FSE8 Series
Dust Monitoring
Operation Manual

FinkTek Co., Ltd.

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Contents

1. Reading Labels

Thanks for purchasing FineTek's Product. This operation manual describes the product features, working principles, operation and maintenance methods. It makes the user fully understand how to use the product correctly, so as to prevent dangerous situations such as device damage or operator injury.

- Please read this operation manual completely and carefully before using the product.
- Please contact the company if this operation manual can't satisfy your demands.
- The content of the operation manual is updated based on the version upgrade, which will be uploaded to the website for the user to access.
- Please don't disassemble or repair the product on your own, as this will make you disqualified from availing of the warranty service. Please send the product back to the company for repair and calibration, or just contact the company.
- Explanation of warning signs:

Danger→ It indicates that wrong operation will cause death or major disasters.

Note→ It indicates that wrong operation will cause injury and device damage to some extent.

Electric shock→ It warns of possible electric shock.

Fire→ It warns of possible fire.

Prohibited→ It indicates the prohibited wrong behavior.

2. Product Warranty

2.1 New Product Warranty

- We don't charge for the inspection, part/s and repair for the product of the company that has a defect within 12 months from the delivery date and meets the warranty terms.
- If the product defect is not due to human error during its transportation, user may
- change to a new unit from the company within 7 days from delivery date.
- When the product needs to be sent back to the factory for repair, please send the whole set, and don't disassemble the parts. Moreover, please be sure it is completely packed to avoid damage and causing more loss and defect during the transportation.
- The warranty is not available for causes that fall under the following circumstances, for which the company shall charge for the inspection, part/s and repair according to the actual condition:
  - The product or its parts are beyond the warranty period.
  - Fault or damage is caused by not following the instruction and use environment described on the operation manual.
  - The product damage is caused by a force majeure factor (natural disasters, floods, fire, earthquakes, lightning, typhoon, etc.), human destruction (scratches, dropping, latch broken, tapping, cracks and punching), human error (using improper voltage, high-humidity, water leakage, stain, corrosion, loss, improper storage, etc.) and other abnormal factors.
  - The damage is caused by the customer or the 3rd party through the installation, addition, expansion, modification and repair of parts not authorized or certified by the company.
  - The volume label information is wrong or unclear, so the product serial number can't be confirmed.

2.2 Repair Warranty

A **6-month** warranty service is provided for the repaired part of the product, during which the same product can be repaired free of charge in case of the same fault.

2.3 Service Network

Company	Address	Telephon	Fax
Taipei Headquarters (Taiwan)	No.16, Tzuchiang St., Tucheng Industrial Park, New Taipei City 23678	+886 2 2269 6789	+886 2 2268 6682
Taichung Sales office (Taiwan)		+886 4 2465 2820	+886 4 2463 9926
Kaohsiung Sales office (Taiwan)		+886 7 333 6968	+886 7 536 8758
Fine automation Co., Ltd. (China)	No. 451, Duhui Road, Zhuanqiao Township, Minhang District, Shanghai City 201109	+86 021 64907260	+86 021 6490 7276
Aplus FineTek (Sensor Inc.)	355 S. Lemon Ave, Suite D, Walnut, CA 91789	1 909 598 2488	1 909 598 3188
FineTek Pte Ltd. (Singapore Branch)	37 Kaki Bukit Place, Level 4 Singapore 416215	+65 6452 6340	+65 6734 1878
FineTek GmbH (Germany Branch)	Bei den Kämpen 26 21220 Seevetal-Ramelsloh, Germany	+49 (0) 4185 8083 12	+49 (0) 4185 8083 80
FineTek Co., Ltd. (Indonesia Branch)	PERGUDANGAN TUNAS BITUNG JL. Raya Serang KM. 13,8, Blok C3 No. 12&15, Bitung Cikupa, Tangerang 15710	+62 (21) 2923 1688	+62 (21) 2923 1988

3. Document Description

3.1 Function

This operating manual provides the information required for the installation, wiring and setting of the FSE8 dust concentration meter. Also included are other important instructions such as operating precautions, system maintenance and troubleshooting. Before using this product, please read the information in this manual and place it in an accessible area.

3.2 Customer Base

The content of this operating manual is for trained professionals, and it should be sufficient in providing practical operation information.

3.3 Authorized Personnel

All operations described in this operating manual can only be performed by authorized factory operators or specially trained staff. Personal protective equipment must always be worn during work to ensure safety.

3.4 Correct Use

The reliability of this product can only be guaranteed if it is used correctly in accordance with the operating instructions, supplementary instructions, and in the correct applicable conditions.

3.5 Warning

Improper or incorrect use of this product may cause application-specific hazards. For example, incorrect installation or adjustment of settings may cause the tank to overflow or damage system components.

3.6 General Safety Instructions

During the entire process, the user must consider the legality of the necessary occupational safety measures, and the current rules and regulations. The safety instructions in this operation manual, national installation standards, effective safety regulations, and accident prevention rules must be observed by the user.

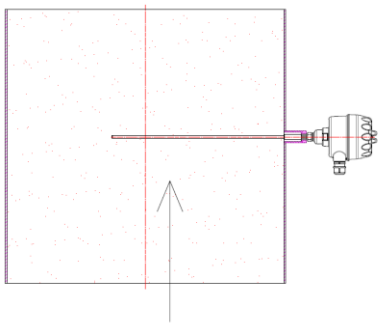
For safety and warranty reasons, intrusive work on any equipment not described in the operating instructions can only be carried out by personnel authorized by the manufacturer. Any replacement or modification is prohibited.

When using the product, you must comply with the safety qualification rules and safety instructions on the equipment.

4. Introduction

4.1 Product Introduction

The dust density meter of the FSE series measures by applying the triboelectric effect. Upon passage, collision or friction or sensing of migratory particles near the sensing rod, a charge will be formed on the sensing rod. The signal is then processed through a series of advanced algorithms in order to filter out noises for the most accurate dust measurement and output.



4.2 Features

- Clearly monitor each dust removal effort
- Optimize the dust remover control system
- Bring down the dust collection maintenance cost
- Protect the safety of equipment in the downstream of the dust remover
- Improve dust-removing efficiency
- Improve factory production and surroundings
- The anti-static type is applicable to an environment with electrostatic dust-removing equipment.
- Capable of displaying dust concentration in mg/m3

4.3 Product Applications

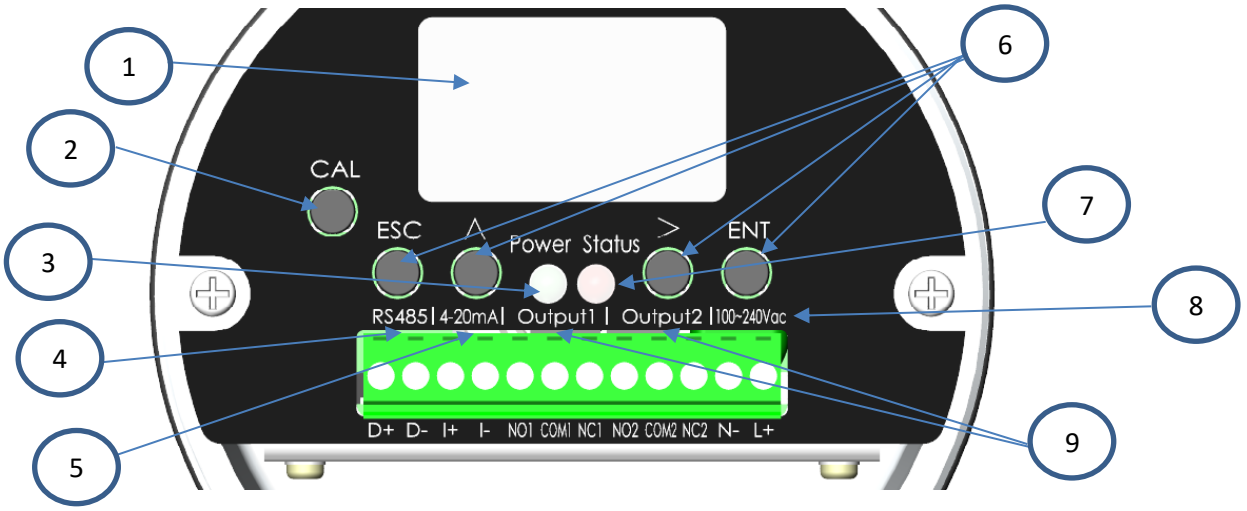
Dust collection equipment in petrochemical, chemical engineering, cement, pulp and paper, iron and steel and mining sectors, transmission equipment, power plants, incinerators, environmental protection, buildings, and feeds (bag filter, cartridge filter, cyclone separator, electrostatic precipitator).

5. Product Specifications

5.1 Specifications

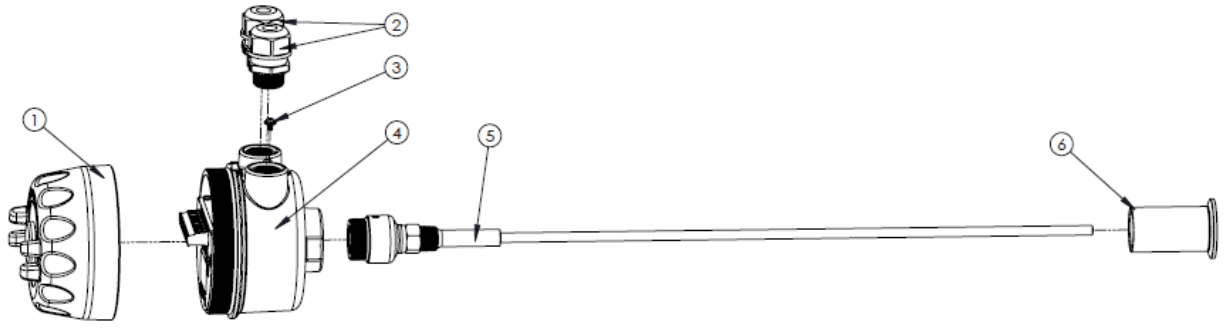
Product Line and Generation Code	FSE8
Working power	100VAC~240VAC，50/60Hz 24VDC ±20%
Current consumption	Max. 10 VA or 5W
Particle size	0.3μm or greater
Measurement range	0.1 mg/m³ ~ 1000 mg/m³ (Certification ranges: 0.1 ~ 100 mg/m³)
Gas flow rate	Min. 3 m/s
Ambient temperature	-30 ~ 70 ˚C
Process temperature	Standard: -40~150 ˚C High-temperature/Anti-static: -40~250˚C
Process pressure	0-6 bar (standard/high-temperature)/0-2 bar (anti-static)
Output	2 sets of SPDT relay (240VAC/5A or 30VDC/1A) 4-20mA (max. loop resistance 500Ω)
Communication	RS-485 (Modbus RTU)
Display	Power LED (green), Status LED (red/green), LCM Display
Process connection	1/2” NPT (standard/high-temperature)/ 2” x 10kg/cm^2 flange (anti-static)
Fluid-contacting material	Vibrating rod: SUS304, SUS316L Insulating material: PEEK
Housing material	Aluminum alloy
Protection	IP67 (The outside diameter of the cable needs to be ø7 –ø10mm)
Probe length	Standard type: 250~568mm Extension type: 588~1000mm Anti-static type: 440mm, 650mm, 860mm, 1070mm, 1280mm,1490mm,1700mm,1910mm

5.2 Introduction to the Motherboard



1	LCM Display	6	Function key
2	Auto-correction key	7	Status indicator
3	Power indicator	8	Power-connecting terminal
4	RS-485 connecting terminal	9	Relay connecting terminal
5	4-20mA output connecting terminal		

5.3 Product Portfolio



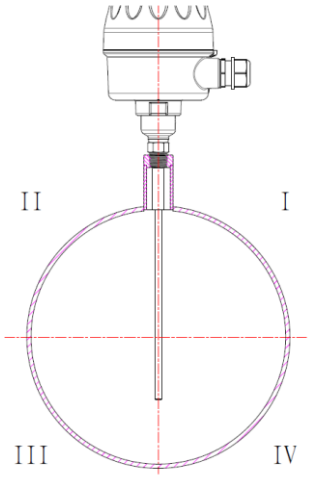
1	Housing cover	4	Housing connected to electricity
2	Cable connector	5	Sensing rod
3	External earthing	6	Process connection

6. Product Installation

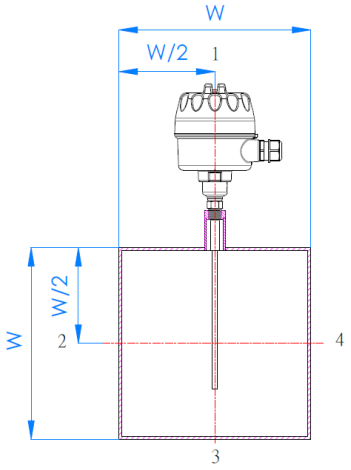
The process connector is welded vertically onto the pipeline; no tilting or deformation is allowed.

When the ambient temperature is over 70℃ or when there is equipment over 70℃ running in the surroundings of the product, the heat source needs to be insulated. Over-temperature will damage the product.

6.1 Choose a location where it will be installed



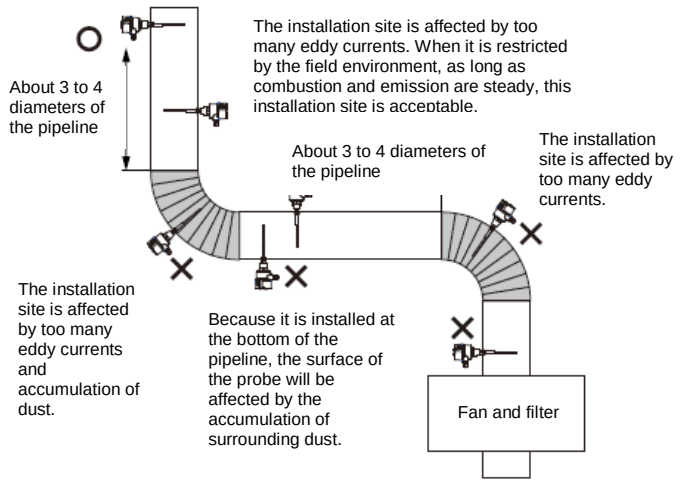
Round pipeline



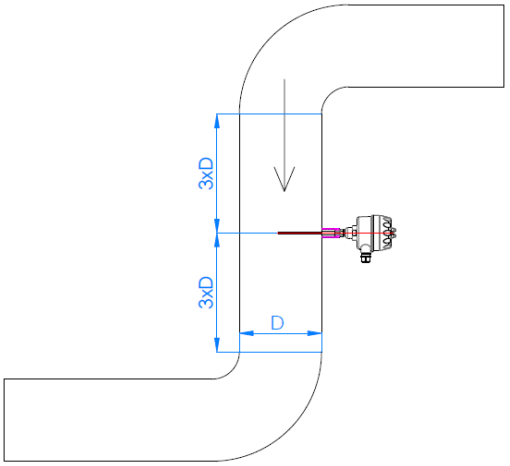
Square pipeline

- In the case of a round pipeline, the dust monitor is installed anywhere between 9 o'clock and 3 o'clock clockwise, as is shown in Zone I and Zone II in the figure.
- In the case of a square pipeline, on the other hand, it is installed on both sides or in the center on the top of the pipeline (never beneath it), as is shown in 1, 2, and 4 in the figure.
- As soon as the installation site is confirmed, it is required to connect the socket onto the pipeline. First, create a hole on the pipeline (which has to be slightly larger than the inner hole of the socket). Make sure that the socket is vertical to where the dust flows and is optimally sealed when welding.

Requirements for installing on the pipeline

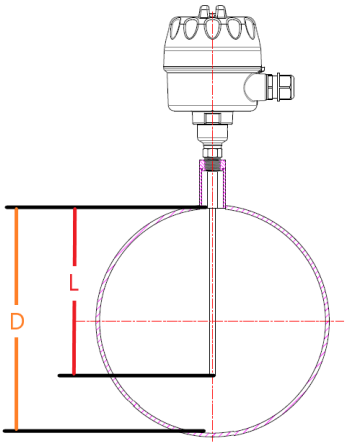


Required installation site



Required straight pipeline

- The product needs to be installed at a distance at least 3 times the pipeline diameter from the elbow (or reducer).
- Install the splicing short pipe and connect it onto the exhaust pipe; the inside diameter needs to be at least greater than 28mm.
- Piping and short pipe splicing at the installation site require conductive metal pipes.
- The bottom of the vibrating rod and the inner wall of the pipeline needs to be greater than 30mm.
- The pipeline needs to be precisely grounded and free of electricity leakage.



6.2 Length of Vibrating Rod

The length (L) of the metal vibrating rod of the dust monitor is between 1/3 and 2/3 of the diameter of the pipeline (D)

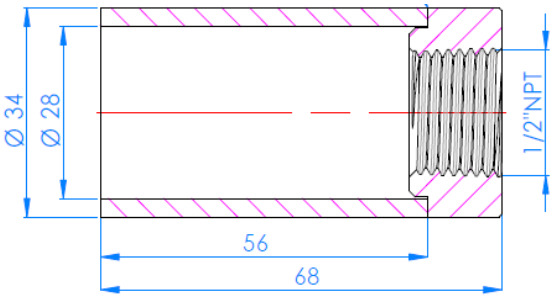
6.3 Pipeline Temperature and Pressure

⚠ If possible, please install the product in a location where the pressure inside the pipeline is below that in the surroundings. This will prevent against exposure of the gas inside the pipeline while the product is being dismantled during installation or maintenance. If the pressure inside the pipeline is higher than that in the surroundings, exposure of the gas inside the pipeline will be a risk while the product is being dismantled.

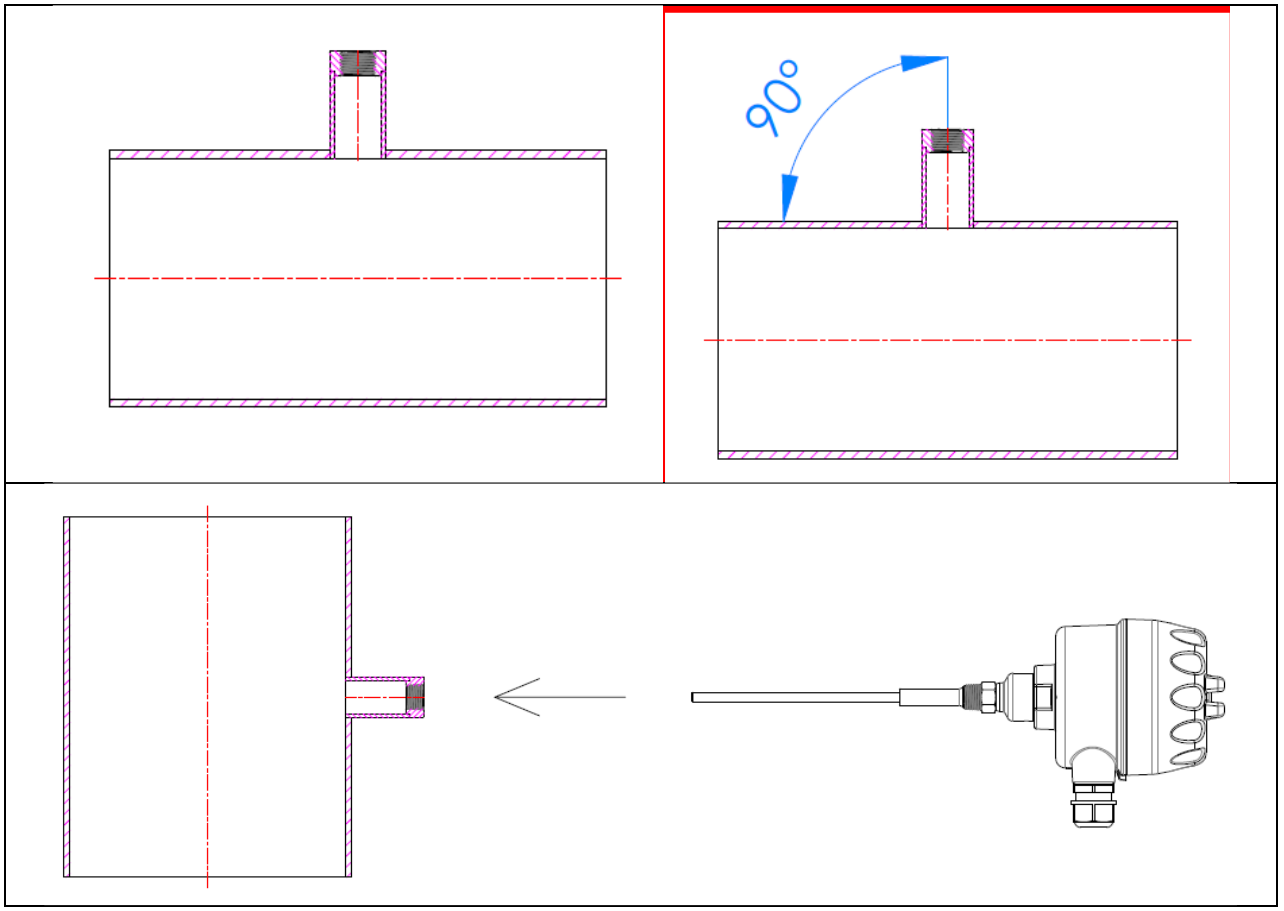
⚠ With a high temperature inside the pipeline, please select a suitable type of product for use and pay attention to the risk of high temperature while the product is being installed.

6.4 Installation

Before installing the product, it is required to create a hole on the pipeline and weld the process splice. The length of the process splice (including the thread) needs to be 68mm and it is advised that the thickness of the splice lining be at least 2mm. Please refer to what is advised in the figure to the right.



- The process splice, upon installation, needs to be vertical to the pipeline; no tilting is allowed and it is required to pay attention to the splicing orientation.
- The process splice is fixed onto the pipeline. First, fix it with four evenly distributed welding points and then weld the whole perimeter.
- Attention needs to be paid to the fact that no deformation or burrs are allowed and no iron chips may remain inside the splice and the pipeline when the process splice is installed onto the pipeline.
- The product is of the NPT thread gauge. Please wrap the tape seal over the NPT thread of the product before fastening the splice.
- The product is of the PF thread gauge; it is required to confirm that the O-ring is installed before fastening.



7. Installation of Electricity

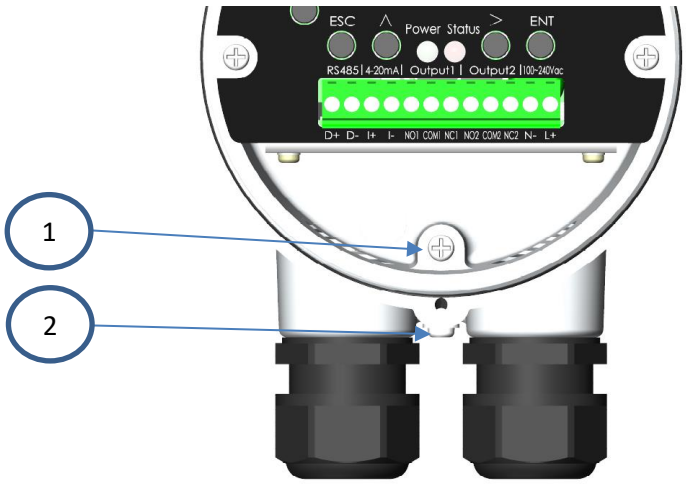
7.1 Connector

The diameter of the guide wire needs to be 0.32mm^2 or 22 AWG at the minimum and 3mm^2 or 12 AWG at the maximum.

The electrical wire used needs to be able to remain at 70℃ over an extended period of time.

Electrical wires with an isolation net can be selected. It is allowed to connect the isolation net where it is grounded inside the junction box.

7.2 Grounding

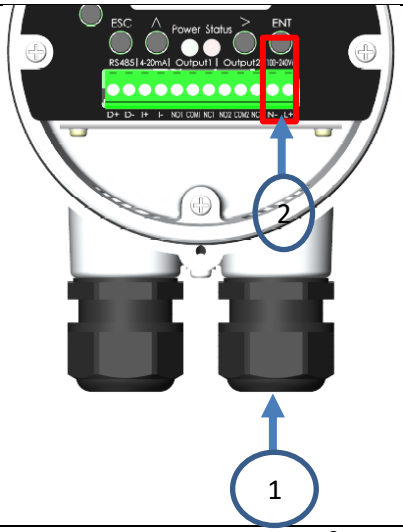


- Both the pipeline and the product need to be grounded. The product can be grounded at two points. 1 is where it is grounded inside the junction box while 2 is where it is grounded outside the junction box.
- The diameter of the guide wire for grounding needs to be greater than 4 mm^2 or 11 AWG.
- The grounding screws inside or outside the junction box are of the M4 specifications. For the guide wire, however, the O-shaped or Y-shaped crimping terminal may be used for connection purposes.

7.3 Terminal Block

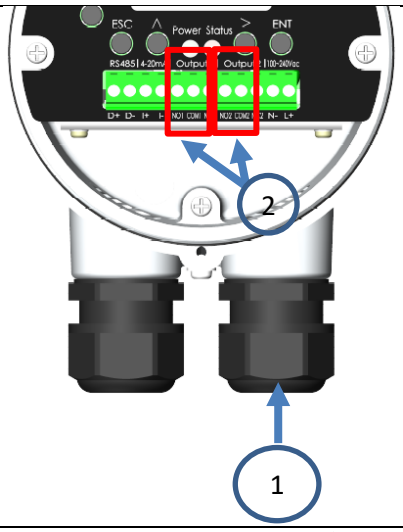
- For the product terminal block, the type with the plug and receptacle separated is used. During wiring, the plug may be removed to facilitate wiring.
- The diameter of the guide wire needs to be 0.32mm^2 or 22 AWG at the minimum and 3mm^2 or 12 AWG at the maximum.
- The advised stripping length of the guide wire is 7mm; please use the flathead screwdriver with a width of 1mm to 2.5mm for wiring purposes.
- During wiring, attention shall be paid to the fact that short circuit is disallowed for the bare copper wire of the guide wire and spacing needs to be at least 5mm.

7.4 Power



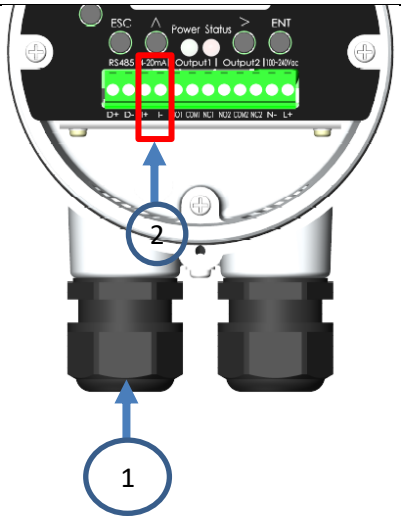
- The diameter of the guide wire needs to be 0.32mm^2 or 22 AWG at the minimum and 3mm^2 or 12 AWG at the maximum.
- The advised stripping length of the guide wire is 7mm; please use the flathead screwdriver with a width of 1mm to 2.5mm for wiring purposes.
- Turn the cable connector marked 1 counterclockwise to release it. Insert the guide wire through the cable connector into the junction box and connect it to 2 and mark L+ and N- on the panel.
- L and N of an AC power product selected are not directional. Please connect the positive end of power of a DC product to L+ and the negative end to N-.

7.5 Relay



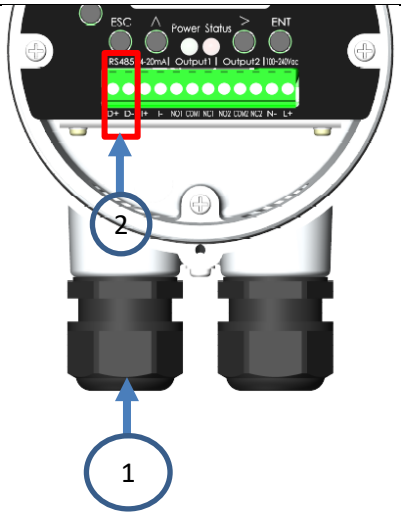
- The diameter of the guide wire needs to be 0.32mm^2 or 22 AWG at the minimum and 3mm^2 or 12 AWG at the maximum.
- The advised stripping length of the guide wire is 7mm; please use the flathead screwdriver with a width of 1mm to 2.5mm for wiring purposes.
- Turn the cable connector marked 1 counterclockwise to release it. Insert the guide wire through the cable connector into the junction box and connect it to 2; mark Output 1(NO1/COM1/NC1) and Output 2 (NO2/COM2/NC2) on the panel.
- Please choose to connect to COM-NO or COM-NC as needed. For the action status, refer to 9.1.

7.6 Analog Current Output



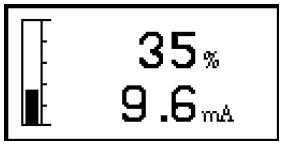
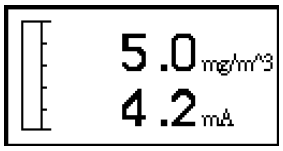
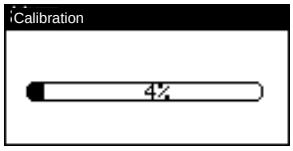
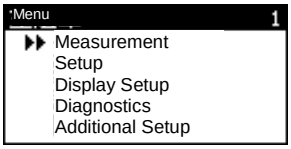
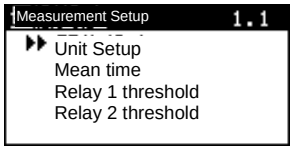
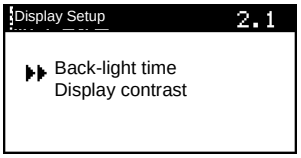
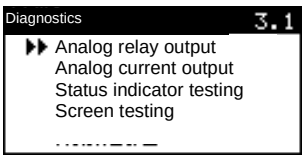
- The diameter of the guide wire needs to be 0.32mm^2 or 22 AWG at the minimum and 3mm^2 or 12 AWG at the maximum.
- The advised stripping length of the guide wire is 7mm; please use the flathead screwdriver with a width of 1mm to 2.5mm for wiring purposes.
- Turn the cable connector marked 1 counterclockwise to release it. Insert the guide wire through the cable connector into the junction box and connect it to 2; mark 4-20mA (I+/I-) on the panel and pay attention to the orientation of the wiring polarity.

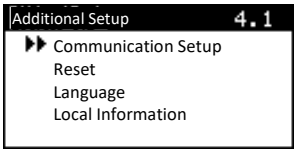
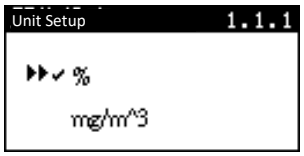
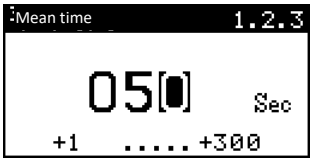
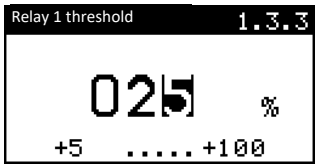
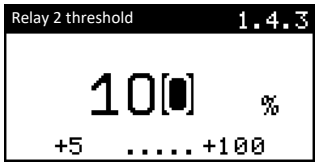
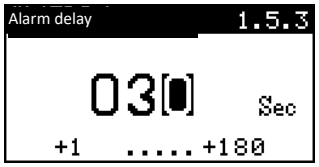
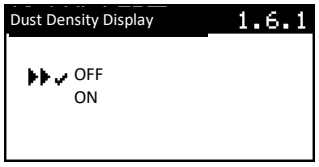
7.7 RS-485

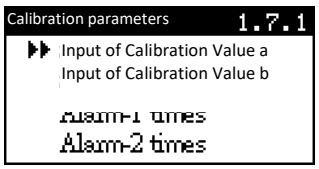
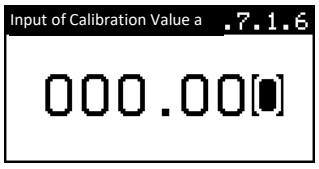
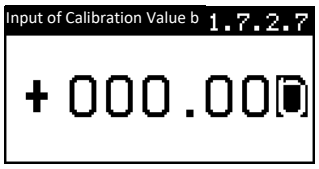
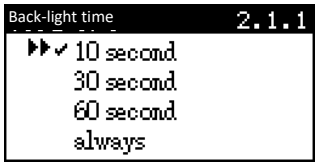
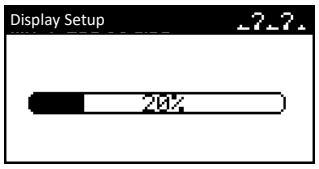


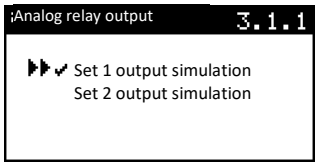
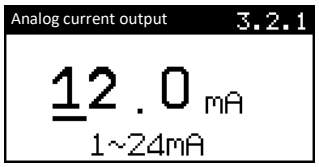
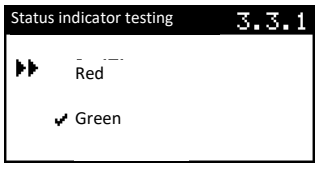
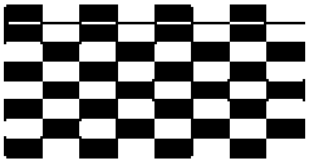
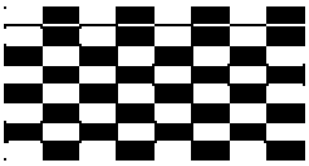
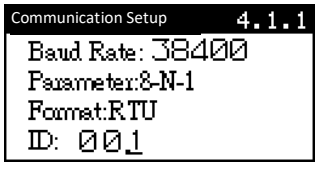
- The diameter of the guide wire needs to be 0.32mm^2 or 22 AWG at the minimum and 3mm^2 or 12 AWG at the maximum.
- The advised stripping length of the guide wire is 7mm; please use the flathead screwdriver with a width of 1mm to 2.5mm for wiring purposes.
- Turn the cable connector marked 1 counterclockwise to release it. Insert the guide wire through the cable connector into the junction box and connect it to 2; mark RS485 (D+/D-) on the panel and pay attention to orientation of the wiring polarity.

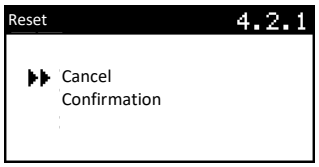
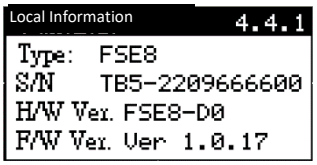
8. System Setup

LCM	Function
	Value (1) 1. The bar chart on the leftmost shows concentration in percentage, with the lower limit of 0% and upper limit of 100%. 2. 4-20mA real-time output results.
	Value (2) With the calibrated value entered to set the dust concentration shown as ON and unit as mg/m^3, the percentage originally displayed is changed to dust density.
	Once automatically calibrated, the calibration status will be shown.
	On the display, press ENT and Measurement Setup, Display Setup, Diagnostics and Additional Setup will appear.
	The Measurement Setup menu includes unit setup, mean time, Relay 1 threshold, Relay 2 threshold, alarm delay, dust density display, calibration parameter and filter.
	The menu of Display Setup includes back-light time and display contrast.
	The diagnostics menu includes simulation of relay output, simulation of current output, status indicator testing and screen testing.

	The Additional Setup menu includes communication setup, reset, language and local information.
	1. It shows the measurement unit. 2. To select the dust density unit mg/m^3, it is required to calibrate and then enter values a and b and set “Dust Density Display” as ON to allow selection. 3. The default is %.
	It measures the mean time of signaling, which can be set between 1 and 300 seconds. The default is 50 seconds.
	It sets the action point of Relay 1, which can be between 5% and 100%; it is impossible to set a value exceeding the Relay 2 threshold. The default is 25%.
	It sets the action point of Relay 2, which can be between 5% and 100%; it is impossible to set a value exceeding the Relay 1 threshold. The default is 100%.
	The alarm delay time of relay output; it can be set between 1 and 180 seconds. The default is 30 seconds.
	Values a and b need to be entered after calibration and then it can be set to be ON.

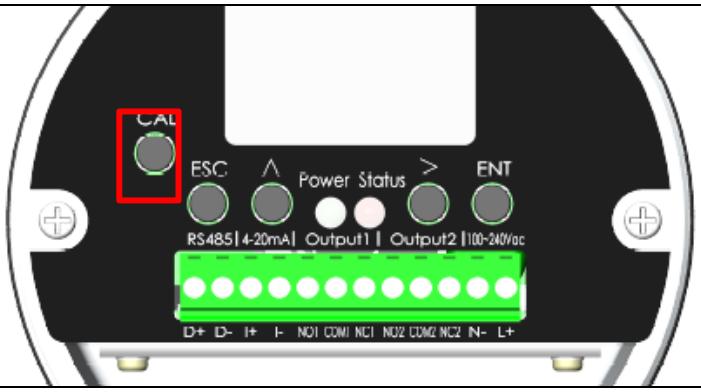
	The Calibration Parameter menu includes input of Calibration Value a, input of Calibration Value b, Alarm-1 times, and Alarm-2 times.
	For calibration, it is advised to apply the weighing method. FSE8 monitors the data through communication during the sampling period. Constants a and b are obtained with 2 points selected and introduced into the formula: y = ax + b, where y is the dust density from the weighing method and x is the corresponding data of FSE8 and Value a is entered.
	For calibration, it is advised to apply the weighing method. FSE8 monitors the data through communication during the sampling period. Constants a and b are obtained with 2 points selected and introduced into the formula: y = ax + b, where y is the dust density from the weighing method and x is the corresponding data of FSE8 and Value b is entered.
	Upon automatic calibration, FSE8 will have the criteria under normal operation of the pipeline as the baseline. Upon completion of calibration, 5 times the baseline will be Alarm-1, which is also the Relay 1 threshold.
	Upon automatic calibration, FSE8 will have the criteria under normal operation of the pipeline as the baseline. Upon completion of calibration, 20 times the baseline will be Alarm-2, which is also the Relay 2 threshold.
	The duration from on to off of back-light when any key is pressed. When “always” is selected, it means that back-light is never OFF.
	The smaller the value the less dense it is while the greater the value, the darker it is.

	Once on the screen, the 4-20mA output current is released according to the settings. When the settings are changed, it is required to press ENT and the output current will be identical to the settings. Only when ESC is pressed will one exit the screen. It restores once out of the screen. 1. Once on the screen, the relay (1/2) output is identical to what is set. 2. Press ENT to set up; those with “v” mean that output is activated. 3. Only when ESC is pressed will one exit the screen. It restores once out of the screen.
	1. Once on the screen, the 4-20mA output current is released according to the settings. 2. When the settings are changed, it is required to press ENT and the output current will be identical to the settings. 3. Only when ESC is pressed will one exit the screen. It restores once out of the screen.
	1. Once on the screen, the status LED output is identical to what is set. 2. Press ENT to set up; those with “v” mean that ON. 3. Only when ESC is pressed will one exit the screen. It restores once out of the screen.
	LCM test; black white black white...display.
	LCM test; white black white black...display.
	It shows the product communication interface parameters; only the ID may be set.

	Restore default settings
	Language
	There are Type, S/N, H/W Ver., F/W Ver.

8.1 Automatic Calibration

- During normal operations, the product will continuously monitor the dust density in airflows. During automatic calibration, the product will analyze current measurement signals and record the mean signal to be the measurement baseline.
- Automatic calibration allows setup of two alarm action points proportional to the baseline. Output 1 action point answers to Alarm-1 times and the default is baseline x 5; the post-calibration Relay 1 threshold is 25%. Output 2 action point answers to Alarm-2 times and the default is baseline x 20; the post-calibration Relay 2 threshold is 100%. When the dust density exceeds the set dust threshold, it triggers the alarm.
- Automatic calibration occurs under normal operating conditions once the product is installed and while equipment monitoring is ongoing.



- To perform automatic calibration, press and hold the CAL key for 5 seconds.
- During automatic calibration, the calibration status appears on the LCM and the status indicator blinks green.
- Please put on the junction box top within 30 seconds to prevent calibration from being affected by the surroundings.
- The status indicator turns green upon successful calibration and it can be used normally.
- The status indicator blinks red upon unsuccessful calibration and the display will show “Calibration Failed;” it is required to press any key to restore the product. The product settings will return to the pre-calibration ones automatically.
- Upon unsuccessful calibration, please check and confirm if it has been installed correctly or if the Alarm-2 times is too great or if the precipitation equipment in front of the pipeline is obsolete or dust collection has failed. The vibrating rod is on contact with the lining of the pipeline to result in short circuit, for example. Perform automatic calibration again once troubleshooting is done.

⚠ The variance in the wind speed inside the pipeline can be within ±10%. In case of any excess, please perform automatic calibration again.

8.2 Modbus RTU Setup

Connect RS-485 to master. The modbus RTU parameters are as follows. The default ID is 1. To put multiple sets in parallel, one can change ID settings between 1 and 127:

Baud rate	38400
Data bits	8
Stop bits	1
Parity	none

8.3 Display Setup

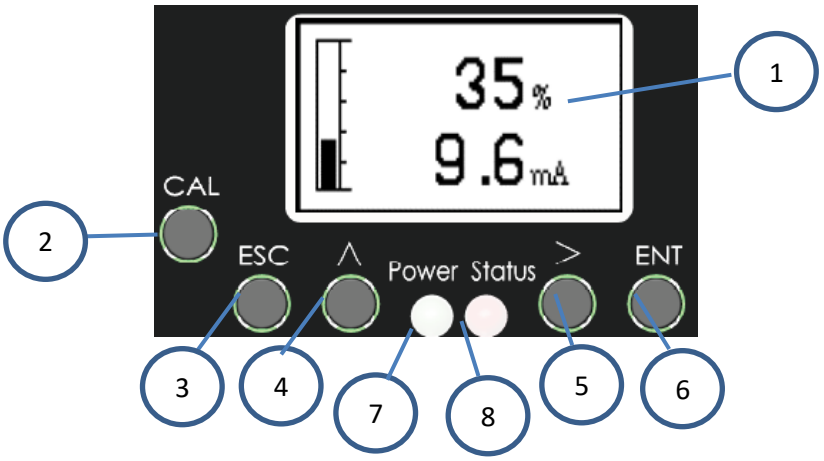
In Display Setup, one can set back-light time and display contrast:

- For general application, when any key is pressed, back-light turns on. Without any key pressed, back-light shuts down automatically in 10 seconds. It can be set up through the back-light time menu. There are 10 seconds (default), 30 seconds, 60 seconds, and “always”. “Always” means that back-light is constantly on.
- For the display contrast, one can set the contrast to be lighter or darker; the default is 20%.

8.4 Output Simulation Testing

Upon completion of wiring and prior to operations of the equipment or to qualify product display, output and wiring, one can apply the output simulation feature. Testing is done on the respective setup screens. The relay (output), analog current 4-20mA, status indicator and screen may be simulated, respectively.

9. Operations



1	The measurement value shows during normal monitoring. Parameters appear on the menu upon setup.
2	The automatic calibration key allows automatic calibration.
3	Previous or Cancel on the Parameter Setup screen.
4	Move Up or Change Value on the Parameter Setup screen.
5	Move Down or Move Cursor to Right on the Parameter Setup screen.
6	Enter Next Menu Screen or Store Parameters on the Parameter Setup screen.
7	Green Power Indicator.
8	Green and Red Status Indicators.

9.1 Display, Relay, LED Indicator and Analog Output Current Status

No.	Product Status	Display			Output		
		Status Indicator		LCM	Output 1	Output 2	4-20 mA
		Green LED	Red LED				
1	Normal Operations	ON	OFF	Value	COM1-NO1: closed COM1-NC1: open	COM2-NO2: closed COM2-NC2: open	Output reflective of the dust level
2	Alert (Alarm-1)	ON	ON	Value	COM1-NO1: open COM1-NC1: closed	COM2-NO2: closed COM2-NC2: open	Output reflective of the dust level
3	Alarm (Alarm-2)	OFF	ON	Value	COM1-NO1: open COM1-NC1: closed	COM2-NO2: open COM2-NC2: closed	Output reflective of the dust level
4	Automatic Calibration (CAL)	Blinking	OFF	Calibration status	COM1-NO1: closed COM1-NC1: open	COM2-NO2: open COM2-NC2: closed	> 22 mA
5	Abnormal	OFF	Blinking	Error message	COM1-NO1: open COM1-NC1: closed	COM2-NO2: open COM2-NC2: closed	> 22 mA

9.2 Unit Display

- Normally, the default is that the output current value and measurement percentage appear on the monitoring screen.
- To show dust density, please refer to the information provided on dust density and calibration. The measurement value is obtained on the basis of the measurement results. A common approach is weight sampling.

9.3 Mean time

During normal operations, the product will continuously monitor the dust density in airflows. Current measurement signals will be analyzed and the mean duration of signal analysis is the mean time. The default mean time of the product is 50 seconds. Signals are analyzed applying the moving average to measurement signals over a period of 50 seconds.

9.4 Alarm Output

By alarm output, it means Output 1 and Output 2 of the relay. When settings are greater than the threshold and it lasts longer than the duration set for alarm delay according to the Relay 1 threshold and Relay 2 threshold menus, it is triggered. The default alarm delay time is 30 seconds. Refer to the table below:

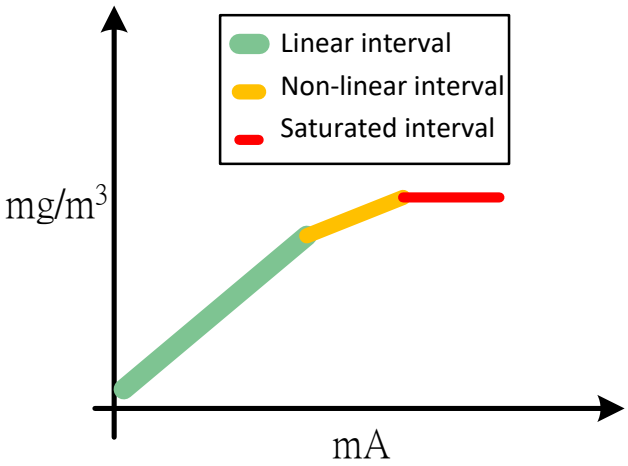
No.	Product Status	Action criteria	Output	
			Output 1	Output 2
1	Normal Operations	Measurement results < Relay 1 threshold Measurement results < Relay 2 threshold	COM1-NO1: closed COM1-NC1: open	COM2-NO2: closed COM2-NC2: open
2	Alert (alarm-1)	Measurement results ≥ Relay 1 threshold and lasting longer than the alarm delay time Measurement results < Relay 2 threshold	COM1-NO1: open COM1-NC1: closed	COM2-NO2: closed COM2-NC2: open
3	Alarm (alarm-2)	Measurement results ≥ Relay 1 threshold and lasting longer than the alarm delay time Measurement results ≥ Relay 2 threshold and lasting longer than the alarm delay time	COM1-NO1: open COM1-NC1: closed	COM2-NO2: open COM2-NC2: closed

9.5 Measurement range

- The product can measure the dust density range. As far as the standard dust adopted in a laboratory (talcum powder) is concerned, for example, the range is 0.1 ~ 1000 mg/m3. Different types of dust, particle sizes, gas flow rates or ambient humidities make a difference.
- The default Alarm-1 times and Alarm-2 times for automatic calibration of the product are 5 times and 20 times, respectively. If the post-automatic calibration baseline is 10 mg/m3 after sampling and weighing, the product alert (Alarm-1) is 50 mg/m3 and Alarm (Alarm-2) is 200 mg/m3.
- A product dust density range between 0.1 and 200 mg/m3 features linear changes.

9.6 Measurement range

- This product can show dust density (mg/m3). Formula-based calculations, however, need to take place with the linear interval (y = ax + b). The obtained a and b are entered into the product. Set Dust Density Display Setup as ON in order to select mg/m^3 for Unit Setup.
- Linear interval calculation y = ax + b, where y means dust density while x means output current. Weight sampling is often adopted for dust density. The output current is documented during the sampling period for the calculation.
- Values a and b that are actually obtained are entered as Calibration Value a and Calibration Value b in calibration parameters; please note that Value b can be positive or negative.
- As is shown in the figure below. For the correlation between the dust density and the output current of this product, the linear interval is usually 0.1 ~ 100 mg/m3.



Example:

- Normally, when the dust collection equipment is free of abnormalities, dust density inside the pipeline is minimal and nearly 0 mg/m3. If 4mA is obtained of the product, it means that the dust density inside the pipeline is close to 0 mg/m3. In reality, however, weight sampling-based measurement results are to be followed.
- Among the examples of sampling points shown in the table below, Sampling Point 1 and Sampling Point 2 are inside the pipeline of the product being measured while the output current is the outcome after corresponding weighing and sampling.

	Yi (mg/m^3)	Xi (mA)	Remarks
Sampling Point 1	2	4.8	When the dust collection equipment runs healthily under ordinary circumstances, 4mA means that the dust density is close to 0 mg/m^3.
Sampling Point 2	20	15	Results from weight sampling

Introduce results into the formula,

a = (Y2-Y1) / (X2-X1) = (20-2) / (15-4.8) = 1.7647 ≒ 1.765 (rounded up to the third decimal place)

b = Yi – aXi = 20 – (1.765 x 15) = -6.475 (rounded up to the third decimal place)

The formula to obtain the results: Yi = 1.765Xi - 6.475. As soon as the Dust Density Display is turned on, the obtained output current will be entered into the product formula to render the dust density.

10. Troubleshooting

No.	Product Status	Error code (Communication)	Display			Possible Cause	Solution
			Status Indicator		LCM		
			Green LED	Red LED			
1	Nothing appears	None	OFF	OFF	OFF	No power supply for the equipment	Check power wiring
						The connector is not plugged.	Please confirm if the terminal block is properly plugged.
						Power falls short of product specification requirements.	Confirm that power is supplied reflective of product specifications; if wiring is too long, pressure drop needs to be taken into consideration.
						Abnormal product	Please contact the local sales representative.
2	Abnormal LED or screen display	None	Works normally	Works normally	No screen or blackout	Screen contrast is set up incorrectly.	Please follow the operating procedure or re-set the contrast through the modbus.
						Abnormal LCM	Please contact the local sales representative.
			OFF	OFF	Works normally	Abnormal product	Please contact the local sales representative.
3	Failed key	None	Works normally	Works normally	Works normally	Abnormal product	Please contact the local sales representative.
4	Abnormal output	None	Works normally	Works normally	Works normally	Incorrect settings	Please test output in the Diagnostics mode first. When it is normal, perform calibration again.
						Abnormal product	Please contact the local sales representative.
5	Abnormal communication	None	Works normally	Works normally	Works normally	Incorrect settings	Please confirm Communication Setup parameters
						Wiring error	Please confirm wiring and pin polarity
						Abnormal product	Please contact the local sales representative.
6	Failed calibration	1	Works normally	Works normally	Works normally	Incorrect earthing	Check the grounding wire and make sure that the equipment is correctly grounded.
						Vibrating rod in contact with pipeline lining	Check and make sure that the vibrating rod is not in contact with pipeline lining.
						The vibrating rod needs to be maintained.	Remove the equipment and clean the vibrating rod applying the non-grinding approach and then put it back.
						Undesirable installation site	Please refer to the installation advice or contact the local sales representative.
7	Abnormal detection	4	OFF	Blinking	It shows abnormal detection.	Incorrect grounding	Check the grounding wire and make sure that the equipment is correctly grounded.
						Vibrating rod in contact with pipeline lining	Check and make sure that the vibrating rod is not in contact with pipeline lining.
						The vibrating rod needs to be maintained.	Remove the equipment and clean the vibrating rod applying the non-grinding approach and then put it back.
						Abnormal product	Please contact the local sales representative.

11. Maintenance

It is advised to clean the sensor end of the vibrating rod with a damp cloth once every 3 months to clean up dust that has built up on the rod.

12. Instructions for Use of Modbus

This product can be monitored remotely through RS-485 wiring. For communication, Modbus RTU is used. Upon completion of wiring, related settings are as follows:

Baud rate	38400
Data bits	8
Stop bits	1
Parity	none
Function code	03 Read Holding Registers (4X)
Data display	Little-Endian byte swap

The table below shows the parameters.

Name	**Address**		**Quantity**	**Coding**	**Explanation**
	HEX	DEC			
Firmware version	0x106E	4206	5	CHAR	Firmware version
S/N	0x107F	4223	6	CHAR	Product Serial No.
Mean time	0x10AC	4268	1	INT16	Mean signal moving time
Delay time	0x109E	4254	1	INT16	Relay output delay time
Measurement result (percentage)	0x1020	4128	2	FLOAT32	Measurement result percentage
Measurement signal value	0x103A	4154	2	INT32	Measurement signal value