

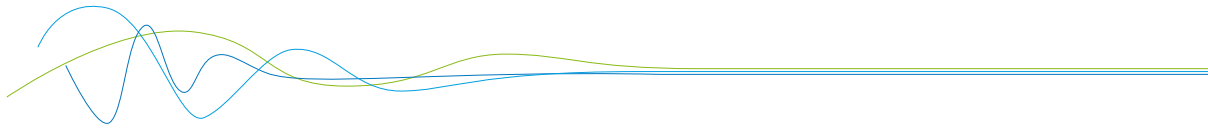


OPERATING INSTRUCTIONS

AirSafe 2 (Ex)

CONTINUOUS AMBIENT AIR DUST MONITORING





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1. Introduction

1.1 Safety

AirSafe 2 requires a $24 \pm 10\%$ V DC supply.
 $24 \pm 10\%$ V DC is regarded as safe.

1.2 Product overview

Thousands of electrodynamic sensors from ENVEA Process have proven their worth for measuring dust concentrations in processing systems.

AirSafe 2 is a measuring device which can monitor the dust concentration in the ambient air, for example in buildings, production halls, silos, boiler houses and at work stations.

AirSafe 2 monitors on the basis of defined limit values.

For example to prevent the creation of dust explosion zones or to detect unnoticed dust emissions from system components.

Dust concentrations which may result in personnel being placed in danger can be detected early and reliably by AirSafe 2.

1.3 How the device works

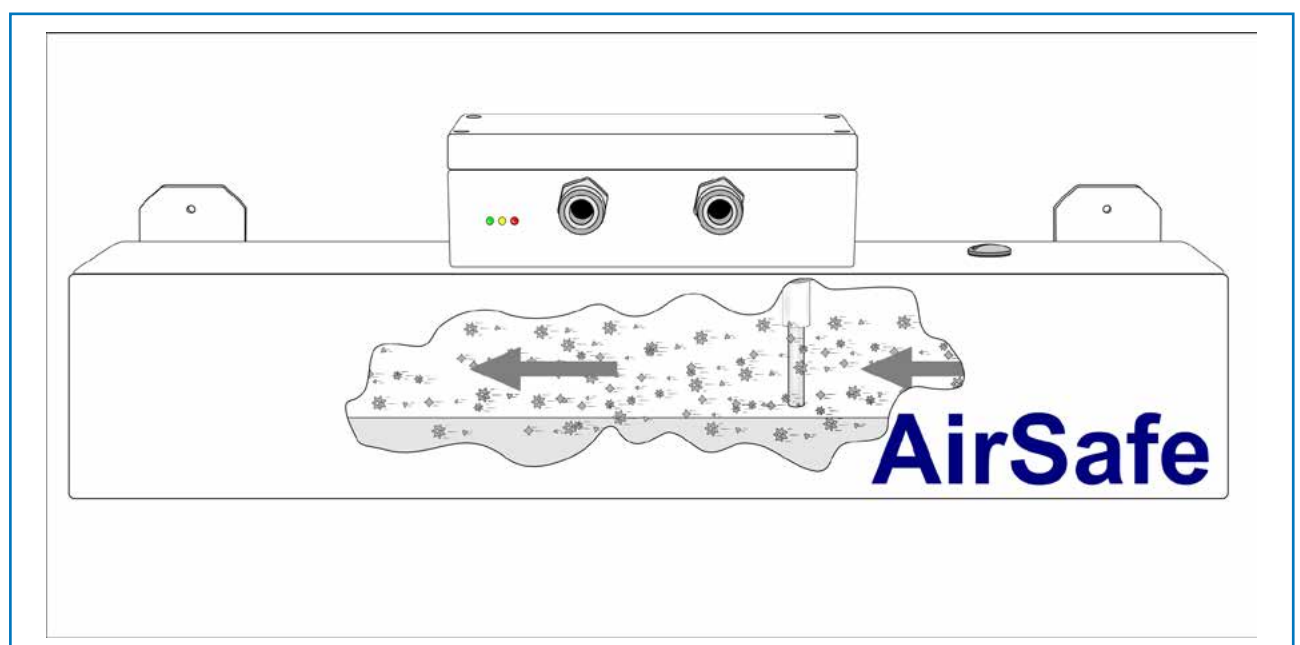
AirSafe 2 consists of a flow duct and an integral electrodynamic dust sensor.

Drawing air into the flow duct generates an air flow of approx. $100 \text{ m}^3/\text{h}$ (EX: $130 \text{ m}^3/\text{h}$).

Dust particles carried in this air flow which pass the sensor create a charge transfer which in turn generates a measurement signal.

The measurement signal is converted into an electrical signal which can then be displayed or output.

The fan is fully monitored and an alarm will be displayed in case of fan failure. This guaranty the validity of the measurement.



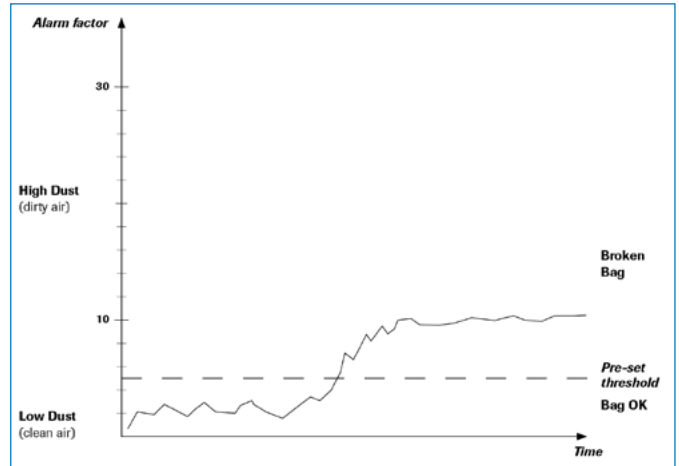
1.4 System

The AirSafe 2 flow duct measures 500 mm in length and has a diameter of 100 x 100 mm.

The integral dust sensor has a 4... 20 mA analog output, a modbus communication port as well as a relay output which switches or trips an alarm if a limit value specified by the customer is exceeded.

The system can also be connected to a computer or PLC using the Modbus RS 485 RTU interface. For connection to a PC a optional ModBus RS 485 to USB converter is needed.

Measurements from up to 10 measurement points can be displayed and saved with the help of an optional pro software package. Signal can be saved and be processed at any time using spreadsheet software.

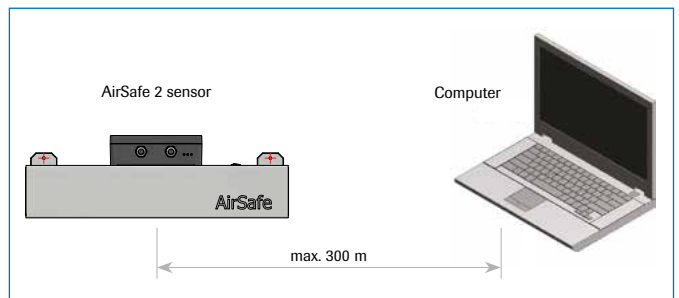


1.5 Assembly and installation

AirSafe 2 can be positioned at any position within a room.

With the exception of excessive ambient temperatures (max. 60 °C) there is no need to position it at specific distances from units or walls.

The brackets provided for this purpose also allow AirSafe 2 to be wall mounted.



1.6 Electrical connection

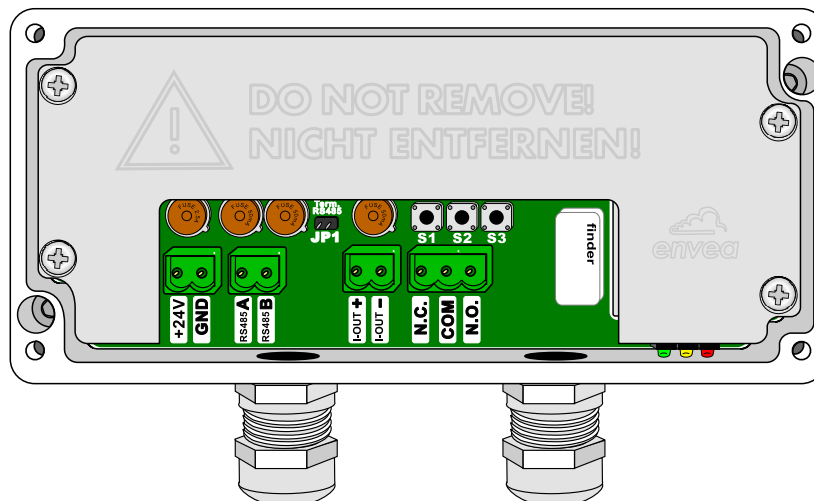
WARNING:

Electrical connection must be made by a professional!

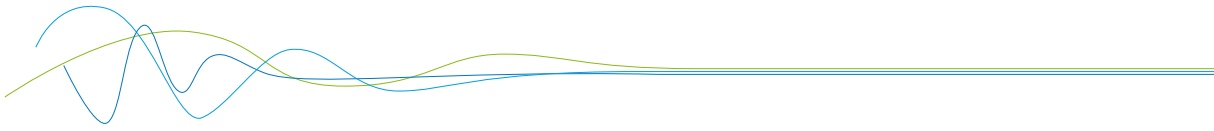
For the 24V DC power supply, please using a protected power supply.

Connection to 4 ... 20mA output and modbus should be made via twisted and shielded cable(s).

The type of cable and wires number per cable will depend of your cabling configuration. 2x M20 cable gland are available.



+24 V GND	Connection to +24 V DC Power supply
RS485 A RS485 B	Connection to ModBus RTU RS 485
I Out + I Out -	Connection to analog output 4 ... 20mA (Active)
NC COM NO	Connection to relay output



2. Dimensions

2.1 Sensor

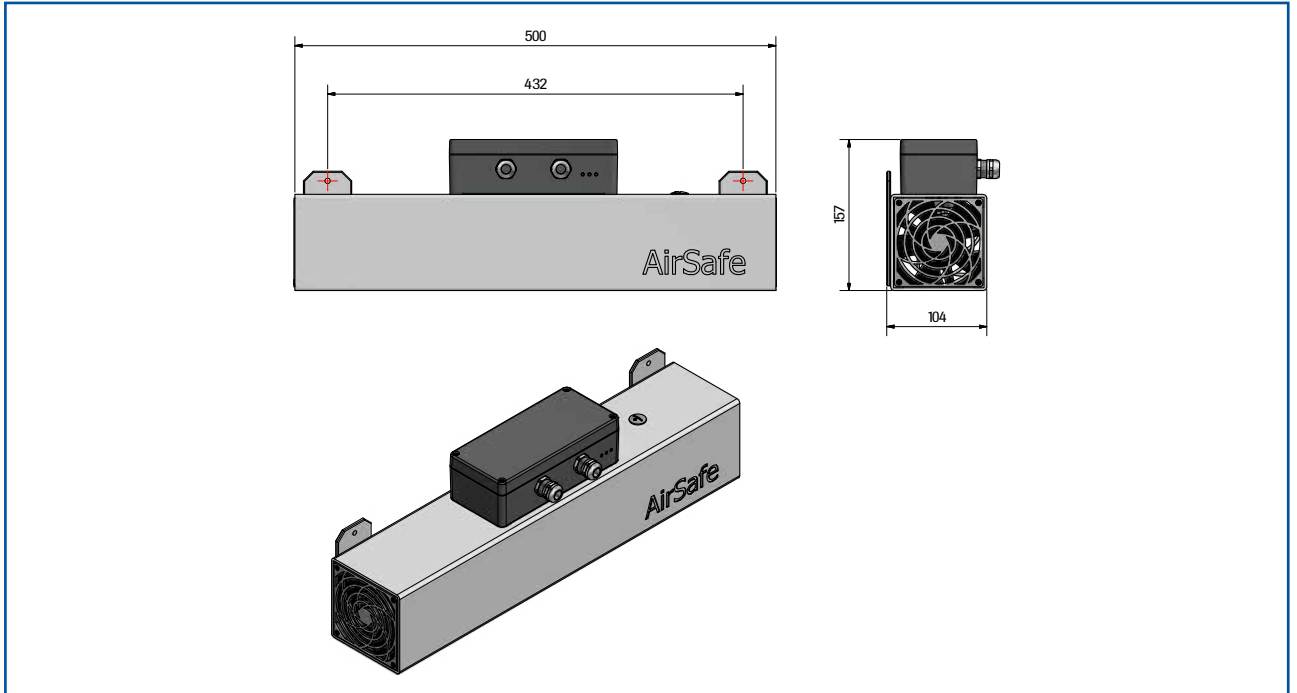


Fig. 1: AirSafe 2 Ex / AirSafe 2 dimensions



3. Ex specification

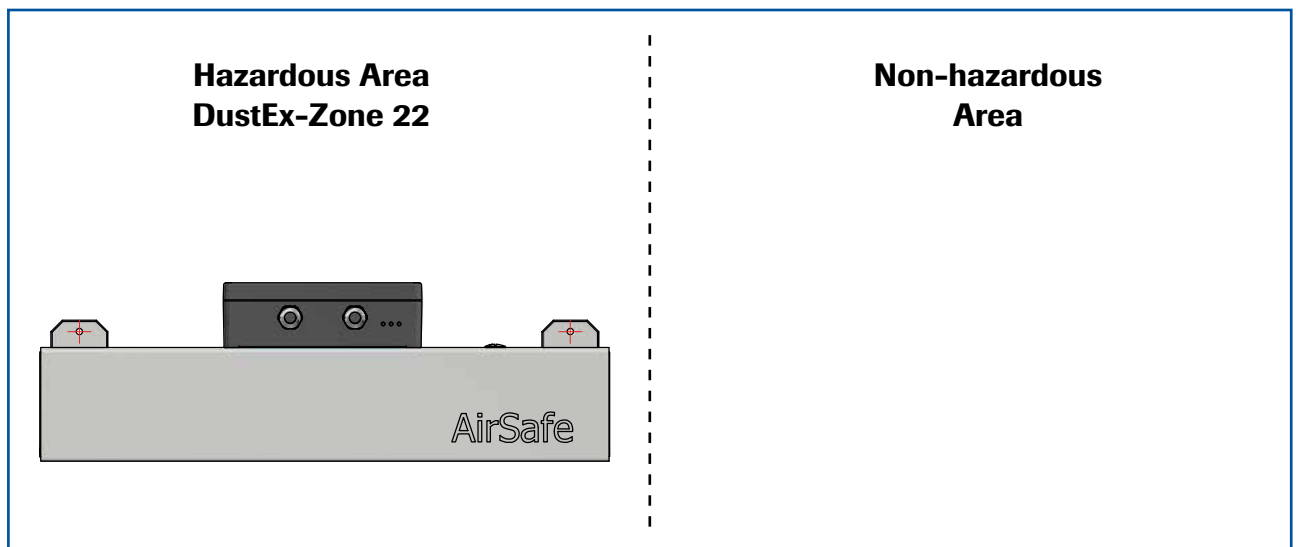
3.1 Marking

AirSafe 2 EX 3D:  II 3D Ex ic tc IIIC T120 °C Dc

This product complies with: EN 60079-0:2012 + A11:2013, EN 60079-31:2014, EN 60079-11:2012.

It is design to be used in Zone 22 Dust EX area.

3.2 Installation



3.3 Ex protection type

The electronics of the AirSafe 2 sensor are designed to be intrinsically safe with respect to the rod probe.

The separation between the intrinsically safe circuit at the rod probe and other parts of the electronics, protected by enclosure for explosive dust atmospheres, takes place within the housing.

With this setup, cabling with intrinsically safe circuits, blue sheathed cables, and blue fittings are not required.

3.4 Special care



Attention: This product must be grounded using the grounding point on the sensor. Grounding cable must have at least a cross-section of 4 mm².

Attention: Only use manual screw driver to open the connecting box.

Attention: In case of noisy or possibly damaged fan, please unplug the sensor immediately from any power source and proceed to cleaning. Contact ENVEA Process or your local dealer in case of need.

Please keep the sensor clean from dust accumulation. Inside of air channel can be easily cleaned by removing the grid opposite to the fan. DO NOT remove the grid on fan side.

Cable glands and stopping plugs certified to EN 60079-0 and EN 60079-31 are acceptable provided they are fitted with the appropriate seal to the enclosure and provide a minimum ingress protection of IP6X.

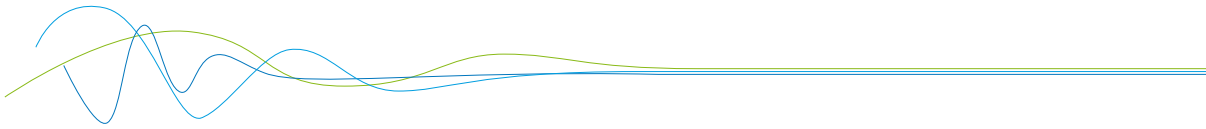
The equipment must not be used in areas affected by charge-producing processes.

If a cable gland is not used, use appropriate stopping plugs.

Do not use the equipment in corrosive atmosphere.

Lifespan of the fan: L10 at Ta = 40°C 70.000h

L10 at Ta = 60°C 45.000h



4. Operation

AirSafe 2 measures the dust content in a gas passing through the sensor using the electrodynamic principle by means of the exchange of charge carriers between the dust particles and the sensor.

4.1 LED indicator

Three LEDs are indicating the state of the Sensor system:

- LED 1: green
- LED 2: orange
- LED 3: red

They will be called in the range red-orange-green as 1-1-1. When the system is powered the LEDs are indicating the most important software parameter settings. Each parameter is represented as a binary number which is flashing a number of blinks to indicate the parameter setting:

Parameter	Red - LED 3	Orange - LED 2	Green - LED 1
Alarm Threshold Factor	0	0	1
Dust Filter Value	0	1	0
Dust Alarm Delay (s)	0	1	1
Vitality Alarm Delay (s)	1	0	0
Alarm Threshold Auto Setup	1	0	1
ModBus Address	1	1	0

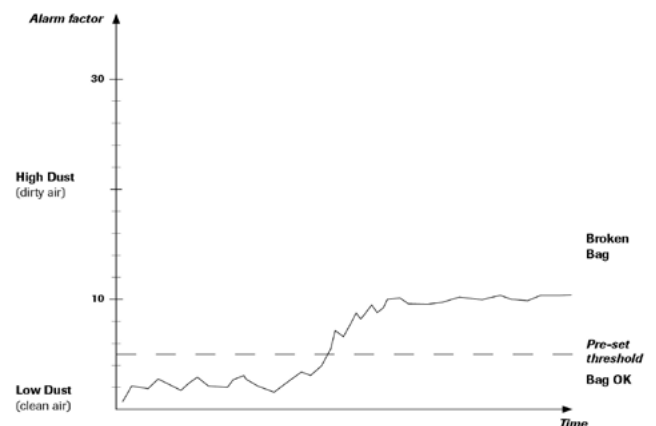
4.2 Alert level

The alert level (Threshold/TRH) is pre-adjusted in factory to a level that allows to detect filter failure in most cases. To adjust to customer's desire there is one button to increase or decrease the switching level by simply changing a multiplier factor. To change the factor see chapter 5.2 One button operation.

This factor allows a 5 times lower TRH than factory setup (Very clean air) to a 6 times higher TRH than factory setting (Dirty air).

- An internal measure value is pre-calibrated in factory to fit most common cases.
- A factor is pre-set to 5
- The Alert level (TRH) can be setup via the Alarm factor. This factor has a range between 1 (very sensitive) to 30 (not sensitive), according to customer conditions.

Higher dust levels can be adjusted with AutoSetup function.



4.3 Normal metering condition

Dust range and Alarm conditions

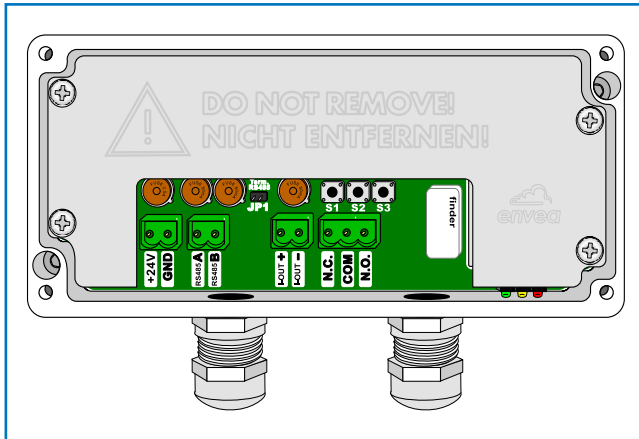
LED 1 (green, 0-0-1) is flashing permanent (slowly) in normal operating and normal dust condition. If the measured dust range increases and comes closer to the Alarm Threshold the flashing frequency increases. If Alarm conditions are reached LED 1 turns off and LED 2 (orange, 0-1-0) indicates the Alarm condition. If dust comes back to lower than the Alarm threshold Relay and LED 2 switches off and LED 1 starts flashing again. LED 3 is not lit in normal operating.

4.3.1 Parameter indication on demand

If S1 is pressed for a short moment the LEDs show the parameter like after power up.

4.4 One-Button-Setup

4.4.1 Parameter setup



Directly on the sensor the parameter can be changed by using a One-Button-Setup.

When Button S1 is pressed all LEDs start blinking on-off simultaneous (1-1-1 to 0-0-0) five times. After this sequence the binary number of the first parameter is lit (0-0-1) for five seconds.

When S1 is kept pressed the sequence starts for the next parameter (five times 1-1-1 to 0-0-0 and then 0-1-0 for the second parameter). And so on...

- When S1 is released while the parameter number is displayed the parameter is selected for changing. LED 2 (orange) starts blinking for 5 seconds.
- When S1 is pressed while LED 2 is blinking LED 1 and LED 2 start to blink synchronously (0-1-1 to 0-0-0).
- Just count the blinks and release S1 as soon as the requested value for this parameter is reached.
- The One-Button-Setup saves this parameter and the menu is left.

4.4.2 Special functions

A – Auto Setup

Auto Setup performs a search for the Alarm Threshold. If activated the sensor measures the dust level over a fix period of 5 minutes and stores the highest dust level. This dust level is taken as the base value for alarm settings. The base value is multiplied with the Alarm Threshold Factor to set the Alarm Threshold value.

To select the Auto Setup function enter the One-Button-Setup and keep S1 pressed until the LEDs display the number 5 (1-0-1).

To start the Auto Setup function release S1 while the LEDs display the number 1-0-1 and press it again.

LED 1 and LED 2 start to blink synchronously (0-1-1 to 0-0-0). Release S1 after 5 blinks.

The LEDs are showing a running line (0-0-1 to 0-1-0 to 1-0-0 ...) during Auto Setup procedure.

B – Default Parameter Restore

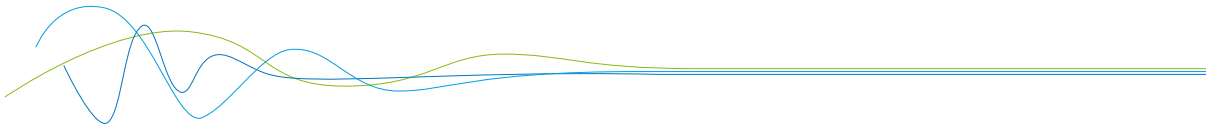
Default Parameter Restore resets all parameters to standard value.

To select the Default Parameter Restore function enter the One-Button-Setup and keep S1 pressed until the LEDs display the number 7 (1-1-1).

To start the Default Parameter Restore function release S1 while the LEDs display the number 1-0-1 and press it again.

LED 1 and LED 2 start to blink synchronously (0-1-1 to 0-0-0).

Default Parameter Restore is performed if S1 is pressed automatically for more than 20 blinks.



4.5 PC Software

The sensor come with DUST Base software as standard. Optional PRO version with recording possibilities and connection up to 10 sensors is available as option.

The communication between PC and sensor is done using the ModBus RS 485 port.

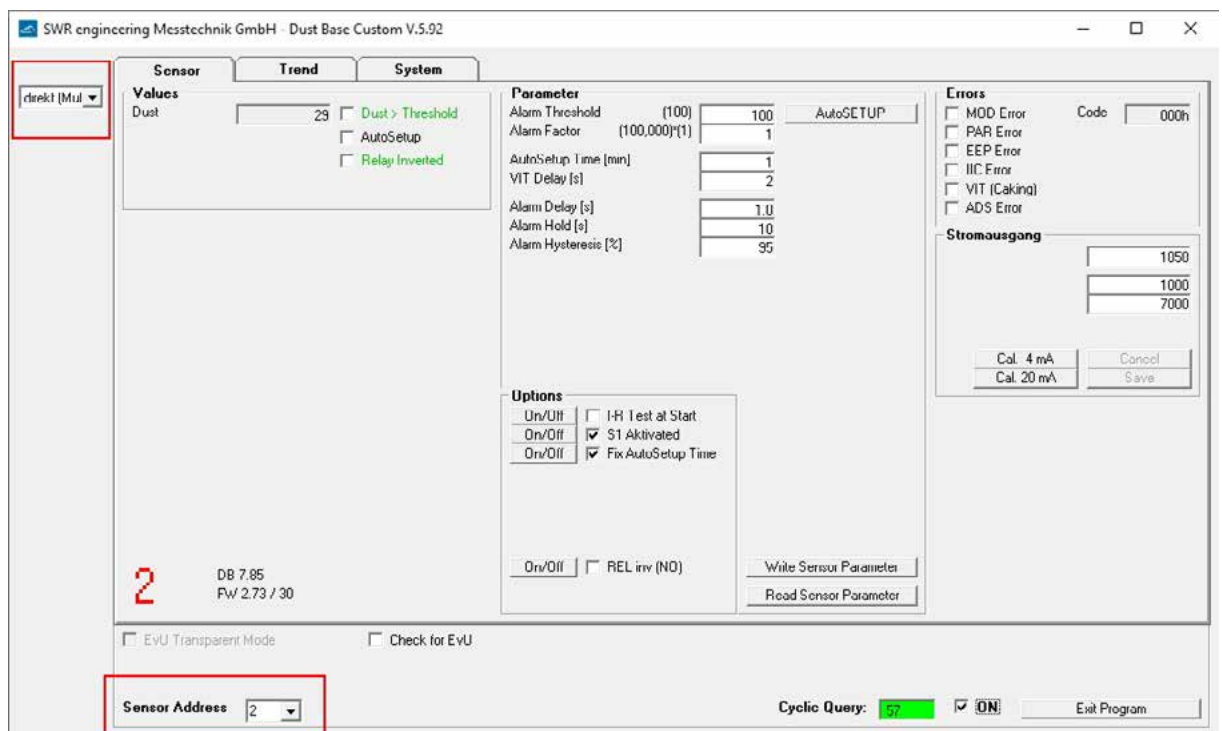
4.5.1 DUST Base Software

This software has been kept very simple and is almost self-explanatory.

A – Software connection

This software is available for download on our website:

<https://www.envea.global/downloads.html>



Please note, that the COM port attributed to the sensor must be between 1 and 16.

When the software start in „direct“ Mode there will be a connection established to the AirSafe 2 at Modbus address #2, ModBus address is selectable.

When the software starts in „auto“ in can connect to a DRC din rail module.

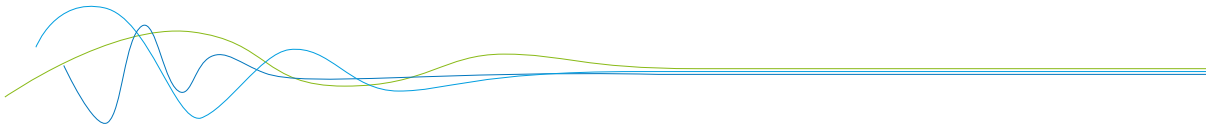
On the left side of the windows:

Choose between Auto, direct or transparent communication

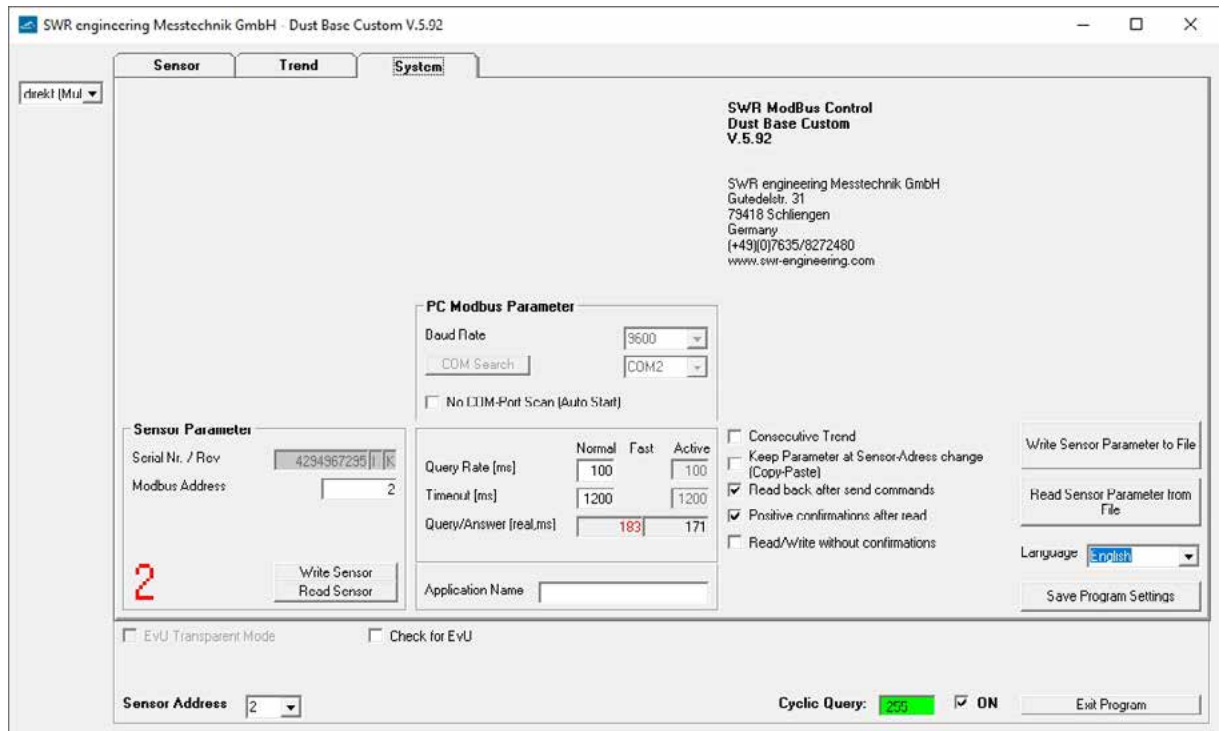
At the bottom of the windows:

To start communication with sensor / DRC you must tick the EIN box.

The windows will turn green when the communication is ON.



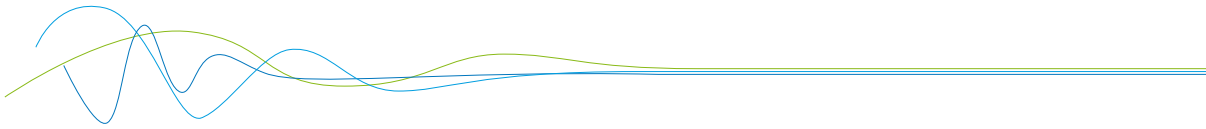
B – System Tab



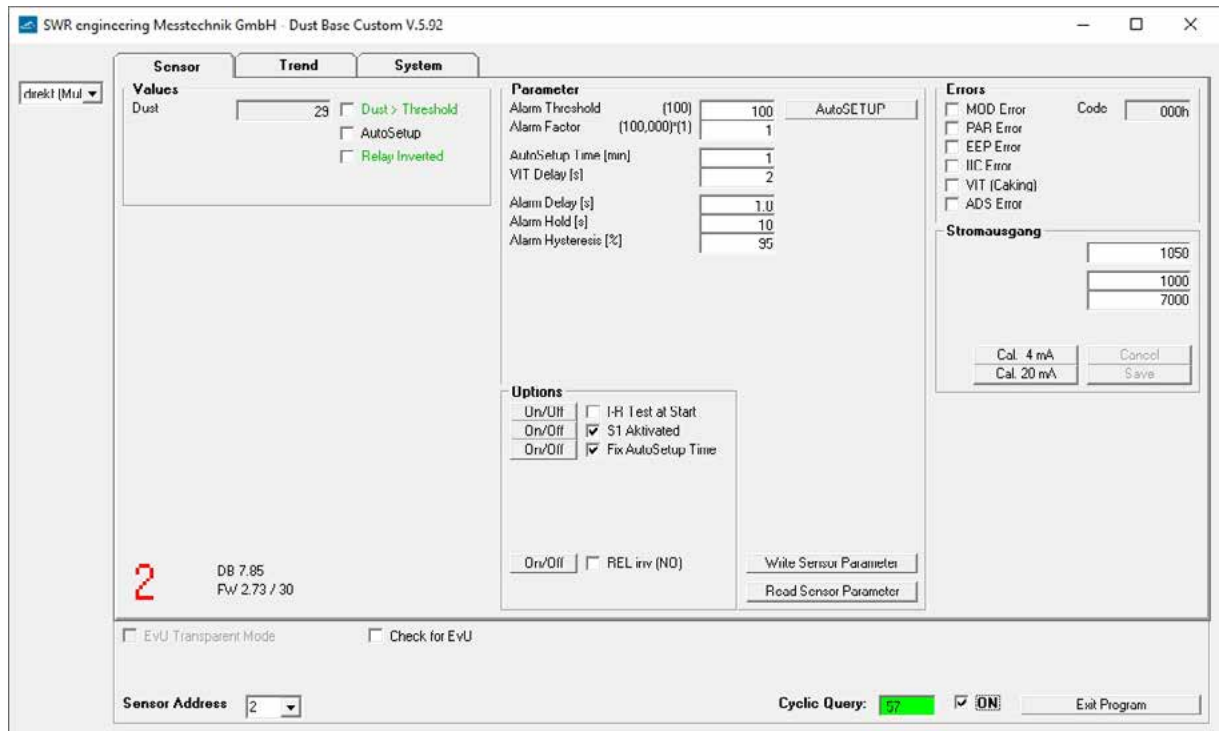
This is where the COM port, Baud rate and sensor address are set:

- ModBus address for direct sensor communication: 2
- ModBus address for DRC communication: 1

Communications parameters are also available, as well as language (GER/ENG) and the possibility to save and write sensor parameters into a file. This also display the fwd version and sensor serial number.



C – Sensor Tab



If errors are found in the sensor by internal system tests, they are marked and the sensor and the DRC display sensor error.

4.5.1.1 Basic parameters

A default parameter set is established for a new destination system with an empty EEPROM:

Parameter	Default	Meaning
ModBus address:	2	Sensor
	1	DRC
TRH value:	1000	Current alarm threshold
TRH factor:	10	Factor
AutoSetup time:	5 [min]	time for AutoSetup function
Alarm delay:	2.5 [s]	No alarm until x seconds after the threshold is exceeded
Alarm hold:	10 [s]	The alarm is held for at least x seconds after the threshold value is exceeded.
Alarm hysteresis:	95 [%]	[%] Alarm cannot be regarded as able to be cancelled until it falls below a figure of x percent of the threshold value.

Switch		
AutoSetup time is fix	1	Fixed, not automatically extended AutoSETUP time = AS Time
	0	With each new maximum value the Auto SETUP is extended by the set AS Time
HW Switch S1 is enabled	1	S1 is enabled
	0	S1 is ignored
DIN Rail relais is NC	1	DIN Rail relay is actuated as NC
	0	DIN Rail relay is actuated as NO

4.5.1.2 AutoSetup

“AutoSetup” starts a search of the alarm value:

The sensor searched for the signal level which corresponds to the current dust load.

See section sensor manual for a detailed description.

4.5.1.3 Sensor measurement data

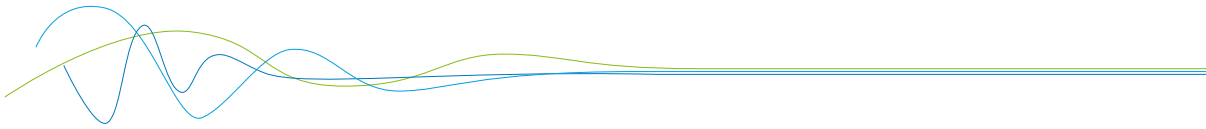
Dust: the measurement for the dust load

- ✓ Delta > TRH: Alarm threshold TRH exceeded
- ✓ Relais INVERT: Switch relay INV to ON so that the alarm output (flag and sensor relay) are inverted
- ✓ AutoSetup: an AutoSetup has been initiated and is currently running

4.5.1.4 Internal sensor error

The “Error” indicator shows the results of function tests which run permanently whilst the system is running.

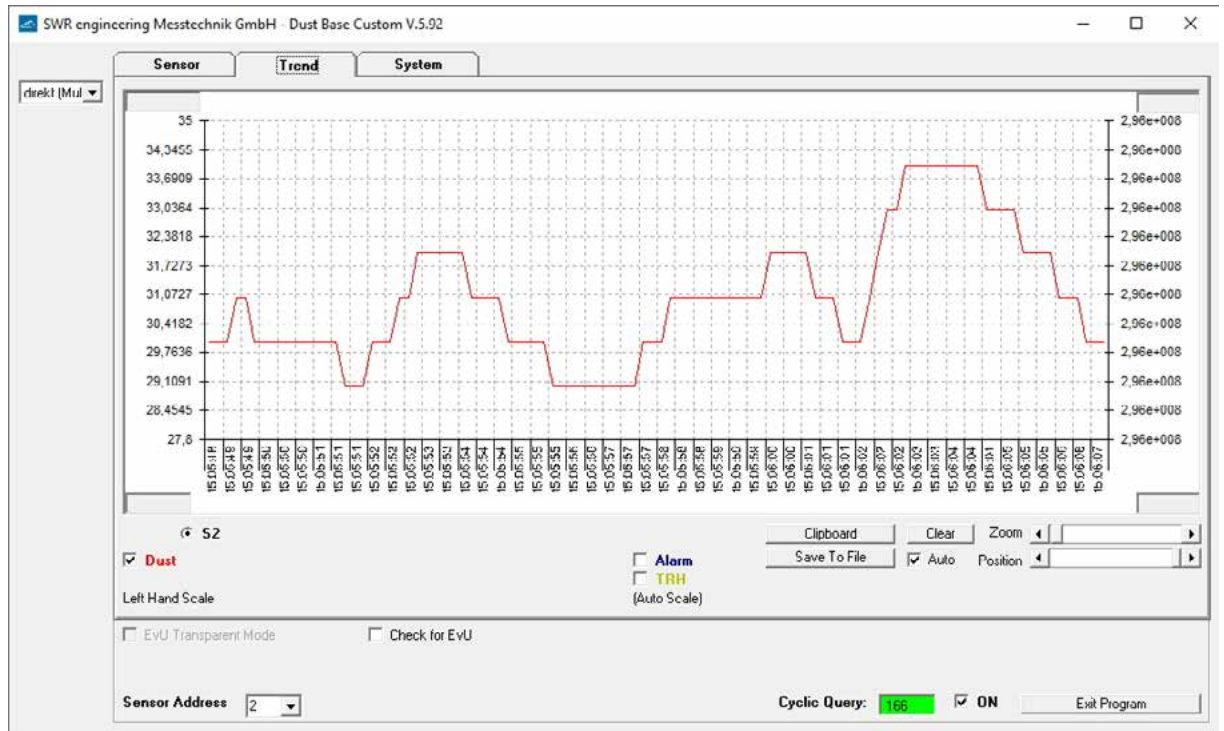
- ✓ MOD conn: ModBus connection is defective
- ✓ Vitality error: restricted measurement range due to coating formation (conductive)
- ✓ IIC disconn: IIC bus defective
- ✓ ADS busy: incorrect internal timing
- ✓ PARA ACC: EEPROM cannot be read/written
- ✓ PARA CHK: EEPROM supplying inconsistent data



D – Trend Tab

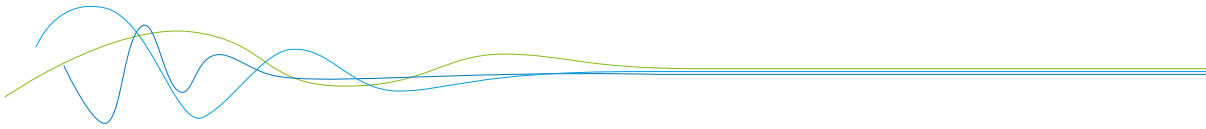
The measurement and calculation values of the sensor can be observed here.

The sensor's dust value is always scaled on the left whilst the switch threshold or the relay output, for example, can be visualised on the right.



We can show the DUST value on the graph (Dust tick box), the Alarm status (Alarm tick box) and the Threshold level (TRH tick box).

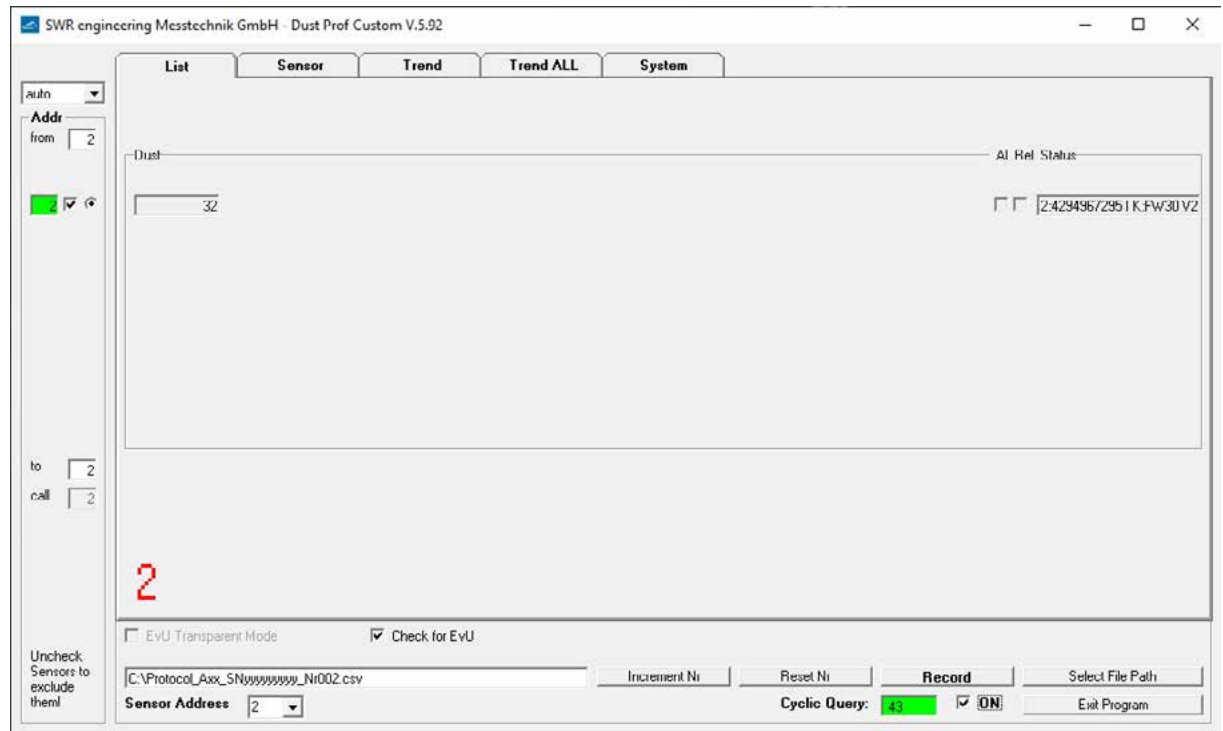
The **TREND** All tab allow you to display the trend of selected sensors together.



4.5.2 DUST Pro Software

Sensor, Trend and System tabs remain similar to DUST Base, but it allows communication up to 10 sensors simultaneously.

A – List Tab



On the left side of the windows:

Adr: List of connected sensors with their address. You can choose with sensor you display using the tick boxes.

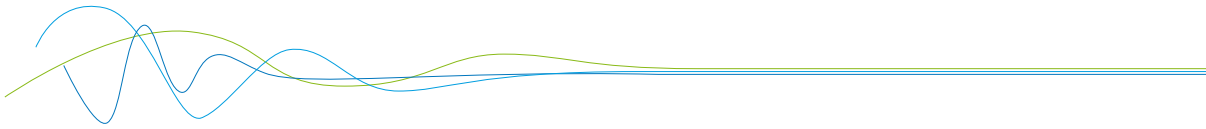
At the bottom of the windows:

To start communication with sensor / DRC you must tick the EIN box. The windows will turn green when the communication is ON.

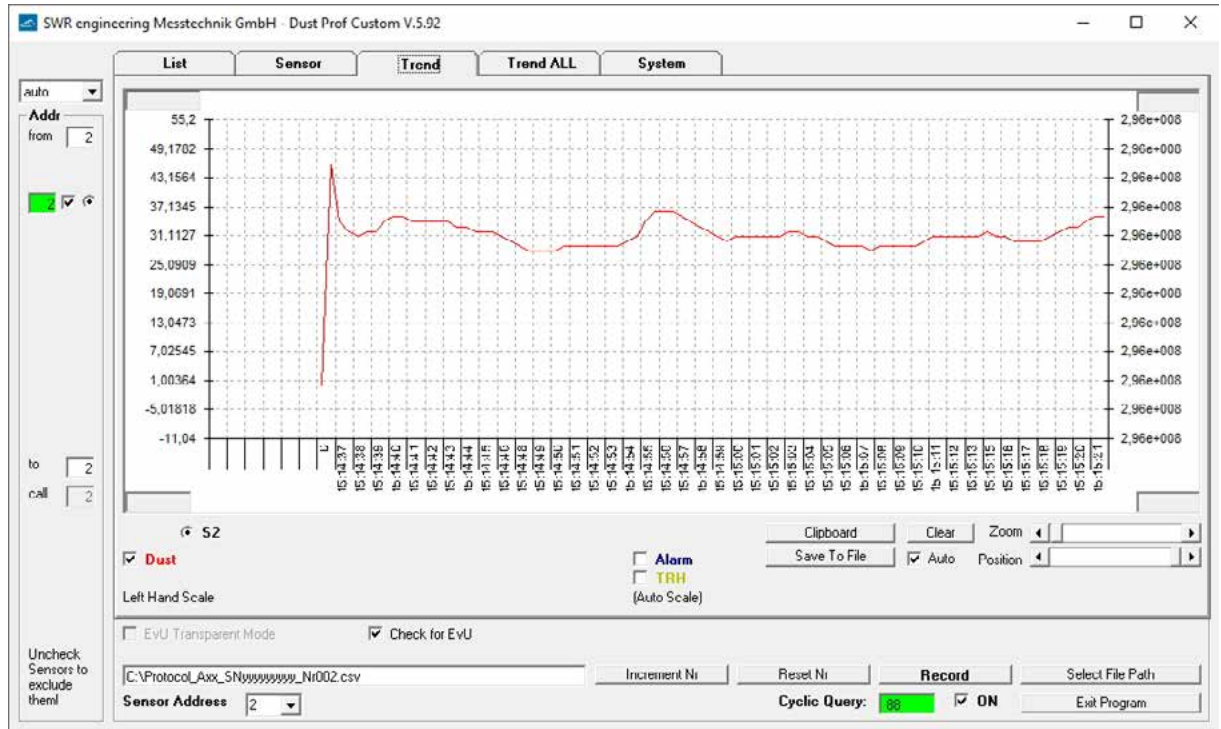
AE Address: You can enter the DRC address if not in Auto

The main feature of the Prof software is to provide the possibility to record data into a .csv file. For this you need to select or create a file using the "Select file path" button. Then press record button to start the data record.

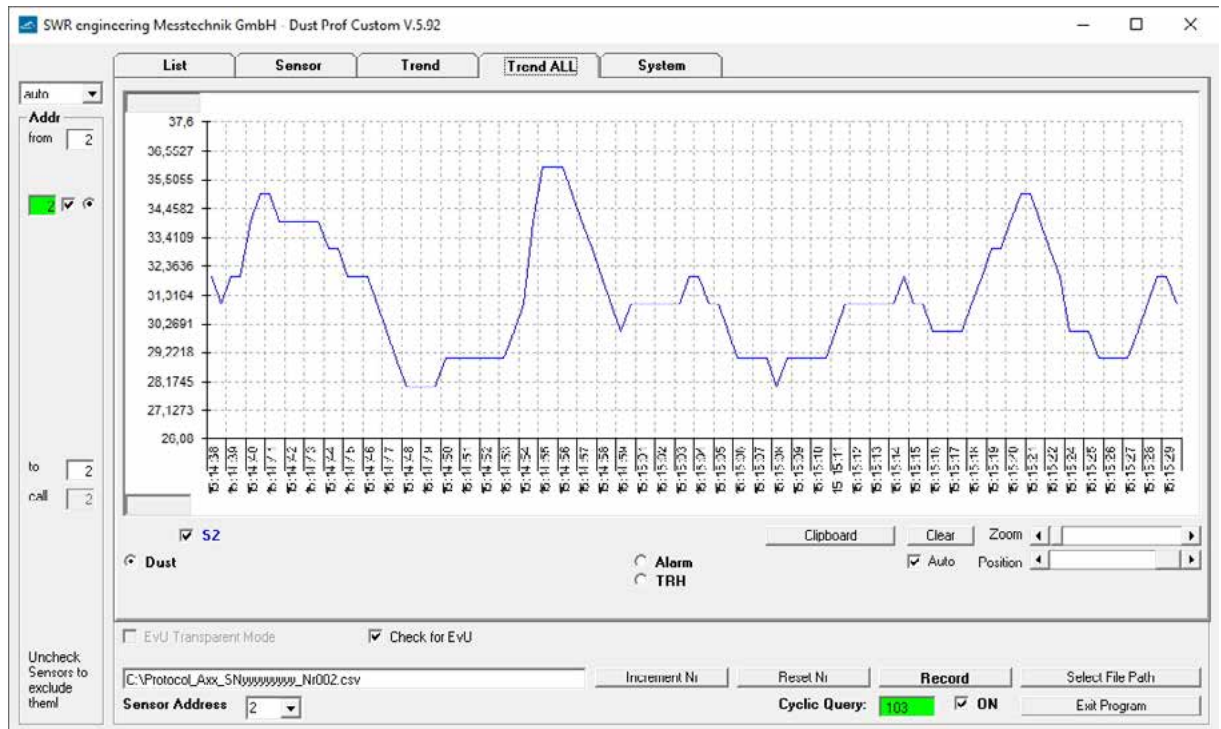
In this tab you have the list of all connected sensors (up to 10 sensors). For each sensor, you will have the DUST level information and the status of sensor (including FW version).



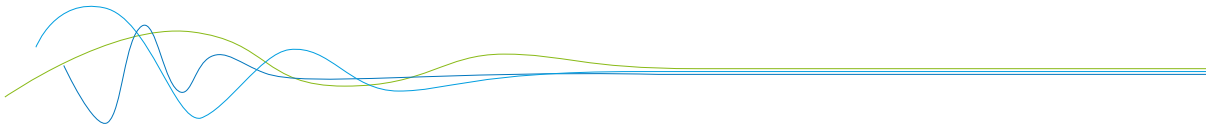
B – Trend Tab



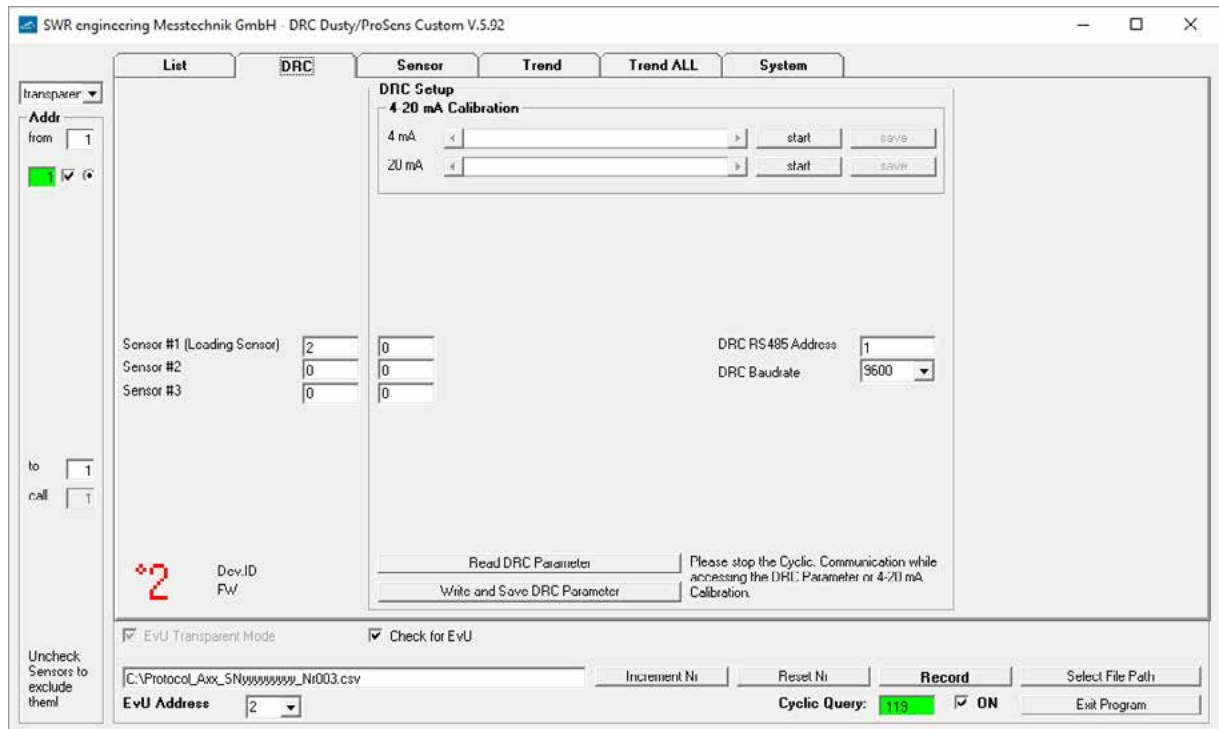
In **Trend** you can display the measurement of the selected sensor.



In **Trend All** all sensors are displayed at the same time.



C – DRC Tab



If a suitable DIN Rail DRC is found, the DRC can be configured here:

- ModBus address saved in the DRC
- Baud rate between PC and DRC
- Calibration of the 4 ... 20 mA output
- ModBus addresses of any sensors

The sensors are registered with their ModBus addresses in fields Sensor #1, #2, #3. If a zero is entered, the sensor is not scanned.

5. Maintenance

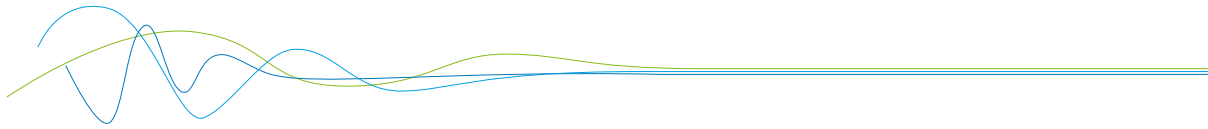
Maintenance work is restricted to cleaning any accumulated particles off the probe and the insulation section using a cloth or dry pressure air.

Grid on both end can be removed using the proper tools to facilitate the cleaning process.

Attention: On EX version, DO NOT remove the grid on fan side.

This is designed to prevent accumulated material resulting in bridge formation against the earthed environment since this has a significantly adverse effect on the measurement. The other aim is to prevent the probe becoming encased with accumulated material.

No maintenance work is required in the sensor housing or on the field electronics. For any other maintenance, please contact ENVEA Process first and follow our instructions.



6. Troubleshooting

6.1 Output relay fails to switch

1. Check power supply and the connection contacts.
2. Check whether the green LED is flashing or the yellow LED is lit. This indicates a problem with the relay contact.
3. Check whether the red LED flashes during an active measurement. Error code!!

If the sensor is still not supplying signals after these checked, contact our agents or ENVEA Process direct.

6.2 Errors

Errors can be seen via the software or via LED's status.

A – Hardware Error condition

If an internal hardware error is detected LED 3 (red, 1-0-0) starts flashing.

Hardware errors cannot be cured on site. Please contact ENVEA Process or you distributor.

Message	Description	LED blink	Relay status	Current output
MOD error	The ModBus connection is not working	1	Alarm	2 mA
EEP error	The EEPROM cannot be read/written to	8	Alarm	2 mA
IIC error	The IIC bus is defective	2	Alarm	2 mA
ADS error	The ADC provides incorrect timing	5	Alarm	2 mA
PAR error	The EEPROM provides inconsistent data	9	Alarm	2 mA

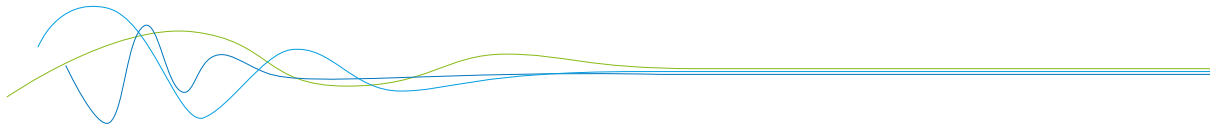
B – Metrology System Error condition

The system checks if the metrology can work properly

Message	Description	LED blink	Relay status	Current output
VIT (coating)	Limited measurement range due to coating (conductive)	3	On-Off	2 mA
FAN	Fan failure	4	On-Off	2 mA

These instruments conform to the following standards:

	Product standard - electrical equipment for measurement, control and laboratory use EMC requirement
	Reference standard EN 661326
	Year of publication (1997) Updates A1 (1998), A2 (2001), A3 (2003)



7. Technical data

Sensor	
Measured objects	Solid particles in a stream of gas
Particle size	0.3 µm or larger
Measurement range	From 0.1 mg/m ³
Ambient temperature	- 20 ... + 60 °C
Humidity	95 % RH (non-condensing)
Measurement technology	Electrodynamic
Fan failure detection	YES
Damping time	1 s
Relay output	Max. rated load: 250 V AC Max. peak current: 6 A Max. rated load 230 V AC: 250 VA Max. breaking capacity DC1: 3/110/220 V: 3/0.35/0.2 A Min. switching load: 500 mW (10 V/5 mA)
Analog output	4 ... 20 mA active output
Modbus	RTU RS 485
Protection Category	IP66
Dimensions	500 x 100 x 157 (L x W x H)
Housing material	St37 powder-coated
Power supply	24 V DC ± 10 %
Power	Max. 12 W
Electrical connection	Screw terminals
Weight	5.5 kg
Marking DustEx	II 3D Ex ic tc IIIC T120 °C Dc

