CONTAMINATION MONITORING PRODUCTS

INSTALLATION, SERVICE AND MAINTENANCE MANUAL

ICMK2.0 AZ2

ATEX-CERTIFIED INLINE CONTAMINATION MONITOR

EN

PASSION TO PERFORM

MP FILTRI®

ENGLISH

PRODUCT OVERVIEW

ICMK2.0 AZ2 - HAZARDOUS ENVIRONMENT INLINE CONTAMINATION MONITOR

The ICMK2.0 AZ2 contamination monitor can automatically measure and save 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 in high risk or explosive environments is required.

Features & Benefits

- ATEX zone II Cat. 3G
- Calibrated to relevant ISO standards
- Manual, automatic and remote control flexibility
- Various communication protocols as standard inc: RS485/MODBUS, CANBUS, 4-20mA
- Award-winning CMP View analysis software
- 8-channel contamination measurement and display
- Measures and displays the following international standard formats: ISO 4406, ISO 11218, NAS 1638, AS 4059 revision E&G Table 1 & 2, GJB420B, GBT14039, GOST 17216, GBT14039, GJB420B
- Moisture and temperature sensing (fluid dependent)
- Data logging and 4000 test result memory
- Multicolour indicators via LCD screen with output alarm signals as standard
- Robust die cast stainless steel construction (Max pressure 420 bar / 6091 PSI)
- Environmental protection IP66

ATEX certification

II 3 G Ex nR IIB T5 GC IP66

Product Presentation

The ICMK2.0 AZ2 measures and quantifies the numbers of solid contaminants in Hydraulic, Lubrication and Transmission applications. The unit is designed to be an accurate instrument for applications utilising mineral oil as the operating fluid. Other fluid media versions are available for offshore [N] and aerospace phosphate ester [S] applications.

The unit can operate using any of the international standard formats:
ISO 4406
ISO 11218
NAS 1638
AS 4059 revision G Table 1 & 2
GJB420B
GBT14039
GOST 17216
GBT14039
GJB420B

The integrated data logger records up to 4000 test results internally

The instrument utilises the light extinction principle whereby a specially collimated precision LED light source is used to illuminate the test media, this light is then captured via a photodiode module. When a particle passes through the beam it reduces the amount of light received by the diode, and from this change in condition, the size of the particle can be deduced and subsequently counted.

Product features

Moisture sensor

The ICMK2.0 AZ2 models measure water content using a capacitive RH (relative humidity) sensor. The result is expressed as percentage saturation. 100% RH corresponds to the point at which free water exists in the fluid, i.e. the fluid is no longer able to hold the water in a dissolved solution.

This is also normally the point at which significant damage occurs in a hydraulic system, so is an ideal measurement scale that is independent of the fluid characteristics.

The water saturation point (100% RH) is temperature dependent, so the temperature is measured at the same time.
This enables results to be compared meaningfully.

The temperature measured is that of the fluid passing through the unit.

Note: This may differ from that of the hydraulic system, depending on flow rate, pipe length and ambient temperature.

It is not intended to be an accurate indication of system temperature, but to provide a reference for the RH measurement at the point of sample. Nevertheless, experience has shown the temperature measured is within a few degrees of that of the hydraulic system, in most applications.

PRODUCT OVERVIEW

Data logger

The ICMK2.0 AZ2 includes a built-in data logger, which adds the facility to log and timestamp test results locally within an internal memory, even when not connected to a computer.

- Test logging is determined by the log settings
- Each log entry is time-stamped and contains the device serial number, so that it can be identified later.
- The device memory has space for around 4000 log entries. When full, the oldest log entry is overwritten.

ATEX CERTIFICATION

II 3 G Ex nR IIB T5 GC IP66

Disclaimer

As a policy of continual improvement, MP Filtri reserves the right to alter the specification without prior notice.

DECLARATION OF CONFORMITY

CE Declaration of Conformity

The products included in this Declaration are all variants of the following:

- With or without a moisture sensor
- Compatible with mineral oil/ synthetic fluids, offshore fluids, phosphate esters (inc aerospace)
- With a keypad display
- With relay outputs
- With RS485 Modus, Canbus, and 4-20mA outputs

For part codes see the Designation & Ordering Code

Product Manufacturer:
MP Filtri UK Ltd
Keep House
Vale Park
Evesham
Worcestershire
WR11 1LB
01386 258500
sales-uk@mpfiltri.com

The products described are in conformity with the following directives:

2014/30/EU Electromagnetic Conformity

Certification Testing that has been carried out is in accordance with:

- DEF STAN 00-35 Part 3 issue 4 Environmental Test Methods
- BS EN 60068 range of standards covering environmental conditions
- BS EN 60529: 1992 + A2:2013 Degrees of Protection provided by enclosures (IP Code)
- BS EN 62262:2002 Degrees of Protection Provided for Electrical Equipment against External Mechanical Impacts (IK Code)
- BS EN 60721-3-4: 1995 Part 3: Classification of Groups of Environmental Parameters and their severities, Section 3.4

Date: September 2024

Signed:
Kris Perks (Engineering Director) on behalf of MP Filtri UK Ltd

TABLE OF CONTENTS

1. General warnings and information for the operator

1.1 General safety warnings

Do not operate, maintain or carry out any procedure before reading this manual. Any individual operating the unit shall wear the following Personal Protective Equipment:

- Protective eyewear
- Safety shoes
- Gloves
- Overalls (or other suitable protective clothing)

Before carrying out any machine installation procedures and/or before use, one should scrupulously follow the instructions listed in this manual. Moreover, it is necessary to comply with the current regulations related to occupational accident prevention and safety in the workplace.

Notices aimed at the prevention of health hazards for personnel operating the machine are highlighted in this document with signs having the following meaning:

It relates to important information concerning the product, its use or part of this documentation to which special attention must be paid

It means that failure to comply with the relevant safety regulations may result in mild injury or property damage.

It means that failure to comply with the relevant safety regulations may result in death, serious injury or serious property damage.

Failure to comply with the relevant safety regulations may result in death, serious injury or serious property damage.

GENERAL WARNINGS

To allow rapid identification of the employees who must read this manual, definitions have been used with the following meaning:

OPERATOR	This is any individual whose task is to use the machine for production purposes. The operator is aware of all the measures taken by the machine manufacturer in order to eliminate any source of injury risk in the workplace and takes into account the operational constraints.
PERSONNEL INVOLVED IN SLINGING AND HOISTING OPERATIONS	This is any individual whose task is to handle the machine or parts of it. Personnel involved in slinging and hoisting operations are aware of the issues regarding the safe transfer of machinery or parts of it and, therefore, uses appropriate lifting equipment, following the instructions provided by the product manufacturer.
MACHINE SETTER	This is any individual whose task is to set up the machine for its operation. The machine setter is aware of the measures taken to eliminate all sources of injury risks in the workplace and takes into account the operational constraints. The machine setter takes all the appropriate precautions in order to operate in utmost safety conditions.
MAINTENANCE TECHNICIAN	This is any individual whose task is to carry out maintenance activities on the machine. The maintenance technician is aware of the possible danger situations that may arise and takes the appropriate precautions in order to eliminate the risks of accidents in the workplace.
ELECTRICIAN	This is any individual whose task is to carry out maintenance activities on the electrical wiring of the machine. The electrician is aware of the possible danger situations that may arise and takes the appropriate precautions in order to eliminate the risks of accidents in the workplace.

The unit shall be taken out of service and/or dismantled in accordance with the current regulations in force in the country where the machinery is installed

CAUTION

1.2 Dangers and hazards that cannot be eliminated

- Risk of hydraulic injection injury
- Burn risk because of high temperatures
- Accidental oil leaks with consequent risk of slipping
- Hose breakage and resulting lubricant loss
- With oil temperatures exceeding 40/45 °C (100/115 °F), it is vital to be extremely careful when handling the unit. Avoid direct contact with hot oil.

AFTER USE - ALL EQUIPMENT SHOULD BE ALLOWED TO COOL PRIOR TO HANDLING

1.3 Personal protective equipment

When operating the unit, personnel must be wearing safety shoes, gloves and goggles/safety glasses. In general, the PPEs to be used according to the activities on the machinery are listed in the following table:

ACTIVITY	PPE
Ordinary operation	Shoes, gloves, goggles, overall 
Planned maintenance	Shoes, gloves, goggles, overall

1.5 Precautions related to product handling of the Liquid Crystal Touchscreen display

- If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water
- Avoid any strong mechanical shock which can break the glass.

2. Transportation and Storage

2.1 Transportation and handling conditions

The unit is shipped in a cardboard box with appropriate protective packaging and these should be recycled accordingly where possible. The packed weight of the device and accessories is 14kg.

2.2 Storage

The unit should be stored in a suitable location away from the production area when not in use. The unit should be stored with the caps provided on the ports. This location should not impede any other production or personnel.

WARRANTY

3. Warranty, Limitations and Disclaimers

MP Filtri warrants that the products that it manufactures and sells will be free from defects in material, workmanship & performance for a period of 12 months from the date of shipment.

Hardware/Firmware

Should the hardware prove defective during the warranty period, MP Filtri, at its discretion, will either repair the defective product or replace it with an equivalent product in exchange for the defective unit without charge for parts, labour, carriage and insurance.

Software

MP Filtri warrants that software will operate substantially in accordance with its functional specification for 12 months from date of shipment provided that the integrity of the operating environment has not been compromised through misuse, inappropriate handling, abnormal operating conditions, neglect or damage (unintentional or otherwise) or the introduction of third party product (software or hardware) that in any way conflicts with the MP Filtri product.

Eligibility

This warranty extends to the original purchaser only or to the end-user client of a MP Filtri authorised affiliate.

How to obtain service?

To obtain service under the terms of this warranty, the customer is required to notify MP Filtri before the expiration of the warranty period and to return the item in accordance with MP Filtri product return policy. Any product returned for warranty repair must be accompanied by a full fault report specifying the symptoms and the conditions under which the fault occurs. Should MP Filtri incur additional cost as a result of a failure to complete the appropriate paperwork, an administrative charge may be levied.

Exclusions

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate care. MP Filtri shall not be obligated to provide service under this warranty if:

a) Damage has been caused by a failure to make a full and proper inspection of the product (as described by the documentation enclosed with the product at the time of shipment) on initial receipt of the product following shipment;

b) Damage has been caused by the attempts of individuals, other than MP Filtri staff to repair or service the product;

c) Damage has been caused by the improper use or a connection with incompatible equipment or product including software applications.

Charges

Under cover of this warranty, MP Filtri will pay the carriage and insurance charges for the shipment of defective product back to site of manufacture and for its return to the client's original site of despatch except when:
a) MP Filtri product return policy has not been followed.

b) Product failure is caused by any of the exclusions described above, when the customer will be liable for the full cost of the repair (parts and labour) plus all carriage and insurance costs to and from MP Filtri premises.

c) The product is damaged in transit and a contributory cause is inadequate packaging. It is the customer's responsibility to ensure that the packaging used to return equipment to MP Filtri is the same, or has equivalent protective qualities, to that used to ship the product to the customer in the first instance. Any damage resulting from the use of inadequate packaging will nullify MP Filtri

obligations under this warranty. Should the customer's product be damaged in transit following a repair at MP Filtri site, a full photographic record of the damage must be obtained (packaging and the product) to support any claim for recompense. Failure to present this evidence may limit MP Filtri obligations under this warranty.

THIS WARRANTY IS GIVEN BY MP FILTRI IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, NON INFRINGEMENT OR FITNESS FOR A PARTICULAR PURPOSE. MP FILTRI LTD SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES (INCLUDING LOSS OF DATA), WE SPECIFICALLY DISCLAIM ANY AND ALL WARRANTIES TO CUSTOMERS OF THE CUSTOMER. THE CUSTOMER'S SOLE REMEDY FOR ANY BREACH OF WARRANTY IS THE REPAIR OR REPLACEMENT, AT MP FILTRI DISCRETION, OF THE FAILED PRODUCT.

MP Filtri Ltd maintains a policy of product improvement and reserves the right to modify the specifications without prior notice.

3.1 Warranty on Recalibration

The prouct is guaranteed for 12 months upon receipt of the device, subject to it being used for the purpose intended and operated in accordance with this User Guide.

MP Filtri UK will only verify the accuracy of the device if the unit is recalibrated every 12 months

Please ensure that the test results in the log are downloaded to CMP View before the device is despatched, in case action taken by MP Filtri UK during the service / recalibration causes the log to be cleared.

NOTE

It is requested that only the device and no ancilliaries are returned for recalibration.

MP Filtri UK will not be held responsible for any items returned as such.

Please ensure the device is packed appropriately for transportation.

PRODUCT DOCUMENTATION

4. Download Area

Please scan the QR codes below to get updated electronic version of the related document.

MOBILE FILTRATION UNIT
General catalogue

Download PDF

CONTAMINATION MONITORING PRODUCTS General catalogue

Download PDF

CMP View Software
Software multilingual

Download Software

CMP View Software
Quick Guide

Select your language and download PDF

5.Technical Specification

5.1 Performance

Technology	LED Based Light Extinction Automatic Optical Contamination Monitor
Particle Sizing	>4, 6, 14, 21, 25, 38, 50, 70µm
Analysis range	ISO 4406 ISO 11218 NAS 1638 AS 4059 revision E & G Table 1 & 2 GJB420B, GBT14039 GOST 17216
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
Moisture & Temperature Measurement	% saturation (RH) and fluid temperature (°C) - Mineral Oil / Diesel version only
Accuracy	±½ ISO code for 4, 6, 14µm ±1 code for 21, 25, 38, 50, 70µm

5.2 Electrical interface

Supply Voltage	9-36V DC			
Supply Current	12V 150mA	24V 80mA	36V 60mA	K version
Power Consumption	2.2W max			
Test Time	Adjustable 10 - 3600 seconds (factory set to 120s)			
Data Storage	Approximately 4000 time-stamped tests in the integral memory			
Keypad & LCD	128x64 pixels, back-lit graphical display			
Communication Options	RS485/Modbus CANbus 4-20mA			

TECHNICAL SPECIFICATION

5.3 Physical attributes

Dimensions	320 mm (h) x 186 mm (w) x 130 mm (d) / 12.6” (h) x 7.3” (w) x 5.1” (d)
Mounting	2 holes - diam 8mm, 145mm/200mm
Weight	10.5 kg / 23.1lbs (device only)
Connections	G1 M16x2 hydraulic connection
Seal Material	M/N Version - Viton® (Contact MP Filtri for any fluids that are incompatible with Viton® seals) S Version - Perflouroelastomer/EPDM test points

5.4 Fluid characteristics

Fluid compatibility	M version - Mineral oil and synthetic fluid N version - M type fluids & Subsea fluids and water based fluids S version - M & N type fluids & phosphate esters and aggressive fluids
Viscosity	≤ 1000 cSt
Fluid temperature	-25°C to +55°C / -13°F to 131°F
Operating Flow Rate	20-400 ml/min
Maximum Pressure	420 bar static / 6091 PSI
Differential Pressure	Typically 0.5 bar / 7.2 PSI

5.5 Environment

Ambient working temperature	-25°C to 55°C K version / -13°F to 131°F
IP Rating	IP66
IK Rating	IK04

5.6 Wetted Parts

M Version	N Version	S Version
Copper Alloy C46400	316 Stainless Steel	316 Stainless Steel
316 Stainless Steel	Sapphire (Al_2O_3)	Sapphire (Al_2O_3)
Sapphire (Al_2O_3)	Viton®	Perfluoroelastomer
Viton®	PTFE	PTFE
PTFE		EPDM
FR4		FR4

5.7 Dimensions

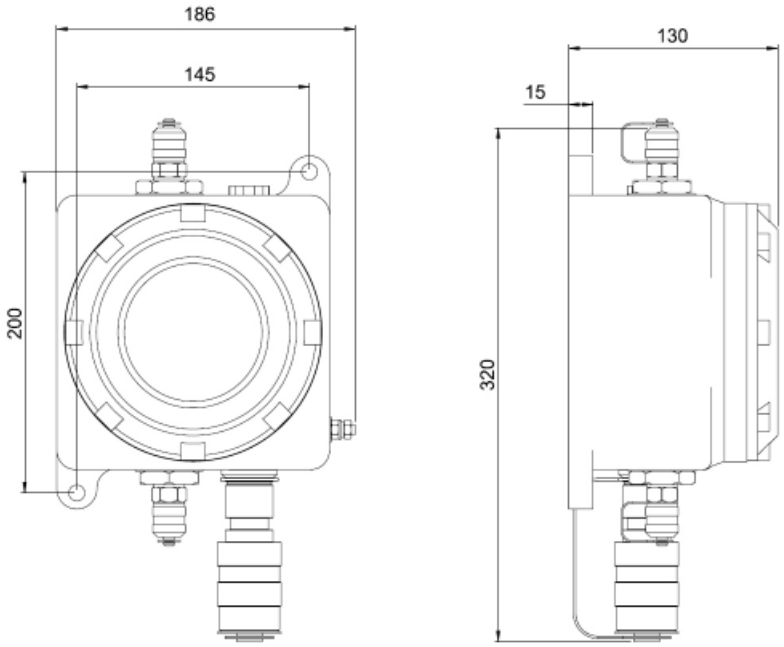


Figure 1

TECHNICAL SPECIFICATION

5.8 Designation & Ordering code

INLINE CONTAMINATION MONITOR ICMK2.0 AZ2

Configuration example: ICM | W | M | K | R | G1 | 2.0AZ2

Series

ICM	Light extinction contamination monitor

Moisture Sensor

0	Without moisture and temperature sensor
W	With moisture and temperature sensor*

Fluid compatibility

M	Mineral oil and synthetic fluid
N	Subsea fluids and water based fluids
S	Phosphate ester and aggressive fluids

Display

K	With on-screen display

Alarm Relays

R	With alarm relays

Test Point

G1	1/4” M16x2 test point

Product Designation

2.0AZ2	Version 2.0 ATEX

* Not available in N version

6. Product Installation and General Operation

6.1 Installation

1 x ICMK2.0 AZ2 edition
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
2 x Hard copy of calibration certificate
1 x Hard copy of ATEX certificate
(*) Specific model will be as per ordered item

6.2 Installation Procedure

- Decide on tapping points in hydraulic circuit
- Locate the unit mechanically and bolt to desired location using fixing holes provided
- The device must be in a vertical orientation, with the oil flowing upwards through it
- Wire back to junction box
- Check flow in acceptable range. There needs to be a differential pressure placed across the device, such that a flow of fluid is generated within the range of the unit
- If there is no suitable differential pressure available, then a flow controller will be needed. One solution is the FC1 which will accept a pressure from 4-420 bar, emitting a constant flow within the range of the device. This should be fitted to the drain side of the device (the top fitting)
- Fix mechanically
- Connect hoses

There must be no extra restriction placed in the drain hose. Do not have a pipe going to a restrictor to control flow. Any such restrictor must be mounted directly to the drain fitting.

NOTE

Fluid flow must be from the bottom fitting to the top, following the direction of flow arrow on the product labelling i.e. the bottom fitting is the inlet and the top fitting is the outlet.

NOTE

- Fit electrical connector, wire back to a junction box

PRODUCT INSTALLATION

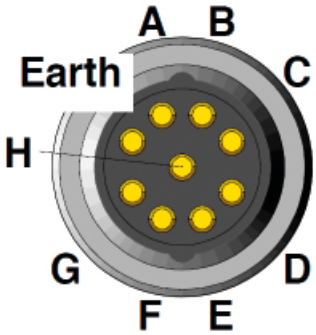
6.3 Electrical interface

A separate USBi product is available for those wishing to simply plug the device into a computer.
This section is for those wishing to do their own wiring to the product. Please be aware the ICMUSBi device is not ATEX-rated and cannot be used inside an active zoned area.

NOTE

Only a cable connector is supplied with each unit. Wiring must be done by the end user using appropriate ATEX-approved cable.
The colours in the wiring example refer to the cable supplied by the USBi product.
Customers using their own ATEX cable will use their own colour scheme.

NOTE



Solder Bucket Number
A = Data -
B = Data +
C = Power OV
D = Power (9-36V DC)
E = Output 1
F = Output 2
G = Common
H = Start

Figure 2: Cable Wiring Details (as viewed when looking at supplied male connector)

MP Filtri Part numbers:
11.646, ICMK2.0 AZ2 ATEX cable socket (ROTA BNIS0920)
11.661, ICMK2.0 AZ2 ATEX cable gland for 11.646 (HAKE321)

6.3.1 DC Power

DC power is connected to pins D and C of the circular connector.
All the other signals are optional.

Item	Minimum	Maximum
Voltage	9V DC	36V DC
Currrent		200mA

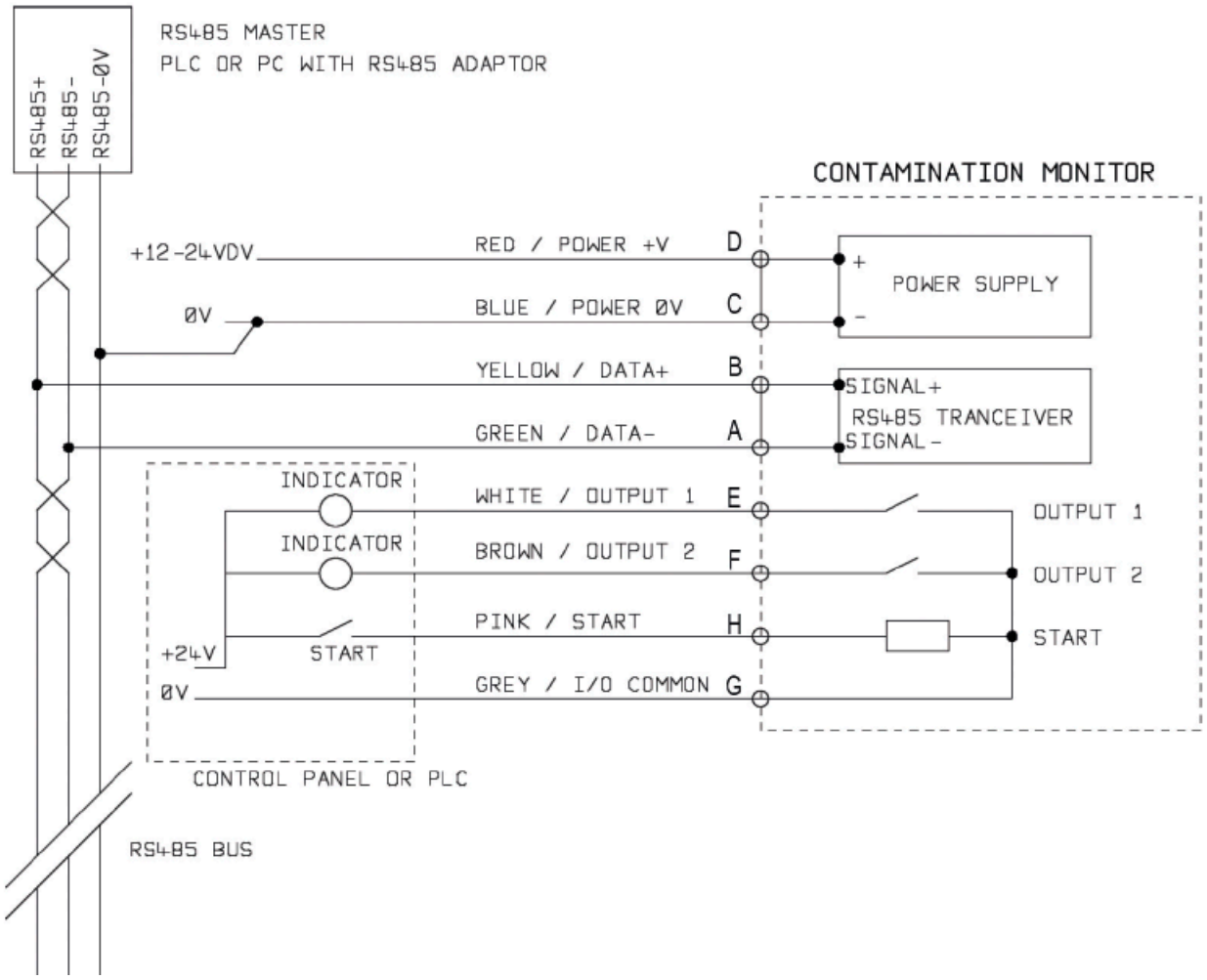


Figure 3: External wiring example

PRODUCT INSTALLATION

6.3.2 Serial Interface

An RS485 interface can optionally be connected to pins A and B.
This can be a PLC running customer software, or a PC with a RS485 adaptor running the supplied CMP View software.
To provide a reference the RS485 0V connection should also be linked to the 0V (as shown in figure 4 below).

The standard control protocol is Modbus RDU. Modbus is a freely available open standard for industrial control.
Adaptors are available to interface to otherindustrial control buses.

MP Filtri's award-winning CMP View analysis software uses Modbus to communicate with the device, but it is also possible for customers to implement their own controller. The CANbus protocol can also be used, see separate ICM-CANbus manual.

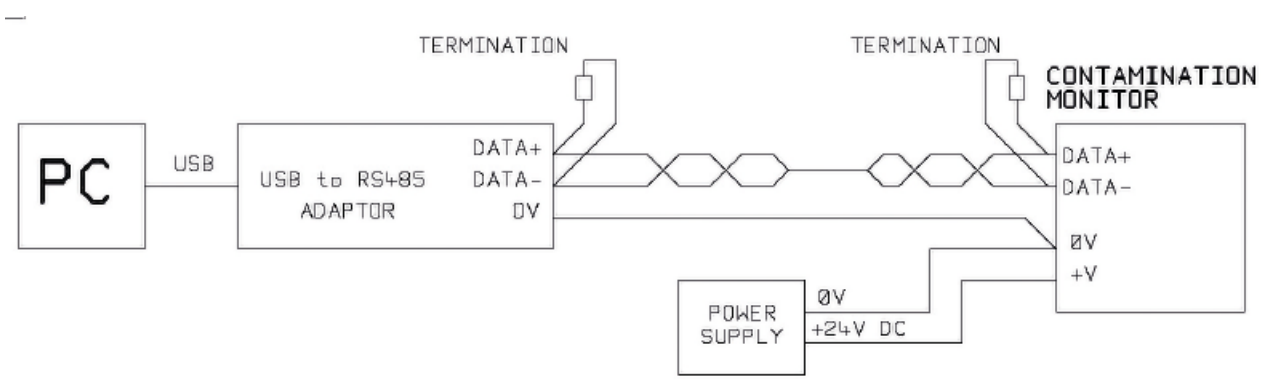


Figure 4: PC Control example

Figure 5 (below) shows a single linked to a PC, using a USB-RS485 adaptor. 100 Ohm termination resistors should be fitted as shown for long cables, for example over 10m. Twisted pair wiring should be used for any length over 2m.

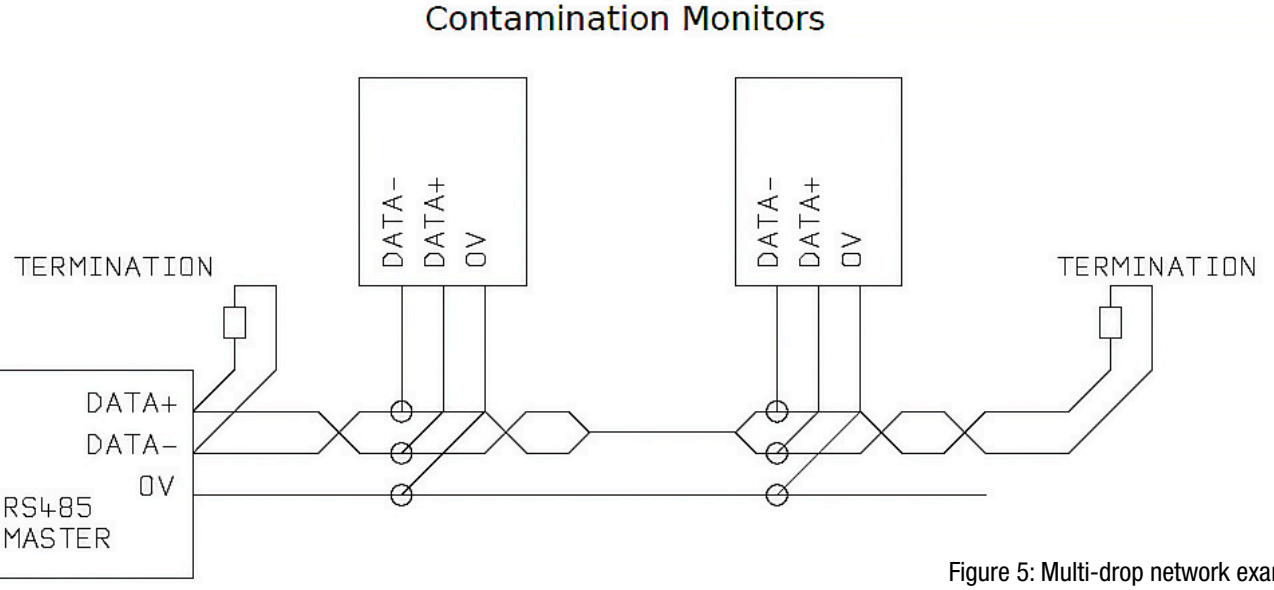


Figure 5: Multi-drop network example

Figure 4 shows how to connect two or more devices to a multi-drop RS485 network. Any termination resistors should be fitted to the network cable ends only.

Spurs off the main RS485 bus should be kept as short as possible, e.g. below 2m. Normally the pre-wired 3m cable available for the device would be used, with a junction box to connect to the RS485 trunk. Either individual DC supplies can be used to power each device, or a single supply run through the trunk cable.

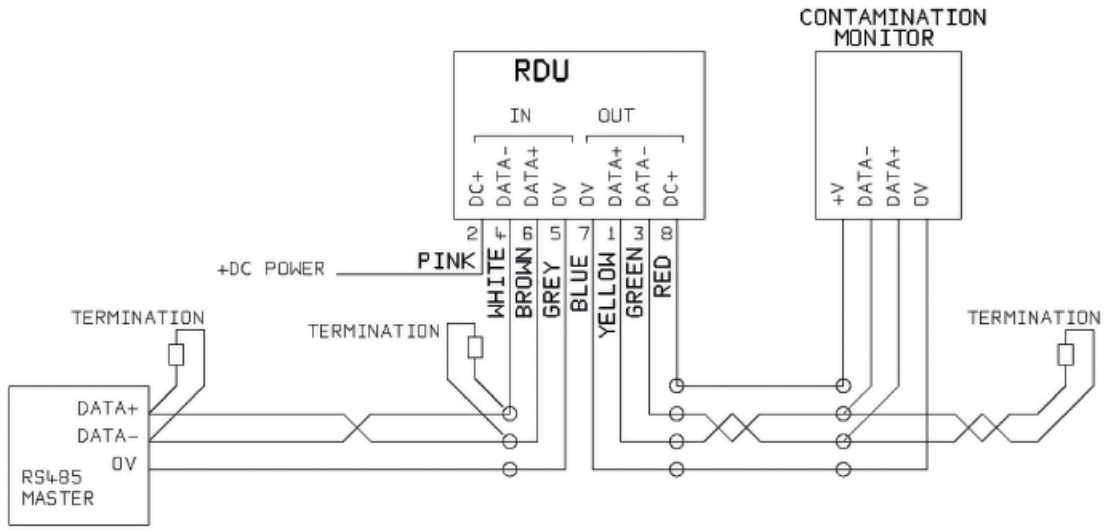


Figure 6: Remote Display Unit Including PC Controller Example

Figure 6 shows how to connect the Remote Display Unit (RDU). The RDU is used when the device's location is not convenient for an operator. It can control and monitor a remote ICMK2.0 AZ2 ATEX, as well as allowing an external controller to be connected to it (for data download, for example).

RDU product is not ATEX rated and must not be used in a zoned area.

CAUTION

6.3.3 Switched Input and Output Signals

The ICMK2.0 AZ2 has one switched input and two switched outputs. These can be used instead of, or in addition to, the RS485 interface for command and control. The RS485 interface is more flexible but requires more software work if CMP View is not used (e.g. control from a PLC).

An alternative is to control the device via these switched outputs, either from a PLC or using a manual switch and indicators. In order to reduce wiring the input and outputs all connect together on one side (see Figure 6). However they are optically isolated from the rest of the system so can be used to switch unrelated signals.

PRODUCT INSTALLATION

6.3.4 Start Signal

The “start signal” is an opto-isolated input that can be used to start a test, it can be used to ensure testing only occurs when the hydraulic system is running. For example, the start signal could be wired to go on and off with the main hydraulic pump or with a solenoid valve that allows fluid flow. That way the log does not fill up with invalid tests that were carried out with no flow.

This could be from a push button or a PLC output. The input accepts AC or DC signals, typically derived from the DC supply voltage. The exact function of this input is determined by the Test Mode setting.

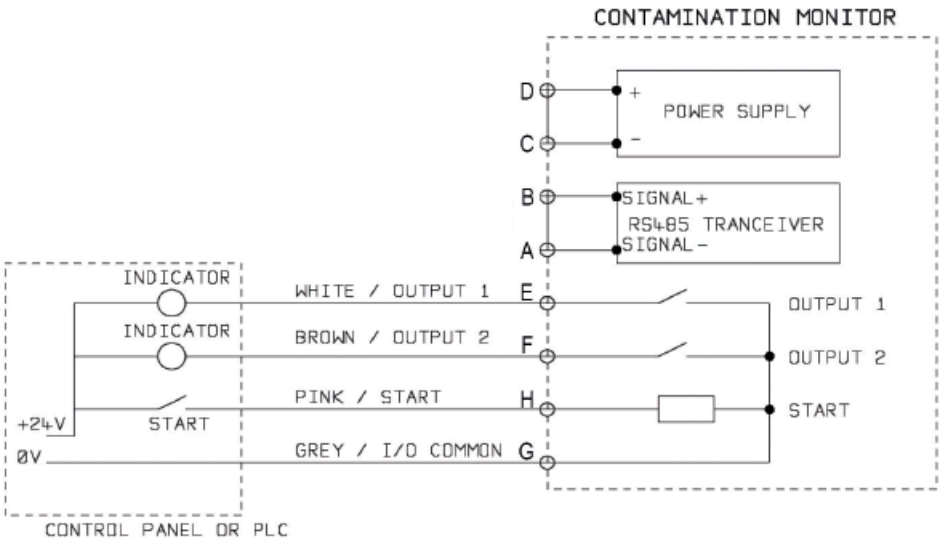


Figure 7: Switched I/O Signals

- When the START signal transitions from OFF to ON, the unit will start a new test or restart any test in progress.
- At the end of the test, the state of the START signal is checked
- If the START signal is still on at the end of a test, another test is started. So that testing continues while the START signal is held on.
- The switching off the start signal will operate as a STOP command. That is, it will abort any test in progress. It will continue to show and report the previous result.
- This new operation mode applies whether or not continuous testing is enabled.
- So for example if “continuous testing” and “stop testing when clean” are both enabled, and if the start signal is being held on throughout testing, then EITHER the start signal vanishing OR a clean result can terminate testing.

Item	Minimum	Maximum
Voltage		36V DC
Current		0.5 A

Other ways to start a test are:

- Via CMP View or PLC Modbus command.
- Periodic automatic testing according to a programmed test mode.

6.3.5 Alarm Outputs

These are opto-isolated switches that can be used to signal external indicators, PLC inputs or other equipment (e.g. pump on/off control). The exact function of these outputs is determined by the Alarm Mode setting. The outputs are "voltage free" contacts that can switch AC or DC signals up to 36V nominal (60V absolute maximum peak voltage).

6.3.6 4-20mA Connection

The two 4-20mA outputs are sourced from the main supply voltage DC+. These may be connected to the 4-20mA inputs of a process indicator or a PLC. The 0V connection is then also normally connected to the PLC 0V.

The 4-20mA outputs can be converted to 0-5V outputs by connecting a 250 ohm resistor between each output and 0V. Similarly they can be converted to 0-10V outputs by connecting 500 ohm resistors.

For detailed Comms protocols please see document number 201.073 on supplied USB stick.

6.4 Hydraulic Connections

High or Low Pressure Parallel Connection

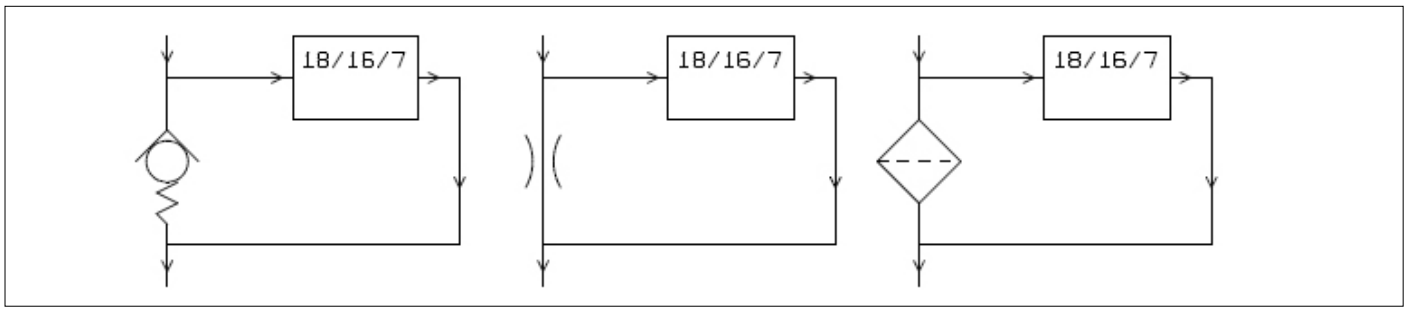


Figure 7a: Working pressure generated by hydraulic component

Low Pressure, Off-Line Operation

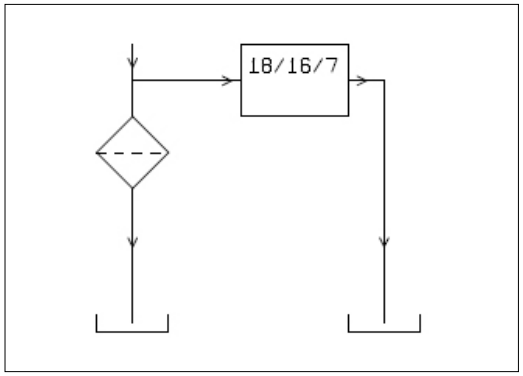


Figure 7b: Working pressure generated by hydraulic component

Very Low Flow Systems

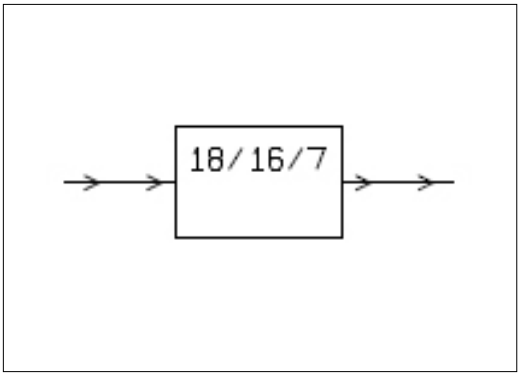


Figure 7c: Entire system flow rate is within the range of the device

PRODUCT INSTALLATION

6.4.1 Flow rates

For the majority of systems, a differential pressure of a few Bar will generate an in-range flow for an ICMK2.0 AZ2 connected using M16 x 2 connection hose hose. The required differential pressure can be obtained by taking advantage of an existing pressure drop within the system. Alternatively one can be created by inserting a check valve. The device can then be connected across this differential pressure source.

Detailed Calculations

In general the flow rate of fluid through the device needs to be kept within the range of the unit (0.5-420 bar). The device measures the flow during operation, so this can be used to check that the flow is correct.

A flow that is out of range will be indicated by a fault code Results taken with out-of-range flows are not logged. The flow is entirely generated by the differential pressure between the ends of the pipes used to connect the .

The pressure needed to generate an in-range flow can be estimated by assuming a target flow, and determining the resulting pressure drop across the and connection piping.

Use Figure 10 to lookup the pressure drop, and manufacturers data to lookup the piping pressure drop at the desired flow. The sum of these two pressures is the pressure needed.

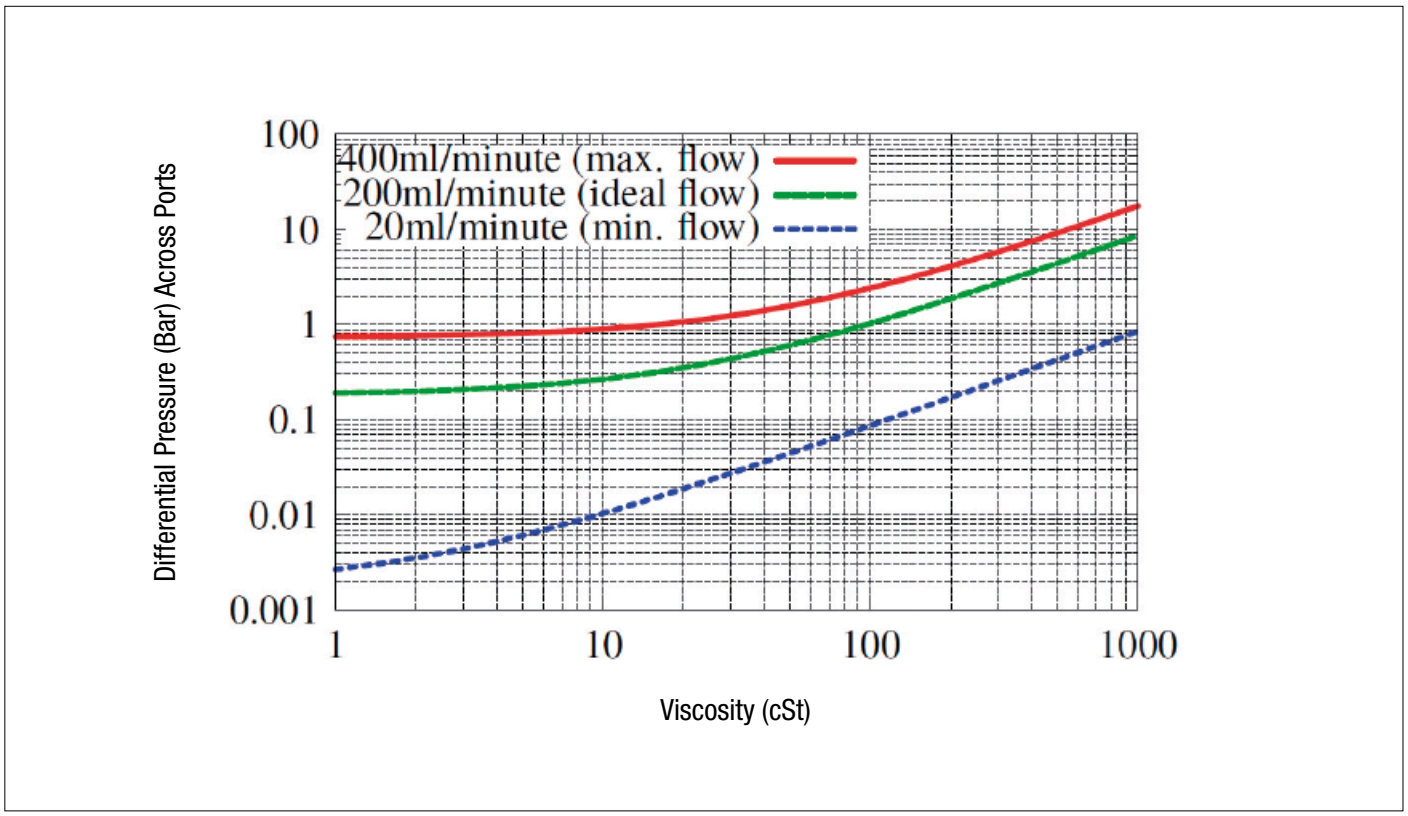


Figure 8: Differential Pressure vs Fluid Viscosity, for various flow rates

The user connects the device between two points in the hydraulic circuit that have this pressure difference.
In order to use the graph:

• Determine the working viscosity of the fluid, e.g. 30 cSt.

• Decide on a desired flow rate. 200ml/minute is normally used since this is in the middle of the flow range. But 100ml/minute is also suitable and uses less oil.

• Use the graph 4 to look up the pressure drop, across the ports, at this flow rate and viscosity. For example at 30cSt and 200ml/minute, this is 0.4 Bar. The maximum and minimum allowed differential pressures can also be determined using the 400ml/min and 20ml/min lines, respectively.

• Determine the additional pressure drop caused by the piping used to connect the ICMK2.0 AZ2. This may be negligible for 1/4 inch piping and over, but is very important for M16 x2 hoses. This information can be found in the manufacturers catalogues. In the case of Mini-mess hoses, at 30 cSt these have a pressure drop of around 10 Bar per meter per lpm of flow. So a 2m total hose length would add a pressure drop of $2 \times 10 \times 0.2 = 4$ Bar. (So in this case the pressure-flow relationship is mainly dependent on hose resistance.)

• Add the pressure drop to that of the hoses, e.g. $4 + 0.4 = 4.4$ Bar.

When the required pressure drop has been found:

• See the figures at the start of this section for examples of where the device could be connected.

• If there is a pair of connections in the hydraulic circuit that operates with a differential pressure near to that calculated, then the can be connected there.

• Alternatively, create the pressure drop by modifying the hydraulic system. For example, insert a check-valve in the circuit with a 4 bar spring.15 The “component” could also be a filter, a restrictor or even a piece of piping if it has a suitable pressure drop across it.

• If none of these options is feasible, then an active flow controller will likely be needed.

• Otherwise connect the across the points identified, taking care to maintain an upward flow of oil through the unit (this reduces trapped air).

Of course in a real system the pressure and viscosity will vary with temperature and operating conditions. But since the working flow range of the device is very wide, this should not be a problem provided it remains within range. On the graph the area between upper and lower lines represents the usable operating region for the device, with the middle line being ideal. The differential pressure and the viscosity can vary from the ideal, provided the system stays within the upper and lower lines. This ensures the flow stays within the working range of 20 - 400 ml/min.

It can be seen that the unit will accommodate a 20:1 variation in either viscosity or differential pressure during operation.

PRODUCT INSTALLATION

Manual Flow Control

Another possibility is to fit a simple manual flow control (flow restrictor) to the outlet of the device.

• This should only be done where the available pressure is less than twice the maximum value calculated. This is because the small orifice size needed to control the flow from a pressure larger than this has a risk of blockage.

• The flow controller must be fitted to the outlet only. If fitted to the inlet it will have a filtering effect.

• The flow controller must be fitted directly to the outlet port.

Active Flow Control

This is only needed for High Pressure, Off-Line Operation.

A pressure compensated flow control valve is fitted to the drain outlet. This maintains a constant flow rate even with a varying inlet pressure (provided this pressure stays above a minimum working value). A suitable valve is the FC1 but other ones can be used too.

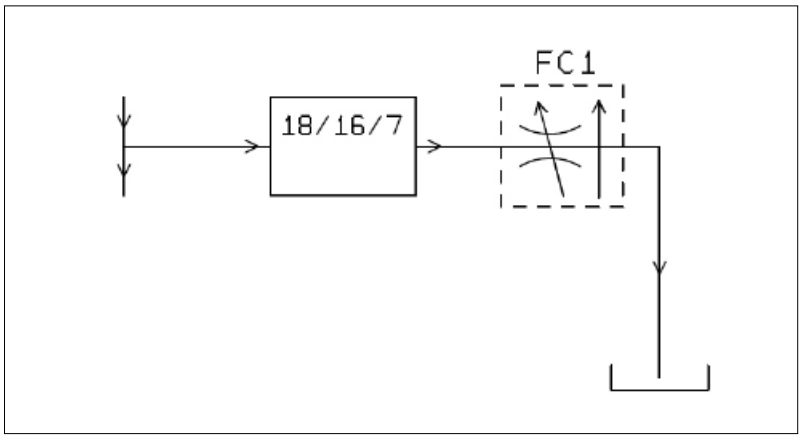


Figure 9: Flow actively regulated

7. General Operation

7.1 Physical Checks

- Oil leaks on and around the unit
- Fatigue in hoses and pipework that might then leak when under system pressure

7.2 Front Panel Operation

ICMK2.0 AZ2 devices have a screen that changes colour.
The alarm thresholds can be set from CMP View.

Figure 10: Front panel

Colour	Indication
Green	Indicates that the test result has passed, i.e. none of the alarm thresholds were exceeded
Yellow	Indicates that the lower cleanliness was exceeded, but not the upper one
Red	Indicates that the upper cleanliness 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
Red Flashing White	Various fault codes can be indicated by the LED turning red and then flashing white a number of times

Please note: If the codes seem confusing, note that a given colour will only ever be seen if the corresponding limit has been specifically set by the user. So for example if a maximum temperature limit has not been set, the violet indication will never be seen. If all that is wanted is a “green or red” light, that can be arranged by simply setting only the cleanliness threshold maximum limit.

If the upper temperature alarm is set, this takes priority over the Contamination and Water alarms. In the event of an over temperature condition, the LED will turn violet only, whether or not there is also a contamination or water alarm condition. The rationale is that an excessive temperature condition could be immediately catastrophic for the hydraulic system.

PRODUCT OPERATION

7.3 Result Display

ICMK2.0 AZ2 models have a small graphical LCD. This allows the display of the test result (current cleanliness level, with water content and temperature if applicable). The graphical format allows a full display of all codes of the standards supported.

The unit powers up in “Rotating Display Mode”. This displays the test result in the selected format. The table below shows the screens that wil be displayed in a rotating format. The screenshots in the right column are the “detailed” version of the display additionally showing the particle counts and flow rate. The particle sizes and count representation are automatically matched to the selected format.

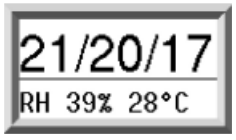
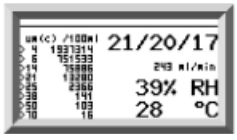
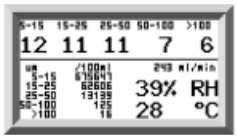
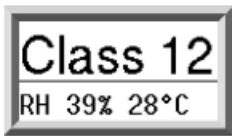
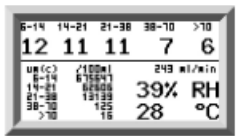
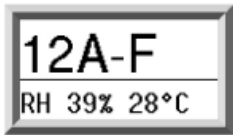
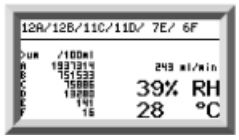
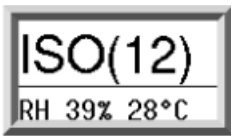
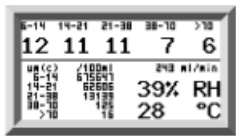
Format	Simple View	Detailed View
ISO4406:1999		
NAS1638		
AS4059E Table 1		
AS4059E Table 2		
ISO11218		

Figure 11: Graphical display modes

There is also a “History” screen which shows the last 10 results.
The operator can switch between these screens using the ∧ and ∨ keys.

The progress of a test is denoted by the horizontal line; it grows from left to right as the test progresses.

When it reaches the right hand side a new result is generated.

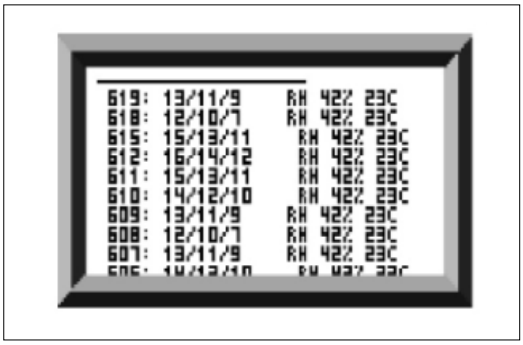


Figure 12: History screen

7.4 Removal and Product Maintenance

When removing the device from the system ensure the system pressure is shut off from the device. Ensure power to the device is switched off. Remove hydraulic connections. Remove product from its installation.

7.5 Remote Control

The device can be controlled using the remote control facility included in the CMP View software package, installed on a PC.

Alternatively customers can use their own software running on a PC or PLC.

Since the product includes a built-in data-logging memory, operators can make use of the remote control facility in one of two ways:

Direct Online Operation

The device is permanently connected to a computer while tests are carried out. The operator can set parameters, type a label and initiate the test. They can then monitor the progress of each test. Each test result is displayed and downloaded into the test database as it is completed.

Disconnected Operation

Here the device operates as a stand-alone item, performing tests on a schedule or under external command from a control system. If a permanent record of the results is needed, an operator can occasionally connect a computer and use CMP View to download the accumulated test data.

7.6 Communications Protocols

For full details see the ICM 2.0 User Manual

8. CMP View Software

MP Filtri has created award-winning software to make it easier than ever before for operators to access and analyse data from its industry-leading range of contamination monitors. It is now an essential tool for all contamination monitors.

CMP View software replaces LPA View and offers a suite of enhancements, including:

- A revolutionary graphical interface displaying all key results visually on a single screen.
- Real-time analysis
- Ability to view short and long-term contamination trends
- Results in a variety of international standards
- Easy learning curve with no need for formal tuition

9 Related Products

9.1 RDU 2.0

The optional RDU 2.0 is a separate accessory product allowing control of an ICMK2.0 AZ2 that is typically inaccessible via the keypad, display and USB download.

The sensor itself is mounted remotely in another unit (normally a non-screened version). This allows the operator full control of the device.

The RDU 2.0 connects “in between” the incoming supply/ serial connections, and the sensor. It is “transparent” to the serial communications. This means that a PLC or CMP View can operate in the usual way to control the device, change settings or download results, without having to unplug the RDU.

Similar components are used for the RDU as for the normal - KU option, so the same instructions apply for operation.

The RDU wiring details are shown in figure 6.

Please note that the RDU cable provided must be plugged into the right hand (remote) connector of the device for it to work.

Please note that the RDU only records tests whilst powered up. If tests are run without the RDU connected then they will have to be downloaded directly from the device.

If the device connected to the RDU has a serial number lower than 1610800, then the power supply must go via the RDU. Serial numbers after 161800 can be powered either via the device or RDU.

The RDU 2.0 is fully backward compatible with the first revision products.

RDU product is not ATEX rated and must not be used in a zoned area.

CAUTION

RELATED PRODUCTS

9.2 USBI

The USBi is a plug-and-play solution for easily connecting a computer to the device.

Please note an adaptor cable will be required to connect to an ICM USBI device (Part no: 11.645)

It includes a USB:RS485 interface with a terminal block pre-wired with the device's cable. An extra terminal block is provided for any customer wiring to external devices.

An external DC adapter supplied can be used to power the complete system, or if the computer is always connected during use, power can be taken directly from the USB cable.

Note: Computer should have mains power applied at all times. Detailed installation and usage instructions are provided in the separate product user guide.

USBI product is not ATEX rated and must not be used in a zoned area.

CAUTION

9.3 FC1

A pressure compensated flow control valve suitable for the device. This may be needed if the application produces an oil flow that varies outside the upper flow range of the unit.

9.4 Spares

11.615	Course screen filter to prevent blockage
Test Hoses	Various hose lengths with M16x2 hydraulic connections on each end, compatible with all fluid types
Test Points	M16x2 test points of various fitting sizes for system installation
Check Valves	Various ratings up to 7 bar and manifold, available for all compatible fluid options.
11.645	ICM USBI adaptor

10 Troubleshooting / FAQ

10.1 Misuse of Product

- The product should be connected to a power supply within the rating of the product and not wired directly to the mains.
- This product should be connected to a hydraulic line; this must not exceed the upper pressure limit of the product
- Connection hoses should never be allowed to lie along the floor when the device is installed and in use.
- The operator should follow all standard operating procedures previously set at the operating location as well as the procedures required by the manufacturer.
- Over-tightening of test points / hoses can damage threads causing the unit to fail.
- The product is designed with no moving components. Should it be used outside of its fluid viscosity specification the unit will flag a flow error and invalidate that test result.

10.2 Fault Finding

10.2.1 LED Flashing / Fault Codes

The device's front panel led indicates a fault by a number of white flashes, with a red background. The number of flashes indicates the fault code, the screen version will also display the fault code and function:

1. Optical - An optical fault could indicate LED failure or blockage of the optical path. Try flushing with Petroleum Ether, or return to MP Filtri UK Ltd.

2. Low Flow - The device stimates the flow by measuring the transition time of the particles. The Low Flow warning indicates that the flow rate is below the minimum recommended level (A). Note that the alarm should be disabled in the settings when used on clean systems, such as flushing/cleaning rigs, where the particle count could reach 14/12/10 or lower.

The unit will still work but may be more susceptible to errors caused by pressure fluctuations. This warning can also come on when there are no particles whatsoever detected, i.e. the fluid is totally "clean". In this case the correct result e.g. 0/0/0 is still generated.

3. High Flow - The flow rate is above the maximum recommended level. This will degrade the accuracy of the particle counts.

4. Logging - Fault with data logging memory.

5. Water Sensor - Fault with the water sensor.

TROUBLESHOOTING/FAQ

10.2.2 Test Status

The status is shown on the screen. This contains a number indicating the current state of the device, according to the table below. This allows a system to remotely monitor the operation of the device, if desired, allowing more specific diagnostics.

However the fault conditions are also indicated on the front panel LED, while ``No Result" in the case of a fault is indicated using special result values as previously described.

Value	Function	Comment
0	NOT READY	Unit is powering up or there is some problem
1	READY	Unit is powering up or there is some problem
2	TESTING	Test in progress
3	WAITING	Waiting between tests*
128	FAULT OPTICAL	LED failure/ sensor blocked/ filled with air
129	FAULT FLOW LOW	Flow too low for reliable test**
130	FAULT FLOW HIGH	Flow too high for reliable test
131	FAULT LOGGING	Fault with data logging
132	FAULT WATER SENSOR	Water sensor failure

* User has set a non-zero test interval.
** Or fluid is totally clean (no particle counts). Flow alarm can be turned off by user if this is a problem, for example cleaning rigs.

10.2.3 Other Faults

Unexpected results obtained from sample

- Check that the microbore pressure hose has been fully connected at both the system and ICMK2.0 AZ2 ends. NOTE: removing either hose from the device is not indicative of flow through the ICMK2.0 AZ2 as the hose end is now at atmosphere. The pressure drop across the device should be verified
- Confirm that the flow through the device is within the range of the unit.
- High water / aeration levels

Remote Device dialogue not responding to buttons being pressed

- Check that correct COM port has been selected in the Remote Device dialogue.
- Check USB driver has been installed.
- Disconnect power supply to the device and then reconnect it.

If the device has been subjected to excessive contamination and a blockage is suspected, a flush with a suitable solvent may clear the blockage.

The standard ICMK2.0 AZ2 is fitted with Viton® seals, so Petroleum Ether or Iso Propyl Alcohol may be used for this purpose, in conjunction with the MP Filtri UK Bottle Sampling Unit. See document 200.093 on supplied USB.

DO NOT USE ACETONE

10.3 Test Duration

The set Test Duration is the amount of time for which particle counts are accumulated, before the test result is updated. The default of 120 seconds is likely to be suitable for most applications. However it is possible to set other values.

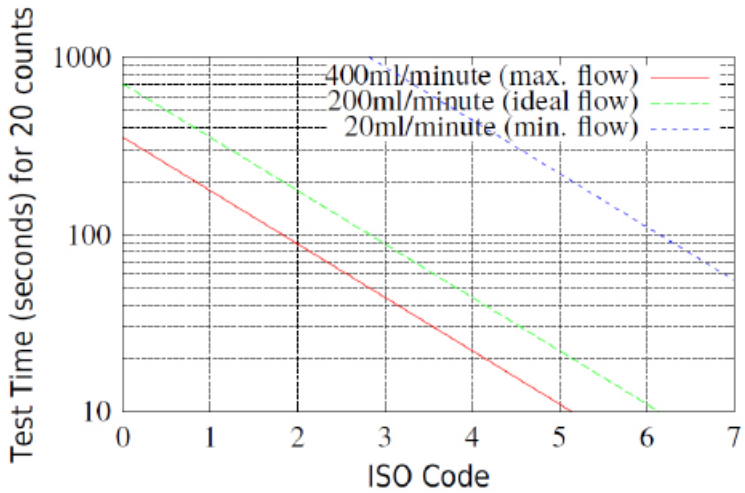
A shorter time enables the unit to respond more quickly to variations in cleanliness. This may be desired in order to reduce the product test time in a production line situation.

A longer test time enables the unit to average out variations in cleanliness and produce a more stable result. This is especially true for the larger particle sizes. In clean systems there are very few of these, so a large amount of fluid needs to be sampled in order to count a statistically significant number.

Another factor is the flow rate. This can be traded off with cycle time, since a higher flow allows the same amount of fluid to be sampled in a shorter time.

“Very Clean” Systems - Longer test times / higher flows are needed.

“Normal” or “Dirty” Systems - Shorter test times or lower flows are acceptable.



Test time needed for reliable indication by ISO code

TROUBLESHOOTING/FAQ

10.4 Clean Working Practices

The majority of hydraulic systems require cleanliness which controls below around a 40 micron threshold (beyond the limit of human eyesight). When analysing particles down to levels of 4µm, 6µm & 14µm you are talking about objects of a cellular/bacterial size. This creates various challenges, and is starting to drive better and cleaner working practices in industry. Our products are at the forefront of this challenge, and will help you to manage the quality and productivity of your systems.

Do

- Do use filter breathers on tank tops
- Do use tank designs, which are self-draining (sloped or conical).
- Do use tanks which can be sealed off from the surrounding environment.
- Do exercise care and use funnels when filling tanks with fluid.
- Do utilize stainless steel and methods such as electro-polishing in the design of system components upstream of your first filter set.
- Do perform off-line analysis in a controlled environment such as a laboratory which should contain fewer airborne contaminants that where the sample was taken from.
- Do use suitable, glass bottles (ideally certified clean) to take samples, along with a hand pump to reduce contamination ingress.
- Do filter your system thoroughly before using it in your production process.
- Do perform a statistically large enough sample of particle analysis results (25) to arrive at a base cleanliness level for your system.
- Do make sure that filters are correctly sized for your applications and cleanliness you are trying to achieve.

Don't

- Don't eat, drink or smoke around critical systems/processes.
- Don't leave tools, objects, clothing or other materials etc. on surfaces or tanks of critical systems.
- Don't use open tanks on critical systems.
- Don't take samples or perform on-line analysis from the top of a reservoir/tank.
- Don't design/use tanks which contain crevices (internal corners etc.).
- Don't assume that if a sample looks clean, that it is. You won't be able to see the contaminants.
- Don't perform off-line analysis in an "un-controlled" environment. e.g. workshop
- Don't rely on a single test for a capable representation of your system.
- Don't start using your system/process until it has gone through a commissioning period whereby contamination levels are relatively stable.
- Don't mix fluids into the same system. They can emulsify and eliminate any chance of a reliable particle count.
- Don't use unsuitable containers to take a fluid sample.

NOTES

NOTES

NOTES

WORLDWIDE NETWORK

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UNITED ARAB EMIRATES • UNITED KINGDOM • USA

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