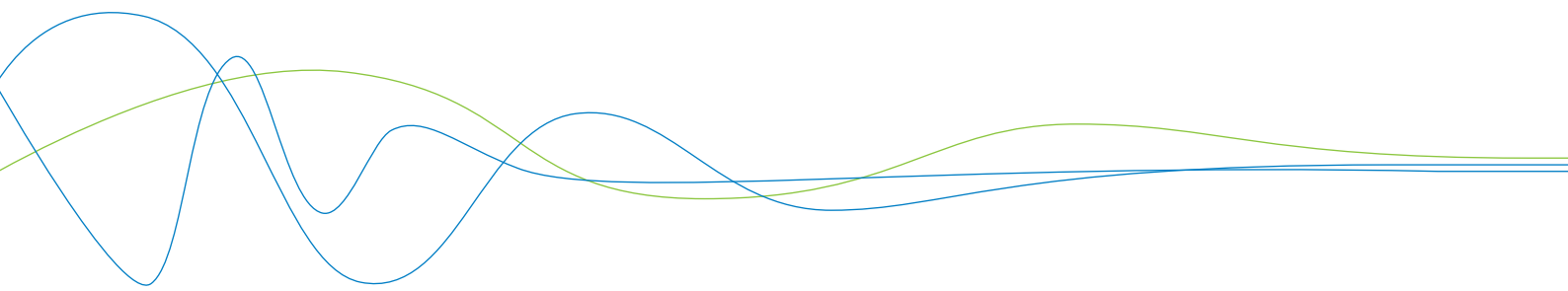
PCME DUST MONITOR 210

SENSOR MANUAL



PCME DUST MONITOR 210

Particulate Measurement System

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1 Introduction

Purpose of this Manual

This manual contains all information necessary for the correct installation, setup, operation, and maintenance of the instrument(s). *The procedures given in this manual must be carried out only by suitably trained and qualified personnel.*

Product Safety

The following symbols are used throughout this manual to indicate procedures that, if not followed correctly, may result in personal injury or damage to the equipment.

WARNING!

Warnings alert the user to a procedure or practice which, if not followed correctly, can result in personal injury or injury of others.

CAUTION!

Cautions alert the user to a procedure or practice which, if not followed correctly, can result in damage to the system or ancillary equipment.

NOTES are used to highlight important information that assists the user in carrying out a procedure or in understanding the text.

Danger from Process

It is possible that the sensor is installed in ducting that contains process particulate (and other flue gas constituents) hazardous to health. This may take one or more of the following forms:

- Particulate which is flammable or explosive;
- Particulate which is toxic or in some other way hazardous to health;
- Particulate contained within high-temperature gas.

Take Precautionary Measures

Unless the process conditions are known to be entirely safe, suitable precautions, such as the use of breathing apparatus or duct purging/ detoxifying, must be employed before entry is made into the duct for installation or maintenance purposes. If in doubt, consult your local Safety Officer and/or local safety procedures.

Safety Procedures

Always observe the following safety precautions. Personnel installing, operating, or maintaining the equipment are responsible for their personal safety, and for the correct handling and use of the equipment in accordance with the safety procedures detailed in this manual.

Follow all warnings and instructions marked on the product and in this manual. These safety instructions must be followed to avoid possible personal injury, injury to others, and damage to the product. If the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

Retain these instructions in a safe and known place for future use.

WARNING!

Risk of personal injury or injury to others. All personnel must be fully trained and adhere to local and, where applicable, site-specific health and safety laws and guidelines.

It is the responsibility of the local organizations to enforce safe working practices at all times.

WARNING! – ELECTRIC SHOCK

Only connect to an earthed supply. This unit is a Class 1 construction and must be connected to a Protective Earth connection (US: GND).

WARNING! – ELECTRIC SHOCK

This product must be connected to a power supply of the same voltage (V) and frequency (Hz) as indicated on the product rating plate and provided in the TECHNICAL DATA section of this manual.

A supply cable with adequate rating must be used. Temperature de-rating must be considered.

WARNING! – ELECTRIC SHOCK

A suitable approved and rated mains isolation device must be installed. The device must be clearly marked and easily accessible (within a 2m/6½ft. radius) to allow the control unit to be switched off when at the unit.

The contact gap of the disconnect device must be at least 3mm.

CAUTION!

Position the equipment to avoid excessive heat, vibration, humidity, and dust.

CAUTION!

No user-replaceable parts inside!

Failure to service or maintain the product, fitting non-approved parts, or carrying out non-approved alterations or servicing can be dangerous and could affect the safety of the product. It may also invalidate the terms and conditions of the product warranty.

Limits of Use

To achieve optimum performance and safe operation the equipment must be operated within the limits detailed in the TECHNICAL DATA section of this manual. Operation outside these limits can result in damage to the equipment or failure to achieve the performance specified.

Pollution Degree 2

This equipment is designed for operation in Pollution Degree 2 environments (non-conductive, transient pollution where occasionally a temporary conductivity caused by condensation must be expected).

Overvoltage Category II

Overvoltage protection for CATII equipment or instruments intended to be supplied for wiring (applicable to both plug-connected and permanently connected equipment).

Additional Information

Product Serial Numbers

Record the product serial numbers of your instruments for future reference. The serial number labels can be found on the right-hand side of the sensor and the control unit enclosures. The instruments' serial numbers are also provided on the corresponding Test Record Card.

Related Documentation

The following product literature may be consulted in conjunction with this manual as applicable. A *Reference Library* with supporting information for your product or system is included with the product documentation.

- TN004 Installation Notes (PCME Technical Note, PPN: 491021)
- TN007 Network Cable Lengths (PCME Technical Note, PPN: 401033)

IMPORTANT NOTE:

For the ATEX/IECEx compliant version of this instrument, consult the Mk5 Ex Addendum (PPN: 460005).

Product Parts and Options

For details of product options, software, accessories, spares, and upgrade options for your instrument, please refer to the PCME DUST MONITOR 210 datasheet and order information available on request and for download from the ENVEA website (see the reverse of this manual).

Certification

ENVEA UK Ltd. hereby declares that this instrument complies – within the limits specified in this manual – with the essential requirements and other provisions of the following European Union Directives: Low Voltage Directive (LVD) and EMC Directive.

For details refer to the Declaration of Conformance for this instrument or system (available from ENVEA or your local ENVEA representative on request).

2 Product Description

2.1 Overview

The instrument is designed for use as a standalone sensor. It has various outputs for connection to plant CEM systems. There is no logging capability in the instrument.

2.2 Technical Data

Stack temperature range[A]	-20 to 250 °C (-4 to 480 °F) Option: up to 400 °C (750 °F)
Application conditions	Suitable for measurement in non-condensing flue gases. **Note**: not suitable for use downstream of ESPs or in applications with water droplets.
Minimum detection level	<0.1 mg/m³
Measurement range	up to 500 mg/m³
Scaling method	• Scaling Factor (standard) • Option: Percentage % of 4-20 mA output
Ambient temperature [A]	-20 to 50 °C (-4 to 120 °F)

2.3 Sensor Specification

PCME DUST MONITOR 210 Sensor	
Sensor variants	• Standard sensor: 0–250 °C • Insulated sensor: 0–250 °C (non-Ex only) • High-temperature sensor: 0–400 °C
Enclosure rating	IP65 (with hinged lid closed)
Outputs	• 4-20 mA output (isolated, 500 Ω) • Fault alarm relay (SPST 1A@24V DC), fail safe • Option: RS-232 output or RS-485 output (Modbus)[B]
Inputs	Plant stop signal (output to zero when plant is off)
Power requirements	• 115–240V AC, 50/60Hz, 32mA • Option: 24V DC, 300 mA (from a local source)
Cable entries	3 x M20 cable glands
Stack connection	1.5″ BSP
Air purge requirements	May be required on some applications. External supply of 5–10 litres/min of dry, clean (oil-free) instrument air, depending on dust loading.
User setup	4 x Setup keys (internal keypad)
External indicators	2 x LEDs (for power and fault alarms)

[A] *At monitoring point. Please note that imperial temperatures given are nominal values.*

[B] *Output options are exclusive; the RS-485 is required for use with the optional Filter Display Module.*

2.3.1 Sensor Options

Quality Assurance	• Electronic Drift checks (manual or automatic) • Short-circuit check
Air purge fittings (ACCAIR)	• Standard or insulated rod air purge fitting (¼″ BSP) • Air Filter and Regulator assembly (-FFR) • Advanced pre/post-Filter Regulator assembly + Flow Regulator (-FFRC)
Rod lengths	Standard lengths: 100, 200, 300, 400, or 500 mm Optional: • Standard sensor: 600, 800, 1000 mm • Insulated sensor: 200 – 1000 mm (non-Ex only) • High-temperature sensor: 600 or 800 mm
Additional options	• RS-232 external lead & connector (fly lead; non-Ex only) • Bag Pulse Module (BPM, graphical display of dust levels) • Remote setup via PC software tool (see below)
Hazardous zones classification	ATEX zone 20/21 (Cat. 1/2D) or zone 22 (Cat. 3). *Refer to the appropriate Ex addendum. Refer to page 7 for more information.*

2.3.2 Cabling

For mains connections – cabling should be rated for use up to +65 °C (150 °F) at least to allow for an ambient temperature of up to +50 °C (120 °F). Consult PCME Technical Note TN007 Network Cable Lengths for information on sensor cabling requirements and considerations (see page 7). Cables supplied by ENVEA meet these requirements.

Maximum cable lengths	• RS-232: 15 m (50 ft.) • RS-485: 1,000 m (0.6 mi / 3,300 ft.)

2.3.3 PC Software (PC-ME DUST TOOLS)

The minimum system specification and requirements (for desktop/laptop PCs) are set out in the following table. The availability of software modules depends upon the type of sensor, for more information see PRODUCT PARTS AND OPTIONS on page 7.

Operating system	Windows XP or higher
System memory	32 Mb RAM 20 Mb free hard disk space
Monitor	1024 x 768 pixels, high-color graphics
Data communications	Serial port (for connection to one or more instruments)
Optical disc drive (DVD/CD)	PC-ME DUST TOOLS software is supplied on a software CD and is also available for download from the ENVEA UK website (www.enveauk.global/software).
Licensing	Multi-user license options (for up to 5 or up to 10 users)

3 Sensor Installation

This chapter provides information on unpacking, installing, and setting up the instrument. It also includes information on requirements and safety guidelines.

3.1 Unpacking and Storage

Remove all transit packaging. Inspect the sensor for signs of damage. If it is damaged, contact ENVEA immediately. If the equipment is to be stored prior to installation, then repack it in the original transit packaging and store in a dry environment.

No responsibility for damage arising from the use of non-approved packaging will be accepted.

NOTE: Ensure all items and accessories specified are present. If not, contact ENVEA or your local ENVEA representative (see the reverse of this manual).

3.2 Prerequisites and Guidelines

3.2.1 Location Requirements

When selecting a mounting location for the sensor the following should be taken into consideration for optimum performance:

- In the longest, straightest, unrestricted section of ductwork available.
- In metallic ductwork (for non-metallic ductwork contact ENVEA).
- Away from ambient or radiated temperatures greater than +50 °C (120 °F).
- Where possible, the equipment should be mounted out of direct sunlight, precipitation, and away from running water.

3.2.2 Cabling Guidelines

WARNING! – TRIPPING HAZARD

Ensure all cables are routed safely to avoid tripping or entangling hazards, and to avoid kinks and pinches.

Cables should be fixed such that they are free from excessive vibration and not under strain. Cables should be secured in accordance with good engineering practice (e.g. using cable trays where possible) and careful consideration should be given to the positioning of cables so that they are not damaged easily.

Cables should be routed to avoid sources of large electromagnetic fields, such as heavy switching gear. Care taken during the installation of the cables ensures a long, maintenance-free life and avoids possible damage to the control unit and sensor.

In summary, the cabling should be installed such that:

- Heavy vibration is minimized to prevent fatigue and failure.
- It is not vulnerable to accidental damage.
- It is away from sources of large electromagnetic fields (if possible).

Refer to the general Installation Guide, PCME Technical Note TN004, for more details (see RELATED DOCUMENTATION on page 7).

3.2.3 Grounding the Sensor

For *ElectroDynamic*® sensors it is essential the sensor body is grounded to the stack wall. In addition, poorly grounded sensors may pick up external noise producing false high readings. Ensure the installation complies with the following requirements:

- The sensor may only be fitted to a metal duct or stack.[C]
- The grounding strap (or Earth wire) provided may be connected to ensure the sensor body is securely grounded to the metallic stack wall. The sensor is electrically grounded to the ductwork by the mechanical connection made between the sensor and the socket, and by the external grounding strap.
- If required, connect the grounding strap between the sensor enclosure and the stack wall leaving sufficient length so that the sensor can be removed and placed on the ground or platform for maintenance.

3.3 Installing and Connecting the Sensor

3.4 Safety Information

WARNING! – DANGER FROM PROCESS

It is possible that the sensors are to be installed in ducting containing process particulate that is a hazard to health.

Unless the process conditions are known to be entirely safe, suitable pre-cautions such as the use of breathing apparatus or duct purging/detoxifying must be employed before any entry is made into the duct for installation or maintenance purposes.

If in doubt, consult your local Safety Officer and/or local safety procedures.

WARNING! – ELECTRIC SHOCK

(1) Ensure that only suitable and rated cables types are used for power supply and interconnection of equipment.

(2) *Mains-powered versions only* – when wiring the mains cable, ensure that the Protective Earth wire (GND) is the longest one, so that if the cable is pulled out accidentally, the Earth wire disconnects last.

WARNING! – ELECTRIC SHOCK

For mains-powered versions – a suitable approved and rated two-pole mains isolation device must be clearly marked and installed close to the unit (within a 2 m/6½ ft. radius) and readily accessible.

CAUTION! – PROBE DAMAGE

Take care when handling the sensor to avoid bending or damaging the probe. Probe damage may result in inaccurate measurements.

CAUTION!

Do NOT try to rotate the sensor by turning its enclosure as this can damage the sensor.

[C] *If the stack is not metallic or you are concerned that the stack may not provide a suitably earthed shield for the sensor, please contact ENVEA UK.*

3.4.1 Mounting the Sensor

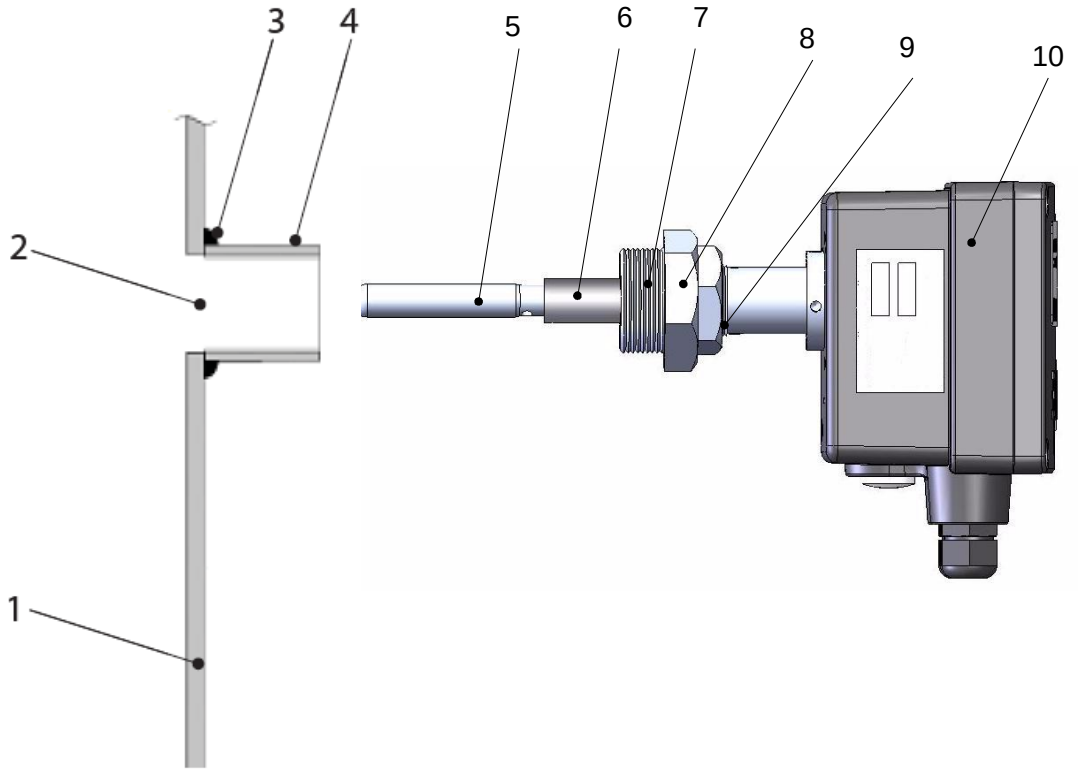

Figure 1: Fitting the sensor to the stack

1 ..... Stack wall
2 ..... Stack wall opening/port hole for probe (at least ∅45 mm)
3 ..... Weld all round
4 ..... 1.5″ BSP socket
5 ..... Probe rod
6 ..... Insulator
7 ..... 1.5″ BSP thread
8 ..... Floating nut
9 ..... Lock nut
10 ..... Sensor enclosure

1. Drill a hole with an ID of at least ∅45 mm in the stack/duct where the sensor is to be located.
2. Fit a 1.5″ BSP socket, which must be securely welded to the stack. Ensure the BSP socket is 90° to the stack or about 5° upward, so the sensor probe points downwards allowing condensate to drain off into the stack.
3. Insert the sensor probe into the socket and secure with the floating nut. Ensure the sensor enclosure is upright with the cable entry glands at the bottom and is adequately supported when tightening the floating nut.
4. Tighten the lock nut. When tightening the lock nut ensure the floating nut is held securely with a wrench.

3.5 Connecting the Sensor

3.5.1 Sensor Connections

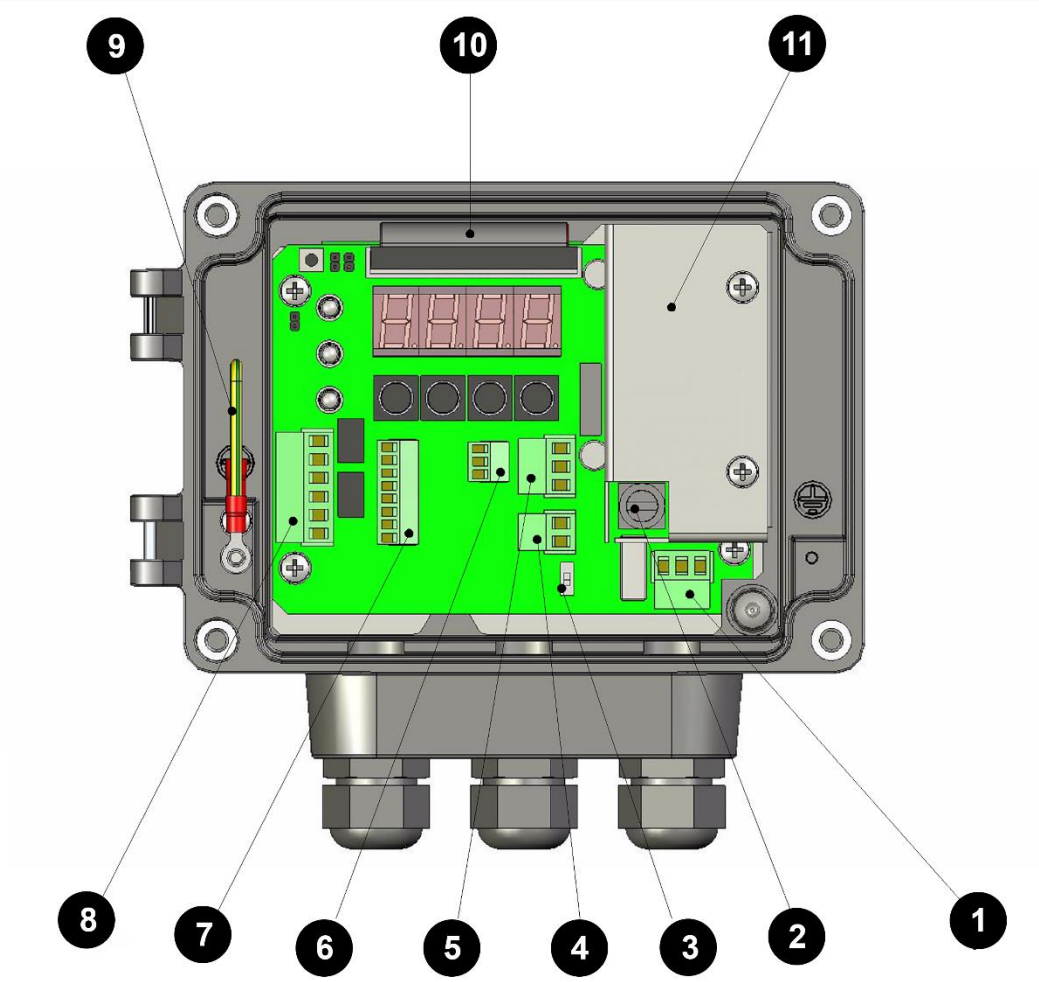

Figure 2: Sensor PCB connections

1 .....Power IN (AC or 24V DC)
2 ..... Fuse holder (mains fuse)
3 ..... Bus termination switch (set to T/terminated)
4 .....4-20 mA output
5 .....*not in use*
6 .....RS-232 connector/port
7 ..... *do not use*
8 .....Fault relay (Relay 1)
9 .....Lid earthing strap *(do not remove)*
10 ..... Connection to CPU board *(do not remove)*
11 .....Power supply/PSU cover *(do not remove)*

3.5.2 Connecting the Sensor Power Supply

WARNING!

Ensure the cabling is not connected to control unit power during wiring.

WARNING! – ELECTRIC SHOCK (MAINS VERSIONS)

This equipment contains lethal voltages!

Do not reverse Live (L) and Neutral (N) – the neutral line is not fused!

Hazardous voltages are still present when the main power supply fuse has failed!

WARNING! – ELECTRIC SHOCK

Ensure that only the cables types specified are used for powering and interconnection of equipment.

All colour references are based on standard ENVEA cables supplied.

The instrument is available in two versions: a mains voltage (AC) version and a 24V DC version. The label on the PSU cover indicates, which model it is. Also, the markings on the power connector indicate the voltage required.

Connect only to a power supply with a voltage corresponding to that on the rating plate.

Connecting the Cables

Easily accessible disconnect devices, such as switches or circuit breakers along with a separate fuse, must be fitted to the power supply wiring for mains-powered sensors and the purge blower unit, if present. These must be located so they can be reached easily (within 2 m / 6½ ft. of the unit).

The isolation devices should connect/disconnect both mains Live (L) and mains Neutral (N) and must be clearly marked as the disconnecting device for the instrument.

3.5.3 Wiring the Mains Power Supply

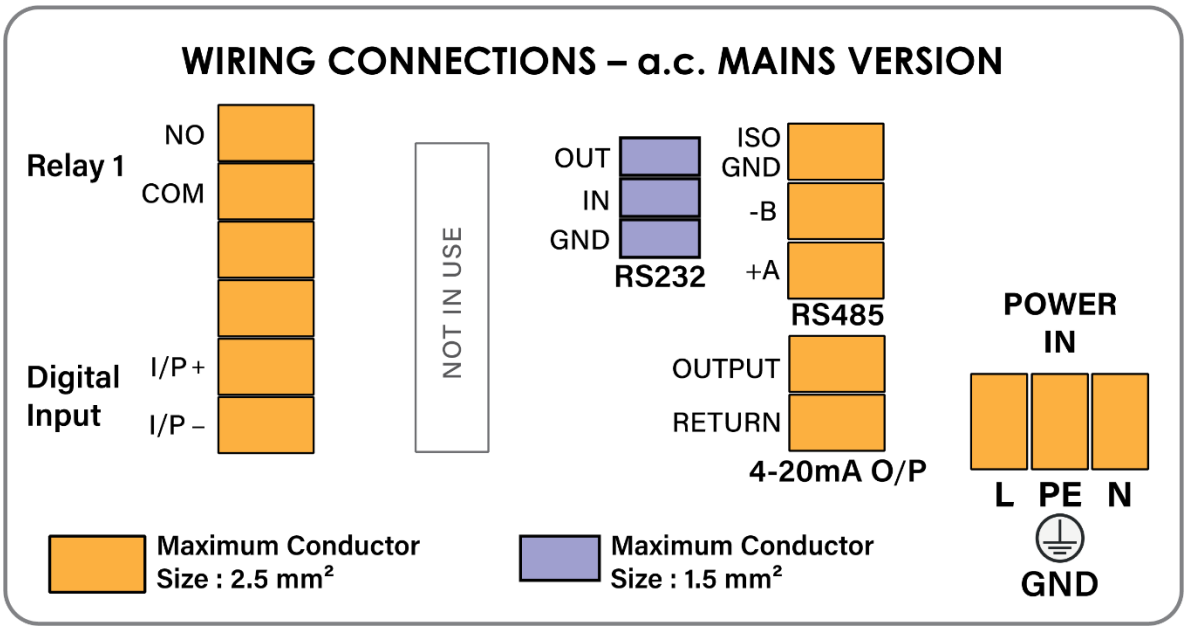

Figure 3: Sensor wiring label – AC versions (inside enclosure lid)

1. Undo the 4 off screws and open the hinged sensor enclosure lid.
2. Note the label on the PSU cover (see FIGURE 4 below).
3. Referring to FIGURE 3 above, undo the 2 off screws and remove the PSU cover.

Mains pin connections (L–R):	
L	Live
PE ⏚	Protective Earth (GND)
N	Neutral

4. Route the power supply cable through the right-hand cable gland and connect to the mains power terminals as outlined in the following table.
5. Replace and secure the power supply cover.
6. Close the enclosure lid and secure with the 4 off screws. *Do not over-tighten.*
7. Switch ON power to the sensor.

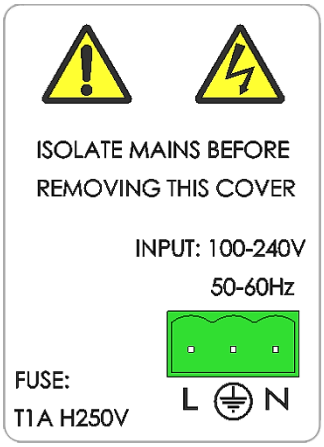

Figure 4: Power supply label (mains)

3.5.4 Wiring the 24V DC Supply

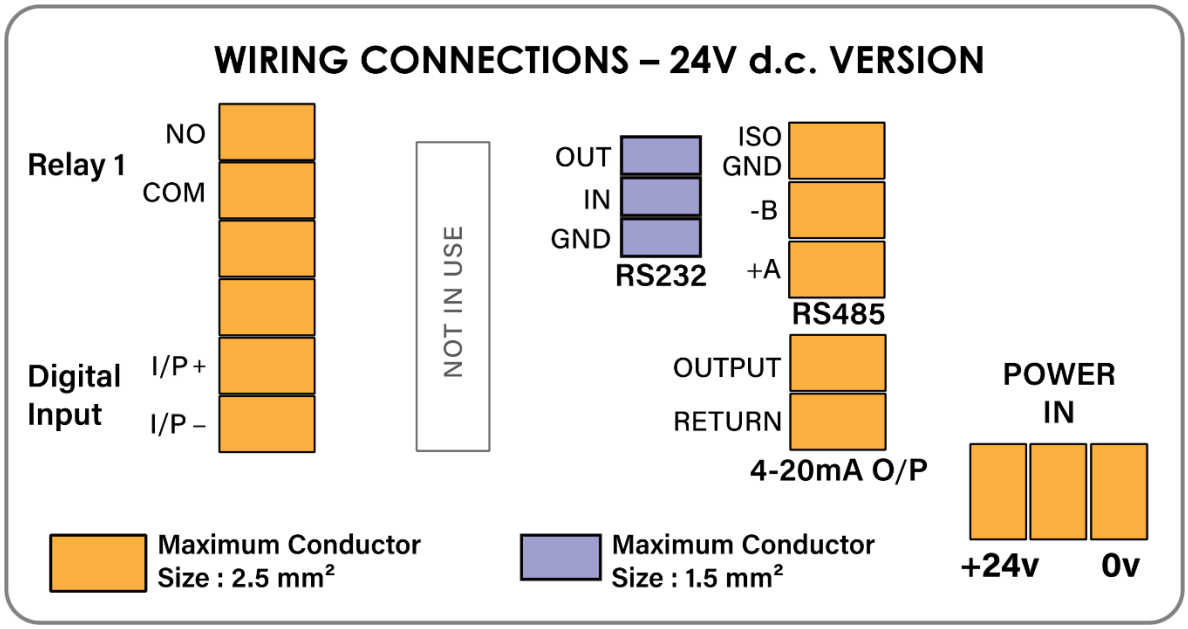

Figure 5: Sensor wiring label – 24V versions (inside enclosure lid)

1. Undo the 4 off screws and open the hinged sensor enclosure lid.
2. Undo the 2 off screws and remove the power supply cover.
3. Route the data cable through the right-hand cable gland and connect to the power supply terminals (POWER IN) as marked on the PCB.

Pin connections (L–R):			
		Wire colour	**POWER IN connector**
+24v	24V DC		
NC	*not connected*		
0v	0V		

4. Replace and secure the power supply cover.
5. Close the enclosure lid and secure with the 4 off screws. *Do not over-tighten.*
6. Switch ON power to the sensor.

4 User Controls and Menu Selection

4.1 Overview of Internal Controls

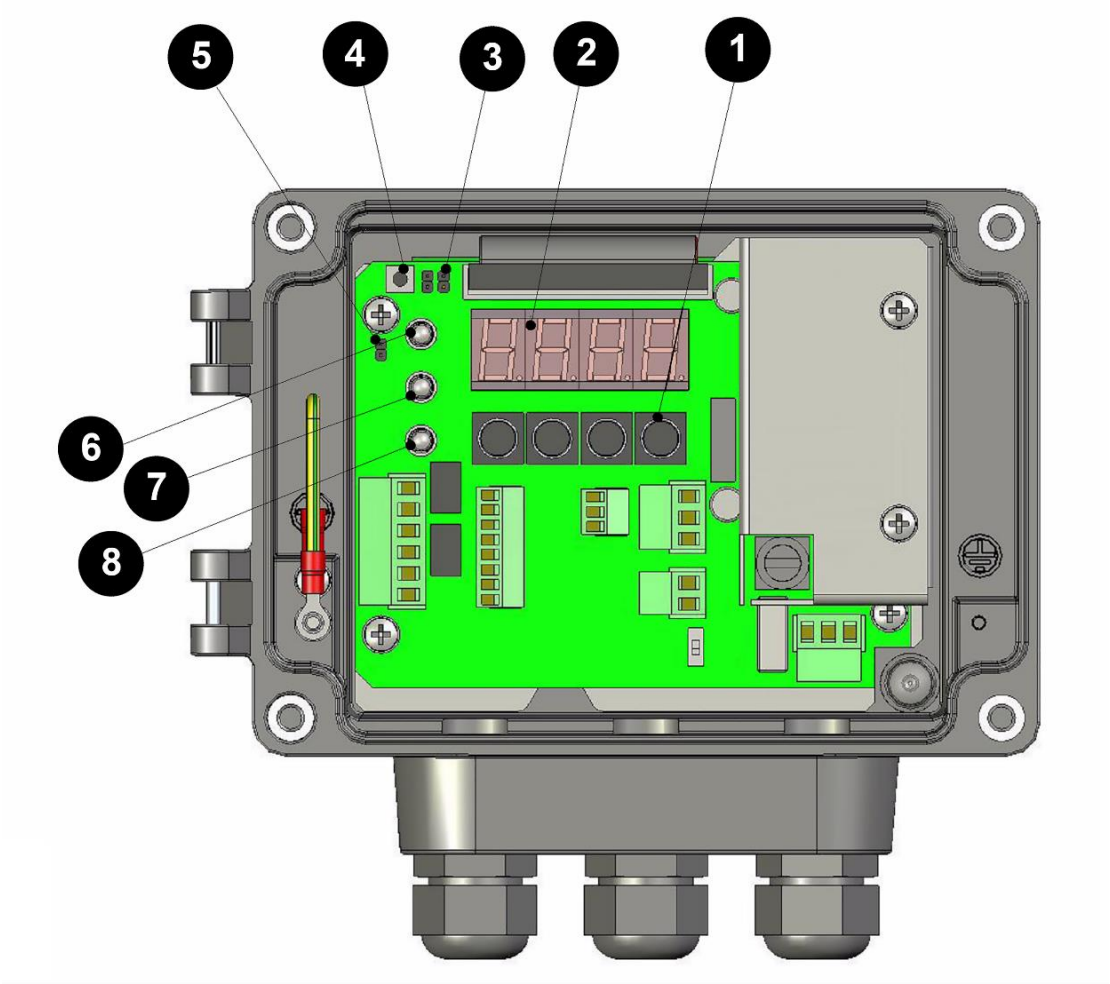

Figure 6: Internal sensor controls

1 ..... Navigation buttons (LEFT, DOWN, UP, RIGHT)
2 .....Four-digit LED display
3 ..... Menu selection (with jumper) [D]
4 .....Reset button
5 .....Firmware upgrade link LK2 [E]
6 ..... Power/status LED
7 .....*not in use*
8 ..... Self-check LED

[D] *LK4 (fitted right) = Standard menu, LK3 (fitted left) = Engineering menu*

[E] *Leave jumper fitted except during firmware upgrades.*

4.2 Navigation and Basic Functionality

The sensor settings are organised into a list of menu headings.

- **Navigation**: use the UP and DOWN keys to scroll between menu headings. Use the RIGHT button to view or edit the settings associated with each menu heading and the LEFT button to return to the previous setting.
- The **first menu heading** contains all the readings available for the instrument: the dust reading and the sensor self-check results.
- **Return to the top of the menu** at any time to view the dust reading by pressing the RESET button at the top left of the display.
- If a **password** has been set, then to edit settings you must first go down to the Password menu and enter this (see below for details).

4.2.1 Accessing Menus and Menu Options

1. Press the **RESET** button at the top left of the display: this returns you to the current dust reading.
2. Press LEFT to display the **DUST** reading (main menu; see also the menu maps at the start of CHAPTERS 5 and 6).
3. Press DOWN to scroll through the menu headings. The menu is circular, pressing DOWN from the **RUN.T** menu returns you to the DUST menu.
4. Press RIGHT repeatedly to view the current settings associated with that menu heading. Press LEFT to return to the previous setting.

NOTE: Additional settings are available in the Engineering menu (move the jumper from LK4 to LK3 and press the RESET button to access this). For more information on menu levels and functions see CHAPTER 6 on page 24.

4.2.2 Changing a Setting

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN and press RIGHT to access the required menu settings.
3. In adjusting mode, the first, left-hand digit of the numerical value will flash.
4. Use the UP and DOWN keys to alter the numerical value. Press LEFT/RIGHT to move between digits. Having entered the last digit, press RIGHT again to accept the value. The number will flash momentarily then the accepted value will be displayed solid.
5. Press LEFT/RIGHT to move onto the next menu item or to get back to the menu heading, so you can scroll to other menu headings.

5 Instrument Settings: Standard Menu

5.1 Standard Menus – Scaling Options

Refer to the TECHNICAL DATA section on page 8 for information on scaling options for your instrument.

5.1.1 Option 1 – Scaling Factor (standard)

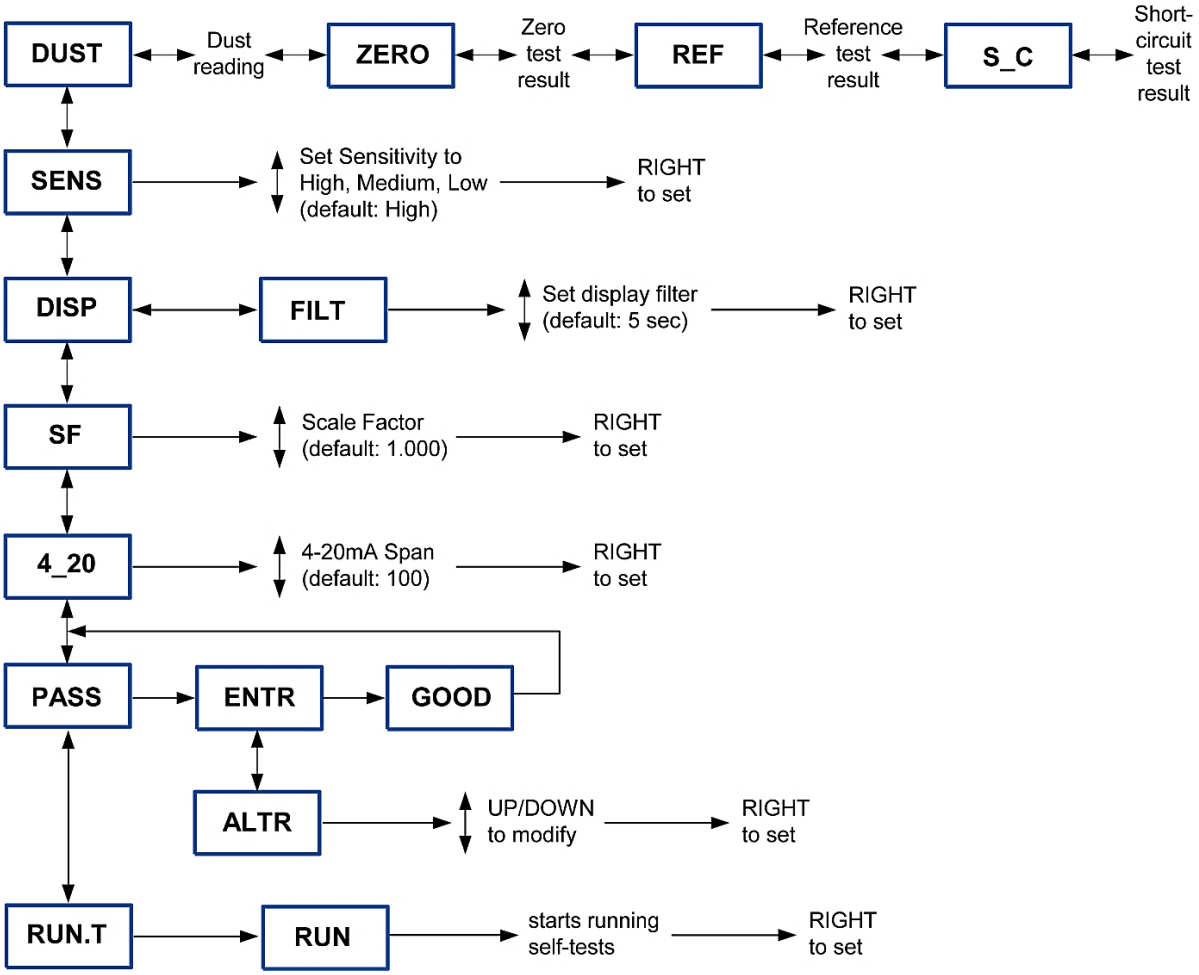

Figure 7: Scaling option 1 – Scaling Factor (standard)

Menu	Meaning	Description
DUST		Displays dust emissions and self-check readings
SENS	Sensitivity	Adjust the instrument sensitivity
DISP	Display Smoothing	Adjust the filter for smoothing the reading on the display
SF	Scaling Factor	Adjust the scaling factor applied to the dust reading
4_20	4-20mA Output	Adjust the span of the 4-20 mA output
PASS	Password	Enter a password to allow adjustment of settings
RUN.T	Run self-tests	Manually activate the self-tests

5.1.2 Option 2 – Percentage % of 4-20mA

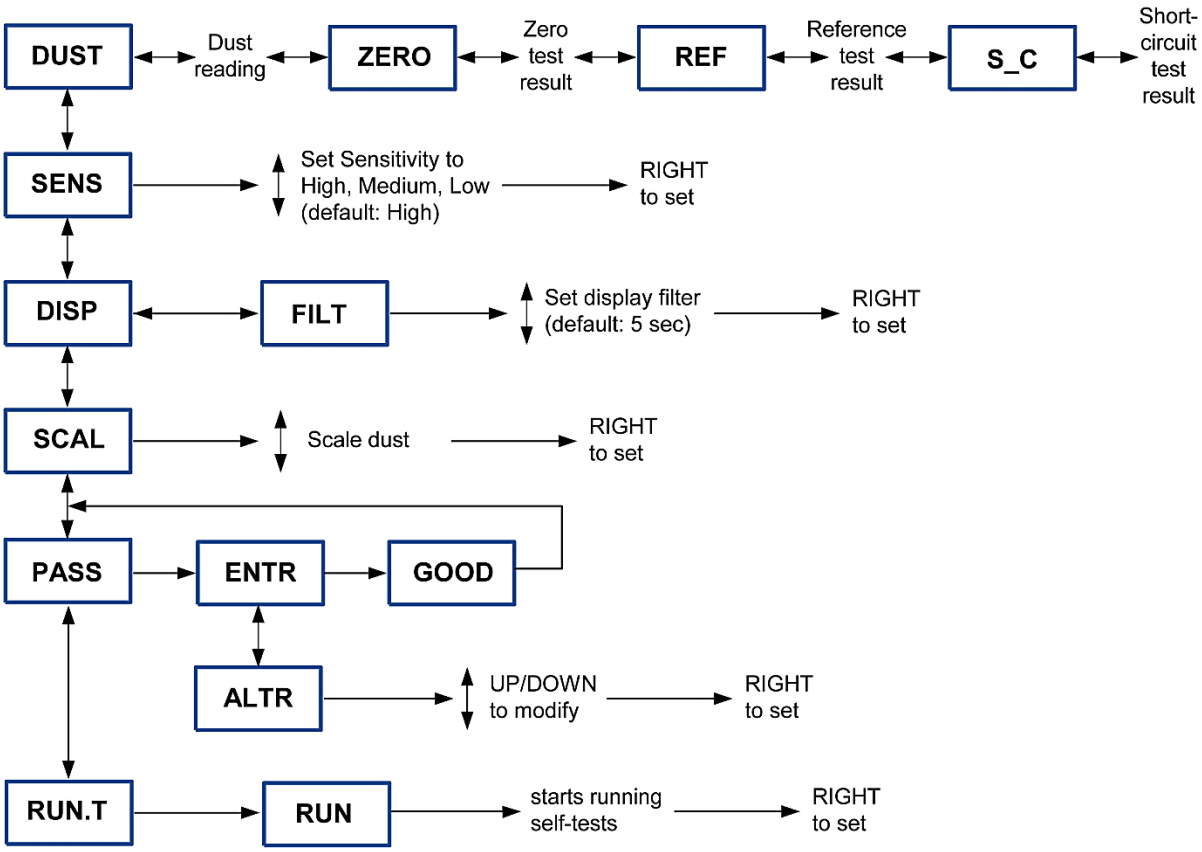

Figure 8: Scaling option 2 – Percentage % of 4-20 mA

Menu	Meaning	Description
DUST		Displays dust emissions and self-check readings
SENS	Sensitivity	Adjust the instrument sensitivity
DISP	Display Smoothing	Adjust the filter for smoothing the reading on the display
SCAL	Scaling	Adjust the scaling of the dust reading
PASS	Password	Enter a password to allow adjustment of settings
RUN.T	Run self-tests	Manually activate the self-tests

5.2 Entering or Changing the Password [PASS]

If a password has been set, this must be entered before values can be changed. Note that the factory default password is **0000**.

1. Scroll DOWN to the **PASS** (Password) menu heading.
2. Press RIGHT: display shows **ENTR** (Enter). Press RIGHT again: the left-hand digit will start to flash.
3. Use the UP/DOWN keys to enter each digit in turn from left to right. Press RIGHT to move from one digit to the next.
4. After you have entered the 4th digit, press RIGHT again.
   a. If you have entered an invalid password, the display will show **BAD**. Press RIGHT to re-enter your password.

b. If you have entered the correct password, the display will show **GOOD**. Press RIGHT. You will then be given the option to alter the current password (display shows **ALTR**). Press RIGHT then enter a new password if required (otherwise just keep pressing RIGHT to leave the password unchanged).

5.3 Sensitivity [SENS]

NOTE: The sensor sensitivity should be set before attempting to scale the instrument. If the sensitivity is adjusted at a later stage, the instrument must be re-scaled.

The sensor has three sensitivities: High (default), Medium and Low. The first step to setting up the sensor is to set the instrument to a sensible sensitivity level. The recommended procedure is to install the sensor and note the reading under normal operating conditions.

- **HIGH sensitivity** (default) – if the reading before scaling is between 0 and 100, leave on High sensitivity;
- **MEDIUM / LOW sensitivity** – if the reading before scaling is >100, reduce to Medium or Low sensitivity.

5.4 Display Smoothing [DISP]

The display smoothing function allows a rapidly fluctuating dust reading to be 'smoothed out', thus providing a more stable displayed value. The filter used is a *walking window* filter. Smoothing applied to the display is also used to calculate alarm conditions for the alarm relays. The 4-20 mA output is smoothed independently via the 4-20 mA Settings menu.

5.4.1 Changing the Display Smoothing Filter

1. Enter the password, if required (see SECTION 5.2 above).
2. Scroll DOWN to the **DISP** menu heading.
3. Press RIGHT: display shows **FILT**.
4. Press RIGHT again: display shows the filter time in seconds (default: 0005 = 5 s).
5. Adjust the value then press RIGHT to return to **DISP**.

NOTE on the range of allowed values –

FILTER: this is an integer value. Allows values between 1 and 9999 secs.

5.5 Scaling Methods

5.5.1 Scaling method 1 – Setting a Scaling Factor [SF]

The Scaling Factor [SF] is used to scale the raw dust reading to provide a mg/m³ reading within the instrument (see SECTION 5.1.1 on page 19 for the menu map). Alternatively, you may output the raw dust reading to your own system (using analogue or Modbus outputs), then calibrate the reading within your system.

The SF scales the raw reading as follows:

```
Dust reading (mg/m³) = Raw instrument reading x SF
```

The Scaling Factor [SF] is applied to the displayed reading. This is then used by analogue (4-20 mA) outputs.

Adjusting the Scaling Factor [SF]

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the **SF** menu heading.
3. Press RIGHT: display shows the current scaling factor (default: 1.000)
4. Adjust each digit value using the UP/DOWN keys, then press RIGHT to move to the next digit.
5. After editing the 4th digit press RIGHT again: the decimal point will flash. Now use UP/DOWN to adjust the position of the decimal point.
6. Press RIGHT to return to the **SF** menu heading.

NOTE on the range of allowed values:

The default SF is 1.000. The range of allowed values is 0.001 to 9999.

5.5.2 4-20mA Span [4_20] (Scaling method 1 only)

The 4-20 mA settings menu allows the span of the 4-20 mA outputs to be set. The **Span** value sets the relationship between the reading on the display and the current output from the 4-20 mA.

For example, if the Span value is set to **100.0** (default), then a display reading of '100.0' will output 20 mA. Display values >100.0 will be clipped at 20 mA. A reading of '0.000' will always output a value of 4mA.

Adjusting the 4-20 mA Settings

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the **4_20** menu heading.
3. Press RIGHT: display shows the span value (default 100.0)
4. Adjust the value then press RIGHT to return to the main menu heading.

NOTE on the range of allowed values:

SPAN: the decimal point is fixed after the 3rd digit. This allows values from 000.1 to 999.9. The 4-20 mA output has an independent filter (default: 5 s). See below on how to change this.

The 4-20 mA output has an independent filter (the FLTR menu). To change this, refer to the Engineering menu chapter (see page 24 ff.) for details and instructions.

5.5.3 Scaling method 2 – Scaling to % of 4-20 mA Output [SCAL]

The dust reading displayed is a percentage (%) reading of the 4-20 mA output range:

- A reading of 0% gives an output of 4 mA
- A reading of 100% gives an output of 20 mA
- A reading of 50% gives an output of 12 mA, etc.
- A reading greater than 100% will over-range the output (20 mA).

With this option the sensor cannot be used to provide a calibrated mg/m³ output.

The SCAL menu (see SECTION 5.1.2 on page 20 for a menu map) allows you to adjust the current dust reading up or down to a sensible, 'normal' level (e.g. 10%). This provides sufficient range on the 4-20 mA output to monitor increases in dust levels in the case of filter failure.

The recommended scaling procedure is:

1. Perform scaling during normal operating conditions.
2. Monitor the current dust reading. If the reading is very variable, go to the **DISP** menu and increase the smoothing filter time (e.g. to 60 seconds).
3. Scroll to **SCAL** and press RIGHT.
4. The current dust reading is displayed as a percentage of the 4-20 mA output range.
5. Use the UP/DOWN keys to scale the reading to the desired level (e.g. 10%).
6. Press RIGHT to confirm and end scaling.

6 Instrument Settings: Engineering Menu

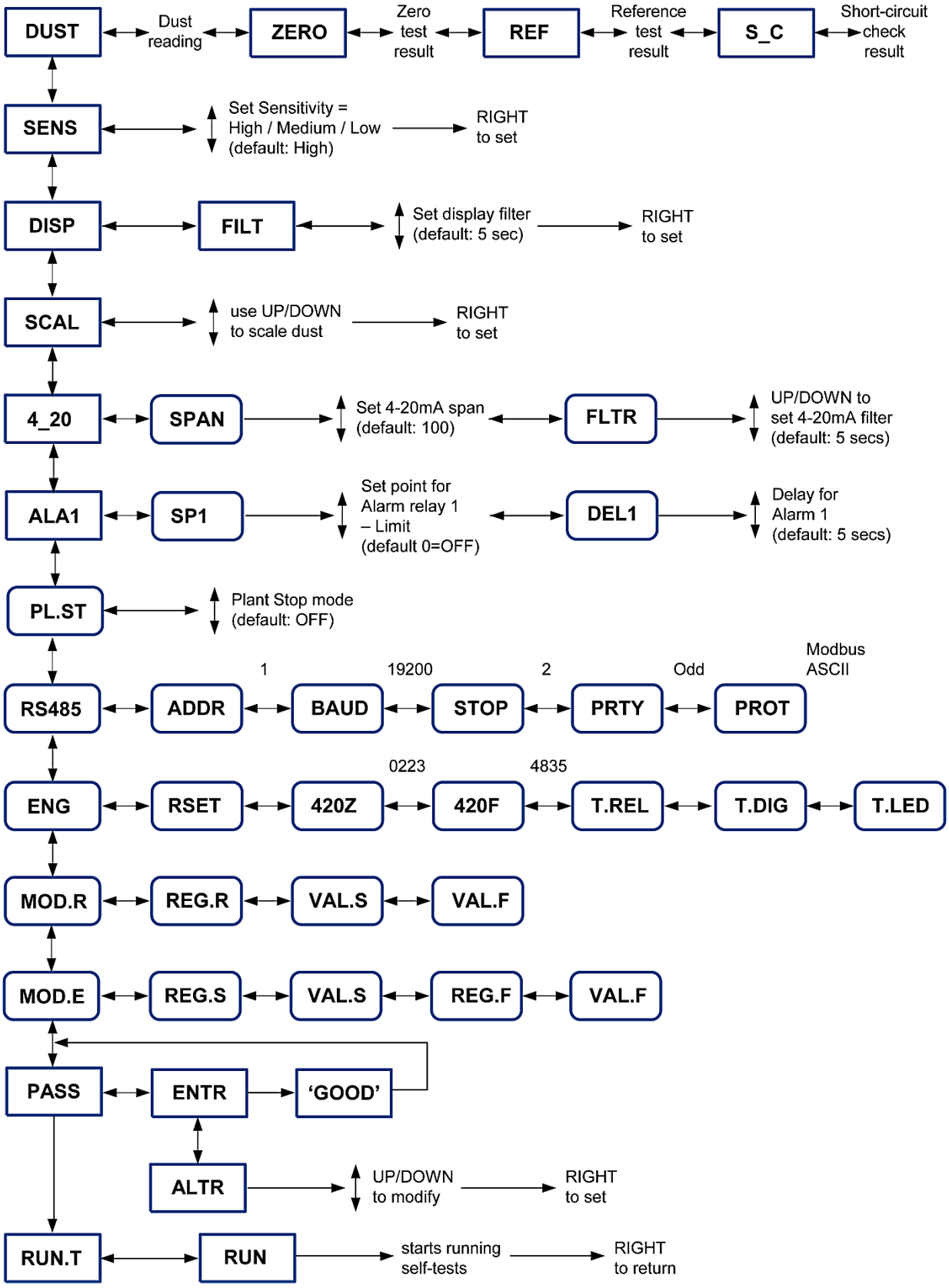

Figure 9: Menu map – Engineering menu (based on scaling method 2)

6.1 Advanced Functions

Menu	Meaning	Description
4_20 FLTR	4-20mA output settings	Adjust filter on the 4-20mA output
ALA1	Alarm settings for Relay 1	View/adjust the alarm set point and delay for Relay 1
PL.ST	Plant Stop	Adjust the behaviour of the plant run/plant stop feature
R485	Modbus RS-485 output	Adjust the settings for the Modbus RS-485 output
ENG	Engineering functions	• 4-20 mA trim settings • Test functions • Factory reset
MOD.R	Modbus Read	Read Modbus register values
MOD.E	Modbus Edit	Edit Modbus register values

6.1.1 Switching to the Engineering (ENG) Menu

1. Move the jumper from **LK4** to **LK3**.
2. Press the **RESET** button.

The additional menus are now available. See FIGURE 9 on page 24 of this manual for the full Engineering menu. Note that the menu shown is based on scaling option 2 [%], see FIGURE 7 on page 19 for basic menu functions for scaling option 1 [SF].

6.2 4-20mA Filter [4_20 FLTR]

The 4-20 mA settings menu allows the Filter [FLTR] of the 4-20 mA outputs to be set. The Filter value sets the amount of smoothing on the output (a *walking window* filter). To set the 4-20 mA to track the display output you need to set the filter time here to the same value as the display filter time.

For logging purposes, you may wish to leave the 4-20 mA unfiltered (default: 1 s) and only set the display filter.

6.2.1 Changing the 4-20mA Filter

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the **4_20** menu heading.
3. Press RIGHT: display shows **FLTR**.
4. Press RIGHT again: display shows the 4-20 mA filter time (default 0005 = 5 s).
5. Adjust the value then press RIGHT to return to the main menu heading.

NOTE on the range of allowed values:

FILTER: this is an integer value. Allows values between 1 and 9999 seconds.

6.3 Emission Alarm Settings [ALA1]

The Alarm Settings menu [ALA1] is used to set up emission alarms used to activate alarm relays in the sensor. Alternatively, you can output the dust reading to your own system (using analogue or Modbus outputs), then set emission alarms in your own system. The ALA1 menu applies to Relay 1. The alarm uses the value from the display to generate alarms.

Menu	Relay	Alarm LED
ALA1	Relay 1 (this is also activated by in case of a self-test fail)	**GREEN** > **RED** (Limit alarm)

6.3.1 Set Point [SP1]

The alarms can be set with different set points; this allows you to set a Limit (High High) alarm level (refer to the menu map on page 24). It is recommended to set the Limit Alarm to your regulatory compliance emission limit.

To disable an alarm trigger point, set the Set Point value to **000.0**. (Note that set points are disabled by default.)

6.3.2 Averaging Filter

Averaging for the alarms depends on the smoothing filter set in the Display menu [**DISP | FILT**]. For regulatory compliance it is recommended to set up to the averaging time specified in your regulation.

Typical values are: 30 min (= 1800 s) or 1 hour (= 3600 s).

HINT: Lower filter times can be used if you need to quickly detect sudden changes in dust reading.

6.3.3 Alarm Delay [DEL1]

The alarm delay is used to prevent temporary high dust spikes – typically generated on process start-up or during bag-filter cleaning – from generating unnecessary alarms. The default alarm delay is 5 seconds. Increase this as required to the duration of the dust spikes you are seeing.

NOTES:

(i) Averaging is done using a *walking window* filter. This means the average values used to generate alarms may differ from the average logged data which uses simple averaging.

(ii) The averaging filter is reset on power up, after pressing the RESET button and after making setting adjustments. During the initial period the reading will be an average of a shorter period than the averaging time. This may result in unwanted alarms.

6.3.4 Change the Alarm Settings – Relay 1 [ALA1]

1. Enter password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the **ALA1** (Alarm 1) menu heading.
3. Press RIGHT: display shows **SP1** (Set Point 1).
4. Press RIGHT again: display shows the set point value (default: 000.0).

5. Adjust the value then press RIGHT: display now shows **DEL1** (Delay 1).
6. Press RIGHT again: display shows the alarm 1 delay in seconds (default: 0005 = 5 seconds).
7. Adjust the value then press RIGHT to return to the **ALA1** menu heading.

NOTE on range of allowed values:

Set Point: the decimal point is fixed after the 3rd digit. This allows values from 000.1 to 999.9

Delay: this is an integer value. Allows values between 1 and 9999 seconds.

6.4 Plant Stop Function [PL.ST]

The digital input to the sensor can be used to disable outputs from the sensor during periods when the plant is not operating.

Connect a digital input from your plant control system to the digital input labelled **IP+/IP-** on the sensor (see FIGURE 3 on page 14 for the location of this item). It requires 24V to be applied across the input to close it.

When the PLANT STOP function is enabled it functions as follows:

- When the digital input is **closed**, this indicates to the sensor that the process is running and the sensor generates outputs as normal.
- When the digital input is **open,** this indicates to the sensor that the process has stopped. The following changes are made:
  - Emission alarms are disabled.
  - The 4-20 mA output is set to 4 mA.
  - The display value and 4-20 mA output are set, either to 0.000 or to the normal dust reading, depending on the setting of the PLANT STOP option (i.e. ZERO or DUST).

6.4.1 Enable the Plant Stop Option

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the **PL.ST** (Plant Stop) menu heading.
3. Press RIGHT: display shows the status of the Plant Stop option (default: OFF).
4. Use UP/DOWN to toggle between settings (see the table below).
5. Press RIGHT to confirm and return to the **PL.ST** menu heading.

6.4.2 Summary of Plant Stop Behaviour

Setting	Emission alarms	Display reading	4-20 mA output
OFF	Enabled	Dust	Dust
ZERO	Disabled	0.00	4mA
DUST	Disabled	Dust	4mA

6.5 Comms Settings

6.5.1 RS-485 Settings [R485]

The RS485 menu is available to adjust communications settings when connecting to the sensor via the RS-485 port.

6.5.2 Changing the RS-485 Settings

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the **RS485** (RS-485 settings) menu heading.
3. Press RIGHT to scroll through and adjust the different RS-485 settings as shown in the below table.
4. Press RIGHT again to return to the **R485** menu heading.

Menu	Meaning	Default value	Range of values
ADDR[F]	Modbus address	1	1 – 255
BAUD	Baud rate	19200	200,600,1200,2400,4800,9600,19.2k
STOP	Stop bits	2	0, 1, 2
PRTY	Parity	Odd	Odd, Even, None
PROT	Modbus protocol	ASCII	ASCII, RTU

6.5.3 RS-232 Settings [RS232]

The RS-232 output has fixed settings (as outlined in the following table).

Menu	Default value
ADDR	As set in the RS-485 menu (see section above).
BAUD	19200
STOP	1
DATA	8
PRTY	None
PROT	Modbus RTU

6.6 Engineering Settings [ENG]

Menu	Description
RSET	Resets the sensor to factory (default) values (see page 31).
420Z	Trims the 4-20mA Zero Offset (4 mA).
420F	Trims the 4-20mA Full Scale (20 mA).
T.REL	Tests the relays.
T.DIG	Tests the digital input.
T.LED	Tests the LEDs.

[F] *The address option [ADDR] allows you to daisy-chain several sensors together into a Modbus RS-485 network. Each unit must be given a unique address.*

6.6.1 Trimming the 4-20mA Outputs [420Z, 420F]

1. Enter the password, if required (see SECTION 5.2 on page 20).
2. Scroll DOWN to the ENG (Engineering) menu heading.
3. Press RIGHT to access the **420Z** and **420F** settings.

When you enter the **4-20 mA Zero [420Z]** setting the sensor will nominally output 4 mA. Use the UP/DOWN buttons to adjust the 4-20 mA Zero calibration value (default: 223) to trim the 4 mA value.

Similarly, when you enter the **4-20 mA Full Scale [420F]** setting the sensor will nominally output 20 mA. Use the UP/DOWN keys to adjust the 4-20 mA Full Scale calibration value (default: 2230) to trim the 20 mA value (default: 4835).

6.6.2 Test Functions [T.REL, T.DIG, T.LED]

The table below shows the operation of the test functions. Use the UP/DOWN buttons to change the values.

Menu	Setting	Result (of test function)
Relays [T.REL]	Set to 0	Relay(s) closed
	Set to 1	Relay1 open
Digital Input [T.DIG]	Open	Display 0000
	Apply 24V to close	Display 0001
LEDs [T.LED]	Set to 0	All LEDs = **GREEN**
	Set to 3	Self-Check LED = **RED**

6.7 Modbus Diagnostics [MOD.R, MOD.E]

6.7.1 Reading Modbus Register Values [MOD.R]

Scroll to the **MOD.R** menu.

REG.R	Enter register number to read (as a short).
VAL.S	Displays the value as a short (S).
VAL.F	Displays the value as a float (F).

6.7.2 Editing Modbus Register Values [MOD.E]

CAUTION! – LOSS OF DATA

Take care when adjusting the register values as this may stop the sensor from functioning correctly!

Scroll to the **MOD.E** menu.

REG.S	Enter register number to write to.
VAL.S	Enter the value to write as a short.
REG.F	Enter register number to write to.
VAL.F	Enter the value to write as a float.

7 Quality Assurance and Self-Tests

7.1 Sensor Self-checks

Self-tests are available to provide monitoring of the integrity of your sensor(s). The sensor can provide alarm notification of self-test failures.

- **ZERO / REF checks**: sensor checks to test for faults with the sensor hardware.
- **SHORT-CIRCUIT (Contamination) check:** if available, this sensor self-check indicates the probe needs cleaning. The short-circuit check performs a test for contamination between the probe rod and the base of the probe by checking for the existence of an electrical short circuit.

Self-check Thresholds

Self-tests	Minimum Pass Level	Ideal Level	Maximum Pass Level	Refer to
Zero check	–	<10	20	
Reference check	950	1000	1120	
Short-circuit check – Standard and Ex variants (Dust zone 22)	900	1000	1150	*Note 2*
Short-circuit check – High-temperature sensors	+5% of Ref. (1060)	1200	+25% of Ref. (1320)	*Notes 1 + 3*
Short-circuit check – Ex variants (Dust zone 20)	+12% of Ref. (1000)	1200	+18% of Ref. (1400)	*Notes 1 + 4*

Note 1 – *Values given are calculated based on the min./max. Reference check (Ref) pass levels, respectively. Values have been rounded to the nearest tens.*

Example: min. pass level: 950 + 5% = 998 (~1000) and max. pass level: 1120 + 25% = 1400.

Note 2 – *Applicable to standard sensors (up to 250°C) and Ex sensors for Dust zone 22 only. Refer to the pass levels recorded in the Test Report for your instrument.*

Note 3 – *Applicable to high-temperature sensors (up to 400°C) only. Refer to the pass levels recorded in the Test Report for your instrument.*

Note 4 – *Applicable to Ex sensor variants for Dust zone 20/21 only. Refer to the pass levels recorded in the Test Report for your instrument.*

7.1.1 Self-check Frequency

- If available, the Zero and Reference drift checks are initiated automatically or manually on demand and will run in succession. If either of the tests fails, an alarm is generated.
- If available, the Short-circuit check runs automatically on an hourly cycle. If the test fails, the test is repeated in 10-minute intervals (i.e. at 20 and 30 minutes). If the test fails on all three occasions, then an alarm is generated.

NOTE: The short-circuit check is performed outside the stack (e.g. on a bench). Without adequate shielding, background noise will cause the short-circuit check to fail on high sensitivity. To test out of stack, place the sensor rod in an earthed shield tube and earth the sensor base or enclosure to the shield tube.

7.1.2 Running Self-tests [RUN.T]

1. Scroll down to the **RUN.T** menu heading.
2. Press RIGHT: the display now shows **RUN**.
3. Press RIGHT again to confirm and run the tests.
4. The Self-check LED starts flashing. All self-checks now run in succession taking a total time of about 60 seconds.
5. Once the tests have completed, return to the main **DUST** menu to view the self-test results (see next section.)

7.1.3 Viewing Self-test Results

1. Go to the **DUST** reading (this is the top menu item).
2. Repeatedly press RIGHT to toggle through the self-test result as follows:

ZERO	Zero test result
REF	Reference test result
S_C	Short-circuit (contamination) test result

NOTES:

(i) If the tests have not run yet, then ' **- -** ' is displayed.

(ii) While the tests are running no values will be shown. Wait for the GREEN LED to stop flashing (see section below).

7.2 Self-test LED

The Self-test LED is used to indicate a self-test failure.

Self-Test LED solid GREEN	Self-tests PASS
Self-Test LED flashing GREEN	Self-tests are RUNNING
Self-Test LED RED	Self-tests FAIL (Relay 1 activates)

Appendix A

A.1 Resetting the Sensor [RSET]

CAUTION! – LOSS OF DATA

Performing a Reset can stop the sensor from working!

A reset will put all instrument settings back to their default values. The procedure given in this section must, therefore, be carried out only by suitably trained and qualified personnel.

This function may be used to reset the sensor, if necessary.

1. Scroll DOWN to the **ENG** (Engineering) menu.
2. Press RIGHT to access the **RSET** submenu.
3. Press RIGHT again to display **0000** and press UP to set the value to **0001**.
4. Press RIGHT to activate the factory reset.

General Compliance

Waste of Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU)

This symbol if marked on the product or its packing indicates that this product must not be disposed of with general household waste. In some countries and the European Union regions, separate collection systems have been set up to handle the recycling of electrical and electronic waste.

Disposing of this product correctly helps prevent potentially negative consequences for the environment and human health. The recycling of materials helps conserve natural resources.

In countries outside the EU:

Dispose of this product at a collection point for the recycling of electrical and electronic equipment according to local government regulations.

RoHS Compliance Statement (2011/65/EU)

ENVEA UK Limited is compliant with the EU Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive).

List of Materials (ISO 14001)

The information is being provided to comply with ISO 14001 Environmental Management, which is part of EMAS, the European Eco-Management and Audit Scheme to reduce waste and energy use, helping organizations improve efficiency, and providing assurance to internal and external stakeholders that environmental impact is being measured and improved.

The following tables provide a list of materials used in the construction of this product.

Sensor – Materials	Where used
316 Stainless steel	Rod and sensor body
Aluminium alloy	Enclosure body
Electronic components	Sensor electronics
Fibreglass	PCB
PTFE	Insulator (for standard and insulated versions)
Viton®	O-rings
Alumina	High-temperature insulator (up to 400 °C)
PEEK	
Sialon	

ENVEA UK SERVICE AND SUPPORT CENTRES

ENVEA UK, part of the ENVEA Group (France), supports distribution and service partners worldwide where teams of ENVEA Sales and Service engineers are available to consult regarding equipment suitability and technical support.

To find a local ENVEA representative for your country or region, please contact us or visit our website at www.enveauk.global/distributor-contact-list.

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