CONTAMINATION CONTROL SOLUTIONS

AUTOMATIC PARTICLE COUNTERS
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.
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.
<table>
<thead>
<tr>
<th>FILTERS</th>
<th>Flow rates up to</th>
<th>Pressure up to</th>
<th>Mounting:</th>
</tr>
</thead>
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<tr>
<td>SUCTION FILTERS</td>
<td>875 l/min</td>
<td>560 bar</td>
<td>- Tank immersed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- In-Line</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- In tank with shut off valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- In tank with flooded suction</td>
</tr>
<tr>
<td>RETURN FILTERS</td>
<td>365 l/min</td>
<td>35 bar</td>
<td>- In-Line</td>
</tr>
<tr>
<td>RETURN / SUCTION FILTERS</td>
<td>3000 l/min</td>
<td>80 bar</td>
<td>- In-Line</td>
</tr>
<tr>
<td>SPIN-ON FILTERS</td>
<td>300 l/min</td>
<td>80 bar</td>
<td>- In-Line</td>
</tr>
<tr>
<td>LOW &amp; MEDIUM PRESSURE FILTERS</td>
<td>750 l/min</td>
<td>560 bar</td>
<td>- In-Line</td>
</tr>
<tr>
<td>HIGH PRESSURE FILTERS</td>
<td>3000 l/min</td>
<td>80 bar</td>
<td>- In-Line</td>
</tr>
</tbody>
</table>

Introduction
**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.
CONTAMINATION CONTROL SOLUTIONS

...because contamination costs!
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## HYDRAULIC FLUIDS

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3. EFFECTS OF CONTAMINATION ON HYDRAULIC COMPONENTS
4. MEASURING THE SOLID CONTAMINATION LEVEL
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<th>Page</th>
</tr>
</thead>
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<td>16</td>
</tr>
</tbody>
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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.

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.

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.
CONTAMINATION MANAGEMENT

- **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.

### 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 of a system 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.

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.
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.

<table>
<thead>
<tr>
<th>Class</th>
<th>Number of particles per ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over</td>
</tr>
<tr>
<td>28</td>
<td>1 300 000</td>
</tr>
<tr>
<td>27</td>
<td>640 000</td>
</tr>
<tr>
<td>26</td>
<td>320 000</td>
</tr>
<tr>
<td>25</td>
<td>160 000</td>
</tr>
<tr>
<td>24</td>
<td>80 000</td>
</tr>
<tr>
<td>23</td>
<td>40 000</td>
</tr>
<tr>
<td>22</td>
<td>20 000</td>
</tr>
<tr>
<td>21</td>
<td>10 000</td>
</tr>
<tr>
<td>20</td>
<td>5 000</td>
</tr>
<tr>
<td>19</td>
<td>2 500</td>
</tr>
<tr>
<td>18</td>
<td>1 300</td>
</tr>
<tr>
<td>17</td>
<td>640</td>
</tr>
<tr>
<td>16</td>
<td>320</td>
</tr>
<tr>
<td>15</td>
<td>160</td>
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<td>14</td>
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<td>12</td>
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</tr>
<tr>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>8</td>
<td>1.3</td>
</tr>
<tr>
<td>7</td>
<td>0.64</td>
</tr>
<tr>
<td>6</td>
<td>0.32</td>
</tr>
<tr>
<td>5</td>
<td>0.16</td>
</tr>
<tr>
<td>4</td>
<td>0.08</td>
</tr>
<tr>
<td>3</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>0.02</td>
</tr>
<tr>
<td>1</td>
<td>0.01</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

> 4 μm<sub>33</sub> = 350 particles
> 6 μm<sub>33</sub> = 100 particles
> 14 μm<sub>33</sub> = 25 particles

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 μm<sub>(c)</sub> and 14 μm<sub>(c)</sub> 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

<table>
<thead>
<tr>
<th>Class</th>
<th>Dimension of contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>6÷14 µm</td>
</tr>
<tr>
<td>0</td>
<td>125</td>
</tr>
<tr>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>2</td>
<td>1 000</td>
</tr>
<tr>
<td>3</td>
<td>2 000</td>
</tr>
<tr>
<td>4</td>
<td>4 000</td>
</tr>
<tr>
<td>5</td>
<td>8 000</td>
</tr>
<tr>
<td>6</td>
<td>16 000</td>
</tr>
<tr>
<td>7</td>
<td>32 000</td>
</tr>
<tr>
<td>8</td>
<td>64 000</td>
</tr>
<tr>
<td>9</td>
<td>128 000</td>
</tr>
<tr>
<td>10</td>
<td>256 000</td>
</tr>
<tr>
<td>11</td>
<td>512 000</td>
</tr>
<tr>
<td>12</td>
<td>1 024 000</td>
</tr>
</tbody>
</table>

- 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.

Table 2 - Class for cumulative measurement

<table>
<thead>
<tr>
<th>Class</th>
<th>Dimension of contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;4 µm</td>
<td>&gt;6 µm</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>000</td>
<td>105</td>
</tr>
<tr>
<td>0</td>
<td>390</td>
</tr>
<tr>
<td>0</td>
<td>780</td>
</tr>
<tr>
<td>1</td>
<td>1 560</td>
</tr>
<tr>
<td>2</td>
<td>3 120</td>
</tr>
<tr>
<td>3</td>
<td>6 250</td>
</tr>
<tr>
<td>4</td>
<td>12 500</td>
</tr>
<tr>
<td>5</td>
<td>25 000</td>
</tr>
<tr>
<td>6</td>
<td>50 000</td>
</tr>
<tr>
<td>7</td>
<td>100 000</td>
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<td>8</td>
<td>200 000</td>
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<td>9</td>
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<td>800 000</td>
</tr>
<tr>
<td>11</td>
<td>1 600 000</td>
</tr>
<tr>
<td>12</td>
<td>3 200 000</td>
</tr>
</tbody>
</table>

- 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.

- 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.
CONTAMINATION MANAGEMENT

- 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.

### 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.**

<table>
<thead>
<tr>
<th>ISO 4406:2017</th>
<th>SAE AS4059 Table 2</th>
<th>SAE AS4059 Table 1</th>
<th>NAS 1638</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 4 μm(c) 6 μm(c) 14 μm(c)</td>
<td>&gt; 4 μm(c) 6 μm(c) 14 μm(c)</td>
<td>4-6 6-14 14-21 21-38 38-70 &gt;70</td>
<td>5-15 15-25 25-50 50-100 &gt;100</td>
</tr>
<tr>
<td>23 / 21 / 18</td>
<td>13A / 12B / 12C</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>22 / 20 / 17</td>
<td>12A / 11B / 11C</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>21 / 19 / 16</td>
<td>11A / 10B / 10C</td>
<td>10</td>
<td>10</td>
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<tr>
<td>20 / 18 / 15</td>
<td>10A / 9B / 9B</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>19 / 17 / 14</td>
<td>9A / 8B / 8C</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>18 / 16 / 13</td>
<td>8A / 7B / 7C</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>17 / 15 / 12</td>
<td>7A / 6B / 6C</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>16 / 14 / 11</td>
<td>6A / 5B / 5C</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>15 / 13 / 10</td>
<td>5A / 4B / 4C</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>14 / 12 / 09</td>
<td>4A / 3B / 3C</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### 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.

**TYPICAL WATER SATURATION LEVEL FOR NEW OILS**

Examples:

- Hydraulic oil @ 30°C = 200ppm = 100% saturation
- Hydraulic oil @ 65°C = 500ppm = 100% saturation

![Graph showing water content vs. temperature]
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 \( \beta_{1000} = 1000 \)).

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

[Diagram of filter element]
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
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.
Technical data

**Technology**
LED Based Light Extinction Automatic Optical Particle Counter

**Particle Sizing**
>4, 6, 14, 21, 25, 38, 50, 70 μm(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)
GB/T14039 Code 8 to 24
GJB4208B 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**
± 1/2 code for 4, 6, 14μ(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) ±3%

**Temperature Measurement**
±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

---

**LPA3**

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

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

<table>
<thead>
<tr>
<th><strong>Technology</strong></th>
<th>Twin laser and twin optical diode detectors Based Light Extinction Automatic Optical Particle Analyser</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Particle Sizing</strong></td>
<td>&gt;4, 6, 14, 21, 25, 38, 50, 70 μm to ISO 4406:2017 Standard</td>
</tr>
<tr>
<td><strong>Analysis range</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Better than 3% typical</td>
</tr>
<tr>
<td><strong>Calibration</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Viscosity range</strong></td>
<td>Up to 400 cSt</td>
</tr>
<tr>
<td><strong>Fluid temperature</strong></td>
<td>- From +5 °C to +80 °C</td>
</tr>
<tr>
<td><strong>Pressure Max</strong></td>
<td>400 bar (gauge) - minimum 2 bar (gauge) required</td>
</tr>
<tr>
<td><strong>Sample Volume / Test time</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Moisture Sensing</strong></td>
<td>% RH (Relative Humidity) ±3%</td>
</tr>
<tr>
<td><strong>Temperature Measurement</strong></td>
<td>±3%</td>
</tr>
<tr>
<td><strong>Data Storage</strong></td>
<td>600 test</td>
</tr>
<tr>
<td><strong>System Pressure Measurement</strong></td>
<td>+/- 0.5% Full Scale Accuracy Min 10 bar</td>
</tr>
<tr>
<td><strong>Communication options</strong></td>
<td>RS232 9 pin D plug</td>
</tr>
<tr>
<td><strong>Ambient Temperature min / max</strong></td>
<td>-10 °C to +80 °C</td>
</tr>
<tr>
<td><strong>Environmental Protection</strong></td>
<td>IPS1 (lid open)</td>
</tr>
<tr>
<td><strong>Weight / Dimensions</strong></td>
<td>9.8 kg, Height 210mm, Depth 260mm, Width 430mm</td>
</tr>
<tr>
<td><strong>Electrical Supply</strong></td>
<td>Voltage 9-36V DC</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>Internal rechargeable battery (mains charger)</td>
</tr>
<tr>
<td><strong>Outer Casing Finish</strong></td>
<td>Anodised Aluminium</td>
</tr>
<tr>
<td><strong>Wetted parts</strong></td>
<td>M - C46400 Cu alloy, 316 stainless steel, FPM, FR4, sapphire.</td>
</tr>
<tr>
<td></td>
<td>N - 316 stainless steel, FPM, sapphire.</td>
</tr>
<tr>
<td></td>
<td>S - 316 stainless steel, perfluoro elastomer, sapphire, EPDM</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td>LPA View software (included)</td>
</tr>
<tr>
<td><strong>LPA2</strong></td>
<td>LPA2 is supplied with a full software package and digital product information</td>
</tr>
</tbody>
</table>
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 μm(c) and 6 μm(c) giving increased accuracy with excellent repeatability.

Laser 2
Standard accuracy laser specifically designed for system contaminants between 6 μm(c) and 70 μm(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 real-time, 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
## Designation & Ordering code

### AUTOMATIC PARTICLE COUNTER LPA2

<table>
<thead>
<tr>
<th>Series</th>
<th>Configuration example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPA2</td>
<td>LPA2 W P M S X 30</td>
</tr>
<tr>
<td>Moisture Sensor</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Without moisture and temperature sensor</td>
</tr>
<tr>
<td>W</td>
<td>With moisture and temperature sensor</td>
</tr>
<tr>
<td>Pressure Sensor</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Without on-screen inlet pressure display</td>
</tr>
<tr>
<td>P</td>
<td>With on-screen inlet pressure display</td>
</tr>
<tr>
<td>Fluid compatibility</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Mineral oil</td>
</tr>
<tr>
<td>N</td>
<td>Subsea fluids and water based fluids (*)</td>
</tr>
<tr>
<td>S</td>
<td>Phosphate ester and aggressive fluids (*)</td>
</tr>
<tr>
<td>Accessories</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Standard unit with carry bag</td>
</tr>
<tr>
<td>T</td>
<td>Standard unit with travel case</td>
</tr>
<tr>
<td>Bottle sampling options</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Without bottle sampling</td>
</tr>
<tr>
<td>Design Reference</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>(*) N and S version, moisture sensor (W) not available</td>
</tr>
</tbody>
</table>
CML2
Compact Twin Laser Contamination Monitor
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.
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 μm 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) ±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)
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 μm(c) and 6 μm(c) giving increased accuracy with excellent repeatability.

Laser 2

Standard accuracy laser specifically designed for system contaminants between 6 μm(c) and 70 μm(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
**Designation & Ordering code**

<table>
<thead>
<tr>
<th>AUTOMATIC PARTICLE COUNTER CML2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series</strong></td>
</tr>
<tr>
<td>CML2</td>
</tr>
<tr>
<td><strong>Moisture Sensor (RH%)</strong></td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>W</td>
</tr>
<tr>
<td><strong>Fluid compatibility</strong></td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>S</td>
</tr>
<tr>
<td><strong>Option</strong></td>
</tr>
<tr>
<td>S</td>
</tr>
<tr>
<td><strong>Option bottle sampler</strong></td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td><strong>Series</strong></td>
</tr>
<tr>
<td>41</td>
</tr>
</tbody>
</table>

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

**Dimensions**

- **397.24**
- **331.43**
- **149.96**
- **345.34**
- **297.95**
- **112.88**
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 μm(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**
± ½ code for 4,6,14 μm(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) ±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)
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

**TYPICAL PRESSURE LINE**

- Check valve 0.5 - 2 bar typical
- PC/Laptop power supply USBI

**TYPICAL RETURN LINE**

- Check valve 0.5 - 2 bar typical
- PC/Laptop power supply USBI

For installation guidance please visit www.mpfiltri.co.uk/ICM-2.0/#Home
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).

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).
ATEX Fluid Contamination Monitors

AZ2
**Description**

**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 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

![Front facing view](image1)

![Right facing view](image2)

![Top facing view](image3)

![Bottom facing view](image4)
Technical data

**Technology**
LED Based Light Extinction Automatic Optical Contamination Monitor

**Particle Sizing**
>4, 6, 14, 21, 25, 38, 50, 70 μm (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**
± ½ code for 4,6,14μm(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) ±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.
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.

**Designation & Ordering code**

**AUTOMATIC PARTICLE COUNTER AZ2**

<table>
<thead>
<tr>
<th>Configurations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICM W M K R G1 AZ2</td>
<td>Moisture Sensor, Mineral / Petroleum based fluids, LCD Display, Relays, M16 x 2 Minimess Connections</td>
</tr>
<tr>
<td>ICM O M K R G1 AZ2</td>
<td>Mineral / Petroleum based fluids, LCD Display, Relays, M16 x 2 Minimess Connections</td>
</tr>
<tr>
<td>ICM O N K R G1 AZ2</td>
<td>Off shore / Water based fluids, LCD Display, Relays, M16 x 2 Minimess Connections</td>
</tr>
<tr>
<td>ICM O S K R G1 AZ2</td>
<td>Phosphate Ester and aggressive fluids, LCD output, Relays, M16x2 Minimess Connections</td>
</tr>
</tbody>
</table>
ICU

In-line Contamination Monitoring Unit
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
### Technical data

**Technology**
LED Based Light Extinction Automatic Optical Contamination Monitor

**Particle Sizing**
>4, 6, 14 μm(c) to ISO 4406:2017 Standard

**Analysis range**
ISO 4406:2017 Code 0 to 20

**Accuracy**
± ½ code for 4,6,14 μm(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

![Diagram of Automatic Particle Counters]

- **Required Surface Finish of Mating Piece**
  - 0.02/100mm

- **Mounting Interface**
  - Dimensions as shown in the diagram.
### AUTOMATIC PARTICLE COUNTER ICU

<table>
<thead>
<tr>
<th>Designation &amp; Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU O M O O G5 P01</td>
</tr>
<tr>
<td>ICU O M O O G5 Px</td>
</tr>
</tbody>
</table>

**Configurations:**
- Without moisture sensor, Mineral oil, Without keypad/display, 4 to 20mA timed multiplex, Manifold mounted, Standard option
- Customized version
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

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-Line contamination monitor</strong></td>
<td>ICM with keypad and backlit display and relays</td>
</tr>
<tr>
<td><strong>Particle Sizing</strong></td>
<td>As ICM: &gt;4, 6, 14, 21, 25, 38, 50, 70 μm&lt;sub&gt;c&lt;/sub&gt; to ISO 4406:2017 Standard</td>
</tr>
<tr>
<td><strong>Fluid Compatibility / Corrosion Resistance</strong></td>
<td>Hydrocarbon based &amp; Synthetic hydraulic fluids</td>
</tr>
<tr>
<td><strong>Circuit Flow Rate</strong></td>
<td>40 ml/min to 400 ml/min</td>
</tr>
<tr>
<td><strong>Viscosity range</strong></td>
<td>Max. 1000 cSt - Min. 10 cSt</td>
</tr>
<tr>
<td><strong>Communication Options</strong></td>
<td>PLC compatible. RS485, RS232 &amp; CanBus (J1939 typical)</td>
</tr>
</tbody>
</table>
| **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 (1013 mbar 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**

**Designation & Ordering code**

<table>
<thead>
<tr>
<th>Series</th>
<th>ACMU</th>
<th>Configuration example</th>
<th>Motor option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ACMU</td>
<td>110V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W</td>
<td>110V Motor (Dual frequency 50Hz/60Hz, single phase)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
<td>230V Motor (single phase)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>400V Motor (3 phase)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>690V Motor (3 phase)</td>
</tr>
</tbody>
</table>

(*) Gauge pressure

LIFTING EYES: Yes x 4 DIN 580, WLL 3400N at 45° (~340K)

LIFTING EYES: Yes x 2 WLL 16000N (~1600Kg)
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

Automatic Particle Counters

ACMU
BS110 & BS500

Bottle Samplers - For use with MP Filtri’s portable APC
BS110 GENERAL INFORMATION

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.
### Technical data

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Chamber Pressure</td>
<td>2.5 bar (36.3 psi) only</td>
</tr>
<tr>
<td>Min. Chamber Pressure</td>
<td>0.61 bar (8.85 psi) to 0.81 bar (11.75 psi)</td>
</tr>
<tr>
<td>For use with...</td>
<td>MP Filtri Portable Contamination Monitoring Products</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>12v, 2 amp</td>
</tr>
<tr>
<td>Wetted Parts (Internal)</td>
<td>Aluminium HE30, 303 Stainless Steel, Polyurethane, FPM, Acrylic</td>
</tr>
<tr>
<td>On/off &amp; Stop/Start signals</td>
<td>Switch (Manual Operation)</td>
</tr>
<tr>
<td>Hydraulic Hoses (External)</td>
<td>600mm x 2mm ID Microbore minimess hose</td>
</tr>
<tr>
<td>Max Flow Rate (ml/min)</td>
<td>Viscosity dependant</td>
</tr>
<tr>
<td>Min Flow Rate (ml/min)</td>
<td>Viscosity dependant</td>
</tr>
<tr>
<td>Visual Pressure Indicator</td>
<td>No</td>
</tr>
<tr>
<td>Weight</td>
<td>7 kg</td>
</tr>
<tr>
<td>Pressure Gauge</td>
<td>No</td>
</tr>
<tr>
<td>Pressure Ranges</td>
<td>2.0 bar (29 psi) options</td>
</tr>
<tr>
<td>IP Rating</td>
<td>IP50</td>
</tr>
<tr>
<td>Fluid Compatibility / Corrosion Resistance</td>
<td>Industrial Hydrocarbon based fluids (typical)</td>
</tr>
<tr>
<td>Min Outlet Pressure</td>
<td>1013 mbar (14.7 psi)</td>
</tr>
<tr>
<td>Max. Fluid Temperature (Continuous)</td>
<td>80°C/176°F</td>
</tr>
<tr>
<td>Min Fluid Temperature</td>
<td>Viscosity dependant</td>
</tr>
<tr>
<td>Max. Viscosity</td>
<td>400 cSt</td>
</tr>
<tr>
<td>Min. Viscosity</td>
<td>1 cSt</td>
</tr>
<tr>
<td>Max outlet pressure</td>
<td>2.0 bar (29 psi) options</td>
</tr>
<tr>
<td>Min. Continuous Ambient Temperature</td>
<td>10°C/50°F</td>
</tr>
<tr>
<td>Max. Continuous Ambient Temperature</td>
<td>55°C/131°F</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>24W</td>
</tr>
<tr>
<td>Warranty</td>
<td>12 months</td>
</tr>
<tr>
<td>Installation</td>
<td>Indoor Use / Laboratory Use</td>
</tr>
</tbody>
</table>

**Connection to use with Particle Analyser**

- **Vacuum cap (not illustrated)**
- **Pressure cap (as illustrated)**
- **Sample bottle**
- **Disposal dip tube**
- **HP connector**
- **Waste connector**
- **To waste bottle**
**BS110**  
**Bottle Samplers**

**Dimensions**

![Diagram of BS110 Bottle Samplers]

**Designation & Ordering code**

<table>
<thead>
<tr>
<th>BOTTLE SAMPLER BS110</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series</strong></td>
</tr>
<tr>
<td>BS110  110ml fluid volume</td>
</tr>
<tr>
<td><strong>Fluid compatibility</strong></td>
</tr>
<tr>
<td>M  Mineral oil and synthetic fluids</td>
</tr>
<tr>
<td><strong>Pressure rating</strong></td>
</tr>
<tr>
<td>0  2 bar</td>
</tr>
<tr>
<td><strong>Pressure cylinder option</strong></td>
</tr>
<tr>
<td>0  Acrylic cylinder assembly</td>
</tr>
</tbody>
</table>

Configuration example: BS110 M 0 0
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.

**Automatic Particle Counters**

**Bottle Samplers**

- 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.
### Technical data

<table>
<thead>
<tr>
<th><strong>Max. Chamber Pressure</strong></th>
<th>2.5bar (36.3psi) (standard), 4.5bar (65.3psi) (high pressure)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Min. Chamber Pressure</strong></td>
<td>0.61bar (8.85psi) to 0.81bar (11.75psi)</td>
</tr>
<tr>
<td><strong>For use with...</strong></td>
<td>MP Filtri Portable Contamination Monitoring Products</td>
</tr>
<tr>
<td><strong>Supply Voltage</strong></td>
<td>12v, 5 amp</td>
</tr>
<tr>
<td><strong>Wetted Parts (Internal)</strong></td>
<td>Aluminium 6082 T6, 303 Stainless Steel, 316 Stainless Steel. Seal &amp; Cylinder material optional</td>
</tr>
<tr>
<td><strong>On/off &amp; Stop/Start signals</strong></td>
<td>Switch (Manual Operation)</td>
</tr>
<tr>
<td><strong>Hydraulic Hoses (External)</strong></td>
<td>600mm x 2mm ID Microbore minimess hose</td>
</tr>
<tr>
<td><strong>Max Flow Rate (ml/min)</strong></td>
<td>Viscosity dependant</td>
</tr>
<tr>
<td><strong>Min Flow Rate (ml/min)</strong></td>
<td>Viscosity dependant</td>
</tr>
<tr>
<td><strong>Visual Pressure Indicator</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>9kg</td>
</tr>
<tr>
<td><strong>Pressure Gauge</strong></td>
<td>Yes (only on 4.5bar version)</td>
</tr>
<tr>
<td><strong>Pressure Ranges</strong></td>
<td>4.5bar (65.3psi) or 2.5bar (36.3psi) options</td>
</tr>
<tr>
<td><strong>IP Rating</strong></td>
<td>IP50</td>
</tr>
</tbody>
</table>

**Fluid Compatibility / Corrosion Resistance**
Industrial, aerospace & off-shore control fluids (typical)

<table>
<thead>
<tr>
<th><strong>Min Outlet Pressure</strong></th>
<th>1013mbar (14.7psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. Fluid Temperature (Continuous)</strong></td>
<td>80°C/176°F</td>
</tr>
<tr>
<td><strong>Min Fluid Temperature</strong></td>
<td>Viscosity dependant</td>
</tr>
<tr>
<td><strong>Max. Viscosity</strong></td>
<td>Not greater than 400cSt (on 2.5bar version)</td>
</tr>
<tr>
<td><strong>Min. Viscosity</strong></td>
<td>1 cSt</td>
</tr>
<tr>
<td><strong>Max outlet pressure</strong></td>
<td>Version dependant: 2.5bar (36.3psi) for O version 4.5bar (65.3psi) for H version</td>
</tr>
<tr>
<td><strong>Min. Continuous Ambient Temperature</strong></td>
<td>10°C/50°F</td>
</tr>
<tr>
<td><strong>Max. Continuous Ambient Temperature</strong></td>
<td>55°C/131°F</td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>60W</td>
</tr>
<tr>
<td><strong>Warranty</strong></td>
<td>12 months</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>Indoor Use / Laboratory Use</td>
</tr>
</tbody>
</table>

**Connection to use with Particle Analyser**
- Sample bottle
- Dip tube
- Removable top unit
- Bayonet locking mechanism
- Operating mode selector
- Base unit
- Top handle
- Top valve
- Hose connection to Analyser
- Visiwick
- On/Off switch
BS500 Bottle Samplers

Dimensions

Configuration example: BS500 V O 0 UK

Designation & Ordering code

<table>
<thead>
<tr>
<th>Series</th>
<th>Fluid compatibility</th>
<th>Pressure rating</th>
<th>Pressure cylinder option</th>
<th>Power adapter options</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS500</td>
<td>500ml fluid volume</td>
<td>2 bar, standard option</td>
<td>Acrylic cylinder assembly</td>
<td>UK power adapter</td>
</tr>
<tr>
<td></td>
<td>Mineral oil and synthetic fluids, Subsea and water based fluids</td>
<td>4 bar, high pressure option (*)</td>
<td>Glass cylinder assembly (**)</td>
<td>EU European power adapter</td>
</tr>
<tr>
<td></td>
<td>Phosphate ester and aggressive fluids</td>
<td></td>
<td></td>
<td>US USA power adapter</td>
</tr>
<tr>
<td></td>
<td>Phosphate ester and aggressive fluids, Mineral oil and synthetic fluids, Subsea and water based fluids</td>
<td></td>
<td></td>
<td>AU/CN Australasia power adapter</td>
</tr>
</tbody>
</table>

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

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

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.

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>Part Code</th>
<th>Dimensions (mm)</th>
</tr>
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<tbody>
<tr>
<td>100 ml - Ultra Clean Bottle (Certified)</td>
<td>P02</td>
<td>Ø 50x92</td>
</tr>
<tr>
<td>100 ml - Standard Bottle Brown Glass</td>
<td>BS0016</td>
<td>Ø 50x91</td>
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<tr>
<td>100 ml - Clear Plastic Bottle</td>
<td>7.111</td>
<td>Ø 51x92</td>
</tr>
<tr>
<td>100 ml - Standard Bottle Tray (72 bottles)</td>
<td>BS0072</td>
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<tr>
<td>210 ml - Ultra Clean Bottle (Certified)</td>
<td>P03</td>
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</tr>
<tr>
<td>210 ml - Standard Bottle</td>
<td>8.054</td>
<td>Ø 65x122</td>
</tr>
<tr>
<td>500 ml - Standard Bottle</td>
<td>8.328</td>
<td>Ø 82x152</td>
</tr>
</tbody>
</table>

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

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.

**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.

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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.

**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 the 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 ø 47-1.2 μm

**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 ø 25-0.8 μm 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
HYDROCARBON AND SYNTHETIC

<table>
<thead>
<tr>
<th>Fluid type</th>
<th>Fluid spec.</th>
<th>ICM</th>
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<th>CML</th>
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<th>BS500</th>
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</table>

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 on product performance with fluid viscosity at 20°C in standard dye coulourant 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.

Compatible  Not compatible  Contact MP Filtri
# FLUID COMPATIBILITY CHARTS

## OFFSHORE & SELECTED WATER BASED FLUIDS

<table>
<thead>
<tr>
<th>Fluid type</th>
<th>Fluid spec.</th>
<th>ICM</th>
<th>LPA</th>
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## AGGRESSIVE FLUIDS

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</table>

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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 on 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.
## FUELS

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<td>BIO-DIESEL</td>
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<td>SUNFLOWER OIL</td>
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<td>RAPSEED OIL</td>
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<td>CORN OIL</td>
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<td>GROUND NUT OIL</td>
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<td>N</td>
<td>S</td>
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<td>CAT BIO HYDO HEES</td>
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<td>M</td>
<td>N</td>
<td>S</td>
<td>M</td>
<td>N</td>
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</tbody>
</table>

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 on 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.
<table>
<thead>
<tr>
<th>Description</th>
<th>Ordering Code</th>
<th>LPA3</th>
<th>LPA2</th>
<th>CML</th>
<th>ICM</th>
<th>BS110</th>
<th>BS500</th>
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<tbody>
<tr>
<td>Minimess Hose Extension kit - 5000mm</td>
<td>SK0500</td>
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<td>Coarse Screen Filter</td>
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<td>●</td>
<td>●</td>
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<tr>
<td>LPA2 Carry Bag</td>
<td>CB0001</td>
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<td>Calibration Verification Fluid</td>
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<tr>
<td>Waste Bottle (1 Litre) - Round</td>
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<tr>
<td>Waste Bottle (1 Litre) - Square (for use with CB0001)</td>
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<tr>
<td>Minimess Pressure Hose - 1500mm, plated steel (mineral/synthetic fluid)</td>
<td>95.Y30Y30X261150</td>
<td>●</td>
<td>●</td>
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<td>●</td>
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<tr>
<td>Minimess Pressure Hose - 600mm, plated steel (mineral/synthetic fluid)</td>
<td>95.Y30Y30X261060</td>
<td>●</td>
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<td>●</td>
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<td>●</td>
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<tr>
<td>Minimess Pressure Hose - Stainless Steel, for use with offshore fluids (N version of CMP units) - 1500mm</td>
<td>95.Y30Y30X161150</td>
<td>●</td>
<td>●</td>
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<tr>
<td>Minimess Pressure Hose - Stainless Steel, for use with offshore fluids (N version of CMP units) - 600mm</td>
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<td>SK0014S30S</td>
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<td>Impact printer paper for use with Series 20 &amp; 30 - single</td>
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<td>Printer ribbon for use with Series 20 &amp; 30 - single</td>
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<td>●</td>
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<td>Printer ribbon for use with Series 20 &amp; 30 - pack of 10</td>
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<td>12V, 2A Power Adapter - UK</td>
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<td>●</td>
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<td>Disposable Dip tubes - pack of 50</td>
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<td>Hand Pump</td>
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<td>Bottle Sampler hand pump and hose kit</td>
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<td>●</td>
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<td>Serial cable to USB converter</td>
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<td>Black support case (without contents)</td>
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<td>Heavy Duty Travel Case for LPA2</td>
<td>TC0005LPA</td>
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<td>Heavy Duty Travel Case for Bottle Sampler</td>
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<td>PC Download cable</td>
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<td>100ml Standard Brown Glass Bottle</td>
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<td>Tray of 72 x 100ml Standard Brown Glass Bottles</td>
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<td>100ml Clear Plastic Bottle</td>
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<td>Box of 20 x 100ml Clear Plastic Bottles</td>
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<tr>
<td>200ml Standard Clear Glass Bottle</td>
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<td>●</td>
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<td>Box of 20 x 200ml Standard Clear Glass Bottles</td>
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<td>500ml Standard Clear Glass Bottle</td>
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<tr>
<td>100ml Ultra-clean Clear Glass bottle, Cleared in accordance with DIN/ISO 5584 and verified to ISO3722</td>
<td>8,029</td>
<td>●</td>
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<tr>
<td>Pack of 25 x 100ml Ultra-clean Clear Glass bottles, Cleared in accordance with DIN/ISO 5584 and verified to ISO3722</td>
<td>8,031</td>
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<tr>
<td>200ml Ultra-clean Clear Glass bottle, Cleared in accordance with DIN/ISO 5584 and verified to ISO3722</td>
<td>8,032</td>
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<tr>
<td>Pack of 20 x 200ml Ultra-clean Clear Glass bottles, Cleared in accordance with DIN/ISO 5584 and verified to ISO3722</td>
<td>8,033</td>
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<td>Power Adapter for 500ml Bottle Sampler</td>
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<td>UK Lead for 8.029</td>
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<td>EU Lead for 8.029</td>
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<td>●</td>
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<tr>
<td>US Lead for 8.029</td>
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<td>CN/ AUS Lead for 8.029</td>
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<tr>
<td>Pouch for pressure hose/waste hose</td>
<td>7,106000</td>
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<td>USB A-B cable</td>
<td>11,081000</td>
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<tr>
<td>USB stick with all user guides and LPA-View Software</td>
<td>13,050001</td>
<td>●</td>
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<td>Fluid Condition Handbook</td>
<td>200,059</td>
<td>●</td>
<td>●</td>
<td>●</td>
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</tr>
</tbody>
</table>
Accessories
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 ICM-RDU 2.0
- 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
Dimensions

Designation & Ordering code

RDU 2.0

Configuration: ICM RDU 2.0
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.

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.
ACCESSORIES

ICM-USBi & ICM-ETHi

Dimensions

ICM-USBi

ICM-ETHi

Designation & Ordering code

ICM-USBi & ICM-ETHi

Configuration:  

ICM  USBi

ICM  ETHi
ICM-FC1

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 400barg 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

![Flow Control Valve Dimensions](image)

Designation & Ordering code

<table>
<thead>
<tr>
<th>Fluid compatibility</th>
<th>Configuration example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Mineral oil</td>
<td>ICM-FC1 M G1</td>
</tr>
<tr>
<td>N Offshore fluids</td>
<td></td>
</tr>
<tr>
<td>S Phosphate ester</td>
<td></td>
</tr>
</tbody>
</table>

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**

![Dimensions Diagram]

**Designation & Ordering code**

| Configuration | SK0040 |
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.

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

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**Designation & Ordering code**

For Ordering Codes see page 81.
HEADQUARTERS

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PASSION TO PERFORM