ellona

DUSTKAIR

User manual

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GENERAL CHARACTERISTICS

The DUSTKAIR is a portable fine particle monitoring device designed for demanding work environments. It consists of a capture module placed as close as possible to the respiratory pathways for precise data collection and a compact communication unit, worn on the belt, which includes a rechargeable battery providing 10 hours of autonomy. Its modular structure and robust casing ensure resistance to shocks and optimal reliability on construction sites and quarries.

1. **Precise identification:** Using a patented identification method based on spectrophotometry and an advanced algorithm, DUSTKAIR detects in real-time the alveolar fraction (<5µm), including crystalline silica, as well as the thoracic fraction (5-10µm).
2. **Average periods/data transmission:** Every 10 seconds for real-time information updates.
3. **Alarm mode:** Customizable thresholds on all measurement channels.
4. **Portable and autonomous design:** Ideal for automated particle exposure control processes.
5. **Advanced software:** Data acquisition and processing software platform.
6. **Software updates:** Always up to date with software hosted on secure servers and an online update feature.

- **Weight:** 570 g
- **Measurement head:** 140x55x40 mm (L x W x H)
- **Calculation module:**
  - 135x76x25 mm without protection (L x W x H)
  - 40x80x42 mm with protective cover (L x W x H)
- **Cord:** 20 to 80 cm in length
- **Protective case shell:** Silicone rubber
- **Battery:**
  - Charging conditions: 10°C – 40°C
  - Battery life: 8 to 10 hours

SAFETY INSTRUCTIONS

GLOSSARY

RISKS

Electrical hazard | Static electricity hazard | Fire hazard | Explosion hazard | Toxic product | Corrosion hazard | Hot or burning surface | Risk of irritation, toxicity

RECOMMENDATIONS

Warning | Unplug the device | Refer to the instruction manual | Wear protective glasses | Wear protective gloves | Do not throw in the trash, recycling center required

The **DUSTKAIR** system is a portable environmental monitoring device that integrates particle sensors. Safe use and compliance with these instructions are essential to ensure user safety and the longevity of the device.

Important

- Any non-compliant use or modification of the device may result in serious risks and void the warranty.
- Always refer to this manual and follow the provided recommendations.

RISKS AND ASSOCIATED INSTRUCTIONS

ELECTRICAL RISK

> **Battery use:** Never attempt to open, disassemble, or modify the DUSTKAIR battery. Only use the charger provided by Ellona.
> **Safe charging:** Charge the device only with a charger that complies with Ellona's specifications. Never charge the battery in a humid environment or near flammable substances.
> **Cable integrity:** Regularly inspect the charging cable and immediately replace it if damaged.
> **Disconnection before maintenance:** Before any maintenance or cleaning operation, ensure the device is turned off and disconnected from its charger.

Warning: Ellona recommends using only the power supply provided with the device to charge the DUSTKAIR battery.

STATIC ELECTRICITY RISK
> Handling Precautions: Avoid direct contact with the internal electronic components. Do not disassemble the device without using anti-static protective equipment.

FIRE RISK
> Do not plug the device into a non-compliant or overloaded socket.
> Avoid exposing the device to extreme heat sources.
> In case of electrical damage or overheating cables, immediately disconnect the device from its charger and contact Ellona.

EXPLOSION RISK
> Restricted use: Do not use the DUSTKAIR in ATEX-classified environments (presence of flammable gases or vapors).

CORROSION RISK
> Do not expose the device to corrosive substances without specific protective equipment.
> Avoid prolonged contact with aggressive chemicals.

HOT OR BURNING SURFACE
> If the device overheats, allow it to cool down before handling it after prolonged use.
> Do not touch the internal components without proper equipment.

GENERAL RECOMMENDATIONS

> **Unplug the device:** Always unplug the device before cleaning, maintenance, or moving it.

> **Refer to the instruction manual:** Consult the manual for installation, configuration, or troubleshooting.

> **Wear protective glasses and gloves:** Mandatory for any handling in a potentially hazardous environment.

> **Do not throw in the trash:** This device contains electronic components. Do not dispose of it with household waste. Take it to an authorized recycling center.

CLEANING AND MAINTENANCE

> **External cleaning:**
  - Unplug the device.
  - Use the bulb provided with the device to clean the measurement head.
  - Do not use compressed air or solvents that may damage the surface.
> **Internal cleaning: Reserved for qualified Ellona personnel only.**
> **Maintenance:** If a part needs to be replaced, only use parts certified by Ellona.

Warning: Any attempt at unauthorized maintenance may compromise your safety and that of the device.

For any questions, assistance, or repairs, please contact an Ellona representative.

LED INDICATORS

The DUSTKAIR is equipped with a status notification LED located on the edge of the device (next to the connection ports). The color displayed indicates the **device's status** or **signals an alert level in environmental analysis**, as shown below:

Operating indicators (mode)	Analysis indicators (alert level)	
Startup (flashing)	**Normal**	Optimal conditions detected, no action required.
Installation (flashing)	**Moderate** (info alert)	Minor anomalies detected, monitoring recommended.
Error	**Severe** (warning alert)	High risk, immediate intervention required.
	Critical	Critical situation, immediate action required.

If the error signal appears permanently, it indicates a network connection error.
Please refer to the '**Network Configuration**' section of this manual to resolve the issue.

SETUP INSTRUCTIONS

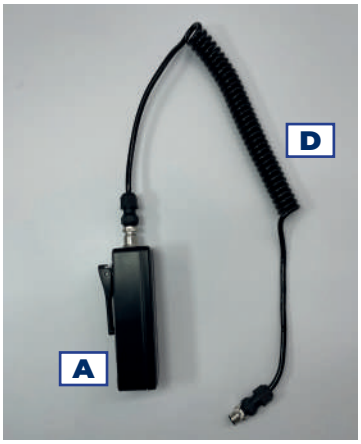
1- UNPACKING AND CONTENT CHECK

> **Unpacking steps**

- Open the package carefully.
- Remove each item and place them on a flat, clean surface.

> **Checklist of contents to verify:**

- Particle measurement head of the DUSTKAIR ..... A
- Connected calculation module of the DUSTKAIR (housing with silicone rubber protection and battery) ..... B
- USB cable with interchangeable connection plugs (US, EU, etc.) C
- Detachable cord to connect the measurement head to the housing ..... D
- Cleaning bulb for the measurement head ..... E



Check that no components are damaged (power cord, measurement head, housing, etc.).

In case of damage, do not power on the device and immediately contact an Ellona representative.

2- INSTALLING YOUR SIM CARD FOR LTE-M NETWORK

(if the SIM card is not already pre-installed)

> **Remove the silicone rubber cover to access the SIM card slot**, located on the lower edge of the device, following the instructions below:

1- Remove the silicone rubber protective cover.

2-Locate the SIM port (A) and insert the card following the indicated orientation.

> **Note:** Use only an LTE-M network SIM card approved by Ellona to ensure optimal compatibility.

3- NETWORK CONNECTION

> First, connect the external power supply and plug the device into a power outlet.

USB-C port for the power supply.

> **Then, initiate the network connection** by following the instructions below:

1- Turn on the device by **pressing the On/Off button once**. A green LED will light up to indicate that it is powered on.

2- **Press the On/Off button 3 times quickly** to start the network installation. A dark blue LED will flash at the front, indicating that the network setup is starting.

> Start the network configuration

1- Use a computer, tablet, or smartphone to search for available networks (LTE or WiFi).
2- **Find the serial number of your DUSTKAIR on the identification plate** located on the back of the device.

3- In the list of available networks, select the network starting with "**R-CPI-**" followed by the serial number.
4- Enter the following password: **ellonacpi**
5- **When connecting to the Wi-Fi network, a web page dedicated to the DUSTKAIR configuration will automatically open.** If this does not happen, enter the following IP address in the address bar of your internet browser (Chrome, Firefox, Edge, etc.): **192.168.4.1.**

> Network selection (LTE or WiFi)

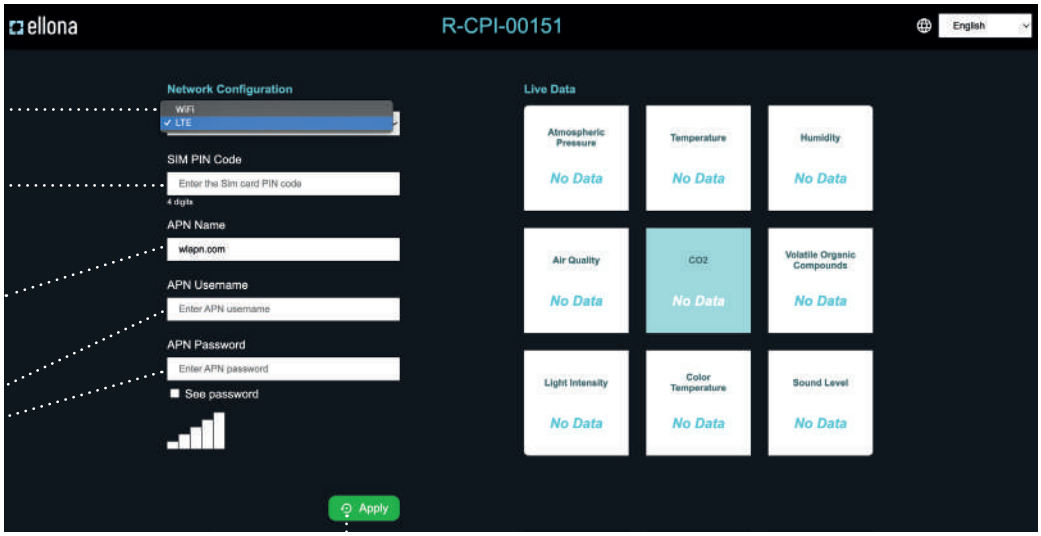
Procedure if LTE Network is selected

1- Select the desired network (LTE) from the dropdown menu

2- Enter the SIM card PIN code, or leave it blank if there is no PIN code

3- Enter the APN (Access Point Name) provided by the operator

4- Fill in the "APN Username" and "APN Password" fields provided by the operator



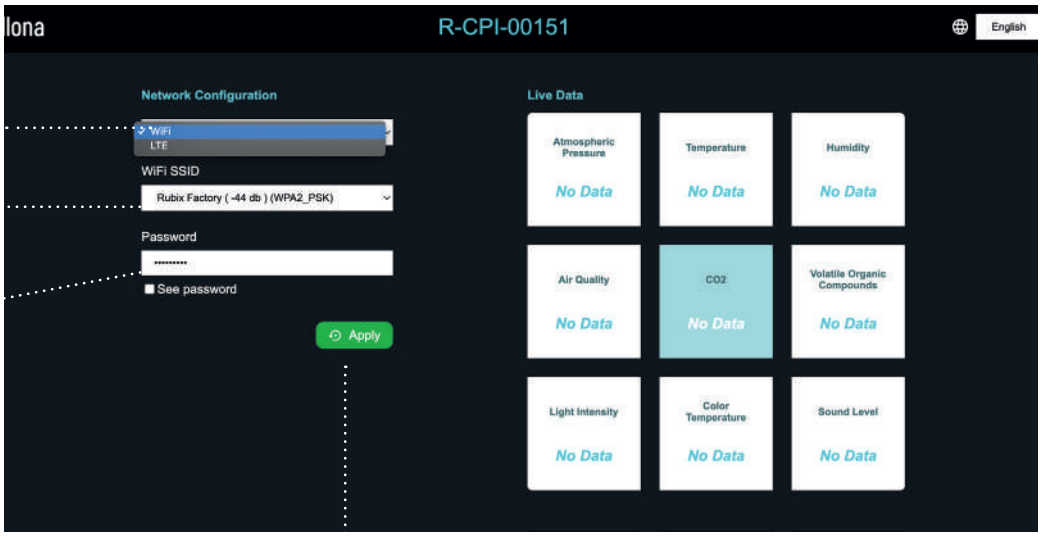
5- Click "Apply" to validate the settings. A confirmation window will appear. Select "OK" to restart the device and activate the LTE-M configuration.

Procedure if WiFi Network is selected

1- Select the desired network from the dropdown menu (WiFi)

2- In the Wi-Fi SSID dropdown list, select the corresponding network

3- Enter the network password in the designated field



5- Click "Apply" to validate the settings.
A confirmation window will appear.
Select "OK" to restart the device and activate the WiFi configuration.

4- USING THE DEVICE

> Make sure the device is sufficiently charged (battery life of 8 to 10 hours).
> The particle measurement head (A) should be positioned near the respiratory pathways.
> The calculation module, equipped with its battery, can be attached to the belt using its clip or placed in the user's pocket.
> The measurement head (B) can be attached to the operator using an integrated clip. This solution minimizes any discomfort and ensures optimal comfort during movement.
> Check the analysis indicators (LED color) to monitor alert levels, as specified below:

Analysis indicators (alert level)

Normal	Optimal conditions detected, no action required.
Moderate (info alert)	Minor anomalies detected, monitoring recommended.
Severe (warning alert)	High risk, immediate intervention required.
Critical	Critical situation, immediate action required.

5- OPERATING AND MEASUREMENT PRINCIPLE

DUSTKAIR is a portable device designed to measure aerosol concentration in real time, particularly in work environments exposed to dust (construction sites, industrial areas, quarries, etc.).

DUSTKAIR relies on a **multi-channel technology** capable of **measuring the size and number of airborne particles,** combined with:

> an **embedded mathematical model** to calculate the mass alveolar fraction depending on the type of material,
> an **intelligent database**, enriched by the chemical analysis of real materials, enabling the estimation of crystalline silica or other pollutants through the recognition of granulometric signatures.

All these features are integrated into the **EllonaSoft platform,** which automatically interprets the data and provides reliable, readable, and actionable results directly in the field.

MEASUREMENT OF THE ALVEOLAR FRACTION

> What is the alveolar fraction?

When we breathe, airborne particles do not all settle in the same part of the respiratory system. The alveolar fraction refers to the portion of particles that are fine enough to reach the pulmonary alveoli, the deepest and most sensitive area of the lungs.

This is crucial in occupational health, as these particles can cause serious respiratory diseases when they are toxic (such as crystalline silica, heavy metals, fumes, etc.).

> How does DUSTKAIR measure this fraction?

DUSTKAIR is equipped with a **high-precision optical sensor** capable of distinguishing particles by size, ranging from **0.3 to 12.4 microns**, using multiple granulometric channels. Each channel measures a specific range of particle sizes.

To determine the alveolar fraction, DUSTKAIR uses a **mathematical model integrated into the EllonaSoft platform**. This model applies a penetration factor to each particle size, based on recognized scientific standards such as:

> ISO 7708:1995 – defining inhalable, thoracic, and alveolar fractions,
> ANSES publications (2023),
> Academic research, such as Brown et al. (2013).

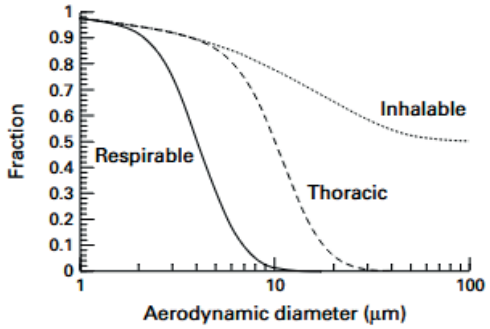
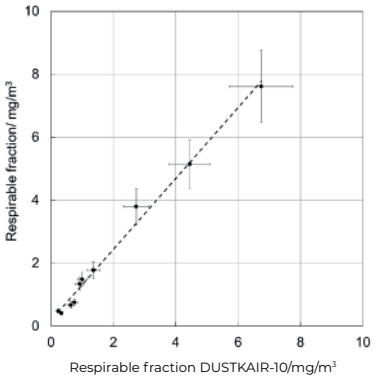


Figure 1 Inhalable, thoracic, and respirable sampling criteria.

This factor reflects the probability that a particle of a given size will reach the alveoli, based on biomedical studies.

> **Result:** DUSTKAIR displays the alveolar concentration in µg/m³
> **Customization: t**he mathematical model can be adapted to the nature of the materials present (e.g., wood dust, cement, metals, sand...) to enhance the accuracy of results in specific contexts.



PREDICTION OF EXPOSURE TO CRYSTALLINE SILICA

> Why monitor crystalline silica?

Crystalline silica (quartz, cristobalite, etc.) is a well-known carcinogen found in many construction materials (concrete, plaster, ceramics, sand, etc.). When inhaled as fine particles, it can cause serious respiratory diseases such as silicosis, pulmonary fibrosis, or lung cancer. This is why monitoring it has become a key issue in occupational risk prevention.

> How does DUSTKAIR estimate the presence of silica?

DUSTKAIR does not directly identify silica through chemical analysis, but uses an indirect, fast, and intelligent method based on analyzing the **granulometric signature of dust particles**:

> During laboratory analysis campaigns, specific materials (e.g., concrete, construction sand) a characterized both by :
    - their particle size signature,
    - their crystalline silica content.
> This data is integrated into an expert database embedded in EllonaSoft.
> During measurement, DUSTKAIR compares the real-time measured signature (every 10 seconds) with those stored in the database. If the embedded artificial intelligence model judges the signature to be close to a material containing silica, it deduces an estimate of the alveolar crystalline silica concentration.

This prediction is useful to quickly identify risky situations, even without immediate laboratory analysis, allowing for rapid response measures (mask wearing, area shutdown, ventilation, etc.).

WARRANTY TERMS

1. Warranty duration
The devices manufactured by ELLONA are covered by a 12-month warranty from the date of delivery. This warranty includes specific components, such as sensors and mass flow meters.

2. Warranty coverage
The warranty covers the following services:
- Repair or replacement of defective components in the event of a proven manufacturing defect.
- Full product replacement if repair is not possible.
- Coverage of labor costs associated with the repair.

3. Warranty exclusions
The warranty does not apply in the following cases:
- Incorrect use or non-compliance with the instructions detailed in the DUSTKAIR user manual and datasheet (including sensor usage conditions).
- Damage caused by accidents (impacts, falls, etc.).
- Improper installation or unauthorized interventions.
- Normal wear and tear of components, such as the battery.
- Damage resulting from unauthorized modifications or the use of spare parts not certified by ELLONA.
- Failures due to the use of non-certified or incompatible accessories.
- Alterations caused by extreme environmental conditions (excessive temperature, humidity, dust, etc.) not covered by the device specifications.

For the exact conditions of use for the sensors, please refer to the DUSTKAIR datasheet.

4. Warranty claim procedure
In case of an issue, the customer is invited to contact ELLONA customer support by providing:
- The product's serial number.
- A copy of the proof of purchase.
- A detailed description of the incident or malfunction encountered.

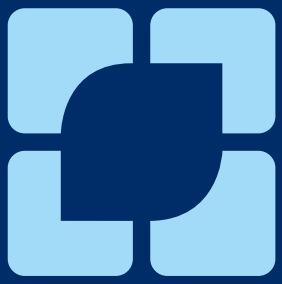
5. Warranty execution
If the product is covered by the warranty, ELLONA commits to:
- Repairing or replacing the defective product within a reasonable timeframe.
- Providing an equivalent replacement product if repair is not possible.

6. Limitation of liability
ELLONA's liability is limited to the repair or replacement of the warranted product. ELLONA cannot be held responsible for indirect or consequential damages, such as:
- Data loss.
- Economic losses.
- Any other operational loss.

7. Warranty transfer
The warranty is strictly reserved for the first buyer of the product and cannot be transferred to a third party.

For further information on the general terms of sale, please refer to the following document: **General Terms and Conditions of Sale**.

8. Revisions and claims
These warranty conditions may be modified according to the specific provisions of the contract between ELLONA and the customer. For any questions or claims regarding the warranty, please feel free to contact our after-sales service.



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