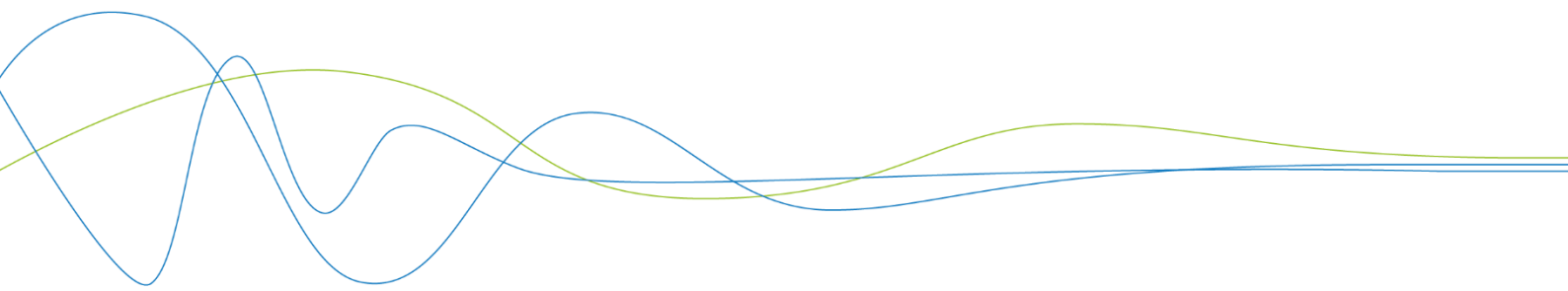
LEAK ALERT 73

USER MANUAL



LEAK ALERT 73

Filter Leak Monitor

USER MANUAL

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1 Introduction

1.1 Purpose of this Manual

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

1.2 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 equipment.

WARNING
Alerts the user to a procedure or practice that can result in personal injury or injury of others if not followed correctly.

CAUTION
Alerts the user to a procedure or practice that can result in damage to the system or ancillary equipment if not followed correctly.

NOTE	Notes are used to highlight important information that may assist the reader in carrying out a procedure or understand the text.

In addition, the following symbols are used on the product:

WARNING
Electric shock.

Protective Earth

1.2.1 Danger from Process

The sensor may be 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 inflammable 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 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.

1.3 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. Warning labels are situated on the system, indicating a hazard at or near the location of the warning label. 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 organisations 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 (GND).

WARNING

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 Specification** section of this manual.

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

WARNING

Electric shock.

For mains powered units – ensure that mains isolation devices are easily accessible (within a 2m/6½ ft. radius) to allow the sensor and purge blower to be switched OFF when at the units.

WARNING

Hazardous voltages.

For mains powered units – switch off and isolate the unit power supply before opening the sensor front cover.

CAUTION

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

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

1.4 Intended Use

The LEAK ALERT 73 is a reliable, robust *ElectroDynamic*® sensor that is particularly suited for use with fabric-filter type dust collectors (baghouses) dust arrestment plant where performance approval is not required. The sensor can be configured for all types of industrial bag filters irrespective of cleaning sequence and offers optional quality assurance, including electronic drift and contamination checks.

The ENVEA's LEAK ALERT family of sensors has been designed to detect low and medium levels of dust leakage in addition to gross filter failure.

1.4.1 Limits of Use

To achieve optimum performance and safe operation, the equipment must be operated within the limits detailed in the **Technical Specification** section of this manual. Operation outside these limits may result in damage to the equipment or failure to achieve the performance specification.

1.5 Additional Information

1.5.1 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.

Included in the reference library:

- TN004 Installation Notes (Publication Part Number (PPN): 491021)
- TN049 Air Purge Information (PPN: 491019)
- TN053 Air Purge Guide for *ElectroDynamic*® Sensors (PPN: 491023)

For products intended for hazardous area applications, refer to the following literature:

- LEAK ALERT Series and DUST MONITOR 210 (for hazardous area applications)- User Manual Supplement (PPN: PC-000870-MA).

1.5.2 Product Parts and Options

For details of product options, software, accessories, spares, and upgrade options for your instrument, please refer to the LEAK ALERT 73 datasheet and order information available on request and for download from the ENVEA website (see the reverse of this manual).

1.6 Certification

1.7 Conformance and Related Standards

ENVEA UK Ltd hereby declares that this instrument – within the limits specified in this manual – conforms to the essential requirements and other provisions of the pursuant of the following:

1. European Union Directives: Low Voltage and EMC.
2. UK Regulation 2016: Low Voltage and EMC.

For details, refer to the relevant Declaration of Conformity (DoC) for this instrument or system supplied with your order.

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 Specification

Stack temperature range	-20 to 400 °C (-4 to 752 °F)
Ambient temperature[A]	-20 to +50 °C (-4 to 122 °F)
Minimum detection level	< 0.1 mg/m³
Measurement range	up to 500 mg/m³
Sensor Key Data	
Sensor variants	Standard sensor: ▪ 0 – 250 °C (up to 482 °F) ▪ 0 – 100 °C (up to 212 °F; non-Ex only) Options: ▪ High-temperature: 0 – 400 °C (up to 752 °F) ▪ Insulated sensor: 0 – 250 °C (up to 482 °F; non-Ex only)
Enclosure rating	IP65
Outputs	▪ 4-20 mA (isolated, 500 Ω) ▪ Warning alarm relay (SPST 1A@24V DC), fail safe ▪ Emission alarm relay (SPST 1A@24V DC), fail safe ▪ Option: RS-232 (Modbus) or RS-485 (Modbus)[B]
Inputs	Plant stop signal (output to zero when the plant is off)
User setup	4-digit display and setup keys (internal; see section **2.2.1** below for additional options).
External indicators	3 off; indicators for power, fault, and emission alarms
Scaling methods	▪ Percentage % of 4-20 mA output ▪ Option: Scaling Factor
Power requirements	▪ 100–240V AC 50/60Hz, 32 mA Option: 24V DC, 300 mA (from a local source)
Cable entries	3x M20 gland/conduit entries
Stack connection	1.5” BSP
Air purge requirements	It may be required on some applications. External supply of 5 – 10 Litres/min of dry, clean (oil-free) instrument air, depending on dust loading.

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

[B] *The output options are exclusive; the RS-485 connection is required for use with the optional BPU.*

2.2.1 Sensor Options

Quality Assurance	▪ Electronic Zero and Reference drift checks, on-demand ▪ Automatic Short-circuit check
Air purge options	▪ Standard air purge fitting (1/4" BSP) ▪ Air Filter and Regulator assembly ▪ Flanged Air Purge Adaptor (standard sensor only)
Rod lengths	Standard probes: 100 – 500 mm (4 – 20", nom.) Options: ▪ Standard sensor: 600, 800, 1000 mm (24, 32, 40", nom.) ▪ Insulated sensor: 200–1000 mm (8 – 40", nom.)
Additional options	▪ RS-232 external connector (fly lead; non-Ex versions only) ▪ External keypad ▪ Externally viewable display ▪ Bag Pulse Display (graphical display of dust levels)
Hazardous zones classification	*Refer to the appropriate Ex addendum. See* ***Related Documentation*** *on page* ***3*** *for more information.*

2.2.2 Cabling

For mains connections – cabling should be rated for use up to +65 °C (149 °F) at least to allow for an ambient temperature of up to +50 °C (122 °F). Consult Technical Note TN007 Network Cable Lengths for information on sensor cabling requirements and considerations (see **Related Documentation** on page **3**).

Cables supplied by ENVEA meet these requirements.

Maximum cable lengths	▪ RS-232: 15 m (49.2 ft.) ▪ RS-485: 1,000 m (0.6 mi / 3,280 ft., nom.)

2.2.3 PC Software Suite (PC-ME DUST TOOLS)

The minimum system specification and requirements (for desktop/laptop PCs) are shown in the following table.

Operating system	Windows XP or higher
System memory	32 Mb RAM 20 Mb free hard disk space
Monitor	1024 x 768 pixels, high-colour 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.envea.global/s/process-en/dahs-software/pc-me-dust-tools/**.

For information on hardware requirements, contact ENVEA or your local ENVEA representative. The availability of software modules depends upon the type of sensor. For more information, see **Product Parts and Options** on page **3**.

3 Sensor Installation

3.1 Introduction

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

3.2 Unpacking and Storage

Remove all transit packaging. Inspect the sensor for signs of damage. If the equipment is to be stored prior to installation, repack 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).

3.3 Prerequisites and Guidelines

3.3.1 Location Requirements

When selecting a mounting location for optical sensors, the following should be considered for optimum performance.

- Mount in the longest, straightest, unrestricted duct available
- Ensure correct sensor grounding.
- Excess vibration will affect sensor readings.
- Ambient or radiating temperatures in the vicinity of the mounting location must not exceed +50 °C (122 °F).

3.3.2 Power Supply to the Sensor

The instrument is available in two versions:

- a mains voltage version (100–240V AC)
- a 24V DC version.

A label on the internal PSU cover indicates the model, voltage, and fuse type (see **Fig. 4** on page **12** for an example). Connect only to a power supply with a voltage corresponding to that on the rating plate (on the sensor enclosure).

Ensure the power required for the sensor is made available near the monitoring point during the preparation stage. For mains-powered sensors, a suitable rated and clearly marked mains isolation device (with separate fuse) must be installed in the power supply wiring.

Mains Wiring Safety Rules

1. Trim back insulation no more than 8 mm (0.3”) and ensure that strands are not left free. Alternatively, use a suitable ferrule.

2. The earth wire (GND) should be longer than both the Live (L) and Neutral (N) to ensure that this will be the last to pull out if the mains cable suffers a tug.

It is recommended to extend the cable insulation fully through the cable gland so individual wires are not damaged.

3.3.3 Cable Routing Guidelines

1. Ensure that the cable sheath fully penetrates the sensor cable gland.
2. Fit blanking plugs to unused cable glands.
3. Ensure cable entry glands are tightened to the cable.
4. Support cables at appropriate intervals.
5. Do NOT route cables where they may be at risk from lightning strikes (for example, overexposed roofs).

3.3.4 Grounding the Sensor

For *ElectroDynamic*® sensors, the sensor body must be grounded to the stack wall. Ensure that the instrument is electrically grounded: via the ductwork by the mechanical connection made between the mechanics and the socket, and by grounding strap provided.

- The sensor must be reliably connected to the stack wall using the grounding strap (earth wire) provided. The grounding strap must be connected prior to installing the sensor in the stack and may be disconnected only after removing the probe from the stack.
- The grounding strap, which connects the sensor/instrument enclosure to the stack, must be long enough so that the instrument may be connected and removed from the stack without disconnecting.

3.4 Installing and Connecting the Sensor

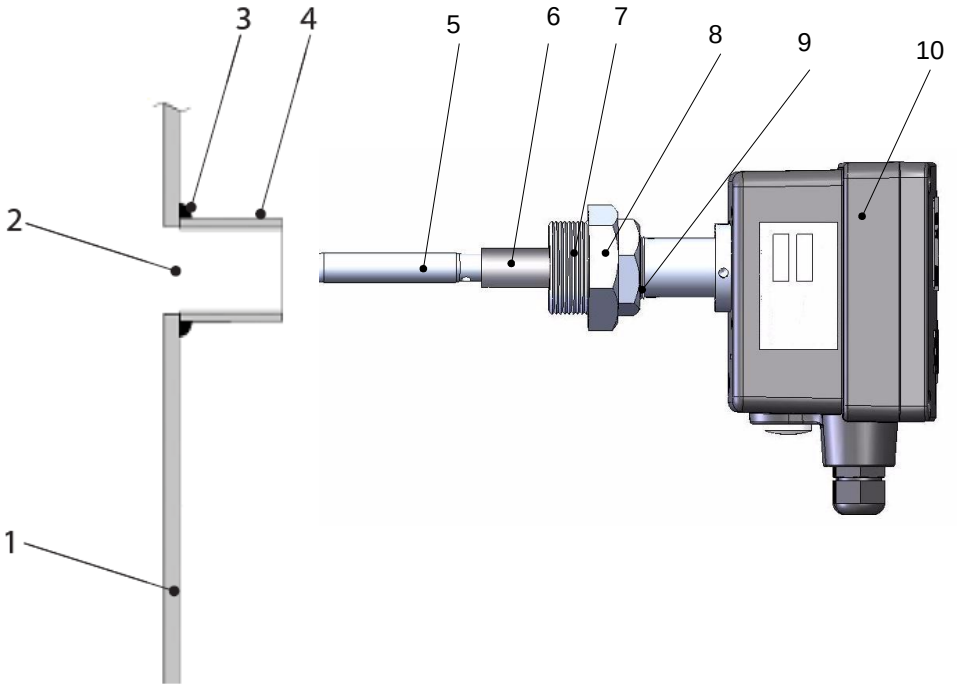
3.4.1 Safety Information

WARNING
Electric shock. (1) Ensure that only suitable and rated cable 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.

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

3.4.2 Fitting the Sensor to the Stack



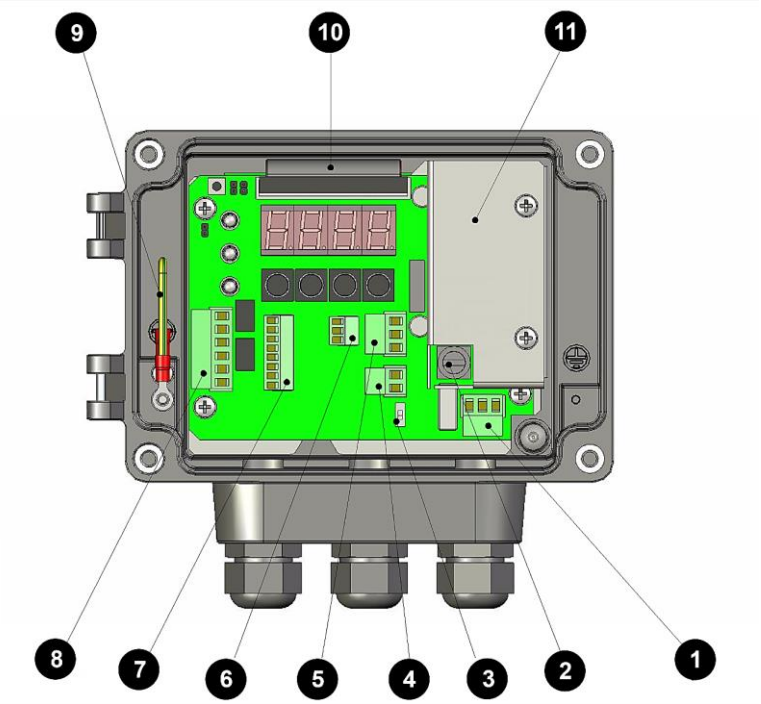
1 ..... Stack wall
2 ..... Stack wall opening/port hole for probe (at least ∅45 mm)
3 ..... Weld all round
4 ..... 1.5" BSP socket
5 ..... Probe rod
6 ..... Insulator
7 ..... 1.5" BSP thread
8 ..... Floating nut
9 ..... Lock nut
10 ..... Sensor enclosure

Fig. 1: Fitting the sensor to the stack.

1. Drill a hole of at least Ø45 mm ID in the stack 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 installed either 90° to the stack or about 5° upward, so the sensor probe points slightly downward, allowing condensate to drain off into the stack.

3. Insert the sensor probe into the socket and secure it 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.

3.4.3 Sensor Connections



1 ..... Power IN[C]
2 ..... Mains fuse holder
3 ..... Bus termination switch (set to **T**/terminated)
4 ..... 4-20mA output
5 ..... RS-485 output (option)
6 ..... RS-232 output (option, also configuration port)
7 ..... *not in use*
8 ..... Relays (2 off) and digital input (1 off)
9 ..... Lid earthing strap *(do not remove)*
10 ..... Connection to CPU board *(do not remove)*
11 ..... Power supply (PSU) cover *(do not remove)*

Fig. 2: Sensor PCB connections.

[C] *See wiring diagrams below for the connector terminals (these can be found in the enclosure lid).*

3.5 Connecting the Power Supply

3.5.1 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. These must be located so they can be reached easily (within 2m/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.

3.5.2 Wiring the Mains Power Supply

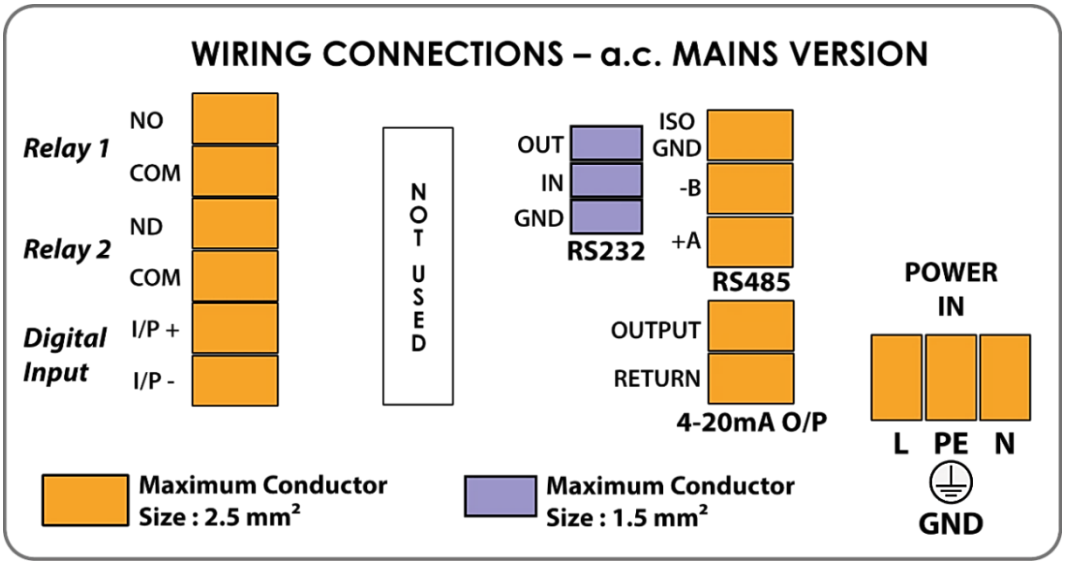


Fig. 3: Sensor wiring label – AC versions (inside enclosure lid).

1. Undo the 4 off screws and open the hinged sensor enclosure lid.
2. Note the label on the power supply cover (see **Fig. 4** below).
3. Referring to **Fig. 2** above, undo the 2 off screws and remove the power supply 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 it with the 4 off screws. Do not over-tighten.
7. Switch ON power to the sensor.

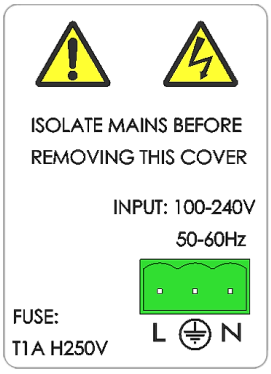


Fig. 4: Power supply label (mains).

3.5.3 Wiring the 24V DC Supply

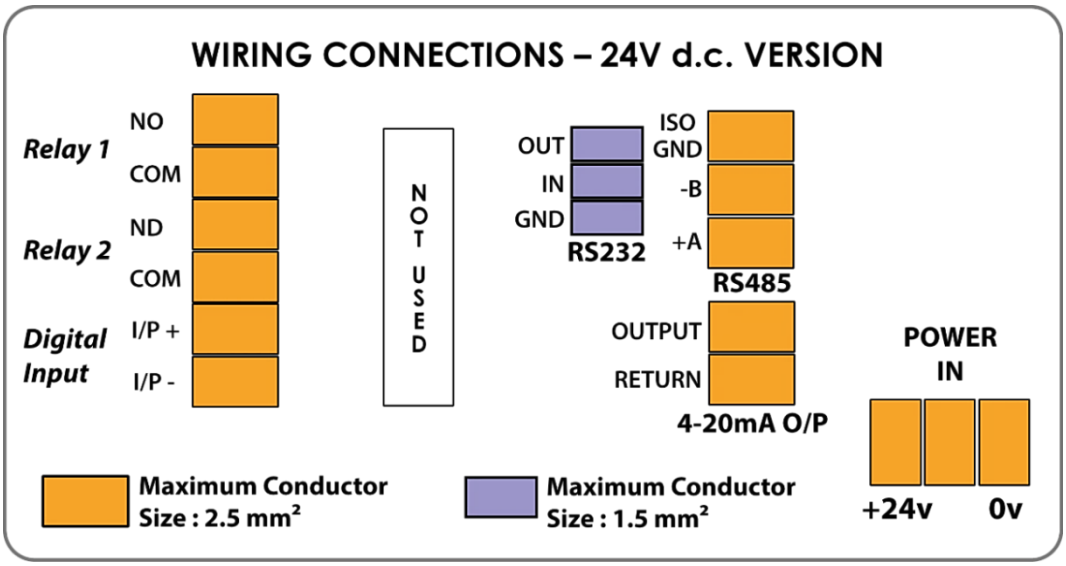


Fig. 5: Sensor wiring label – 24V versions (inside enclosure lid).

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 it 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

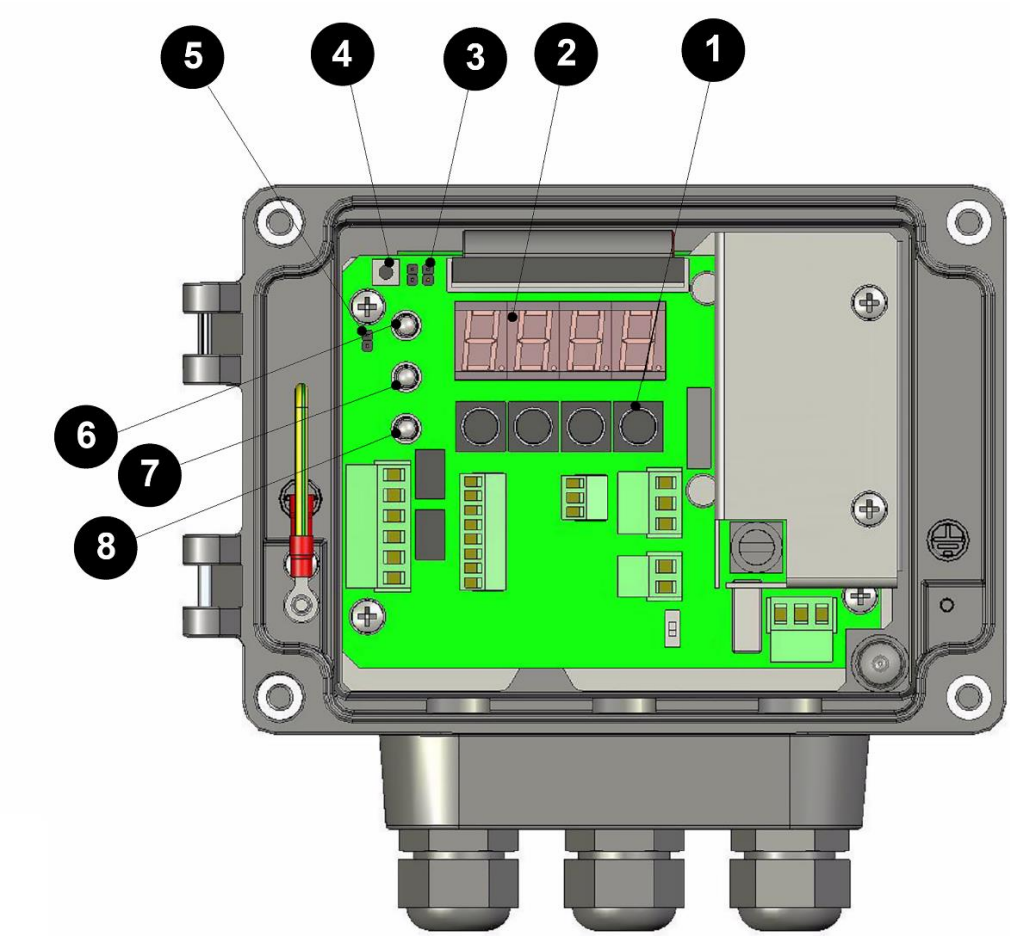


Fig. 6: Internal sensor controls.

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 .....Emission Alarm LED

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.

- Use the UP and DOWN buttons to scroll between menu headings. Press 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** menu (the 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 (top).
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 section **6** on page **20**.

4.2.2 Changing a Setting

1. Enter the password, if required (see section **5.2** on page **17**).
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 buttons to alter the numerical value. Use LEFT/RIGHT to move between digits.
5. 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.
6. Press LEFT/RIGHT to move onto the next setting/submenu or to return to the menu heading so that you can scroll to other menu headings.

5 Instrument Settings: Standard Menu

5.1 Standard Menus – Scaling Methods

Refer to the TECHNICAL SPECIFICATION on page 5 for information on scaling options for your instrument.

5.1.1 Scaling Method 1 – % of 4-20mA

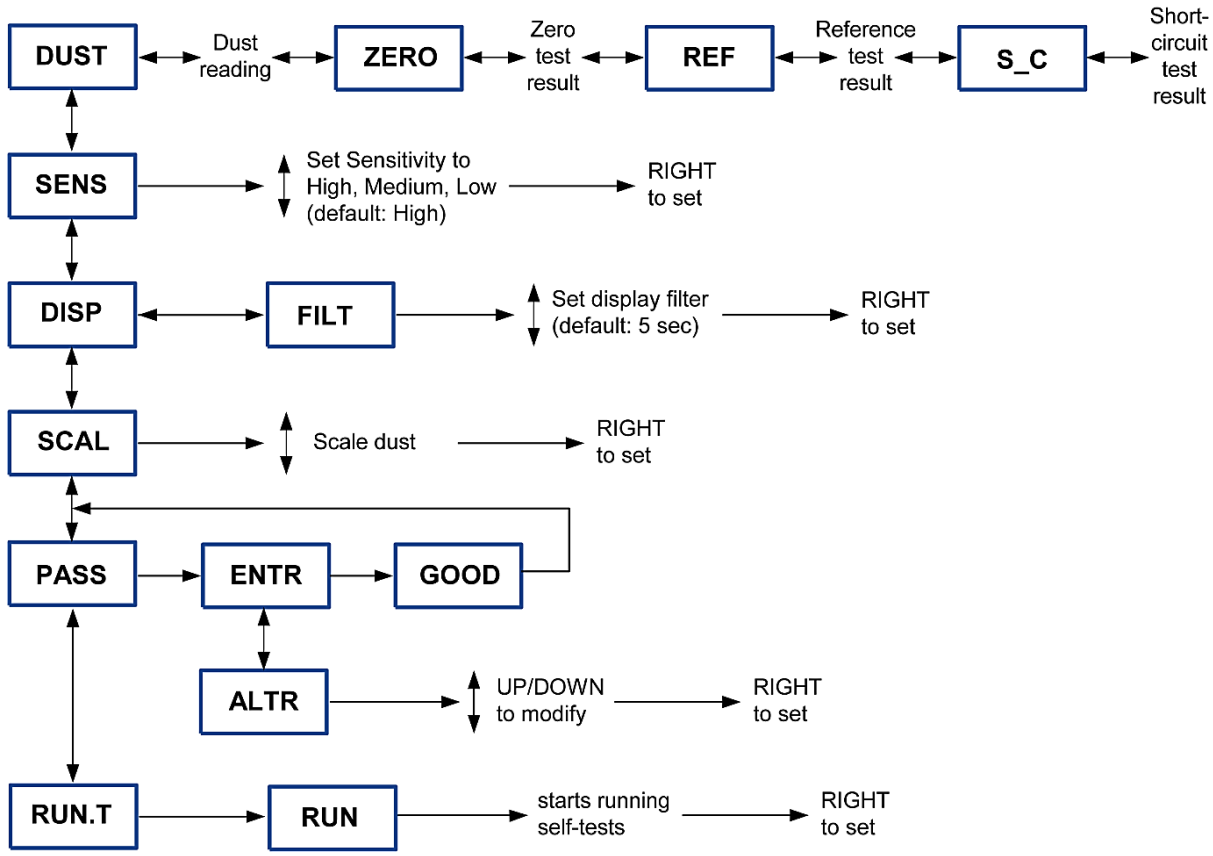


Fig. 7: Standard menu – Scaling method 1 (% of 4-20mA).

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

5.1.2 Scaling Method 2 – Scaling Factor (Option)

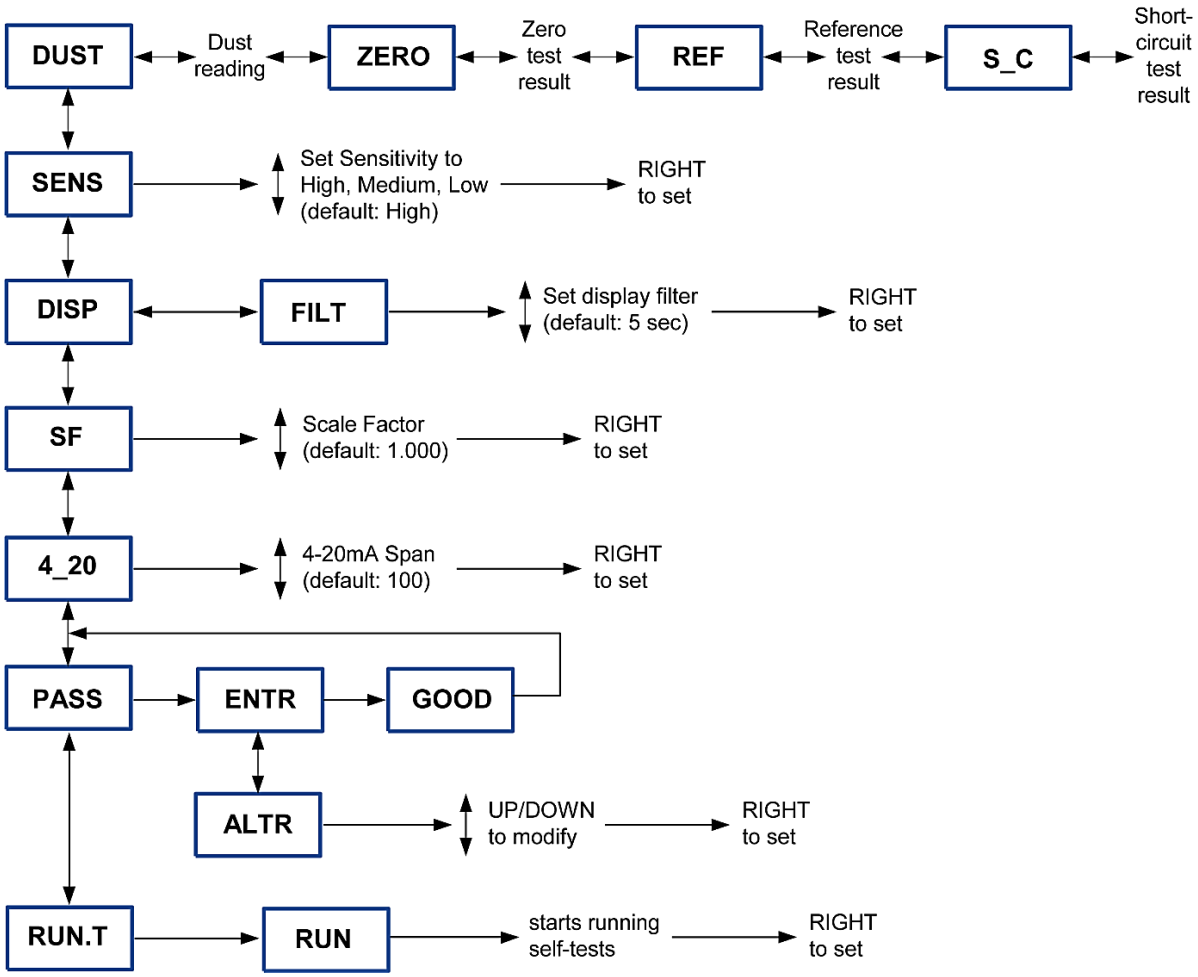


Fig. 8: Standard menu – Scaling method 2 (SF).

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 4-20mA output
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.

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

   Note that the factory default password is **0000**.
7. 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 sensitivity settings: High (default), Medium, and Low. The first step when 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 dust 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: the display shows **FILT**.
4. Press RIGHT again: the display shows the filter time in seconds (default: 0005 = 5 s).

1. Adjust the value, then press RIGHT to return to **DISP**.

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

5.5 Scaling Methods

5.5.1 Scaling Method 1 – Scaling to % of 4-20mA Output [SCAL]

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

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

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

The SCAL menu (see section **5.1.1** on page **15** for a menu map) allows you to adjust the current dust reading up or down to a sensible, 'normal' level (for example, 10%). This provides sufficient range on the 4-20mA 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 display **DISP** menu and increase the smoothing filter time (for example, to 60 secs).
3. Scroll to **SCAL** and press RIGHT.
4. The current dust reading is displayed as a percentage (%) of the 4-20mA output range.
5. Use the UP and DOWN buttons to scale the reading up or down to the desired level (for example, 10%). When complete, press RIGHT to confirm and end scaling.

5.5.2 Scaling Method 2 – 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 **5.1.2** on page **16** for a 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 Scaling Factor

The SF is applied to the displayed reading and is then used by:

- Analogue (4-20mA) outputs.

Adjusting the Scaling Factor

1. Enter the password, if required (see section **5.2** on page **17**).

2. Scroll DOWN to the **SF** menu heading.
3. Press RIGHT: the display shows the current scaling factor (default: 1.000)
4. Adjust each digit value using the UP/DOWN buttons, 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 the UP/DOWN buttons to adjust the position of the decimal point.
6. Press RIGHT to return to the **SF** menu heading.

NOTE

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

5.6 4-20mA Span [4-20mA] (Scaling Method 2 only)

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

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

5.6.1 Adjusting the 4-20mA Settings

1. Enter the password, if required (see section **5.2** on page **17**).
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

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

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

6 Instrument Settings: Engineering Menu [ENG]

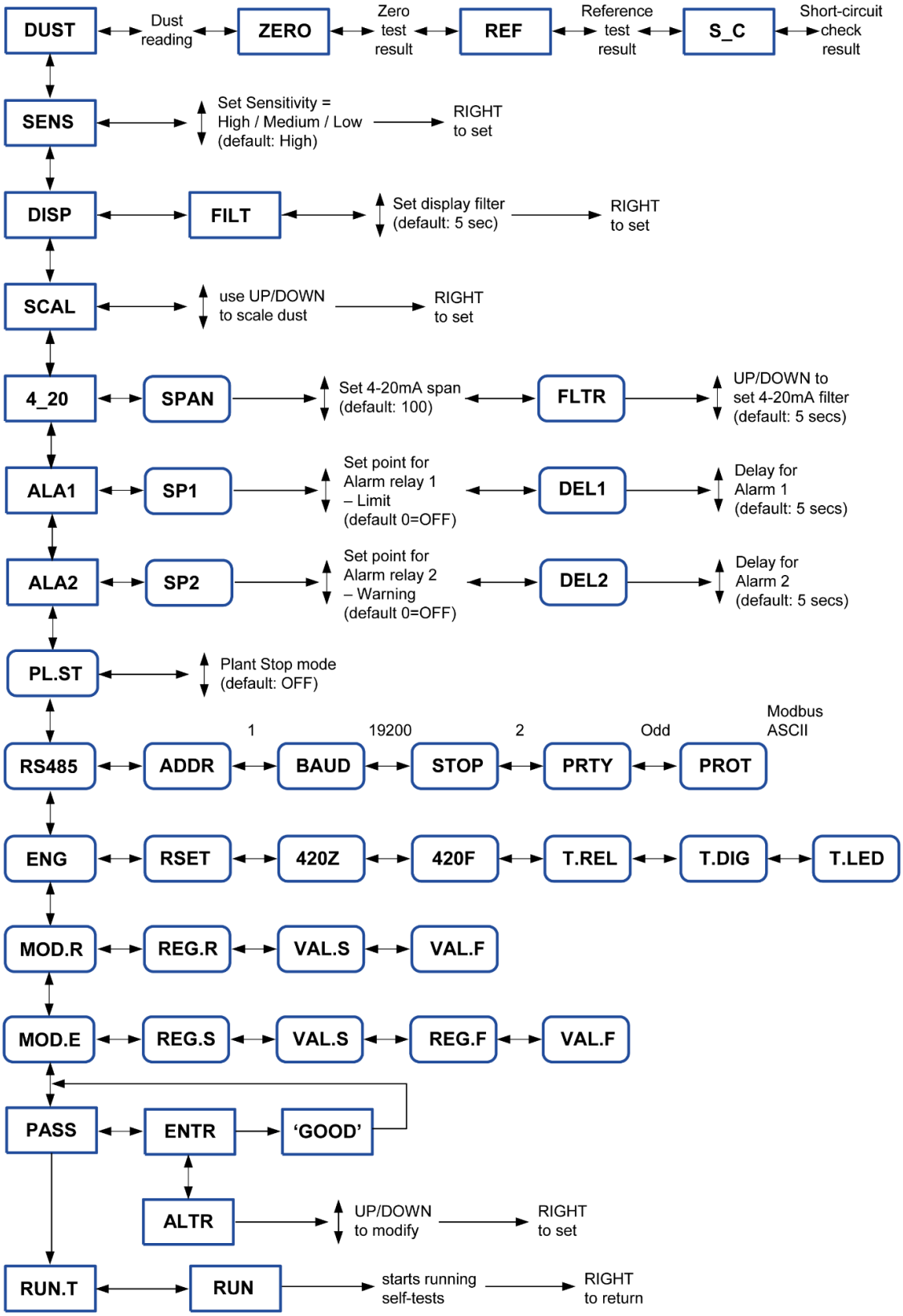


Fig. 9: Engineering menu [ENG] (based on scaling method 1).

6.1 Advanced Functions

Menu	Meaning	Description
4_20 FLTR	4-20mA output settings	Adjust filter on the 4-20mA output
ALA1	Alarm Settings (Relay 1)	View/adjust the alarm set point and delay for Relay 1
ALA2	Alarm Settings (Relay 2)	View/adjust the alarm set point and delay for Relay 2
PL.ST	Plant Stop	Adjust the behaviour of the plant run/plant stop feature
R485	Modbus RS-485 Output	Adjust settings for the Modbus RS-485 output
ENG	Engineering settings	▪ 4-20mA 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 Setup

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

The additional menus are now available. See **Fig. 9** on page **20** of this manual for the full Engineering menu. Note that the menu shown is based on scaling option 1 [SCAL]. See **Fig. 8** on page **16** for basic menu functions for scaling option 2 [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 **17**).
2. Scroll DOWN to the **4_20** menu heading.
3. Press RIGHT: the 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 Filter: this is an integer value. Allows values between 1 and 9999 seconds.

6.3 Emission Alarm Settings [ALA1, ALA2]

The Alarm Settings menus [ALA1, ALA2] are used to set up emission alarms used to activate the two alarm relays in the sensors. 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, ALA2 applies to Relay 2. Both alarms use the value from the display to generate alarms.

The emission alarms also activate the Emission Alarm LED.

Menu	Relays	Emission Alarm LED [LD5]
ALA1	Relay 1 (also activated by Self-Test fail)	**GREEN** > **RED** (Limit Alarm)
ALA2	Relay 2	**GREEN** > **AMBER** (Warning Alarm)

6.3.1 Set Points [SP1, SP2]

The two alarms can be set with different Set Points to allow you to set a Warning (High) and Limit (High High) alarm level. It is recommended to set the Limit Alarm to your regulatory compliance emission limit. Optionally, set the warning alarm to a lower value to give an early warning of a potential problem.

- To disable either of the alarms, set the Set Point value to **000.0.**
- The default Set Point level is '000.0' (disabled).

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 mins (1800 secs)
- 1 hour (3600 secs).

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

6.3.3 Alarm Delay [DEL1, DEL2]

The alarm delay is used to prevent temporary high dust spikes from generating unnecessary alarms. Dust spikes are typically generated at process start-up or during bag-filter cleaning. The default Alarm Delay is 5 s. Increase this as required to the duration of the dust spikes you are seeing. Note that you can set different alarm delays in the two alarms if required.

NOTE

(1) 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.

(2) The averaging filter is reset at power-up, after pressing the RESET button and after making setting adjustments. Therefore, 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 the password, if required (see section **5.2** on page **17**).
2. Scroll DOWN to the **ALA1** (Alarm 1) menu heading.
3. Press RIGHT: the display shows **SP1** (Set Point 1).
4. Press RIGHT again: the display shows the set point value (default: 100.0).
5. Adjust the value, then press RIGHT: display now shows **DEL1** (Delay 1).
6. Press RIGHT again: display now shows the alarm delay (default: 0005 = 5 s).
7. Adjust the value, then press RIGHT to return to the **ALA1** menu heading.

NOTE

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.

6.3.5 Change the Alarm Settings – Relay 2 [ALA2]

Repeat for the ALA2 menu settings.

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 **Fig. 3** on page **11** for the location of this item). 24V must be applied across the input to close the input.

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 (Emission Alarm LED + Relays)
- The 4-20mA output is set to 4mA.
- The display value and 4-20mA output are set to either **0.000** or the normal dust reading, depending on the setting of the Plant Stop option (for example, ZERO or DUST).

6.4.1 Enable the Plant Stop Option

1. Enter the password, if required (see section **5.2** on page **17**).
2. Scroll DOWN to the **PL.ST** (Plant Stop) menu heading.
3. Press RIGHT: the display shows the Plant Stop option, for example, **OFF** (default).
4. Use UP/DOWN to toggle between options (see the below table).
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	4-20mA 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 comms settings for use when connecting to the sensor via the RS485 port.

6.5.2 Changing the RS-485 Settings

1. Enter the password, if required (see section **5.2** on page **17**).
2. Scroll DOWN to the **RS485** (RS-485 Settings) menu heading.
3. Press RIGHT to scroll through and adjust the different RS485 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	19.2k	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	ASII, RTU

[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.*

6.5.3 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 29).
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.

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

1. Enter the password, if required (see section **5.2** on page **17**).
2. Scroll DOWN to the ENG (Engineering) menu heading.
3. Press RIGHT to access the **420Z** and **420F** settings.

   3a. When you enter the **4-20mA Zero [420Z]** setting, the sensor will nominally output 4 mA. Press UP/DOWN to adjust the 4-20 mA Zero calibration value (default: 223) to trim the 4 mA value.

   3b. Similarly, when you enter the **4-20mA Full Scale [420F]** setting, the sensor will nominally output 20 mA. Press UP/DOWN to adjust the 4-20 mA Full Scale calibration value (default: 223) 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	Relay1 and Relay2 closed
	Set to 1	Relay1 open
	Set to 2	Relay2 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 1	Emission Alarm LED = **AMBER**
	Set to 2	Emission Alarm LED = **RED**
	Set to 3	Self-Check LED = **RED**

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

6.7.1 Reading Modbus Register Values [MOD.R]

Go 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. Adjusting register values may stop the sensor from functioning correctly.

Go 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 Tests (Options)

Optional sensor checks are available to provide monitoring of the integrity of your instrument. The sensor provides alarm notifications of sensor test failures.

- **ZERO / REF checks**: self-checks to test for faults with the sensor hardware.
- **SHORT-CIRCUIT (Contamination) check**: if available, this sensor check indicates that 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.

7.1.1 Sensor Checks – Pass Levels

Sensor Checks	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: minimum pass level: 950 + 5% = 998 (~1000) and maximum pass level: 1120 + 25% = 1400.

Note 2 *– Applicable to standard and insulated sensor variants (up to 250 °C) and ATEX / IECEx sensor variants 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 ATEX / IECEx sensor variants for Dust zone 20/21 only. Refer to the pass levels recorded in the Test Report for your instrument.*

7.1.2 Frequency of Sensor Checks

- If available, the Zero and Reference drift checks are initiated manually on demand and will run in succession. If either test fails, an alarm is generated.

- If available, the Short-circuit check runs automatically on an hourly cycle. If the test fails, it is repeated at 10-minute intervals (for example, at 20 and 30 minutes). If the test fails on all three occasions, then an alarm is generated.

NOTE

The Short-circuit check should be performed outside the stack (for example, on a bench). Without adequate shielding, background noise will cause the short-circuit test to fail on high sensitivity.

To test the sensor out of the stack, place the sensor rod in an earthed shield tube and earth the sensor base or enclosure to the shield tube.

7.1.3 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 will now run in succession, taking a total time of about 1 minute.
5. Once the tests have been completed, you can return to the **DUST** display menu heading to view the self-test results (see next section).

7.1.4 Viewing Self-Test Results

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

ZERO	Zero test result
REF	Reference test result
S_C	Short Circuit (contamination) test result

NOTE

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

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

7.1.5 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 RUNNING
Self-Test LED RED	Self-tests FAIL (Relay 1 activates)

8 Maintenance

8.1 Safety Information

WARNING

Electric shock.

This section is intended for ENVEA-trained service engineers only.

Only trained and competent personnel should work inside the instrument with mains power connected and switched on.

WARNING

Danger from the 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 precautions 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 the local Safety Officer and/or local safety procedures.

WARNING

Hazardous voltages.

This equipment contains lethal voltages.

For mains-powered units – hazardous voltages are still present when the main power supply fuse has failed.

CAUTION

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

8.2 Inspecting and Cleaning the Sensor

CAUTION

(1) Do not allow moisture to penetrate the units.

(2) Wipe the outside of the enclosures with a dry or damp (but not wet) cloth only. – *Insulated sensor probe rods should be cleaned with a damp cloth only, as using dry cloths can cause static build-up!*

(3) Do NOT use solvents or oil-based cleaners to remove contamination or accumulations of dirt, as these can damage the surfaces and the seals and insulator on the sensor.

(4) An abrasive, such as wire wool or wire brushes, may only be used on the sensor metal parts.

The nature of many processes is such that a build-up of particulate may develop on the sensor rod. This build-up will normally not affect the instrument's performance, but it is recommended to remove the build-up periodically.

If the probe rod requires cleaning, remove the sensor from the duct and thoroughly clean the entire rod, paying particular attention to the area of the non-

metallic insulator and about 25mm (1”) of the metal parts on either side of the insulator (the aim is to prevent shorting across the insulator). The cleaning may be performed using wire wool. For sticky or stubborn deposits, a cleaning agent may be used (use a fast-drying solvent cleaner – *not water*). Always ensure that the probe rod is thoroughly dried before refitting the sensor.

The instructions below cover the standard sensor. Depending on the application and the type of sensor, the sensor may comprise several parts, a screw-on probe rod, heat shield, or an additional air purge. All sensor parts should be cleaned as outlined in this section.

Always refer to the **Safety Information** at the start of this chapter before commencing cleaning procedures.

NOTE

(1) Where an air purge is attached to the sensor, this must remain switched ON until the sensor has been fully removed from the stack/duct.

(2) The purge air section must be fitted to the sensor, and purge air must be connected and switched ON before the sensor is re-inserted into the duct.

(3) *Do not disconnect the grounding strap.* The grounding strap (or wire) should be long enough to remove the sensor from the stack/duct and place it on the ground or platform without disconnecting the sensor.

1. Switch OFF the power. If the sensor is mains powered, isolate the sensor from the power supply.
2. For sensors with floating nut designs: referring to the installation diagram **Fig. 1** on page **9**), fully loosen the lock nut.
3. If the thread behind the lock nut is very dirty, this should be cleaned before loosening the nuts.
4. Undo the floating nut and remove the sensor from the process carefully.
5. Fully release the floating nut, then move both the floating and lock nuts back from their positions.
6. Check that the lock nut and floating nut move freely.
7. Apply a small amount of copper slip or grease to the mounting thread. This prevents binding and helps ensure a good grounding is maintained with the stack/duct.
8. Using a damp cloth or stiff brush, remove any contamination from the probe rod, insulator, and the back of the sensor enclosure (if applicable, also the heat shield).

NOTE

(1) Clean the sensor parts using a rotational cleaning action to prevent scratches, particularly along the sensor probe (especially when using wire wool).

(2) If an air purge is present, check the purge air flow is sufficient. Replace the filter, if necessary.

9. Restore power to return the sensor to normal operation.

10. If available, run the self-checks to ascertain the correct functioning of the sensor. If the sensor self-checks are successful, go to the next step.

NOTE	Do not place the sensor on the ground while it is running tests.

11. Replace the sensor in the stack/duct. First, tighten the floating nut, then fully tighten the lock nut to secure the sensor in position.
12. Ensure the sealed connectors are secure and undamaged.
13. Inspect the connecting cables (where possible) to ensure they are not damaged or stressed.
14. Check that no moisture or foreign bodies have entered the sensor enclosure. Ensure the lid is refitted securely.

8.3 Changing the Fuse (Mains-powered Sensors only)

WARNING
Hazardous voltages. Hazardous voltages are still present when the fuse has failed. Disconnect and isolate the instrument from the power supply. Fuses must only be changed by a trained and competent person.

CAUTION
Hazardous voltages. There is a replaceable fuse in the sensor. The replacement fuse must be of the correct type and rating (see **Fig. 4** on page **12**). If a replacement fuse fails immediately, contact ENVEA or your local ENVEA service representative. Do NOT replace with a higher value fuse!

1. Switch OFF and isolate the instrument from power.
2. Referring to **Fig. 2** (on page **10**), loosen the 4 off screws securing the sensor enclosure, and open the hinged lid.
3. Referring to item 2, **Fig. 2** (on page **10**), remove the fuse holder using a flat-blade screwdriver or coin.
4. Replace the fuse (with a fuse of the same type), then re-install the fuse holder.
5. Refit the enclosure lid and secure it using the 4 off screws.
6. Restore and switch ON the power.

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. Therefore, the procedure given in this section must 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 packaging, indicates that this product must not be disposed of with general household waste. In most countries and 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

ENVEA UK Ltd 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

The following table provides a list of materials used in the construction of this product.

Sensor – Materials	Where used
Low- and standard temperature variants (up to 100 °C and 250 °C)	
316 Stainless steel	Rod and sensor body
Aluminium alloy	Enclosure body
Electronic components	Sensor electronics
Fibreglass	PCB
PTFE	Insulator (standard and insulated versions)
Nylon	Insulator (up to 100 °C only)
High-temperature variant (up to 400 °C)	
Alumina	Insulator (high-temperature variants)
PEEK	
Sialon	High-temperature insulator

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ENVEA SERVICE AND SUPPORT CENTRES

ENVEA UK Ltd, 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.

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