alignment using a spirit level.

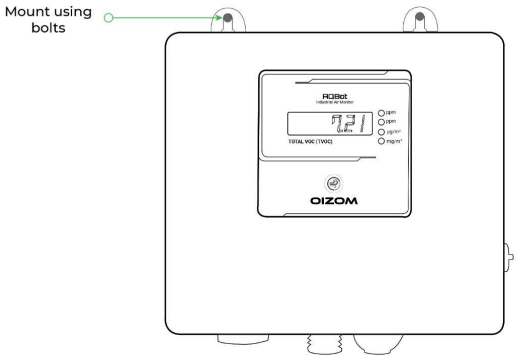


Figure 5.3 Fixing the device on the wall

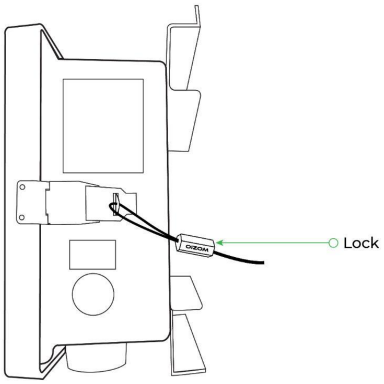


Figure 5.4 Locking the enclosure

Lock the enclosure after installation for safety or to avoid tampering with the device on the field. After locking, you can simply follow the steps mentioned in Section 4.4 Initial setup to put the monitor in operation.

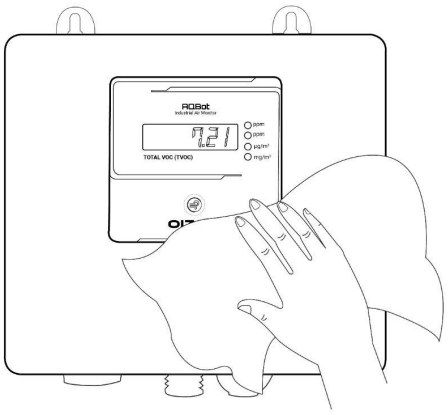
6. Operation and Maintenance

It is advisable that each operation measure is performed by a skilled/trained person.

6.1 Cleaning

While the monitor will not need frequent maintenance, it is highly advisable to keep regular checks. Periodic cleaning is important to ensure optimum performance. Monthly or quarterly regular maintenance activity has to be carried out depending upon the surroundings. The activity includes cleaning the dust inlet and outlet mesh and general cleaning of the exterior. The below steps need to be followed for the cleaning of the device

6.1.1 Device



Clean the dust accumulation or water spots using a soft cloth.

Figure 6.1 Device Cleaning

The device requires some basic cleaning using a brush or soft cloth.
The display must be cleaned so there is no issue in reading the concentration of parameters due to dust or water spots due to rain. The strobe should also be cleaned so that the red color is clearly visible from a distance once it is triggered due to a threshold breach. Cleaning of the OGS is also recommended with a soft cloth or a brush to remove any deposited dust which can disrupt the diffusion process of the sensor.

6.1.2 Dust sample inlet and outlet(Applicable for AQBot PM)

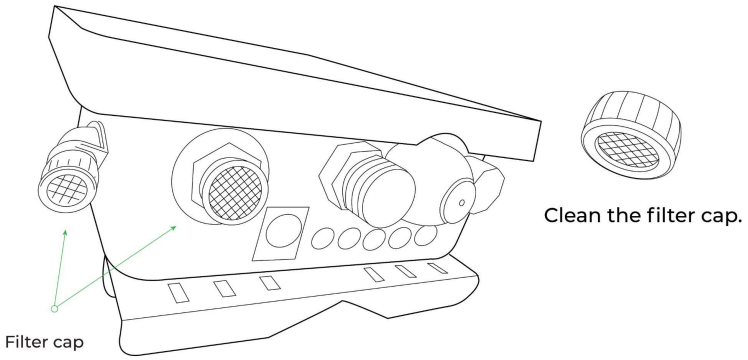


Figure 6.2 Cleaning of dust sample inlet and outlet

One filter cap is on the left side of the monitor whereas one filter cap is located at the bottom. Remove the filter caps by rotating them anticlockwise. Ensure that you remove the filter cap and not the nut and gasket. Clean the filter mesh with a soft cloth or a brush followed by blowing air into the filter mesh for removing dust or debris. Once cleaned thoroughly, rotate the filter cap clockwise to fix it.

6.2 On-site Calibration

NOTE: This section is applicable for AQBot™ with Gas Parameters only.

Gas sensors need to be calibrated and periodically checked to ensure sensor accuracy and system integrity. The intervals between calibration can vary for different sensors. To maintain measurement accuracy, we recommend that sensors are re-calibrated yearly or more often if measurement certainty is critical for the application. The sensors can be sent back to the Oizom facility if the data is faulty for replacement or calibration.

Using a zero air cylinder, users can calibrate the AQBot™ at their premises even without the need to de-install the unit. The calibration module in the on-device data visualization software allows the user to check the sensor response and apply drift in the sensor reading if required. The correction will be saved and updated immediately without any dependency on our support team.

The below-mentioned step-to-step process will help in calibrating gas sensors in the AQBot™ using calibration standards such as zero air cylinders at the installed location without having to send the instrument back to Oizom Calibration Laboratory.

6.2.1 Calibration Prerequisites

General Considerations

- It is not recommended to perform calibration immediately after installation. The sensor should be allowed to adapt to environmental conditions.
- Before initiating calibration, it is important to ensure that AQBot™ sensor data is in stable condition. The device should be kept running for at least 24 hours before commencing the calibration procedure.
- If the sensor data is not stable, wait for a few hours before performing calibration.

Calibration Gas Considerations

- The calibration gas accuracy and quality play an important role in a successful calibration. Gas calibration should be done using certified calibration gases procured from a reputed supplier.
- As per EPA regulations, the calibration gas standards used to calibrate AQBot™ must be traceable[1] to either a NIST Traceable Reference Material (NTRM) or a NIST-certified Gas Manufacturer's Internal Standard (GMIS).
- Although zero air standard is not required to be traceable to a primary standard, it is important to ensure that zero air used is free of all gas pollutants.
- The use of a 1 L gas cylinder is recommended for ease of transport and accessibility.

- Recommended environmental conditions for gas calibration are:
  - Ambient Temperature: 20 ± 2 ℃
  - Relative Humidity: 54 ± 10 %

  It is recommended that the same environmental conditions are maintained throughout the calibration for better results.

- Recommended test conditions for gas calibration are
  - Gas Flow rate: 500-1000 sccm
  - Gas Pressure: 0.3 - 0.5 bar
  - Gas Temperature: 20 ± 2 ℃

Safety Guidelines

- Store compressed gas cylinders in cool, dry, and well-ventilated areas.
- Read all label information and Material Safety Data Sheet (MSDS) of the gas and keep it within reach.
- Ensure that the piping, regulators, or any other connections are gas-tight to prevent

[1] Traceable (as defined in EPA - QA handbook Vol II) means that the standard has been compared and certified, either directly or via not more than one intermediate standard, to a primary standard such as a NIST Standard Reference Material (NIST SRM) or an EPA/NIST-approved Certified Reference Material (CRM).

gas leaks. Use compatible leak test solutions (e.g., soap and water) or leak test instruments.

6.2.2 Calibration Procedure

The AQBot™ Onsite gas calibration software allows quick, easy, and automated calibration. AQBot™ should be kept running for at least 24 hours before scheduled calibration to ensure the stability of the data. Additionally, the device must be connected to the power supply and stable network connection (i.e. the LED switch is either cyan breathing or pink blinking).

Accessories Required for Calibration

- Electronic device to view the Oizom Onsite Gas Calibration software (laptop/tablet)
- Portable zero air cylinder (with 0.5 LPM fixed flow regulator) OR zero air generator (with a controlled flow of up to 1 LPM)

  Recommended gas cylinder details:
  Caliport (portable pure gas): Zero grade air filled in a new 0.5-liter aluminum portable high-pressure canister with c10 valve having a purity of 99.999 % along with fixed flow regulator (0.5 lpm)

- Tygon / PTFE tube
- Calibration Hood
- General PPE safety kit

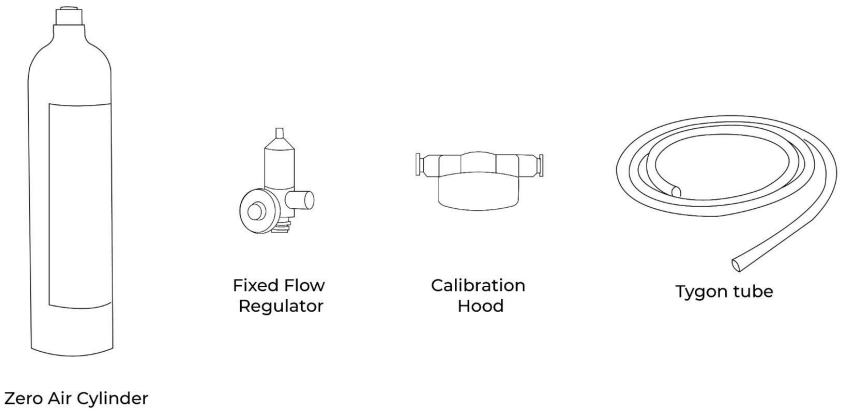


Figure 6.3 Accessories required for Onsite Calibration

AQBot™ Calibration Setup

- On the AQBot™ remove the OGS cap and connect the OGS calibration hood.
- Connect one end of the tube to the regulator on the gas cylinder and another end to the inlet.
- Connect the smart device to the AQBot™ on-device data visualization tool. [Refer to Section 4.4.4 Connectivity for detailed steps]

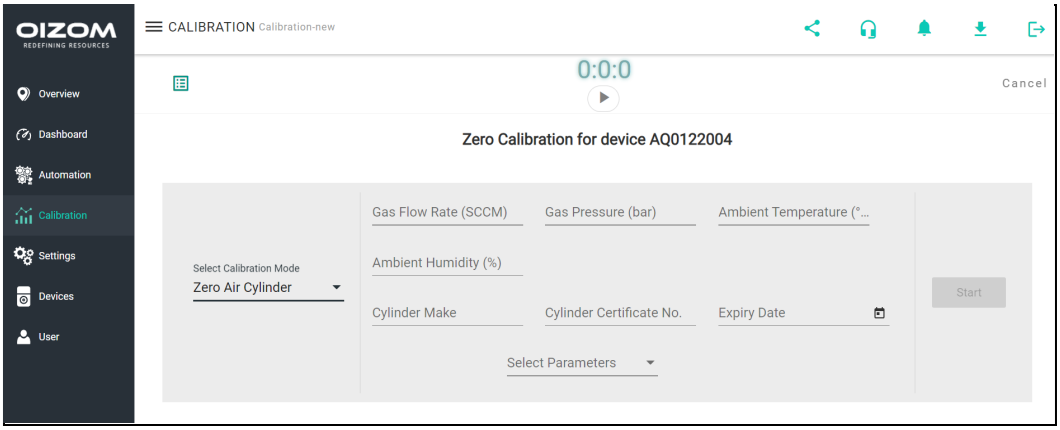


Figure 6.4 Calibration module on ENVIZOM™

- Open the 'Settings' tab and click on the 'Enable calibration mode' button at the bottom.

  Once the calibration mode is enabled, the data from the AQBot™ can only be accessed in the calibration module. Please, that any data recorded while the calibration mode is enabled will not be stored in the data table of the device.

- Open the 'calibration' tab.
- Click on '+' at the top right of the screen to add a new calibration.
- A calibration form will open. Fill in the details and select Zero Calibration in the drop-down menu.
- Enter the test details, such as temperature and humidity conditions, applied flow rate and pressure, gas cylinder make, certificate number, and expiry date. Select the gas parameter to be calibrated from the dropdown menu.

Zero Calibration of AQBot™

- Open the flow of gas using the fixed flow regulator.
- On the 'calibration' module, press play. The data will start to appear on the screen in the table as well as in the graphical form.

- Pass the gas until a stable concentration is achieved. It will take approx 2-5 minutes. Once a stable reading is achieved, click on pause. The zero offset is automatically calculated based on the sensor data.
- Click on 'Edit' to edit the offset values to be applied to the sensor.
- Next, click on 'Validate'. All the previous data will be removed.
- Click on 'Play' again. The offset is applied to the gas sensors and the updated data is now visible on the screen. Click on the 'Validate' button again. Keep validating until a stable zero reading is achieved.
- Once the calibrated data is validated, and you are satisfied with the zero calibration, click on 'Update and Save'. At this point, you can add additional notes in the comment box. Click on update and the offset will be applied to the sensor data.
- Close the supply of zero air.
- Remove the tube from the Calibration Hood.
- Remove the Calibration Hood and replace the OGS sensor cap on the AQBot™.
- Open the 'Settings' tab and click on the 'Disable calibration mode' button at the bottom.
- Go to the 'Overview' table view and wait for the new data point to arrive. Once the recent data is received, close the browser.

The on-site zero calibration process is now complete. Remove the calibration hood and put the OGS cap back on the OGS.

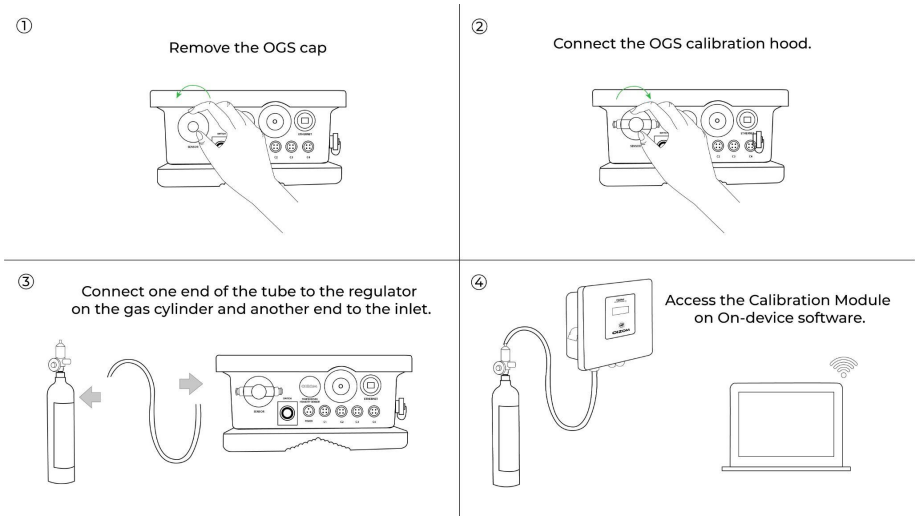


Figure 6.5 Onsite- calibration methodology

6.3 Replacements

The AQBot™ is designed for continuous use and requires minimal maintenance and calibration. Easy replacement steps can be followed by the user for continuous operation.

Replacement of any sensor should not take place when the monitor is live and powered on. Always switch off the monitor before sensor replacement or troubleshooting procedure. All necessary safety precautions are to be followed as mentioned in Section 2. Safety.

If replacement of any other component is required other than the below listed, Oizom or its representative needs to be contacted for the same.

Every sensor has a limited life span. The sensor life depends on the average pollutant concentration in the area. The sensors need to be replaced once their performance starts to deteriorate and the system starts giving unstable data.

6.3.1 Noise sensor(applicable to AQBot Noise)

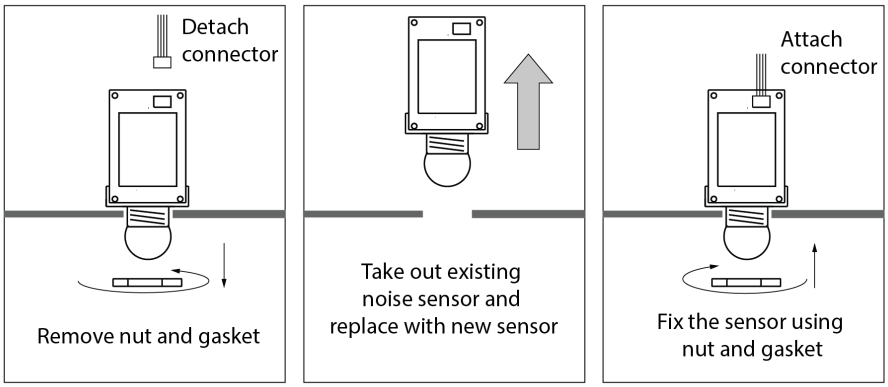


Figure 6.6 Replacement of noise sensor

Ensure that the monitor is switched OFF by switching OFF the AC power supply before opening the enclosure before performing the replacement activity. Open the enclosure and you can locate the noise sensor. First, detach the connector and then remove the nut and gasket by rotating it anti-clockwise. Pull the noise sensor out after it is detached completely from the body. Now replace the old sensor with a new one and fix it by rotating it clockwise. Fix the gasket and nut. Attach the connector and close the enclosure. Switch ON the device.
Note: If you wish to replace the cable then ensure to note or mark the connector position on the motherboard. The connector on the motherboard must be placed where the word NOISE is mentioned.

6.3.2 Dust sensor(applicable to AQBot PM)

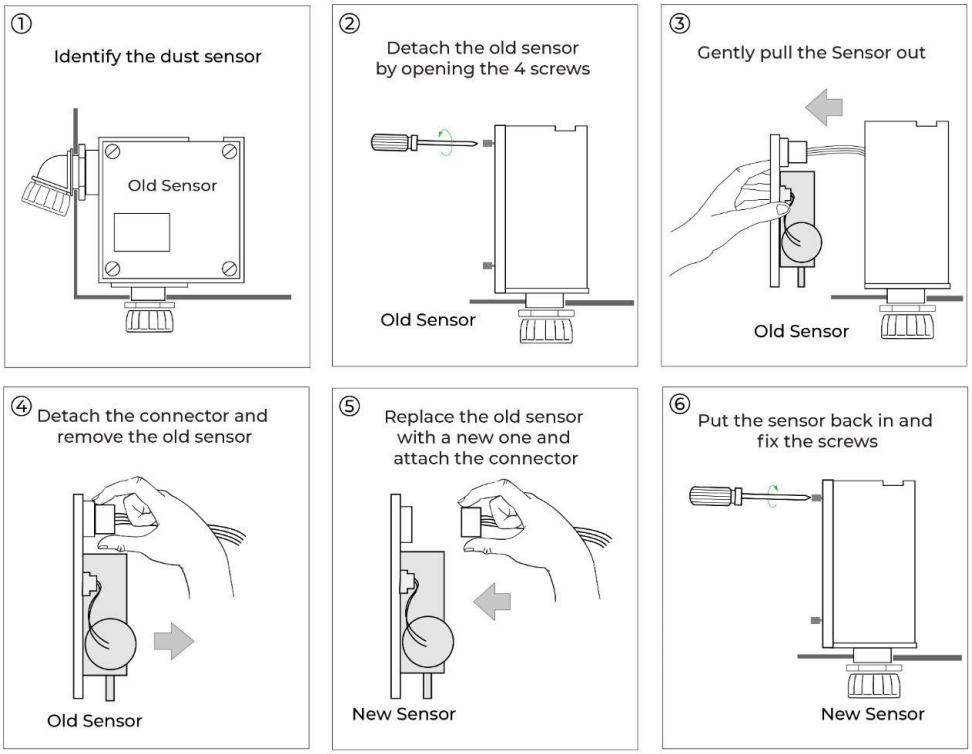


Figure 6.7 Replacement of dust sensor

Ensure that the monitor is switched OFF by switching OFF the AC power supply before opening the enclosure and performing the replacement activity. First, open the enclosure, identify the dust sensor and detach the old sensor by removing the 4 screws. Gently pull out the sensor and detach the connector to remove the old sensor. Replace the old sensor with a new one and attach the connector. Put the sensor back in and fix the 4 screws. Close the enclosure and switch ON the device.

Note: If you wish to replace the cable then ensure to note or mark the connector position on the motherboard. The connector on the motherboard must be placed where the word PM100 is mentioned.

6.3.3 THP (Temperature, Humidity, Pressure) Sensor

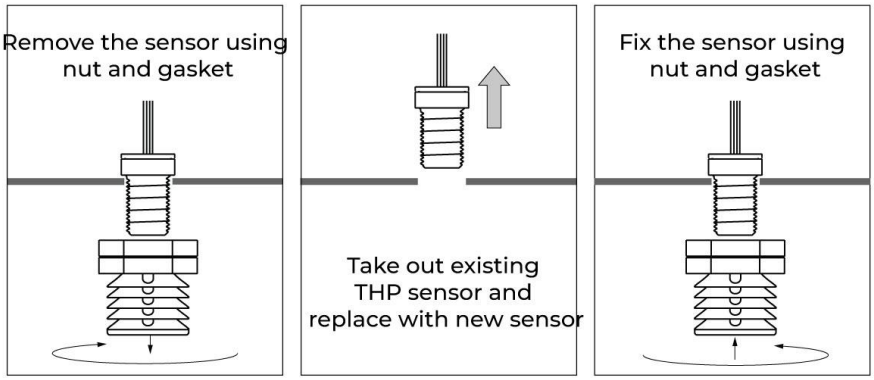


Figure 6.8 Replacement of THP sensor

Ensure that the monitor is switched OFF by switching OFF the AC power supply before opening the enclosure before performing the replacement activity. Open the enclosure and you can locate the THP sensor. Now detach the connector and remove the sensor using the anti-clockwise motion of the nut and gasket. Hold the disc and cone body of the THP sensor to assist in the removal of the THP sensor. Replace the old sensor with a new one and fix it by a clockwise motion using the nut and gasket. Place the disc and cone body on the exterior to assist in the fixing of the sensor. Close the enclosure and switch ON the device.

Note: If you wish to replace the cable then ensure to note or mark the connector position on the motherboard. The connector on the motherboard must be placed where the word TEMP-1MM is mentioned.

6.3.4 Oizom Gas Sensor (OGS)

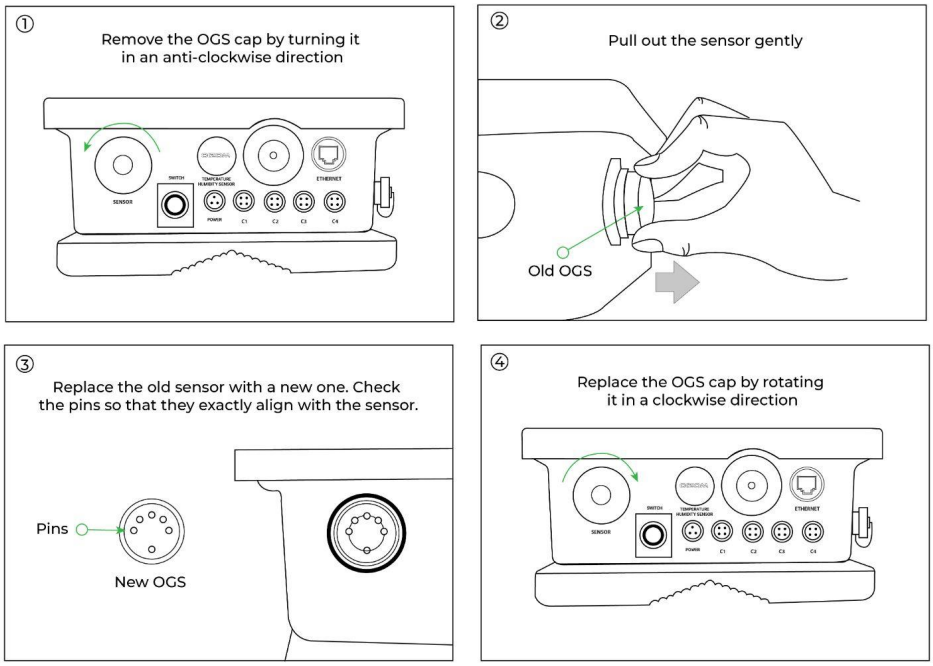


Figure 6.9 Replacement of OGS

Ensure that the monitor is switched OFF by switching OFF the AC power supply before opening the enclosure prior to performing the replacement activity. Remove the OGS cap by rotating it in an anticlockwise motion. Replace the old OGS by pulling it out gently and placing the new OGS at the same location. Ensure the new sensor is fixed firmly as loose contact may lead to loss of data. Now fix the OGS cap over the sensor by rotating in a clockwise motion and switching ON the device.

After OGS replacement, the sensor must be allowed a sufficient stabilization time of 24-48 hours before the data is used for monitoring purposes.

Note: At the end of the product's life, do not dispose of any electronic sensor, component, or instrument in the domestic waste, but contact a Certified E-Waste Recycler in your locality for disposal instructions.

7. Diagnosis/Debugging

Power and network availability are the prime checks in case of equipment failure. If the issue is still unresolved after remote diagnosis, on-site troubleshooting can be planned by an engineer. The below table lists the types of alerts users can receive based on the faults.

Table 7.1 List of alerts

Parameter	**Error Values (device data)**	**Message / Label**
General	**after installation (or relocation)	Stabilizing (for next 24 hrs)
General	**if monitor online after 2 days due to power cut	Stabilizing (for next 24 hrs)
General	**during calibration	Under Calibration
General	missing values for less than 24 hours	Possible Network issue
General	missing values for more than 24 hours	Under Troubleshooting
** - for gas sensors only		

7.1 Reboot

Rebooting is required when there is an issue of network availability on site. Sometimes, you can also experience that the sensor data is erroneous like constant 0 or constant value for unexpected time.
Some of the errors/faults can be solved by simply rebooting the device.
Simply push the switch and turn OFF the monitor. Post 1 min press the switch again to turn ON the monitor.

Still experiencing issues with your AQBot™?

Our remote support team is available for troubleshooting. Our system generates automated alerts in case of any malfunctioning and these alerts are received by our support team and issues are raised for our on-field well-trained service team who are equipped with tools and components provided by OIZOM. If you have any query or issue regarding the installation or functioning of our products, please reach out to our customer support team at the below-given contacts:

Contact No: +91-8866660083 **Email Id:** support@oizom.com