



Stationary fine dust sensor TM-F Operating manual

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Table of contents	page
1. Introduction	3
2. Installation of TM-F	3
2.1 Electrical installation	4
3. Putting into operation	4
4. Function and adjustment of the purging air supply	4
4.1 Controlling and adjusting of the zero point.....	5
4.2 Cleaning of the lighttraps and transmitter-/receiver diode.....	5
4.3. Setting the measuring range	5
5. Warranty	5
6. Service and maintenance	6
7. Copyright	6
8. Appendix.....	7
8.1 Connector assignment.....	7
8.2 TM-F top view	8
8.3 TM-F Front view.....	8
8.4 Analogue board circuit (jumper ST7 Gain, offset-adjust)	9
9. Recommended installations.....	10
9.1 Open outlet of a duct.....	10
9.2 Installation in a duct, stack or tube.....	10
9.3 Recommended installations.....	11
10. Technical data	13
11. Accessory	14
12. Spare parts and consumables	14

1. Introduction

The straylight photometer TM-F was developed especially for stationary operation for dust measuring in emission or immission tasks. The instrument is suitable for measuring airborne dust of a very low concentration. Combining a scattering angle of 70° to the forward direction with an infrared light beam of 880 nm results in a good agreement to sampling curves of the Johannesburg convention and to the U.S. ACGIH curve. The very high sensitivity - the typical lower detection limit is approx. $> 5 \mu\text{g}/\text{m}^3$ for DEHS-particles of 1 micron diameter - makes it possible for the TM-F to measure the residual concentration of filters, monitoring the dust concentration of working places, operating as a high sensitive smoke sensor etc. Great importance was attached to a simple and sturdy sensor, which is easy to install and to maintenance.

The sensor TM-F was constructed as flow suitable In-situ sensor. It can be installed directly to stacks, air conditioning systems or can be mounted to ceilings and walls. No additional sampling is necessary, because the measuring chamber is self-ventilated. The output signal and the particle concentration are proportional. The measuring ranges have been adjusted to measure extremely low aerosol concentrations. The sensor is suitable to measure solid particles as well as aerosols (oil etc.).

A separate clean air supply generates a mantle of clean air surrounding the measuring chamber to prevent optics against soiling with dust. A pressure gradient between inlet and outlet of the chamber, which is produced by the clean air nozzle inside the sensor, sucks in the sample gas without any additional ventilation. This makes it possible to measure dust in closed rooms without the need to install additional fans etc.

2. Installation of TM-F

The TM-F can be mounted directly with an device in air-ducts (channels or tubes) at the clean air side of filters or filterplants. Recommended location see item 8. As the instrument can measure lowest from 0 (zero) m/s air-velocity, it can be mounted everywhere even under the ceiling of a hall. The measuring point has to be at least 6 times the stack/tube diameter away from a bend. If this is not possible, a straightener has to be used to produce a laminar flow.

The sensor must be axial-flowed through by the sampling gas. Otherwise there is a risk of faster soiling. Please take a thread fibre to find out the current direction of flow, if the flow direction is unknown. During installation the machinery to be controlled must be switched off. If not possible, the sensor can be installed with already operating clean air supply. This step prevents soiling of the sensor.

IMPORTANT: It is absolutely necessary to take care of the flow direction indicated on the sensor, i. e. flow direction and the arrow mark on the sensor have to have the same direction.

It must be taken care that the sensor must not operate without being connected to a clean air supply. In this case the inlet of the sensor must be closed. This is also important, if the sensor does not operate. A suitable cover is a rubber plug, a splicing tape or wrapping up the sensor into a plastic foil.

2.1 Electrical installation

For operation it is only necessary to connect the sensor via the 7-pin plug to the power supply. See item 7, appendix 7.1 The sensor offers a floating current of 4-20 mA corresponding to 0 to 100 % of signal.

IMPORTANT: Only authorized persons are to be allowed to connect the sensor to the power supply.

3. Putting into operation

After the installation has been finished, switch the instrument to the main power. A signal corresponding to the actual dust concentration can be measured via a digital ammeter. The analog output signal is a current of 4 mA (no dust) and 20 mA (max. dust) according to the switched measuring range. Dust concentrations can be simulated via an insertion of for instance a wire into the measuring chamber. In this case be careful and don't scratch the lacquer of the chamber.

4. Function and adjustment of the purging air supply

The purging air will be lead in the TM-F in a tubing with an internal diameter of about 9 mm. The connection between purging air hose and TM-F will be affected by the nipple of the purging air inlet (operation instruction p.8).

The quantity - which is needed to keeping clean the air inside the measure cell - is determined by the rate of flow of the measuring gas. A low rate of flow of the testing gas needs a lower quantity of the covering air than a high rate of flow. The TM-F should have a minimum distance of 6XD (D = diameter) of a tubing or a chimney curvature.

The suitable purging air volumes are of about 10 to 20 litres per minute in the case of a slow testing gas flow (< 10 m/s) and of about 25 to 50 litres per minute in the case of high flow velocities (15 to 25 m/s).

The purging air will be lead in a compressed air free of oil, water and particles. A series connection of two oil and water seperators has been succesful.

The particle filter should have a minimum diameter of 120 mm. To seperate particles there should be used membrane filters with a pore size of 0,2µm.

As an **option** (see on p. 12) there can be received a pure air supply unit. This pure air supply unit of the TM-F filter delivers about 2m³/h by using a hose with an inside diameter of about 9 mm and a length of < 10 m.

The pure air supply unit recommended by HUND suits for gas velocities from 0 to 20 m/s. A regulation or a reemploy of purging air quantity is not necessary.

The installation of the purging air apparatus should be selected in such a way, that the warm purging air does not condense on the way to the sensor. it is recommendable to install the purging air pump in straight proximity of the sensor to avoid line losses.

4.1 Controlling and adjusting of the zero point

After some time a drift of the zero point may occur. Reasons may be found in a soiled air filter of the clean air supply, a turbulent air flow, a drop out of clean air as well as drifts in electronic components. To correct this drift you open the cover of the TM-F and adjust the zero-point via the potentiometer for signal offset - see 7.3 analog-electronic-board, offset-poti or signal offset. You start the zero point adjustment procedure closing the chamber inlets of TM-F by the enclosed two rubber plugs. The plug with the small concentric cut out must close that inlet towards the arrowhead shows.

To adjust the signal offset potentiometer you need a digital ammeter to measure at the signal outputs - see 7.1 plug-diagrams - of the pins 1 to 5.

You adjust the signal offset to 4 mA or 0 Volt. When finished, remove the rubber plugs.

4.2 Cleaning of the lighttraps and transmitter-/receiver diode

Screw out the screws at the four edges of the small cover of TM-F and open the TM-F. Look at the black measuring chamber. The lighttraps and the transmitter- and receiver tube can be removed for cleaning purposes. Pull the relevant locking mechanism (PIN). Caused by inner sealing rings this procedure can be a little bit difficult. In that case please turn the relevant tube carefully backwards and forwards during pulling out the tube. Clean the lenses only with a soft-cotton-swap or a Q-tip. Do not damage or scratch the black lacqueur. Blow out carefully the tubes with clean pressure air if necessary. Now pull the locking pin again and insert the relevant tube in it's sit. Be sure that the locking pin is engaged hereafter. After finishing this procedure you have to adjust the zero point of the TM-F again, in any case.

4.3. Setting the measuring range

The electronic board - see 7.3 analog board - contains a jumper bridge (ST 7) for changing the measuring range. If the jumper bridge is open the measuring range is 0-2mg/m³ and if it is bridged by the jumper the measuring range is 0-20 mg/m³.

Important notice:

Ex works the measuring range is adjusted to 0-20 mg/m³. The measuring ranges refer to DEHS-Aerosol, d = 1 µm. Other measuring ranges are available on request. If you have changed the measuring range by the jumper we recommend to check the zero point of the TM-F.

5. Warranty

Please refer to our general terms of delivery, payment and sales.

HUND warrants all parts non-subject to wear for a period of 6 months after the date of original purchase. Tampering of unauthorized persons, whatever may be the reason, will result in expiring of the warranty and promised attributes.

6. Service and maintenance

Service and maintenance must be done by HUND or by HUND-authorized third parties only. Do not use sharp tools or aggressive chemicals for cleaning. The surfaces may be cleaned with a moist rag or clean and dry pressure air. The measuring chamber can be cleaned by leading a pressure jet into the chamber and blow off the dust carefully. After that the zero point must be adjusted. Refer to chapter 3.

We strictly advise that only the filter cartridge inside of the TM-F can be exchanged by the user and service can only be recommended for the removable infrared-transmitter, infrared receiver and both lighttraps-tubes, see page 8 of the operating manual. There is no further user-serviceable components inside of the TM-F. HUND does not take responsibility for damages as a result of ignoring the instructions mentioned above.

7. Copyright

All rights, including translation, reserved. No parts of this manual may be changed, modified, copied or adapted without written authorization of HUND's subject to change.

This operating manual has been written very accurately and controlled for errors by HUND. In no event HUND will be liable to you for any mistake, including lost profits, lost savings, or other incidental or consequential damages arising out of the use or inability to use this manual, even if advised of the possibility of such damages, or any claim by any other party.

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Address:

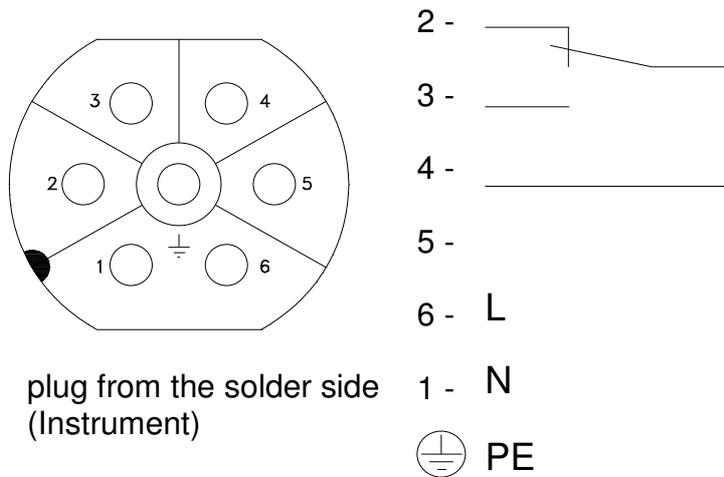
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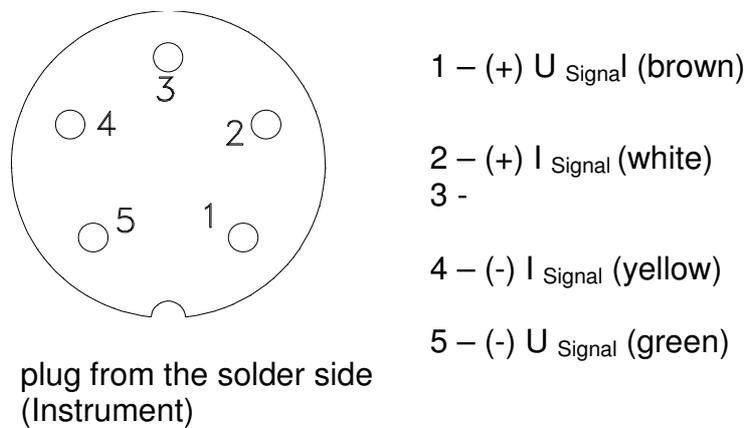
8. Appendix

8.1 Connector assignment

Important notice:
pay attention to VDE 100 regulation!

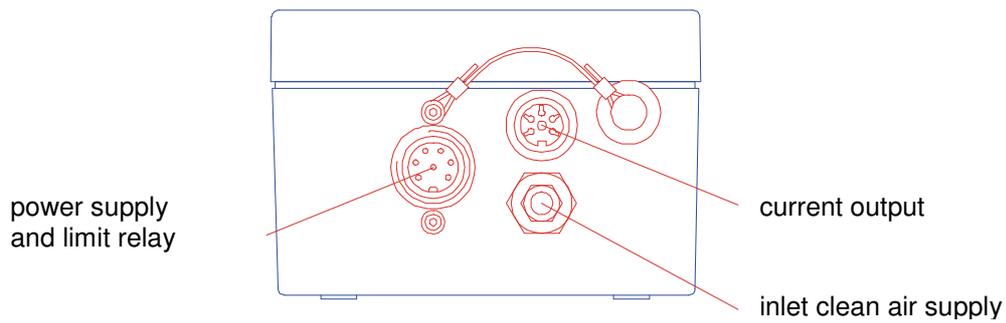
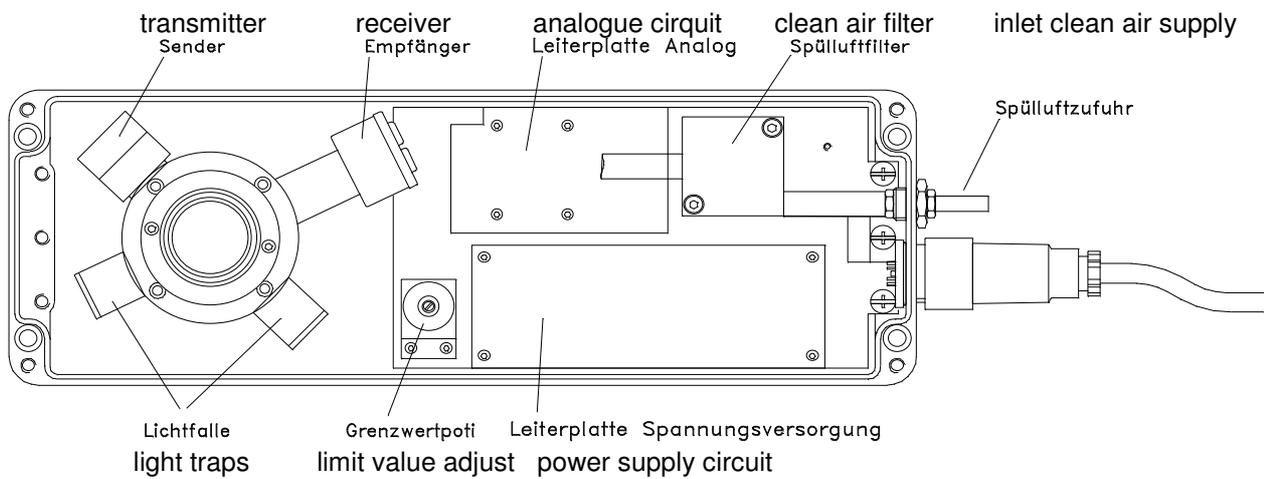


plug power supply and limit relay



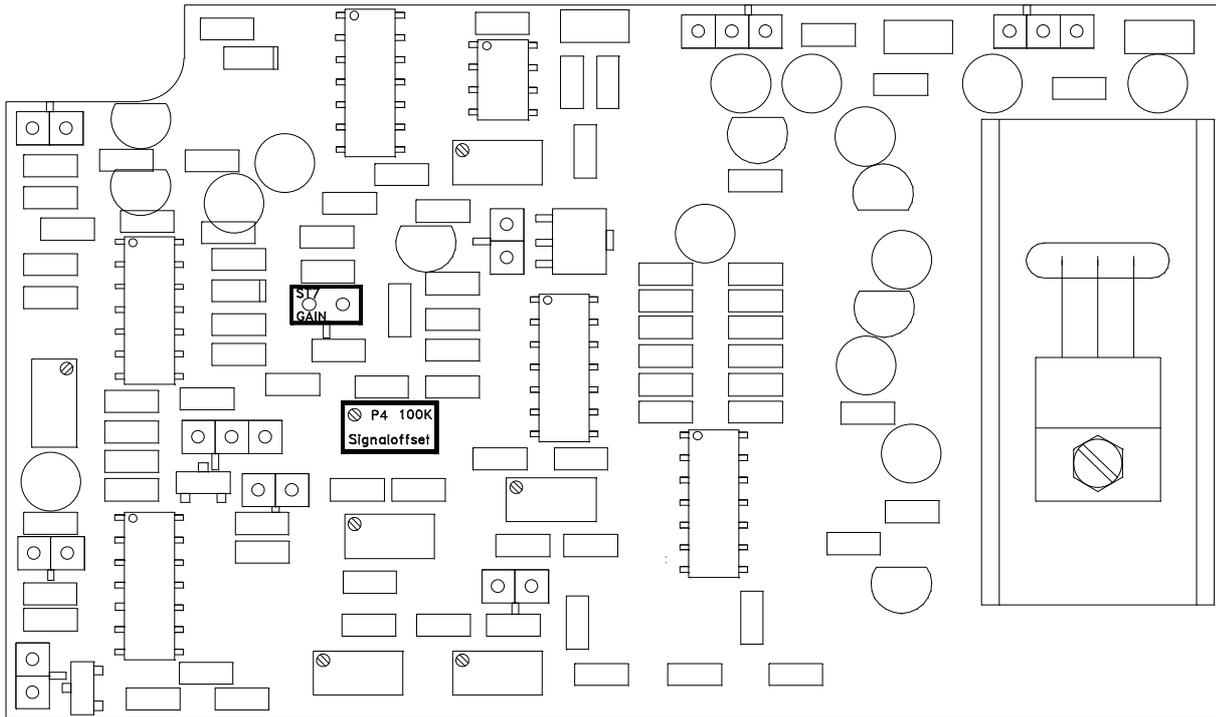
plug current and voltage output

8.2 TM-F top view



8.3 TM-F Front view

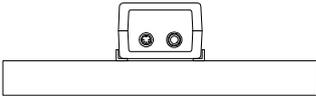
8.4 Analogue board circuit (jumper ST7 Gain, offset-adjust)



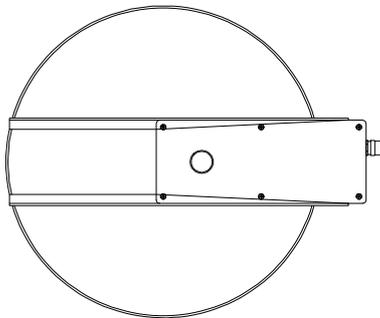
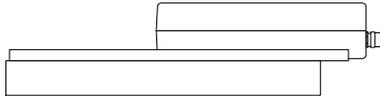
9. Recommended installations

9.1 Open outlet of a duct

front view

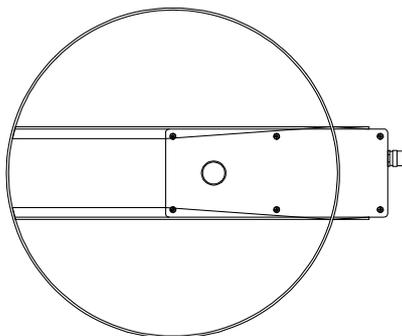
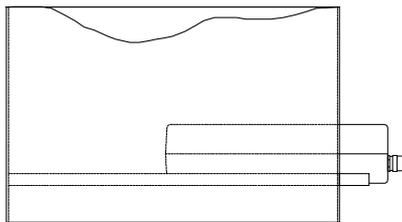
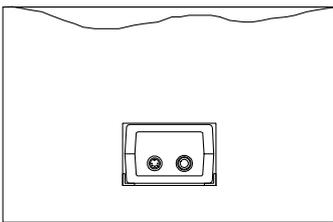


side view

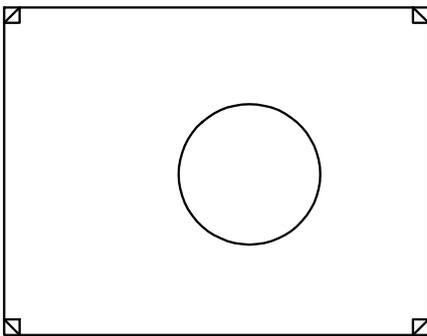
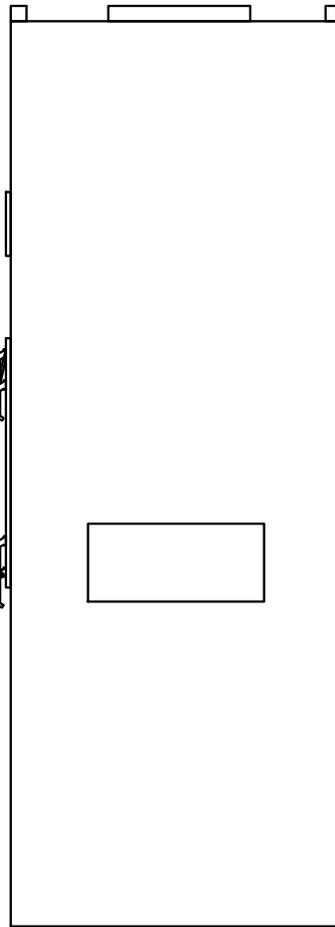
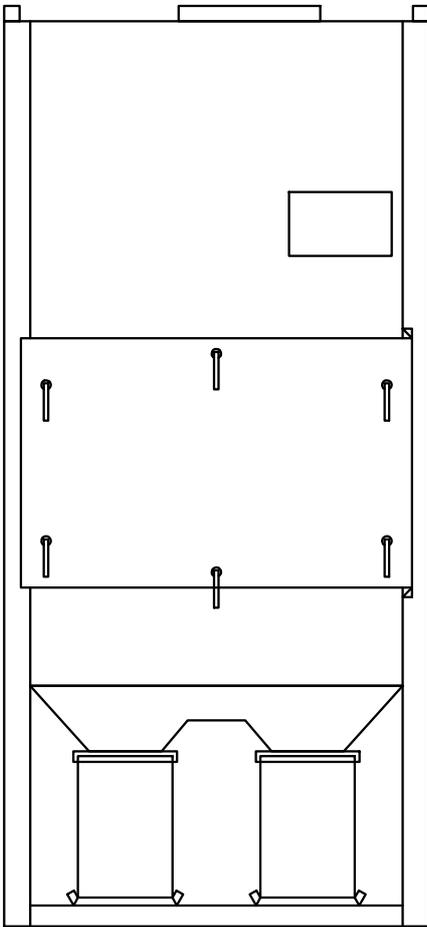


top view

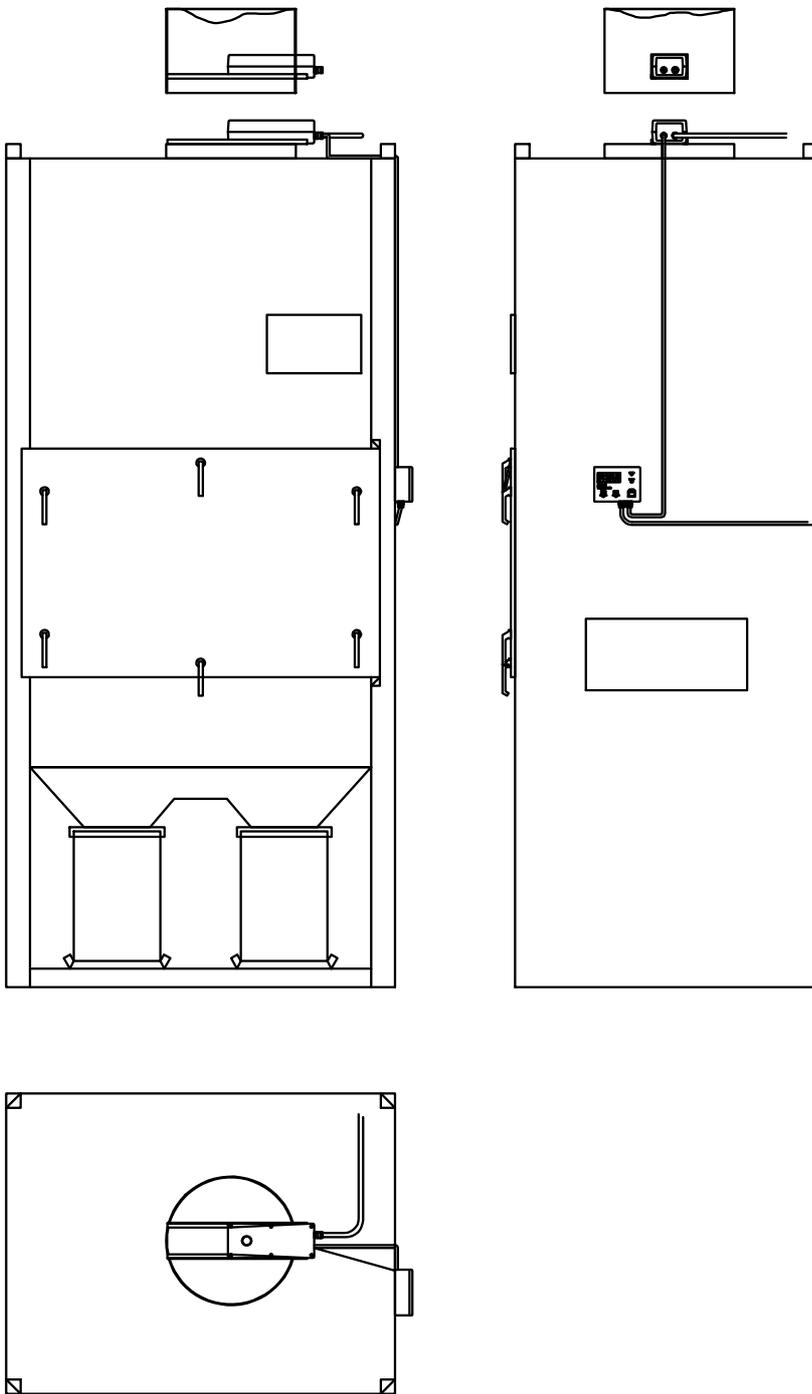
9.2 Installation in a duct, stack or tube



9.3 Recommended installations



recommended installations



10. Technical data

Type	: Stationary fine dust sensor TM-F
Principle of measurement	: straylight, 70° to forward direction, wavelength 880 nm
Measuring ranges	: 2, standard calibration 0-2 and 0-20 mg/m ³ for DEHS-aerosol, d = 1 micron. : The calculation to gravimetric units is possible after comparative measurement
Accuracy	: Calibration approx. 5 % Lower detection limit approx. 5 µg/m ³ for DEHS-aerosol, DEHS means: Di-Ethyl-Hexyl-Sebacate
Limits	: 1, adjustable via potentiometer from 0-100 %, inside of the TM-F
Tolerance of limits	: approx. +/- 5 %
Alarm output	: 1 limit relay, driving capability AC, 5A, 230 V
Operating	: from 0 - approx. 30 m/sec. airflow in duct or channel
Signal output	: 4-20 mA life, non-isolated, max. load 20 Ω
Clean air	: via separate clean air supply unit; Volume approx. 10-20 l/min. for airflows in duct or channel < 10 m/sec. and 25 -60 l/min. for flows about 15 to 25 m/sec. Formula: $D = 2 v$ D = liter/minute v = airflow in dust/channel in m/sec.
Clean air filter	: Integrated in the TM-F, Type: MANN + HUMMEL C31/1 Nominal value stream: $\Delta P =$ Particle size: η99 1µm
Temperatures	: Storages - 20 to + 80 °C Operation + 5 to + 70 °C
Rel. humidity	: non-condensing
Power supply	: AC 230V, 50 cycles, approx. 8VA
Dimensions and weight	: approx. 320x120x80 mm, 3 kgs.

11. Accessory

Option	: Clean air supply unit	Art.-no. 001.0097.000
	1 set (5 pieces) filter	Art.-no. 001.0081.100
	cartridges for a. m. unit	

12. Spare parts and consumables

Rubber plug		Art.-no. 593.0031.0
Rubber plug with concentric cut out		Art.-no. 593.0032.0
1 set (5 pieces) filter cartridges to exchange the filter inside of TM-F		Art.-no. 001.0050.004
Jumper		Art.-no. 628.0079.0
Mains supply cable with 7-pin plug		Art.-no. 001.0090.011
Signal cable with 5-pin plug		Art.-no. 001.0090.012
Fuse 0,1A in power supply board, inside of TM-F		Art.-no. 670.0202.0