

# **Product manual**

**M-DUST**

## **Particle Sensing Unit**

[www.particle-sensor.com/](http://www.particle-sensor.com/)

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## 1. Product Features

M-DUST is a Particulate Sensor System. It detects the particle concentration expressed in  $\mu\text{m}/\text{m}^3$ . It detects particles such as: smoke, pollen, dust, and any other particle with size greater than 1  $\mu\text{m}$ .

The system has an external PM10 or PM2.5 filter.

It works with a detection method based on light scattered principle.

A differential pressure is measured between the inside and the outside M-DUST box to evaluate the filter condition. This also accounts for both long life of the M-DUST sensor components and high quality of results.

A mini vacuum pump controls the air flow inside the M-DUST sensing unit. Different vacuum pumps can be integrated according to customer's request and national laws for PM10 and PM2.5 measurement.

The communication interface is based on a 5-DIN connector. The pump supply voltage is transferred through a 2 pin connector.

System configuration is detailed in the Section 2.

### **Character**

- High sensitivity to dust particle with size level greater than or equal to 1  $\mu\text{m}$
- Low-noise level
- Long-life, low-cost and portable particle sensor
- Modular interconnection between Particle Sensing Unit, air filter and vacuum pump.

### **Application**

- Air quality monitoring
- Industrial PM analysis
- Domestic smoke analysis
- Portable particulate detection

## 2. Configuration

The base sensor kit includes:

1. a Particle Sensing Unit
2. a mini vacuum pump
3. a metallic filter holder
4. 5 PM filters

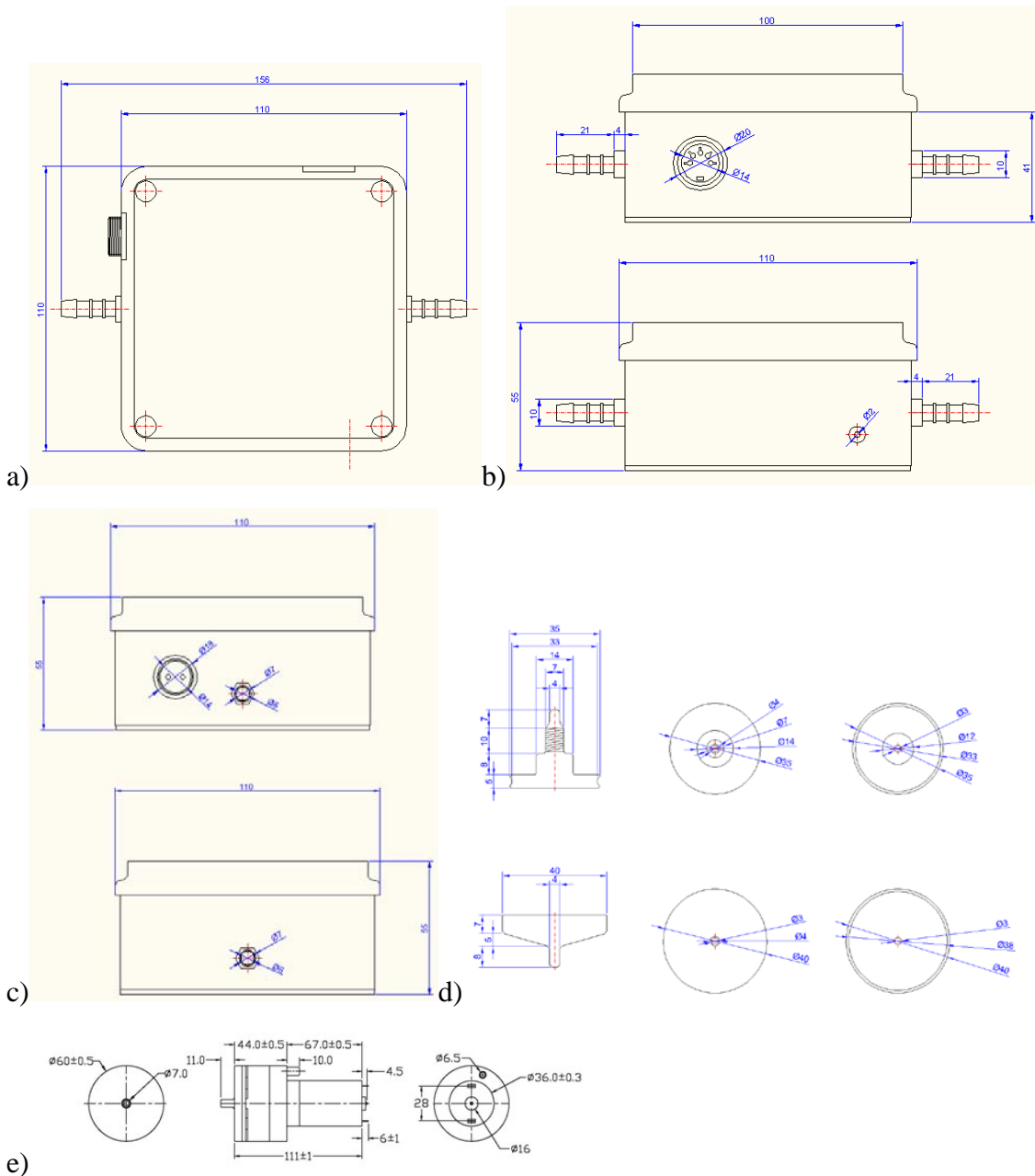


Fig. 1. Mechanical drawing: a,b,c) Particle Sensing Unit; d) filter holder; e) mini vacuum pump

Viewing Fig. 1.b the 5-DIN connector has the following configuration (according to DIN female standard): 1→+5VDC; 2→P; 3→[PM]; 4→GND; 5→+12VDC.

The sensor provides in real time 2 kind of information:

1. analogue data for PM concentration ( $V_1$ );
2. PM filter status alert ( $V_2$ ). This allows the user to easily understand when a filter replacement is necessary or when the vacuum pump requires a re-calibration.

The pump requires a re-calibration process between 30h and 50h of activity. PM Filters should be replaced depending on the environment dust concentration. For instance, a PM10 filter in a traditional urban environment works correctly for 16h continuously, reaching a differential pressure up to 15 kPa (test conducted in Bari, Italy).

The adopted pump ensures a constant flow of 20 l/min (setting the voltage supply to 12VDC and without filters). If it changes a re-calibration and/or filter replacement is necessary.

### 3. Output Characteristics

Fig. 2 shows the output characteristic for the PM concentration. The value should stay between the upper limit and the lower limit of standard dust sensor unit. The characteristic shown in Fig. 2 refers to the TSP (i.e. the particle sensing unit without a PM filter). Diagrams related to different PM filters are shown in Fig. 3 and Fig. 4.

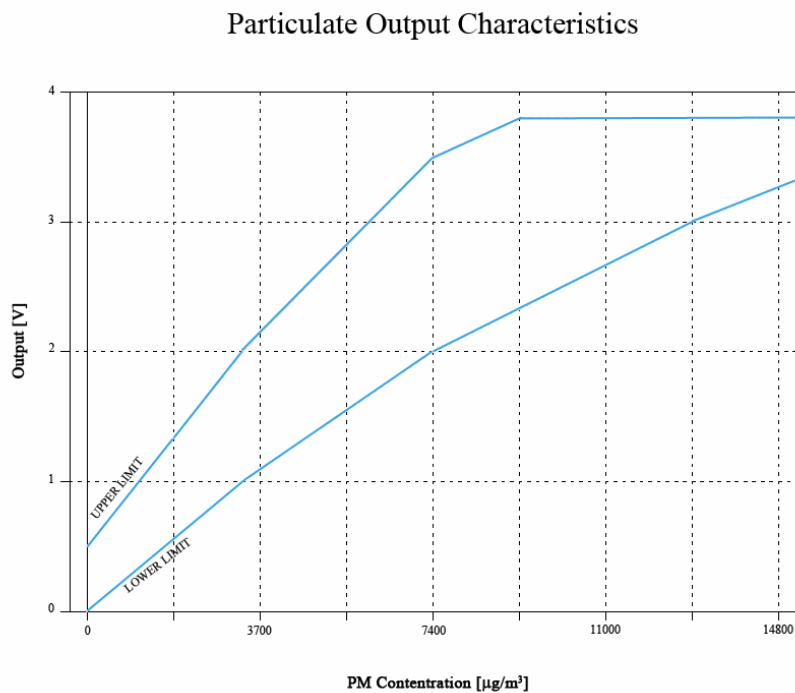


Fig. 2. Output characteristic for PM concentration.

The formula to evaluate the pressure (kPa) starting from the output voltage ( $V_2$ ) at the pin 2 is:

$$\Delta P = (0,4 * V_2 - 1) / 27,77 \text{ [kPa]}$$

## 4. Technical Data

### Particle Sensing Unit

Detectable particle size:	2.5 $\mu\text{m}$ [10 $\mu\text{m}$ ]
Detectable range of concentration:	0 - 80 $\mu\text{g}/\text{m}^3$ [0 - 2500 $\mu\text{g}/\text{m}^3$ ]
Output voltage range ( $V_1$ - PM):	0 $\div$ 4 V
Output voltage range ( $V_2$ - P):	0 $\div$ 5 V
Output relative pressure range:	-25kPa $\div$ 25 kPa
Supply voltage:	5 VDC $\pm$ 10%
Power consumption:	1 W max.
Operating range	
Temperature:	0 $\div$ 40 $^{\circ}\text{C}$ (recommended storage condition -30 $\div$ 60 $^{\circ}\text{C}$ )
Humidity:	< 95% RH
Time for stabilization:	1 min after power turned on
Input/Output interface	
Power/signal connector:	5-DIN socket panel screw mount
Flow connector:	Straight connector 1/8in BSPT 6mm ID hose
Dimensions:	116,5x144x55 (WxDxH [mm])
Weight:	400g approximately

### Mini Vacuum Pump

Supply voltage:	12 VDC
Power consumption:	24 W max.
Power connector:	2 pin socket panel screw mount
Inflation Time:	< 5 sec
Maximum pressure:	> 60 KPa
Noise:	<65 dB
Leakage:	< 10 mmHg/min
Flow:	>13 l/min

Pipe diameter: Ø 7 mm  
Dimensions: Ø 60\*111 mm

**Filter holder**

Material: Aluminium (body) and plexiglass (top)  
# parts: 2  
Gasket: O'ring is included  
Pipe diameter: Ø 4 mm  
Dimensions: Ø 40\*41 mm

Particulate Output Characteristics

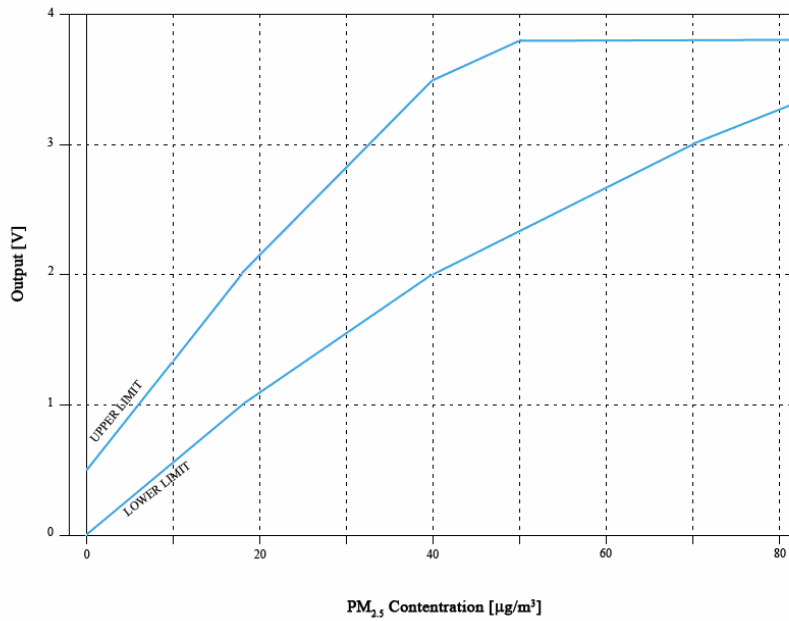


Fig. 3. Output characteristic for PM2.5 concentration.

Particulate Output Characteristics

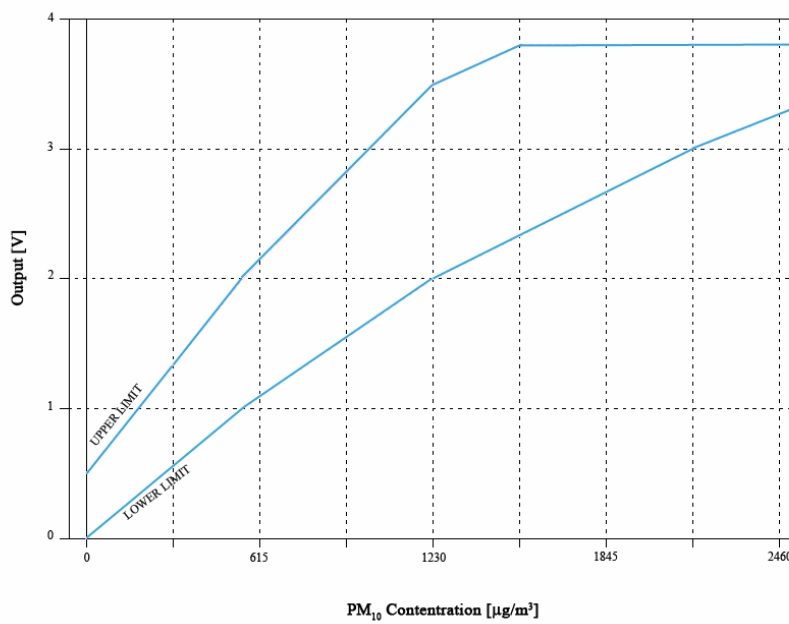


Fig. 4. Output characteristic for PM10 concentration.