



**PARTICLE
MEASURING
SYSTEMS®**
a spectris company

Without measurement there is no control



HPD III High Pressure Diffuser

OPERATIONS MANUAL

HPD III High Pressure Diffuser

Operations Manual



HEADQUARTERS

5475 Airport Blvd
Boulder, Colorado 80301 USA
T: +1 303 443 7100, +1 800 238 1801

Instrument Service & Support

T: +1 800 557 6363
Customer Response Center
T: +1 877 475 3317
E: Info@pmeasuring.com

GLOBAL OFFICES

AUSTRIA
T: +43 1 71 728 285
E: pmsaustria@pmeasuring.com

BENELUX
T: +32 10 23 71 56
E: pmsbelgium@pmeasuring.com

BRAZIL
T: +55 11 5188 8227
E: pmsbrazil@pmeasuring.com

CHINA
T: +86 21 6113 3600
E: pmschina@pmeasuring.com

FRANCE
T: +33 (0)1 60 10 32 96
E: pmsfrance@pmeasuring.com

GERMANY
T: +49 6151 6671 632
E: pmsgermany@pmeasuring.com

ITALY
T: +39 06 9053 0130
E: pmsrl@pmeasuring.com

JAPAN
T: +81 3 5298 8175
E: pmsjapan@pmeasuring.com

KOREA
T: +82 31 286 5790
E: pmskorea@pmeasuring.com

MEXICO
T: +52 55 2271 5106
E: pmsmexico@pmeasuring.com

NORDIC
T: +45 707 028 55
E: pmsnordic@pmeasuring.com

PUERTO RICO
T: +1 787 718 9096
E: pmspuertorico@pmeasuring.com

SINGAPORE
T: +65 6496 0330
E: pmssingapore@pmeasuring.com

SWITZERLAND
T: +41 71 987 01 01
E: pmsswitzerland@pmeasuring.com

TAIWAN
T: +886-3-5525300 Ext: 301
E: pmstaiwan@pmeasuring.com

HPD III High Pressure Diffuser Operations Manual
P/N 1000012512 Rev I
© 2021 by Particle Measuring Systems, Inc.
All rights reserved.

IsoAir® and Lasair® are registered trademarks of Particle Measuring Systems, Inc.
Apiezon® is a registered trademark of M&I Materials Ltd.
Airnet® is registered trademark of Particle Measuring Systems, Inc.
Cajon® is a registered trademark of the Cajon Machining Company Corporation.
All trademarks appearing in this manual are the property of their respective owners.

DO NOT REPRODUCE OR DISTRIBUTE

CONFIDENTIAL DOCUMENT

This confidential document contains proprietary information, which is protected by copyright. All rights are reserved. No part of this document may be reproduced, distributed, or transmitted in any form without the prior written consent of Particle Measuring Systems. The information contained in this document is subject to change without notice.

Quality Statement

The Quality Policy of Particle Measuring Systems is to strive to meet or exceed the needs and expectations of our customers and to align the activities of all employees with the common focus of customer satisfaction through continuous improvement in the quality of our products and services.

Manual Conventions

WARNING

A warning in the text is used to notify the user of the potential for bodily injury or death.

CAUTION

A caution in the text is used to highlight an item that if not done, or incorrectly done, could damage the instrument and/or any materials or devices affected by the instrument.

— NOTICE —

A notice in the text is an instructional communication regarding requirements or policies issued by Particle Measuring Systems.

NOTE: A note in the text is used to highlight an item that is of operational importance to the user.

It is important that you observe cautions and warnings while performing the procedures described in this manual. Caution and warning labels may be located on and inside the instrument to alert you to potentially hazardous conditions. Please familiarize yourself with this information.

This page is intentionally left blank.

Table of Contents

Quality Statement	ii
Manual Conventions	iii
Chapter 1: Introduction	1-1
Functional Components	1-3
High Pressure Gas Inlet/Connector	1-3
Critical Orifice	1-3
Vent and Filter	1-4
Sample Outlet	1-4
Gas Flow Rates	1-4
0.1 CFM (High Pressure)	1-5
1.0 CFM (High Pressure)	1-6
1.0 CFM (Low Pressure)	1-7
50 LPM (High Pressure)	1-8
50 LPM (Low Pressure)	1-9
100 LPM (High Pressure)	1-10
100 LPM (Low Pressure)	1-11
Specifications	1-12
Chapter 2: Installation	2-1
Unpacking	2-1
Installation	2-2
Chapter 3: Maintenance	3-1
Minimizing Contamination	3-1
Purging the High Pressure Diffuser	3-1
Replacing the 4-VCR Fitting Gasket	3-2
Replacing the Filter	3-2

This page is intentionally left blank.

Chapter 1

Introduction

The HPD III high pressure diffuser from Particle Measuring Systems reduces the pressure of gases to a level acceptable to particle counters designed to operate at atmospheric pressure. The HPD III high pressure diffuser (see **Figure 1-1**) can be used for sampling pressurized clean dry air (CDA), nitrogen, or argon. For other gases, such as carbon dioxide (CO₂), contact Particle Measuring Systems.

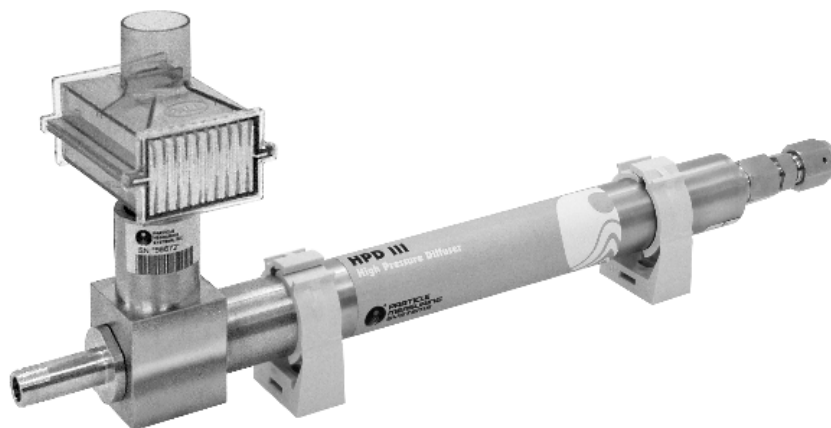


Figure 1-1 HPD III High Pressure Diffuser

This chapter includes an introduction to the HPD III high pressure diffuser, including:

- Functional Components (see page 1-3)
- Gas Flow Rates (see page 1-4)
- Specifications (see page 1-12)

The following table summarizes the acceptable pressure range for each flowrate model.

Table 1-1 Pressure range for HPD III flowrate models

Part Number	Model Description	Flow Rate	CDA Pressure Range (PSI)	Nitrogen Pressure Range (PSI)	Argon Pressure Range (PSI)	Carbon Dioxide Pressure Range (PSI)
90103560	0.1 CFM High Pressure	0.1 CFM (2.83 LPM)	25.0 - 100.0	22.5 - 98.0	29.0 - 119.0	31.0 - 126.0
90103561	1.0 CFM High Pressure	1.0 CFM (28.3 LPM)	25.0 - 120.0	24.0 - 98.0	30.0 - 122.0	32.0 - 129.0
90103565	50 LPM High Pressure	1.77 CFM (50 LPM)	25.0 - 100.0	23.5 - 98.0	31.5 - 120.0	32.5 - 128.0
90103566	100 LPM High Pressure	3.53 CFM (100 LPM)	60.0 - 100.0	58.0 - 98.0	71.0 - 120.0	75.0 - 128.0
90103567	1.0 CFM Low Pressure	1.0 CFM (28.3 LPM)	5.0 - 25.0	5.0 - 24.5	7.5 - 32.0	8.5 - 34.0
90103568	50 LPM Low Pressure	1.77 CFM (50 LPM)	5.0 - 25.0	5.0 - 24.5	7.5 - 31.5	8.5 - 33.5
90103569	100 LPM Low Pressure	3.53 CFM (100 LPM)	20.0 - 60.0	19.5 - 58.5	24.5 - 72.0	26.5 - 77.0

NOTE: Nitrogen, argon, and carbon dioxide are only available with the Lasair Pro Aerosol Particle Counter.

Functional Components

The HPD III high pressure diffuser consists of the following functional components:

- High pressure gas inlet/connector
- Critical orifice
- Vent
- Sample outlet

High Pressure Gas Inlet/Connector

The inlet/connector is a Cajon male 4-VCR type.

Critical Orifice

The high pressure critical orifices reduce high pressure gas from 5 – 120 psi (based on the CDA pressure ranges for specific models) to approximately atmospheric pressure. The orifice included is dependent upon the flow rate for the unit's exhaust. The flow rate can be 0.1 CFM, 1.0 CFM, 50 LPM, or 100 LPM. This flow rate and pressure range is selected when ordering the HPD III high pressure diffuser from Particle Measuring Systems and the appropriate critical orifice is installed.

Vent and Filter

Excess gas is vented through the gas vent outlet and filter, allowing the HPD III high pressure diffuser to accommodate a broad range of pressures.

When the pressurized gas is flowing, the excess gas is filtered before being exhausted to the room.

When the sample gas is off, the vacuum created by the particle counter causes room air to be pulled through the vent air filter and back into the high pressure diffuser. This allows the user to leave the particle counter ON, even when the gas supply is OFF.

CAUTION

When the flow is from the room into the HPD III high pressure diffuser, the particles left in the filter from venting can now be drawn back into the instrument. Over time, this will make it unlikely that the particle counter can zero-count when drawing air in through the filter.

Sample Outlet

The sample outlet tubing attaches to the inlet of the particle counter. The size of the exhaust port is dependent upon the flow rate ordered when purchasing the high pressure diffuser.

Gas Flow Rates

The HPD III high pressure diffuser is available in the following configurations:

- 0.1 CFM High Pressure (see page 1-5)
- 1.0 CFM High Pressure (see page 1-6)
- 1.0 CFM Low Pressure (see page 1-7)
- 50 LPM High Pressure (see page 1-8)
- 50 LPM Low Pressure (see page 1-9)
- 100 LPM High Pressure (see page 1-10)
- 100 LPM Low Pressure (see page 1-11)

0.1 CFM (High Pressure)

NOTE: The following information is specific to CDA.

Table 1-2 0.1 CFM High Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Outlet Flow Rate (SLPM)
20	3.35
25	3.87
40	5.41
60	7.51
80	9.63
100	11.40

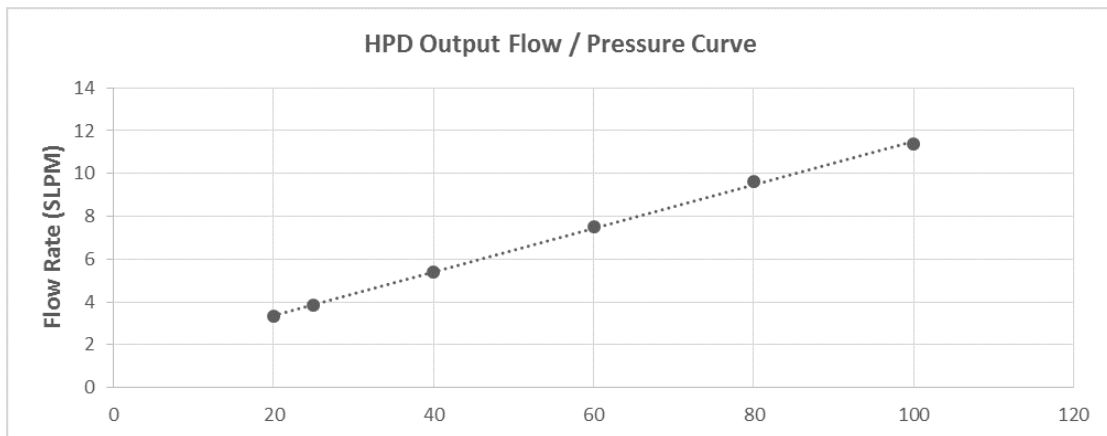


Figure 1-2 0.1 CFM High Pressure – Output Flow/Pressure Curve

1.0 CFM (High Pressure)

NOTE: The following information is specific to CDA.

Table 1-3 1.0 CFM High Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Flow Rate (SLPM)
20	33.00
25	38.12
40	53.90
60	73.35
80	94.50
100	115.00
120	135.00

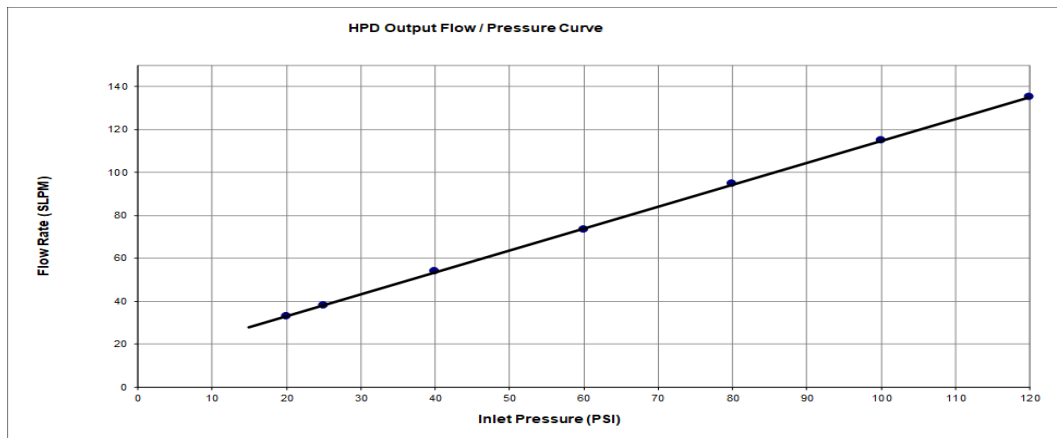


Figure 1-3 1.0 CFM High Pressure – Output Flow/Pressure Curve

1.0 CFM (Low Pressure)

NOTE: The following information is specific to CDA.

Table 1-4 1.0 CFM Low Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Flow Rate (SLPM)
5	35.50
10	48.90
15	61.10
20	72.50
25	85.50

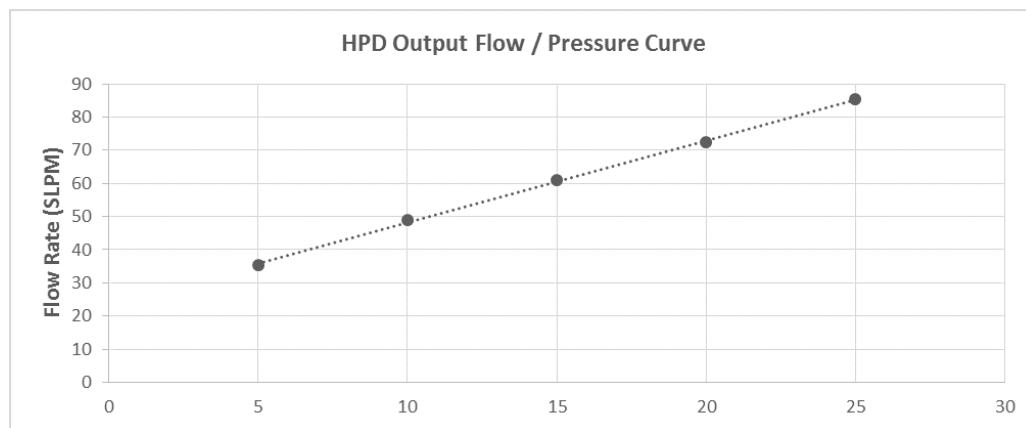


Figure 1-4 1.0 CFM Low Pressure – Output Flow/Pressure Curve

50 LPM (High Pressure)

NOTE: The following information is specific to CDA.

Table 1-5 50 LPM High Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Flow Rate (SLPM)
20	51.65
25	61.60
40	92.80
60	128.50
80	164.50
100	201.50

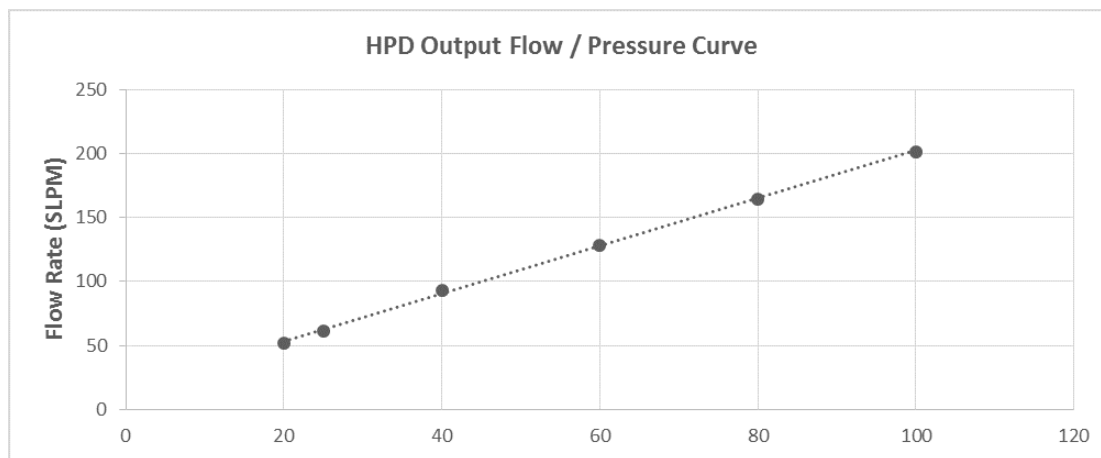


Figure 1-5 50 LPM High Pressure – Output Flow/Pressure Curve

50 LPM (Low Pressure)

NOTE: The following information is specific to CDA.

Table 1-6 50 LPM Low Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Flow Rate (SLPM)
5	62.8
10	87.2
15	108.4
20	128.2
25	148.4

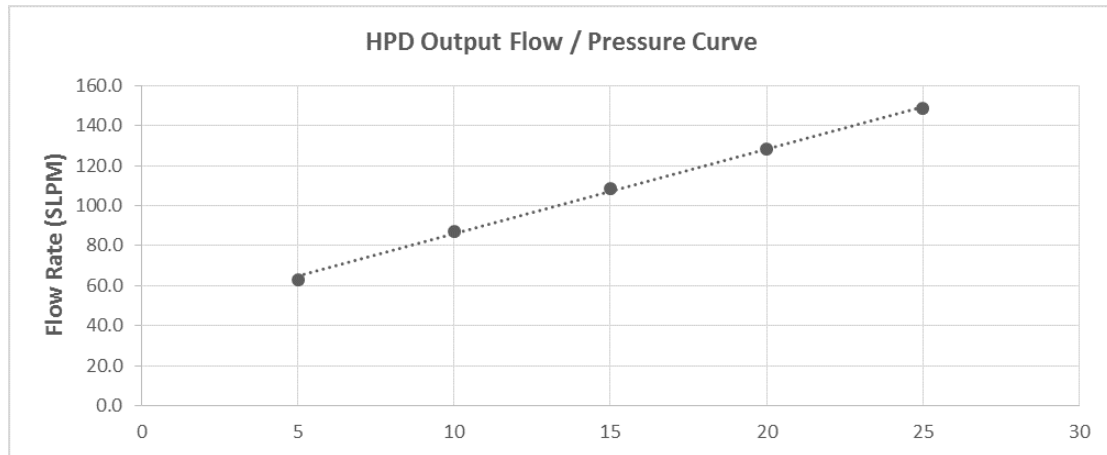


Figure 1-6 50 LPM Low Pressure – Output Flow/Pressure Curve

100 LPM (High Pressure)

NOTE: The following information is specific to CDA.

Table 1-7 100 LPM High Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Flow Rate (SLPM)
20	51.65
40	92.80
60	128.50
80	164.50
100	201.50

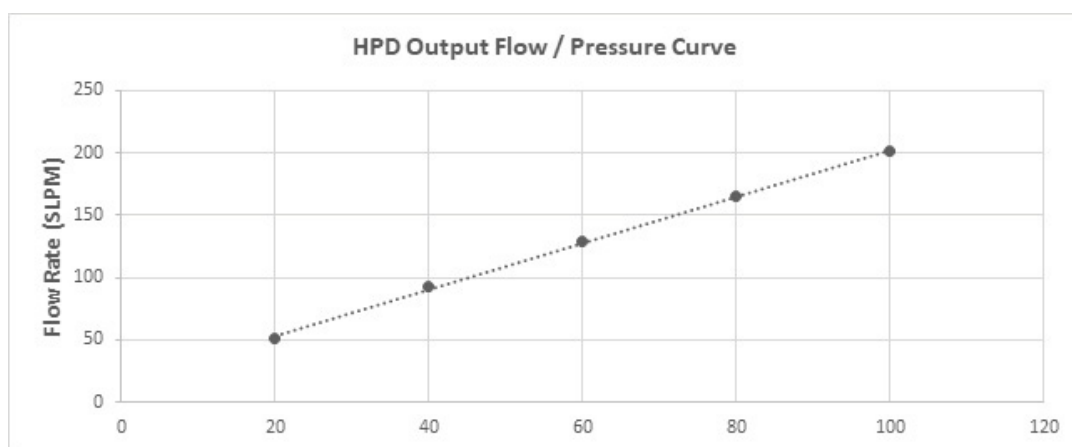


Figure 1-7 100 LPM High Pressure – Output Flow/Pressure Curve

100 LPM (Low Pressure)

NOTE: The following information is specific to CDA.

Table 1-8 100 LPM Low Pressure – Inlet Pressure and Outlet Flow

Inlet Pressure (PSI)	Flow Rate (SLPM)
20	128.3
30	167.6
40	207.2
50	244.5
60	283.8

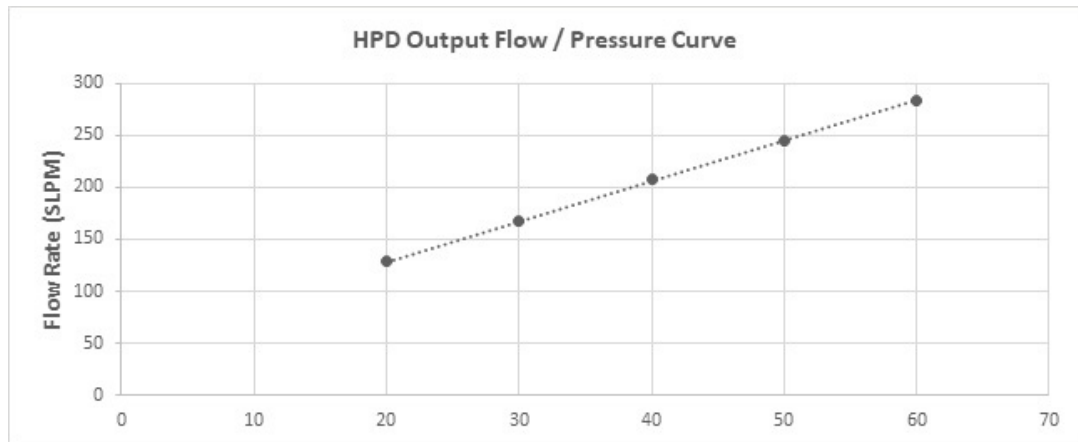


Figure 1-8 100 LPM Low Pressure – Output Flow/Pressure Curve

Specifications

Compatible instruments	• IsoAir[®] Pro-E particle counter • IsoAir[®] Pro-Plus particle counter • Lasair[®] III particle counter (models 310B, 310C, 350L, 5100) • Lasair Pro particle counter (models 310, 350, 5100) • IsoAir[®] PLUS particle sensor (models 310 and 510), IsoAir 310P particle counter • Airnet[®] and Airnet II particle sensor (models 510, 510 OPC, 510XR, and 510XR OPC) • Airnet II particle sensors (models 301, 301 OPC, 501, and 501OPC) • Airnet particle sensor (model 310)
Sample gas type	• Nitrogen • Argon • Clean, dry air (CDA) • Carbon dioxide (CO₂) NOTE: Do NOT use with toxic or combustible gases.
Sample gas operating limits	4 – 30 °C (39 – 86 °F) 0 – 85% RH (Limited by the particle counter.)
Materials Enclosure Gaskets	316L Stainless steel 316 Stainless steel, Buna-N O-rings
Inlet fitting	Cajon male VCR-type, #4 size, class 316L stainless steel with ruby orifice
Outlet fitting	Barb fitting for 0.75", 0.5", 0.375", or 0.125" ID tubing (dependent on flow rate)
Particle size range	0.3 – 25 µm
Pressure range for CDA, operating High Pressure Low Pressure	25 - 100 psi for 0.1 CFM, 50 LPM 60 - 100 psi for 100 LPM 25 - 120 psi for 1.0 CFM 5 - 25 psi for 1.0 CFM, 50 LPM 25 - 60 psi for 100 LPM
Pressure range for nitrogen, operating High Pressure Low Pressure	22.5 - 98 psi for 0.1 CFM 24 - 98 psi for 1.0 CFM 58 - 98 psi for 100 LPM 5 - 24.5 psi for 1.0 CFM, 50 LPM 19.5 - 58.5 psi for 100 LPM

Pressure range for argon, operating High Pressure Low Pressure	29 - 119 psi for 0.1 CFM 30 - 122 psi for 1.0 CFM 31.5 - 120 psi for 50 LPM 71 - 120 psi for 100 LPM 7.5 - 32 psi for 1.0 CFM 7.5 - 31.5 psi for 50 LPM 24.5 - 72 psi for 100 LPM
Pressure range for carbon dioxide, operating High Pressure Low Pressure	31 - 126 psi for 0.1 CFM 32 - 129 psi for 1.0 CFM 32.5 - 128 psi for 50 LPM 75 - 128 psi for 100 LPM 8.5 - 34 psi for 1.0 CFM 8.5 - 33.5 psi for 50 LPM 26.5 - 77 psi for 100 LPM
ISO Class	Less than 5% of ISO Class 5 requirements
Pressure, purge	Proof up to 200 psi of purge gas
Weight	2.7 pounds (1.25 kg)
Dimensions Enclosure (H, W, D) Vacuum support tubing and fittings	14.8 × 2.75 × 5.5 inches (37.6 cm × 99 cm × 13.97 cm) 39.4 inches (100 cm)
Environmental Temperature: Humidity, sample gas Altitude:	4 – 30 °C (39 – 86 °F) 0 – 85% RH, non-condensing 0 – 2,000 m (6560 ft)
Filter efficiency Vent filter	> 99.999% efficient at 0.3 μm
Replacement parts VCR gasket Filter O-Ring Exhaust default filter Exhaust sterile filter (Optional)	P/N 1000009001 P/N 1000012251 P/N FL37 P/N 1000021454

This page is intentionally left blank.

Chapter 2

Installation

Unpacking

The HPD III high pressure diffuser is shipped with the tubing and fittings required to connect it to the particle counter.

>> To unpack the instrument

1. Carefully remove the diffuser from its shipping container.
2. Inspect the packing container and instrument for damage. If the instrument has been damaged in shipment, notify the shipper immediately.
3. Verify that the following items are included with the diffuser. If any of these items are missing, contact Particle Measuring Systems for a replacement.
 - High pressure diffuser assembly
 - Orifice with end cap (assembled on the diffuser)
 - Exhaust filter (assembled on the diffuser)
 - Three (3) feet of interconnect tubing

NOTE: The size is flow rate dependent.

- Two (2) mounting clamps
- Two (2) replacement VCR gaskets
- *HPD III High Pressure Diffuser Operations Manual*

Installation

When using the 0.1 CFM unit, mount the HPD III high pressure diffuser flow in a downward direction to minimize any particle transport loss. The 1.0 CFM, 50 LPM and 100 LPM units can be mounted in any directional configuration.

NOTE: Minimize counting errors by minimizing vibration; do not hard-mount the HPD III high pressure diffuser directly into a gas line.

>> To install the instrument

1. Identify a location for mounting the HPD III high pressure diffuser, and secure the two (2) mounting clamps to the location.
2. Place the high pressure diffuser inside the clamps, and press the ends of each clamp together to secure the high pressure diffuser.
3. Remove the end cap from the male 4-VCR fitting, and attach the fitting to the source of process gas (or clean dry air) utilizing a female 4-VCR fitting from the gas source.

NOTE: Make sure the gasket is in place. See **Figure 3-1** on page 3-2 for an assembled view.
Also, make sure to use a new gasket each time this connection is changed.

NOTE: The Particle Measuring Systems High Pressure diffuser uses the Swagelok® Cajon VCR Fitting to ensure a safe and reliable connection to the high pressure gas line.
A variety of adaptors for the specific sample point connection may be found on the Swagelok website or in the catalog available below:

- <https://www.swagelok.com/downloads/webcatalogs/EN/MS-01-24.PDF>

For further assistance, contact Particle Measuring Systems.

WARNING

Make sure that any processed gas connected is within the specifications for the HPD III high pressure diffuser. Failure to follow this instruction may cause bodily injury and/or damage to the instrument (and/or any materials or devices affected by the instrument).

4. Attach the supplied tubing from the sample outlet (barb fitting) of the high pressure diffuser to the sample inlet of the particle counter.

CAUTION

Always use the threaded metal fitting to cap the inlet of the HPD III high pressure diffuser's sample inlet when the diffuser is removed from service. Otherwise, the orifice may become contaminated. The supplied vinyl cap should also be placed on the exhaust port when the diffuser is removed from service.

5. Ensure that the filter is installed on the high pressure diffuser.
6. Start the particle counter.

CAUTION

The particle counter should always be started prior to applying pressurized gas.

7. Open the gas line to supply process gas to the diffuser.
8. Continue by following the particle counter's recommended setup procedures. See the Particle Measuring Systems' operations manual for your specific particle counter for instruction.

This page is intentionally left blank.

Chapter 3

Maintenance

You can perform the following maintenance actions to help protect the HPD III high pressure diffuser and ensure that the instrument operates effectively.

CAUTION

Do NOT disassemble any portion of the HPD III high pressure diffuser. This may damage or contaminate critical components. Unauthorized disassembly of the diffuser may void the warranty.

Minimizing Contamination

It is important that the diffuser be exposed to as little contamination as possible. When exposed to dirty sample gas, the HPD III high pressure diffuser will start to accumulate particles internally. Eventually, the accumulation of particles will cause the instrument to fail its zero-count test. The zero-count specification is 5% of ISO Class 5.

To increase the time before the HPD III high pressure diffuser needs servicing, place the protective shipping caps on both the high pressure inlet and exhaust port whenever the unit is not connected to pressurized tubing (such as during times of storage or transportation). Also, minimize the exposure of the unit to non-clean air and other gases.

Purging the High Pressure Diffuser

NOTE: Due to the complex nature of isolating a source of contamination or leakage, always consult with Particle Measuring Systems before beginning this procedure.

After sampling a gas source with a high concentration of particles, it may be necessary to purge the diffuser with filtered gas to help remove contaminants in the system. When purging the diffuser, a pressure of up to 200 psi may be used. If a low background cleanliness level is not needed, this may not be necessary.

CAUTION

When purging the diffuser, make sure that the particle counter is NOT attached.

If purging fails to restore a low background, it is likely due to severe contamination of a critical component or to a leak. In this case, the high pressure diffuser may need additional cleaning. Contact Particle Measuring Systems for assistance.

A new diffuser has a background level that meets 5% of ISO Class 5.

Replacing the 4-VCR Fitting Gasket

Each time you remove the 4-VCR fitting, it is recommended that you replace the gasket. Refer to Figure 3-1, “4-VCR Fitting Connection Assembly” for a close-up view of the gasket assembly.

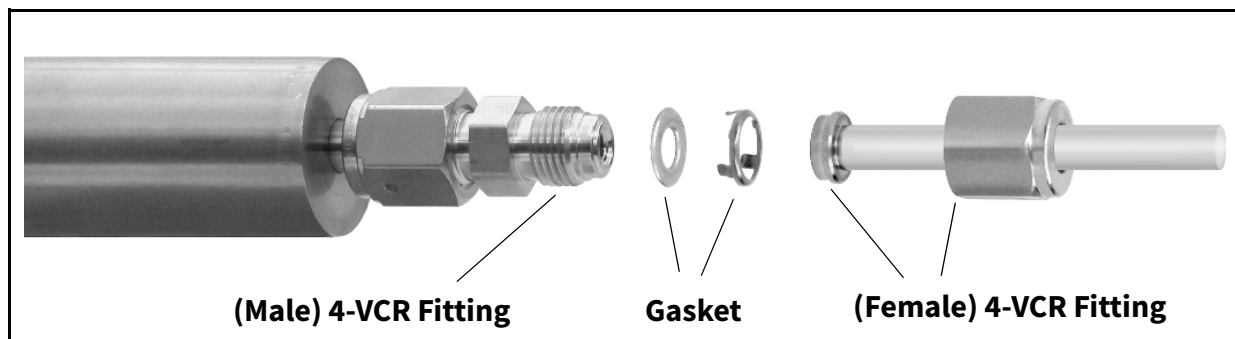


Figure 3-1 4-VCR Fitting Connection Assembly

Replacing the Filter

Pull the entire filter housing out of the HPD III high pressure diffuser unit. Apply a thin film of Apiezon® (or equivalent) vacuum grease around the outside diameter of the replacement filter before installing, and replace O-ring as necessary based on the condition of the O-ring.