

Auburn FilterSense

Particulate Monitor
Model DynaCHARGE™ PM I

INSTALLATION & OPERATING MANUAL

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1 Notifications

1.1 Technical Support Contact

Auburn FilterSense provides industry leading Engineering and Technical Support for all product lines. The Technical Support department is staffed with a team of engineering professionals. Areas of assistance provided by the Technical Support department include:

- Pre-Installation Site Analysis
- Product Installation
- General Operation
- Application-Specific Review
- Routine Calibration
- EPA Compliance
- Performance Upgrades and Add-On Features

To assure the best and most efficient technical support, please be prepared with the following information prior to contacting Auburn FilterSense. If it is determined that the component be returned for evaluation/repair, a Return Material Authorization (RMA) number will be issued. You must include the RMA number on the packing slip and mark the outside of the shipping container.

- Company Name_____
- Product Model Number_____
- Product Serial Number_____
- Date of Installation_____
- Reason for Return_____

Auburn FilterSense Technical Support may be reached by:

Phone: (978) 927-4304

Fax: (978) 927-4329

E-Mail: info@AuburnFilterSense.com

**Address: AUBURN FILTERSENSE
800 Cummings Center, 355W
Beverly, Ma. 01915, USA**

Hours of Operation: 8:00AM – 5:00PM U.S. Eastern Time

- Any control unit or particulate sensor that was exposed to hazardous materials in a process must be properly cleaned in accordance with OSHA standards and a Material Safety Data Sheet (MSDS) must be completed before it is returned to the factory.
- All shipments returned to the factory must be sent by prepaid transportation.
- All shipments will be returned F.O.B. factory.
- Returns will not be accepted without an RMA number.

1.2 Disclaimer

This document contains important information necessary for proper operation of the product. It is strongly urged that all users of the product read this manual in its entirety. All instructions should be followed properly and any questions that arise should be discussed with Auburn FilterSense LLC.

Any use or distribution of this document without the express consent of Auburn FilterSense is strictly prohibited. Any reproduction is prohibited without written permission.

In no event will Auburn FilterSense be liable for any mistake, including lost profits, lost savings, environmental compliance costs, or other incidental or consequential damages or injury arising out of the use or inability to use this manual, even if advised of the possibility of such damages, or any claim by any other party. Terms and conditions supplied with each order contain additional liability limitations related to this product.

1.3 Symbols and Conventions

WARNING



Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Warning statements help you to:

- Identify a hazard.
- Avoid a hazard.
- Recognize the consequences.

Identifie les informations sur les pratiques ou les circonstances qui peuvent entraîner des blessures corporelles ou la mort, des dommages matériels ou des pertes économiques.

Les avertissements vous aident à:

- Identifier un danger
- Évitez un danger
- Reconnaître les conséquences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.



Identifies information, sections or statements in this manual that apply to approved hazardous area systems, regulations, or installation.

Identifie les informations, sections ou déclarations de ce manuel qui s'appliquent aux systèmes, réglementations ou installations approuvés pour zones dangereuses.

1.4 Safety

WARNING



AREA CLASSIFICATION (CLASSIFICATION DE ZONE)

Before installing any device, confirm area classification requirements as specified on the product label. Do not install any device that is not tagged as suitable for the required area classification.

Avant d'installer un appareil, confirmez les exigences de classification de zone telles que spécifiées sur l'étiquette du produit. N'installez aucun appareil qui n'est pas étiqueté comme adapté à la classification de zone requise.

ENVIRONMENT (ENVIRONNEMENT)

Before installing any device, confirm ambient temperature, process temperature, and process pressure requirements. Do not install any device that is not tagged as suitable for the required temperatures and pressures.

Avant d'installer un appareil, vérifiez les exigences de température ambiante, de température de processus et de pression de processus. N'installez aucun appareil qui n'est pas étiqueté comme adapté aux températures et pressions requises.

NOT A SAFETY RATED DEVICE (PAS UN DISPOSITIF DE SÉCURITÉ ÉVALUÉ)

This model must not be used independently for safety or as a critical input signal to a safety system. This model is designated for general process control, diagnostics, and environmental monitoring. Safety must be addressed with the detailed engineering, redundancy, and safety certified components where applicable. Consult factory for critical safety applications.

Ce modèle ne doit pas être utilisé indépendamment pour la sécurité ou comme signal d'entrée critique vers un système de sécurité. Ce modèle est conçu pour le contrôle général des processus, les diagnostics et la surveillance environnementale. La sécurité doit être abordée avec l'ingénierie détaillée, la redondance et les composants certifiés de sécurité, le cas échéant. Consultez l'usine pour les applications de sécurité critiques.

GROUNDING (MISE À LA TERRE)

Before turning on the instrument, you must connect the protective earth terminal of the instrument to a proper earth ground. Grounding to the neutral conductor of a single-phase circuit is not sufficient protection.

Avant de mettre l'instrument sous tension, vous devez connecter la borne de terre de protection de l'instrument à une prise de terre appropriée. La mise à la terre du conducteur neutre d'un circuit monophasé ne constitue pas une protection suffisante.

INSTALLATION AND SERVICE PERSONNEL (PERSONNEL D'INSTALLATION ET DE SERVICE)

Only appropriately licensed professionals should install this product. Always disconnect power before servicing.

Personnel must be familiar with operational hazards, such as those caused by hot, pressurized, or toxic gases, liquids, or particulates.

Service of individual electronics is limited to replacement of the electronics module. Do not attempt to disassemble electronics. Any components that are not operating properly should be returned to Auburn FilterSense for service.

Seuls les professionnels agréés doivent installer ce produit. Débranchez toujours l'alimentation avant de procéder à l'entretien.

Le personnel doit être familiarisé avec les dangers opérationnels, tels que ceux causés par des gaz, des liquides ou des particules chauds, sous pression ou toxiques.

L'entretien de l'électronique individuelle est limité au remplacement du module électronique. N'essayez pas de démonter l'électronique. Tous les composants qui ne fonctionnent pas correctement doivent être renvoyés à Auburn FilterSense pour réparation.

WARNING



1.5 Associated Documentation

This manual is to be referenced in conjunction with the following Auburn FilterSense documentation:

Product Information

Publication Number	Title
228-1077	Auburn FilterSense Particulate Monitoring Application and Alarm Guide
225-1084	Control Drawing, PS10 Hazardous Area Wiring Using PM1
225-1085	Control Drawing, PM 1-T Intrinsically Safety Wiring
EXXXX	Project Specific Drawings if Applicable

Specific Conditions of Use:

1. When the manufacturer of the equipment has not identified the type of protection to be used for installation on the label, the user shall, on installation, mark the label with the type of protection used. Once the type of protection has been marked it shall not be changed.
2. The PM 1-T shall be used with the EATON MTL5541/S-T when installed in the hazardous area according to 225-1085 (I.S. Barrier not required for H2 locations).
3. NEMA 4X and IP66 ratings only apply to the probe assembly when installed per drawing 225-1084.
4. The maximum permitted ambient temperature of the PM 1 Transmitter is 71 °C. To avoid the effects of process temperature and other thermal effects care shall be taken to ensure the surrounding ambient and the ambient inside the transmitter housing does not exceed 71°C.
5. To prevent the risk of electrostatic sparking the painted surface of the enclosure should only be cleaned with a damp cloth.

Conditions particulières d'utilisation:

1. Lorsque le fabricant de l'équipement n'a pas identifié le type de protection à utiliser pour l'installation sur l'étiquette, l'utilisateur doit, lors de l'installation, marquer l'étiquette avec le type de protection utilisé. Une fois que le type de protection a été marqué, il ne doit pas être modifié.
2. Le PM 1-T doit être utilisé avec l'EATON MTL5541/S-T lorsqu'il est installé dans la zone dangereuse conformément à 225-1085 (barrière I.S. non requise pour les emplacements H2)..
3. Les indices NEMA 4X et IP66 s'appliquent uniquement à l'ensemble de sonde lorsqu'il est installé conformément au schéma 225-1084.
4. La température ambiante maximale autorisée du transmetteur PM 1 est de 71 °C. Pour éviter les effets de la température du processus et d'autres effets thermiques, il faut veiller à ce que la température ambiante et la température ambiante à l'intérieur du boîtier du transmetteur ne dépassent pas 71 °C.
5. Pour éviter le risque d'étincelles électrostatiques, la surface peinte du boîtier ne doit être nettoyée qu'avec un chiffon humide.

2 Introduction

2.1 PM 1 Overview

The DynaCHARGE™ PM 1 is a single point/basic functionality particulate monitor employing charge induction sensing for reliable continuous monitoring of particulate in stacks, ducts, and pipes. Applications include filter leak detection, cyclone overflow, and powder flow/no flow. The PM 1 is available in two versions.

PM 1

- PM 1-A
 - Basic Particulate Monitor with Alarm Relay Outputs
 - Integral Electronics Only
- PM 1-T
 - Basic Particulate 4-20mA Transmitter
 - Integral Electronics Only



The PM 1 is also available in a PRO version for demanding process control and EPA compliance applications. Refer to separate manual for the PM 1 PRO.

PM 1 PRO

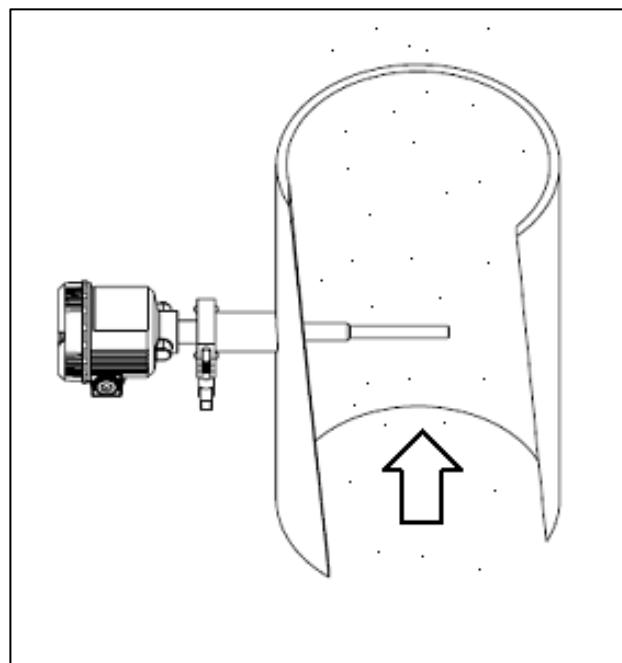
- PM 1 PRO-A
 - Advanced, High-Performance Particulate Monitor with Alarm Relay Output
 - Integral or Remote Electronics
 - Graphical Display/Keypad
- PM 1 PRO-AT
 - Advanced, High-Performance Particulate Monitor with Alarm Relay Outputs and Analog Output
 - Integral or Remote Electronics
 - Graphical Display/Keypad
- PM 1 PRO-T
 - Advanced, High-Performance Particulate 4-20mA Transmitter
 - Integral or Remote Electronics
 - Graphical Display/Keypad
- Refer to the PM 1 PRO manual or contact Sales @AuburnFiltersense.com for more information.



Principle of Operation

As particles flow near or around the electrically isolated sensing probe, minute charge is continuously induced into the probe. The charge flows through a measurement circuit to ground. The induced charge signal is digitally analyzed and processed to provide an output that is reasonably linear to mass. The unit of measure is picoamperes (pA). For highest accuracy and linearity to mass, refer to model PM 100 PRO.

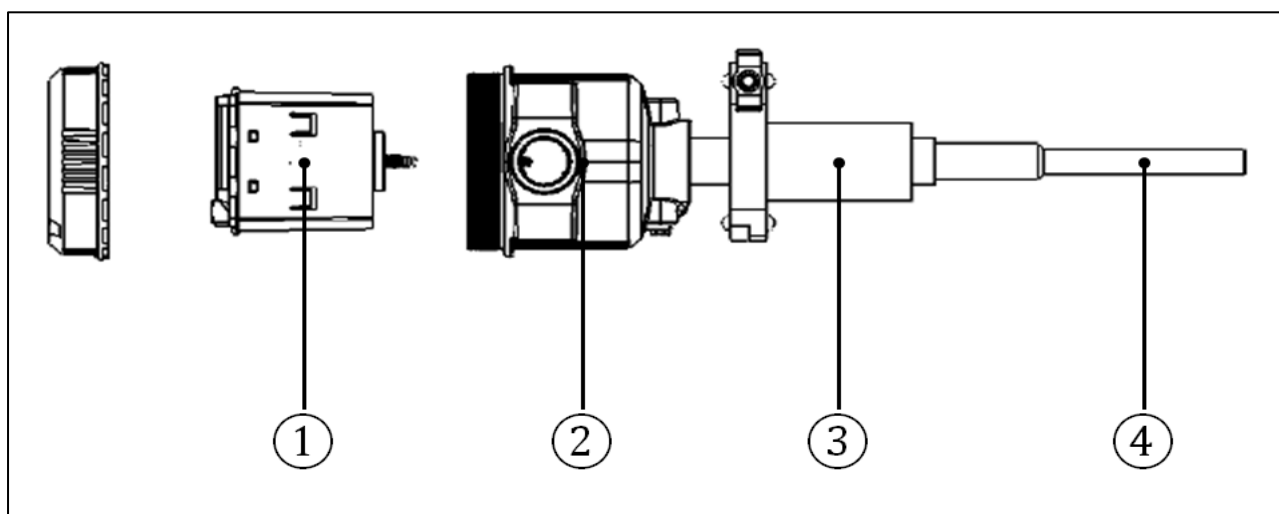
For best understanding of particulate levels, 4-20 mA analog outputs should be converted to pA at remote recording devices or remote displays.



2.2 Components

The PM 1 consists of the following main elements:

- ① Electronics Module
- ② Electronics Enclosure
- ③ Process Mount
- ④ Sensing Probe



2.3 Technical Data

Electronics Module

Parameter	Model Code	Specifications	Notes
Measurement Technology		Charge Induction	
Measurement Units		Picoamperes (pA)	1 x 10 ⁻¹² A
Input Voltage	-U -D -T	Universal AC/DC Power (20 to 250 VAC/VDC) DC Power Only (18-60 VDC) 18-32 VDC Loop Power	The -U & -D are available only for the PM1-A. The -T available only for the PM1-T models.
Input Power	-A	3 Watts Max.	
Electronic Resolution, Range	-R1 -R2 -R9	0.5pA, Range 0 to 5,000pA 5.0pA, Range 0 to 5,000pA 10.0pA, Range 0 to 100,000pA	The -R9 is recommended for Powder Flow Applications
Minimum Detection Level	-R1 -R2 -R9	~1-5 mg/m ³ ~5-10 mg/m ³ ~10 mg/m ³	
Minimum Particle Size		0.3 Micron	
Temperature Ambient	-ST -LT	-13 °F to 140 °F (-25 °C to 60 °C) -40 °F to 160 °F (-40 °C to 71 °C) -40F to +185F (-40C to +85C)	Operating Storage
Relay Outputs	-A	Form A (SPST) 250 VAC / 1A (Resistive), 1A (Inductive) 30 VDC / 1A (Resistive), 1A (Inductive)	Type Max Rating
4-20mA Output	-T	500Ω Max. Loop Impedance @ 24 VDC Loop Power Adjustable via Keypad	Rating Span
Enclosure	-N4 -N4W	NEMA 4/IP 66 Aluminum, Powder Coated (Pending) Type 4/IP66 Aluminum (Powder Coated) with Window (Pending)	
Area Classification	-G -H0 -H2	Ordinary/General Purpose, (UL, CSA, CE) Special - Hazardous Location, ATEX Zone 2, 22 self-certification, Groups IIC/IIIC, T4/T135 Hazardous Location, Class II, Division 2 Groups A-G, T4; Zone 21,21 (tb,tc). UL, CSA, ATEX, IECEx.	

Sensor Probe

Parameter	Detail/Code	Specifications	Notes
Mounting	-N05 -G05 -R05 -Q15	NPT Male, 0.5 in., 316L BSPP (G thread) Male, 0.5 in., 316L BSPT (R thread) Male, 0.5 in., 316L Quick Clamp, 1.5 in., 316L	
Probe Type	-B -C	Bare 316L Stainless Steel Fully Insulated, Teflon Coated, 316L	The Fully insulated probe CANNOT be used with H2
Process Temperature Operating Range	-T12 -T14	-13 °F to 250 °F (-25 °C to 121 °C) -13 °F to 450 °F (-25 °C to 232 °C)	T14 CANNOT be used with H2
Process Pressure Operating Range	-P0	Full Vacuum to 10PSI (0.69 Bar) Max.	For Higher Pressures Refer to PM 1 PRO

2.4 Model Configuration

DynaCHARGE™ PM 1 Particulate Monitor

Order
Code

Base Unit

Transmitter (4-20 mA), 2-Wire Loop Power	PM 1-T
Alarm (2 Relays)	PM 1-A

Power Supply (PM 1-A Only)

Universal AC/DC Power (20 to 250 VAC/VDC)	U
DC Power Only (18-60 VDC)	D

Resolution and Range

Resolution: 0.5 pA, Range: 0 to 5,000 pA	R1
Resolution: 5.0 pA, Range: 0 to 5,000 pA	R2
Resolution: 10.0 pA, Range: 0 to 100,000 pA	R9

Probe Length

Length - 1.5 in (3.8 cm)	L1.5
Length - 3.0 in (7.6 cm)	L3
Length - 6.0 in (15.2 cm)	L6
Length - 12 in (30.5 cm)	L12
Length - 18 in (45.7 cm)	L18
Length - 24 in (60.9 cm)	L24
Length - 30 in (76.2 cm)	L30
Length - 36 in (91.4 cm)	L36

Process Mount

NPT Male 0.5 in (1.3 cm) with Mounting Coupling, 316L	N05
BSPP (G thread) Male, 0.5 in., 316L	G05
BSPT (R thread) Male, 0.5 in., 316L	R05
Quick Clamp, 1.5 in., 316L	Q15

Process Temperature

-13 °F to 250 °F (-25 °C to 121 °C)	T12
-13 °F to 450 °F (-25 °C to 232 °C)	T14

Process Pressure

Full Vacuum to 10 PSI (0.69 Bar) Max.	P0
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Additional

Bare 316L Stainless Steel	B
Fully Insulated, Teflon Coated, 316L (Coated CANNOT be used with H2)	C

Enclosure

NEMA 4/IP 66 Aluminum, Powder Coated (Approval Pending)	N4
N4W (Type 4/IP66 Aluminum (Powder Coated) with Window (Approval Pending)	N4W

Area Classification

Ordinary/General Purpose, (UL, CSA, CE)	G
Special - Hazardous Location, ATEX Zone 2, 22 self-certification, Groups IIC/IIIC, T4/T135	H0
Hazardous Location, Class II, Division 2 Groups A-G, T4; Zone 21,21 (tb,tc). UL, CSA, ATEX, IECEx.	H2

3 Installation

WARNING



- Only trained professionals should install/maintain this product.
- Shutdown processes that include high temperatures, high pressures, toxic gases, hazardous particulate, or explosion risks prior to installing or removing equipment.
- Seuls des professionnels qualifiés doivent installer / entretenir ce produit.
- Arrêtez les processus qui incluent des températures élevées, des pressions élevées, des gaz toxiques, des particules dangereuses ou des risques d'explosion avant d'installer ou de retirer l'équipement.

3.1 Location

Area Classification

- Do not install any device that is not tagged as suitable for the required area classification.
- Check label for the following:
 - Area classification
 - Certification numbers as required.
 - FM20NUS0012
 - FM20NCA0006
 - FM20ATEX0034X
 - FM22UKEX0094X
 - FM20ATEX0033X
 - FM22UKEX0033X
 - FM20US0127X
 - FM20CA0064X
 - IECExFMG20.0035X

Hazardous Area Label Example

AUBURN FILTERSENSE
800 Cummings Center, 355W, Beverly MA 01915 USA
PARTICULATE MONITOR

MODEL: PM 1-T
S/N: 99999999
OUTPUT: 4-20ma, w/HART
MOUNT: 2.0" Quick Clamp
WETTED MAT'L: Teflon, 316ss
AMBIENT TEMP: -40 to 160F (-40 to 71C)
PROCESS TEMP: -40 to 250F (-40 to 121C)
PROCESS PRS: Full Vac. to 10PSI (0.69bar)

INPUT: 18-32 VDC
RANGE: 0.5-100,000pA
LENGTH: 18" Active

MFG DATE: 04/2021

UK CA 1725 CE 2809

FM APPROVED

Temperature and Pressure

- Confirm compatibility of pressure and temperature ratings with process and installation area.
- Check label for the following:
 - Process temperature rating
 - Process pressure rating

Hazardous Area Side Label Examples

APPROVAL CERTIFICATES:
FM20ATEX0034X, FM22UKEX0094X,
FM20US0127X,
FM20CA0064X, IECExFMG20.0035X

Intrinsically Safe Side Label Examples

AREA: ☒ II 1 G Ex ia IIC T4 Gb ☐
☐ II 2 G Ex ib IIC T4 Gb ☐
☐ II 3 G Ex ic IIC T4 Gb ☐
☐ II 1 D Ex ia IIIC T135 Da ☐
☐ II 2 D Ex ib IIIC T135 Db ☐
☐ II 3 D Ex ic IIIC T135 Dc ☐
CL I, II DIV 1-2 GRP A-G T4
INTRINSICALLY SAFE WHEN WIRED USING CONTROL
DWG 225-1085 AND APPROVED SAFETY BARRIER

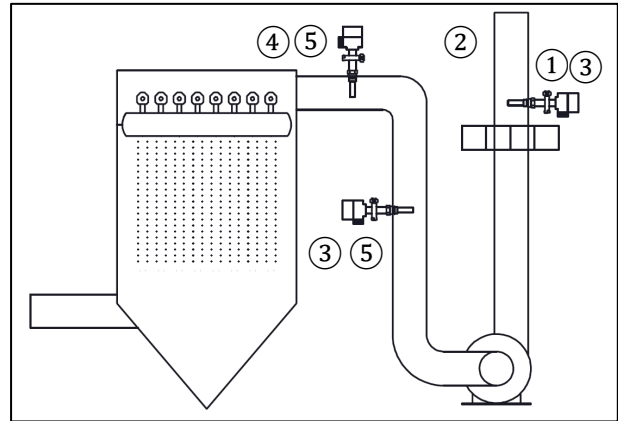
APPROVAL CERTIFICATES:
FM20ATEX0033X, FM22UKEX0093X,
FM20ATEX0034X, FM22UKEX0094X
FM20US0127X, FM20CA0064X,
IECExFMG20.0035X
WARNING: DISCONNECT PM 1 POWER BEFORE SERVICING
AVERTISSEMENT: DÉBRANCHEZ L'ALIMENTATION DU PM 1
AVANT L'ENTRETIEN

The following factors should be considered:

- Confirm compatibility of all sensor ratings with process and installation area.
- Check label for the following:
 - Wetted materials
 - Enclosure rating
- Installation must be in grounded metal duct/pipe. Consult factory for non-metallic duct/pipe solutions.
- High levels of vibration should be avoided.

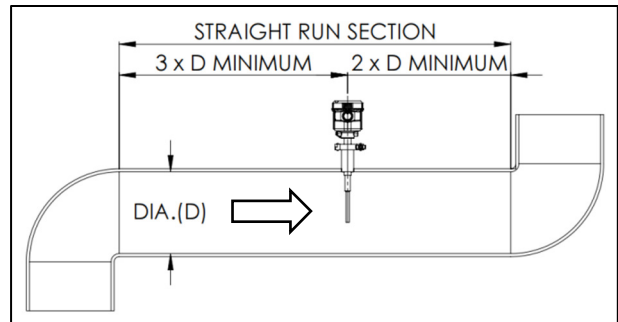
Filter Outlet Locations

- ① Ensure good access.
- ② Avoid locating within one pipe diameter or 36 inches of vertical stack exit to protect against weather. Horizontal exits allow for closer placement to open weather.
- ③ Straight runs and laminar flow best for measurement.
- ④ Short straight runs are acceptable for basic leak detection.
- ⑤ Accessible negative pressure locations may be preferred to prevent exposure to toxic gases and particulate.



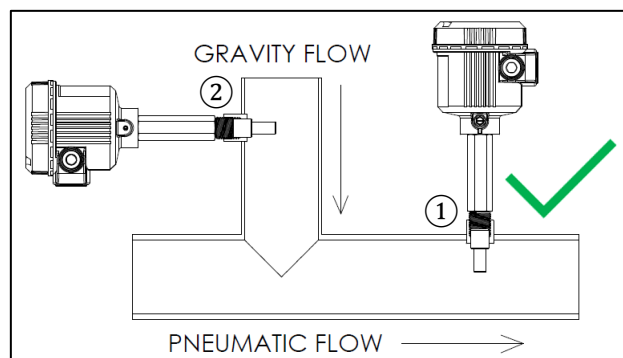
Straight Run Considerations

- Install in straight run if possible (not required).
- Three (3) duct diameters upstream.
- Two (2) duct diameters downstream.
- Straight run can be horizontal or vertical.



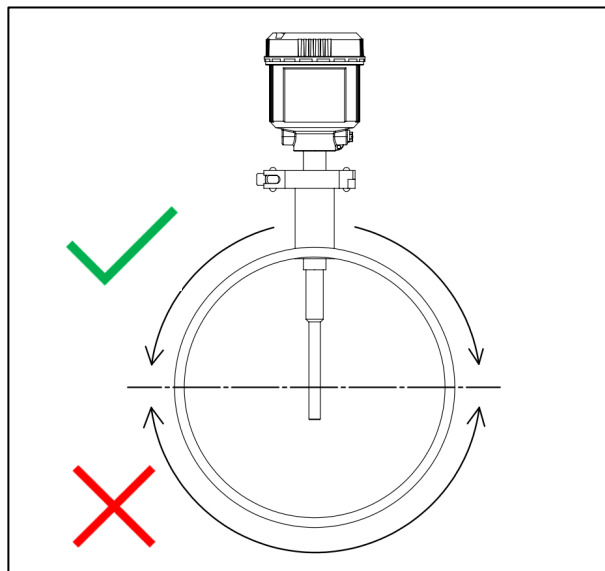
Powder Flow Locations

- ① Best installed in pneumatic section (positive or negative pressure).
 - ② For gravity feed, consult factory.
- Grounded metal duct required.
 - Consult factory for nonmetallic duct/pipe solutions.
 - Follow [straight run considerations](#).



Horizontal Pipes/Ducts

- Side or top mount recommended.
- Bottom mount not recommended.
- Proper mount and installation location will prevent buildup.
- For further installation advice please contact sales@AuburnFiltersense.com

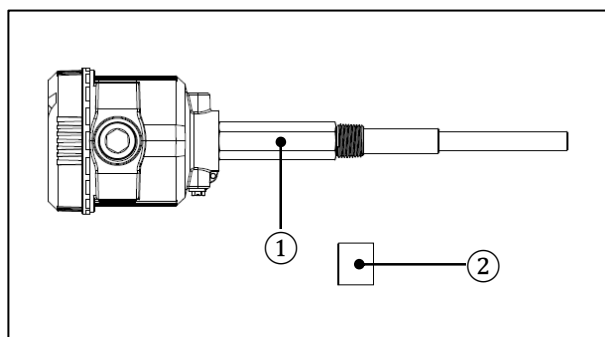


3.2 Process Mounts

The following types of process mounts are available:

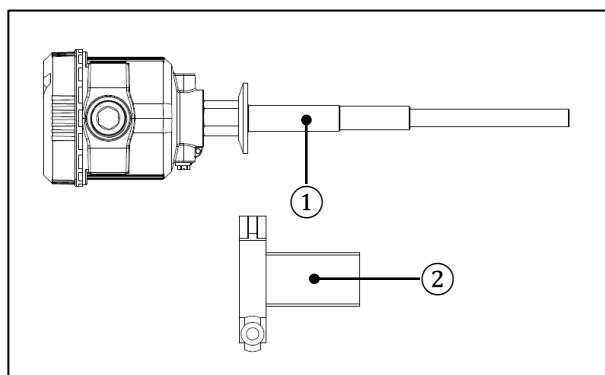
Threaded

- NPT Standard
 - BSPP (G) / BSPT (R) Optional
- ① Threaded Nipple
 - ② Threaded Half-Coupling Process Mount



Quick-Clamp

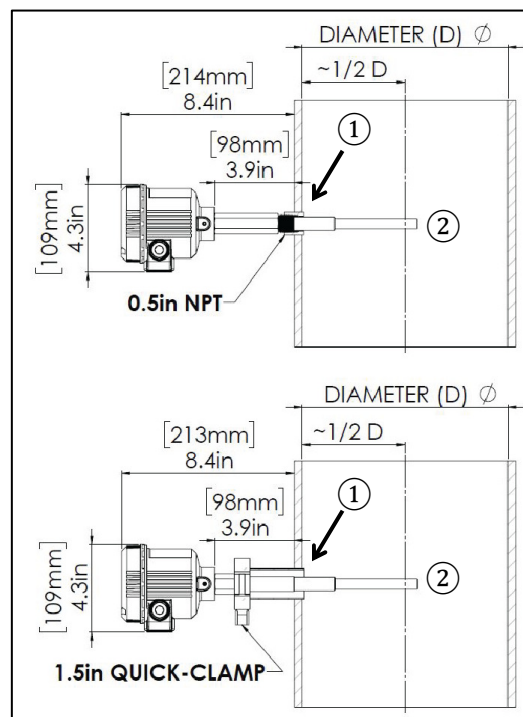
- 1.5" Tri-Clamp
 - Allows quick and easy removal from process
 - Allows rotation to easily align
- ① Quick-Clamp Nipple
 - ② Quick-Clamp Process Mount Kit
 - Ferrule
 - Tri-Clamp
 - Gasket



3.3 Sensor Mounting

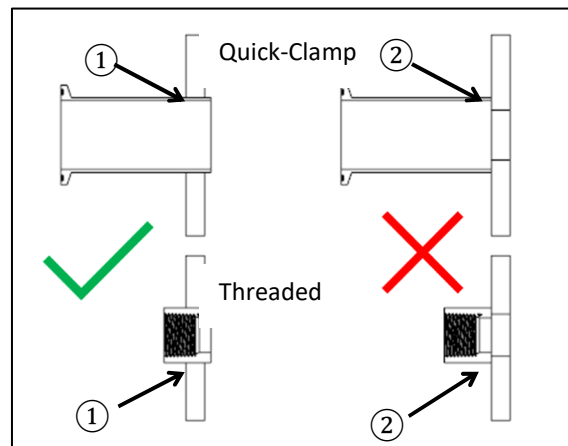
Sensor Mounting Considerations

- ① Process mount should protrude into process 0.125 in (3.175 mm) to 0.5 in (12.7 mm).
- ② Sensor probe should extend approximately 1/2 of the duct diameter for filter outlet applications and 1/4 to 1/2 of the pipe diameter for powder flow applications.
- In smaller pipes, the probe should be 1 in (25.4 mm) minimum from the opposing side.
- High levels of vibration should be avoided.



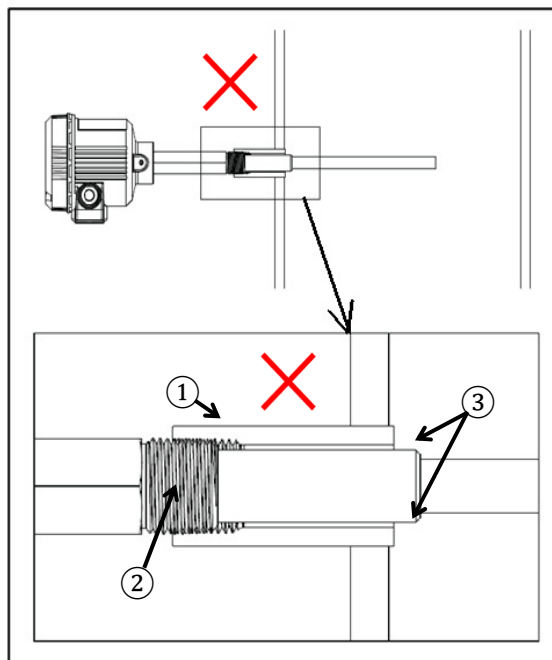
Welding and Clearance

- ① "Through weld" half coupling or quick-clamp mount to ensure proper clearance and to prevent particulate buildup in mount. Process mount should protrude into process 0.125 in (3.175 mm) to 0.5 in (12.7 mm).
- ② Do not face weld.
- Weld in center of the duct/pipe, perpendicular to the flow.
- Air and watertight seal.



Improper Extensions

- ① Do not use an extended or improper mount.
 - ② Longer mounts can cause the nipple not to protrude into the process.
 - ③ Extended mounts can cause particulate buildup on the insulator and sensing probe.
- Contact the factory for custom sensor nipple extensions for proper installation in an existing port.
 - Do not use non-stainless steel mounts that may corrode and cause corrosive residue to drip on the sensor.

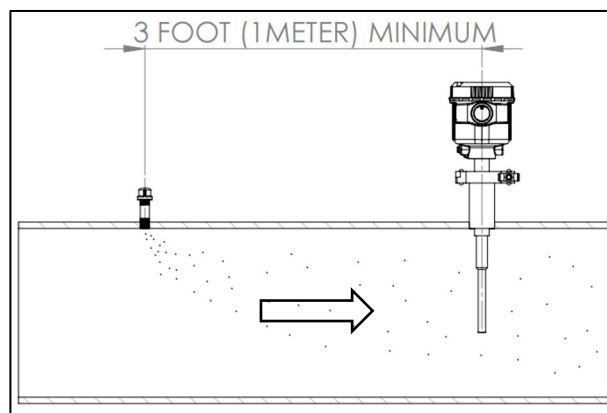


3.4 Test Port

Installation of a sensor test port is for introducing particulate upstream of the sensor as a method for checking the response to an increase in particulate. Some applications are required by EPA regulations to include a sensor test port for [Response Testing](#).

Location and Mounting

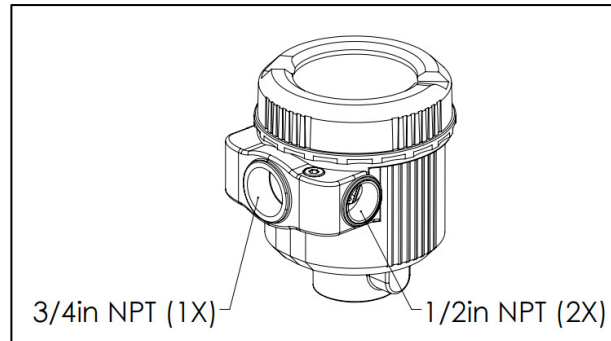
- Non-hazardous areas only.
- Negative pressure location.
- Install at least 3 ft upstream of the particulate sensor.
- In line with sensor on the same side of the duct.
- If possible, locate the test port at ground level and/or a location with easy access.
- If the test port must be located at an inaccessible location, a length of tubing can be used to improve access.
- Typical test port is a 1/8" NPT x 3" long nipple with a cap or shutoff valve.



4 Wiring

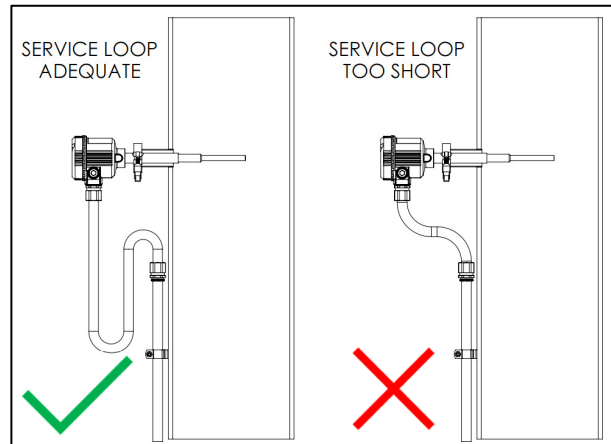
Conduit Entries

- One (1) $\frac{3}{4}$ " and two (2) $\frac{1}{2}$ " NPT entries provided.
- Conduit fittings should be tight.
- Conduit should be routed downward to prevent moisture from entering enclosure.
- The three plastic shipping thread protectors must be removed and replaced during installation to prevent water entry into the housing.



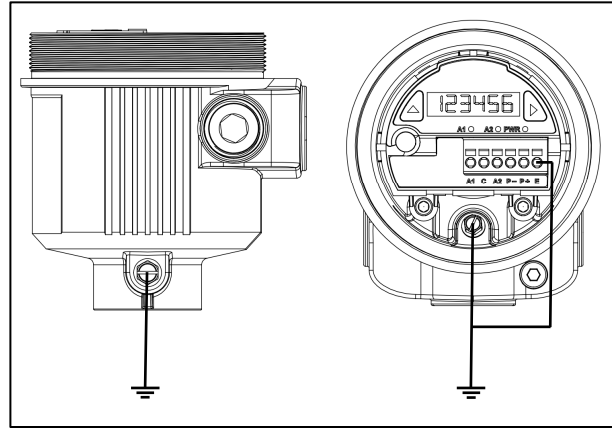
Recommended Service Loop

- Flex conduit or instrument cabling and ground cable should be sufficient length to allow removal of the sensor.
- Recommended service loop is 1 to 2 times the sensor probe length.
- Service loop should extend downward to prevent moisture from entering enclosure.



Grounding

- Required for reliable operation and safety.
- PM1-T: Earth ground connection is made through the process mount (for threaded mounts do not use Teflon tape, use conductive pipe dope or conductive grease). Grounding to the enclosure ground studs is not required.
- PM1-A: Earth ground connection should be made to one of the three ground locations:
 - External enclosure ground screw.
 - Internal enclosure ground screw.
 - Electronics module earth ground terminal.
- Analog wiring cable shield should be terminated to earth ground in PLC/DCS cabinet or at panel meter (terminate at one end only).
- Ground wire should not impede service loop.



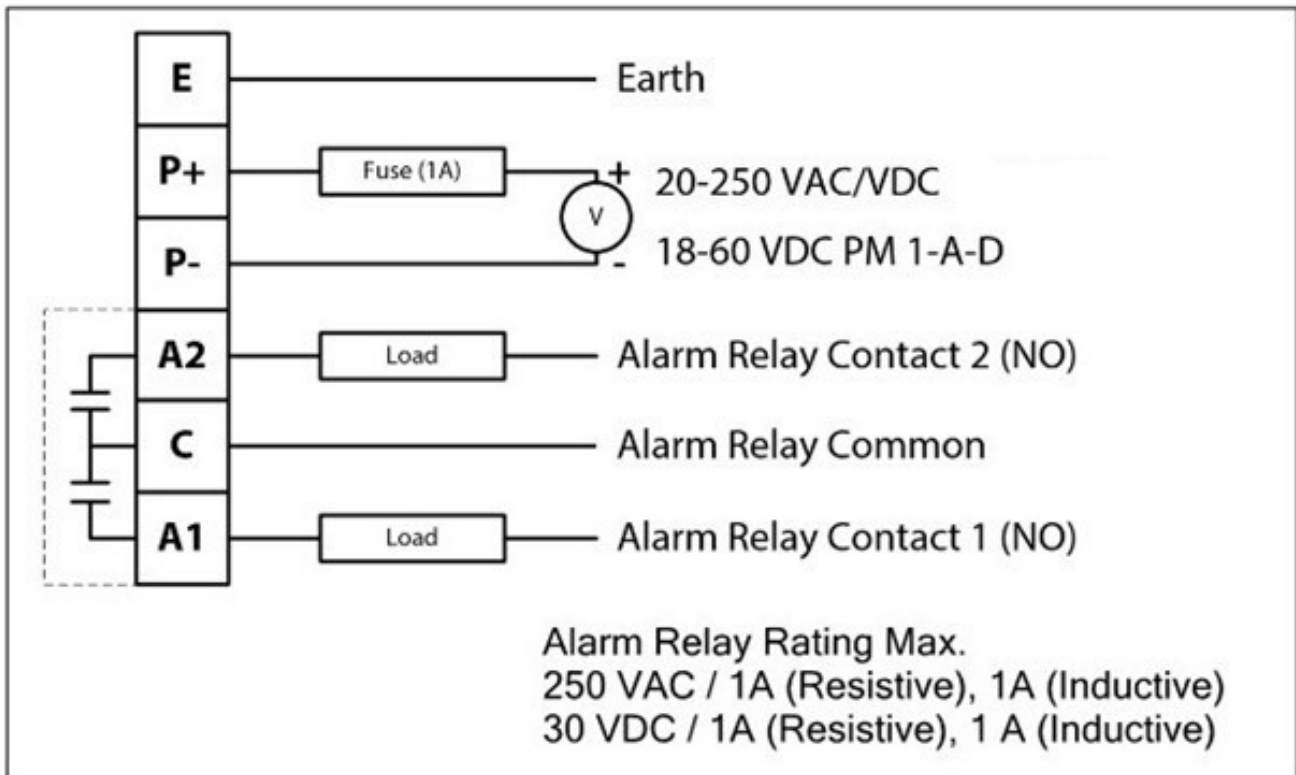
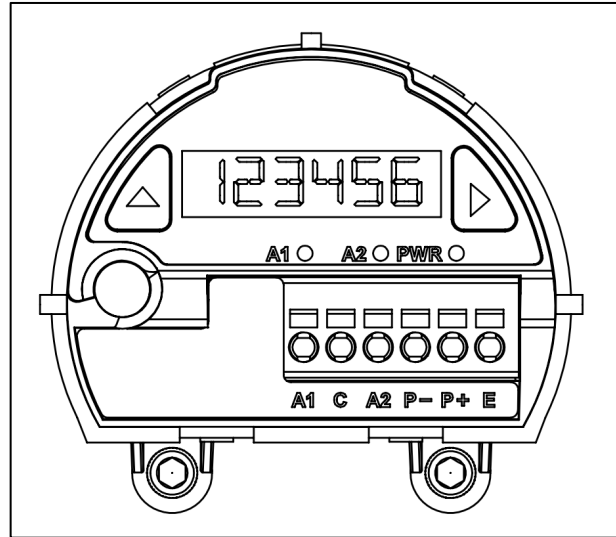
GROUNDING IN HAZARDOUS AREAS (MISE À LA TERRE DANS LES ZONES DANGEREUSES)

- For hazardous area applications, an external sensor earth ground cable is required to maintain sensor grounding during installation and maintenance.
- The ground cable must remain attached when the sensor is temporarily removed from the process. Do not disconnect the ground cable.
- Hazardous area installation of the PM1-T must be performed using drawing 225-1085, "Control Drawing, PM1-T Intrinsically Safety Wiring". The PM1-T unit must be marked for correct hazardous area installation and required ratings.
- Pour les applications en zone dangereuse, un câble de mise à la terre du capteur externe est nécessaire pour maintenir la mise à la terre du capteur pendant l'installation et la maintenance.
- Le câble de masse doit rester attaché lorsque le capteur est temporairement retiré du processus. Ne déconnectez pas le câble de masse.
- L'installation en zone dangereuse du PM1-T doit être effectuée à l'aide du dessin 225-1085, «Schéma de contrôle, câblage de sécurité intrinsèque PM1-T». L'unité PM1-T doit être marquée pour une installation en zone dangereuse correcte et les classifications requises.

4.1 Terminal Connections

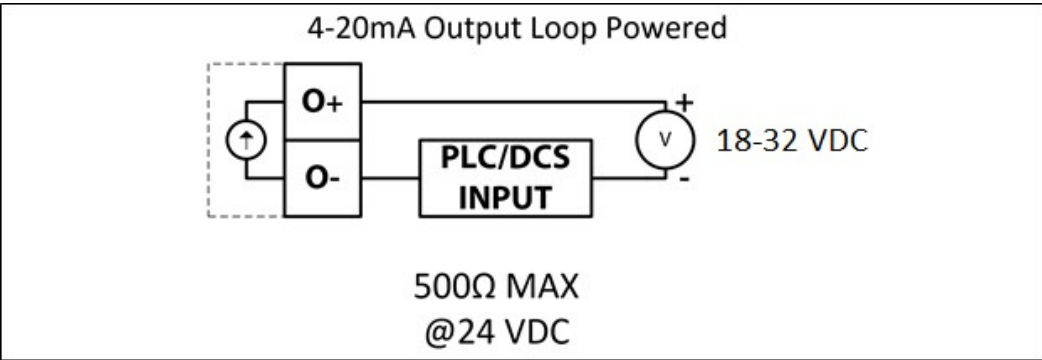
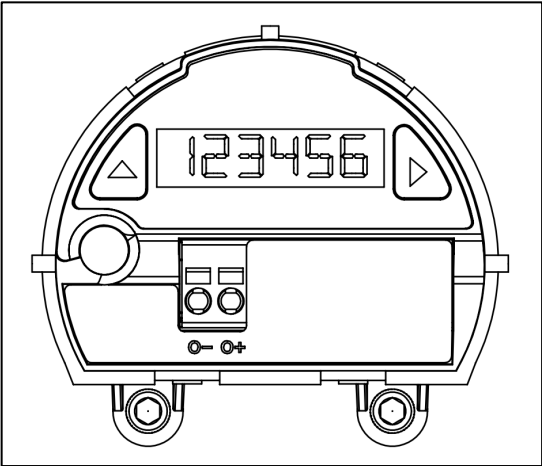
PM 1-A

- Terminal connections for power and two [alarm relays](#).
- All wiring must be rated for 250V minimum.
- Always disconnect power before connecting/ removing wiring from the terminal connectors.



PM 1-T

- Terminal connection for loop powered [analog output](#).
- All wiring must be rated for 250V minimum.
- Always disconnect power before connecting/ removing wiring from the terminal connectors.
- Analog 4-20mA wire should be 22 AWG stranded shielded twisted pair, Belden 88761 or equivalent.
- Analog wiring cable shield should be terminated to earth ground in PLC/DCS panel/cabinet (terminate one end only).



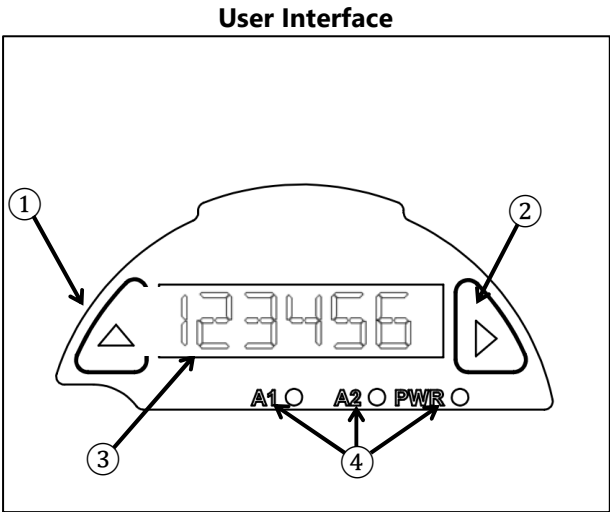
5 Operation

5.1 User Interface

The user interface consists of two navigation keys and a digital readout. The PM 1-A also includes status LEDs for power and alarms. Upon power up, the particulate measurement is shown, from which the user can view live values or choose to access the [Settings](#).

Keypad	
Key	Description
① Up/Next 	• Next reading or setting • Increment value
② Right/Enter 	• Enter setting • Move cursor right • Accept value

Display and LEDs	
Key	Description
③ Digital Readout	• 6-Character display with decimals
④ Status LEDs	• PM 1-A only • Alarms and power indications



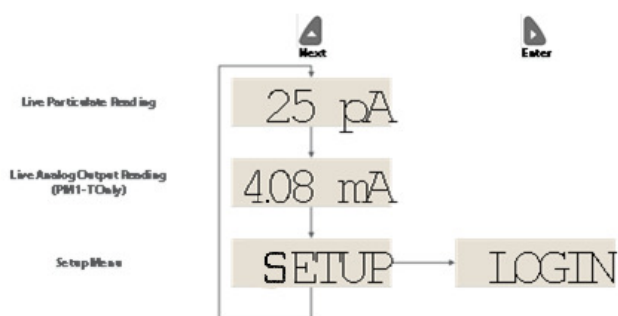
Status LEDs (PM 1-A Only)

LED	State	Meaning
A1	Red Off	- Alarm 1 active - Alarm 1 inactive
A2	Red Off	- Alarm 2 active - Alarm 2 inactive
PWR	Green Off	- Power - No power

5.2 Settings

Live Particulate Reading

Upon power up, the **Live Particulate Reading** is shown in picoamps (pA) (the actual measured value from particulate charge). Pressing the NEXT key will cycle from the **Live Particulate Reading (pA)** to the corresponding **Live 4-20mA Reading** (PM 1-T only), and the **Setup** display. Pressing the ENTER key on **Setup** will enter the **Login** display.

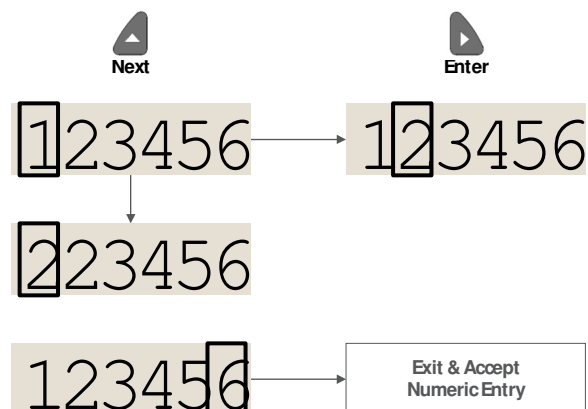


User Login

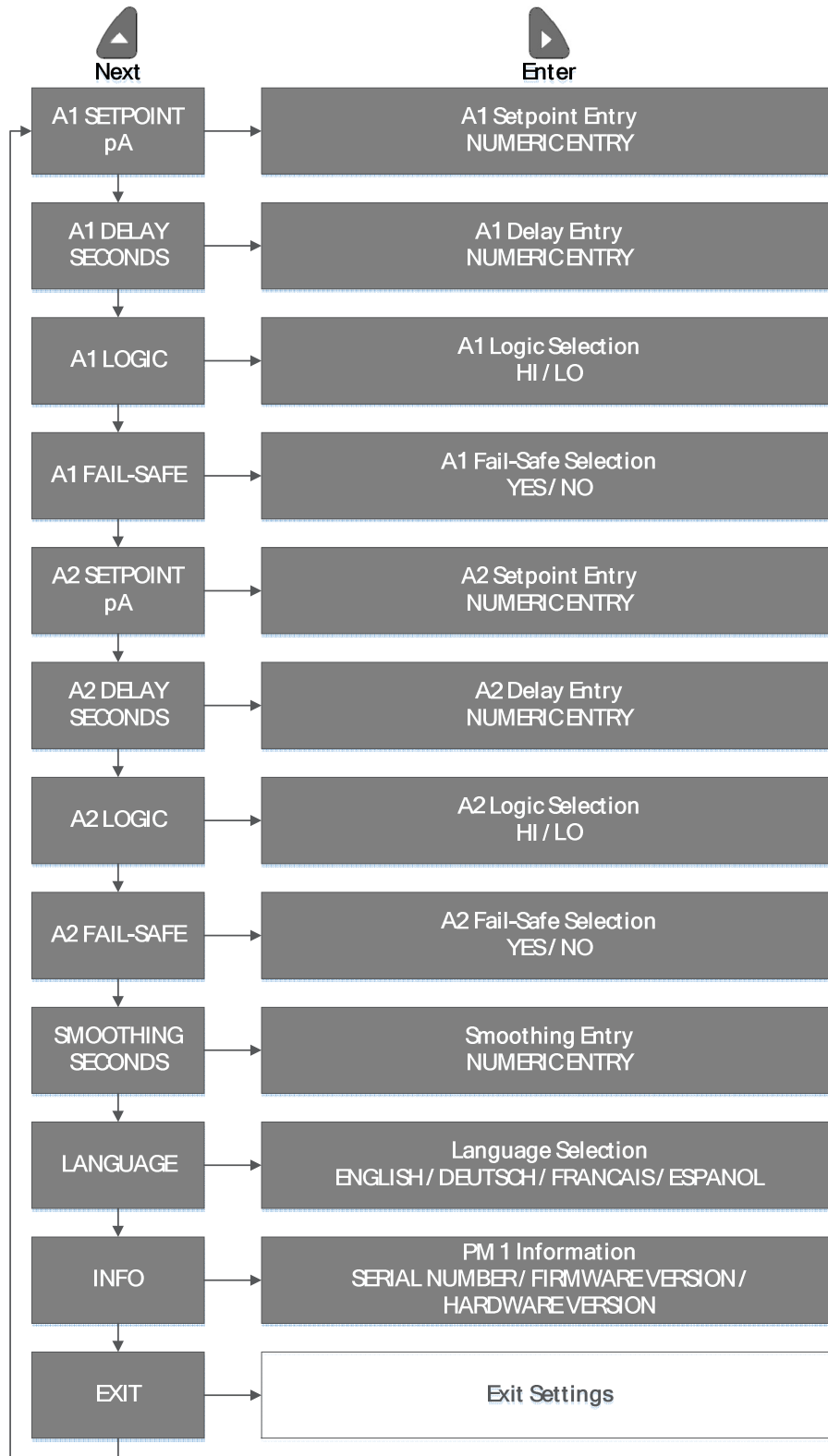
Login is required to access the **Settings** and is valid until power is removed, or after 5 minutes without keypad activity. Default passwords cannot be changed.

User Level	Password	Permissions
Operator	0	View live process readings and all settings, no changes allowed.
Engineer	55	View and change all settings.

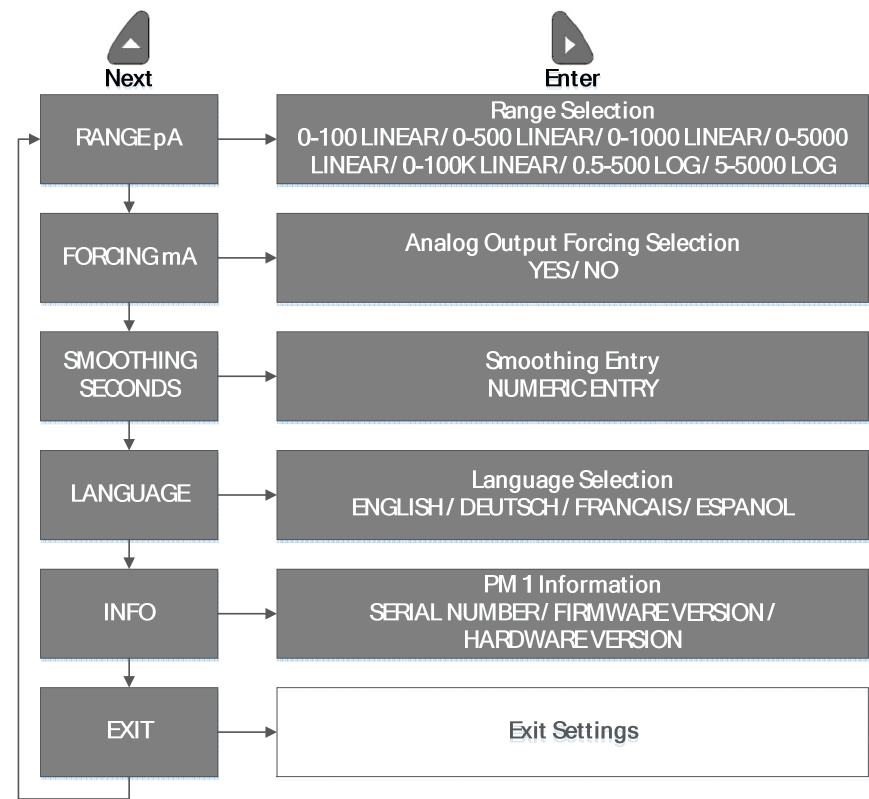
Numeric Entry



Settings (PM 1-A)



Settings (PM 1-T)



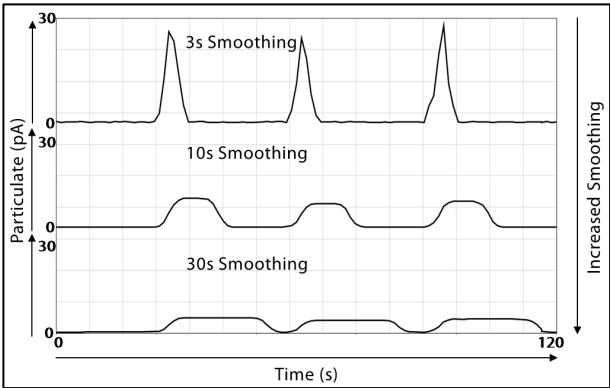
6 Commissioning

6.1 Signal Smoothing

IMPORTANT

Alarms and ranges should be adjusted **after** changes are made to **Smoothing Seconds**.

- A signal smoothing adjustment is provided to fine tune the real-time output.
- Adjust for reasonably stable baseline readings, while response to peaks remains dynamic and fast.
- Adjusting too high may limit setting an alarm based on peaks.
- Adjusting too low may result in an output that is too dynamic to easily interpret.



Smoothing Seconds example. Actual response is application dependent.

Setting	Default	Notes
Smoothing Seconds	3	Signal smoothing. Increase for smoother reading, decrease for more dynamic.

6.2 Alarms (PM 1-A)

Two alarms are available in the PM 1-A. An alarm will be activated when the particulate measurement increases above (HI **Alarm Logic**) or decreases below (LO **Alarm Logic**) the **Alarm Setpoint** continuously for a period longer than the **Alarm Delay** setting. The LED status will correspond with the associated alarm. The default alarm configuration is listed below.

IMPORTANT

ALARM LEVELS

Appropriate alarm levels will vary by process and user needs. Default alarm levels should not be relied on without careful review of each process.

Alarm Settings

Setting	Default	Notes
A1 Setpoint pA	30	Limit for alarm 1 activation
A1 Delay Seconds	10	Amount of time reading must be in alarm condition to activate alarm 1
A1 Logic	HI	Activation logic (HI or LO)
A1 Fail-Safe	No	Determines relay state of alarm 1 output (closed/open)
A2 Setpoint pA	100	Limit for alarm 2 activation
A2 Delay Seconds	5	Amount of time reading must be in alarm condition to activate alarm 2
A2 Logic	HI	Activation logic (HI or LO)
A2 Fail-Safe	No	Determines relay state of alarm 2 output (closed/open)

Alarm Logic

Alarm Logic defines how the particulate alarms are activated. When the **Alarm Logic** setting is set to **HI**, the alarm is activated when the input rises above the **Alarm Setpoint** continuously for a period longer than the **Alarm Delay**. When **Alarm Logic** is set to **LO**, the alarm is activated when the input falls below the **Alarm Setpoint** continuously for a period longer than the **Alarm Delay**. **LO Alarm Logic** is used for loss of flow applications.

Fail-Safe Relay State

Fail-Safe Mode	Power Off/Removed	Normal Operation	Active Alarm
Normal (No)	Open	Open	Closed
Fail-Safe (Yes)	Open	Closed	Open

6.3 Analog Output (PM 1-T)

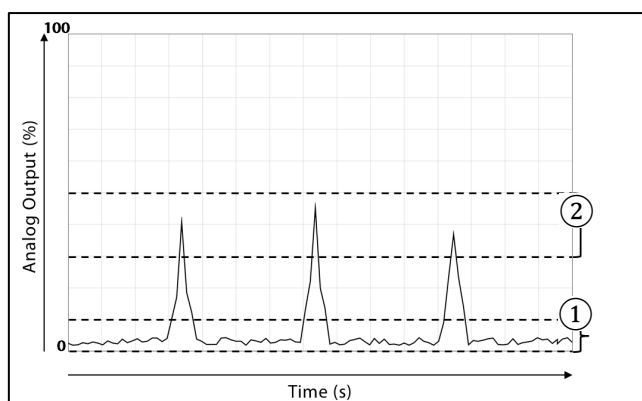
The PM 1-T is a 4-20mA transmitter, which can be used for trending live particulate readings in external devices. The selectable **Range** can be set to one of five linear ranges or two logarithmic ranges. After selecting the desired **Range**, the output can be forced to verify proper wiring and scaling in the connected device.

Analog Output Settings

Setting	Default	Notes
Range pA	0-1000 Linear	Range selection for the analog output. Available ranges include 0-100 Linear, 0-500 Linear, 0-1000 Linear, 0-5000 Linear, 0-100K Linear, 0.5-500 Log, 5-5000 Log.
Forcing mA	No	Stepwise simulation of analog output (YES or NO)

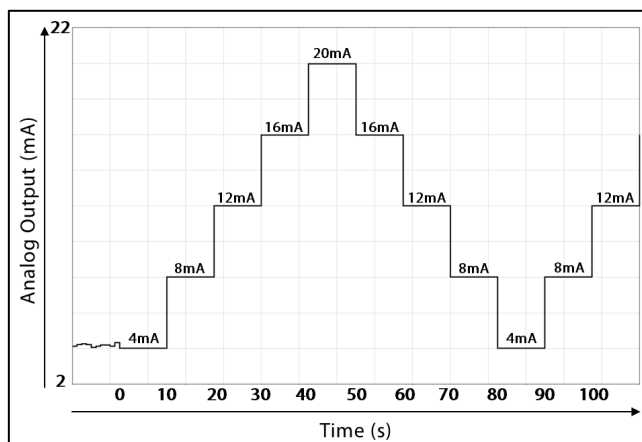
Analog Output Range Selection

- Range selection recommendations:
 - ① Baseline is 0-10% of range.
 - ② Peaks are 30-50% of range.



Analog Output Forcing

- Set **Forcing mA** to **Yes** to force a step-change output for testing the analog output in a stepwise manner.
- Output will follow the pattern shown.
- Each step will last for 10 seconds from 4mA to 20mA and back down in a cyclic pattern.
- Forcing cycles will either end automatically after four (4) cycles (5 minutes 30 seconds) or can be stopped before completion by setting **Forcing mA** to **No**.
- Once simulation has ended, the analog output will continue with normal operation.



7 Alarm Setpoint Guidance

Alarms should be set based on observing the output over the full range of normal operating conditions. For fabric filter applications, monitor the readings when the filter media is in good non-leaking condition and with cleaning both disabled and enabled. For filter applications, baseline and peak particulate readings following cleaning cycles should be noted.

Once a good set of readings is observed, alarms should be set based on the alarming objective. In all cases recall the output of a DynaCHARGE™ particulate monitor is reasonably linear/proportional to mass. This means that if the readings increase by a factor of 3, for example, the amount of particulate will have increased by a factor of 3. If during normal operation the baseline is always 0pA, contact the factory for a model with lower detection capabilities.

The following are the main approaches to setting the alarms.

Leak Alarming (focus is on detecting leaks in filter media)

- Adjust **Smoothing Seconds** for good response to cleaning cycles while keeping the baseline fairly stable.
- Set a **HI** (peak) alarm to capture increasing cleaning cycle peak readings at 1.5x to 5x typical peak height with a 1- to 5-second delay. This provides an early warning alarm.
- Set a **HIHI** (baseline) alarm to capture increasing baseline readings at 2x to 10x average baseline reading with a 30- to 180-second delay.

Proportional Alarming (focus is on detecting a relative change in the mass concentration)

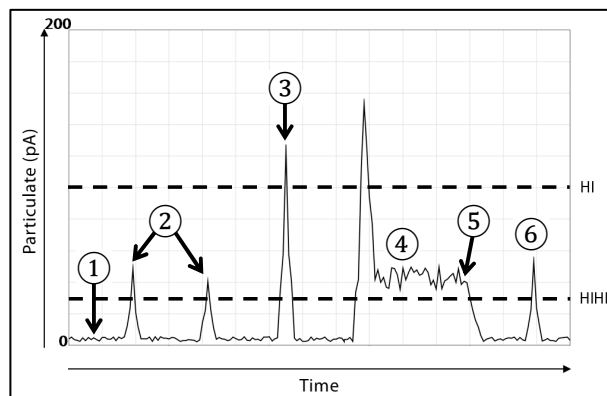
- Adjust **Smoothing Seconds** for relatively stable particulate readings.
- Set a **HI** (peak) alarm at a desired multiple over the average baseline reading with a 1- to 60-second delay.
- Set a **HIHI** (baseline) alarm at a desired multiple over the average baseline reading with a 30- to 360-second delay.

Powder Flow Alarming

- Adjust **Smoothing Seconds** for relatively stable particulate flow readings.
- Set a **HI** (increased powder flow) alarm above the desired powder flow rate.
- Set a **LO** (loss of powder flow) alarm below the desired powder flow rate.

Example of Typical Baghouse/Dust Collector Readings

- ① Normal baseline.
- ② Normal peaks from cleaning cycles.
- ③ Filter wear causes an increase in the cleaning peak. Early warning alarm of filter leak-through (HI alarm).
- ④ Filter leak increases, causing a baseline shift. HIHI alarm triggered.
- ⑤ Filter replaced.
- ⑥ Baseline and cleaning peaks return to normal levels.



Typical Readings for Modern Efficient Fabric Filters

Average Baseline	Peaks (After Cleaning Cycles)	Filter Condition
1 to 10pA	Less than 50pA	No significant leaks
10 to 100pA	50 to 500pA	Onset of leaks
100 to 1000pA	500 to 5000pA	Significant leaks present

8 Functional Verification

To verify operation after commissioning or otherwise as needed, the following 3 checks should be performed:

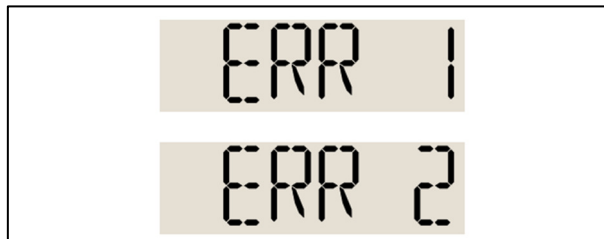
1. [Power-Up Check](#)
2. [System-Zero Check](#)
3. [Response Testing](#)
 - As needed the device can be returned to the factory for full electronics testing and mechanical checkout.

8.1 Power-Up Check

A **Power-Up Check** can be initiated to check the general functionality of the particulate monitor. The check occurs each time the instrument is powered up. A failed status result will remain until power is cycled and the error has cleared. Follow the steps below to run a **Power-Up Check**:

Power-Up Check Procedure

1. Cycle power to the PM 1.
2. If ERR 1 or ERR 2 is displayed on the digital readout, follow the steps outlined in the [Troubleshooting](#) section of this manual.



8.2 System-Zero Check

A **System-Zero Check** is an in site (fully installed) test of the entire system when there is no airflow. A **System-Zero Check** confirms proper installation and zeroing of the electronics and sensing probe when fully installed.

System-Zero Procedure

1. Shut down the process and fan. Ensure process flow has completely stopped. The slightest amount of flowing particles can create a signal.
2. Monitor the particulate reading for a system zero.

8.3 Response Testing

Response Testing is performed to verify response to an actual increase in particulate.

Response Testing Procedure

1. Introduce particulate upstream of the sensor using one of the following methods:
 - a. Pulse filters while process is running and collecting particulate.
 - b. Inject particulate using [sensor test port](#) (1 tsp of talc powder or actual process dust recommended).
 - c. Increase particulate flow by changing process.
2. Monitor the particulate reading for an increase in particulate.

WARNING



RESPONSE TESTING (TEST DE RÉPONSE)

- Particulate injections should only be performed in non-hazardous areas.
 - A response test can trigger alarm activation depending on alarm setpoints and the amount and type of particulate injected.
 - Les injections de particules ne doivent être effectuées que dans des zones non dangereuses.
 - Un test de réponse peut déclencher l'activation d'une alarme en fonction des points de consigne d'alarme et de la quantité et du type de particules injectées.
-

8.4 Factory Testing

Contact Auburn FilterSense to request an RMA to return the device for full factory testing. NIST traceable calibration certificates are available on request. The following parts can be returned for calibration:

1. PM 1 (Electronics Module)
2. PM 1 (Electronics Module & Sensor Probe)

9 Troubleshooting

Issue	Action
Display reads ERR 1	• Replace electronics module. • Return faulty electronics module to factory for evaluation/repair.
Display reads ERR 2	• Inspect the electronics enclosure to check that water has not entered the enclosure. ◦ If water is found, contact Technical Support. • Inspect the particulate sensor and process mount for particulate buildup, moisture, and/or damage. ◦ Clean the sensor of all particulate and moisture. ◦ If damage is found, contact Technical Support. • After performing the above inspections, cycle power to the particulate monitor. If the issue remains, contact Technical Support.
Zero Reading (with process running)	• Perform a Response Test. • If response is confirmed, baseline detection level may not be suitable for the application. Contact factory for PM 1 electronics module with lower detection capabilities. • If response is not confirmed, contact Technical Support.
Elevated Flat-Lined Reading (with process running)	• Perform a Power-Up Check to verify the electronics module. • Confirm correct scaling between 4-20mA output and PLC. • Inspect the electronics enclosure to check that water has not entered the enclosure. ◦ If water is found, contact Technical Support. • Perform a Response Test. • Perform a System-Zero Check. • If the issue remains, contact Technical Support.
Low Reading (with process running)	• Confirm correct scaling between 4-20mA output and PLC. • Perform a Response Test. If the system responds properly, reevaluate the selected Alarm Setpoints.
High Dynamic Reading (with process running)	• Check to make sure the particulate has not increased. Leaking filters and filter cleaning cycles can cause high dynamic readings. The particulate sensor detects very low levels of particulate. Small leaks can cause alarms. • Verify PM 1 is grounded to earth with less than 1Ω of impedance per the specifications in the Grounding section. • Check the Signal Smoothing adjustment. • Confirm correct scaling between 4-20mA output and PLC. • If nothing is found, perform a System-Zero Check.
Relay Not Responding	• Verify alarm LED status. Remove all wiring from the output and connect the output to an ohmmeter. Check continuity across relay output circuit.
Analog Output Not Responding	• Use a multimeter in series to verify that the milliamps match the milliamp measurement on the digital readout. • Force the analog output.

10 Maintenance

WARNING



- Only trained professionals should install/maintain this product.
- Shutdown processes that include high temperatures, high pressures, toxic gases, hazardous particulate, or explosion risks prior to installing or removing equipment.
- Seuls des professionnels qualifiés doivent installer / entretenir ce produit.
- Arrêtez les processus qui incluent des températures élevées, des pressions élevées, des gaz toxiques, des particules dangereuses ou des risques d'explosion avant d'installer ou de retirer l'équipement.

Electronics Module

DynaCHARGE™ electronics are normally drift free and require no periodic maintenance or electronics calibration by the user. General electronics calibration is automatically confirmed with PRO models equipped with device health checks. Electronics calibration is automatically fully verified with PRO models equipped with advanced EPA automatic self-test. As desired or required for quality programs or regulations, the entire device or the electronics module may be returned to the factory for NIST traceable electronics calibration certification.

Particulate Sensor

DynaCHARGE™ particulate sensors properly configured for the application generally do not require periodic maintenance other than an annual inspection. This should be verified by conducting functional verification checks of the electronics and manually inspecting the sensor after one and six months of operation. After these two initial checks, if no need for sensor maintenance is observed, an annual inspection is recommended. For EPA compliance and critical measurement applications, PRO models with device health checks and EPA automatic self-tests are recommended to provide added assurance between annual inspections and to automate regulatory inspection requirements. Please contact Auburn FilterSense for appropriate model selection advice.

Particulate Monitor Inspection

Each inspection should consist of the following:

- Visually inspect inside the sensor enclosure.
- Remove the sensor from the process and inspect the probe and insulator for buildup and/or moisture.
 - The sensor probe and insulator may be wiped down with a damp rag.
 - Fully insulated probes are recommended for processes with moisture and most conductive particulates.
- Inspect the inside of the process mount for buildup and/or moisture.
- Check the outputs.
- Perform [Functional Verification](#) checks.

11 Spare Parts

Spare parts for the PM 1 include the following:

- PM 1 Electronics Module
- PM 1 Enclosure and Sensor/Nipple/Probe Assembly

Please see the [Model Configuration](#) section for spare parts configuration and examples. Add –SP to a part number to specify a spare part.

11.1 Electronics Module Replacement

The PM 1 is designed so that the electronics module can be easily replaced. An electronics module can be replaced by following the steps below:

1. Remove the cover to the PM 1.
2. Record all settings from the existing electronics module.
3. Disconnect all power to the PM 1.
4. Remove all wiring (power and outputs) from the terminal connections.
5. Remove the entire device from the process.
6. Remove the two 9/64" hex screws that connect the electronics module to the enclosure.
7. Remove the electronics module from the enclosure and replace with spare electronics module.
8. Follow the above steps in reverse to complete the replacement.

