

CONTAMINATION CONTROL SOLUTIONS

AUTOMATIC PARTICLE COUNTERS



PASSION TO PERFORM





A WORLDWIDE LEADER IN THE FIELD OF HYDRAULIC FILTRATION EQUIPMENT.

Our company started life in 1964, when Bruno Pasotto decided to attempt to cater for the requests of a market still to be fully explored, with the study, design, development, production and marketing of a vast range of filters for hydraulic equipment, capable of satisfying the needs of manufacturers in all sectors. The quality of our products, our extreme competitiveness compared with major international producers and our constant activities of research, design and development has made us a worldwide leader in the field of hydraulic circuit filtering. Present for 50 years in the market, we have played a truly decisive role in defining our sector, and by now we are a group capable of controlling our entire chain of production, monitoring all manufacturing processes to guarantee superior quality standards and to provide concrete solutions for the rapidly evolving needs of customers and the market.

MARKET LEADER



Our work is based on a skillful interaction between advanced technology and fine workmanship, **customizing products according to specific market requests**, focusing strongly on innovation and quality, and following every step in the manufacturing of both standard and special products, fully respecting customer expectations.



Our customer-oriented philosophy, which enables us to satisfy all customer requests **rapidly and with personalized products**, makes us a **dynamic and flexible enterprise**. The possibility of constantly controlling and monitoring the entire production process is essential to allow us to guarantee the quality of our products.

WORLDWIDE PRESENCE

Our foreign Branches enable us to offer a diversified range of products that allow us to successfully face the aggressive challenge of international competition, and also to maintain a stable presence at a local level.

The Group boasts **8** business branches



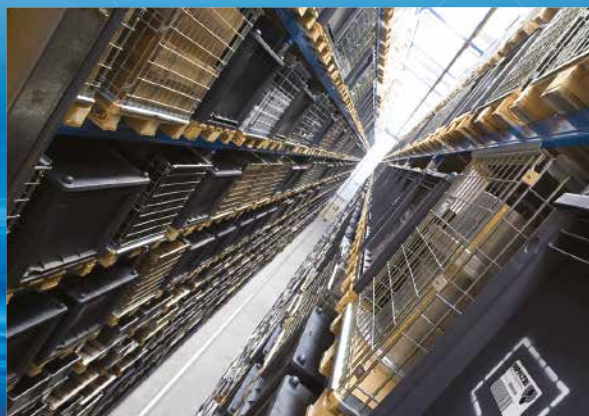
TECHNOLOGY

Our constant **quest for excellence in quality and technological innovation** allows us to offer only the best solutions and services for applications in many fields, including general industry, test rigs, lubrication, heavy engineering, renewable energies, naval engineering, offshore engineering, aviation systems, emerging technologies and mobile plant (i.e. tractors, excavators, concrete pumps, platforms).



AND PRODUCTION

Our high level of technological expertise means **we can rely entirely on our own resources, without resorting to external providers.** This in turn enables us to satisfy a growing number of customer requests, also exploiting our constantly updated range of machines and equipment, featuring **fully-automated workstations** capable of **24-hour production.**





SUCTION FILTERS

Flow rates
up to 875 l/min

Mounting:
- Tank immersed
- In-Line
- In tank with
shut off valve
- In tank
with flooded suction

RETURN FILTERS

Flow rates
up to 3000 l/min

Pressure
up to 20 bar

Mounting:
- In-Line
- Tank top
- In single
and duplex designs

RETURN / SUCTION FILTERS

Flow rates
up to 300 l/min

Pressure
up to 80 bar

Mounting:
- In-Line
- Tank top

SPIN-ON FILTERS

Flow rates
up to 365 l/min

Pressure
up to 35 bar

Mounting:
- In-Line
- Tank top

LOW & MEDIUM PRESSURE FILTERS

Flow rates
up to 3000 l/min

Pressure
up to 80 bar

Mounting:
- In-Line
- Parallel manifold version
- In single
and duplex designs

HIGH PRESSURE FILTERS

Flow rates
up to 750 l/min

Pressure from 110 bar
up to 560 bar

Mounting:
- In-Line
- Manifold
- In single
and duplex designs

PRODUCT RANGE

MP Filtri can offer a vast and articulated range of products for the global market, suitable for all industrial sectors using hydraulic equipment.

This includes filters (suction, return, return/suction, spin-on, pressure, stainless steel pressure) and structural components (motor/pump bell-housings, transmission couplings, damping rings, foot brackets, aluminium tanks, cleaning covers).

We can provide all the skills and solutions required by the modern hydraulics industry to monitor contamination levels and other fluid conditions.

Mobile filtration units and a full range of accessories allow us to supply everything necessary for a complete service in the hydraulic circuits.



STAINLESS STEEL HIGH PRESSURE FILTERS

Flow rates up to 125 l/min
Pressure from 320 bar up to 1000 bar

- Mounting:
- In-Line
 - Manifold
 - In single and duplex designs

CONTAMINATION MONITORING PRODUCTS

- Online, in-line particle counters
- Off-line bottle sampling products
- Fully calibrated using relevant ISO standards
- A wide range of variants to support fluid types and communication protocols

MOBILE FILTRATION UNITS

Flow rates from 15 l/min up to 200 l/min

POWER TRANSMISSION PRODUCTS

- Aluminium bell-housings for motors from 0.12 kW to 400 kW
- Couplings in Aluminium Cast Iron - Steel
- Damping rings
- Foot bracket
- Aluminium tanks
- Cleaning covers

ACCESSORIES

- Oil filler and air breather plugs
- Optical and electrical level gauges
- Pressure gauge valve selectors
- Pipe fixing brackets
- Pressure gauges

CONTAMINATION CONTROL SOLUTIONS

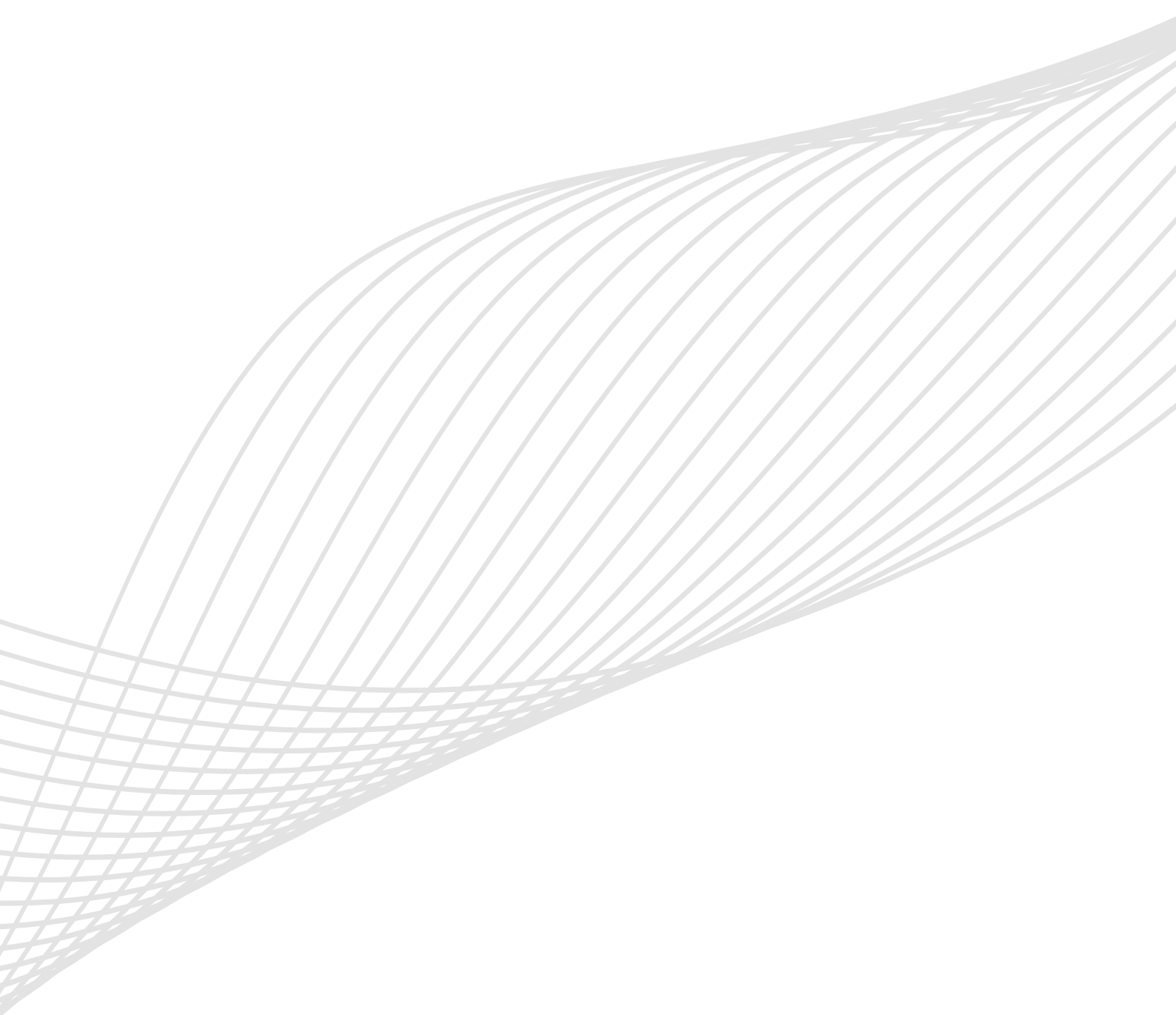


...because contamination costs!

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Contamination management

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1 HYDRAULIC FLUIDS

The fluid is the vector that transmits power, energy within an oleodynamic circuit. In addition to transmitting energy through the circuit, it also performs additional functions such as lubrication, protection and cooling of the surfaces.

The classification of fluids used in hydraulic systems is coded in many regulatory references, different Standards.

The most popular classification criterion divides them into the following families:

- MINERAL OILS

Commonly used oil deriving fluids.

- FIRE RESISTANT FLUIDS

Fluids with intrinsic characteristics of incombustibility or high flash point.

- SYNTHETIC FLUIDS

Modified chemical products to obtain specific optimized features.

- ECOLOGICAL FLUIDS

Synthetic or vegetable origin fluids with high biodegradability characteristics.

The choice of fluid for an hydraulic system must take into account several parameters.

These parameters can adversely affect the performance of an hydraulic system, causing delay in the controls, pump cavitation, excessive absorption, excessive temperature rise, efficiency reduction, increased drainage, wear, jam/block or air intake in the plant.

The main properties that characterize hydraulic fluids and affect their choice are:

- DYNAMIC VISCOSITY

It identifies the fluid's resistance to sliding due to the impact of the particles forming it.

- CINEMATIC VISCOSITY

It is a widespread formal dimension in the hydraulic field.

It is calculated with the ratio between the dynamic viscosity and the fluid density.

Cinematic viscosity varies with temperature and pressure variations.

- VISCOSITY INDEX

This value expresses the ability of a fluid to maintain viscosity when the temperature changes.

A high viscosity index indicates the fluid's ability to limit viscosity variations by varying the temperature.

- FILTERABILITY INDEX

It is the value that indicates the ability of a fluid to cross the filter materials. A low filterability index could cause premature clogging of the filter material.

- WORKING TEMPERATURE

Working temperature affects the fundamental characteristics of the fluid. As already seen, some fluid characteristics, such as cinematic viscosity, vary with the temperature variation.

When choosing a hydraulic oil, must therefore be taken into account of the environmental conditions in which the machine will operate.

- COMPRESSIBILITY MODULE

Every fluid subjected to a pressure contracts, increasing its density.

The compressibility module identifies the increase in pressure required to cause a corresponding increase in density.

- HYDROLYTIC STABILITY

It is the characteristic that prevents galvanic pairs that can cause wear in the plant/system.

- ANTIOXIDANT STABILITY AND WEAR PROTECTION

These features translate into the capacity of a hydraulic oil to avoid corrosion of metal elements inside the system.

- HEAT TRANSFER CAPACITY

It is the characteristic that indicates the capacity of hydraulic oil to exchange heat with the surfaces and then cool them.

2 FLUID CONTAMINATION

Whatever the nature and properties of fluids, they are inevitably subject to contamination. Fluid contamination can have two origins:

- INITIAL CONTAMINATION

Caused by the introduction of contaminated fluid into the circuit, or by incorrect storage, transport or transfer operations.

- PROGRESSIVE CONTAMINATION

Caused by factors related to the operation of the system, such as metal surface wear, sealing wear, oxidation or degradation of the fluid, the introduction of contaminants during maintenance, corrosion due to chemical or electrochemical action between fluid and components, cavitation. The contamination of hydraulic systems can be of different nature:

- SOLID CONTAMINATION

For example rust, slag, metal particles, fibers, rubber particles, paint particles or additives

- LIQUID CONTAMINATION

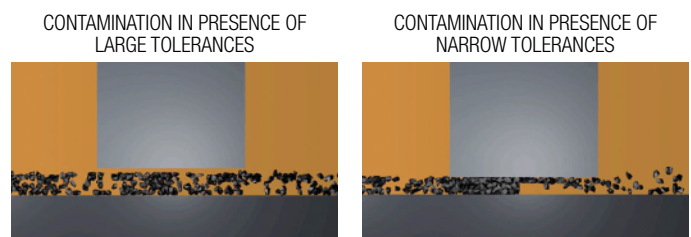
For example, the presence of water due to condensation or external infiltration or acids

- GASEOUS CONTAMINATION

For example, the presence of air due to inadequate oil level in the tank, drainage in suction ducts, incorrect sizing of tubes or tanks.

3 EFFECTS OF CONTAMINATION ON HYDRAULIC COMPONENTS

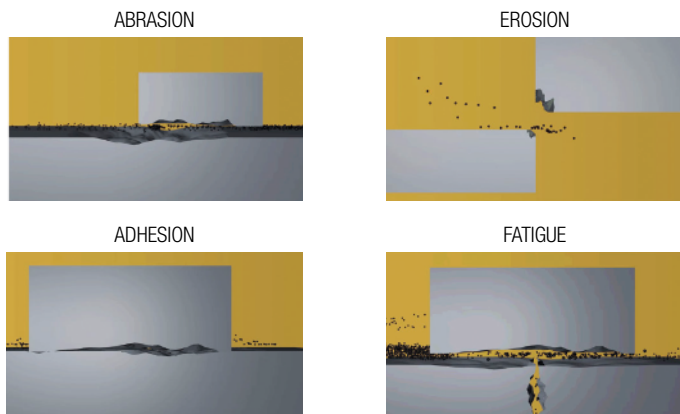
Solid contamination is recognized as the main cause of malfunction, failure and early degradation in hydraulic systems. It is impossible to delete it completely, but it can be effectively controlled by appropriate devices.



Solid contamination mainly causes surface damage and component wear.

- SURFACE EROSION
Cause of leakage through mechanical seals, reduction of system performance, variation in adjustment of control components, failures.
- ADHESION OF MOVING PARTS
Cause of failure due to lack of lubrication.
- DAMAGES DUE TO FATIGUE
Cause of breakdowns and components breakdown.

- MODIFICATION OF FLUID PROPERTIES
(COMPRESSIBILITY MODULE, DENSITY, VISCOSITY)
Cause of system's reduction of efficiency and of control.
It is easy to understand how a system without proper contamination management is subject to higher costs than a system that is provided.
- MAINTENANCE
Maintenance activities, spare parts, machine stop costs
- ENERGY AND EFFICIENCY
Efficiency and performance reduction due to friction, drainage, cavitation.



Liquid contamination mainly results in decay of lubrication performance and protection of fluid surfaces.

DISSOLVED WATER

- INCREASING FLUID ACIDITY
Cause of surface corrosion and premature fluid oxidation
- GALVANIC COUPLE AT HIGH TEMPERATURES
Cause of corrosion

FREE WATER - ADDITIONAL EFFECTS

- DECAY OF LUBRICANT PERFORMANCE
Cause of rust and sludge formation, metal corrosion and increased solid contamination
- BATTERY COLONY CREATION
Cause of worsening in the filterability feature
- ICE CREATION AT LOW TEMPERATURES
Cause damage to the surface
- ADDITIVE DEPLETION
Free water retains polar additives

Gaseous contamination mainly results in decay of system performance.

- CUSHION SUSPENSION
Cause of increased noise and cavitation.
- FLUID OXIDATION
Cause of corrosion acceleration of metal parts.

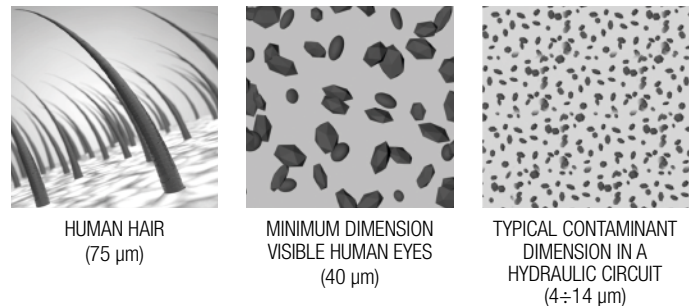
4 MEASURING THE SOLID CONTAMINATION LEVEL

The level of contamination of a system identifies the amount of contaminant contained in a fluid.

This parameter refers to a unit volume of fluid.

The level of contamination may be different at different points in the system. From the information in the previous paragraphs it is also apparent that the level of contamination is heavily influenced by the working conditions of the system, by its working years and by the environmental conditions.

What is the size of the contaminating particles that we must handle in our hydraulic circuit?



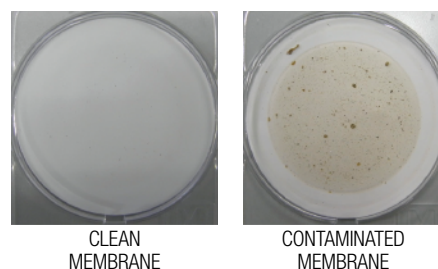
Contamination level analysis is significant only if performed with a uniform and repeatable method, conducted with standard test methods and suitably calibrated equipment.

To this end, ISO has issued a set of standards that allow tests to be conducted and express the measured values in the following ways.

- GRAVIMETRIC LEVEL - ISO 4405

The level of contamination is defined by checking the weight of particles collected by a laboratory membrane. The membrane must be cleaned, dried and desiccated, with fluid and conditions defined by the Standard.

The volume of fluid is filtered through the membrane by using a suitable suction system. The weight of the contaminant is determined by checking the weight of the membrane before and after the fluid filtration.



CONTAMINATION MANAGEMENT

- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - ISO 4406

The level of contamination is defined by counting the number of particles of certain dimensions per unit of volume of fluid. Measurement is performed by Automatic Particle Counters (APC).

Following the count, the contamination classes are determined, corresponding to the number of particles detected in the unit of fluid.

The most common classification methods follow ISO 4406 and SAE AS 4059 (Aerospace Sector) regulations.

NAS 1638 is still used although obsolete.

Classification example according to ISO 4406

The code refers to the number of particles of the same size or greater than 4, 6 or 14 μm in a 1 ml fluid.

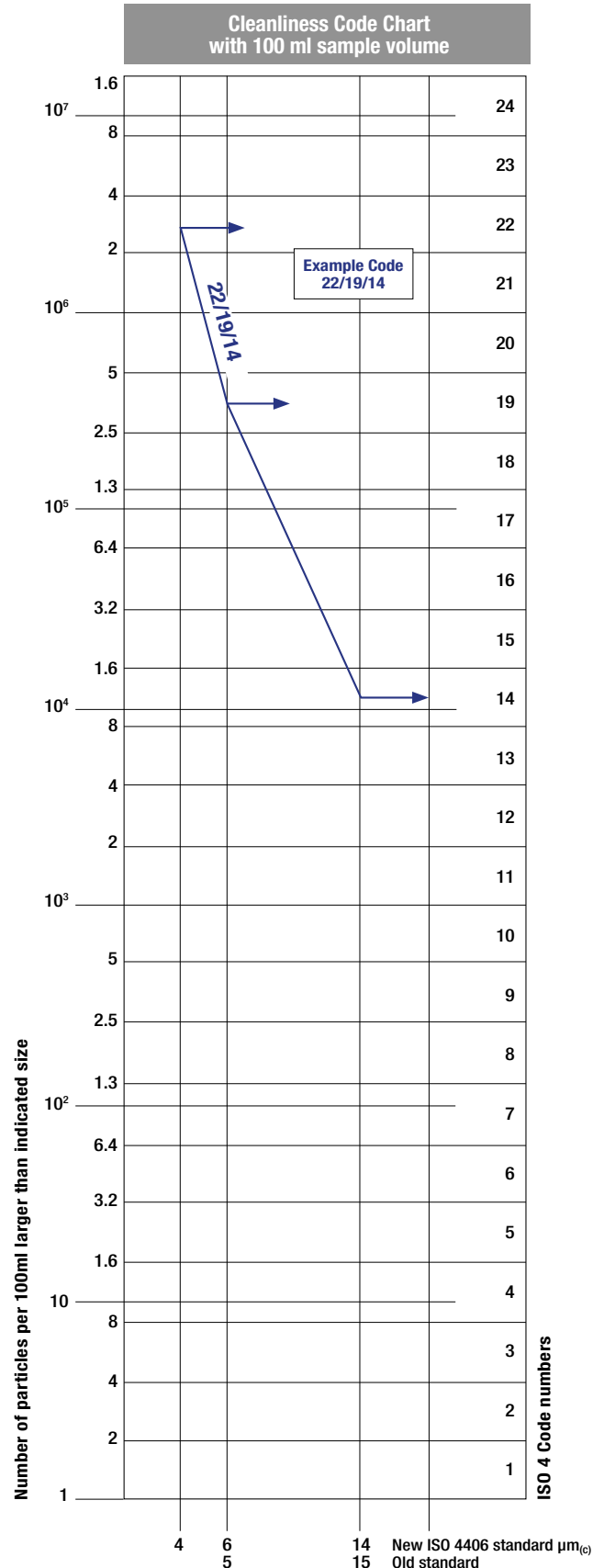
Class	Number of particles per ml	
	Over	Up to
28	1 300 000	2 500 000
27	640 000	1 300 000
26	320 000	640 000
25	160 000	320 000
24	80 000	160 000
23	40 000	80 000
22	20 000	40 000
21	10 000	20 000
20	5 000	10 000
19	2 500	5 000
18	1 300	2 500
17	640	1 300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64
5	0.16	0.32
4	0.08	0.16
3	0.04	0.08
2	0.02	0.04
1	0.01	0.02
0	0	0.01

- > 4 $\mu\text{m}_{(c)}$ = 350 particles
 - > 6 $\mu\text{m}_{(c)}$ = 100 particles
 - > 14 $\mu\text{m}_{(c)}$ = 25 particles
- 16 / 14 / 12

ISO 4406:2017 Cleanliness Code System

Microscope counting examines the particles differently to APCs and the code is given with two scale numbers only.

These are at 5 μm and 15 μm equivalent to the 6 $\mu\text{m}_{(c)}$ and 14 $\mu\text{m}_{(c)}$ of APCs.



- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - SAE AS 4059-1 and SAE AS 4059-2

Classification example according to SAE AS 4059-1 and SAE AS 4059-2

The code, prepared for the aerospace industry, is based on the size, quantity, and particle spacing in a 100 ml fluid sample. The contamination classes are defined by numeric codes, the size of the contaminant is identified by letters (A-F).

It can be made a differential measurement (Table 1) or a cumulative measurement (Table 2)

Table 1 - Class for differential measurement

Class	Dimension of contaminant				
	6÷14 µm _(c)	14÷21 µm _(c)	21÷38 µm _(c)	38÷70 µm _(c)	>70 µm _(c)
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1 000	178	32	6	1
3	2 000	356	63	11	2
4	4 000	712	126	22	4
5	8 000	1 425	253	45	8
6	16 000	2 850	506	90	16
7	32 000	5 700	1 012	180	32
8	64 000	11 400	2 025	360	64
9	128 000	22 800	4 050	720	128
10	256 000	45 600	8 100	1 440	256
11	512 000	91 200	16 200	2 880	512
12	1 024 000	182 400	32 400	5 760	1 024

- 6÷14 µm_(c) = 15 000 particles
 - 14÷21 µm_(c) = 2 200 particles
 - 21÷38 µm_(c) = 200 particles
 - 38÷70 µm_(c) = 35 particles
 - > 70 µm_(c) = 3 particles
- Class 6

Table 2 - Class for cumulative measurement

Class	Dimension of contaminant					
	>4 µm _(c) A	>6 µm _(c) B	>14 µm _(c) C	>21 µm _(c) D	>38 µm _(c) E	>70 µm _(c) F
000	195	76	14	3	1	0
00	390	152	27	5	1	0
0	780	304	54	10	2	0
1	1 560	609	109	20	4	1
2	3 120	1 217	217	39	7	1
3	6 250	2 432	432	76	13	2
4	12 500	4 864	864	152	26	4
5	25 000	9 731	1 731	306	53	8
6	50 000	19 462	3 462	612	106	16
7	100 000	38 924	6 924	1 224	212	32
8	200 000	77 849	13 849	2 449	424	64
9	400 000	155 698	27 698	4 898	848	128
10	800 000	311 396	55 396	9 796	1 696	256
11	1 600 000	622 792	110 792	19 592	3 392	512
12	3 200 000	1 245 584	221 584	39 184	6 784	1 024

- > 4 µm_(c) = 45 000 particles
 - > 6 µm_(c) = 15 000 particles
 - > 14 µm_(c) = 1 500 particles
 - > 21 µm_(c) = 250 particles
 - > 38 µm_(c) = 15 particles
 - > 70 µm_(c) = 3 particle
- Class from 2F to 4E

- CLASSES OF CONTAMINATION ACCORDING TO NAS 1638 (January 1964)

The NAS system was originally developed in 1964 to define contamination classes for the contamination contained within aircraft components.

The application of this standard was extended to industrial hydraulic systems simply because nothing else existed at the time.

The coding system defines the maximum numbers permitted of 100ml volume at various size intervals (differential counts) rather than using cumulative counts as in ISO 4406:1999. Although there is no guidance given in the standard on how to quote the levels, most industrial users quote a single code which is the highest recorded in all sizes and this convention is used on MP Filtri APC's.

The contamination classes are defined by a number (from 00 to 12) which indicates the maximum number of particles per 100 ml, counted on a differential basis, in a given size bracket.

Size Range Classes (in microns)

Maximum Contamination Limits per 100 ml					
Class	5÷15	15÷25	25÷50	50÷100	>100
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1 000	178	32	6	1
3	2 000	356	63	11	2
4	4 000	712	126	22	4
5	8 000	1 425	253	45	8
6	16 000	2 850	506	90	16
7	32 000	5 700	1 012	180	32
8	64 000	11 400	2 025	360	64
9	128 000	22 800	4 050	720	128
10	256 000	45 600	8 100	1 440	256
11	512 000	91 200	16 200	2 880	512
12	1 024 000	182 400	32 400	5 760	1 024

- 5÷15 µm_(c) = 42 000 particles
 - 15÷25 µm_(c) = 2 200 particles
 - 25÷50 µm_(c) = 150 particles
 - 50÷100 µm_(c) = 18 particles
 - > 100 µm_(c) = 3 particles
- Class NAS 8

- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - ISO 4407

The level of contamination is defined by counting the number of particles collected by a laboratory membrane per unit of fluid volume. The measurement is done by a microscope.

The membrane must be cleaned, dried and desiccated, with fluid and conditions defined by the Standard. The fluid volume is filtered through the membrane, using a suitable suction system.

The level of contamination is identified by dividing the membrane into a predefined number of areas and by counting the contaminant particles using a suitable laboratory microscope.

MICROSCOPE CONTROL AND MEASUREMENT



COMPARISON PHOTOGRAPHS

1 graduation = 10µm



ISO 4406:1999	Class 16/14/11	Class 22/20/17
SAE AS4059E Table 1	Class 5	Class 11
NAS 1638	Class 5	Class 11
SAE AS4059E Table 2	Class 6A/5B/5C	Class 12A/11B/11C

- CLEANLINESS CODE COMPARISON

Although ISO 4406:2017 standard is being used extensively within the hydraulics industry other standards are occasionally required and a comparison may be requested. The table below gives a very general comparison but often no direct comparison is possible due to the different classes and sizes involved.

ISO 4406:2017	SAE AS4059 Table 2	SAE AS4059 Table 1	NAS 1638
> 4 $\mu\text{m}_{(c)}$ 6 $\mu\text{m}_{(c)}$ 14 $\mu\text{m}_{(c)}$	> 4 $\mu\text{m}_{(c)}$ 6 $\mu\text{m}_{(c)}$ 14 $\mu\text{m}_{(c)}$	4-6 6-14 14-21 21-38 38-70 >70	5-15 15-25 25-50 50-100 >100
23 / 21 / 18	13A / 12B / 12C	12	12
22 / 20 / 17	12A / 11B / 11C	11	11
21 / 19 / 16	11A / 10B / 10C	10	10
20 / 18 / 15	10A / 9B / 9B	9	9
19 / 17 / 14	9A / 8B / 8C	8	8
18 / 16 / 13	8A / 7B / 7C	7	7
17 / 15 / 12	7A / 6B / 6C	6	6
16 / 14 / 11	6A / 5B / 5C	5	5
15 / 13 / 10	5A / 4B / 4C	4	4
14 / 12 / 09	4A / 3B / 3C	3	3

5 RECOMMENDED CONTAMINATION CLASSES

Any are the nature and the properties of fluids, they are inevitably subject to contamination. The level of contamination can be managed by using special components called filters.

Hydraulic components builders, knowing the problem of contamination, recommend the filtration level appropriate to the use of their products.

Example of recommended contamination levels for pressures below 140 bar.

Piston pumps with fixed flow rate	•					
Piston pumps with variable flow rate			•			
Vane pumps with fixed flow rate		•				
Vane pumps with variable flow			•			
Engines	•					
Hydraulic cylinders	•					
Actuators					•	
Test benches						•
Check valve	•					
Directional valves	•					
Flow regulating valves	•					
Proportional valves				•		
Servo-valves					•	
Flat bearings			•			
Ball bearings				•		
ISO 4406 CODE	20/18/15	19/17/14	18/16/13	17/15/12	16/14/11	15/13/10
Recommended filtration $\beta_{x(c)} \geq 1.000$	$\beta_{20(c)} > 1000$	$\beta_{15(c)} > 1000$	$\beta_{10(c)} > 1000$	$\beta_{7(c)} > 1000$	$\beta_{7(c)} > 1000$	$\beta_{5(c)} > 1000$

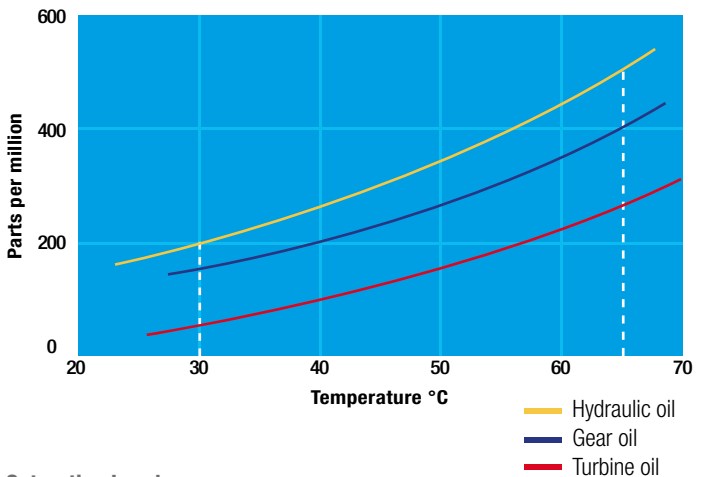
6 WATER IN HYDRAULIC AND LUBRICATING FLUIDS

Water Content

In mineral oils and non aqueous resistant fluids water is undesirable. Mineral oil usually has a water content of 50-300 ppm (@40°C) which it can support without adverse consequences.

Once the water content exceeds about 300ppm the oil starts to appear hazy. Above this level there is a danger of free water accumulating in the system in areas of low flow. This can lead to corrosion and accelerated wear.

Similarly, fire resistant fluids have a natural water which may be different to mineral oil.



Saturation Levels

Since the effects of free (also emulsified) water is more harmful than those of dissolved water, water levels should remain well below the saturation point.

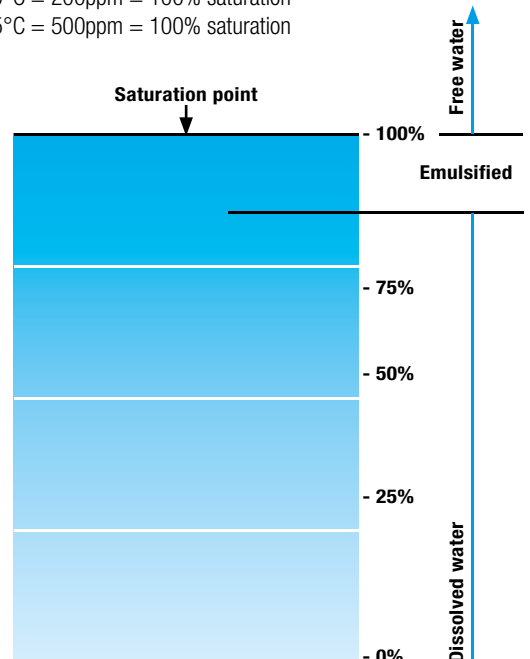
However, even water in solution can cause damage and therefore every reasonable effort should be made to keep saturation levels as low as possible. There is no such thing as too little water. As a guideline, we recommend maintaining saturation levels below 50% in all equipment.

TYPICAL WATER SATURATION LEVEL FOR NEW OILS

Examples:

Hydraulic oil @ 30°C = 200ppm = 100% saturation

Hydraulic oil @ 65°C = 500ppm = 100% saturation



W - Water and Temperature Sensing

"W" option, in MP Filtri Contamination Monitoring Products, indicates water content as a percentage of saturation and oil temperature in degrees centigrade. 100% RH corresponds to the point at which free water can exist in the fluid. i.e. the fluid is no longer able to hold the water in a dissolved solution.

The sensor can help provide early indication of costly failure due to free water, including but not exclusive to:

- Corrosion
- Metal surface fatigue e.g. bearing failure
- Reduced lubrication & load carrying characteristics

Different oils have different saturation levels and therefore RH (relative humidity) % is the best and most practical measurement.

Water absorber

Water is present everywhere, during storage, handling and servicing.

MP Filtri filter elements feature an absorbent media which protects hydraulic systems from both particulate and water contamination.

MP Filtri's filter element technology is available with inorganic microfiber media with a filtration rating 25 µm (therefore identified with media designation WA025, providing absolute filtration of solid particles to $\beta_{X(C)} = 1000$).

Absorbent media is made by water absorbent fibres which increase in size during the absorption process.

Free water is thus bonded to the filter media and completely removed from the system (it cannot even be squeezed out).

By removing water from your fluid power system, you can prevent such key problems as:

- corrosion (metal etching)
- loss of lubricant power
- accelerated abrasive wear in hydraulic components
- valve-locking
- bearing fatigue
- viscosity variance (reduction in lubricating properties)
- additive precipitation and oil oxidation
- increase in acidity level
- increased electrical conductivity (loss of dielectric strength)
- slow/weak response of control systems

Product availability - UFM Series:

- UFM 041
- UFM 051
- UFM 091
- UFM 181
- UFM 919

Filter Media

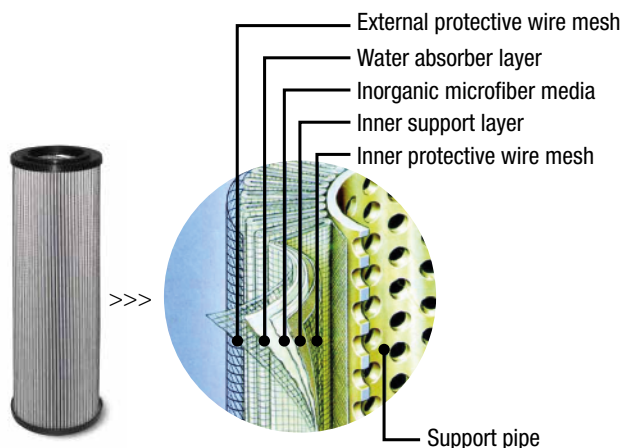


Fabric that absorbs water

Absorber media layer



The Filter Media has absorbed water



You can see right through our results

It's no secret the presence of particles in the hydraulic fluid is the primary cause of failure, unreliability and short component life in hydraulic systems - whether they be fluid power, lubrication or fuel. We have developed an extensive range of products to help you safeguard your machines and systems from potential failure.

Benefits:

- **Promptly measures and maintains the appropriate fluid cleanliness level**
- **Damages and downtime are minimised, reducing costs**
- **Provides a maintenance regime to immediately respond to an incident**

Applications:

- **Industrial hydraulic and lubrication systems**
- **Mobile hydraulics**

Automatic Particle Counters

LPA3



LPA2



CML2



ICM 2.0



AZ2



ICU



ACMU



BS110 & BS500



VPAF100



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LPA3

Portable Particle Counters



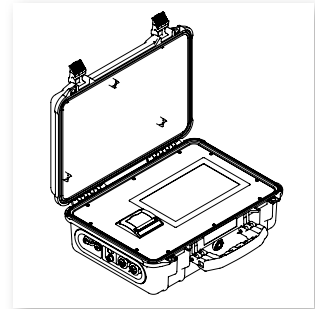
Description

Automatic Particle Counters

Portable Particle Counter

MP Filtri's new LPA3 is the most advanced portable particle counter in the world. Whether you are working in the lab or in the field, the LPA3 delivers a fast, accurate and comprehensive hydraulic health check in a robust yet portable package.

Its real-time monitoring and predictive maintenance technology safeguards machinery, enhances performance and productivity, and reduces costs and unplanned downtime. Featuring the latest breakthroughs in optical and photodiode technology, the new LPA3 enhances the reliability and longevity of complex hydraulic systems and is ideal for quality control in in-house manufacturing applications. The LPA3 is compatible with the full range of Bottle Samplers.



► Features & Benefits

- Online/realtime monitoring
- Comprehensive hydraulic health check
- Proactive maintenance capabilities
- High-speed sample times
- Programmable 10.1" (25.6cm) touchscreen display
- Perfectly portable at just 10kg
- Programmable sample volumes
- Precision Instrument
- Live trend analysis option
- Measures and displays the following international standard formats; ISO 4406, NAS 1638, AS 4059E&F, GBT 14039, GJB420B
- Moisture and temperature sensing
- Data logging and enhanced 4000 test result memory
- Key performance information at a glance
- LPA View software (included)
- Ideal for hydraulic, lubrication, and subsea fluids
- Integrated printer option
- Full accessories kit included
- Long-life Lithium Ion battery

Scope of Supply

- 1 x LPA3 (*)
- 1 x M16x2 microbore pressure hose, 1500mm long, pouch
- 1 x 2000mm quick release waste hose for LPA3 and pouch
- 1 x 1L waste receptacle
- 1 x Power Lead c/w UK/EU/US/AUS/CN heads
- 1 x USB cable
- 1 x Digital USB copy of user guides/software/drivers
- 2 x Hard copy of calibration certificate
- 5 x Thermal printer paper
- 1 x Carry bag

(*) Specific model will be as per ordered item

See Accessories at page 83.



Front facing view



Right facing view



Closed case
Front facing view



Closed case
Side view

Technical data

Technology

LED Based Light Extinction Automatic Optical Particle Counter

Particle Sizing

>4,6,14,21,25,38,50,70 $\mu\text{m}_{(c)}$ to ISO 4406:2017 Standard

Analysis range

ISO 4406:2017 Code 8 to 24

NAS 1638 Class 2 to 12

AS4059/ISO11218 Rev.E Table 1 Size Codes 2-12

AS4059/ISO11218 Rev.E Table 2 Size Codes, A:000 to 12, B:00 to 12,

C:00 to 12, D:2 to 12, E: 4 to 12,F: 7 to 12

AS4059 Rev.F Table 1 Size Codes 2-12

AS4059 Rev.F Table 2 Size Codes, cpc (000 to 12, 00 to 12, 2 to 12, 4 to 12, 7 to 12)

GBT14039 Code 8 to 24

GJB420B Size codes, A:000 to 12, B:00 to 12, C:00 to 12, D:2 to 12, E: 4 to 12, F: 7 to 12

Accuracy

$\pm 1/2$ code for 4, 6, 14 $\mu\text{m}_{(c)}$; ± 1 for larger sizes

Calibration

Each unit individually calibrated with ISO Medium Test Dust (MTD) based on ISO 11171, on equipment certified by I.F.T.S to ISO 11943

Viscosity range

Up to 400 cSt

Fluid temperature

Minimum: +5 °C

Maximum: +80 °C

Ambient temperature

Minimum: -10 °C

Maximum: +80 °C

Pressure Max

Minimum: 2 bar

Maximum: 420 bar

Sample Volume / Test time

Maximum 100ml per pump stroke.

Test volumes programmable by end user.

Pre-set volumes also available.

Moisture Sensing

% RH (Relative Humidity) $\pm 3\%$

Temperature Measurement

$\pm 3\%$

Data Storage

4000 tests

System Pressure Measurement

+/- 0.5% Full Scale Accuracy Min 10 bar

Communication options

USB Output

Environmental Protection

IP66 (Lid closed) IP54 (Lid open)

Weight / Dimensions

10 kg, Height 292mm, Depth 155mm, Width 435mm

Electrical Supply

18-19V 2.1-3.0A

Power

Long-life Lithium Ion internal rechargeable battery (mains charger)

Software

LPA View software (included)

LPA3 is supplied with a full software package and digital product information



How LPA3 works - www.mpfiltri.com/index.php/products/oil-service/lpa-3.html

FOCUS ON

Exclusive MP Filtri technology

Featuring the latest breakthroughs in LED and photodiode technology, the LPA3 delivers increased accuracy combined with excellent repeatability.

W-Option

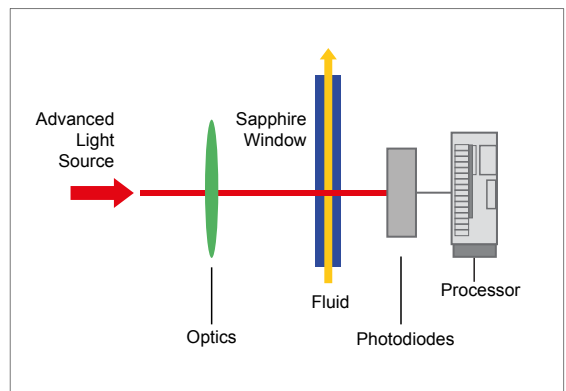
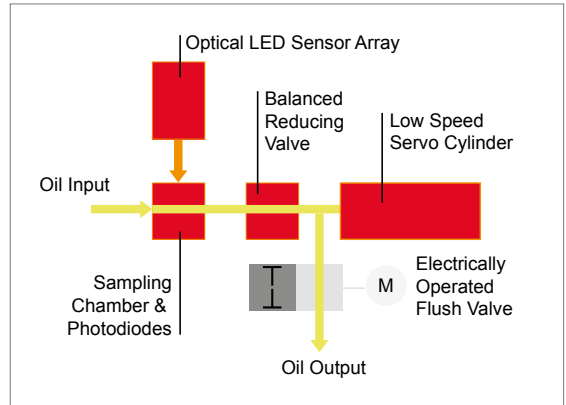
Water Saturation level (RH%) and fluid temperature sensor option.

P-Option

Live Pressure Readout (bar/PSI) on display screen.

LED light source

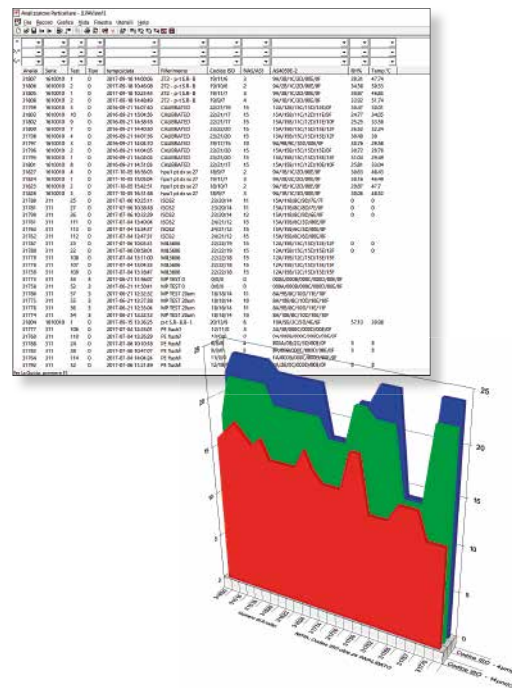
A single point high accuracy LED measures particles across all sizes giving increased accuracy with excellent repeatability.



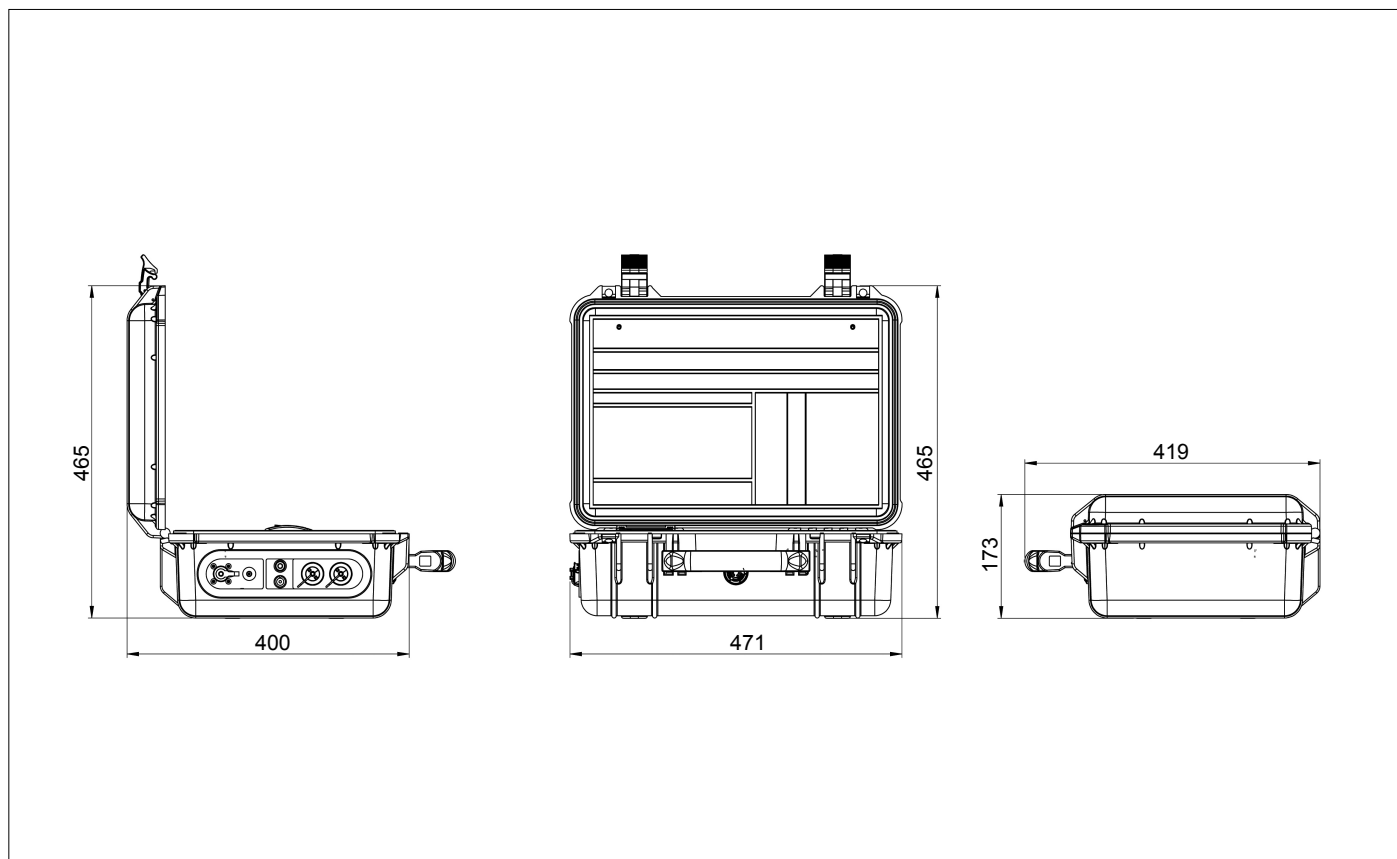
LPA View Software

The LPA View software is used with the LPA3, LPA2, CML2 and ICM particle counters. When connected to LPA View, MP Filtri CMPs can transfer results in realtime, or alternatively, historical results can be downloaded from the CMP's inbuilt memory.

- Runs on Windows XP, 7, and Windows 10
- Full adjustment & control of product settings, test times and alarms
- Easy test report generation
- Trend analysis
- Graphical display options
- Universal format across our contamination monitoring product range



Dimensions



Designation & Ordering code

AUTOMATIC PARTICLE COUNTER LPA3		Configuration example: LPA3					
Series	LPA3 Light extinction particle counter	W	P	M	0	0	1
Moisture Sensor							
0	Without moisture and temperature sensor						
W	With moisture and temperature sensor						
Pressure Sensor							
0	Without on-screen inlet pressure display						
P	With on-screen inlet pressure display						
Fluid compatibility							
M	Mineral oil and synthetic fluid						
N	Subsea fluids and water based fluids (*)						
S	Phosphate ester and aggressive fluids (*) (**)						
External Result Option							
0	Without on board printer						
1	With on board printer						
Design Reference							
0	Std option with full accessory kit and carry bag						
Country Plug Type							
1	UK, EU, US, AUS/CN						

(*) **N** and **S** version, moisture sensor (**W**) not available (**) **S** Version Available soon

LPA2

Twin Laser Particle Analyser



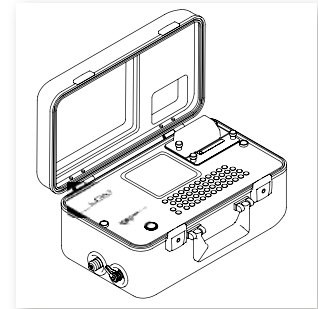
Description

Automatic Particle Counters

Twin Laser Particle Analyser

The LPA2 is a highly precise, lightweight & fully portable instrument suitable for on-site and laboratory applications. It can automatically measure and display particulate contamination, moisture and temperature levels in various hydraulic fluids. The LPA2 can be connected to the MP range of bottle sampler products to enable laboratory based particle counting.

The LPA2 is a solution for online monitoring of contamination in your hydraulic fluid, providing an immediate hydraulic health check. It employs predictive maintenance procedures to help reduce downtime and in turn costs.



> Features & Benefits

- LPA2 saves time: online/realtime monitoring
- Immediate hydraulic health check
- Predictive maintenance procedures can be employed
- Reduced downtime for industrial and mobile plants
- Reduced costs associated with downtime
- The lightest machine in its class
- Fully portable
- Precision Instrument
- Full Calibration based on ISO11171
- Measures and displays the following international standard formats; ISO 4406:2017, NAS 1638, AS 4059E
- Moisture and temperature sensing
- Data logging and 600 test result memory
- Manual and remote control flexibility
- LPA View software (included)
- Full size QWERTY keyboard
- Various test programme settings
- Full accessories kit included
- Internal rechargeable battery capable of performing 100 tests between charges

Scope of Supply

- 1 x LPA2 (*)
- 1 x M16x2 microbore pressure hose, 1500mm long
- 1 x 2000mm quick release waste hose for LPA2
- 1 x 1L waste receptacle
- 1 x 12V, 2A power adapter c/w UK/EU/US/AUS/CN heads
- 1 x 9 pin serial cable
- 1 x USB to serial converter
- 1 x 3 pin socket for external signals
- 1 x Hard copy of product user guide
- 1 x Digital copy of user guides/software/drivers
- 2 x Hard copy of calibration certificate
- 2 x Thermal printer paper
- 1 x Carry bag

(*) Specific model will be as per ordered item

See Accessories at page 83.



Front facing view



Right facing view



Closed case
Right facing view



Closed case
Left facing view

Technical data

Technology

Twin laser and twin optical diode detectors Based Light Extinction
Automatic Optical Particle Analyser

Particle Sizing

>4,6,14,21,25,38,50,70 $\mu\text{m}_{(c)}$ to ISO 4406:2017 Standard

Analysis range

ISO 4406:1999 Code 8 to 24
NAS 1638 Class 2 to 12
AS4059 Rev. E Table 1 Size Codes 2-12
AS4059 rev. E Table 2 Size Codes, A:000 to 12, B:00 to 12, C:00 to 12,
D:2 to 12, E: 4 to 12, F: 7 to 12

Accuracy

Better than 3% typical

Calibration

Each unit individually calibrated with ISO Medium Test Dust (MTD) based
on ISO 11171, on equipment certified by I.F.T.S. To ISO 11943

Viscosity range

Up to 400 cSt

Fluid temperature

- From +5 °C to +80 °C

Pressure Max

400 bar (gauge) - minimum 2 bar (gauge) required

Sample Volume / Test time

8 ml. (short): 2:50
15 ml. (normal): 5:00
30 ml. (dynamic): 10:00
24 ml. (bottle sampler): 8:00
15 ml. (continuous): 5:00

Moisture Sensing

% RH (Relative Humidity) $\pm 3\%$

Temperature Measurement

$\pm 3\%$

Data Storage

600 test

System Pressure Measurement

+/- 0.5% Full Scale Accuracy Min 10 bar

Communication options

RS232 9 pin D plug

Ambient Temperature min / max

-10 °C to +80 °C

Environmental Protection

IP51 (lid open)

Weight / Dimensions

9.8 kg, Height 210mm, Depth 260mm, Width 430mm

Electrical Supply

Voltage 9-36V DC

Power

Internal rechargeable battery (mains charger)

Outer Casing Finish

Anodised Aluminium

Wetted parts

M - C46400 Cu alloy, 316 stainless steel, FPM, FR4, sapphire.
N - 316 stainless steel, FPM, sapphire.
S - 316 stainless steel, perfluoro elastomer, sapphire, EPDM.

Software

LPA View software (included)

LPA2 is supplied with a full software package and digital product information

FOCUS ON

Exclusive MP Filtri technology

The combination of the two lasers with a unique optics and photodiode package enables the LPA2 to give increased accuracy combined with excellent repeatability.

W-Option

Water Saturation level (RH%) and fluid temperature sensor option.

P-Option

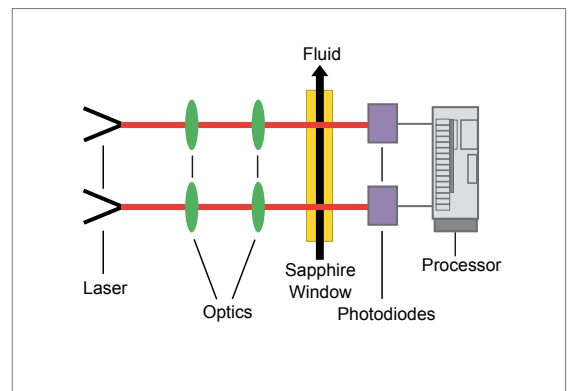
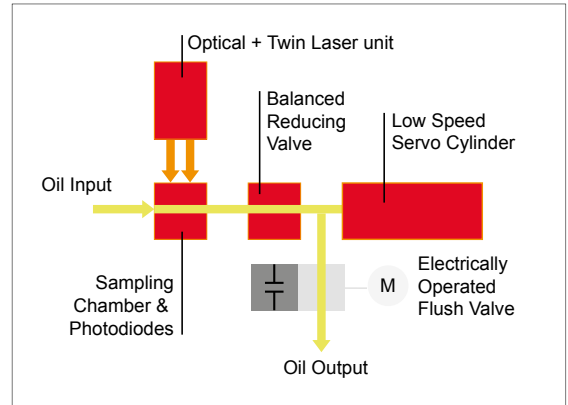
Live Pressure Readout (bar) on display screen.

Laser 1

A single point high accuracy laser measures particles of contamination at $4 \mu\text{m}_{(c)}$ and $6 \mu\text{m}_{(c)}$ giving increased accuracy with excellent repeatability.

Laser 2

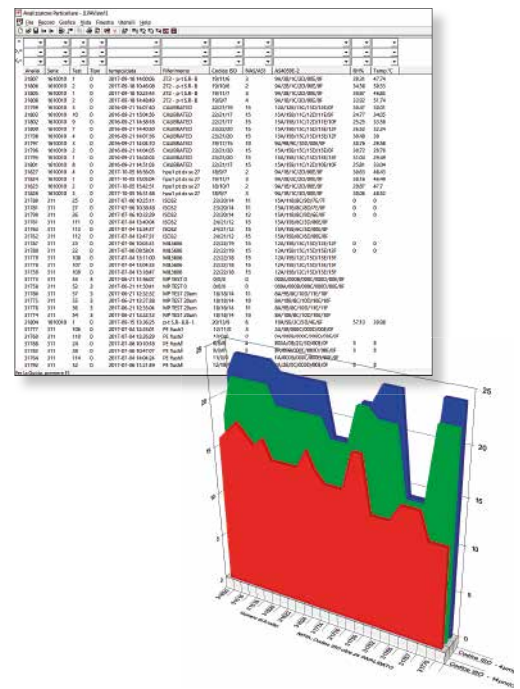
Standard accuracy laser specifically designed for system contaminants between $6 \mu\text{m}_{(c)}$ and $70 \mu\text{m}_{(c)}$.



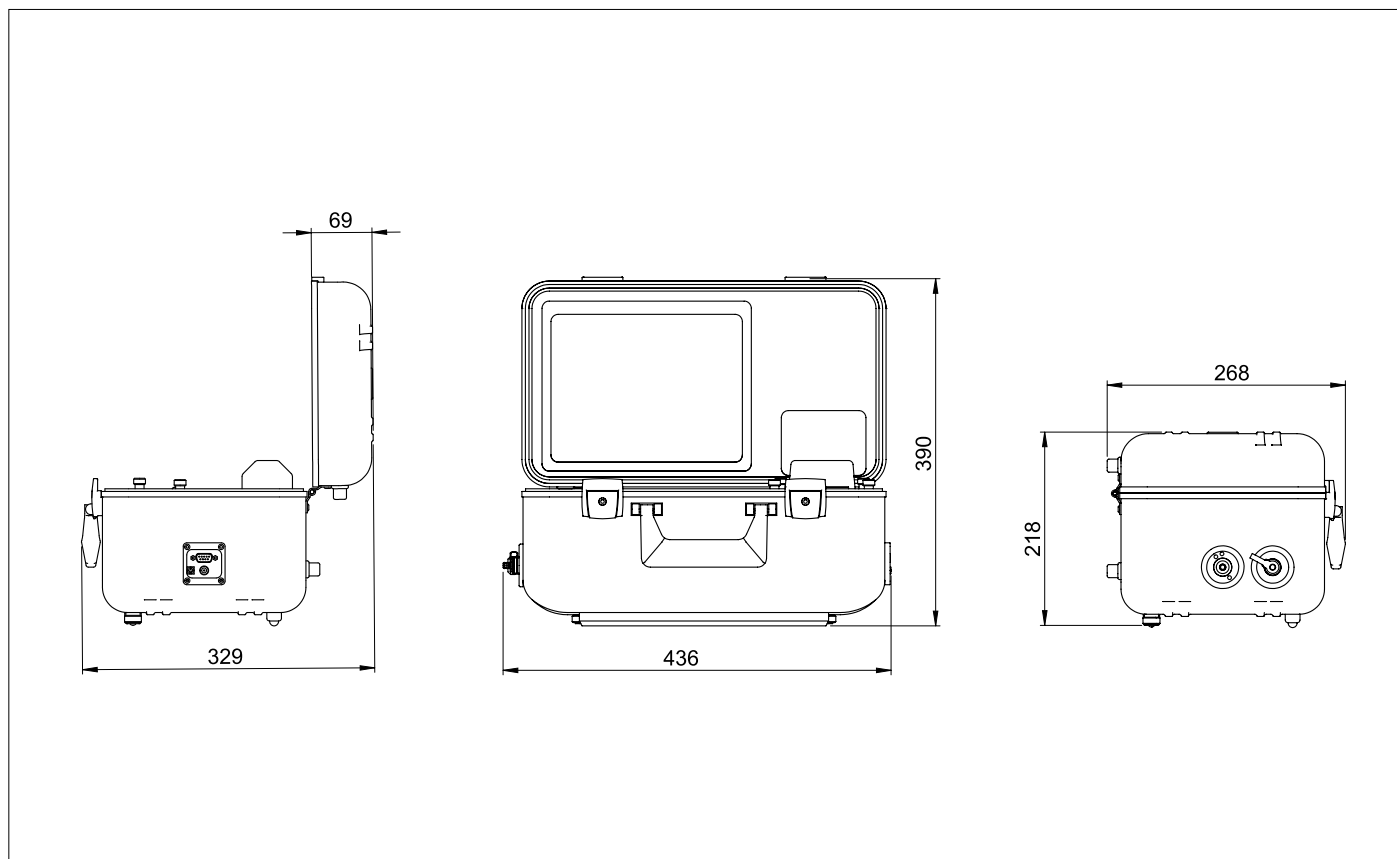
LPA View Software

The LPA View software is used with the LPA3, LPA2, CML2 and ICM particle counters. When connected to LPA View, MP Filtri CMPs can transfer results in realtime, or alternatively, historical results can be downloaded from the CMP's inbuilt memory.

- Runs on Windows XP, 7, and Windows 10
- Full adjustment & control of product settings, test times and alarms
- Easy test report generation
- Trend analysis
- Graphical display options
- Universal format across our contamination monitoring product range



Dimensions



Designation & Ordering code

AUTOMATIC PARTICLE COUNTER LPA2		Configuration example:						
Series	LPA2 Twin laser particle analyser	LPA2	W	P	M	S	X	30
Moisture Sensor								
O	Without moisture and temperature sensor							
W	With moisture and temperature sensor							
Pressure Sensor								
O	Without on-screen inlet pressure display							
P	With on-screen inlet pressure display							
Fluid compatibility								
M	Mineral oil							
N	Subsea fluids and water based fluids (*)							
S	Phosphate ester and aggressive fluids (*)							
Accessories								
S	Standard unit with carry bag							
T	Standard unit with travel case							
Bottle sampling options								
X	Without bottle sampling							
Design Reference								
30								

(*) N and S version, moisture sensor (W) not available

CML2

Compact Twin Laser Contamination Monitor



Description

Automatic Particle Counters

Compact Twin Laser Contamination Monitor

The CML is a portable, accurate instrument-suitable for 'on-site' applications. It can automatically measure and display particulate contamination, moisture and temperature levels in various hydraulic fluids.



> Features & Benefits

- Compact
- Light and portable
- Mains Operated/battery (if fitted)
- Full Calibration based on ISO11171
- Measures and displays the following international standard formats: ISO 4406:2017, NAS 1638, AS 4059E and ISO 11218
- Data logging and 600 test result memory
- Manual and remote control flexibility

Scope of Supply

- 1 x CML2 (Specific model will be as per ordered item)
- 1 x M16x2 microbore pressure hose, 1500mm long
- 1 x Quick release waste hose for LPA2
- 1 x 1L waste receptacle
- 1 x 12V, 2A power adapter c/w UK/EU/US/AUS/CN heads
- 1 x 9 pin serial cable
- 1 x USB to serial converter
- 1 x Hard copy of product user guide
- 1 x Digital copy of user guides/software/drivers
- 2 x Hard copy of calibration certificate
- 1 x Carry bag

See Accessories at page 83.



Front facing view



Right facing view



Closed case
Right facing view



Closed case
Left facing view

Technical data

Technology

Twin laser and twin optical diode detectors Based Light Extinction Automatic Optical Contamination Monitor

Particle Sizing

>4, 6, 14, 21, 25, 38, 50, 70 $\mu\text{m}_{(0)}$ to ISO 4406:2017 Standard

Analysis range

ISO 4406:2017 Code 8 to 24

NAS 1638 Class 2 to 12

AS4059 Rev. E Table 1 Size Codes 2-12

AS4059 rev E, Table 2 Size Codes, A:000 to 12, B:00 to 12, C:00 to 12,

D:2 to 12, E: 4 to 12, F: 7 to 12

Accuracy

Better than 3% typical

Calibration

Each unit individually calibrated with ISO Medium Test Dust (MTD)

based on ISO 11171, on equipment certified by I.F.T.S. To ISO 11943

Viscosity range

Up to 400 cSt

Fluid temperature

From +5 °C to +80 °C

Ambient Temperature

From -10 °C to +60 °C

Temperature Measurement

± 3 °C

Pressure

Minimum: 2 bar

Maximum: 400 bar

Sample Volume / Test time

8 ml. (short): 2:50

15 ml. (normal): 5:00

30 ml. (dynamic): 10:00

24 ml. (bottle sampler): 8:00

15 ml. (continuous): 5:00

Data Storage

600 tests

Communication options

RS232 9 pin D plug

Environmental Protection

IP51 (lid open)

Moisture Sensing

% RH (Relative Humidity) $\pm 3\%$

Weight

6 kg

Electrical Supply

Voltage 9-36V DC

Power

Internal rechargeable battery (series 41)

Outer Casing Finish

Injection Molded Ultra High Impact structural copolymer

Wetted parts

M - C46400 Cu alloy, 316 stainless steel, FPM, FR4, sapphire.

N - 316 stainless steel, FPM, sapphire.

S - 316 stainless steel, perfluoro elastomer, sapphire, EPDM.

Software

LPA View software (included)

FOCUS ON

Exclusive MP Filtri technology

The combination of the two lasers with the unique optics and photodiode package enables the CML2 to give increased accuracy combined with excellent repeatability.

W-Option

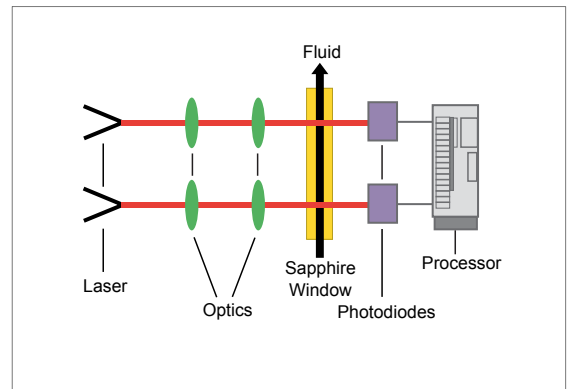
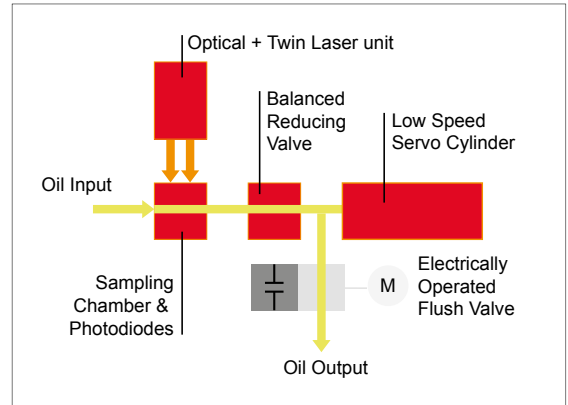
Water Saturation level (RH%) and fluid temperature sensor option.

Laser 1

A single point high accuracy laser measures particles of contamination at 4 $\mu\text{m}_{(c)}$ and 6 $\mu\text{m}_{(c)}$ giving increased accuracy with excellent repeatability.

Laser 2

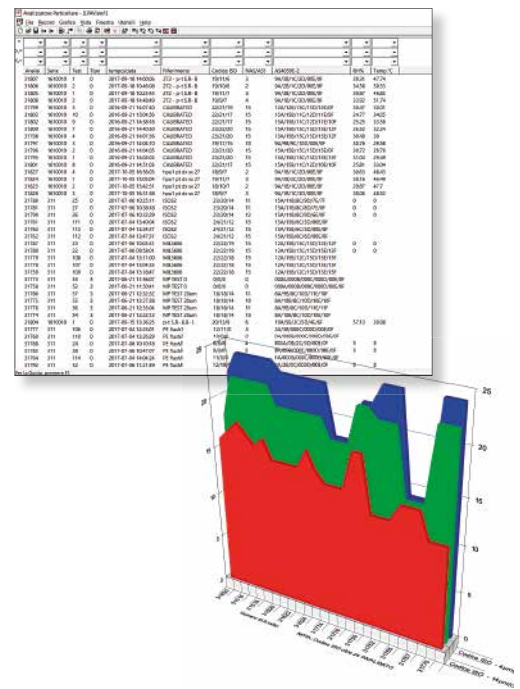
Standard accuracy laser specifically designed for system contaminants between 6 $\mu\text{m}_{(c)}$ and 70 $\mu\text{m}_{(c)}$.



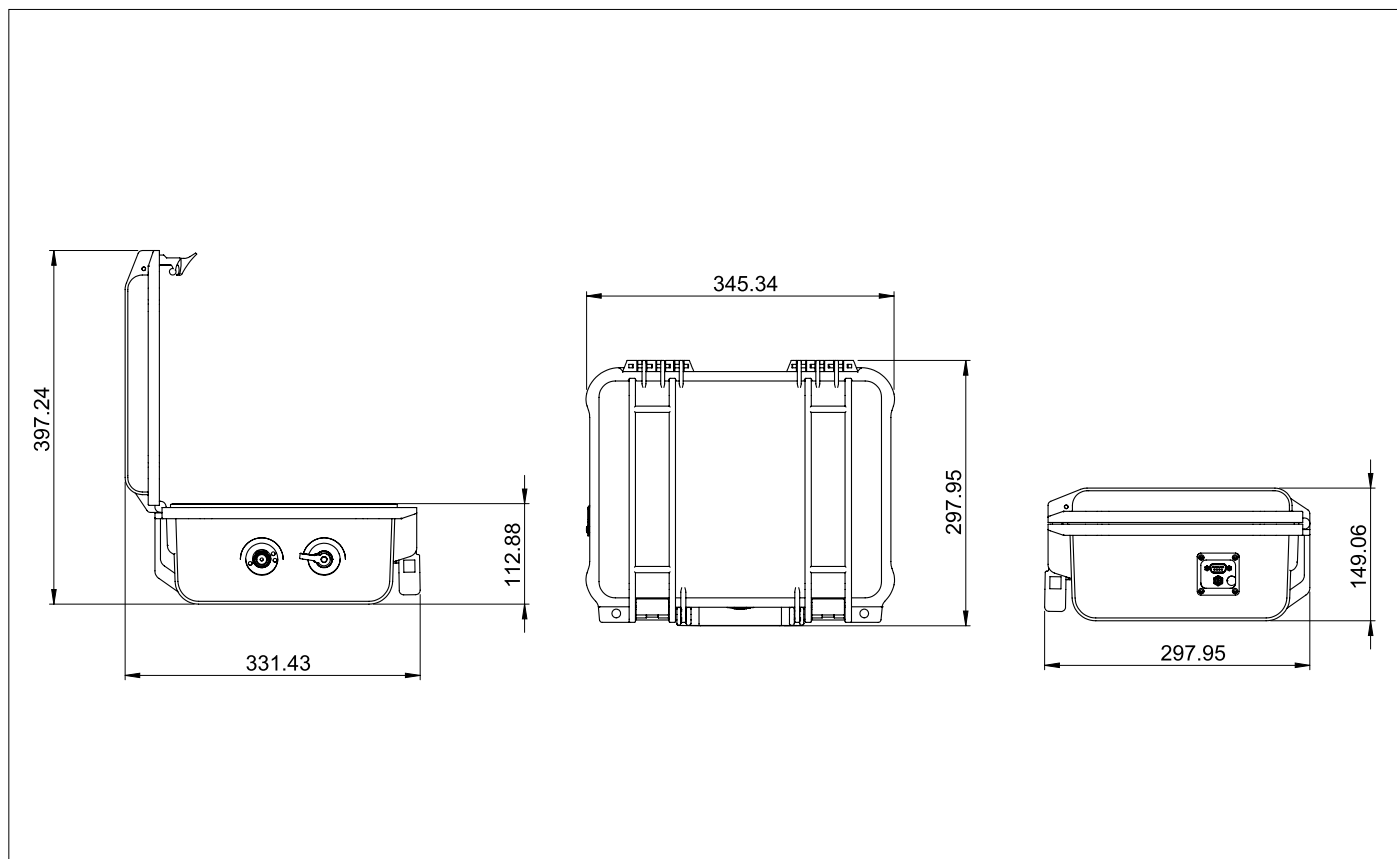
LPA View Software

The LPA View software is used with the LPA3, LPA2, CML2 and ICM particle counters. When connected to LPA View, MP Filtri CMPs can transfer results in realtime, or alternatively, historical results can be downloaded from the CMP's inbuilt memory.

- Runs on Windows XP, 7, and Windows 10
- Full adjustment & control of product settings, test times and alarms
- Easy test report generation
- Trend analysis
- Graphical display options
- Universal format across our contamination monitoring product range



Dimensions



Designation & Ordering code

AUTOMATIC PARTICLE COUNTER CML2

Series	Configuration example:	CML2	W	M	S	X	41
CML2 Compact twin laser contamination monitor							
Moisture Sensor (RH%)							
0 Without moisture and temperature sensor							
W With moisture and temperature sensor							
Fluid compatibility							
M Mineral / synthetic oil							
N Subsea fluids and water based fluids (*)							
S Phosphate ester and aggressive fluids (*)							
Option							
S Standard units							
Option bottle sampler							
X Without bottle sampling							
Series							
41 With display and push buttons, with internal rechargeable battery							

(*) **N** and **S** version, moisture sensor (**W**) not available

ICM 2.0

In-Line Contamination Monitor



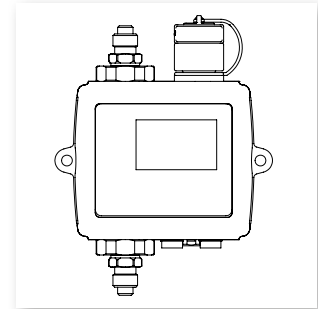
Description

Automatic Particle Counters

In-Line Contamination Monitor

The ICM 2.0 automatically measures and displays particulate contamination, moisture and temperature levels in various hydraulic fluids.

It is designed specifically to be mounted directly to systems, where ongoing measurement or analysis is required, and where space and costs are limited.



> Features & Benefits

- 8 channel contamination measurement & display
- Measures and displays the following international standard formats: ISO 4406:2017, NAS 1638, AS 4059E
- Moisture and temperature sensing fluid dependent
- Data logging and 4000 test result memory
- Manual, automatic and remote control flexibility
- Multicolour indicators via LCD (K versions) and LED with output alarm signals as standard
- Robust die cast aluminium construction
- LPA View software (included)
- Pressure max. 420 bar
- Environmental protection IP65/67 versatile
- Secondary connector to allow the simultaneous control/download of results during operation
- Option available to download all results onto a USB stick, direct from the ICM
- 4-20mA analogue output as standard

Scope of Supply

- 1 x ICM 2.0 (Specific model will be as per ordered item)
- 1 x 3m Twisted Pair Cable Assembly
- 1 x Hard copy Quick start/wiring installation guide
- 1 x Hard copy Fluid Condition Handbook
- 1 x Digital copy of user guides/software/drivers
- 1 x Hard copy of calibration certificate

See Accessories at page 83.

Status LED

All ICM 2.0 versions have a multicolour indicator on the front panel, which is used to indicate the status or alarm state. ICM-K versions also have a screen that changes colour. The alarm thresholds can be set from LPA-View via the serial interface.

Screen and multicolor indicators

- Green indicates that the test result passed, i.e. none of the alarm thresholds were exceeded
- Yellow indicates that the lower cleanliness limit was exceeded, but not the upper one
- Red indicates that the upper cleanliness limit was exceeded
- Blue indicates that the upper water content limit was exceeded
- Red/Blue Alternating indicates both cleanliness and water content upper limits exceeded
- Violet indicates that the upper temperature limit was exceeded



Technical data

Technology

LED Based Light Extinction Automatic Optical Contamination Monitor

Particle Sizing

>4, 6, 14, 21, 25, 38, 50, 70 $\mu\text{m}_{(c)}$ to ISO 4406:2017 Standard

Analysis range

ISO 4406:2017 Code 0 to 25

NAS 1638 Class 00 to 12

AS4059 Rev. E Table 1&2 Sizes A-F: 000 (Lower Limits are Test Time dependent)

Accuracy

$\pm \frac{1}{2}$ code for 4,6,14 $\mu\text{m}_{(c)}$ ± 1 code for larger sizes

Calibration

Each unit individually calibrated with ISO Medium Test Dust (MTD) based on ISO 11171, on equipment certified by I.F.T.S. ISO 11943

Operating Flow Rate

20 - 400 ml/minute

Viscosity range

≤ 1000 cSt

Fluid temperature

From -25 °C to +80 °C

Ambient Temperature

From -25 °C to +80 °C (non K version)

From -25 °C to +55 °C (K version)

Temperature Measurement

± 3 °C

Pressure

Maximum: 420 bar

Test time

Adjustable 10 - 3600 seconds. Factory set to 120 seconds.

Start delay & programmable test intervals available as standard

Flow rate measurement

Indicator only

Data Storage

4000 tests

Communication options

RS485, MODBUS, CANBUS, 4-20mA time multiplex as standard

Relays

Two solid state relays fitted to "R" version for output to alarm circuits

Environmental Protection

IP 65/67 versatile IK04 Impact Protection

Moisture Sensing

% RH (Relative Humidity) $\pm 3\%$

Weight

1.6 kg

Electrical Supply

Voltage 9-36V DC

Power consumption

<2.2 W

Outer Casing Finish

Polyurethane BS X34B. Colour BS381-638 (Dark Sea Grey)

Industry 4.0 ready with appropriate accessory product

Wetted parts

M - C46400 Cu alloy, 316 stainless steel, FPM, FR4, sapphire.

N - 316 stainless steel, FPM, sapphire.

S - 316 stainless steel, perfluoro elastomer, sapphire, EPDM.

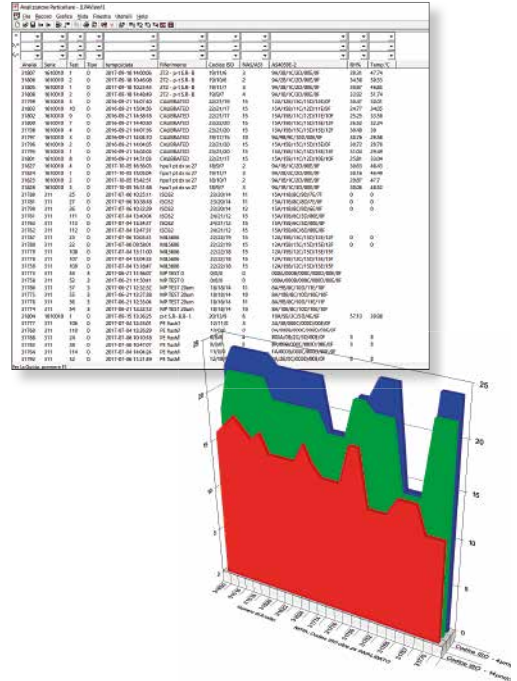
Software

LPA View software (included)

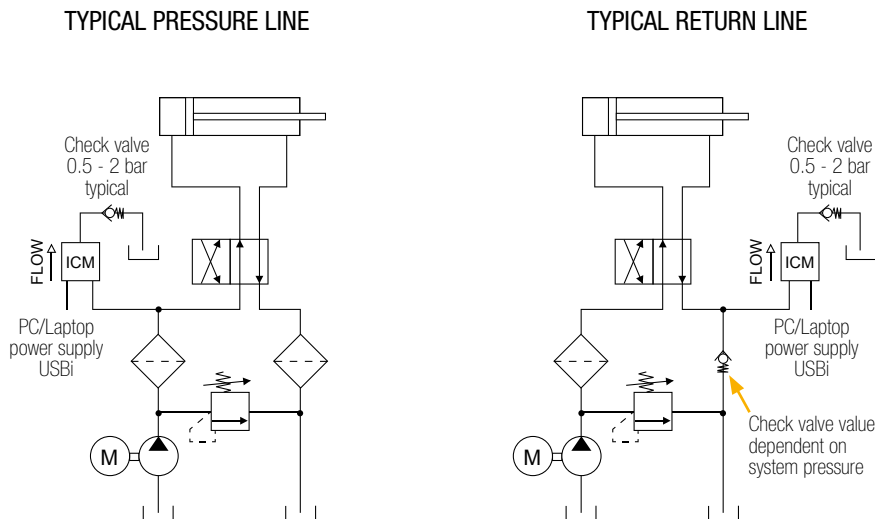
LPA View Software

The LPA View software is used with the LPA3, LPA2, CML2 and ICM particle counters. When connected to LPA View, MP Filtri CMPs can transfer results in realtime, or alternatively, historical results can be downloaded from the CMP's inbuilt memory.

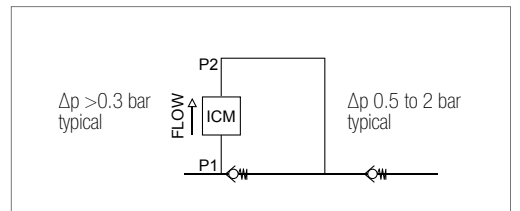
- Runs on Windows XP, 7, and Windows 10
- Full adjustment & control of product settings, test times and alarms
- Easy test report generation
- Trend analysis
- Graphical display options
- Universal format across our contamination monitoring product range



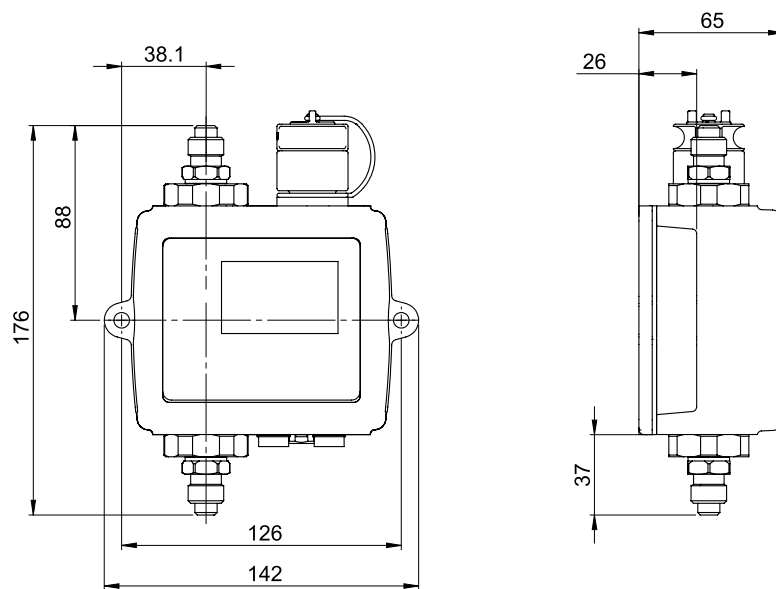
Hydraulic Circuit



For installation guidance please visit www.mpfiltri.co.uk/ICM-2_0/#Home



Dimensions



It is important to ensure a 0.5 - 2 bar differential across the ICM 2.0

The ICM 2.0 can be used as a standalone product or can be controlled by external PC, PLC or the ICMRDU2.0 (Remote Display Unit. 10m control cable supplied as standard).

Designation & Ordering code

AUTOMATIC PARTICLE COUNTER ICM 2.0

Series	Configuration example:	ICM	W	M	K	R	G1	2.0
ICM In-Line Contamination Monitor								
Moisture Sensor (RH%)								
0 Without moisture and temperature sensor								
W With moisture and temperature sensor								
Fluid compatibility								
M Mineral/synthetic oils								
N Subsea fluids and water based fluids (*)								
S Phosphate ester and aggressive fluids (*)								
Keypad / Display								
0 Without keypad / display								
K With keypad / display								
Device output								
R With relays / external alarm outputs								
U Test record transfer (direct to USB stick) plus relays/external alarm outputs								
Connections								
G1 ICM complete with M16 x 2 pressure test point connections fitted								
G3 1/4" BSP - Female port								
G4 7/16" UNF - Female port								
Series								
2.0								

(*) **N** and **S** version, moisture sensor (**W**) not available

AZ2

 ATEX Fluid Contamination Monitors

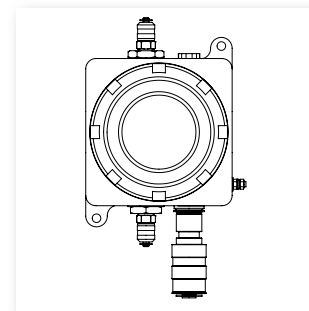


Description

Particle Counters

Ex Atex Zone 2, Cat 3G, Fluid Contamination Monitors

Our AZ2 contamination monitor can automatically measure and save particulate contamination, moisture and temperature levels in various hydraulic fluids. They are designed specifically to be mounted directly to systems where ongoing measurement or analysis is required in high risk or explosive environments.



> Features & Benefits

- 8 channel contamination measurement & display
- Measures and displays the following international standard formats: ISO 4406:2017, NAS 1638, AS 4059E
- RS485, MODBUS, CANBUS
- Moisture and temperature sensing fluid dependent
- Data logging and 4000 test result memory
- Automatic and remote control flexibility
- Multicolour indicators via onboard LED with output alarm signals as standard
- LPA View software (included)

Scope of Supply

- 1 x ICMKAZ2 (*)
- 1 x Atex approved non wired cable connector and gland
- 1 x Hard copy Fluid Condition Handbook
- 1 x Digital copy of user guides/software/drivers
- 1 x Hard copy of calibration certificate
- 1 x Hard copy of atex certificate

(*) Specific model will be as per ordered item

See Accessories at page 83.

Status LED

All AZ2 versions have a multicolour indicator on the front panel, which is used to indicate the status or alarm state. The alarm thresholds can be set from LPA-View via the serial interface and bespoke connector (available on request).

Multicolor indicators

- Green indicates that the test result passed, i.e. none of the alarm thresholds were exceeded
- Yellow indicates that the lower cleanliness limit was exceeded, but not the upper one
- Red indicates that the upper clean liness limit was exceeded
- Blue indicates that the upper water content limit was exceeded
- Red/Blue Alternating indicates both cleanliness and water content upper limits exceeded
- Violet indicates that the upper temperature limit was exceeded



Front facing view



Right facing view



Top facing view



Bottom facing view

Technical data

Technology

LED Based Light Extinction Automatic Optical Contamination Monitor

Particle Sizing

>4, 6, 14, 21, 25, 38, 50, 70 $\mu\text{m}_{(c)}$ to ISO 4406:2017 Standard

Analysis range

ISO 4406:2017 Code 0 to 25

NAS 1638 Class 00 to 12

AS4059 Rev. E Table 1&2 Sizes A-F: 000 to 12

ISO 11218 00-12 (Lower Limits are Test Time dependent)

Accuracy

$\pm \frac{1}{2}$ code for 4,6,14 $\mu\text{m}_{(c)}$ ± 1 code for larger sizes

Calibration

Each unit individually calibrated with ISO Medium Test Dust (MTD) based on ISO 11171, on equivalent certified by I.F.T.S. ISO 11943

Operating Flow Rate

20 - 400 ml/minute

Viscosity range

≤ 1000 cSt

Fluid temperature

From -25 °C to +80 °C

Ambient Temperature

From -25 °C to +80 °C

Temperature Measurement

± 3 °C%

Pressure

Maximum: 400 bar (for high frequency pressure pulse and out range temperature applications contact MP Filtri)

Test time

Adjustable 10 - 3600 seconds. Factory set to 120 seconds.

Start delay & programmable test intervals available as standard

Flow rate measurement

Indicator only

Data Storage

4000 tests

Communication options

RS485, RS232, MODBUS, CANBUS as standard

Relays

Two solid state relays fitted to "R" version for output to alarm circuits

Environmental Protection

IP66

Moisture Sensing

% RH (Relative Humidity) $\pm 3\%$

Weight

10.5 kg

Electrical Supply

Voltage 9-36V DC

Current Supply

12V - 150mA

24V - 80mA

36V - 60mA

Power consumption

<2.2 W

Outer Casing Finish

Stainless Steel

Wetted parts

M - C46400 Cu alloy, 316 stainless steel, FPM, FR4, sapphire.

N - 316 stainless steel, FPM, sapphire.

S - 316 stainless steel, perfluoro elastomer, sapphire, EPDM.

Software

LPA View software (included)

Atex classification

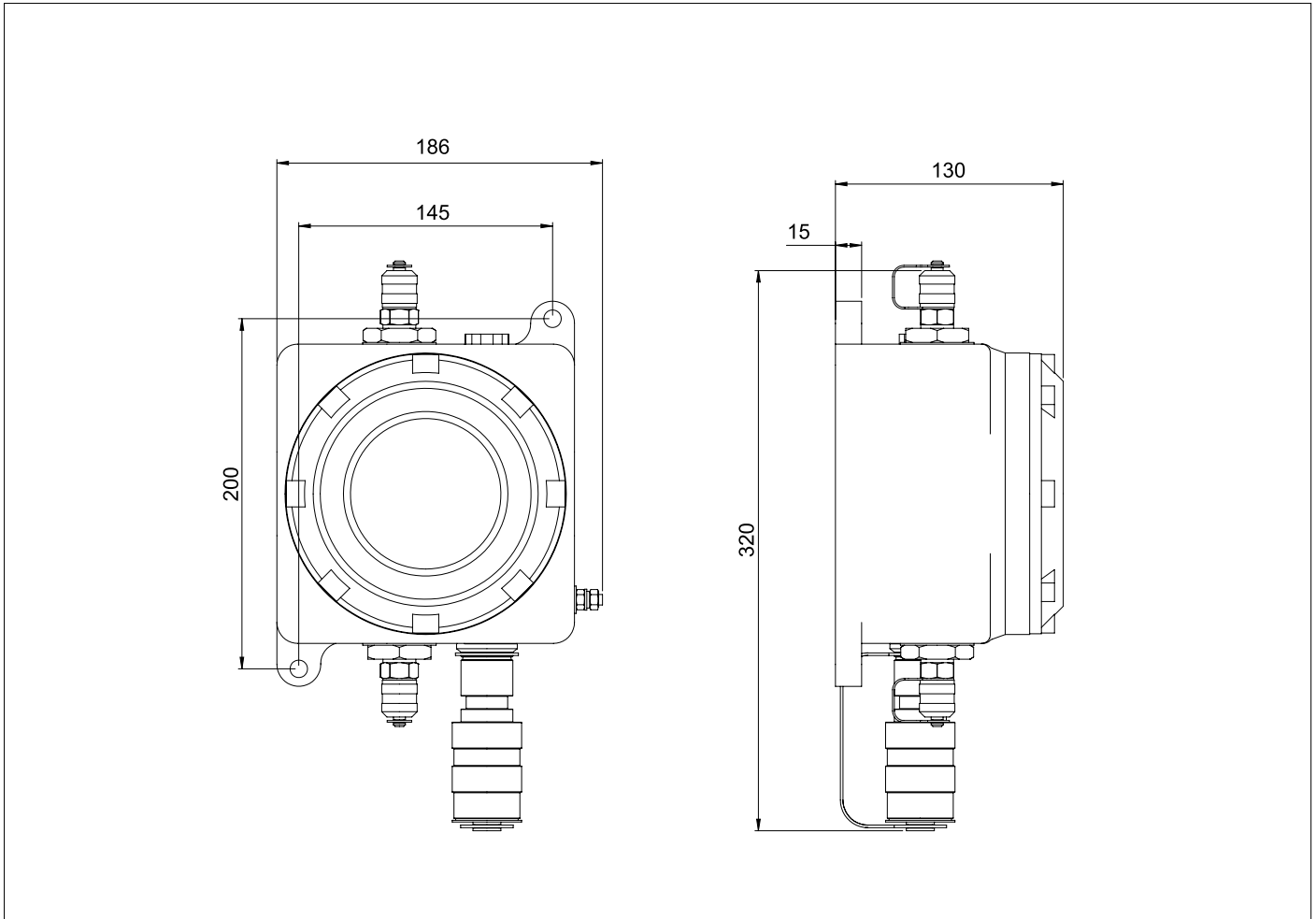
CE  3 G EX nR IIB T5 GC IP66

ICM AZ2 cable wiring details

MP Filtri do not supply an ATEX approved cable with the ICM AZ2 products as customers may run such cables through varying ATEX zones. Wiring diagrams supplied, please consult product user guide for full information.

Note: an adapter cable and ICMUSBi product will be required should LPA View be utilised as the control software. These accessories are only suitable for use outside of the zoned areas

Dimensions



Designation & Ordering code

AUTOMATIC PARTICLE COUNTER AZ2

Configurations :

- ICM W M K R G1 AZ2 Moisture Sensor, Mineral / Petroleum based fluids, LCD Display, Relays, M16 x 2 Minimes Connections
- ICM O M K R G1 AZ2 Mineral / Petroleum based fluids, LCD Display, Relays, M16 x 2 Minimes Connections
- ICM O N K R G1 AZ2 Off shore / Water based fluids, LCD Display, Relays, M16 x 2 Minimes Connections
- ICM O S K R G1 AZ2 Phosphate Ester and aggressive fluids, LCD output, Relays, M16x2 Minimes Connections

All of MP Filtri's AZ2 products are designed to be run via PLC control & the Modbus communication protocol.

Note: All units are fully compatible with and can be programmed via our bespoke windows based LPA View software.

ICU

In-line Contamination Monitoring Unit



Description

Automatic Particle Counters

In-line Contamination Monitoring Unit

The ICU automatically measures particulate contamination levels in various hydraulic fluids and is designed for industrial applications.

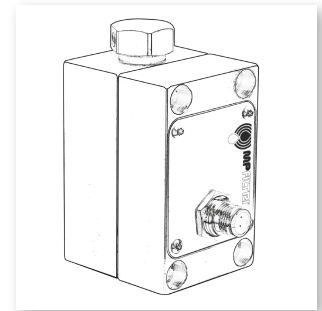
It is designed to be manifold mounted directly to systems, where ongoing measurement or analysis is required, and where space and costs are limited.

> Features & Benefits

- Manifold mounting
- 3 channel contamination measurement
- Measures ISO 4406:2017
- Robust design and construction
- Pressure max. 350 bar
- Environmental protection IP65/67 versatile
- 4-20mA analogue output as standard

Scope of Supply

- 1 x ICU0M00G5P01
- 1 x Installation kit:
 - 4 x M6x1.0x60mm long fixing bolts
 - 2 x 6.50 ID x 1.5 CSD FKM o-ring seals
- 1 x Hard copy of calibration certificate



Right facing view



Front / Left facing view

Technical data

Technology

LED Based Light Extinction Automatic Optical Contamination Monitor

Particle Sizing

>4, 6, 14 $\mu\text{m}_{(c)}$ to ISO 4406:2017 Standard

Analysis range

ISO 4406:2017 Code 0 to 20

Accuracy

$\pm \frac{1}{2}$ code for 4,6,14 $\mu\text{m}_{(c)}$ across the analysis range

Calibration

Each unit individually calibrated with ISO Medium Test Dust (MTD) based on ISO 11171, on equipment certified by I.F.T.S. ISO 11943

Operating Flow Rate

200 ml/minute controlled by the built in flow control valve

Viscosity range

≤ 1000 cSt

Fluid temperature

From 0 °C to +80 °C

Ambient Temperature

From 0 °C to +60 °C

Pressure

Minimum: 50 bar

Maximum: 350 bar

Test time

Adjustable 10 - 3600 seconds

Communication options

4-20 mA time multiplex as standard

Environmental Protection

IP 65/67 versatile

Weight

1.4 Kg

Electrical Supply

24v DC +/- 20%

Power consumption

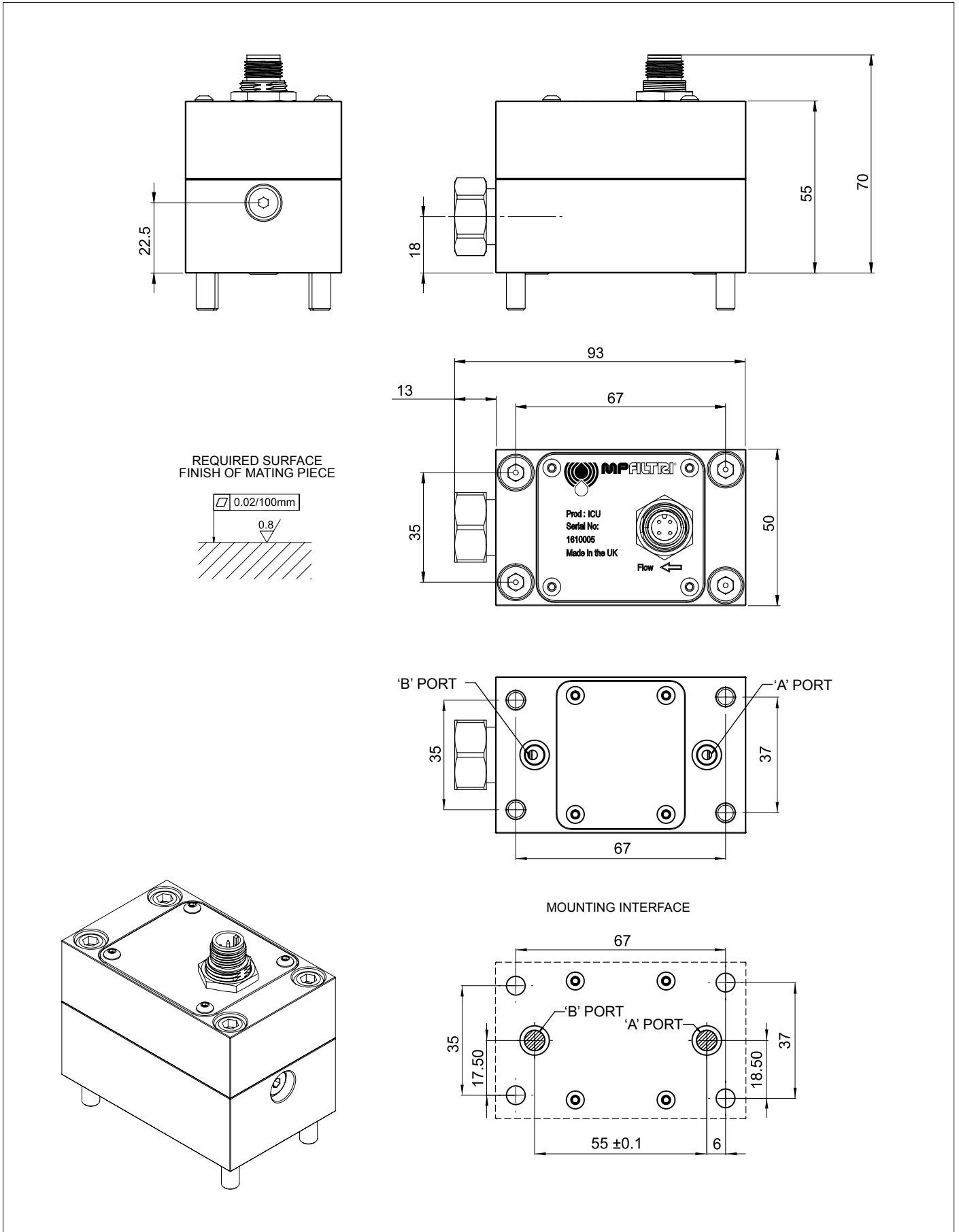
<2.2 W

Cable

Electrical cable has to be ordered separately (optional accessory),

MP Filtri item no. 13.061000 - ICU Cable M12 4 pin 1.5m long.

Dimensions



AUTOMATIC PARTICLE COUNTER ICU

Configurations :

ICU 0 M 0 0 G5 P01

Without moisture sensor, Mineral oil, Without keypad/display, 4 to 20mA timed multiplex, Manifold mounted, Standard option

ICU 0 M 0 0 G5 Pxx

Customized version

ACMU

Auxiliary Contamination Monitoring Unit



Description

Automatic Particle Counters

Auxiliary Contamination Monitoring Unit

Incorporating the ICM, the ACMU is specifically designed for aerated, viscous and/or un-pressurized hydraulic/lubrication systems.

Where can it be used?

- Wind/Tidal/Wave Energy
- Gearbox applications
- Gearbox monitoring
- Offshore & ship systems
- Lubrication & Oil systems
- Mobile Equipment
- Test Benches

When should it be used?

- Entrained air or turbulent flows
- Higher viscosity fluids
- Unpressurized systems

Why should it be used?

- Easy to retro-fit
- Exceptional communication & 4000 test memory
- Reliable & accurate performance

Available versions:

- Cabinet version
- Plate version



Closed Cabinet version
Front/Right facing view



Open Cabinet version
Front facing view



Plate version
Front facing view

Scope of supply

- 1 x ACMU (Specific model will be as per ordered item, 1/4" BSP inlet/outlet ports as standard)
- 1 x 3m Twisted Pair Cable Assembly (Plate version)
- 1 x 5m length twisted pair cable (Cabinet version)
- 2 x 1/4" BSP to 7/16 JIC coupling
- 1 x Hard copy Quick start/wiring installation guide
- 1 x Hard copy Fluid Condition Handbook
- 1 x Digital copy of user guides/software/drivers
- 1 x Hard copy of calibration certificate

See Accessories at page 83.

Hydraulic Hoses (External)

Customer to source their own

Re-calibration

Defined by customer Quality Controls recommended 1 year

Technical data

In-Line contamination monitor

ICM with keypad and backlit display and relays

Particle Sizing

As ICM: >4, 6, 14, 21, 25, 38, 50, 70 $\mu\text{m}_{(c)}$ to ISO 4406:2017 Standard

Fluid Compatibility / Corrosion Resistance

Hydrocarbon based & Synthetic hydraulic fluids

Circuit Flow Rate

40 ml/min to 400 ml/min

Viscosity range

Max. 1000 cSt - Min. 10 cSt

Communication Options

PLC compatible. RS485, RS232 & CanBus (J1939 typical)

Fluid Temperature (Start Up)

Minimum: Viscosity dependant. Not greater than 1000 cSt

Maximum: +80 °C

Fluid Temperature (Continuous)

Minimum: Viscosity dependant. Not greater than 1000 cSt

Maximum: +80 °C

Ambient Temperature (Start Up)

From -40°C to +50 °C

Inlet Pressure

Min. Positive pressure - Max. 50 bar gauge pressure (pump option dependant)

Outlet Pressure

Min. Atmosphere (1013mbar at sea level) - Max. 3 bar (gauge pressure)

Moisture Sensing (RH%)

Available with or without moisture sensor

Weight

21 Kg (cabinet version) - 13 Kg (plate version)

Electric Motor

110V AC, 230V AC, 415V AC, 690V AC

Power Consumption

0.25 kW max

USBi Comms Junction Box

See USBi user guide - cabinet version

No junction box - plate version

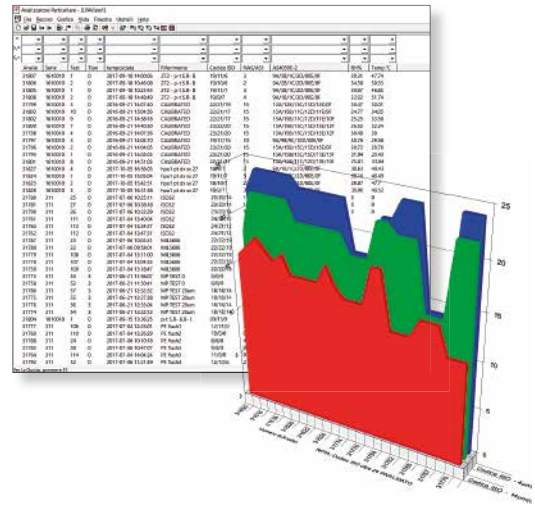
Industry 4.0 ready with appropriate accessory product

ACMU GENERAL INFORMATION

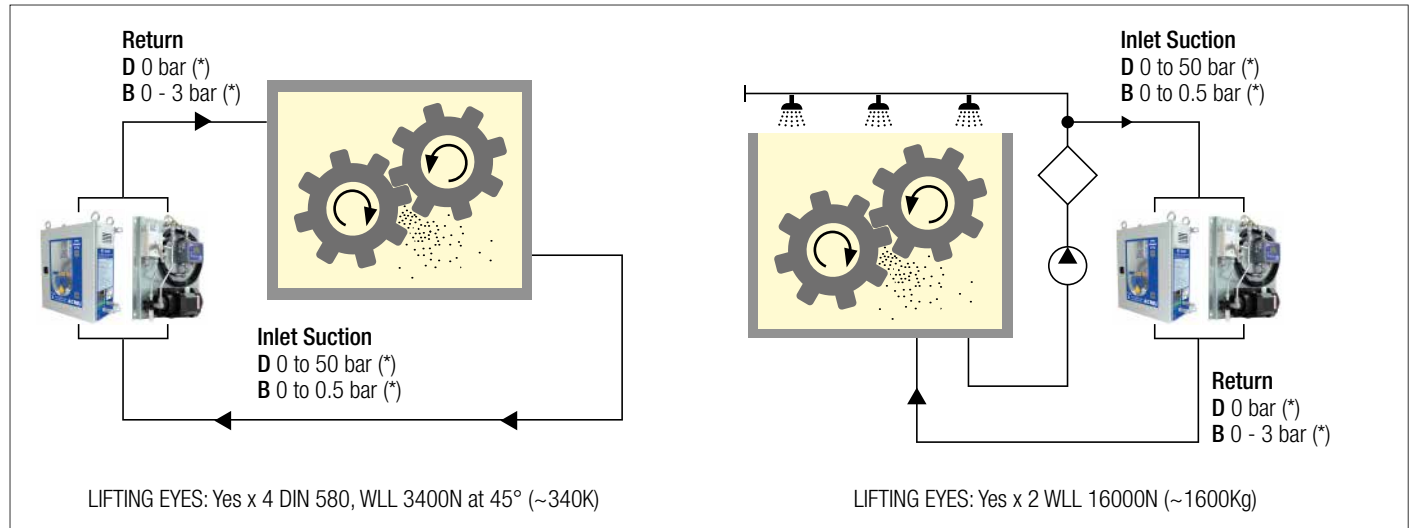
LPA View Software

The LPA View software is used with the LPA3, LPA2, CML2 and ICM particle counters. When connected to LPA View, MP Filtri CMPs can transfer results in realtime, or alternatively, historical results can be downloaded from the CMP's inbuilt memory.

- Runs on Windows XP, 7, and Windows 10
- Full adjustment & control of product settings, test times and alarms
- Easy test report generation
- Trend analysis
- Graphical display options
- Universal format across our contamination monitoring product range



Type of applications



(*) Gauge pressure

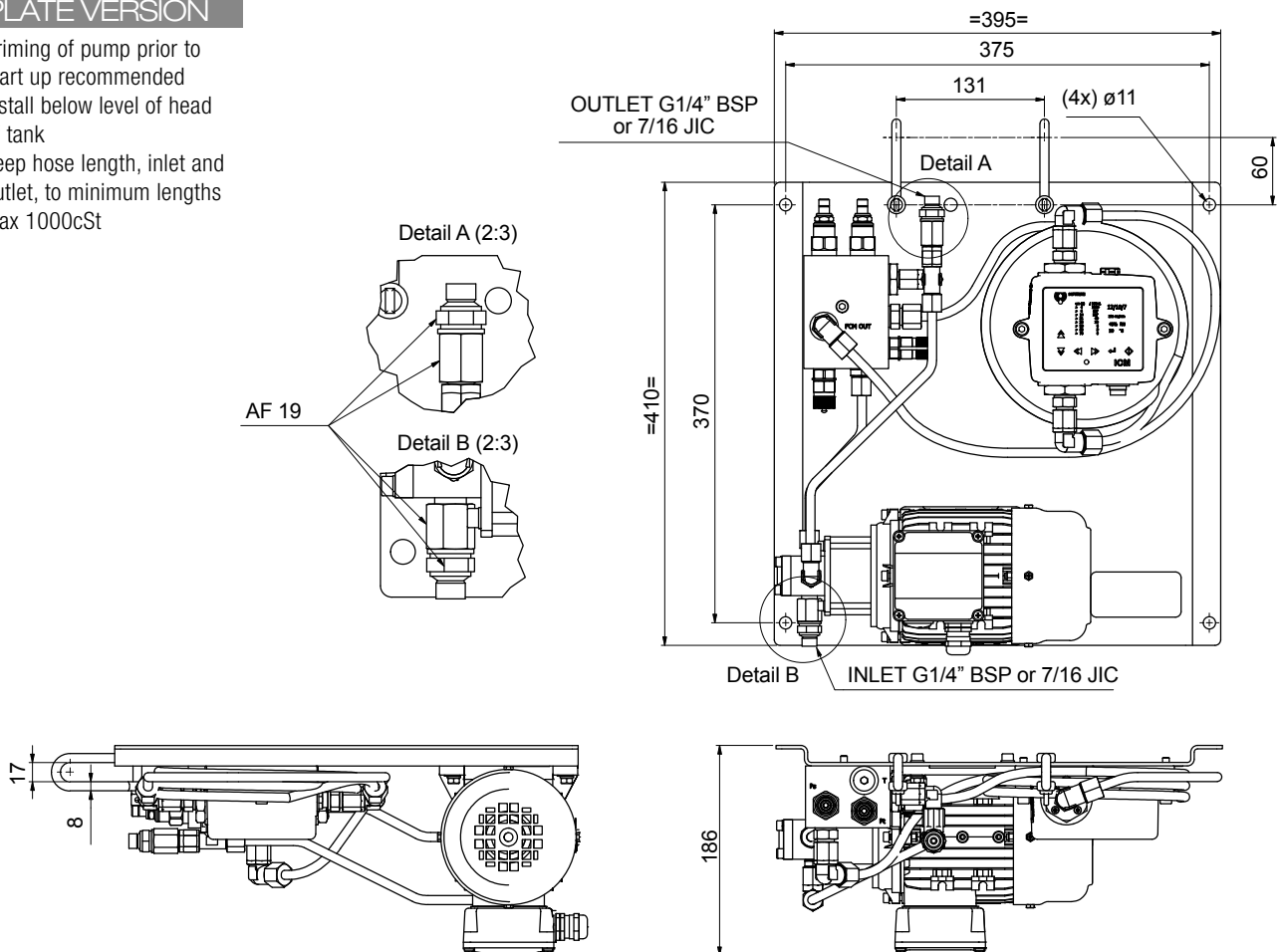
Designation & Ordering code

AUTOMATIC PARTICLE COUNTER ACMU

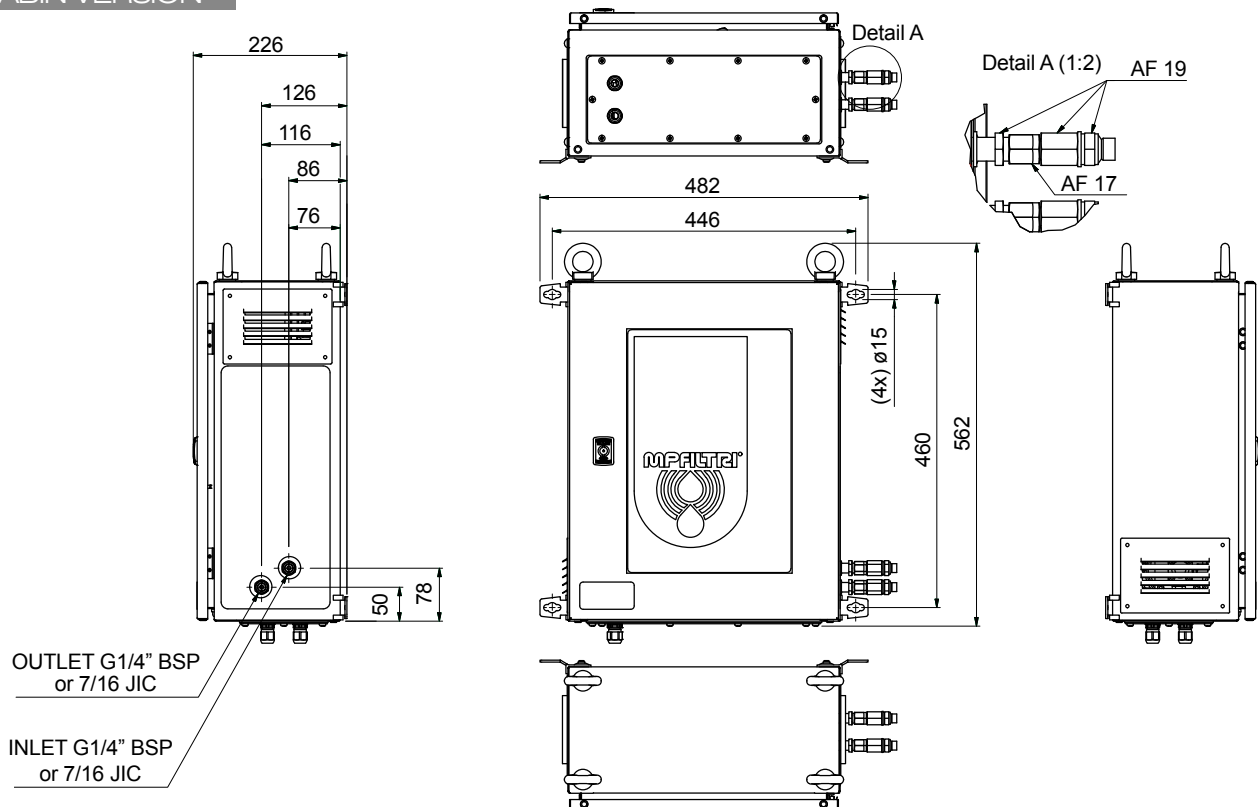
Series	Configuration example: ACMU	W	D	C	S	230V
ACMU						
Moisture Sensor (RH%)						
O	Without moisture and temperature sensor					
W	With moisture and temperature sensor					
Pressure Sensor						
D	Up to 50 bar inlet (gauge pressure), atmosphere outlet					
B	0.5 (gauge pressure) {1 bar max inlet}, 3 bar (gauge pressure) max outlet					
Type						
C	Cabinet version (supplied with 5 metre communication lead)					
P	Plate mounted version (supplied with ICM 3 metre cable)					
Version						
S	Standard version					
Motor option						
110V	110V Motor (Dual frequency 50Hz/60Hz, single phase)					
230V	230V Motor (single phase)					
400V	400V Motor (3 phase)					
690V	690V Motor (3 phase)					

PLATE VERSION

- Priming of pump prior to start up recommended
- Install below level of head of tank
- Keep hose length, inlet and outlet, to minimum lengths
- Max 1000cSt



CABIN VERSION



BS110 & BS500

Bottle Samplers - For use with MP Filtri's portable APC



Description

Automatic Particle Counters

Bottle Samplers

The 110ml bottle samplers are suitable for off-line and laboratory applications where fluid sampling at point of use is inaccessible or impractical.

A fluid de-aeration facility comes as standard.

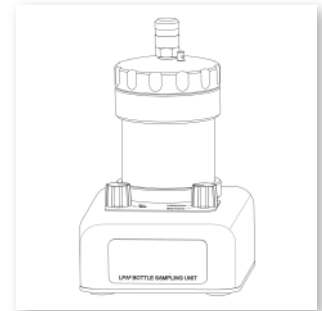
> Features & Benefits

- Vacuum feature for de-aeration of fluids
- Compatible with all portable MP Filtri Contamination Monitoring Products
- Strong Laboratory aesthetic
- Transparent outer for visual indication
- Full accessories kit included
- Includes carry case (BS110)
- Contact MP Filtri for use with fluids other than those stated

Scope of Supply

- 1 x 110ml Bottle Sampling unit
- 1 x Pressure cap
- 1 x Vacuum cap
- 1 x M16x2 microbore pressure hose, 600mm long
- 1 x 1L waste receptacle
- 1 x 12V, 2A power adapter c/w UK/EU/US/AUS/CN heads
- 1 x pack of disposable dip tubes
- 1 x hand pump
- 1 x length of hose for hand pump
- 3 x 100ml clear plastic bottles
- 1 x Hard copy of product user guide
- 1 x Digital copy of user guides/software/drivers
- 2 x Thermal printer paper
- 1 x Carry case

See Accessories at page 83.



Left facing view



Front facing view



Open case
Front facing view

Technical data

Max. Chamber Pressure

2.5bar (36.3psi) only

Min. Chamber Pressure

0.61bar (8.85psi) to 0.81bar (11.75psi)

For use with....

MP Filtri Portable Contamination Monitoring Products

Supply Voltage

12v, 2 amp

Wetted Parts (Internal)

Aluminium HE30, 303 Stainless Steel, Polyurethane, FPM, Acrylic

On/off & Stop/Start signals

Switch (Manual Operation)

Hydraulic Hoses (External)

600mm x 2mm ID Microbore minimess hose

Max Flow Rate (ml/min)

Viscosity dependant

Min Flow Rate (ml/min)

Viscosity dependant

Visual Pressure Indicator

No

Weight

7kg

Pressure Gauge

No

Pressure Ranges

2.0bar (29psi) options

IP Rating

IP50

Fluid Compatibility / Corrosion Resistance

Industrial Hydrocarbon based fluids (typical)

Min Outlet Pressure

1013mbar (14.7psi)

Max. Fluid Temperature (Continuous)

80°C/176°F

Min Fluid Temperature

Viscosity dependant

Max. Viscosity

400 cSt

Min. Viscosity

1 cSt

Max outlet pressure

2.0bar (29psi) options

Min. Continuous Ambient Temperature

10°C/50°F

Max. Continuous Ambient Temperature

55°C/131°F

Power Consumption

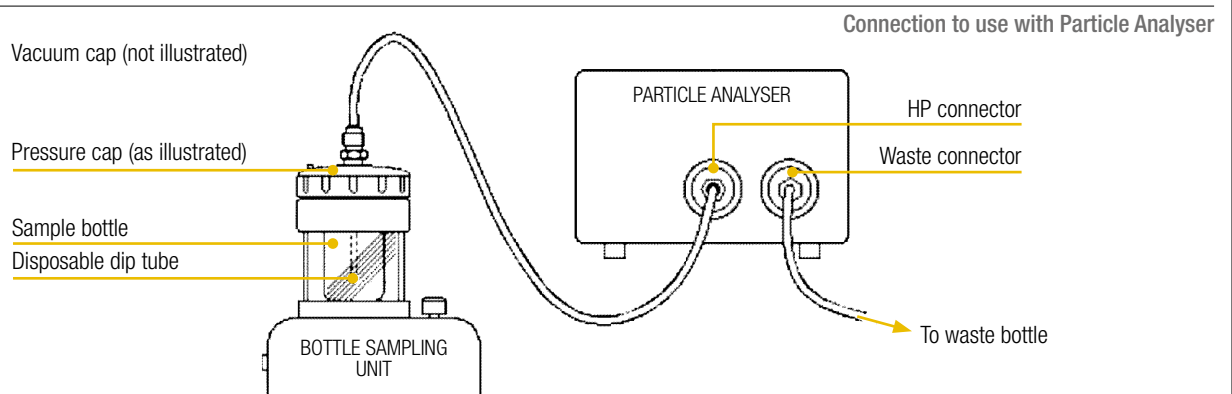
24W

Warranty

12 months

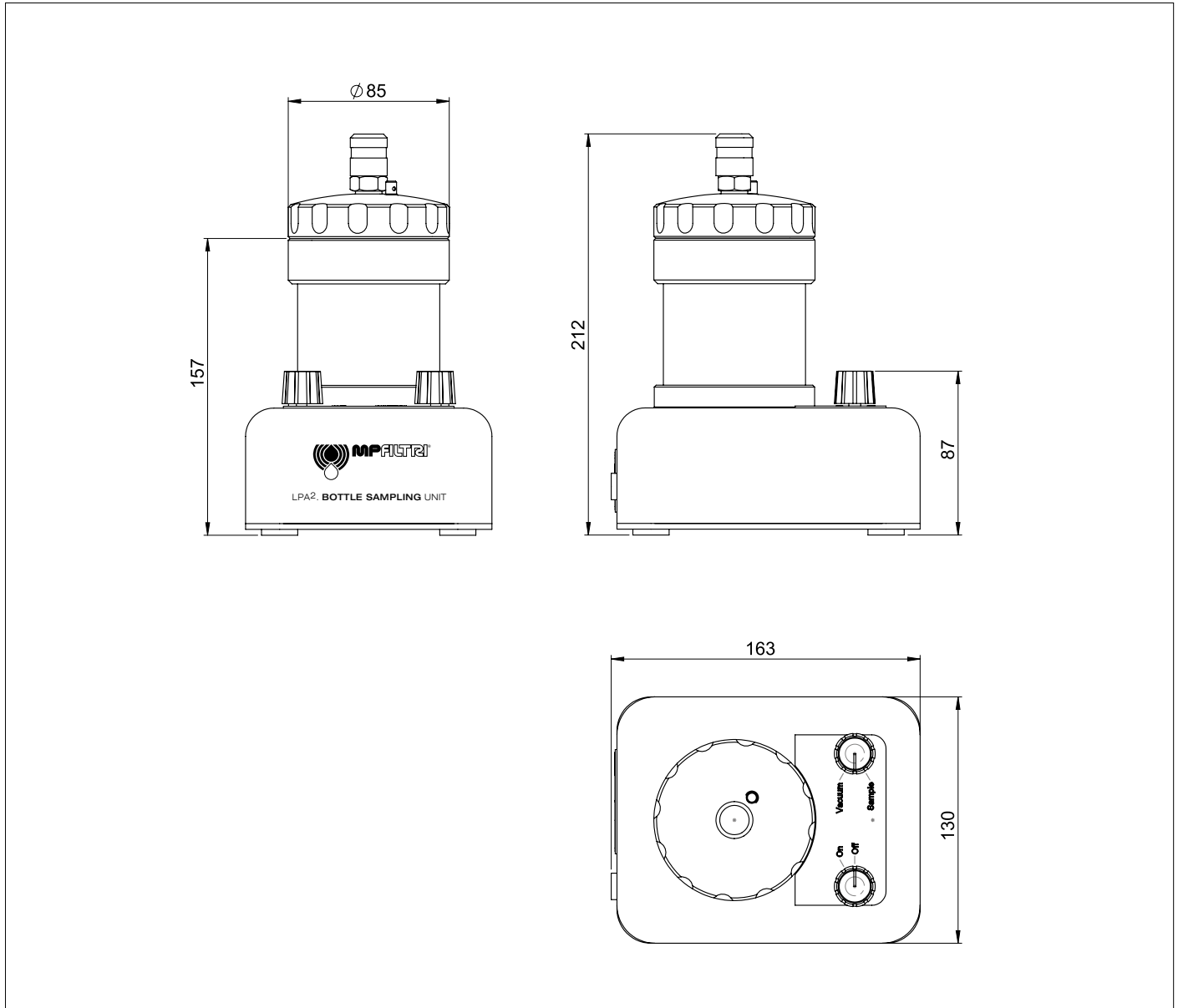
Installation

Indoor Use / Laboratory Use



BS110 Bottle Samplers

Dimensions



Designation & Ordering code

BOTTLE SAMPLER BS110				
Series	BS110	110ml fluid volume	Configuration example:	BS110 M 0 0
Fluid compatibility	M	Mineral oil and synthetic fluids		
Pressure rating	0	2 bar		
Pressure cylinder option	0	Acrylic cylinder assembly		

Description

Automatic Particle Counters

Bottle Samplers

The 500ml bottle samplers are suitable for off-line and laboratory applications where fluid sampling at point of use is inaccessible or impractical.

A fluid de-aeration facility comes as standard.

> Features & Benefits

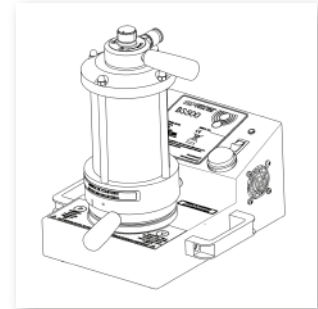
- Vacuum feature for de-aeration of fluids
- Compatible with all portable MP Filtri Contamination Monitoring Products
- Strong Laboratory aesthetic
- Transparent outer for visual indication
- Full accessories kit included
- Contact MP Filtri for use with fluids other than those stated

Scope of Supply

- 1 x 500ml Bottle Sampling base unit (*)
- 1 x Top cap, pressure/vacuum chamber (*)
- 1 x M16x2 microbore pressure hose, 600mm long
- 1 x Power adapter
- 1 x UK/EU/US/AUS/CN power lead*
- 3 x 210ml clear glass bottles
- 2 x 500ml clear glass bottles
- 1 x Digital copy of user guides/software/drivers

(*) Specific model will be as per ordered item

See Accessories at page 83.



Front / Left facing view



Front / Right facing view



Back / Right facing view



Back / Left facing view

Technical data

Max. Chamber Pressure

2.5bar (36.3psi) (standard), 4.5bar (65.3psi) (high pressure)

Min. Chamber Pressure

0.61bar (8.85psi) to 0.81bar (11.75psi)

For use with....

MP Filtri Portable Contamination Monitoring Products

Supply Voltage

12v, 5 amp

Wetted Parts (Internal)

Aluminium 6082 T6, 303 Stainless Steel, 316 Stainless Steel.
Seal & Cylinder material optional

On/off & Stop/Start signals

Switch (Manual Operation)

Hydraulic Hoses (External)

600mm x 2mm ID Microbore minimess hose

Max Flow Rate (ml/min)

Viscosity dependant

Min Flow Rate (ml/min)

Viscosity dependant

Visual Pressure Indicator

Yes

Weight

9kg

Pressure Gauge

Yes (only on 4.5bar version)

Pressure Ranges

4.5bar (65.3psi) or 2.5bar (36.3psi) options

IP Rating

IP50

Fluid Compatibility / Corrosion Resistance

Industrial, aerospace & off-shore control fluids (typical)

Min Outlet Pressure

1013mbar (14.7psi)

Max. Fluid Temperature (Continuous)

80°C/176°F

Min Fluid Temperature

Viscosity dependant

Max. Viscosity

Not greater than 400cSt (on 2.5bar version)

Not greater than 1500cSt (on 4.5bar version)

Min. Viscosity

1 cSt

Max outlet pressure

Version dependant: 2.5bar (36.3psi) for O version

4.5bar (65.3psi) for H version

Min. Continuous Ambient Temperature

10°C/50°F

Max. Continuous Ambient Temperature

55°C/131°F

Power Consumption

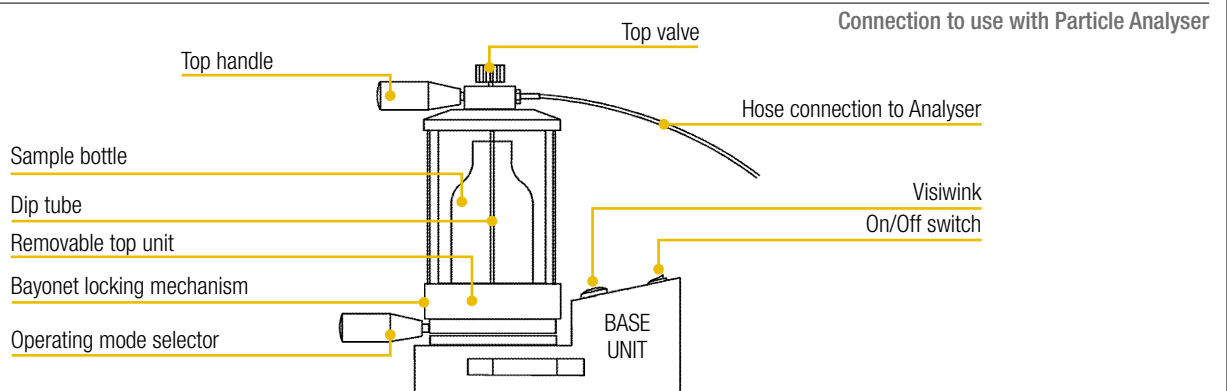
60W

Warranty

12 months

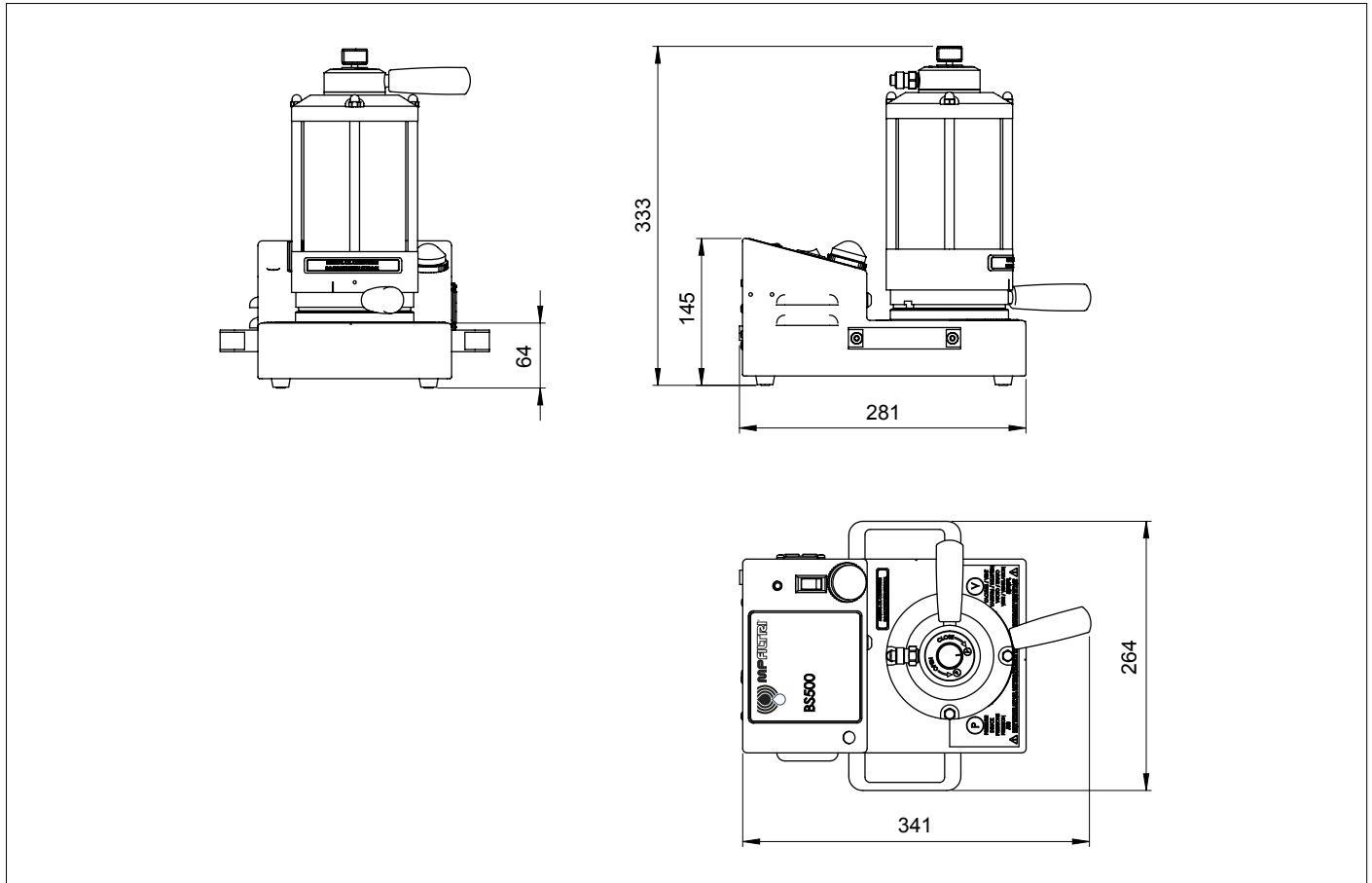
Installation

Indoor Use / Laboratory Use



BS500 Bottle Samplers

Dimensions



Designation & Ordering code

BOTTLE SAMPLER BS500	
Series	Configuration example: BS500 V 0 0 UK
BS500	500ml fluid volume
Fluid compatibility	
V	Mineral oil and synthetic fluids, Subsea and water based fluids
E	Phosphate ester and aggressive fluids
S	Phosphate ester and aggressive fluids, Mineral oil and synthetic fluids, Subsea and water based fluids
Pressure rating	
0	2 bar, standard option
H	4 bar, high pressure option (*)
Pressure cylinder option	
0	Acrylic cylinder assembly
S	Glass cylinder assembly (**)
Power adapter options	
UK	UK power adapter
EU	European power adapter
US	USA power adapter
AU/CN	Australasia power adapter

(*) = H version only available in BS500 V version

(**) = Glass version only available in BS500 E & S version

HOW SAMPLING

Bottles



At MP Filtri we offer a range of standard & ultra-clean glass bottles for your sampling needs:

100 ml, 210 ml & 500 ml Standard Bottles (not certified clean)

- 100 ml, available in amber glass or clear plastic varieties
- 210 ml, available in clear glass
- 500 ml, available in clear glass

100 ml & 210 ml Ultra Clean Glass Bottles

- Certified to ISO 3722 Hydraulic fluid power
- Fluid sample containers
- Qualifying and controlling cleaning methods
NAS 0 to NAS 00/ AS4059E Table 1 Class 0

Glass Colour

Clear glass provides better visibility of the sample, making de-aeration easier to monitor. Amber glass may reduce the effect of UV light on the sample, reducing the risk of microbial growth and FAME (fatty acid methyl esters) which can be significant in fuel analysis.

DE-AERATION & CLEANLINESS

Samples should be shaken vigorously before use however this causes the sample to become aerated which means leaving it to settle.

The BS500 & BS110 de-aeration facility reduces this settling time, allowing more samples to be analysed thereby increasing productivity.



SAMPLING FACTORS

Below are some of the factors which should be considered when taking a sample. For guidance on sampling procedures refer to ISO 4021 & the product user guide.

- Location of the take-off point
- Homogeneity of the sample
- Local area cleanliness
- Bottle cleanliness
- Equipment cleanliness
- Flushing / Cleaning fluid cleanliness
- Operator clothing & cleanliness
- Air cleanliness



100 µm
Dust particle
(dead skin)



40 µm
Pollen



24 µm
White blood cell



10 µm
Dust mite faeces



8 µm
Red blood cell



3 µm
E-coli bacteria

HOW SAMPLING

Sample hand pump



For systems where there is no practical access to a test point, a sample may need to be taken from an un-pressurized reservoir.

For this occurrence we offer a simple **hand pump device** with both off-line sampling products which provides for clean and efficient sampling.

The design ensures that only the hose is in contact with the sample fluid, providing greater confidence in analysis, and we provide a range of adapters to suit our various bottle sizes.

The pump can be fully dismantled for cleaning and the sample hose plus main seal can be replaced to further improve clean practise.

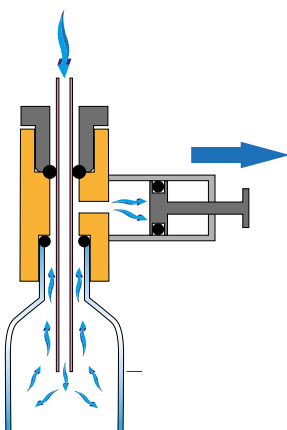
Ultra clean bottles cleaned to and in accordance with DIN/ISO 5884.

Ultra clean bottles cleanliness verified to ISO 3722.

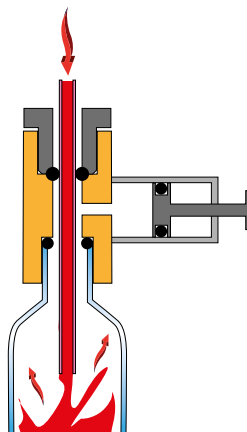
NAS 1638 cleanliness certification of between Class 00 and Class 0.

Descriptions	Part Code	Dimensions (mm)
100 ml - Ultra Clean Bottle (Certified)	P.02	Ø 50x92
100 ml - Standard Bottle Brown Glass	BS0016	Ø 50x91
100 ml - Clear Plastic Bottle	7.111	Ø 51x92
100 ml - Standard Bottle Tray (72 bottles)	BS0072	N/A
210 ml - Ultra Clean Bottle (Certified)	P.03	Ø 65x130
210 ml - Standard Bottle	8.054	Ø 65x122
500 ml - Standard Bottle	8.328	Ø 82x152

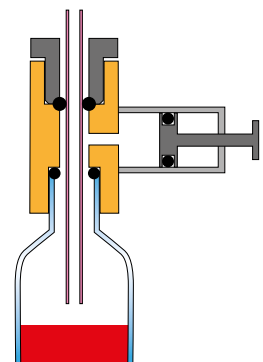
HOW IT WORKS



Priming the pump causes a vacuum inside the bottle, syphoning fluid from the reservoir.



The design of the pump means that only the hose is in contact with the fluid protecting the quality of the sample.



The sample level should always finish below the level of the hose. The bottle can now be removed and capped.

The pump and its associated parts are also available as a spares. See spares list page 81.

VPAF100

Patch test kit



Description

Automatic Particle Counters

Kit for the fluids sampling and the visual analysis of the solid contaminants

> Features & Benefits

In hydraulic fluid power systems, power is transmitted through a liquid under pressure within a closed circuit.

The use of more and more sophisticated devices forces users to keep fluids under control, particularly in monitoring solid contamination.

The presence of solid contamination causes wear, reduces efficiency and the lifespan of components, and adversely affects functionality and performance.

Fluids generally used in fluid power systems are:

- Mineral oil
- Synthetic oil
- Vegetable oil
- Water based emulsions
- Water glycol

Their physical and chemical properties are influenced by following parameters:

- Working pressure
- Solid particles contamination
- Liquid contamination (other fluids or water)
- Modification of original additives

One of the simplest methods to keep fluids under control is to check solid particle contamination; for this reason is useful to have special devices such as a fluid contamination kit.

The VPF100 kit has been created to enable static and dynamic fluid sampling in power systems.

The dynamic sampling is possible when the system has special devices such as valves, pressure reduction, points of sampling, etc.

Kit composition

- Bag 1 pc.
- Monocular microscopy 100X 1 pc.
- Electrical vacuum pump 1 pc.
- Glass filtration apparatus ml 250 1 pc.
- Sprinkler 500 ml with Swinnex filter 1 pc.
- Glass Beaker 500 ml 1 pc.
- Manual pump for fluid samples 1 pc.
- Graduated cylinder in 50 ml 1 pc.
- Valve for manual samples collection 1 pc.
- Bottle for solvent fluid 500 ml 1 pc.
- Bottles for sampling fluid 250 ml 3 pc.
- Tweezers 1 pc.
- Membrane 0.8 mm f 25 for Swinnex filter 100 pc.
- Membrane 1.2 mm f 47 for samples 50 pc.
- Minimes tube 1 m 1 pc.
- Minimes tube 2 m 1 pc.
- Labels for bottles 50 pc.
- Sheet for membrane f 47 50 pc.
- Adhesive for membrane f 47 3 pc.
- Instruction guide 1 pc.

Principal components technical data

Microscope:

- Monocular microscope.
- Achromatic lens 10x. (100 magnifications)
- Focusing with knob.
- Revolving battery light.
- Rotating base, with vertical or inclined vision.
- Anti-dust cover.

Pump

- Single-phase 230 V 50 Hz
- Power absorbed: 50 W
- Current absorbed: 0.55 A
- Fuses: 2 - 1 A

Pumps are designed for:

- Air, gases and vapours from + 5 to + 40 °C
- Keep purity of fluid also when a high precision is required.
- Functioning with a maximum overpressure of 2.4 bar.

Microscope analysis

Microscope analysis allows determining nature and sizes of solid particles inside the fluid.

Table below shows a statistical list of contaminants inside the fluids.

“Other” indicates for example paints, additives precipitation, residuals, etc. Colour, geometric shape and particles brightness constitute some of parameters to classify contaminants.

Nature of contaminants

- Bright metal
- Dark metal
- Silica
- Rubbers and plastic
- Fibres
- Other

Particles Quantitative analysis

After determination of the nature (and sizes) of particles inside the fluid, it is useful to quantify the contamination inside system.

Determination of quantitative contamination is done by taking fluid sample from the system (preferably in working conditions) and following the sample fluid analysis with an automated particle counter or with a portable particle counter that is linked directly to the system.

They give immediate results according to standard ISO 4406 or NAS 1638. Both particle counters, portable or not, have values and counter indications. Please note the portable particle counters need a minimum pressure to work correctly. They produce immediate results.

Technical data

Sampling

Static: manual pump

Dynamic: Kit minimess + tap + probe

Patch test

Membrane \varnothing 47-1.2 μ m

Visual analysis

Portable monocular microscope 10x

Electric pump for vacuum

230V 50Hz - Absorbed power 50 W

Samples filtration system

Glass collecting flask - 0.5lt

250ml membrane glass holder

Solvent spray with \varnothing 25-0.8 μ m membrane holder

Accessories for identification and test report

Container labels

Membrane support cartons

Adhesive film for membrane protection

Rigid carrying case

Height 400mm, depth 515mm, width 270mm.

Weight 11kg

Dustproof closure with lockable closure



FLUID COMPATIBILITY CHARTS

HYDROCARBON AND SYNTHETIC

Fluid type	Fluid spec.	ICM				LPA				CML				BS110		BS500		
		M	(W)	N	S	M	(W)	N	S	M	(W)	N	S	M	V	E	S	
SYNTHETIC OR MINERAL BASED LIQUIDS	AEROSHELL FLUID 31 (OX-19)	Yellow	Yellow	Green	Green	Yellow	Yellow	Green	Green	Yellow	Yellow	Green	Green	Yellow	Green	Red	Green	
	AEROSHELL FLUID 51	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	AEROSHELL FLUID 602	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	CASTROL CONSTAB PS 10W-40	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	DIESEL CALIBRATION OIL 4113	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	FINA POLYGLYCOL FLUID	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Yellow	
	GEAROL ISO VG 320	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	ISO 32	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	ISO 46	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	ISO 68	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	MIL-H-5606	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	MIL-H-83282	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	MIL-H-87257	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	MOBILGEAR SHC XMP 320	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Yellow	
	NATO H-515 (OM-15)	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	NATO H-520 (OM-18)	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	NATO H-537	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN PG 100	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Yellow	
	RENOLIN PG 1000	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Yellow	
	RENOLIN PG 150	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN PG 220	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN PG 320	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Red	Green	
	RENOLIN PG 460	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Yellow	
	RENOLIN PG 68	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN PG 680	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Yellow	
	RENOLIN UNISYN OL 100	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN UNISYN OL 150	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN UNISYN OL 32	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN UNISYN OL 46	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
	RENOLIN UNISYN OL 68	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	
STATOIL HYDRAULIC 131	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green		
AERO HF585B	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green		
MOBIL DTE 25	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green		

For special applications or for fluids not mentioned in this table, please contact MP Filtri Technical and Sales Department. Alternatively, visit the services section of our website where we have details on fluid testing and analysis. For guidance on moisture sensing compatibility, contact MP Filtri Technical and Sales Department. Typically conductive fluids are not compatible with the moisture sensor.

■ Compatible
■ Not compatible
■ Contact MP Filtri

Please note that compatibility is based product performance with fluid viscosity at 20°C in standard dye colourant or natural state. Tests are conducted with the suitable fluid in its pure state. Performance of solutions or mixed emulsions cannot be guaranteed. "Compatibility" is defined as a liquid which does not suffer short or long term degradation as a result of coming into contact with the wetted materials contained within the product. It is also a confirmation that the transparency of the liquid is suitable for the sensitivity of the product range.

For details on the specific product code required for your fluid, contact contact MP Filtri Technical and Sales Department.

FLUID COMPATIBILITY CHARTS

OFFSHORE

Fluid type	Fluid spec.	ICM				LPA				CML				BS110		BS500	
		M	(W)	N	S	M	(W)	N	S	M	(W)	N	S	M	V	E	S
OFFSHORE & SELECTED WATER BASED FLUIDS	HW443	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	HW443R	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	HW453	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	HW540	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	HW540	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	PELAGIC 100	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	PELAGIC 50	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	TRANSAQUA HT	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	TRANSAQUA HT2	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	FRESH WATER	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	DE-IONISED WATER	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	SEAWATER	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Green	Green
	HOUGHTO-SAFE 273 CTF	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Green	Green
	HOUGHTO-SAFE BC24046	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	WATER GLYCOL HFC 46	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green
	LF2100 (99%WATER, 1% MIX)	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Green	Green
	SV3	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Red	Green	Green

AGGRESSIVE FLUIDS

Fluid type	Fluid spec.	ICM				LPA				CML				BS110		BS500	
		M	(W)	N	S	M	(W)	N	S	M	(W)	N	S	M	V	E	S
PHOSPHATE ESTHER & AGGRESSIVE LIQUID APPLICATIONS	HYJET IV	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Green	Green
	HYJET V	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Green	Green
	SKYDROL 500B	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Green	Green
	SKYDROL LD4	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Green	Green
	SKYDROL 500B4	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Red	Green	Red	Red	Green	Green

- Compatible
- Not compatible
- Contact MP Filtri

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For details on the specific product code required for your fluid, contact contact MP Filtri Technical and Sales Department.

FLUID COMPATIBILITY CHARTS

FUELS

Fluid type	Fluid spec.	ICM				LPA				CML				BS110		BS500		
		M	(W)	N	S	M	(W)	N	S	M	(W)	N	S	M	V	E	S	
FUELS	JET A-1	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JET A	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JET B	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JP1	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JP5	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JP6	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JP7	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JP8	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	JPTS	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	FT JET FUEL	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	GTL JET FUEL BLEND	Yellow	Yellow	Green	Green	Red	Red	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	Red	Green
	DIESELS	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	Green	Green

BIO FLUIDS

Fluid type	Fluid spec.	ICM				LPA				CML				BS110		BS500		
		M	(W)	N	S	M	(W)	N	S	M	(W)	N	S	M	V	E	S	
BIODEGRADABLE FLUIDS & VEGETABLE OILS	BIO-ETHANOL	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	
	BIO-DIESEL	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	
	PLANTOHYD N SERIES	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	
	PANOLIN HLP SYNTH 22	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	
	SUNFLOWER OIL	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
	RAPESEED OIL	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
	CORN OIL	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
	GROUND NUT OIL	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	
	CAT BIO HYDO HEES	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	

■ Compatible
■ Not compatible
■ Contact MP Filtri

For special applications or for fluids not mentioned in this table, please contact MP Filtri Technical and Sales Department. Alternatively, visit the services section of our website where we have details on fluid testing and analysis. For guidance on moisture sensing compatibility, contact MP Filtri Technical and Sales Department. Typically conductive fluids are not compatible with the moisture sensor.

Please note that compatibility is based product performance with fluid viscosity at 20°C in standard dye colourant or natural state. Tests are conducted with the suitable fluid in its pure state. Performance of solutions or mixed emulsions cannot be guaranteed. "Compatibility" is defined as a liquid which does not suffer short or long term degradation as a result of coming into contact with the wetted materials contained within the product. It is also a confirmation that the transparency of the liquid is suitable for the sensitivity of the product range.

For details on the specific product code required for your fluid, contact contact MP Filtri Technical and Sales Department.

SPARE PARTS LIST

Description	Ordering Code	LPA3	LPA2	CML	ICM	BS110	BS500
Minimess Hose Extension kit - 5000mm	SK0500	●	●	●	●		
Minimess Hose Extension kit - 10000mm	SK0100	●	●	●	●		
Coarse Screen Filter	SK0040	●	●	●	●		
LPA2 Carry Bag	CB0001		●				
Calibration Verification Fluid	PCCF	●	●	●		●	●
Waste Bottle (1 Litre) - Round	SK0012	●	●	●			
Waste Bottle (1 Litre) - Square (for use with CB0001)	SK0013		●	●			
Minimess Pressure Hose - 1500mm, plated steel (mineral/synthetic fluid)	95.Y30Y30X261150	●	●	●	●		
Minimess Pressure Hose - 600mm, plated steel (mineral/synthetic fluid)	95.Y30Y30X261060	●	●	●	●	●	●
Minimess Pressure Hose - Stainless Steel, for use with offshore fluids (N version of CMP units) - 1500mm	95.Y30Y30X161150	●	●	●	●		
Minimess Pressure Hose - Stainless Steel, for use with offshore fluids (N version of CMP units) - 600mm	95.Y30Y30X161060	●	●	●		●	●
Series 30 Waste Hose	SK0014S30	●	●	●			
Series 30 Waste Hose - Stainless Steel, for use with offshore fluids (N version of CMP units) - 2m	SK0014S30N	●	●	●			
Series 30 Waste Hose - Perfluorelastomer seals, for use with Phosphate Esters (S version of CMP units) - 2m	SK0014S30S	●	●	●			
Impact printer paper for use with Series 20 & 30 - single	SK0018		●				
Impact printer paper for use with Series 20 & 30 - box of 20	SK0018-20		●				
Printer ribbon for use with Series 20 & 30 - single	SK0020		●				
Printer ribbon for use with Series 20 & 30 - pack of 10	SK0020-10		●				
Thermal printer paper for Series 30.1 - single	6,160		●				
Thermal printer paper for Series 30.1 - box of 20	6.160-20		●				
Thermal printer paper for LPA3	63,083000	●					
12V, 2A Power Adapter - UK	6,209		●	●		●	
Disposable Dip tubes - pack of 50	BS0018					●	
Hand Pump	BS0020					●	
Hand Pump Hose- 1000mm	BS0022					●	
Bottle Sampler hand pump and hose kit	BS0024					●	
Serial cable to USB converter	SK0026		●	●			
Black support case (without contents)	BS0040					●	
Heavy Duty Travel Case for LPA2	TC0005LPA		●				
Heavy Duty Travel Case for Bottle Sampler	TC00055B						●
PC Download cable	6,123		●	●			
100ml Standard Brown Glass Bottle	BS0016					●	
Tray of 72 x 100ml Standard Brown Glass Bottles	BS0072					●	
100ml Clear Plastic Bottle	7,111					●	
Box of 20 x 100ml Clear Plastic Bottles	7,112					●	
200ml Standard Clear Glass Bottle	8,054						●
Box of 20 x 200ml Standard Clear Glass Bottles	8,054						●
500ml Standard Clear Glass Bottle	8,328						●
100ml Ultra-clean Clear Glass bottle, Cleaned in accordance with DIN/ISO 5584 and verified to ISO3722	P.02					●	
Pack of 25 x 100ml Ultra-clean Clear Glass bottles, Cleaned in accordance with DIN/ISO 5584 and verified to ISO3722	P.0225					●	
200ml Ultra-clean Clear Glass bottle, Cleaned in accordance with DIN/ISO 5584 and verified to ISO3722	P.03						●
Pack of 20 x 200ml Ultra-clean Clear Glass bottles, Cleaned in accordance with DIN/ISO 5584 and verified to ISO3722	P.0320						●
Power Adapter for 500ml Bottle Sampler	8,029						●
UK Lead for 8.029	8,031	●					●
EU Lead for 8.029	8,032	●					●
US Lead for 8.029	8,030	●					●
CN/AUS Lead for 8.029	8,072	●					●
Power Adapter for LPA3	61,034000	●					
Pouch for pressure hose/waste hose	7,106000	●	●	●			
USB A-B cable	11,081000	●					
USB stick with all user guides and LPA-View Software	13,055001	●	●	●	●	●	●
Fluid Condition Handbook	200,059	●	●	●	●	●	●

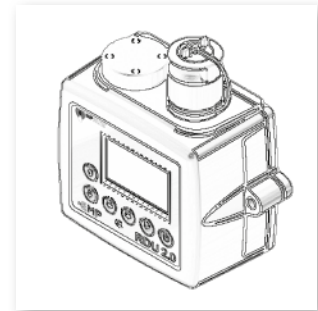
Accessories



Description

Remote Display Unit

Depending on your application, access and visibility of particle counting equipment can sometimes be an issue. The ICM-RDU has specially been developed to dovetail with its parent ICM 2.0. So you have the option to control and monitor the ICM 2.0 remotely. Supplied with a 10m cable as standard.



> Features & Benefits

- Large backlit display
- Keypad interface
- Robust die-cast aluminium construction

Scope of Supply

- 1 x ICMRDU2.0
- 1 x 10m Twisted Pair Cable Assembly
- 1 x Digital copy of user guides/software/drivers

Status LED

All RDU 2.0 versions have a multicolour indicator on the front panel, which is used to indicate the status or alarm state. RDU-K versions also have a screen that changes colour. The alarm thresholds can be set from LPA-View via the serial interface.

Screen and multicolor indicators

- Green indicates that the test result passed, i.e. none of the alarm thresholds were exceeded
- Yellow indicates that the lower cleanliness limit was exceeded, but not the upper one
- Red indicates that the upper cleanliness limit was exceeded
- Blue indicates that the upper water content limit was exceeded
- ● Red/Blue Alternating indicates both cleanliness and water content upper limits exceeded
- Violet indicates that the upper temperature limit was exceeded



Left facing view



Right facing view

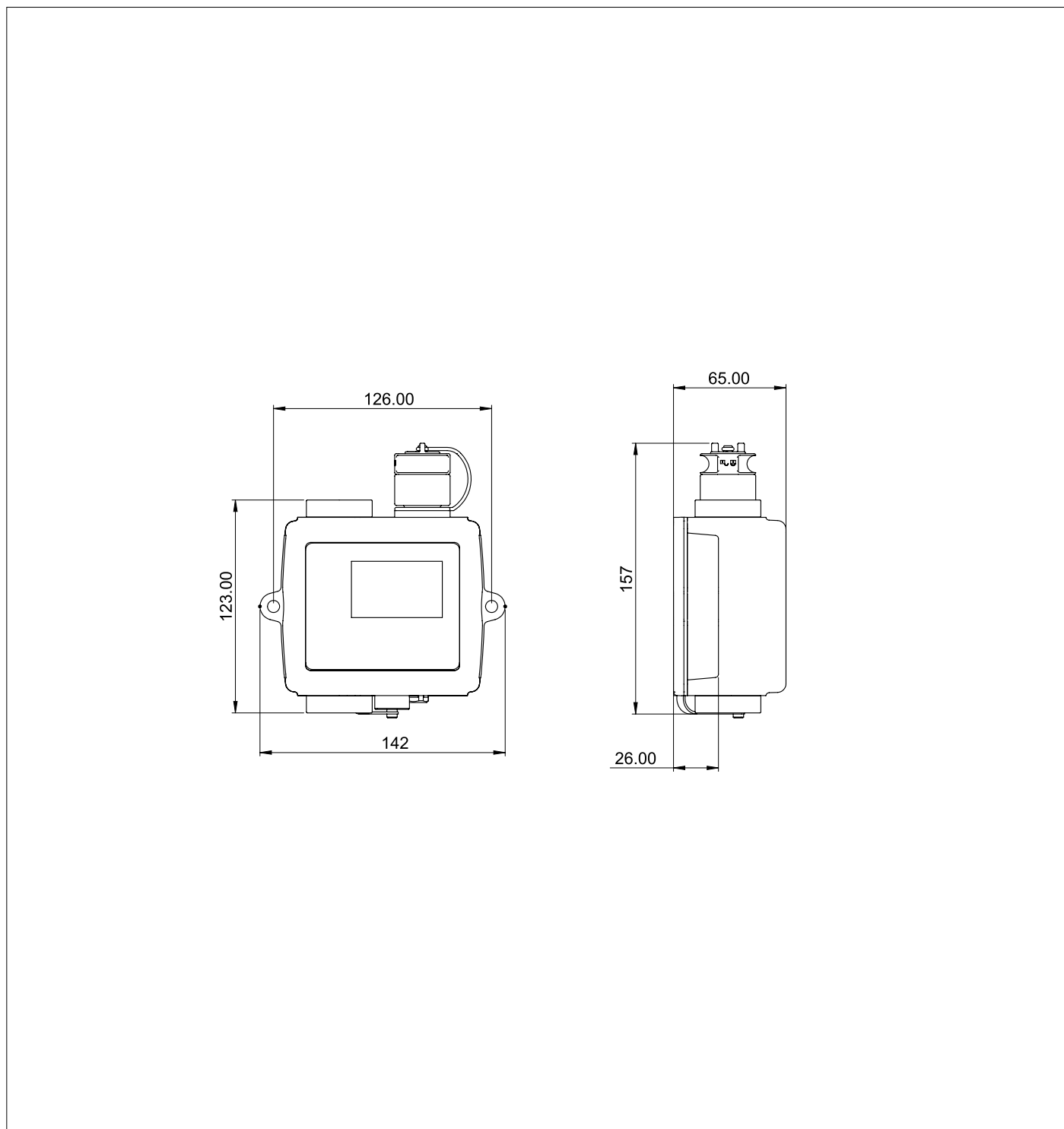


Top view with USB port



Bottom view

Dimensions



Designation & Ordering code

RDU 2.0

Configuration:

Description

Auxiliary Communication Options

We offer four auxiliary communication devices to operate with the ICM 2.0:

ICM-USBi:

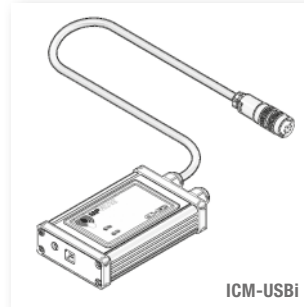
Two auxiliary communication devices are available to order with the ICM. A USB interface which allows for communication via a laptop (RS485 to RS232 converter) & an ethernet device for remote access via a network hub.

Both devices can transmit power to the ICM/RDU electrical circuit using a DC power adapter.

The USBi has the additional benefit of supplying power via the USB cable directly. Both devices come with a DC Power adapter and 3m twisted pair cable as standard.

ICM-ETHi:

An ethernet device enables remote access via a network hub via Com Port redirection software.



ICM-USBi



ICM-ETHi

> Features & Benefits

- Compact
- Off the shelf solution
- Robust aluminium construction

Plug and play technology

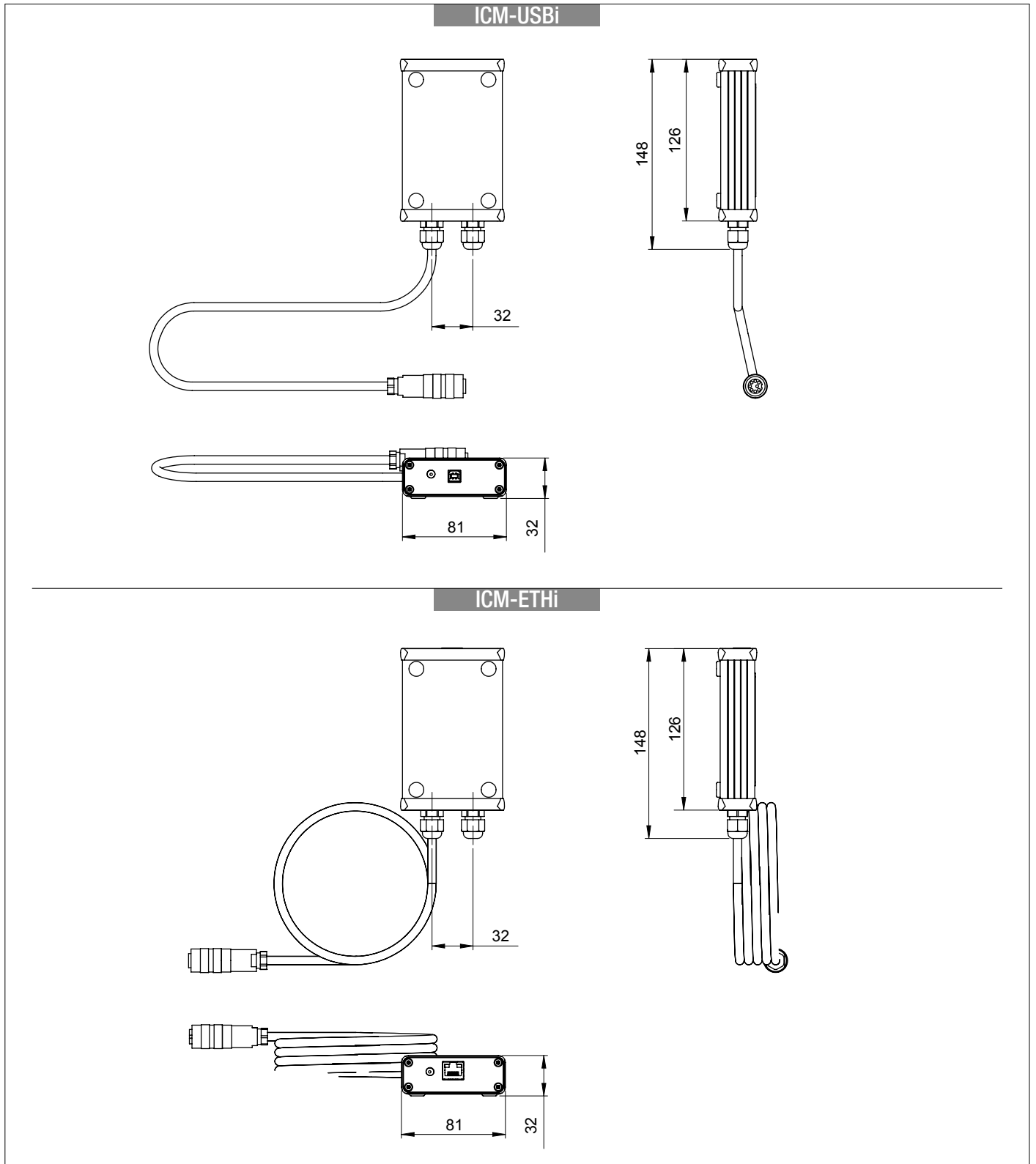
- Robust aluminium construction
- Compact
- Supplied with 3m twisted pair cable as standard.
- All devices can transmit power to the ICM/RDU electrical circuit using the supplied DC power adapter.

ICM-USBi



ICM-ETHi





Designation & Ordering code

ICM-USBi & ICM-ETHi

- Configuration:
- ICM USBi
 - ICM ETHi

Description

Flow Control Valve

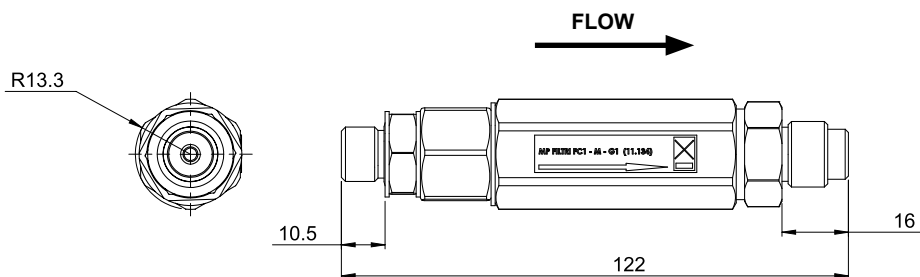
The FC1 is a pressure compensated flow control valve which can operate across a range of fluid types and is compatible with the ICM where flow rate exceeds operating parameters. Max pressure rating 400bar at normal hydraulic system temperatures.

> Features & Benefits

- Pressure compensated
- Regulates flow to within ICM specification
- Various connection options
- Viscosity independent
- Hexagonal form for ease of installation



Dimensions



Designation & Ordering code

ICM-FC1

Series	Configuration example: ICM-FC1 M G1		
ICM-FC1			
Fluid compatibility			
M Mineral oil			
N Offshore fluids			
S Phosphate ester			
Connections			
G1 ICM complete with M16 x 2 pressure test point connections fitted			
G3 1/4" BSP - Female port			
G4 7/16" UNF - Female port			

Description

Screen Filter

The SK0040 coarse screen filter adapter is designed to limit the ingress of large particles into MP Filtri's range of Contamination Monitoring Products (CMP).

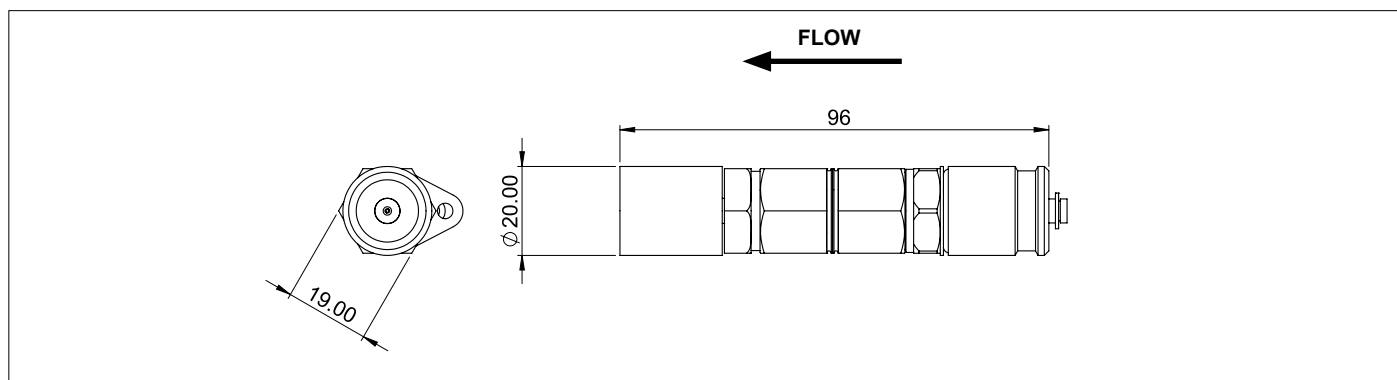
> Features & Benefits

- Part number: SK0040
- Inlet connection: M16x2 male test point
- Outlet connection: M16x2 female thread form
- Pressure rating: 400 bar
- Mesh rating: 600µm



Used with LPA3, LPA2, CML2 and ICM2.0

Dimensions



Designation & Ordering code

SK0040

Configuration:

Description

> Features & Benefits

We supply laboratory standard and certified clean sampling bottles. 100ml, 210ml and 500ml bottle sizes are available and are easily incorporated into our range of bottle samplers.



Designation & Ordering code

BS110 - BS500

For Ordering Codes see page 81.

Description

> Features & Benefits

Replacement hoses.

Pressure Hose

M16x2 Micro bore pressure hose by length (various available) long
Plated steel (alternative material options available)

Pressure hoses are able to connect MP Filtri products directly to your hydraulic systems.

Waste Hose

Length: 2000mm

OD: 8mm

ID: 5mm

Standard material: Polyurethane*

Fitting type: Quick release coupling (brass as standard)

*Other versions available to suit the M, N and S versions of CMP

- LPA3
- LPA2
- CML2
- BS110 - BS500
- ICM 2.0



- LPA3
- LPA2
- CML2



Designation & Ordering code

HOSES

For Ordering Codes see page 81.



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PASSION TO PERFORM



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