

# DM30 Dustsens

## User Manual

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# 1 PREFACE

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## 1.1 Safety Information

This user manual describes how to safely install and operate Sonitus Systems’ DM30 Dustsens particulate monitor.

The meanings of the warning and caution symbols that are employed in this user manual are described here so that users are aware of potential hazards when using the DM30 Dustsens.

|   |  |
|---|--|
| <br><b>CAUTION</b>   | <p>Failure to follow the procedure outlined in this manual could result in damage to the instrument or personal injury. If you are unsure how to operate this instrument, please contact the distributor directly before attempting to use it.</p> |
|    | <p>Caution, susceptible to electro-static discharging (ESD).</p>   |
| <br><small>CAUTION<br/>CLASS 3B<br/>LASER RADIATION<br/>WHEN OPEN<br/>AVOID EXPOSURE<br/>TO BEAM</small> | <p>Caution, Class 3B laser.</p>  |
|    | <p>Warning, Protective Earth Ground. This instrument must be <u>earthed</u> by connecting a suitable earth wire to the earth terminal within the Mains Connector.</p>  |
| <br><b>Warning</b><br>High temperature   | <p>Warning, High Temperature, risk of burns. Incorrect handling of the monitors heating system may result in exposure to high temperatures, resulting in the risk of incurring burns</p>   |
|    | <p>Caution, risk of electric shock.</p>  |

Failure to adhere to the cautions and warnings can result in damage to property or injury.

### WARANTY NOTE

- The DM30 Dustsens is only compatible with equipment supplied or verified by Sonitus Systems. Using other uncertified equipment may impair the performance of the product
- When the mains power adapter is used, the equipment should be connected to the appropriate isolation mechanism for emergency disconnection
- DO NOT attempt to use the equipment outside without the enclosure.
- The device is equipped with an active drying heater. DO NOT touch the aluminium heater tube while active.

## 1.2 Laser safety

- The DM30 device contains a Class 3B laser product.
- The laser is located inside the optical particle counter (OPC), which is held in the AS10 sensor assembly. The AS10 is housed inside the DM30 Dustsens.
- The laser is not considered to be dangerous if used correctly.
- **DO NOT** attempt to disassemble the OPC.
- **DO NOT** power the device when the AS10 sensor is disconnected.

## 1.3 Heater safety

- The DM30 Dustsens uses a high-powered heater to reduce humidity coming into the inlet.
- **DO NOT** touch the heating inlet when it is turned on.  
The heater **must be allowed to cool down for a minimum of 5 minutes** after powering down the system before handling.

## 2 GENERAL DESCRIPTION

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### 2.1 Airborne Particulate Monitoring with the DM30 Dustsens

The DM30 Dustsens (DM30) instrument is designed for measuring airborne particulate matter (PM) in outdoor environments. The DM30 records real-time, accurate, mass-concentrations of particulate matter (PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>) using an optical particle counter (OPC). The DM30 Dustsens also simultaneously records the environmental variables of temperature (°C/°F) and relative humidity (%) using external sensors.

The OPC uses a light scattering technique to determine the concentrations of airborne particulates in the air. The combination of a fan and heating system, enables air to be drawn into the DM30, where it is dried to reduce the presence of moisture droplets. As the particles pass by a photometer they are counted and profiled. The DM30 has the capability of recording a range of particle sizes from 0.35 µm to 40 µm.

The DM30 continually determines the PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> unit mass concentrations in micrograms per cubic meter of air (µg/m<sup>3</sup>). These readings are averaged, stored, and can be viewed in real-time via the Sonitus Cloud. The DM30 connects to the internet using an internal 4G modem. The user interface can also be accessed over Wi-Fi® to view data stored on the DM30.

The DM30 instrument is verified in our dedicated laboratory. The verification consists of a direct comparison of the response of the particulate monitor with an internationally recognised equivalence method instrument exposed to an aerosol of a standardised dust, with a certified particle size distribution.

### 2.2 Main Features of the DM30

- Real-time continuous measurement of ambient airborne particulates
- Reliable, low maintenance for dusty environments
- High-capacity optical particle counter
- Particulate matter sizes of PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> are recorded
- Simultaneous temperature and relative humidity readings
- High resolution of particle sizes down to 0.35 µm
- Plug and play installation

### 2.3 Intended Use

The DM30 is designed for use in a range of applications and environments. The instrument is designed for monitoring outdoor ambient airborne particulate pollutants but can also be used to measure particulates in indoor environments. The DM30 can detect high concentrations of airborne particle in the size range of 0.35 to 40 µm. The DM30 is designed to be low maintenance.

The inlet and exhaust are serviceable by the end user. The instrument is equipped with a baffled inlet and an auto-regulated flow rate to mitigate the influence of wind in changing environments.

## 2.4 Limitations of use

To ensure optimal performance and safe operation, the DM30 must be operated within the limits specified in Section 4 (Operation) of this user manual. Operation outside these limits may result in damage to the instrument or failure to achieve the performance specification.

Operation of the DM30 outside of the specified temperature limits for extended periods of time may reduce the operating lifetime of the instrument.

The DM30 is not approved for use in potentially explosive atmospheres or with potentially aggressive substances such as with acids or gases.

The DM30 can be adversely affected by dense fog conditions, resulting in higher measurement values. Any obstruction placed over the air inlet or outlet may also result in adversely affected measurement values.

## 2.5 User Responsibility

Only suitably trained personnel may install and operate the DM30 in accordance with the instructions provided in this user manual and the relevant regulations.

The DM30 Dustsens user manual should be kept onsite for reference.

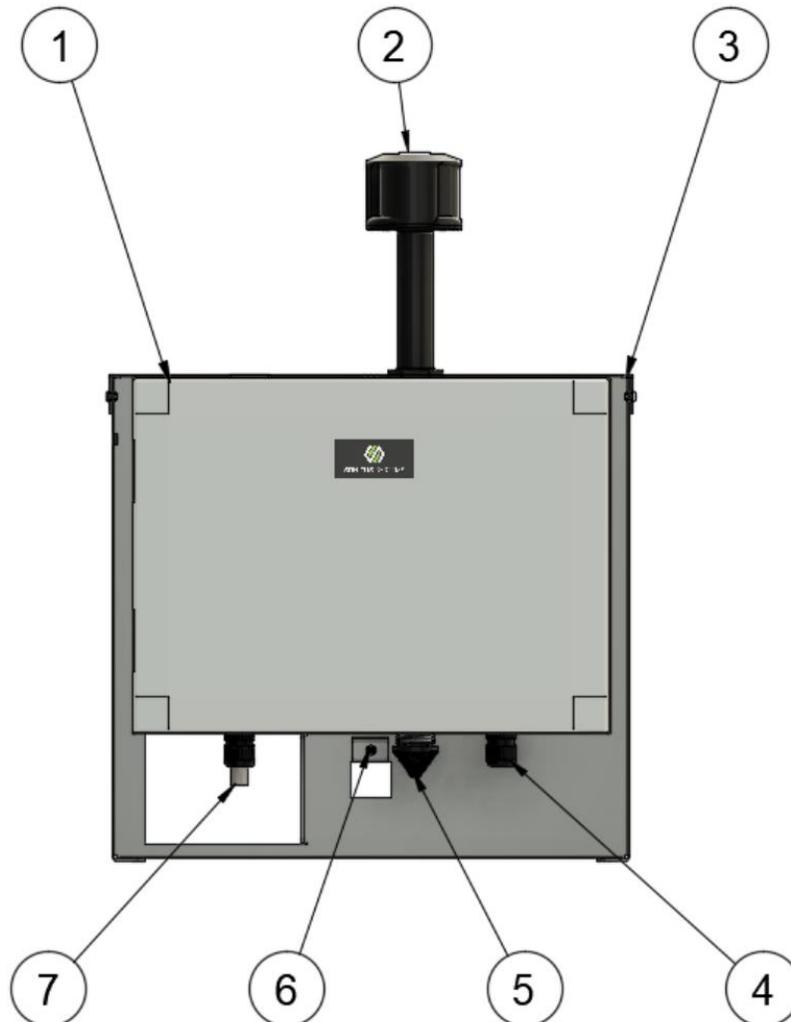
Repairs and verifications should only be carried out by personnel approved by Sonitus Systems. Only the manufacturer's approved components are to be used as replacement parts.

Only suitably qualified personnel may carry out maintenance on this instrument.

Sonitus Systems will not be liable for any injury or damage caused by incorrect installation, operation or maintenance resulting in a failure to follow procedures and safety instructions provided in this user manual.

### 3 OVERVIEW AND LAYOUT

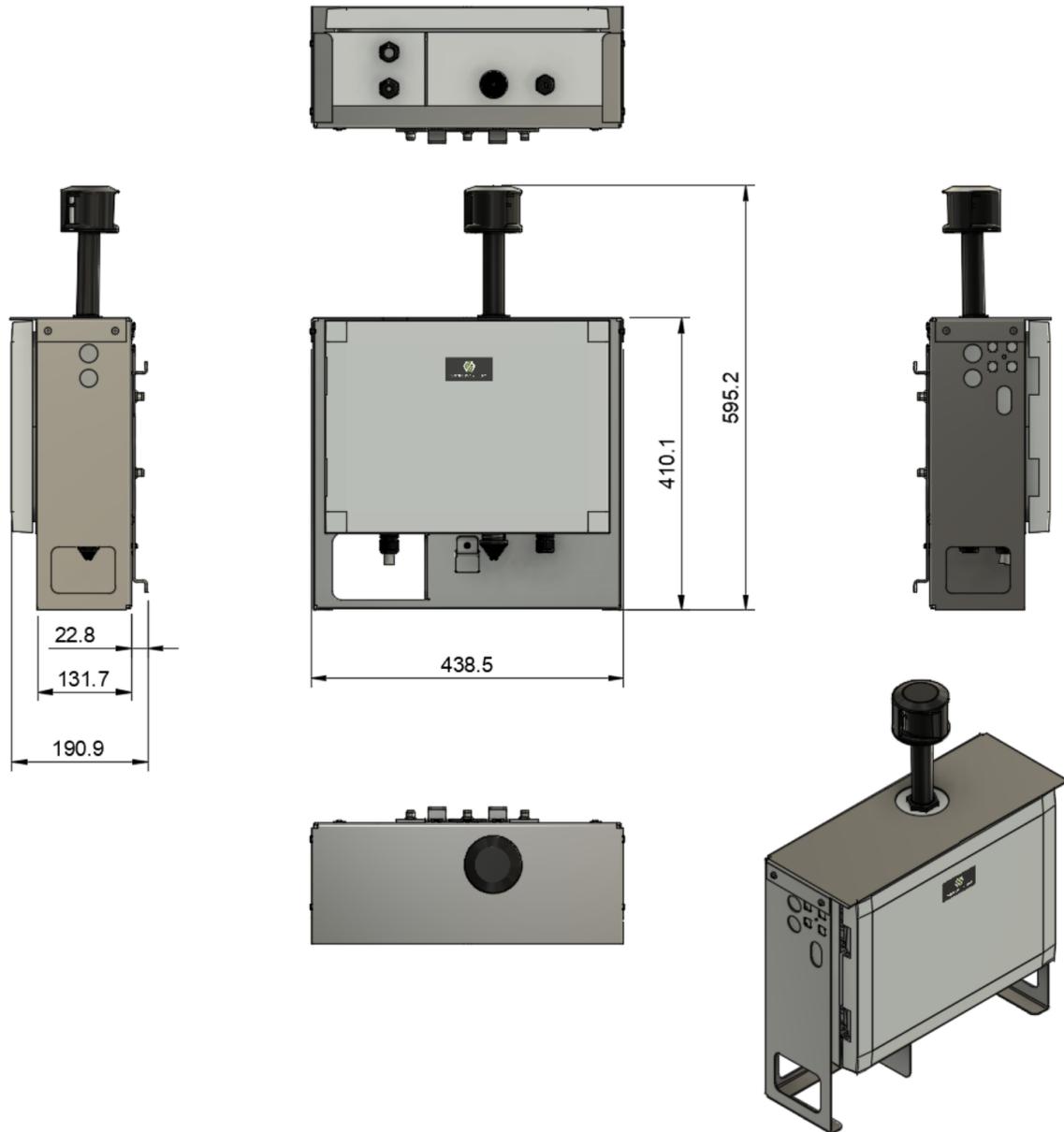
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- 1: DM30 main enclosure
- 2: Dust sampling heated inlet
- 3: Metal protection surround
- 4: Mains (110-220 VAC) input
- 5: Dust sampling air exhaust
- 6: Wall mounting bracket with locking security screw
- 7: Relative humidity and temperature external sensors

### 3.1 DM30 Dustsens Specifications

#### 3.1.1 Dimensions



### 3.1.2 DM30 Dustsens Specifications

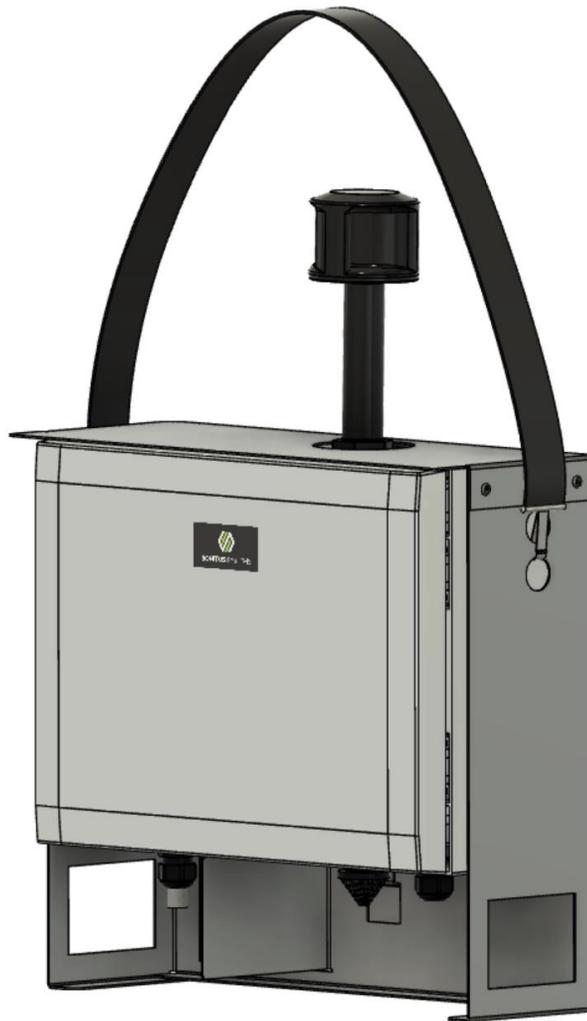
| Dust sensor                         | Description  |
|-------------------------------------|--|
| Sensor type                         | Optical particle counter                             |
| Laser classification                | Class 1  |
| Particle range                      | 0.35 to 40 $\mu\text{m}$ (Spherical equivalent size) |
| Size categorisation                 | 24 bins  |
| Sampling interval                   | 1 to 30 seconds                                      |
| Total flow rate                     | 5.5 L/min  |
| Sample flow rate                    | 210 mL/min   |
| Maximum particle count rate         | 10000 particles/second                               |
| Detection limits                    | 0.01 to 1500 $\mu\text{g}/\text{m}^3$                |
| Sampling heater                     |  |
| Power output range                  | 0 - 18 Watts   |
| Effective heating range             | 0 (at %RH < 70) to 45°C (at %RH < 40)                |
| Temperature and humidity sensors    |  |
| Operating range                     | -40 to 125°C   |
| Temperature resolution              | 0.01°C (Lowest repeatability = 0.15°C)               |
| Temperature measurement range       | 0 to 90°C at $\pm 0.2^\circ\text{C}$ accuracy        |
| Relative humidity resolution        | 0.01 %RH (Lowest repeatability= 0.21 %RH)            |
| Relative humidity measurement range | 0 to 100 %RH at $\pm 2$ %RH accuracy                 |
| System specifications               |  |
| Local data storage capacity         | 8 GB   |
| Data logging interval               | 1 to 30 minutes                                      |
| Wi-Fi                               | 802.11a/b/g/n  |
| GSM supported networks              | 2G/3G/4G   |
| Operating temperature range         | -10 to 55°C  |
| Humidity range                      | 0 to 95 (non-condensing) %RH                         |
| Mains Power                         | 100-240 Vac (50/60 Hz)                               |
| Overall power consumption           | 24 Watts (2 Amps at 12 Volts DC with heater on)      |
| Weight                              | 12 kg  |
| Ingress protection rating           | IP64 (Excluding dust sampling path)                  |
| Impact protection rating            | IK08   |

### 3.1.3 DM30 Handling

The DM30 can be transported using the following methods:

#### **Shoulder Strap**

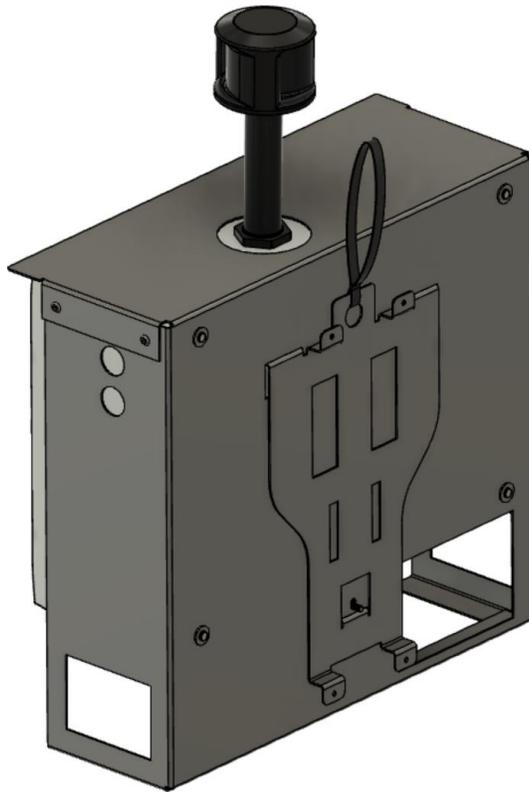
The DM30 can be transported using a shoulder strap attached to the dedicated lifting openings located on each side of the metal surround cover, as depicted below.



### Single Point Lift

The wall bracket provides a fixing point for lifting using a single anchor point, as shown below.

**Note:** The M5 security screw must in position before using the bracket to lift the entire system.

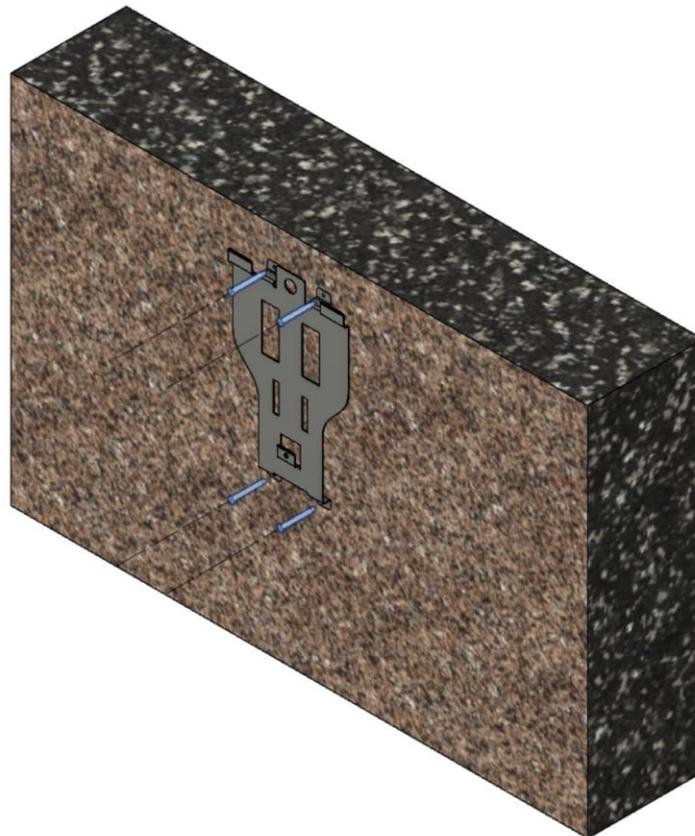


### 3.2 How to Install the DM30 Dustsens

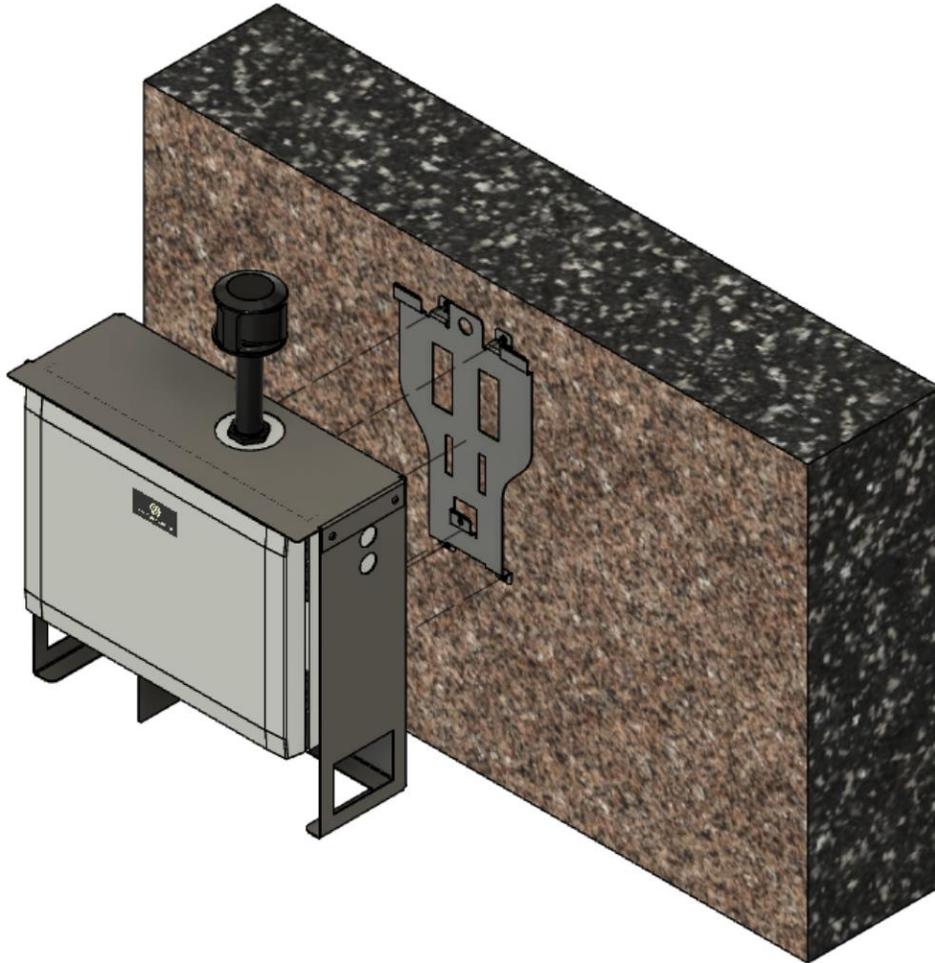
#### NOTE

- The DM30 Dustsens is designed to be mounted approximately 1.5 metres above the ground.
- To ensure highest quality of performance allow the inlet to be placed above the wall/ hoarding for optimal free flowing into the inlet.
- **DO NOT** position the devices upside down as this would have a damaging effect on the inlet

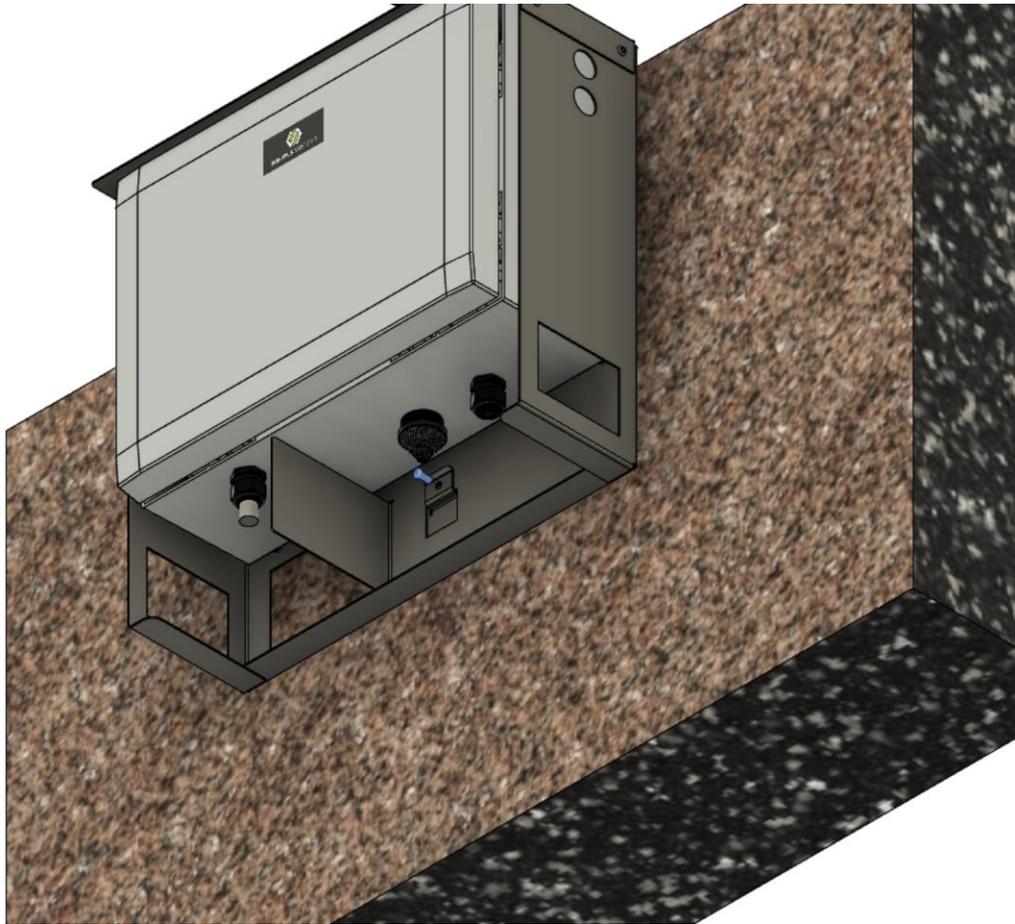
- Fix support bracket to the wall using four screws (selected based on the material) and heavy-duty raw plugs (if not fixing directly into wood or metal). Ensure the bracket is firmly fixed into position with the screws as shown below.



- Slide DM30 over, onto the support bracket and slide it down onto the three support lugs.



- Fix the DM30 in place using the M5 security screw



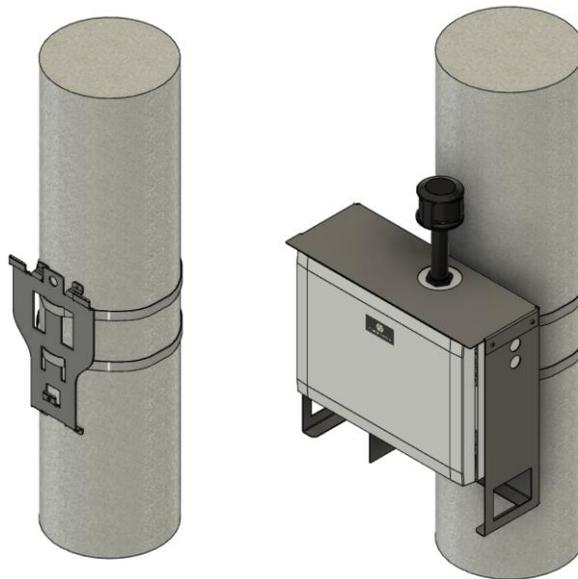
### 3.2.1 DM30 Dustsens Mounting Options

- **Wall mount**



- **Pole mount**

Attached to pole using steel straps



### 3.3 How to Commission the DM30 Dustsens

The following steps detail the commissioning procedure of the DM30 device.

**1. Power up the device**

**2. Inspect green LED on the EM20 logger for the following sequence:**

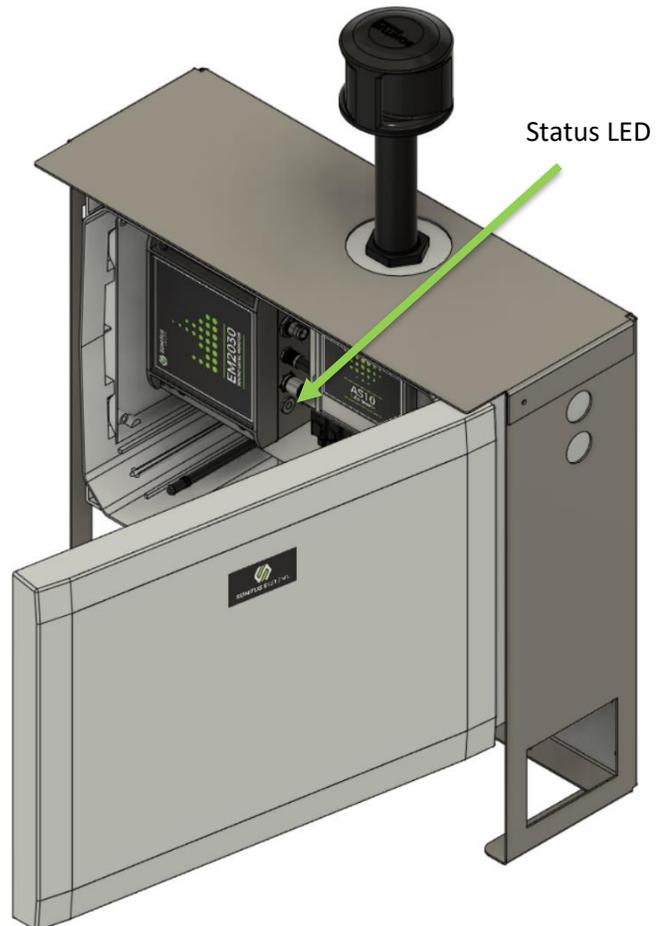
The LED switches ON for 5 seconds to show power is being supplied

The light stays OFF until the system has booted up and reached the next measurement time slot e.g. even 5 minute mark

The LED will begin flashing ON and OFF once per second. This means the system is operating normally and sampling is in progress (faster flashing indicates an error - refer to Troubleshooting Section 6.2)

**3. When the DM30 is powered up it will broadcast a Wi-Fi network. Scan for “Sonitus-Systems-DM30-0xxxx” SSID (using a Wi-Fi enabled device such as a mobile phone, tablet or laptop). The last 4 digits of the network name will show the DM30 serial number**

**4. Check for results on Sonitus Cloud after 15 minutes. The default upload schedule sends readings to the cloud every 15 minutes**



## 4 OPERATION/USE

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### 4.1 Checks before using the DM30 Dustsens

1. Perform a general visual inspection
2. Ensure nothing is blocking the sampling inlet or the exhaust of the device
3. Check that nothing has been dislodged during transport or installation
4. Verify that all connections are in place

### 4.2 How to Use the DM30 Dustsens

#### 4.2.1 Operating Environment

This device is designed for use in outdoor environments but can also be used indoors.

#### 4.2.2 Starting/Stopping the DM30's Operation

- To start the DM30, connect to the mains power supply.
- To stop the DM30, simply turn off the power to the unit.

#### 4.2.3 Local Operation

The DM30 has a standard Wi-Fi communication capability and can communicate with any laptop or mobile device which has a Wi-Fi connection and a web browser.

Each DM30 is labelled with a serial number. This serial number is the unique identifier of the unit, used for communication over the Wi-Fi link.

The DM30 acts as an access point, generating a unique Wi-Fi network. The network name is linked to the device serial number. For example, if the serial number of the device is 00223 the unique Wi-Fi network will be named "Sonitus-Systems-DM30-00223." To connect to the DM30 simply join the Wi-Fi network (password supplied separately) and the appropriate settings will automatically be applied.

Instructions on how to access the user interface are contained in Section 5.

#### 4.2.4 Remote Operation

Remote operation is managed using the Sonitus Cloud. The Sonitus Cloud allows users to view measurement data, device status and edit certain measurement settings.

## 5 USER INTERFACE

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### 5.1 Understanding the User Interface

Communications to the dust monitor are handled through a standard web browser.

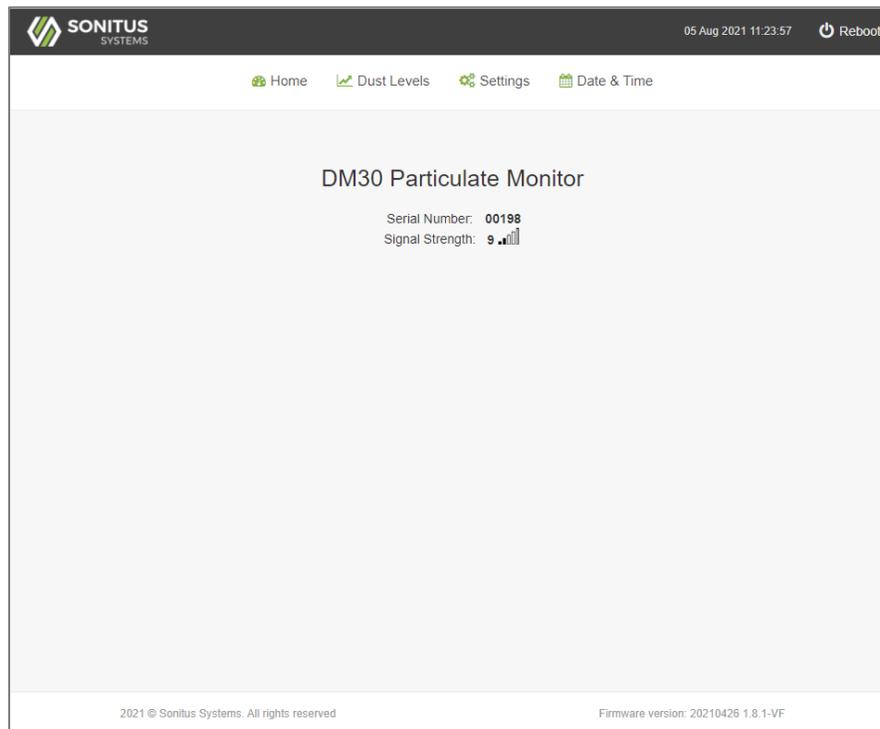
**Note:** It is recommended that you download the latest version of your web browser before logging in to the dust level monitor.

To log into the dust monitor, first connect to the Wi-Fi network following the steps above in section 4.2.3. Next, open your browser and enter the IP address of the unit into the address bar of the web browser, as shown below:

http://10.1.1.2

**Note:** There should be no *www* preceding the number in the address bar.

Once you have correctly entered these details you will be logged into the DM30 user interface and you will see the home page, as displayed below.



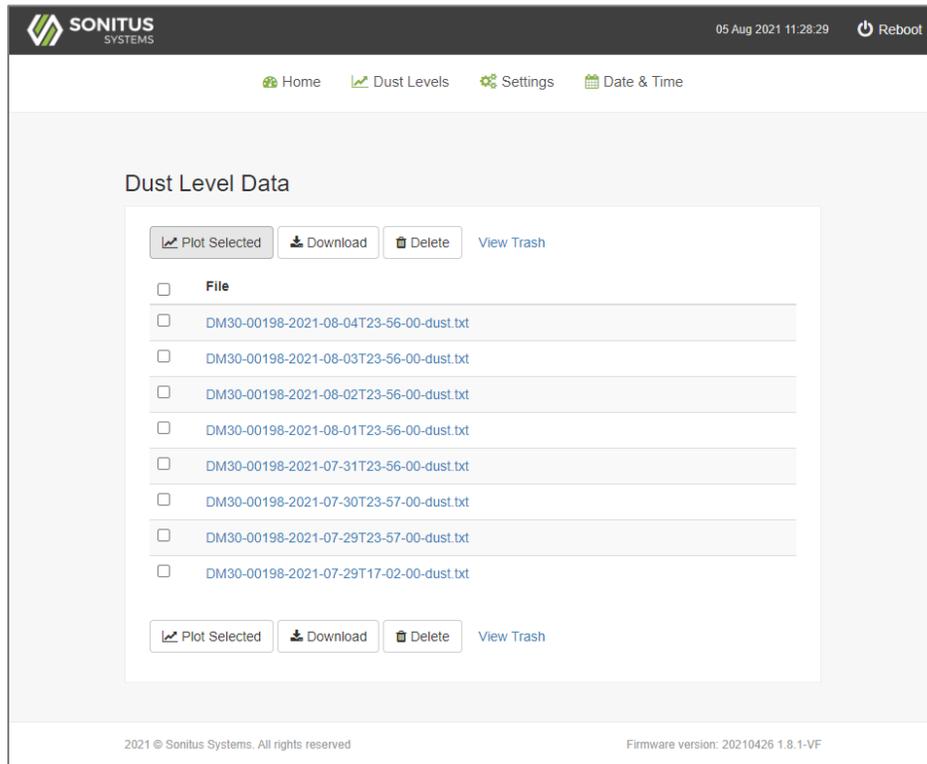
*DM30 User Interface Home Page*

The home page displays some basic information about the unit such as the serial number, signal strength and the software version. Also displayed on the home page are links to pages which access some of the main features. These pages and their associated functionality are detailed below.

At the top of the home page is the **Reboot** button. This button performs a manual reset of the monitoring unit. This should be used after making a change to the system settings, or during a troubleshooting process as outlined in the troubleshooting section of this manual.

## 5.2 Dust Levels Data Page

This page displays a listing of all files contained in the memory of the monitoring unit. Filenames contain the name of the DM30 unit and the date and time at which the monitoring run began. During normal operation there is a single dust data file produced each day. Click on the name of a file to view its contents.



*Dust Level Data Page*

```
# Unit S/N: OPC-N3 177050019
# Start time: Wed Aug 4 23:56:30 2021, Scaling applied: linear
# dd/mm/yyyy hh:mm:ss,      PM1,      PM2.5,      PM10,      RHpre,      Tpre,      DPpre
05/08/2021 00:05:00,        0.75,        1.00,        1.14,        56.17,      21.74,      12.62
05/08/2021 00:10:00,        0.99,        1.32,        1.52,        56.20,      21.73,      12.62
05/08/2021 00:15:00,        1.05,        1.40,        1.88,        56.22,      21.72,      12.62
```

*Example results file*

The file header (denoted by a # at the beginning of the line) gives information about the unit and the monitoring run. The data is logged at regular time intervals. The columns of data show the results for the particulate matter sizes. These include PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>.

Clicking the box next to each file name allows you to select the file either for download or to be deleted. Press the “Select All” button to select all the listed files.

To download the data files to your computer, click “Download Selected”. This will download a zip file containing all selected files which you can save to a location of your choice.

To generate a plot of the data simply select the desired files and click “Plot Selected.” This will generate a plot of PM<sub>10</sub> levels for the range of files chosen.

To delete files from the Dust Data folder, select the appropriate files and click “Move to Trash”. This will move the files to the Trash folder on the system. Click “View Trash” to see what files are contained here.

**Note:** Files in the Trash directory are still taking up space in memory. If you do not wish to keep these files, then enter the Trash folder by clicking “View Trash”, select the files you wish to permanently delete and click “Delete Selected Files”. Click “Empty Trash” to delete all files in the folder. Alternatively, you can restore files to the main dust measurement data page for downloading by selecting the files and clicking “Restore Selected Files”.

To return to the home page from the dust measurement data page simply click on the Sonitus Systems logo at the top of any page.



*Dust Level Plot Page*

## 5.3 Sonitus Cloud

The Sonitus Cloud provides tools for managing projects related to the DM30 dust monitors. A username and password will be supplied separately. After logging in, users can:

- Change email and password preferences
- View the performance of individual monitors including breaches of limits
- Manage projects with multiple different DM30 monitors

On the Sonitus Cloud platform, tutorials are available on how to complete a range of functions. This is found under the 'Support' heading on the top right hand of any page.

These tutorials will not be covered in the manual of the DM30 dust monitor.

### 5.3.1 Changing email and password preferences

After logging in to the Sonitus Cloud platform, users can change their email and passwords. By clicking on the top right of the screen (where the username is displayed) users can select edit info. Here users can change their Name, Company, Email and Phone Number.

#### *5.3.1.1 Checking the performance of your monitor*

Once you are logged in to the Sonitus Cloud you can check the status of your devices by clicking on the "Monitors" link. This will show you a list of all monitors assigned to your account. Select the monitor you are interested in to check the status.

The Monitor page will show you the latest reading along with when the measurement was recorded.

You will also be able to see equipment details including the factory verification date and when the device is due for service.

Additional settings like limit alerts and connectivity alerts can be changed here.

If the monitor is currently assigned to a project, you will be able to view the latest readings by clicking on the chart symbol.

#### *5.3.1.2 Downloading data*

Data can be downloaded directly from the cloud from the "Grid" page, which is accessed from your project or through the monitor information page. After selecting the dates of interest, select download. The download will be in csv format.

## 6 MAINTENANCE

|   |   |
|---|---|
|  | <p>Warning, high temperature, risk of burns. Incorrect handling of the monitors heating system may result in exposure to high temperatures, resulting in the risk of burns.</p> |
|  | <p>Caution, risk of electric shock. Ensure that mains power is disconnected before performing any maintenance checks.</p>   |

### 6.1 How to Maintain the DM30 Dustsens

#### 6.1.1 DM30 Maintenance

- **Cleaning the dust inlet head**
  1. Un-screw the large inlet head (carefully twist inlet head anti-clockwise).
  2. Remove the three PH2 screws.
  3. Remove the heat distribution unit.
  4. Brush using a soft plastic bristle brush and blow clean
  5. Reassemble inlet head
  6. Screw the inlet head back on the inlet tube. **Be careful not to overtighten the inlet.**



#### 6.1.2 Maintenance Schedule

Maintenance tasks shall be done according to the following plan, by a suitably trained technician:

| Task                                       | Frequency  |
|--|--|
| Clean dust <b>inlet</b> and <b>exhaust</b> | In very dusty conditions check regularly for dust build up around the mesh and clean if required, otherwise no maintenance is required |
| Return the unit for <b>verification</b>    | Every 12 months  |

## 6.2 Troubleshooting and repair

### 6.2.1 Troubleshooting

| Error                               | Cause   | Solution   |
|-------------------------------------|---|--|
| Product does not start              | Ensure mains power is present                                       | Check <b>PSU</b> and <b>EM20</b> .   |
| Product is not transmitting         | No GSM signal   | Check mobile Received Signal Strength Indicator (RSSI) value via local Wi-Fi interface and reposition unit if required. (An optional high gain antenna is available) |
| LED on the EM20 is flashing rapidly | Bad connection between the EM20 and the AS10 or the AS10 is damaged | Check wire connections between EM20 and AS10. Otherwise contact Sonitus Systems.   |

The following section addresses some issues which may be encountered when installing and communicating with the dust monitoring unit. A brief explanation of how to address each issue is given. In addition, Sonitus Systems' staff will always be happy to deal with your queries over the phone or by email.

➤ ***I can see the "Sonitus-Systems-DM30" wireless network, but I can't connect***

The Wi-Fi connection does not provide an internet connection to your phone or tablet. Some mobile devices may ask you to confirm that you want to keep the Wi-Fi connection.

This can cause some mobile devices to disconnect from the DM30 Wi-Fi network. If this happens you may need to reconnect until your device stays connected to the Wi-Fi network (up to 3 attempts).

If your laptop or PC is set to connect to another Wi-Fi network, such as an internal company network then you may need to change settings by following the steps below.

**Note:** The instructions below are for the Microsoft Windows operating system. The procedure described here may vary for other operating systems.

To connect to the dust monitor, go through the following steps:

- Change the IP address of wireless device by clicking on the wireless signal icon in the icon tray on the bottom right of the screen (beside the clock).
- At the bottom of the pop-up menu select “Open Network and Sharing Centre.”
- In the Network and Sharing Centre click on “Change Adaptor Settings.” This is located on the left-hand side menu.
- Right click on the icon for the Wireless Connection and select “Properties” from the menu.
- On the “General” tab, scroll down the list and select the last option “Internet Protocol (TCP/IP)”. Now click the Properties button.
- In the properties dialog menu select “Obtain an IP address automatically.”
- Click OK to confirm the settings.

You should now be able to connect to the “Sonitus-Systems-DM30” wireless network.

➤ ***The monitoring unit is powered on, but I cannot see the wireless network.***

Ensure that you are close enough to the dust monitoring unit to detect the Wi-Fi signal, approximately 50 metres. There should be minimal obstruction between you and the monitor i.e. buildings, walls etc.

The DM30 monitor can be set to low power mode which will switch off the Wi-Fi after a user defined period of time. To gain access to a device that is in low power mode you will need to reboot the monitor by powering the DM30 off and back on again.

If you still cannot detect the wireless network, it may be necessary to inspect the monitor to ensure it is powered up. The green LED on the front of the EM20 logger unit allows for a simple check that the unit is powered up. A flashing LED every second indicates that the unit is operating and gathering data. A solid, constantly on LED indicates that the unit is powered on but not collecting dust data. Ensure that the Wi-Fi antenna is properly connected. If the wireless network is still not available, it may be necessary to perform a full reset by powering down the unit and restarting. A rapidly flashing LED indicates that the unit is not able to communicate with the dust sensor unit. Power down the unit and ensure that the cables between the two units are correctly connected and then power back up the unit.

➤ ***The LED on the front of the EM20 is not on.***

The unit is not powered on. Ensure that the mains supply is working. Inspect the power supply connector to the EM20 unit, ensure it is securely connected. Check that the LED of the power supply unit is on.

➤ ***The clock on the monitor does not match my clock.***

Over an extended period of time the system clock may drift by a small amount (less than 5 minutes per year). The time can be reset by going to the **Set Date and Time** interface page, accessible through the monitor's home page. Instructions on setting the time are given above. If the GSM connection is active, the time will be automatically synchronised with an online time server each day.

➤ **Changes to the clock or system settings are not applied.**

The user interface requires that you use the most recent version of your internet browser. Certain versions of Internet Explorer are not fully compatible with the system interface. Using these versions means that not all functions are available, for instance, setting the clock through the **Set Date and Time** page may not alter the time. Update your internet browser to the most recent version, for example, the newest version of Google Chrome or Mozilla Firefox.

## 7 DISPOSAL

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### 7.1 How to Dispose of the DM30 Dustsens

The DM30 must be disposed of according to WEEE specifications.

|   |   |
|---|---|
| <p><b>This instrument must be recycled/disposed of according to handling and disposal requirements for waste electrical and electronic equipment (WEEE)</b></p> |  |
|---|---|

## 8 TECHNICAL SUPPORT

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Sonitus Systems' technical support team are available to provide expert technical advice and troubleshooting assistance.

Please contact our technical support team:

**Tel: +353-1-6778443**

**Email: [support@sonitussystems.com](mailto:support@sonitussystems.com)**

### 8.1 Disclaimer

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## 9 APPENDICES

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### 9.1 Spare Parts

#### 9.1.1 Spare/Replacement Parts

| Image   | Name              | Article Number |
|---|-------------------|----------------|
|    | AS10 Dust Sensor  | AS10           |
|  | Power supply unit | DM30-PSU-1     |
|  | Inlet             | AS10-IN-1      |

## 9.2 Glossary

| Term              | Meaning   |
|-------------------|---|
| PM <sub>10</sub>  | Total mass of particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 10 µm aerodynamic diameter  |
| PM <sub>2.5</sub> | Total mass of particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 2.5 µm aerodynamic diameter.  |
| PM <sub>1</sub>   | Total mass of particulate matter which passes through a size-selective inlet with a 50% efficiency cut-off at 1 µm aerodynamic diameter.  |
| OPC               | Optical particle counters (OPC) are light-scattering devices which draw a volume of air into a small chamber. Inside this chamber, the air is lit by a narrow beam of (laser) light. The extent of light-scattering through the presence of particles in the sample air is measured by a photodetector. |
| ESD               | Electro-static discharge. Electronic components are sensitive to sudden electro-static discharges, therefore it is important to wear an earthing strap.   |
| PSU               | Power supply unit   |
| EM20              | Environmental monitor hub   |
| DM30              | Dust monitor  |
| AS10              | Dust sensor   |