

4750-PM

USER GUIDE

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 4750-PM Particulate Measurement System



Health and Safety Information



Read all of the instructions in this booklet - including all the **WARNINGS** and **CAUTIONS** - before using this product. If there is any instruction which you do not understand, **DO NOT USE THE PRODUCT.**

Safety Signs



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or personal injury.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to the user or users, or result in damage to the product or to property.

NOTE

Indicates a potentially hazardous situation which, if not avoided, could result in damage or loss of data.

Signs and Symbols used on equipment and Documentation



Caution, risk of electric shock.



Caution, attention to possibility of risk of damage to the product, process or surroundings. Refer to instruction manual.



Caution, hot surface.



Protective Conductor Terminal.



Observe precautions for handling electrostatic discharge sensitive devices.

Equipment Operation

Use of this instrument in a manner not specified by AMETEK Land may be hazardous. Read **and understand** the user documentation supplied **before** installing and operating the equipment.

The safety of any system incorporating this equipment is the responsibility of the assembler.

Protective Clothing, Face and Eye Protection

It is possible that this equipment is to be installed on, or near to, machinery or equipment operating at high temperatures and high pressures. Suitable protective clothing, along with face and eye protection must be worn. Refer to the health and safety guidelines for the machinery/equipment before installing this product. If in doubt, contact AMETEK Land.

Electrical Power Supply

Before working on the electrical connections, all of the electrical power lines to the equipment must be isolated. All the electrical cables and signal cables must be connected exactly as indicated in these operating instructions. If in doubt, contact AMETEK Land.

Storage

The instrument should be stored in its packaging, in a dry sheltered area.

The maximum storage temperature is 10°C (18°F) higher than the maximum operating temperature.

The minimum storage temperature is 10°C (18°F) lower than the minimum operating temperature.

Refer to the Technical Specification for details of the operating temperature limits.

Unpacking

Check all packages for external signs of damage. Check the contents against the packing note.

Lifting Instructions

Where items are too heavy to be lifted manually, use suitably rated lifting equipment. Refer to the Technical Specification for weights. All lifting should be carried out in accordance with local and national regulations.

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Return of Damaged Goods

IMPORTANT If any item has been damaged in transit, this should be reported to the carrier and to the supplier immediately. Damage caused in transit is the responsibility of the carrier not the supplier.

DO NOT RETURN a damaged instrument to the sender as the carrier will not then consider a claim. Save the packing with the damaged article for inspection by the carrier.

Return of Goods for Repair

If you need to return goods for repair please contact our Customer Service Department for details of the correct returns procedure.

Any item returned to AMETEK Land should be adequately packaged to prevent damage during transit.

You must include a written report of the problem together with your own name and contact information, address, telephone number, email address etc.

Design and Manufacturing Standards

The Quality Management System of Land Instruments International is approved to BS EN ISO 9001 for the design, manufacture and on-site servicing of combustion, environmental monitoring and non-contact temperature measuring instrumentation.

Registered ISO 9001 Management System approvals apply in the USA.

UK Calibration Laboratory: UKAS 0034.

USA Calibration Laboratory: ANAB Accredited ISO/IEC 17025.

National Accreditation Board for Testing and Calibration Laboratories approvals apply in India.

Operation of radio transmitters, telephones or other electrical/electronic devices in close proximity to the equipment while the enclosure doors of the instrument or its peripherals are open, may cause interference and possible failure where the radiated emissions exceed the EMC directive.

The protection provided by this product may be invalidated if alterations or additions are made to the structural, electrical, mechanical, pneumatic, software or firmware components of this system. Such changes may also invalidate the standard terms of warranty.

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1

INTRODUCTION

1 Introduction

1.1 Purpose of this Manual

This manual contains all information necessary for the correct installation, setup, operation, and maintenance of the instrument. 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 which, if not followed correctly, can result in personal injury, injury of others, or death.



CAUTION!

Alerts 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 assist the user in carrying out a procedure or in understanding the text.

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



WARNING!

Risk of electric shock.



WARNING!

Laser radiation.

1.2.1 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 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, if 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!**

Risk of 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 DATA section of this manual.

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

**WARNING!**

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

**WARNING!**

Hearing damage. Running the blower produces high sound pressure levels. Prolonged unprotected exposure may cause hearing damage. Use suitable personal protective equipment (PPE).

**WARNING!**

Laser radiation. This product contains a Class 3R laser.

Avoid direct eye exposure to the emitted laser radiation at all times during installation, maintenance, and normal operation.

Use of controls or adjustments or performance of procedures other than those specified in this manual can result in hazardous radiation exposure.

**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 and could affect the safety of the product. It may also invalidate the terms and conditions of the product warranty.

1.4 Intended Use

The 4750-PM is a continuous particulate monitoring instrument suitable for measuring dust concentrations and monitoring filter performance in medium to large stacks for industrial and combustion processes. The sensor illuminates particles in the stack with laser light to detect and measure the amount of back-scattered light. The measurement of back-scattered light is amplified and processed by the onboard electronics.

The instrument can measure very low to high dust concentrations, making it suitable for monitoring filter performance in chemical, metal, and mineral plants, and for continuous emission monitoring in power plants and combustion processes, including refinery boilers and metal-smelting applications.

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 DATA section of this manual. Operation outside these limits may result in damage to the equipment or failure to achieve the performance specification.

Pollution Degree 2

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

Overvoltage Category II

Overvoltage Category II is for equipment or instruments intended to be supplied from the building wiring. It applies both to PLUG-CONNECTED EQUIPMENT and to PERMANENTLY CONNECTED EQUIPMENT.

1.5 Additional Information

1.5.1 List of Abbreviations

The following abbreviations and terms are used in this manual:

Acronym	Meaning
AEL	Accessible Emission Limit (for lasers)
CF	Calibration factor
HRC	High rupturing capacity (fuse)
L/min	Litres per minute (purge air flow rate)
MAU	Manual Audit Unit
min./max.	minimum/maximum
n/a	not applicable
PPE	Personal protective equipment
SPCO	Single pole, changeover (electrical switch)

1.6 Certification

1.6.1 Conformance and related Standards

AMETEK Land declares that this instrument—within the limits specified in this manual—complies with the essential requirements and other provisions of the following European Union Directives: Low Voltage Directive (LVD), EMC Directive.

For details refer to the Declaration of Conformance for this instrument or system.

1.6.2 Laser Standards

This product is designed to be compliant with the following laser standards:

IEC 60825-1:2014

Safety of laser products – Part 1: Equipment classification and requirements	Class 3R lasers have a maximum output power of 5 mW (or 5 times the AEL for a Class 1 product). Radiation in this class is considered low risk, but potentially hazardous.
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US Federal Laser Product Performance Standard (FLPPS)

21 CFR, Parts 1040 (Performance Standards for Light-Emitting Products), Title 21, sections 10 (laser products) and 11 (specific purpose laser products).
Note: under Laser Notice 50, the FDA accepts classification and labelling to IEC 60825-1.

END OF SECTION



2

TECHNICAL DATA

2 Technical Data

2.1 Process and Application Conditions

Stack temperature range (at monitoring point)	-20 to 250 °C (-4 to 480 °F) Option: up to 400°C (750 °F)
Stack pressure	±20 mb(g)
Stack diameter ^B	Ø1.5 to 15 m (5 to 50 ft.)
Sensor – Key Data	
Measurement type	Dust concentration (in mg/m ³)
Measurement capability	0 – 1000 mg/m ³
Resolution	0.1 mg/m ³
Zero drift	<3%
Span drift	<3%
Response time	2 seconds
Environmental information	
Application conditions	Suitable for measurement in non-condensing flue gases. Note: not recommended for use in applications with water droplets
Location	This equipment is for outdoor or sheltered use.


2.2 4750-PM Sensor Specification

Sensor version	Standard sensor: 0 – 250 °C (up to 480 °F)
Weight	9.6 kg (21 lb)
Overall dimensions	L 354 x H 216 x B 204 mm (14 x 8.5 x 8 in.) incl. flange and cable glands
Enclosure	
Temperature range	-20 to 50 °C (-4 to 120 °F), ambient ^C
Dimensions	W 199 x H 180 x D 107 mm (7.8 x 7 x 4.2 in.), incl. glands and hinges
Protection rating	IP65
Material	Die-cast aluminium LM6M (epoxy coated)
Cable entries	3 x M20 cable glands

^B Include standoff length (see Section 4.4.2 for details).

^C Care should be taken to install the instrument out of direct sunlight to minimize the effect of radiating heat, which may subject the sensor to temperatures above +50 °C (120 °F).

Features	<ul style="list-style-type: none"> • Emission and warning alarm levels • Sensor checks: <ul style="list-style-type: none"> • Zero and Reference checks • Purge Air Flow self-check • Password protection • Calibration (internal) • External status indicators
I/O	
Outputs	<p>1 x 4-20 mA:</p> <ul style="list-style-type: none"> • Max. load 500 Ω • Isolated • Max. working insulation voltage is 560Vpeak <p>2 x Alarm relays :</p> <ul style="list-style-type: none"> • Voltage free • Max. 24V DC or AC r.m.s nominal (18–36V DC range), 0.5A • Insulation resistance 1 GΩ @500V DC <p>1 x RS-485 output</p>
Inputs	<p>1 x digital input:</p> <ul style="list-style-type: none"> • Isolated • Max. working insulation voltage is 560Vpeak • Reverse polarity protected
Power Requirements	
Power Supply Voltage	100 to 240V AC, 50/60Hz, 1 A
Power Consumption	1.7W / 2.2W (@24V)
Fuse ^D	5 mm x 20 mm HRC, type T1AH250V (approved to IEC 60127, UL recognized)
Additional Requirements	
Air Purge requirements	<p>Requires an external supply of 1,000l/min of dry, clean (oil-free) air.</p> <p>A suitable purge blower unit is available. For details refer to the table in Section 5.6.1</p>
Laser	<p>This product is equipped with a Class 3R laser.</p> <p>Max. power output = 5 mW, Wavelength = 650 nm</p>



WARNING!

Laser radiation. This product contains a Class 3R laser.

Avoid direct eye exposure at all times !

^D AMETEK Land recommends the following approved fuses: Schurter type SMD-SPT 0001.2704 or Cooper-Bussmann S505-1-R.

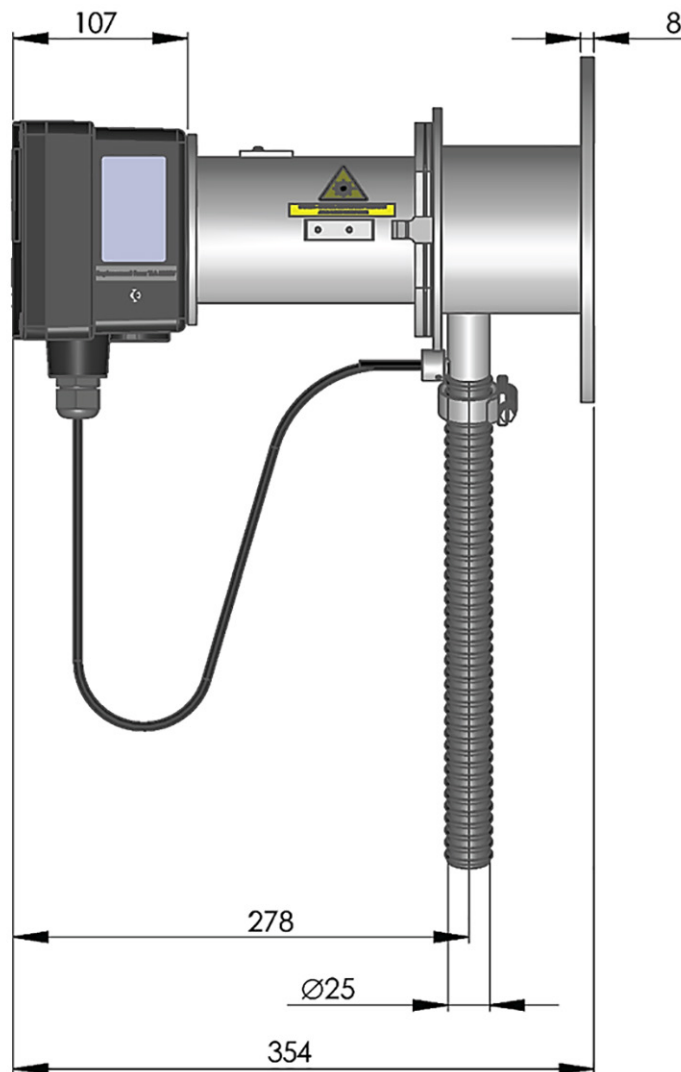
2.2.1 Quality Assurance

Zero and Span Checks	Manually initiated (on demand)
Air Purge Flow self-check (option)	Continuously monitors the purge air feed to detect a 'low flow' or 'no flow' condition. ^E
Auditing	Single-value Manual Audit Unit (MAU)

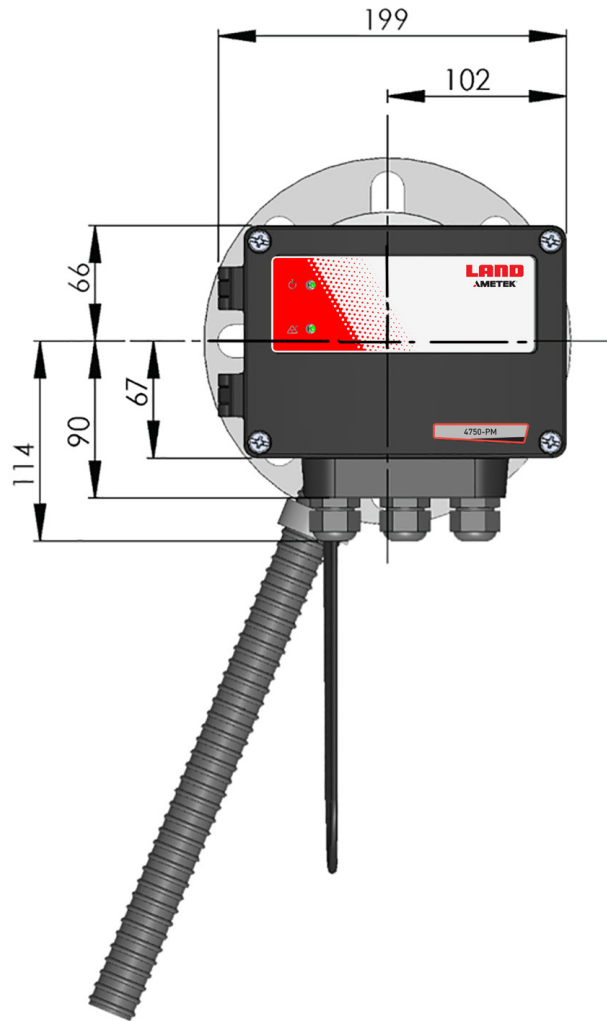
^E This feature includes an optical shield to protect the instrument's optics by minimizing flue gas deposition onto optical surfaces (see Section 4.3.7).

2.2.2 Dimensional Drawings - Sensor

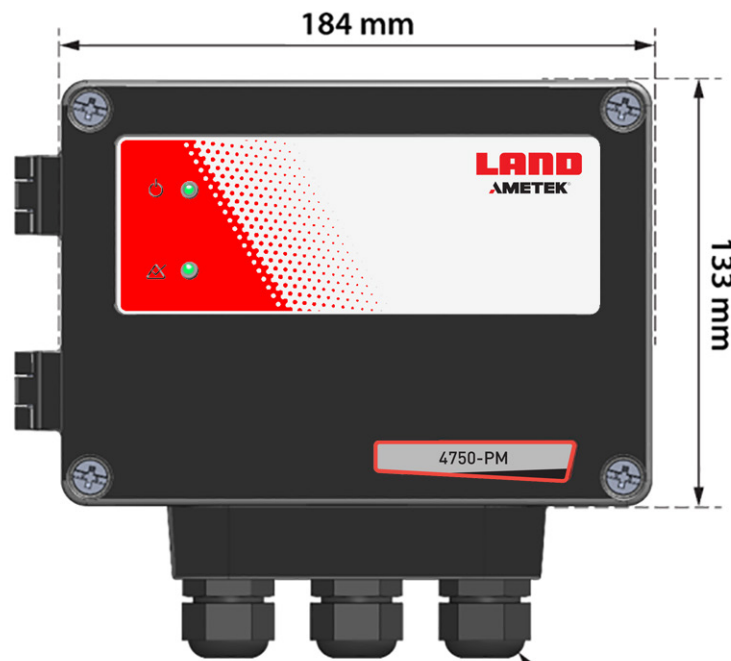
- (a) Side view (incl. blower hose) (c) Enclosure dimensions (excl. hinges, glands)
- (b) Front view (excl. blower hose) (d) Flange dimensions (rear view)



(a)

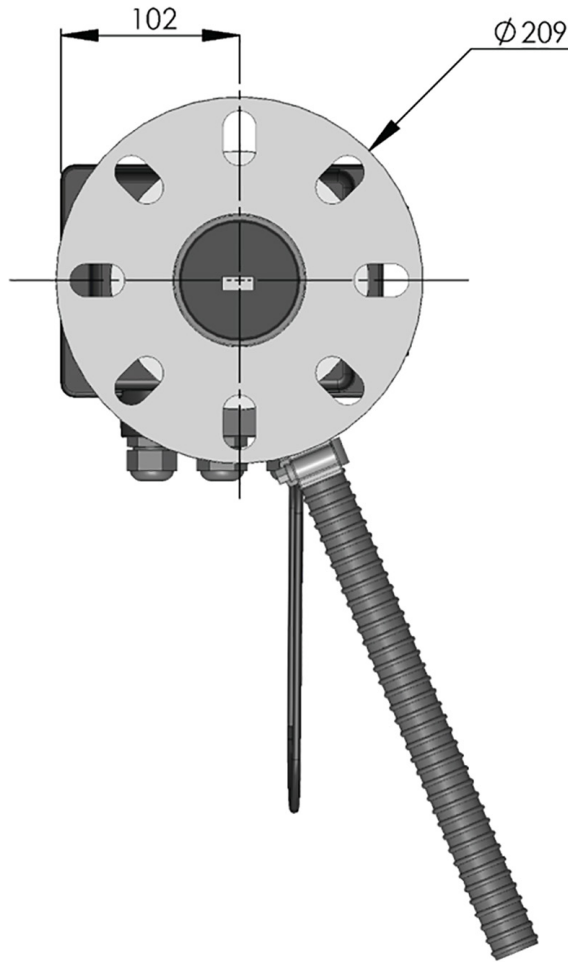


(b)



(c)

M20 cable glands



(d)

2.2.3 Sensor Options

Stack Connection	<ul style="list-style-type: none"> • 3 in 150 lb ANSI flange • DN80 PN10/PN16 flange • JIS 100-5k, -10k flange <p>Eight slots (19 x 31.5 mm/0.7 x 1.2 in) on a PCD of Ø156 mm (Ø6 in). Mounting hole ID: Ø80 to 110 mm (Ø3.2 to 4.3 in).</p>
Additional Options	<ul style="list-style-type: none"> • Optical shield (to protect the optical elements) • Flue gas blocker (stack cover plate) • Medium Purge Blower (see Section 2.2.4)
Hazardous Zones Classification	Refer to the relevant Ex manual. See also Product Parts and Options for more information.

2.2.4 Purge Air Blower (Option)

Type	Medium Purge Blower
Power supply voltages (options)	<ul style="list-style-type: none"> • 110V AC, 50/60Hz, 7 A • 230V AC, 50/60Hz, 2.3 A
Blower Tubing	3 m (10 ft.) hose with fittings (supplied)
Air Filter	Standard (included); recommended change: every 1–3 months, depending on ambient conditions
Noise Pressure Level	>80 dBA
Cable Entries	1 x M20 cable gland
Optional Accessories	
Weather Cover	Recommended for adverse conditions, including torrential rain, snow, and high ambient temperatures. Ambient temperature rating: -20 to +50 °C (-4 to 120 °F) Dimensions: W 480 x H 324 x 259 mm (18.9 x 12.8 x 10.2 in)

2.3 Cabling

All 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).

Cables supplied by AMETEK Land meet these requirements.

Maximum Cable Lengths	RS-485: 1,000 m (0.6 mi/3,300 ft nom.)
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2.3.1 Power Supply Cable Specification

For mains power connections use an appropriate cable with a conductor area range from 0.75 – 2.5 mm², in accordance with your local regulations.

A suitable approved and rated two-pole mains isolation device (and separate fuse) must be clearly marked and installed close to the instrument (within a 2 m/6½ ft radius), so that it is accessible when at the unit. The contact gap of the disconnect device must be at least 3 mm. See also Section 4.3.4.

2.3.2 Data Cable Specification

The minimum requirements for network cabling are outlined in the following table. Cables supplied by AMETEK Land meet these requirements.

Type	4-core (2-pair) cable
Conductor Size	0.5 mm ² (16/0.2)
Current Rating	Max 1 A rms (per core)
Working Voltage	Max 440 V rms
Cable Shielding	Flame retardant PVC outer sheath (OD Ø7.9 mm/0.3 in), with overall tinned copper, braided or foil screen. Note: for electrically noisy environments the use of a braided, screened cable is recommended. For very noisy environments, use a cable with multiple layers of foil and braid shielding.
Resistance	<40 Ω/km (12.192 Ω/kft), recommended for long cable runs
Compliance	BS5308 part 2, type 1

END OF SECTION



3

PRODUCT DESCRIPTION

3 Product Description

3.1 About the 4750-PM

The **4750-PM** backscatter sensor with two external status indicators and protected, internal user controls is suitable for measuring dust concentrations and monitoring filter performance in medium to large stacks or ducts for industrial and combustion processes. The sensor can measure dust concentrations as low as 0.1 mg/m³, making it particularly suitable for the low dust levels found after bag filters. It is unaffected by changes in flue gas velocity associated with variable speed fans or plant-load changes and, for a given particle size and type, the instrument response is proportional to dust concentration.

The instrument has been designed to comply with the TUV suitability testing scheme to EN 15267 and, due to its wide dynamic operating range, may be used in higher dust loading applications as well as for process optimization applications.

3.2 Components

3.2.1 4750-PM Sensor

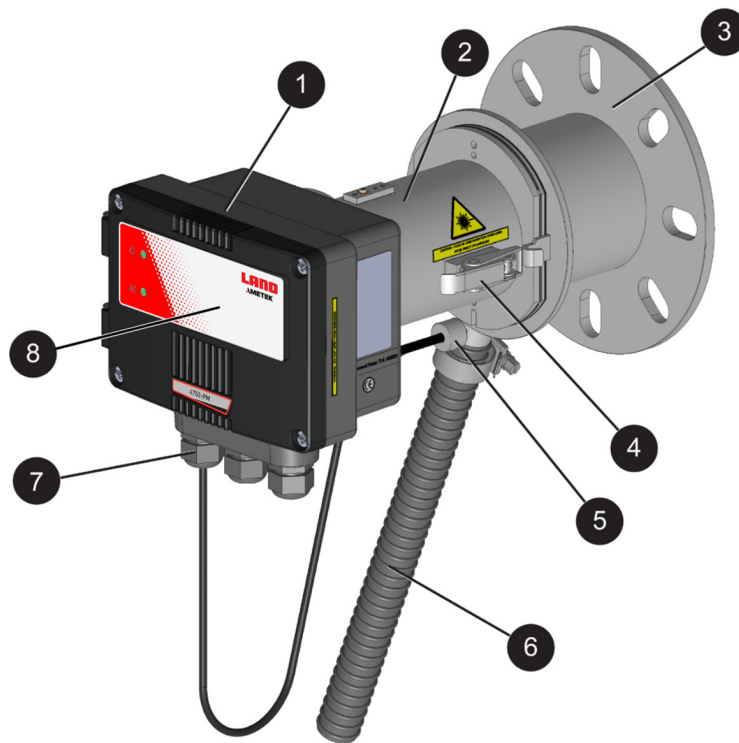


Fig. 3-1 4750-PM Sensor

1	Sensor enclosure with hinged lid	5	Purge Air Flow sensor
2	Hinged sensor body	6	Purge air supply (flexible tube with hose clip)
3	Inbuilt flange (sensor-to-stack connection)	7	M20 cable glands (3 off)
4	Quick-release clamp	8	Sensor interface with external status indicators (2 off)

3.2.2 Sensor Display and Controls

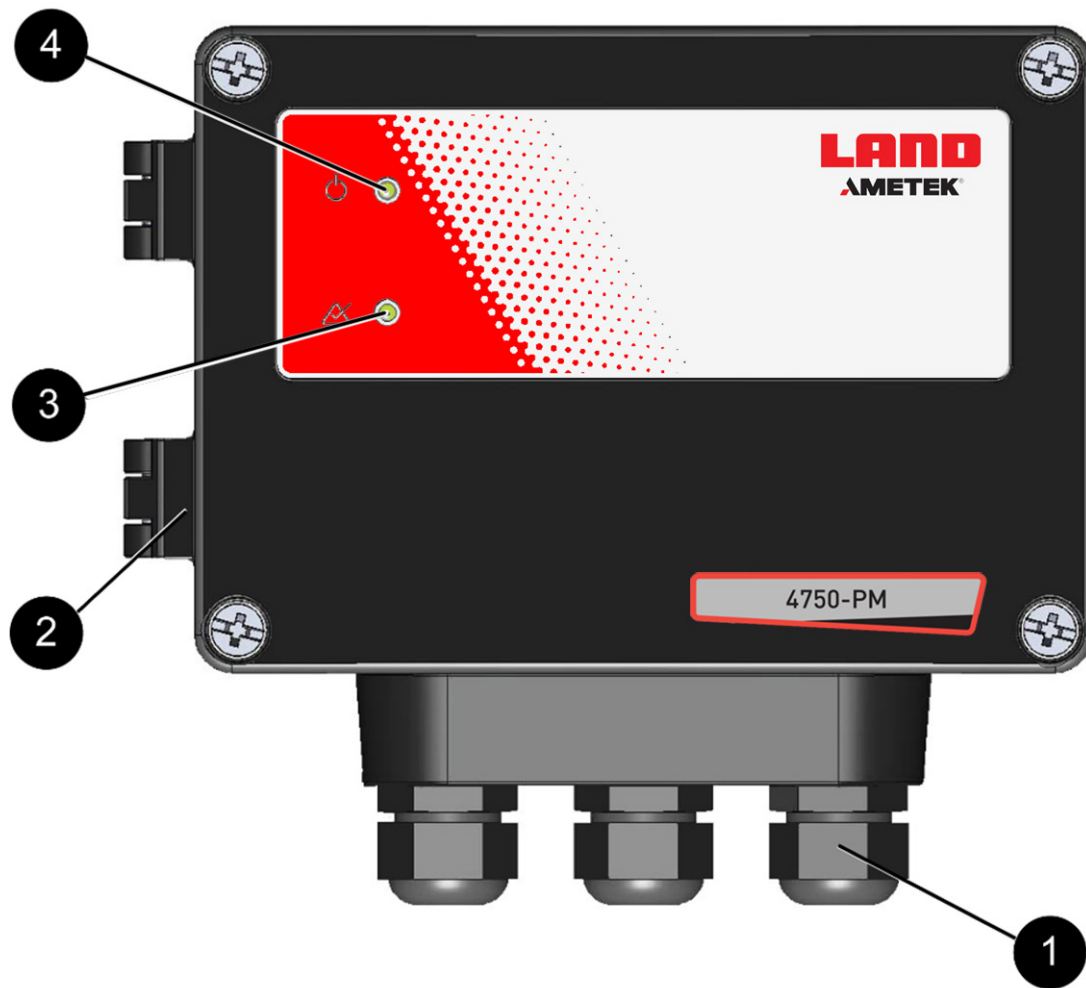


Fig. 3-2 4750-PM Sensor Display and Controls

1 M20 cable glands (3 off)	3 Self-check LED
2 Hinged enclosure lid (with 4 off screws)	4 Power/Comms LED

3.2.3 Internal Sensor Controls

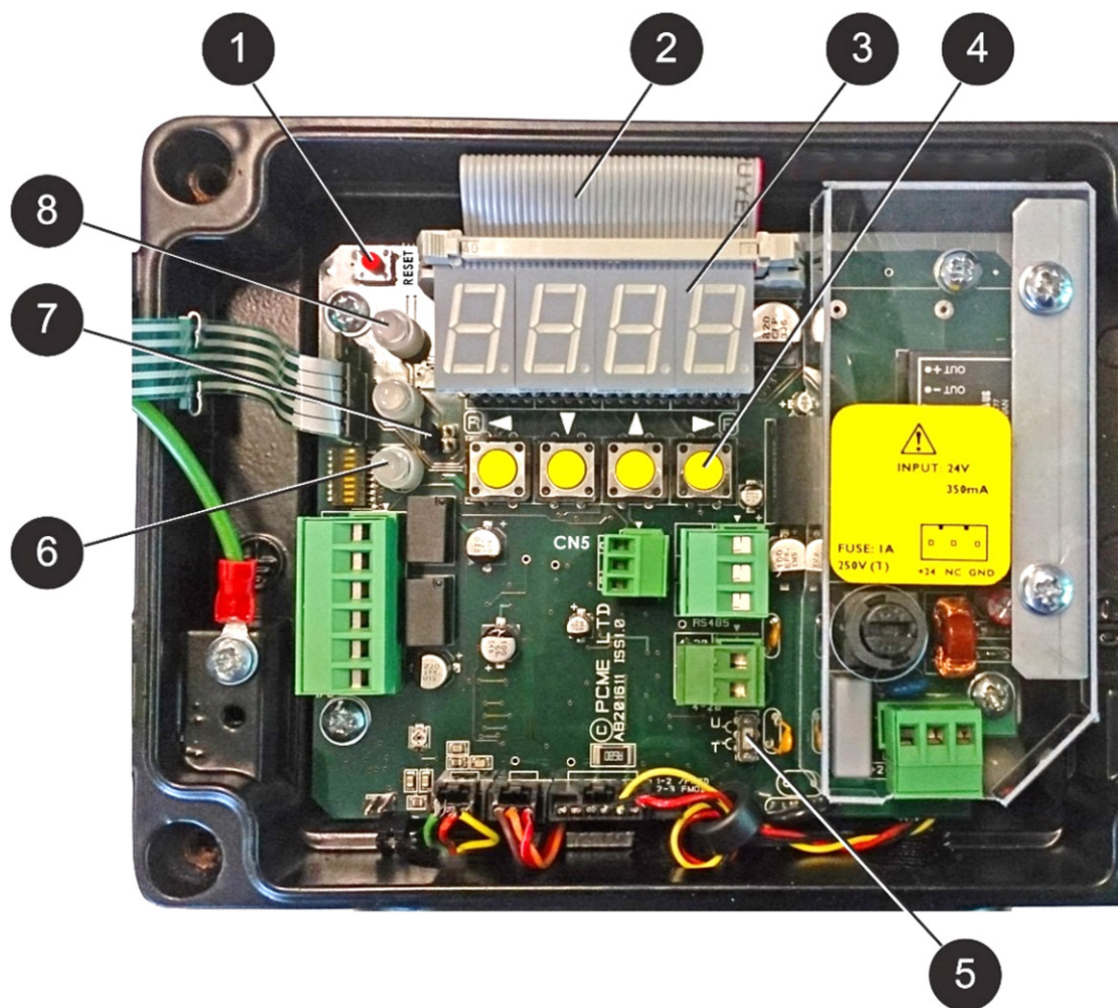


Fig. 3-3 Internal Sensor Controls

1	RESET Button	5	Bus termination switch
2	Connection to CPU board (do not remove)	6	Self-check LED
3	Four-digit LED display	7	Menu selection (locations LK3, LK4 with jumper)
4	Navigation buttons (LEFT, DOWN, UP, RIGHT)	8	Power/status LED

3.3 Sensor

The **4750-PM** backscatter sensor comprises the electronics and optical components (including a laser module and photodiode detector) required to illuminate particles in the stack with laser light to detect and measure the amount of back-scattered light. The 4750-PM is a standalone sensor, either mains powered or receiving 24V DC from a local source. The sensor has a large internal four-digit display and user control buttons, the sensor display has two status indicators for monitoring the sensor status. The hinged sensor body allows easy cleaning and is convenient when performing manual audit checks.

3.3.1 Sensor Checks

Manually triggered Zero and Span sensor checks ensure consistent data quality and reliable performance. An automatic Air Purge Flow self-check is available to continuously monitor the purge air flow to the sensor and trigger an alarm if the purge air flow fails or is greatly reduced. The automatic sensor self-check is standard on high-temperature sensor variants (see below).

3.4 Purge Air Blower

The 4750-PM sensor requires purge air at all times during installation, operation, and maintenance. AMETEK Land supplies the Medium Purge Blower, which provides a continuous supply of purge air to the sensor (for more information see page Section 2.2). A Purge Air Flow sensor is available to monitor the constant, sufficient supply of purge air to the sensor. The Purge Air Flow sensor is standard on high-temperature sensor variants (refer to the Section 2.2.3 Sensor Options).

3.5 Principle of Operation

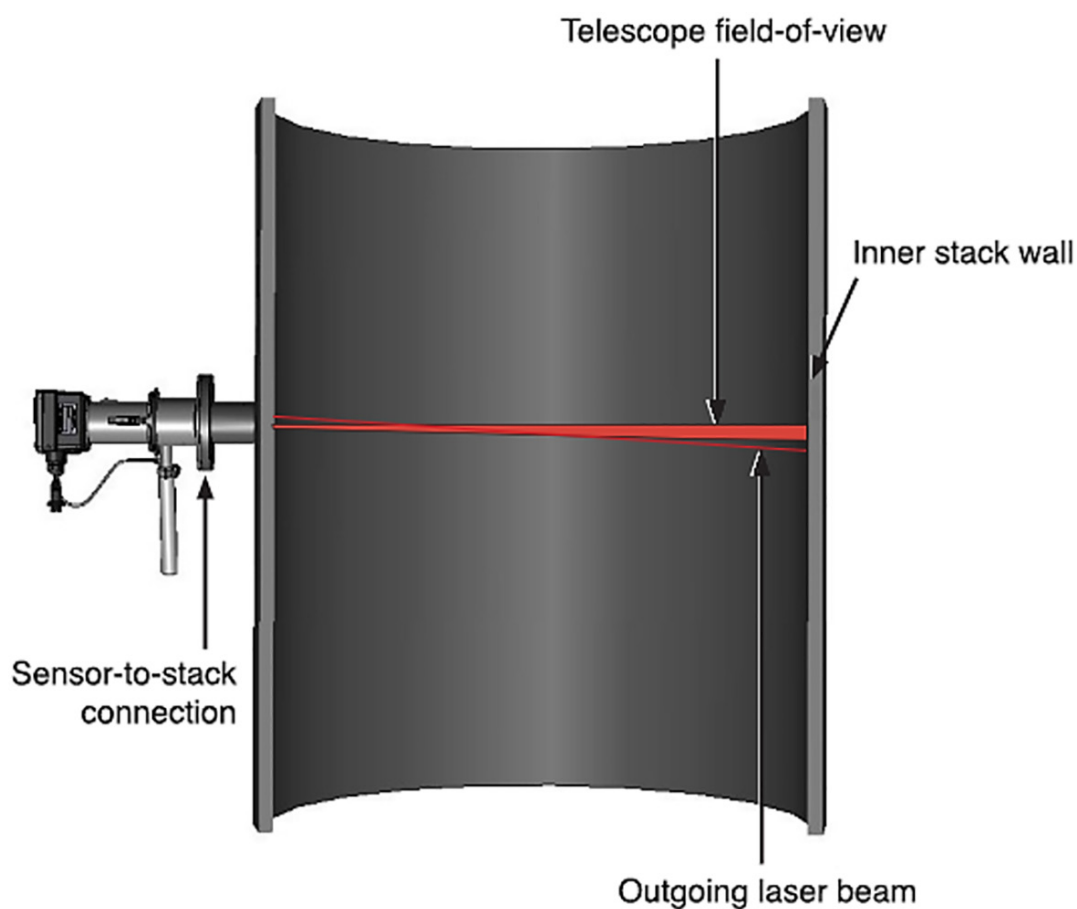


Fig. 3-4 Principle of Operation

Particles in the stack are illuminated by a laser and the amount of light scattered back from the particles is measured. Stray scattering from the far side of the stack wall is eliminated by tuning the instrument's field-of-view. Ambient light is eliminated by use of a modulated laser source. The instrument response is proportional to the dust concentration, allowing the instrument to be calibrated to provide an mg/m^3 reading.

END OF SECTION

A decorative graphic in the top left corner. It features a large, bold, black number '4' on a light gray background. To the right of the '4', there are several overlapping, semi-transparent gray parallelograms that create a sense of depth and movement. A bright blue parallelogram is positioned at the top right of this graphic, pointing towards the right edge of the page.

4

INSTALLATION

4 Installation

4.1 Unpacking and Inspection

Carefully unpack the unit and retain the packaging to return equipment for servicing or repair. If the equipment is damaged in any way, return it to AMETEK Land or your local AMETEK Land representative in its original packaging (see contact details on the rear cover of this guide).

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 this is not the case, please contact AMETEK Land or your local AMETEK Land representative.
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The 4750-PM sensor is supplied as a compact package; if supplied, the purge air blower is supplied separately.

The sensor may be supplied with the following items and accessories:

4750-PM	Description
Standard	Sensor (incl. enclosure and body with built-in flange)
Optional	Purge Air Flow sensor (fitted)

If supplied, the purge blower is packed separately and may include the following parts:

Medium Blower Unit	Description
Standard	3 m flexible hose (incl. fixings)
Optional	Weather cover

4.2 Preparation – Overview of Process

There are four stages to installing and commissioning a 4750-PM system:

- 1) Pre-installation preparations – before the instrument/system arrives on site
- 2) Installation – when the instrument/system has arrived on site
- 3) Commissioning
- 4) Calibration

4.2.1 Pre-Installation Preparations

- Selecting the monitoring point and orientation of the sensor.
- Carrying out the required welding, access, power, cabling, and air purge preparations.

4.2.2 Installation Procedures


Installation covers the following activities:

- Connecting the sensor to the air purge and switching on the air purge.
- Fitting the sensor to the stack.
- Setting up the sensor parameters.

When installation is complete, perform the quick power-up check before attempting calibration. More information on sensor installation and setup in the following chapters.

4.3 Prerequisites and Guidelines

4.3.1 Laser Safety



WARNING!

Laser radiation. This product contains a Class 3R laser.

Avoid direct eye exposure to the emitted laser radiation at all times during installation, maintenance, and normal operation.

Use of controls or adjustments or performance of procedures other than those specified in this manual can result in hazardous radiation exposure.

A laser radiation warning label (below) is affixed on the right-hand side of the sensor enclosure that indicates the nature of the emitted radiation.

Take precautions when performing maintenance on the sensor, especially when the sensor body is open, as laser light could exit in this position!

LASER RADIATION


AVOID DIRECT EYE EXPOSURE

CLASS 3R LASER PRODUCT

Max. Power: 5mW, Wavelength: 650nm
 Complies with 21 CFR 1040.10 & 1040.11
 and with IEC/EN 60825-1 Edition 2 (2014)

4.3.2 Environmental Information

Where possible, avoid placing the sensor in a location that would be subjected to excessive vibration, heat, or dust. For more information on ambient conditions refer to Section 2 Technical Data.



NOTE

The sensor should be mounted such that it is not close to significant sources of EMC interference. Failure to observe this may result in fluctuating readings at certain frequencies.

Ambient Light

An important consideration when choosing the location of the sensor is the effect of excessive ambient sunlight reaching the detector. In order to eliminate interference from ambient sunlight, the sensor should be mounted as far from the top of the stack as practicable, taking the location and guidelines of the isokinetic sampling ports into consideration.

4.3.3 Access to the Sensor (Clearances)

Appropriate health and safety considerations need to be applied due to the size and weight of the sensor (see Section 2.2).

Maximum Weight	Maximum Length	Minimum Clearance Required
9.6kg (21lb)	354 mm (14 in)	470 mm (approx 1.5 ft)

The above table gives the maximum weight and length of the sensor, and the minimum unobstructed clearance required in front of the sensor enclosure to allow unhindered installation, opening, and removal of the sensor.

4.3.4 Power Supply to the Sensor


Ensure the power required for the sensor is made available near the point of monitoring 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. For more information refer to Section 2.3 Cabling.

When installing, leave sufficient cable to allow the sensor to be removed and placed on the ground or platform without disconnecting (see also Section 4.3.5 below).

Mains Wiring Safety Rules

Trim back the wire insulation to no more than 8 mm (0.3 in) and ensure that strands are not left free. Alternatively, use a suitable ferrule. It is recommended to extend the cable insulation fully through the gland so individual wires are not damaged and a good seal is formed. Ensure cable glands are tightened securely, either by hand or using a suitable spanner.

4.3.5 Cable Routing Guidelines



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

- 1) Ensure the cable sheath fully penetrates the sensor cable gland.
- 2) Fit blanking plugs to unused cable glands.
- 3) Ensure cable entry glands are securely tightened to the cable.
- 4) Support cables at appropriate intervals.
- 5) Do NOT route cables where they may be at risk from lightning strike (e.g. over exposed roofs).
- 6) Leave sufficient length so the sensor can be removed from the stack/duct and laid on the ground or platform without disconnecting.

4.3.6 Purge Air Supply



CAUTION!

Purge air must be supplied to the sensor at all times during installation, servicing, and normal operation in the duct/stack.

The Medium Purge Blower unit is designed to supply sufficient purge air under normal stack conditions. For more information and requirements see Section 2.2.4. The purge blower may be installed in upright or horizontal orientation. It is strongly recommended that the blower is located close to the sensor, as close as the flexible hose allows. A weather cover for the purge blower is available to protect the unit from harsh weather conditions. The mounting holes are Ø11 mm in diameter.



NOTE

A mains power supply is required for the purge blower that is separate from the power supplied to the sensor and that must be fitted with a mains isolation device and fuse (see Section 4.5.3).

4.4 Installing the Sensor

4.4.1 Connecting the Purge Blower



WARNING!

Risk of electric shock. A suitable approved and rated two-pole mains isolation device must be installed close to the unit (within a 2 m/6½ ft. radius), readily accessible. The contact gap of the disconnect device must be at least 3 mm.



WARNING!

Hearing damage. Running the blower produces high sound pressure levels. Prolonged unprotected exposure may cause hearing damage. Use suitable personal protective equipment (PPE).



CAUTION!

Purge air must be supplied to the sensor at all times during installation, servicing, and normal operation in the duct/stack.

Users must have access to the purge air fail sensor alarm and monitor this regularly. If the alarm is triggered, purge air must be restored.

If using the Medium Purge Blower, attach it to the sensor using the flexible hose and fittings provided. Fit the hose onto the short tubing connection (Ø25.4 mm/1 in) protruding at an angle from the lower part of the sensor body and secure it with the hose clip provided. See Fig. 3-1 for the location of this item and the dimensioned drawings, Section 2.2.2.

4.4.2 Fitting the Sensor to the Stack

Attach the sensor unit to the stack flange. Ensure that the sensor enclosure is vertical with the cable glands at the bottom facing downward and that the air purge is attached to the sensor and switched ON.



NOTES

- (i) The sensor is fitted with an Earth stud and grounding strap (supplied), ensure this is firmly connected to the stack/ duct. Ensure the grounding strap (earth wire) is long enough to remove and place the sensor on the ground or platform without disconnecting if required.
- (ii) The sensor optics have been designed so that there is no need to install a beam dump at the far side of the stack. However, be aware of possible interference, which may be due to the stack diameter and/or reflectivity of the stack wall. For more information and assistance contact AMETEK Land.

Stack Connection (Flange)

The stack connection is either a 3 in 150lb ANSI or DN80 PN10/16 flange. The port hole in the stack must allow for a standoff with an ID of $\text{Ø}80\text{--}110\text{mm}$ (3.2 – 4.3 in).

The sensor flange connection is a combined (dual-size) flange to match the 4 off holes of the 3 in 150lb ANSI or the 4 off holes of the DN80 PN10/16 flange, i.e. it has eight slotted holes to allow for square or diamond stack flange orientation/arrangement. The flange should be fitted to the stack wall as shown in Fig. 4-1.

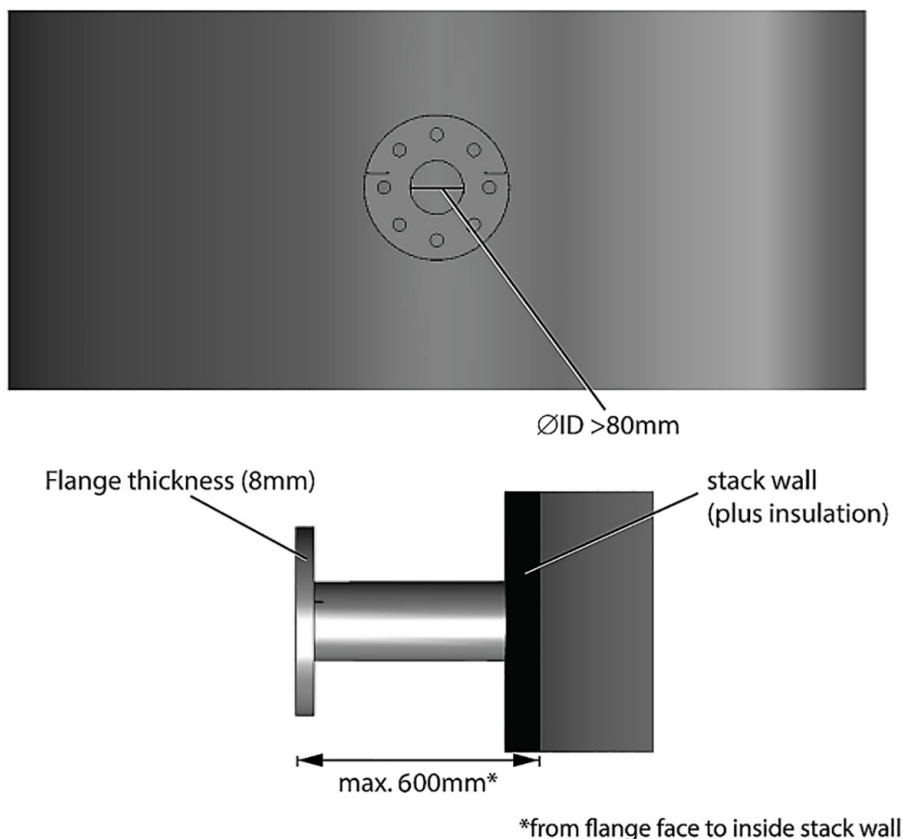


Fig. 4-1 Stack Port Hole and Standoff dimensions

The minimum distance between the flange and the opposite inner wall of the stack must be at least 2 m (6 ½ ft.). For stacks with a diameter of less than Ø2 m (6 ½ ft.), the standoff must be sufficiently long to make the total length from the flange to the far wall at least 2 m. The maximum standoff length (i.e. the distance from the flange face to the nearside inner wall, see Fig. 4-1) is 600 mm (2 ft).

**NOTES**

- (i) The mounting-hole dimensions are in line with the DN80 and ANSI flanges. Ensure that the size of the hole in the stack or standoff is larger than Ø80 mm. The sensor flange will also accommodate JIS 100-5 and 100-10 stack flanges. Refer to Section 2.2.3.
- (ii) All references for flanges are for dimensions only and do not relate to the pressure rating.

4.5 Connecting the Sensor

4.5.1 Safety Information

**WARNING!**

- (i) Ensure that only the cables types specified are used for power and interconnection of equipment.
- (ii) 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.

4.5.2 Sensor Connections

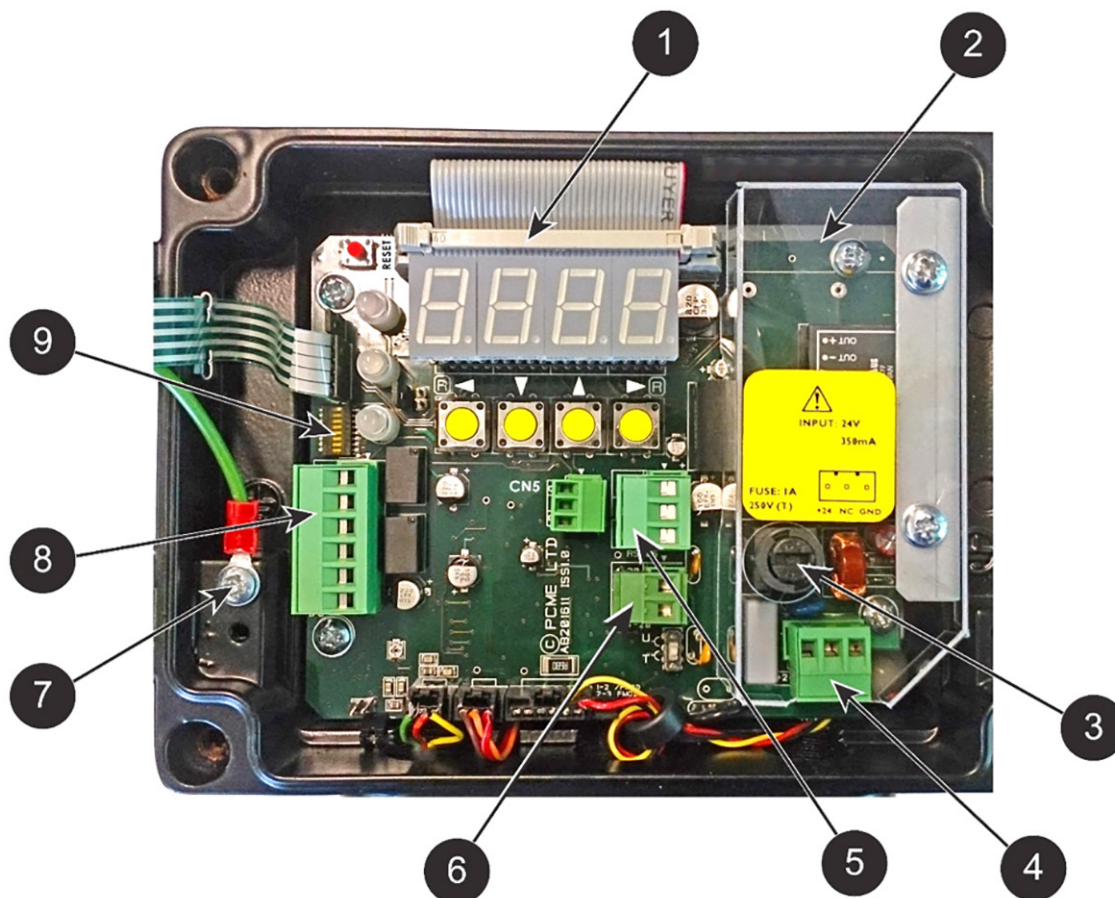


Fig. 4-2 4750-PM Sensor PCB Connections

1	Connection to CPU board (do not remove)	6	4-20mA output
2	Power supply and (clear) power connection cover	7	Lid earthing strap (do not remove)
3	Mains fuse holder	8	Relays (2 off) and digital input
4	Power IN	9	Address (DIP) switch
5	RS485 output		

4.5.3 Connecting the Power Supply

Connecting the Cables

An easily accessible disconnect device, such as a switch or circuit breaker along with a separate fuse, must be fitted to the power supply wiring, one each per (mains-powered) sensor and purge blower unit. These must be located so they can be reached easily (within a radius of 2 m/6½ ft). Isolation devices should connect/disconnect both mains Live (L) and mains Neutral (N) and must be clearly marked as the disconnecting device for the unit. The contact gap of the disconnect device must be at least 3 mm.

Wiring the Mains Supply

- 1) Referring to Fig. 3-2 (on page 3-2), undo the 4 off screws and open the hinged sensor enclosure lid.

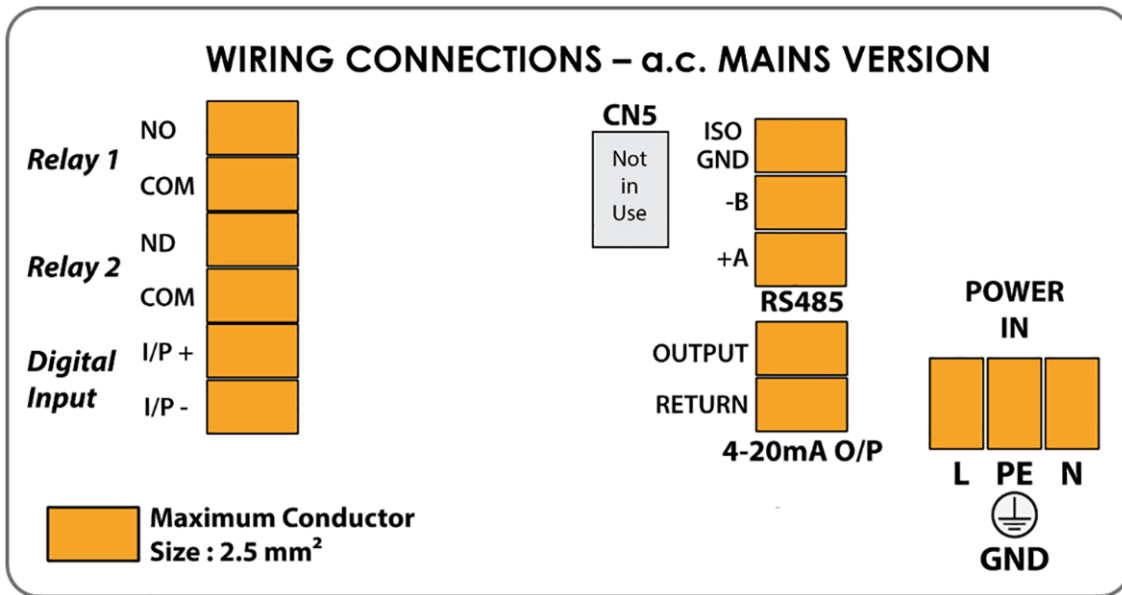



Fig. 4-3 Sensor connections label for mains versions (inside enclosure lid)

- 2) Note the label on the power supply cover (see Fig. 4-4 below).
- 3) Referring to item 2, Fig. 4-2, undo the 2 off screws and remove the power supply cover.

Mains Pin Connections (L-R)	
L	Live
PE 	Protective Earth (GND)
N	Neutral

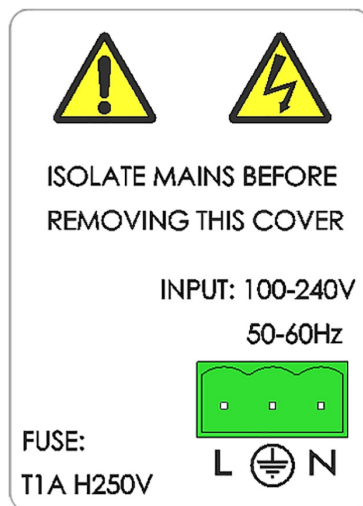


Fig. 4-4 Sensor mains supply label

- 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, then proceed to carrying out the **Power-up Quick Check** (See Section 4.6).

4.5.4 Bus Termination Switch

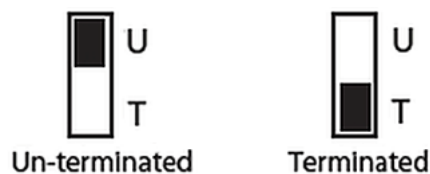


Fig. 4-6 Bus Termination Switch

Refer to see Fig. 3-3 on page 3-3 for the location of the Bus Termination Switch (Item 5)

If the sensor is in the middle of the network, set the bus termination switch to **U** (un-terminated)

If the sensor is at the end of the network and for single-channel systems, the switch must be set to **T** (terminated).

4.5.5 Communications Settings (SW7)

Setting the Network Address

Each sensor must have a unique address on the network (for ON = switch position is to the LEFT). The Modbus address is set by means of the dip switch (see item 11, Fig. 4-2 for its location) using a suitable implement (such as a small flat-blade screwdriver).

Only switches 1 through 5 are used to set valid addresses (from 1 to 32). The address switch uses binary coding to calculate the address.

Example: to set sensor address number 5: set both switch 1 (binary 1) and switch 3 (binary 4) to ON = LEFT (resulting in 4 + 1 = 5).

MODBUS Communications Settings

Both Modbus communications protocols, ASCII and RTU, are available and can be set via the dip switch (see item 11, Fig. 4-2 for its location). Use switch positions 6 through 8 to define the communications protocol settings. Note that the baud rate is set to default value. Use switches 6 and 7 to define the baud rate; currently both switches are set to OFF (RIGHT) for the default baud rate.

RTU is a faster communications protocol than the standard ASCII protocol. For RTU mode set switch 8 to OFF (RIGHT), meaning parity is set to 'none' or to ON (LEFT) for ASCII, meaning parity is set to 'odd'.

The settings are as follows:

Setting	Value	Setting	Value
Baud rate	19200 (default)	Stop bits	1
Parity	None (Modbus RTU) Odd (Modbus ASCII)	Data bits (Comms mode)	8 (Modbus RTU) or 7 (Modbus ASCII)

4.5.6 RS485 Connection (CN7)

Referring to the wiring diagrams above (or in the sensor lid), route a suitable cable through a vacant cable gland and connect to the RS485 connector terminals.

Pin Connections (Top to Bottom)		POWER IN Connector
Wire Colour		
ISO GND		
-B		
+A		



NOTE

The maximum cable length for RS485 is 1,000m (0.6 mi/3,300 ft nominal).

4.5.7 Digital Input Connection

Referring to item 8, Fig. 4-2 (on page 4-8), route a suitable cable through a vacant cable gland and connect to the Digital Input terminal. The maximum voltage across input is 48V, nominal 24V. The maximum current allowed per pin is 16 mA.

4.5.8 4-20mA Output Connections

Referring to item 6, Fig. 4-2 (on page 4-8), route a suitable cable through a vacant cable gland and connect to the 4-20mA O/P terminal.

4.5.9 Alarm Contact Connections

The sensor is fitted with two voltage-free relays (SPCO). The relays can be used to a maximum of 24V DC nominal (18–36 V range), 0.5A.

Referring to item 8, Fig. 4-2 (on page 4-8), route a suitable cable through a vacant cable gland and connect to the Relay 1/Relay 2 terminals.

4.6 Power-up Quick Check

To set up the system quickly, first ensure that the power to the sensor is ON and that the purge air blower is also connected and ON.

- 1) On power-up, the display shows a two-part number, e.g.

17.55

where

- 17 – is number indicating that the sensor is a Type 4750-PM and
 - 55 – is the installed software version, in this example v5.5
- 2) This is followed by 170, indicating a 4750-PM
 - 3) Both status LEDs should be GREEN when the sensor is first switched ON.

If the Purge Air Fail alarm is available and active and the self-check LED is RED, this indicates that the air purge has failed. (If this option is not available, the LED will remain GREEN as long as other self-checks are successful, even if there is no air flow!)

The system installation is now complete, and the instrument is ready for commissioning (i.e. setup and calibration).

END OF SECTION



5

OPERATION

5 Operation

5.1 Sensor Settings Overview

For the 4750-PM, the settings are accessed via the internal keypad on the instrument. The settings functions and menu structure are described in this section.

The sensor settings are organised into a hierarchical list of menu headings. The DUST reading is displayed by default.

Use the UP/DOWN navigation buttons to scroll through the menu settings.

Use the RIGHT (arrow) button to view and/or edit the settings associated with each menu/submenu (e.g. PASS <> ENTR <> ALTR).

Use the LEFT (arrow) button to cancel any changes and return to the previous menu setting.

The Standard and Engineering menus are circular menus, pressing DOWN when reaching the last menu entry (RUN.T) displays the top menu (DUST).

5.1.1 Menu Navigation and User Interface

For information on internal and external layouts, refer to Section 3.2 Components.

Feature	Action	Description
External Controls		
Power/Status LED	Switch power ON [Status]	GREEN = ON RED = Electronic Fault Off = No power
Self-check LED	[Status]	GREEN = ON GREEN (slow blink) = Sensor checks are running (changes to RED when a check fails) RED = Sensor check(s) failed
Internal Controls		
Four-digit display	[viewing only]	Displays menus/parameters and values.
RESET button	RESET	Press to return to DUST and when accessing the Engineering menu
Navigation buttons (4-button row) ^F	LEFT, DOWN, UP, RIGHT	Select menu option to modify. Select entry value. Confirm entry.
LK3, LK4 jumper	Set jumper to LK4	Displays the Standard menu (default).
	Set jumper to LK4 and press RESET	Displays the Engineering menu.

^F The positions/labels are marked on the sensor PCB

5.1.2 Menu Options

Two menus are available, the Standard menu and the Engineering menu. The range of accessible functions in each menu can be found in the relevant menu section (see Sections 5.2 and 5.3).



NOTE

If a password has been set, you must enter the password before you can change any of the settings (See Section 5.2.2)

5.2 Standard Menu

The following procedures introduce the principles that apply to all settings functions in this chapter. The range of essential functions available in the standard menu is shown in the below menu map. If required, set the jumper to **LK4** (default) and press the **RESET** button to display this menu (see item 1, Fig. 3-3 on Page 3-3).

5.2.1 Standard Menu Map (Flow Diagram)

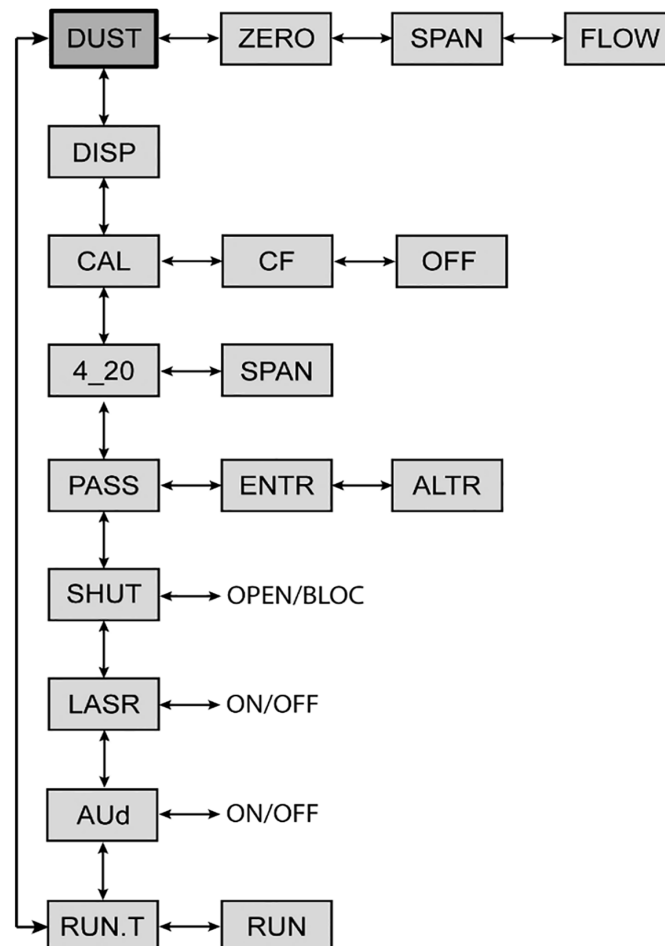


Fig. 5-1 Menu map – Standard menu

The Standard menu can be navigated and settings can be changed using the internal user controls. The **DUST** menu setting provides access to all current readings available on the instrument: the dust measurement reading and the sensor check results (for Zero, Span, and Flow, if available).

5.2.2 Password (PASS)

The password is a four-digit code that can be set to prevent unauthorized access.

The password must be entered before any settings can be changed.

Entering the Password (ENTR)

- 1) Scroll DOWN to the **PASS** menu.
- 2) Press RIGHT to display **ENTR**, then RIGHT again: the first digit starts flashing.
- 3) Use the UP/DOWN buttons to change the value. Press RIGHT to move to the next digit.
- 4) Press RIGHT to confirm the password and return to the main menu.

Changing the Password (ALTR)

- 1) Scroll DOWN to the **PASS** menu and press RIGHT.
- 2) Enter the correct four-digit password. If you have entered a valid password, the display will show **GOOD**.
- 3) Press RIGHT to change the current password (display shows **ALTR**).
- 4) Press RIGHT again to enter a new password. Otherwise press RIGHT repeatedly to leave the password unchanged and return to the main menu.

5.2.3 Display Smoothing Time Value (DISP)

Not currently in use.

5.2.4 Calibration (CAL)

Setting the Calibration Factor

The sensor can be calibrated to scale the raw dust reading to provide a mg/m³ value directly from the instrument. Alternatively, the raw dust readings can also be output to your own system (using analogue or Modbus outputs), then calibrated within your system. The dust reading is calibrated from a raw dust reading using this formula:

$$\text{Dust reading [mg/m}^3\text{]} = (\text{CF} \times \text{raw reading}) - \text{offset}$$

where

CF is the calibration factor and

Offset is the reading when there is no dust in the measurement path.

The calibration factor [CF] is used to set the scaling between raw dust readings, measured in scattered units and dust measured in mg/m³. The offset [OFF] can be used to remove the effect of stray light reflected by the far stack wall. This is most often seen in small stacks with light-coloured walls.



NOTE

For initial calibration of the instrument, use the default CAL setting (1.000) and Offset = 0.0

The Calibration Factor is applied to the value displayed. This reading is then used by the analogue 4 to 20 mA output. To configure the sensor to provide mg/m³ dust readings for a particular stack or duct see **Calculating a new Calibration Factor** below.

Adjusting the Calibration Factor (CF) and Offset (OFF)

- 1) Scroll DOWN to **CAL** (Calibration) and press RIGHT to access the **CF** (Calibration Factor) submenu.
- 2) Press RIGHT again to display the current **CF** (default: **1.000**).
3. Use the UP/DOWN buttons to change the value. Press RIGHT to move to the next digit.
- 4) Adjust the decimal point: after editing the fourth digit press RIGHT again, the decimal point starts flashing. Use the UP/DOWN buttons to adjust the position of the decimal point.
- 5) If required, repeat steps 2 through 3 to adjust the offset [**OFF**].
- 6) When complete, press RIGHT or LEFT repeatedly to return to the main menu.

Calculating a New Calibration Factor

To calculate a new calibration factor [CF] that will allow correct configuration of the dust reading to correspond to the actual mg/m³ reading in the stack, use the formula below. Note that the instrument readings during the period of an isokinetic sampling run need to be recorded, then calculate as follows:

$$\text{new CF} = \text{current CF} \times \frac{(\text{Sampling Result [mg/m}^3\text{)})}{(\text{Average Sensor Reading [mg/m}^3\text{)})}$$

Note that this assumes that the offset [OFF] has been set correctly so that the instrument reads '0' mg/m³ in a dust-free environment.

5.2.5 4-20mA Output [4_20]

The 4-20mA settings menu [**4_20**] allows the span of the 4-20mA output to be set. The Span value sets the relationship between the reading on the display and the current output from the 4-20mA output.

Example: if the Span value is set to 100, then a display reading of '100' will output 20mA (=the Span value). Display values above 100.0 will be clipped at 20mA. A reading of '0.000' will always output a value of 4mA.

Changing the 4-20mA Span Settings (SPAN)

- 1) Scroll DOWN to the **4_20** and press RIGHT to access the menu. The display shows the current **Span** value (default: **100**).
- 2) Use the UP/DOWN buttons to change the value. Press RIGHT to move to the next digit.
- 3) Press RIGHT to return to the main menu.



NOTE

The range of allowed values for span: the decimal point is fixed after the 3rd digit; this allows displaying values ranging from 000.1 to 999.9.

5.2.7 Laser Function (LASR)

Select the **LASR** menu to switch the laser ON or OFF.



WARNING!

Laser radiation. This product contains a Class 3R laser.

Avoid direct eye exposure to the emitted laser radiation at all times during installation, maintenance, and normal operation.

5.2.8 Audit Mode (AUd)

Use the **AUd** menu to control automatic sensor and system checks. This setting should be OFF by default and during normal operating conditions.

When carrying out an audit of the instrument, it is important that the sensor is put into Audit mode, i.e. it is switched ON. This disables the compensation checks and the Calibration Factor.



NOTES

- (i) Ensure that the Audit mode [AUd] is turned OFF after the manual audit has been completed and that the instrument is returned to normal operation. Failure to do this may result in incorrect readings being recorded.
- (ii) The Audit mode does not affect the physical performance of the instrument, this is necessary to allow the instrument readings to be compared to the audit filter values.

5.2.9 Run Sensor Checks Manually (RUN.T)

- 1) Scroll DOWN to the **RUN.T** (Run Tests) menu.
- 2) Press RIGHT to access the menu. The display shows **RUN**.
- 3) Press RIGHT again to initiate the sensor checks. The Self-check LED starts to flash to signal the tests are running. The total runtime for all three tests is approx. 1 minute.
- 4) When complete, return to the **DUST** menu and press RIGHT to view the sensor test results (see also Section 5.6.3).

5.3 Engineering Menu

The Engineering menu provides an expanded list of options to control and interrogate the sensor (see Fig. 5-2 below). Move the jumper from **LK4** to **LK3** and press the **RESET** button to access this menu.

Use the internal navigation buttons (see Fig. 3-3) to view and adjust the below settings.

**NOTE**

If a password has been set, this must be entered password before you can change any of the settings (see Section 5.2.2).

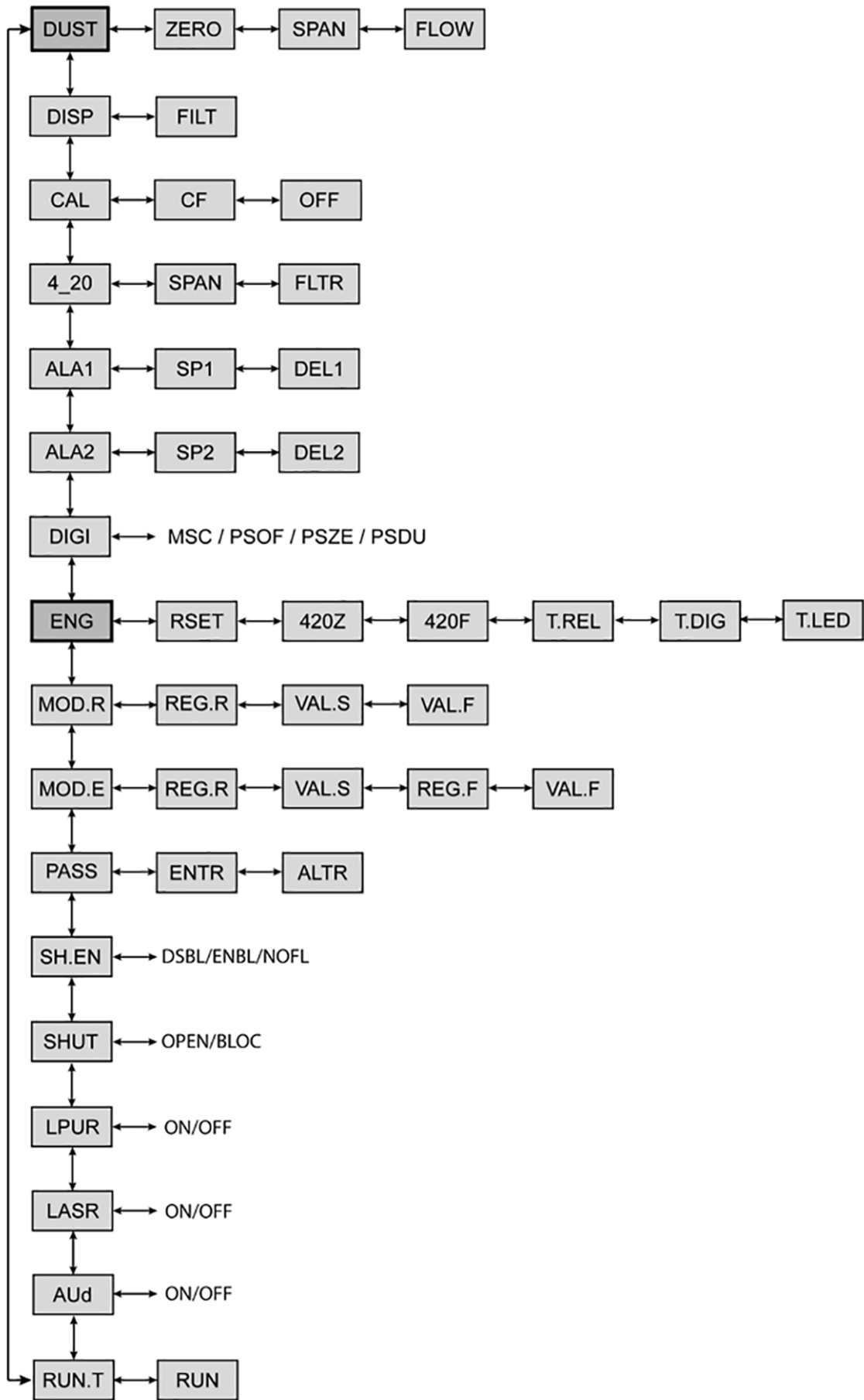


Fig. 5-2 Engineering Menu

5.3.2 Engineering Functions [ENG]

Several test, reset and 4-20 mA adjustment functions can be accessed via this menu.

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

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

- 1) Scroll DOWN to the ENG menu.
- 2) Press RIGHT repeatedly to access the **420Z** and **420F** submenus. To adjust the values, proceed as follows:
 - a. When accessing the 4-20 mA Zero [**420Z**] setting, the sensor nominally outputs 4 mA. Use the UP/DOWN buttons to adjust the 4-20 mA Zero calibration value (default: 223) to trim the 4 mA value.
 - b. Similarly, when accessing the 4-20 mA Full Scale [**420F**] setting, the sensor nominally outputs 20 mA. Use the UP/DOWN buttons to adjust the 4-20 mA Full Scale calibration value (default: 4385) to trim the 20 mA value.

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

- 1) Scroll DOWN to the **ENG** menu.
- 2) Press RIGHT repeatedly to access the test function submenus.
- 3) Use the UP/DOWN buttons to change the values. The table below shows the operation of the test functions.

Setting	Value	Meaning
Relays [T.REL]	Set to 1 Set to 2	Relay 1 Open Relay 2 Open
Digital Input [T.DIG]	Open Apply 24V to close	Display 0000 Display 0001
LEDs [T.LED]	Set to 0 Set to 3	All LEDs = GREEN Self-check LED = RED

5.3.3 Emission Alarm Status [ALA1, ALA2]

The alarm settings menus [ALA1, ALA2] are used to set up emission alarms used to activate two alarm relays in the sensor. The ALA1 menu corresponds to Relay 1 and ALA2 corresponds to Relay 2. Both channels use the value from the display to generate alarms.

Alarm Set Points [SP1, SP2]

The two alarms can be set using different set points to define a Warning (High) and a Limit (High High) Alarm level. It is recommended to set the Limit alarm to your local regulatory compliance emission limit.

Optionally, set the Warning alarm to a lower value to give early warning of a potential problem.

- To disable either alarm, set the relevant Set Point value to **0000** (disabled).
- The default Set Point values are '000' (i.e. not set).

Alarm Delay [DEL1, DEL2]

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



NOTES

- (i) Different alarm delays can be set on the two alarms. Averaging is done using an historical walking window filter. This means the average values used to generate alarms may differ from the average logged data, which uses simple averaging.
- (ii) On power-up complete the adjusting the settings, then press the **RESET** button to reset the averaging filters. During the initial period readings will be an average of a shorter period than the averaging time. This may result in unwanted alarms

Changing the Alarm Settings for Relay 1 [ALA1]

1. Scroll DOWN to the **ALA1** (alarm 1) menu, then press RIGHT to display **SP1** (set point 1).
2. Press RIGHT again to display the current set point value (default: **100**).
3. Use the UP/DOWN buttons to change the value. Press RIGHT to move to the next digit.
4. When complete, press RIGHT. The display now shows **DEL1** (delay 1).
5. Press RIGHT again to display the alarm/**ALA 1 delay** (default: 5secs = **0005**).
6. Use the UP/DOWN buttons to change the value. Press RIGHT to move to the next digit.
7. When complete, press RIGHT to return to the main menu.

Changing the Alarm Settings for Relay 2 [ALA2]

To change the settings, scroll down to **ALA2** and repeat the above procedure for Relay 2.

5.3.4 Digital Input (DIGI)

The digital input on the sensor can be used to manually run sensor checks or to disable outputs from the sensor during periods when the plant is not operating (PLANT STOP function).

A digital input from the plant control system must be connected to the digital input on the sensor terminals labelled **IP+/IP-** (see Fig. 4-3 for its location); 24V must be applied across the input to close the input.

When the PLANT STOP function is enabled, it operates 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.

In this case the following changes are made:

- Emission alarms (relays) are disabled.
- The 4-20 mA output is set to 4 mA.
- The display value and 4-20 mA output is set to either **0000** or the normal dust reading, depending on the setting of the 'Plant Stop' option (ZERO/DUST).

Enabling Digital Input

- 1) Scroll DOWN to the **DIGI** menu.
- 2) Press RIGHT to access the menu, then press UP/DOWN to select the desired option. A summary of available options (PLANT STOP behaviour) is provided in the table below.
- 3) Press RIGHT to return to the main menu.

Setting	Meaning	Emission alarms	Display reading	4 - 20mA Output
MSC	Run self-checks	n/a	n/A	n/a
PSOF	Plant Stop OFF	Enabled	Dust	Dust
PSZE	Plant Stop ZERO	Disabled	0.00	4 mA
PSDU	Plant Stop DUST	Disabled	Dust	4 mA


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

5.4.1 Viewing Modbus Register Values [MOD.R]

Select the **MOD.R** menu.

Setting	Description
REG.R	Enter the 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)

5.4.2 Editing Modbus Register Values (MOD.E)

	<p>NOTE</p> <p>Take care when adjusting register values as this may stop the sensor from functioning correctly</p>
---	---

Select the **MOD.E** menu.

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

5.4.3 Shutter Enable (SH.EN)

For sensors with optical shields – the sensor may be fitted with an optical shield, which closes automatically to partially protect the optical elements if the air purge flow is interrupted or falls. By default, this function is disabled (**DSBL**).


- Set **SH.EN** to **ENBL** (enabled), so that the shutter will automatically close to protect the sensor optics should the purge air supply be interrupted or fall below a set threshold.
- Set **SH.EN** to **NOFL** if the instrument is not fitted with a Purge Air Flow Sensor.

If the protective shield has been activated due to a purge flow failure or because the flow rate has fallen below the minimum threshold, it will remain in the 'blocked' position until it is reset manually (see Section 5.2.6 for more information).

5.4.4 Laser Power (LPUR)

The laser power can be adjusted in order to change the dust measurement range.

- For LOW dust concentrations, laser power should be set to **OFF**.
- For HIGH dust concentrations, laser power should be set to **ON**.

	<p>NOTE</p> <p>When laser power is set to ON, the resolution of the sensor is lower.</p> <p>For high-range MAU values, LPUR must be set to ON when carrying out audit checks and switched OFF again afterwards— unless it is configured for high dust levels (see also Section 5.7 for details).</p>
---	---

5.5 Data Communication

There is no data logging capability on the sensor. Available communication methods are shown in the table below (see Section 2.3 Cabling for information on maximum cable lengths).

Connection	Description
4-20 mA	Analogue output
RS485	Digital output, suitable for long-distance cabling.

5.5.1 4-20mA Communications

Refer to Section 5.2.5 for instructions on setting the 4-20mA output.

5.5.2 RS-485 Comms Settings [R485]

Set the RS-485 communications settings using the address switch on the instrument (see Section 4.5.5 for details).

5.6 Sensor Checks and Controls

5.6.1 Sensor Checks

Sensor checks are provided as standard on the **4750-PM**, both for auditing purposes and to provide quality assurance. The following sensor tests are available:

- Manual Zero and Span checks, which are run from the sensor on demand;
- Purge Air Flow check (optional automatic sensor self-check; requires a Purge Air Flow sensor; see Section 2.2.3). This is a standard feature on high-temperature sensors. The air purge flow check monitors the purge air flow continuously. Test failure suggests that purge air is not present or insufficient.

Sensor Check	Minimum Pass Level	Ideal Level	Maximum Pass Level
Zero test	-2	0	2
Span test	90	100	110
Purge Air Flow Self-check	5 ^G	20-40	-

^G If the purge air flow falls below the minimum threshold, the purge blower filter should be changed.



NOTES

- (i) If the tests have not been run yet, then [- -] is displayed for the ZERO and SPAN settings (and FLOW, if available). If required, initiate the sensor tests manually (see Section 5.2.9 for instructions).
- (ii) If available, the Purge Air Flow check runs continuously.
- (iii) No values are shown while the tests are running. Wait for the Self-check LED to stop flashing (see next section).

5.6.2 Self-check LED

The Self-check LED is used to indicate a sensor check fail (see item 3, Fig. 3-2). The **4750-PM** has manually activated sensor performance checks. During normal operation, if the Self-Check LED turns RED, the Purge Air Flow check has detected that the purge air flow has stopped or is insufficient.

Connection	Description
GREEN (solid)	Sensor checks PASS
GREEN (flashing)	Sensor checks RUNNING
RED (solid)	A sensor check has failed (Relay 1 activates).

5.6.3 Viewing Sensor Check Results

For information on initiating sensor checks manually from the sensor refer to Section 5.2.9. Refer to the Standard or Engineering menu maps (Sections 5.2 and 5.3 respectively).

- 1) If required, select the **DUST** menu, then press RIGHT repeatedly to display each self-check and the current reading (see table below for details).
- 2) Press RIGHT to return to the main menu or press LEFT to return to the previous setting.


Sensor Check	Reading Displayed
ZERO	Zero test result
SPAN	Span (or Upscale) test result
FLOW	Purge air flow test result (if available)

5.7 Auditing the Sensor

The Manual Audit Unit (MAU) is a standalone unit that is used to audit the instrument to ensure operational performance. The MAU is a single-value, compact audit kit or block. The audit unit filter is calibrated to yield a different instrument response; the value is labelled on the front of the MAU. The MAU is attached to the sensor body opening (see Fig. 5-4) to check the optical path and measure the instrument’s response to a stable scatter source.

5.7.1 High-Range Audit Value Units

Audit units with a high-range audit value (ACCAUD-XXX-1-300) are marked with a label (see Fig. 5-3). If an audit unit has been calibrated for a high-range setting, ensure that the **LPUR** (laser power) setting is set to 'ON' before commencing the audit check.

	<p>NOTE</p> <p>Laser power may already be set to 'ON' for normal operation. Therefore, when the audit check is complete, always return LPUR to its initial setting (see Section 5.4.4 for details).</p>
---	--

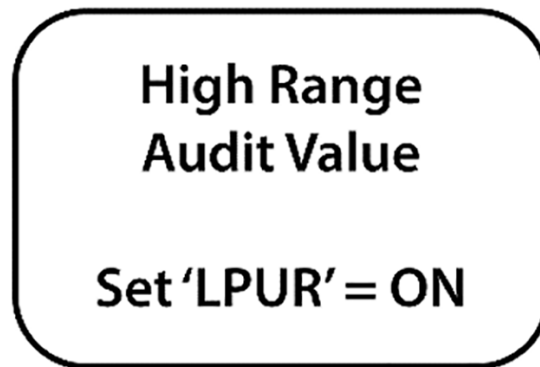


Fig. 5-3 High-range audit value label

5.7.2 Performing a Manual Audit



WARNING!

Laser radiation. This product contains a Class 3R laser.



WARNING!

Contaminants. Disconnecting the unit from a positive pressure stack or opening it may result in hot stack gas or dust escaping. Use suitable PPE. Check for any specific health implications of process gas and/or dust before carrying out an instrument audit.



NOTE

Ensure that the shutter (if fitted) and tube are both clean before assembling and attaching the MAU block. If necessary, clean these by following the cleaning procedures (see Section 6.3).

^L *Note that these factors are still stored in the instrument and will be applied when the Audit Mode is switched off at the end of the audit procedure.*

- 1) Set the Audit mode [**AUd**] to **ON**. This sets the displayed output to the raw dust reading (i.e. without the Calibration Factor or offset applied; see Section 5.2.8).
- 2) Unhook the quick-release clamp and open the sensor body (Fig. 5-4).
- 3) Close the flue gas blocker (if fitted) to prevent stack gas exiting the open port.

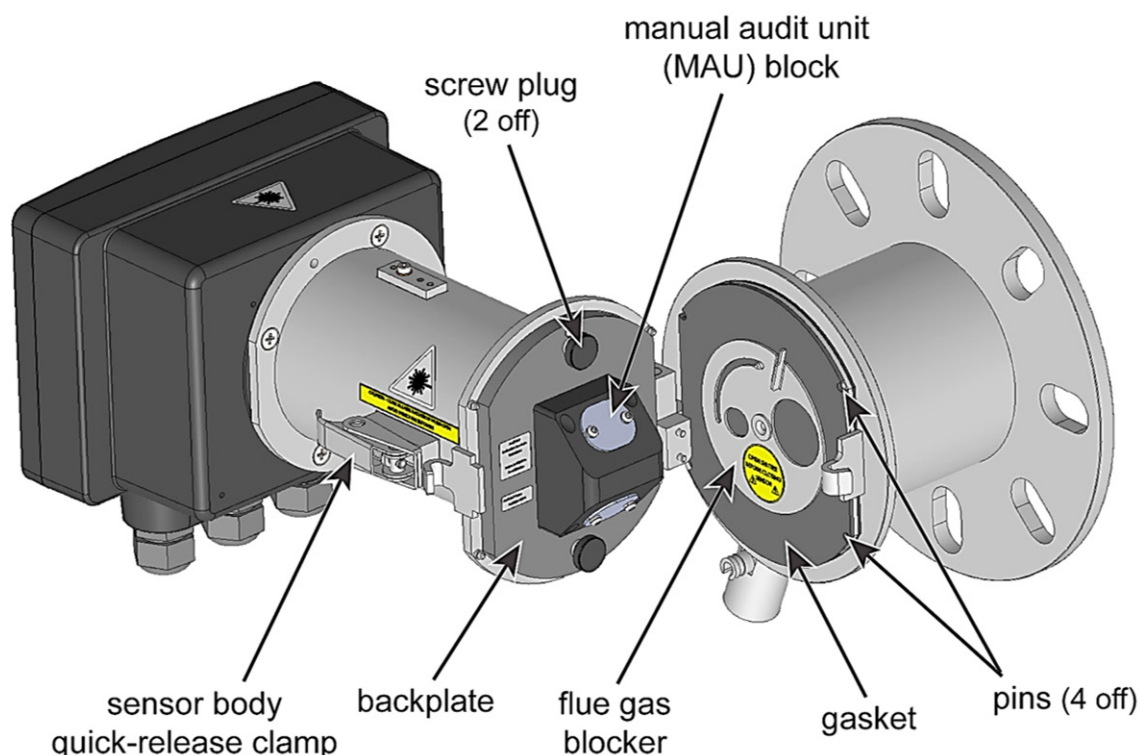


Fig. 5-4 Manual Audit Unit placed in the sensor

- 4) The MAU comes with two blanking tubes (1 off short and 1 off long). Fit the appropriate tube to the MAU by inserting it into the opening on the rear of the MAU backplate (see Fig. 5-5 below).
 - a) If an optical shield is fitted, use the SHORT tube.
 - b) If the sensor does NOT have an optical shield, fit the LONG tube.

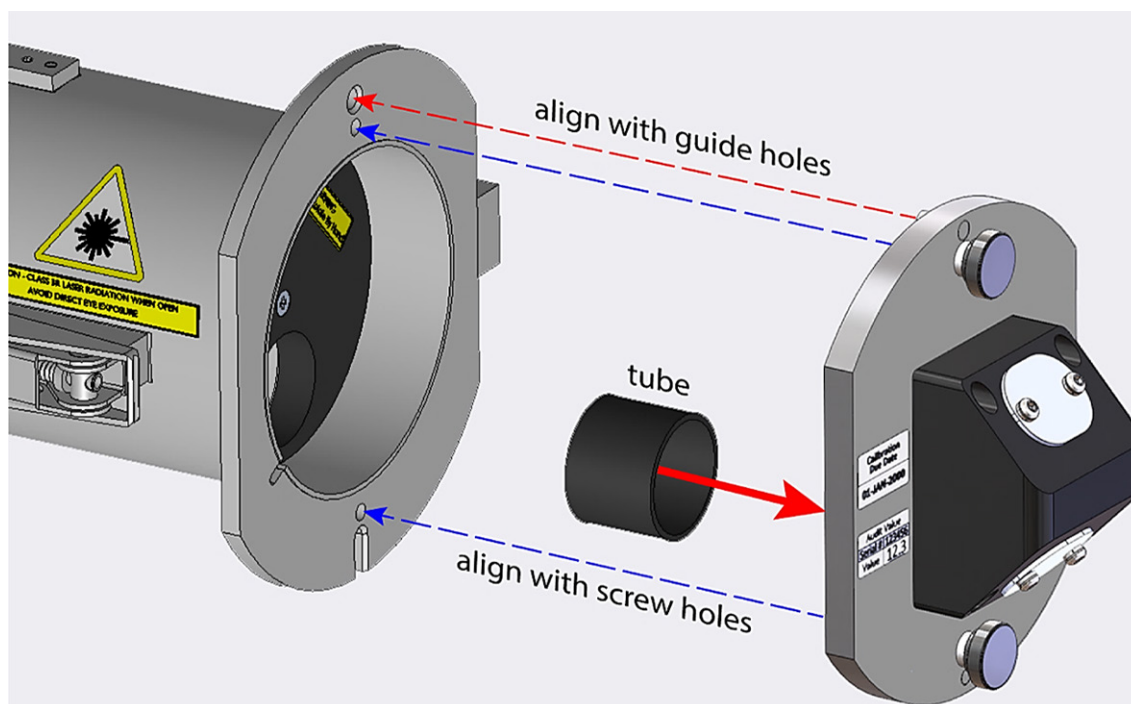


Fig. 5-5 Attaching the MAU block and blanking tube

- 5) Referring to Fig. 5-5, attach the MAU to the sensor body as shown:
 - a) Insert the appropriate tube in the opening on the rear of the MAU backplate.
 - b) Align the guide holes and screw plug holes, then attach the backplate and secure with the 2 off screw plugs at the top and bottom.
- 6) Record the **DUST** reading. The single-value MAU has its base value marked on it. The reading on the sensor display should match the MAU's base value.
- 7) When done, remove the MAU block and blanking tube from the sensor and place them in the carry case to keep them clean.
- 8) Check that the sensor parts are free from contamination. If fitted, rotate the flue gas blocker to open the port, then close and secure the sensor body with the quick-release clamp.

The sensor should now return to normal operation with the display showing the current dust level in the stack.
- 9) Switch OFF the Audit mode [**Aud**] to re-enable the compensation checks and the calibration.

**NOTES**

- (i) The Audit mode does not affect the physical performance of the instrument; it is necessary to allow the instrument reading to be compared to the audit filter value.
- (ii) If available, the Purge Air Flow check runs continuously.
- (iii) The MAU should be kept clean, dry, and safe at all times. It should be returned to AMETEK Land annually for calibration.

END OF SECTION



6

MAINTENANCE

6 Maintenance

6.1 Safety Information

**WARNING!**

Risk of electric shock. This section is intended for AMETEK Land trained service engineers only.

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

**WARNING!**

Laser radiation. This product contains a Class 3R laser.

Avoid direct eye exposure to the emitted laser radiation at all times during installation, maintenance, and normal operation.

Take precautions when performing maintenance on the sensor, especially when the sensor body is open, as laser light could exit when in this position

**WARNING!**

Hazardous Voltages.

This equipment contains lethal voltages!

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

**WARNING!**

Contaminants. Disconnecting the unit from a positive pressure stack may result in hot stack gas or dust escaping. Use protective gloves and other PPE.

Check for any specific health implications of process gas and/or dust before commencing maintenance.

6.2 Preventative Maintenance Plan

Level	Interval	Actions
Visual inspection	Weekly	<ul style="list-style-type: none"> • Check that all connections are secure. • Check that the purge blower is functioning correctly.
Basic Preventative Maintenance	Monthly	<ul style="list-style-type: none"> • Check equipment and clean. • Check if the purge blower filter needs changing.
Inspection	Every 6 Months ^M	This inspection should be performed by an AMETEK Land-trained engineer. Check that the filter of the air purge blower has been changed (or change this if required).
Engineer Service	Annually	The annual check is an in-depth check of the equipment and includes calibration of the instrument. Servicing must be performed by AMETEK Land or a trained Service Centre engineer.

^M Depending on stack conditions and contamination.

6.3 Cleaning the Sensor



WARNING!

Contaminants. Disconnecting the unit from a positive pressure stack may result in hot stack gas or dust escaping. Use protective gloves and other PPE.

Check for any specific health implications of process gas and/or dust before commencing maintenance.



WARNING!

Laser radiation. This product contains a Class 3R laser.

Avoid direct eye exposure to the emitted laser radiation at all times during installation, maintenance, and normal operation.



CAUTION!

- 1) Wipe the outside of the sensor enclosure with a dry or damp (but not wet) cloth only.
- 2) Do not allow moisture to penetrate the unit.
- 3) Do NOT use solvents or oil-based cleaners to remove contamination or accumulations of dirt as these can damage the surfaces and seals on the sensor.
- 4) An abrasive, such as wire wool, or wire brushes may be used on the sensor metal parts only.

- 1) Keep the air purge running throughout this procedure.
- 2) Switch OFF the laser (see Section 5.2.7).
- 3) If the sensor is mains powered, switch OFF power and isolate the sensor power supply.
- 4) Referring to Fig. 6-1, undo the quick-release clamp and open the sensor body.
- 5) Close the flue gas blocker (if fitted) to prevent stack gas exiting the open port.
- 6) Remove any contamination from the surface of the gasket using clean compressed air. Use wire wool or a wire brush to remove sticky residue on the metal sensor parts only.



NOTES

It is best practice to not apply the cleaning fluid directly to the surface you are trying to clean. Instead, place the small amount needed onto the cleaning tool, such as a wipe and then use this to clean the surface with a single wipe over the surface before discarding the wipe.

Dry the surface with clean, compressed air.

- 7) When cleaning is complete, open the flue gas blocker (if fitted), then close the sensor body and secure with the clamp.
- 8) Restore ON power, then switch ON the laser.
- 9) If required (e.g. after a 'Low Flow' alarm, purge flow failure, or after a shutdown period), reset the optical shield (see Section 5.2.6).

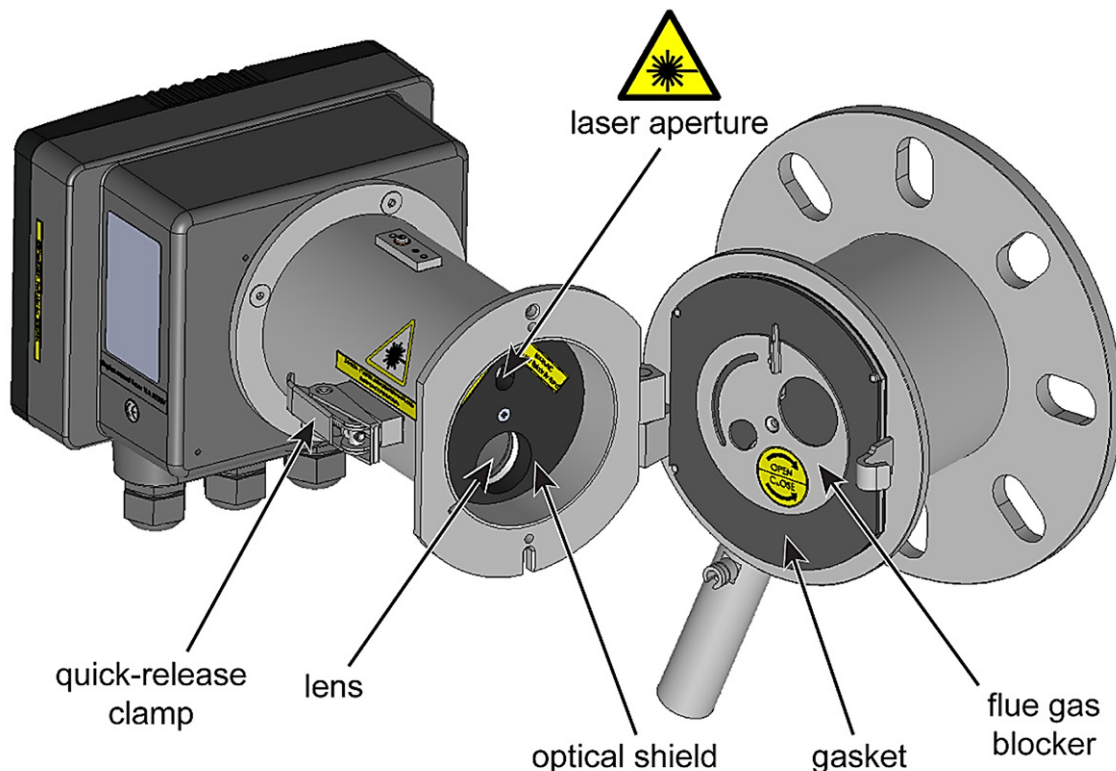


Fig. 6-1 Sensor hinged open for cleaning

6.3.1 Extended Shutdown Periods (Plant Operation Cycle)

For instruments fitted with an optical shield – the instrument is powered OFF for a temporary, extended shutdown period (or outage) as part of the regular plant operation cycle, prepare the instrument as follows:

- 1) On the Standard menu select **SHUT | BLOC** (see Section 5.2.6).



NOTES

Closing the shutter does not form a complete environmental seal.

- 2) Switch OFF the purge blower.
- 3) Then power OFF the sensor.

On plant start-up or if the purge has been disconnected for a long period, contamination will have built up around the shutter. In this case carry out the cleaning procedure outlined above.

6.4 Changing the Fuse (Mains-powered Sensors only)



WARNING!

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!

There is a replaceable fuse in the sensor. The replacement fuse must be of the correct type and rating (see Section 2.2).

If a replacement fuse fails immediately, contact AMETEK Land or your local service representative.

Do NOT replace with a higher value fuse!

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

6.5 Troubleshooting

Refer to the Section 6.1 Safety Information section provided at the start of this chapter and as given in the sections referenced below.

6.5.1 Common Issues

Symptom	Solution	Further options
Power/Comms LED is OFF	Check power cables and fuse. If necessary, replace the fuse (see Section 6.4).	
Alarm LED is flashing RED or AMBER	Likely cause: the sensor reading is above the alarm level (this may also be due to a sensor check fail, see below).	Contact AMETEK Land or our local representative for assistance.
Sensor check has failed	<ol style="list-style-type: none"> (1) Rerun the sensor tests to determine which check is causing the alarm. (2) Carry out the sensor cleaning procedure (see Section 6.3), then rerun the checks. (3) If the sensor checks fail repeatedly, the sensor PCB may need replacing 	

6.5.1 Alarms

The **4750-PM** monitors threshold conditions that can be set in the instrument to comply with local regulations and guidelines. Alarm conditions are indicated by an alarm LED (refer to Fig. 3-2).

Alarm	Description
Zero fault	Fault with the sensor electronics. Please contact AMETEK Land or our local representative for assistance.
Span fault	Fault with the sensor electronics or the laser (see troubleshooting sensor check failures above). Please contact AMETEK Land or our local representative for assistance.
Air Purge Flow Failure > Low Flow Alarm	The sensor requires a continuous supply of purge air and may have become contaminated. The sensor optics should be cleaned (see Section 6.3).

END OF SECTION

A decorative graphic in the top left corner. It features a large, bold, black number '7' on a light gray background. To the right of the '7', there are several overlapping, semi-transparent gray parallelograms that create a sense of motion or depth. A bright blue parallelogram is positioned at the top right of this graphic, pointing towards the right.

7

RESETTING THE SENSOR

7 Resetting the Sensor



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) Switch to and 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.

END OF SECTION



8

GENERAL NOTICES

8 General Notices

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

AMETEK Land Instruments International 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)

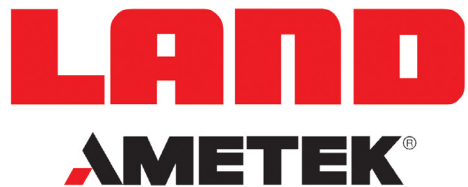
This information is being provided to comply with ISO 14001 Environmental Management, which is part of EMAS, the European Eco-Management and Audit Scheme to reduce waste and energy use, helping organizations improve efficiency, and providing assurance to internal and external stakeholders that environmental impact is being measured and improved. The following table provides a list of materials used in the construction of this product.

Sensor - Materials	Where Used
316 Stainless steel	Sensor body and flange
Aluminium alloy	Sensor enclosure
Electronic components	Sensor electronics
Fibreglass	PCB
Quartz	Lens
Silicon	Gasket
Viton®	O-rings

END OF SECTION

4750-PM

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Continuous product development may make it necessary to change these details without notice.

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