應用研究：含甲醇與水的乙烯流體中線上微量氧分析

流體說明

該製程流體源自石化乙烯氣體管線，其中含有微量碳氫化合物、甲醇及微量水分。透過微氧分析儀（氧氣濃度範圍 0–100 ppm）對此流體氣體進行氧氣分析，以確保產品純度並防止下游設備發生氧化或聚合反應。

氣體組成及濃度(%)

乙烯（C_2H_4）96.30
乙烷 (C_2H_6) 2.47
甲醇 (CH_3OH)** 1.08
氮氣 (N_2) 0.21
甲烷 (CH_4) 0.0023
乙炔（C_2H_2） 0.032
氧氣 (O_2)** 0.0008
水 (H_2O)** 0.0034

取樣點製程條件：

- 溫度：9.2 °C
- 壓力：7.9 kg/cm2G（約 8.9 barG）
- 流入分析儀的流量：0.5 SLPM
- 總旁路流量：4.5 SLPM

在此條件下，甲醇與水可能部分冷凝，形成約 1 % v/v 液相（主要為甲醇）。

目標:

為保護微量氧分析儀免受甲醇與水污染，應採取以下措施：

- 有效去除液滴與氣溶膠。
- 確保快速響應與穩定的樣品條件。
- 維持低壓降且流体無兩相存在。

系統配置:

第一階段 – 旋風過濾分離器:

型號：MaestroGuard® MMF-80

功能：採用離心分離與雙層 ePTFE 膜技術，實現甲醇/水滴的主要去除。

參數規格:

類型:雙層聚四氟乙烯膜旋風分離器（MaestroGuard® 膜片編號 4）。

濾膜屬性: 聚四氟乙烯（PTFE），經化學處理——阻隔液體，包括甲醇。

流量設定: 旁路流量 3.5 公升/分鐘。

旋風直徑 36毫米 離心式加速: ~40–60 克，流速3.5 公升/分鐘 → 強效預分離效果。目的: 在雙層 ePTFE膜處理階段前去除超過 95%的液體負荷。

結果：

在 3.5 公升/分鐘的流速下，旋風分離效應完全啟動，產生顯著的離心加速度，確保絕大多數冷凝的甲醇/水液滴在抵達膜層前即被去除。兩層聚四氟乙烯（PTFE）膜提供最終防護，即使在流量或壓力變化時，亦能防止液體滲透。

第二階段 – 精細過濾分離器

型號：MaestroGuard™ MF-100

功能：分析儀進樣品入前的最終精緻階段。

參數規格

類型:緊湊型過濾分離器，配備單層聚四氟乙烯（PTFE）膜（MaestroGuard™ 膜號4）

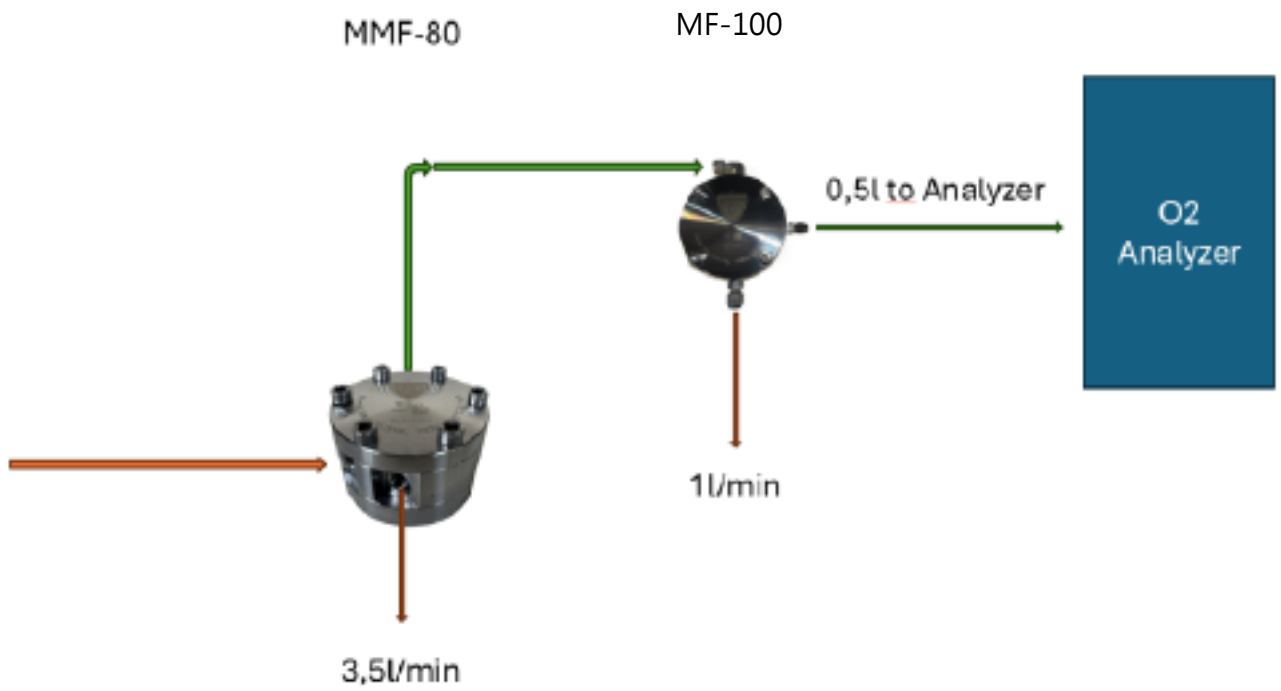
流動配置: 旁路流量 1 公升/分鐘；分析儀流量 0.5 公升/分鐘

外殼 SS316L 不鏽鋼 (1/4" NPT 或 G¼)

功能：捕獲任何殘留的細微氣溶膠（<1 微米）或蒸氣

結果：

MF-100 確保進入氧氣分析儀的氣流保持潔淨、乾燥且僅含氣體，從而保障電化學cell的 期穩定性與最小漂移。



設計功能的優勢

_雙階段分離（旋風分離器 + 薄膜）:消除大顆粒與細微的甲醇/水液滴。

_化學處理的聚四氟乙烯膜防止甲醇潤濕與液體滲透。

_優化旁路流量（3.5 公升/分鐘）:確保強勁離心效果（約 50 g），實現卓越的預分離效果。

_低壓差設計:維持快速分析儀響應與穩定流量。

_ 全 316L 不鏽鋼與聚四氟乙烯/ 氟碳橡膠材質:對乙烯/甲醇混合物具有完全的化學耐受性。

_模組化配置（MMF-80 + MF-100）:維護簡便、佔用空間小、整合彈性高。

_減少分析儀停機時間防止O2 sensor中毒與污染故障。

_ 環境安全:受控的排水收集與甲醇蒸氣排氣。

結論:

MaestroGuard™ MMF-80 + MF-100 組合為在含甲醇、乙烯流中運作的微氧分析儀，提供強韌的雙階段保護系統。

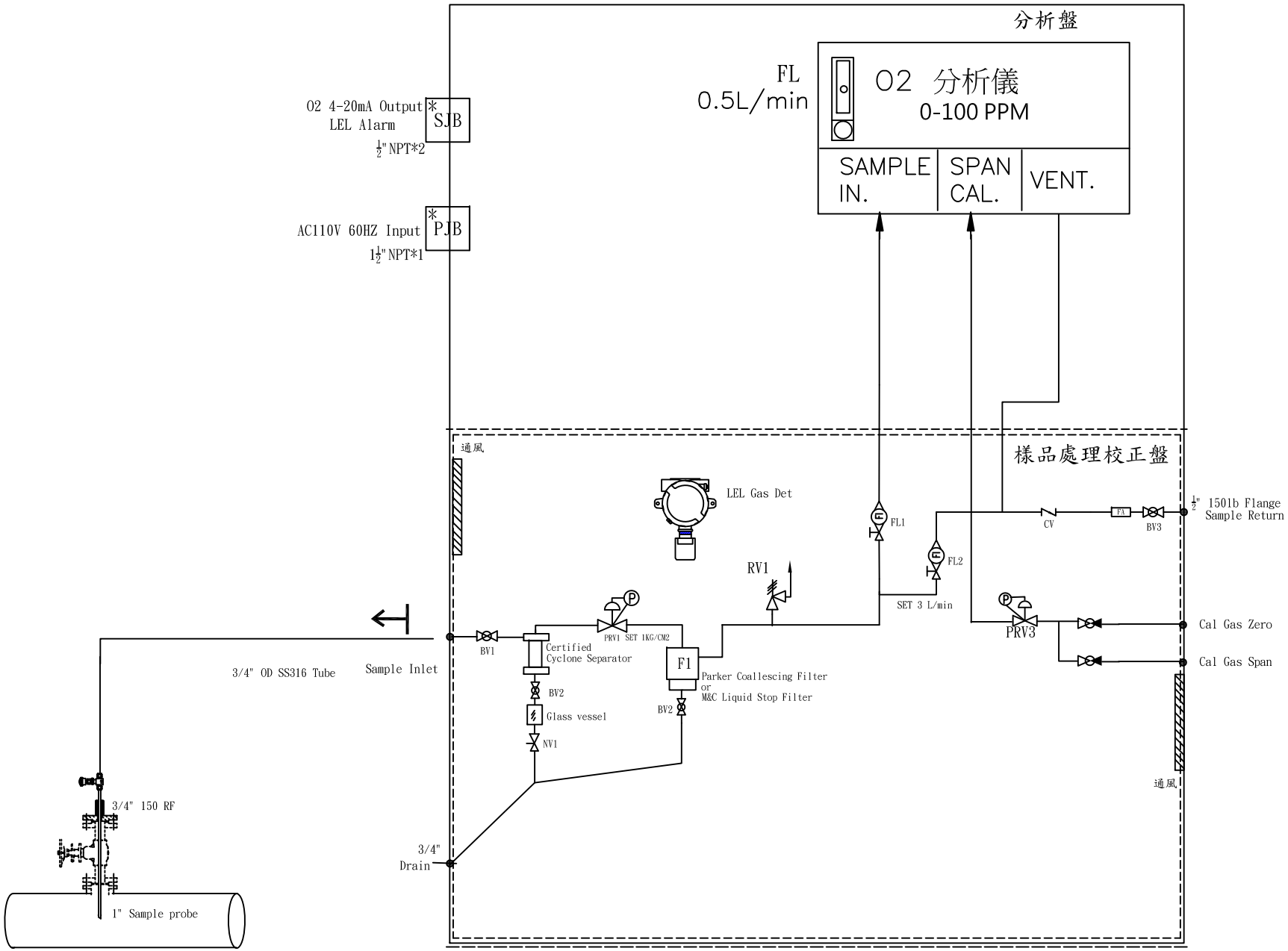
- MMF-80 作為高效旋風預分離器，搭載 MaestroGuard™第 4 號膜元件，可在 3.5 L/min 旁路流量下實現可靠的甲醇/水分離。
- MF-100 作為最終膜過濾器，確保僅有潔淨乾燥的乙烯氣體以 0.5 L/min 的流量輸送至分析儀。

此配置可確保：分析儀讀數穩定，延長電池壽命、快速響應、最低維護需求。

– 密封材料（O 型環）:FFKM

（Kalrez 類型）

- 材質：全氟彈性體（FFKM），例如 Kalrez® 6375（或 Chemraz®/Simriz® 等效材料）
- 硬度：75 Shore A（典型值）
- 溫度：–20 … +250 °C（應用範圍：0–85 °C）
- 相容性：與甲醇、水、乙烯及微量碳氫化合物相容性極佳
- 滲透/老化：極低 → 使用壽命長
- 用途：適用於所有 MMF-80 及 MF-100 型號的保壓密封件（含蓋板、膜片座、排水裝置）



Components & Condition:
0.21% Nitrogen,
0.0008% Oxygen,
0.0023% Methane,
96.30% Ethylene,
2.47% Ethane,
0.032% Acetylene,
1.08% Methanol
0.0034% Water
9.2 C Temp,
7.9 kg/cm2G,

RETURN LINE
0.1kg/cm2G Length 40M
to V-3790

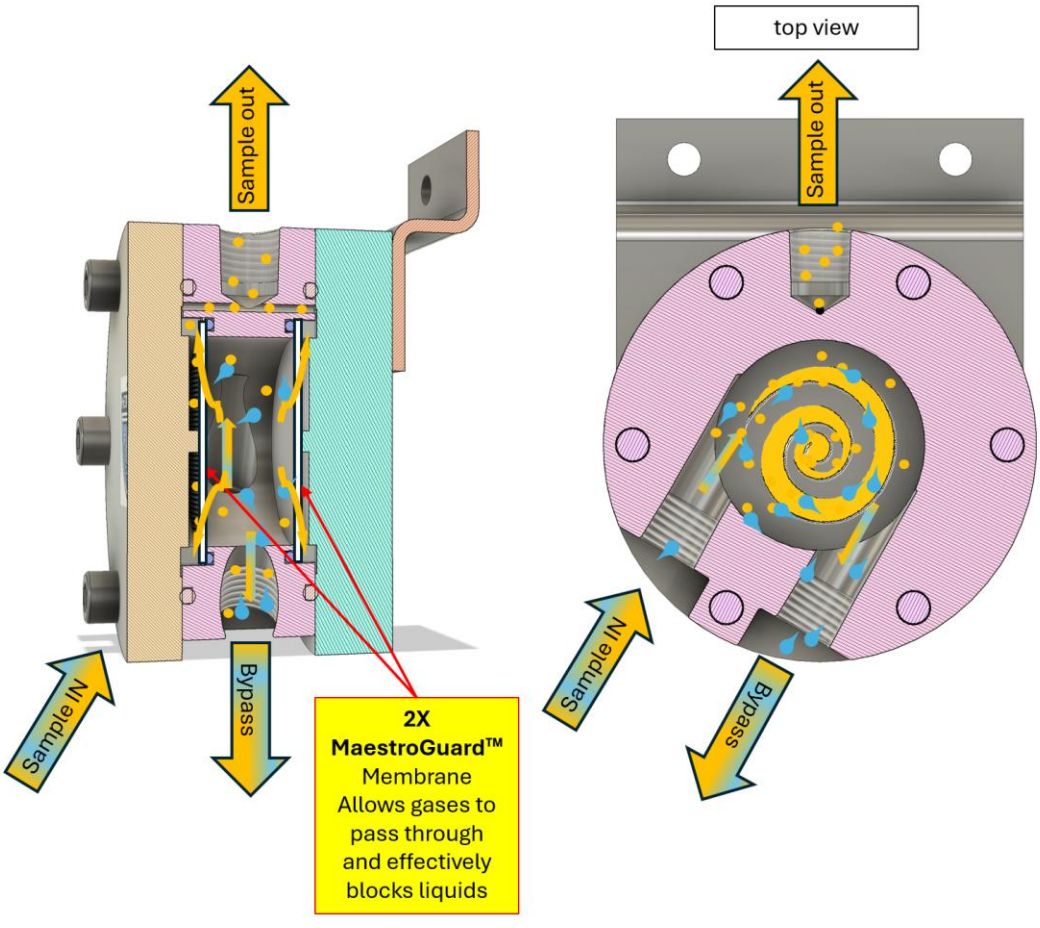
Product Brief – MaestroGuard™ Filter

MMF-80-316L-160

1. Product Overview

The **MMF-80 MaestroGuard™ Filter** is a compact, high-performance filter designed for critical gas sampling systems. It combines **parallel multi-membrane filtration**, **mechanical particle pre-separation**, and **self-cleaning bypass drainage**—resulting in **exceptional flow capacity**, **prolonged filter life**, and **minimal maintenance** requirements.

Functional diagram illustrating the MF-series of MaestroGuard™ filter



2. Key Features

The MMF-80 features a carefully engineered **internal spiral flow path** that significantly enhances phase separation and membrane protection:

- **Dual MaestroGuard™ Membrane Chambers (Parallel)**
  The pre-separated gas then passes through **two parallel MaestroGuard™ membrane zones**, allowing clean gas to pass while liquids and particles are retained.
- **Centrifugal Pre-Separation**
  Spiral inlet design creates a rotational flow that mechanically removes heavier droplets and particulates before they reach the membranes.
- **Self-Cleaning Bypass Channel**
  Continuously drains separated liquids and contaminants from the membrane chamber, preventing saturation and extending filter life.
- **Low-Flow, High-Precision Operation**
  Optimized for small-volume gas sampling systems in analytical and environmental applications.
- **Aggressive Cleaning for Harsh Streams**
  The internal swirl and bypass design also supports effective operation in dirty or multiphase gas flows, where oil mist, aerosols, and solid particles are present.
- **Robust and Compact Housing**
  Corrosion-resistant stainless steel body for integration in industrial or ATEX-rated environments.
- **Bypass Drainage Path**
  Collected liquids and contaminants are directed downward into a **dedicated bypass channel**, continuously flushed out to maintain membrane dryness and performance.
- **Vertical Sample Outlet**
  The clean, dry gas exits at the top—ready for precise downstream analysis.

This **internal spiral-bypass design** not only increases filtration effectiveness but also extends membrane life by preventing overload and fouling.

3. Technical Specifications

Housing Material	Stainless Steel 316L (1.4404)
Filter Element	2 x MaestroGuard™ membrane
Filtration Efficiency	< 0.1 µm absolute - customizable
Operating Pressure	Up to 160 bar
Temperature Range	–40°C to 260°C (depending on seal)
Flow Rate	210 L/h air @ 100mbar
Bypass flow	250ml to 6l/min (per application to drain or back to process)
Internal volume	78ml in centrifugal system and 20ml after filtration
Connections	NPT Female or on request
Seal Materials	FKM or FFKM
Certificates / Compliance	EN 10204 3.1, CE, ATEX, PED 2014/68/EU, ISO 11114-4, ISO 15156 / NACE MR0175

No self-ignition hazard – compliant with requirements for explosive environments.

4. Application Areas

- **Gas Analysis Systems**
  Effectively removes entrained liquids and fine particulates from corrosive or inert gas samples. Ideal for use with infrared sensors, TCDs, chromatographs, and moisture **analyzers.**
- **Oil and Fuel Sample Conditioning**
  Separates free water and solid contaminants from oil or diesel vapor samples, protecting sensitive analytical components.
- **Hydrogen and Alternative Fuel Systems**
  Prevents ingress of droplets and aerosols in fuel cell and hydrogen quality monitoring systems.
- **Environmental & Stack Gas Monitoring**
  Ensures accurate low-level detection of pollutants such as NO_x, SO_2, CO, CO_2, and VOCs—even under humid or wet sampling conditions.
- **Industrial Process Control**
  Provides robust filtering in wet, oil-laden, or dust-rich gas streams—especially in harsh or remote processing environments.
- **Pharmaceutical and Chemical Manufacturing**
  Supplies dry, contaminant-free gas samples to instrumentation used for product validation and process compliance.
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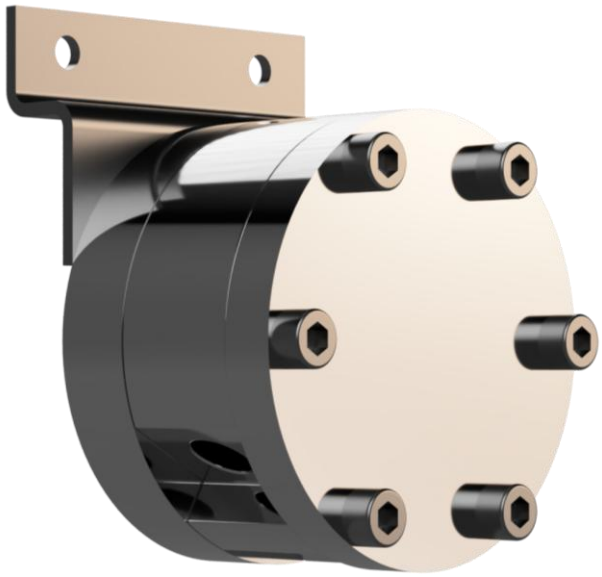

5. Ordering Information

Order Number	Description
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MMF-80-316L-160-FFKM-V1	MMF-80 MaestroGuard™ membrane Filter, 160 bar, O-ring FFKM
MMF-80-316L-160-PTFE-V1	MMF-80 MaestroGuard™ membrane Filter, 160 bar, O-ring PTFE
Option	
MBMMF-80-SS	MMF-80 Mounting Bracket in Stainless Steel 316L
Spare Parts	
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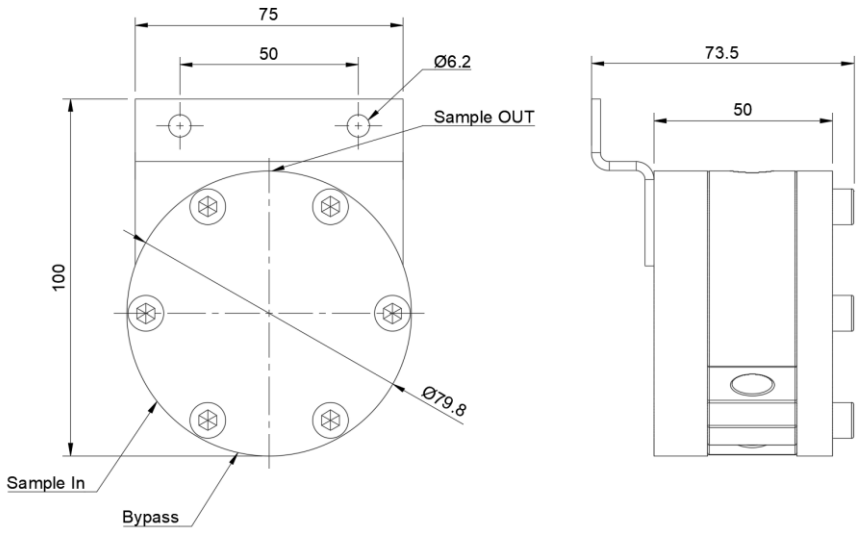
MMF-80-SS-V1	MMF-80 Support screen, 316L

6. Benefits

- **Superior Gas Purity**
  Only clean, dry gas passes through the dual membrane system—protecting downstream analyzers from water, oil mist, aerosols, and fine particulates.
- **Extended Filter Lifetime with Minimal Maintenance**
  The combination of centrifugal pre-separation and self-cleaning bypass flow prevents membrane fouling and saturation, greatly reducing maintenance frequency.
- **Optimized for Multiphase and Contaminated Gas Streams**
  Handles challenging conditions with entrained liquids, oil droplets, and particles, making it ideal for oil & gas, refining, and chemical processing applications.
- **Low Bypass, High Separation Efficiency**
  Achieves effective gas-liquid separation with minimal sample loss—ideal for systems with limited sample flow or strict energy constraints.
- **Compact and Easy to Integrate**
  Space-saving design with flexible mounting options allows use in analyzer cabinets, field units, and mobile platforms.
- **Cross-Sector Versatility**
  Suitable for precision applications (e.g. hydrogen, pharma, environmental) as well as robust industrial settings, including offshore platforms, refineries, and process gas systems.
- **Minimizes downtime** – long service intervals and low maintenance

7. Dimensions



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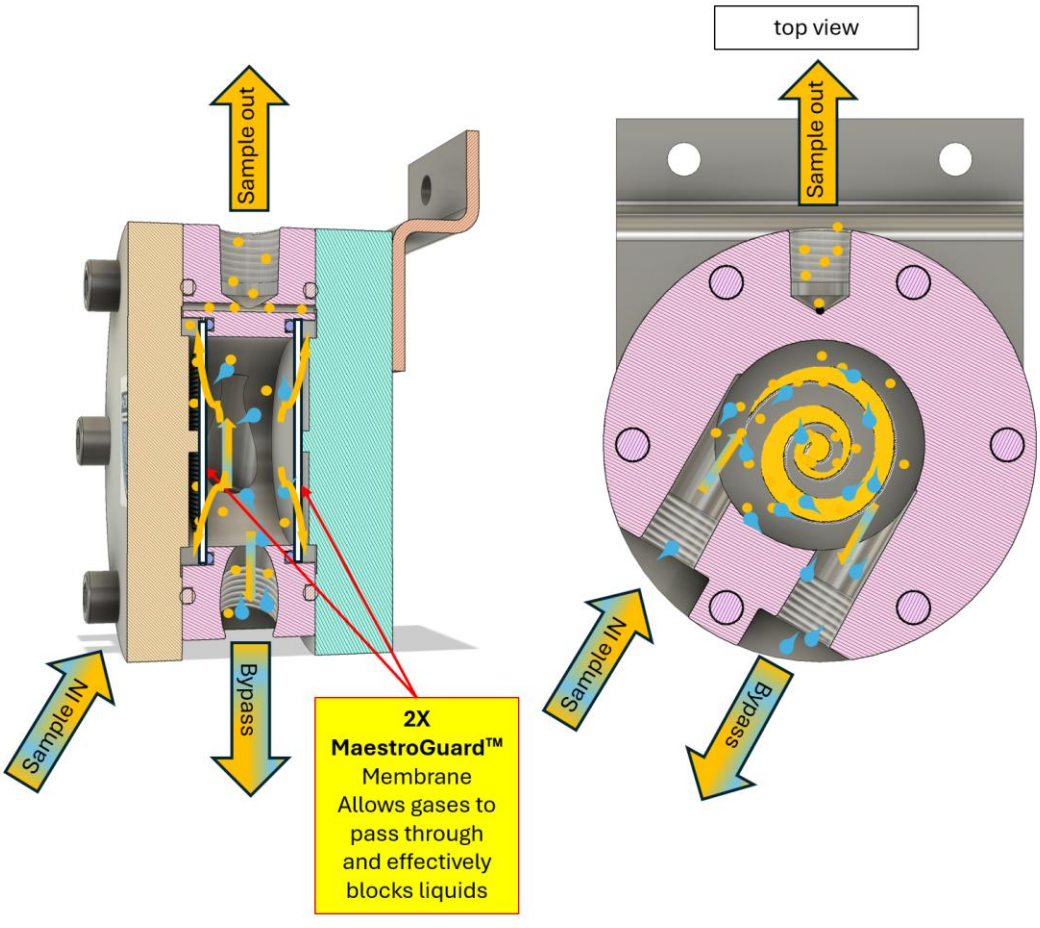

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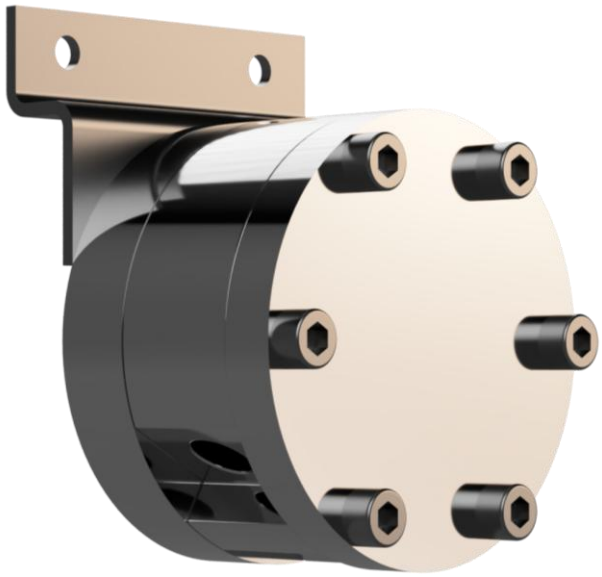

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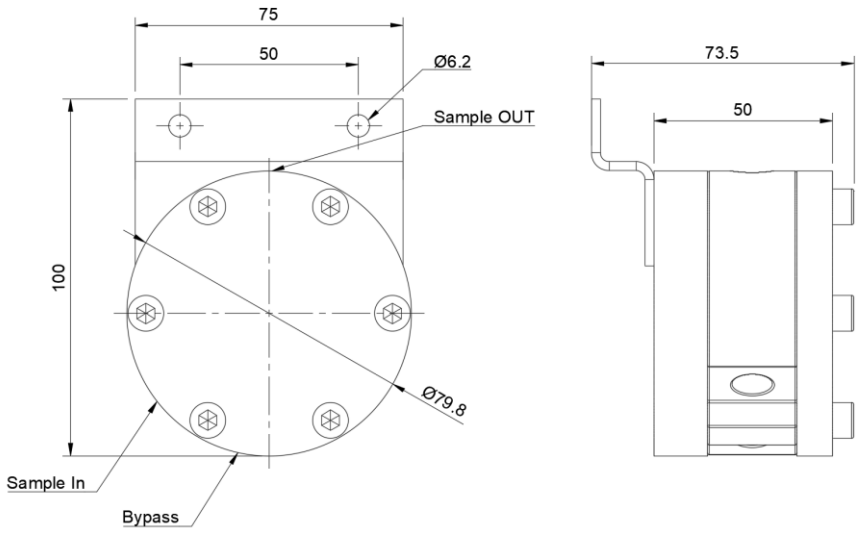

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