FCU 1210
FluidControl Unit

Operating and Maintenance Instructions
English (translation of original instructions)
Valid from firmware versions V 2.40 up
Document No.: 3545830a
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All details are subject to technical modifications.

Technical specifications are subject to change without notice.

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Preface

For you, as the owner of a product manufactured by us, we have produced this manual, comprising the most important instructions for its operation and maintenance.

It will acquaint you with the product and assist you in using it as intended in an optimal manner.

Keep it in the vicinity of the product so it is always available.

Note that the information on the unit's engineering contained in the documentation was that available at the time of publication. There may be deviations in technical details, figures, and dimensions as a result.

If you discover errors while reading the documentation or have additional comments or suggestions, contact us at:

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We look forward to receiving your input.

“Putting experience into practice”
Technical Support
Contact our technical sales department if you have any questions on our product. When contacting us, please always include the model/type designation, serial no. and part-no. of the product:
Fax: ++49 (0) 6897 / 509 - 846
E-mail: filtersystems@hydac.com

Modifications to the Product
We would like to point out that changes to the product (e.g. purchasing additional options, etc.) may mean that the information in the operating instructions is no longer applicable or adequate.

After modification or repair work that affects the safety of the product has been carried out on components, the product may not be returned to operation until it has been checked and released by a HYDAC technician.

Please notify us immediately of any modifications made to the product whether by you or a third party.

Warranty
For the warranty provided by us, please refer to the General Terms of Sale and Delivery of HYDAC FILTER SYSTEMS GMBH.

Refer to these at www.hydac.com ⇒ General terms and conditions.
Using the Documentation

Note that the method described for locating specific information does not release you from your responsibility of carefully reading these instructions prior to starting the unit up for the first time and at regular intervals in the future.

What do I want to know?

I determine which topic I am looking for.

Where can I find the information I’m looking for?

The documentation has a table of contents at the beginning. There, I select the chapter I’m looking for and the corresponding page number.

The documentation number with its index enables you to order another copy of the operating and maintenance instructions. The index is incremented every time the manual is revised or changed.
General Safety Precautions

These operating instructions contain the key instructions for properly and safely operating the FCU.

Obligations and Liability

The basic prerequisite for the safe and proper handling and operation of the FCU is knowledge of the safety precautions and warnings.

These operating instructions in general, and the safety precautions in particular, are to be adhered by all those who work with the FCU.

Adherence is to be maintained to pertinent accident prevention regulations applicable at the site where the product is used.

The safety precautions listed here are limited solely to using the FCU.

The FCU has been designed and constructed in accordance with the current state of the art and recognized safety regulations. Nevertheless, hazards may be posed to the life and limb of the individual using the product or to third parties.

The FCU is only to be used as follows:

- Only for proper or designated use.
- Only when in safe, perfect condition.

Immediately remedy any malfunctions that might impair safety.

Our General Terms and Conditions apply. They are made available to the owner upon concluding purchase of the unit at the latest. Any and all warranty and liability claims for personal injuries and damage to property shall be excluded in the event they are attributable to one or more of the following causes.
Explanation of Symbols and Warnings, etc.

The following designations and symbols are used in this manual to designate hazards, etc.:

- **DANGER**: Denotes situations which can lead to death if safety precautions are not observed.
- **WARNING**: Denotes situations which can lead to death if safety precautions are not observed.
- **CAUTION**: Denotes situations which can lead to severe injuries if safety precautions are not observed.
- **NOTICE**: Denotes situations which can lead to property damage if instructions are not followed.

Proper/Designated Use

The fluid control unit, FCU, was developed to intermittently monitor solid particle contamination, temperature and % saturation level in hydraulic systems.

Analyzing the size and quantity of contamination enables quality standards to be verified and documented and the requisite optimization measures to be implemented.

Any other use shall be deemed to be improper and not in keeping with the product's designated use.

Proper or designated use of the product extends to the following:

- Typical application: Short-time measurement of system cleanliness
- Maintaining adherence to all the instructions contained herein.
- Performing requisite inspection and maintenance work.
Improper Use or Use Deviating from Intended Use

Improper use may result in hazards like the following:

- Use of the FCU 1000 for permanent monitoring (i.e. continuous operation)
- Improper connection of the FCU pressure or return hoses.
- It is not permitted to operate the FCU 1000 on a measurement point where the pressure exceeds 345 bar.
- Operation of the FCU on board networks without central "Load Dump" fuse.

Informal Safety Precautions

Always keep the operating and maintenance instructions near the measurement device.

In addition to the manual, the general and local regulations concerning accident prevention and protection of the environment should be available and observed.

Ensure that all information relating to safety and potential hazards of the FCU are kept in a legible condition. Replace them if necessary.

Check the hoses and connectors for leaks on a daily basis.

WARNING

Hydraulic systems are under pressure
Bodily injury
- Depressurize the system before performing any work on it.

What to Do in Case of Emergency

In the event of an emergency, disconnect the FCU from the power supply and from the hydraulic system.
Safety Measures to Be Followed during Normal Operation

Do not operate the FCU unless all the safety devices function properly. The product is to be checked once a day for visible external damage and for the proper functioning of the safety devices.

Electrical Hazards

**WARNING**

Electric shock

Bodily injury

► Any work involving the power supply must be done by a properly trained, certified electrician.

Check the FCU electrical equipment on a monthly basis. Immediately replace loose connections, damaged cables and hoses with original parts.
Training and Instruction of Personnel

The owner is obliged to only let persons work on the FCU, who:

- are familiar with the fundamental occupational safety and accident prevention regulations and have been properly instructed in the use of the FCU.
- have read and understood these operating instructions.

Only properly trained and instructed personnel may work with the FCU.

The areas of responsibility of your staff must be established in a clear-cut manner.

Staff who are still being trained may only work on the FCU when supervised by a suitably experienced person.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Individuals</th>
<th>Individuals undergoing training</th>
<th>Individuals with technical training/engineering background</th>
<th>Electrician</th>
<th>Supervisor with the appropriate authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commissioning</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Operation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Troubleshooting/locating the source of malfunction</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Remediing of mechanical faults</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Remediing of electrical faults</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Maintenance</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Repair work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Decommissioning/storage</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Maintenance, Servicing and Troubleshooting

Conduct the prescribed adjustments, maintenance/servicing and inspection work in accordance with the respective schedules.

Disconnect the FCU power connector from the power supply when performing any service, inspection or repair work.

Any screwed fittings which have been undone/removed are to be checked to see that they have been properly resecured.

Once maintenance work is complete, check that the safety devices are still working properly.

Modifications to the FCU

Do not make any modifications (design modifications, extensions) to the FCU without the prior consent of the manufacturer.

Any modifications require written permission from HYDAC FILTER SYSTEMS GMBH.

Immediately replace any parts which are not in perfect condition. Use only original spare parts.

Cleaning the FCU and disposal of the media and agents used

The cleaning agents and flushing oils used are to be handled and disposed of properly.

The manufacturers’ instructions relating to possible use, personal protective equipment and appropriate disposal must be observed.
Storing the FCU

Make sure to store the FCU in a clean, dry place.

Before putting the FCU into storage, it must be completely drained and flushed. See page 45 for details on flushing the FCU.

Observe the conditions required for storage.

Storage temperature: -40°C … +80°C / -40°F … +176°F
Relative humidity: max. 90%, non-condensing

Decoding the model code label

For identification of the FluidControl Unit, see the type label. The label shows product ID and major technical application data.

See page 68 for more details on the model code.
Checking the scope of delivery

The FluidControl Unit FCU comes packed and ready for operation. Before commissioning the FCU, check the contents of the consignment to make sure everything is present.

The following items are supplied:

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>FluidControl Unit 1210, including attachable bag for cables and hoses</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>24 V DC adapter with four connection cables/adapters</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>INLET pressure hose with screw connection 1620, color: black, length = 2 m / 78.74 inch</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>INLET suction hose, open end, transparent, length = 0.3 m / 11.81 inch</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>OUTLET Return hose, open end, transparent, length = 1 m / 39.37 inch</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>Operating and maintenance instructions</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>Certificate of calibration</td>
</tr>
</tbody>
</table>
What the FCU 1210 can do

The FCU 1210 is a portable service unit for the temporary measurement of solid particle contamination.

The integral pump and hoses supplied can be used on:

- Control circuits
- Pressure circuits
- non-pressurized tanks

The FCU can be connected to low- or medium-pressure hydraulic and lubrication lines from which a small flow of oil is diverted for measurement purposes.

The design of the FCU allows the users to connect directly to a machine hydraulic (Scheduling Oil Sample - SOS) port or at a system control pressure to obtain accurate particle counts. The FCU can be used in the field for bottle sampling analysis.

Applications for the FCU include the servicing and repair of mobile hydraulic systems.

Additional features include:

- Optical measurement of the degree of solid particle contamination
- Applicable for hydraulic fluids (up to ISO VG 68) 10 … 350 mm²/s / 16 … 1622 Sus
- Automatic measurement and display of cleanliness ratings in accordance with:
  - ISO 4406:1999; SAE AS 4059 (D)
- Measurement accuracy +/- 1 ISO code in the calibrated range
- Supply voltage of 24 V DC / 4 A for operation on mobile machine on-board power supplies
- Maximum operating pressure 45 bar / 650 psi
- Pressure resistant to maximum 345 bar / 5000 psi
- Integrated pump for the automatic control of oil flow
Restrictions on the use of the FCU 1210

NOTICE

Impermissible operating conditions

The FCU will be destroyed

► The FCU may only be used with mineral oils or mineral oil-based raffinates.
► Observe the permissible viscosity range (up to ISO VG 68):
  10 ... 350 mm²/s or 46 ... 1622 SUS
► Only operate the FCU for brief periods of time (S4 to DIN EN 60034 / VDE 0530).
► When the pump has been operating for 30 minutes, the FCU must be shut off for at least 10 minutes to cool down.

NOTICE

Connection of the FCU to board networks

The FCU will be destroyed

► Use the FCU only on board networks which have a central "Load Dump" fuse.
  The Load Dump with a maximum of 30 V DC must be installed and effective.
Counting particles in the FCU 1000

The measuring principle of the light blockade procedure is shown in simplified form in the following sketch.

The light source transmits monochromatic light through the flow of oil to a photo detector, which produces a particular electrical signal. If a particle gets between the light source and the photo detector, then a shadow will be cast on the photo detector.

This shadow causes a change in the electrical signal generated by the photo detector. This change makes it possible to determine the size of the shadow cast by the particle and thus to gauge the size of the particle itself.

This procedure makes it possible to determine the cleanliness class according to ISO 4406:1987, ISO 4406:1999, NAS 1638 and SAE AS 4059.

The disruption factors of this measurement principle are foreign fluids and small gas bubbles that lead to refractions, thus causing them to be counted as particles as well.

Each of the signal peaks corresponds to the shadow cast by one particle. The signal height or amplitude reflects the particle size. Thresholds are used to classify the particle sizes >2, >5, >15, >25 µm or >4, >6, >14, >21 µm(c).
How the FCU 1000 functions

From the oil source (either a pressure port or a reservoir or a bottle sample) a continuous oil current is established through the INLET connector by an electrically controlled gear pump (16).

The suction screen (17) protects the pump from coarse contamination.

The oil current to be analyzed flows through an optical Contamination Sensor (1). The contaminant particles contained in the oil current cause the light beam to be darkened in a pulse-like manner. An electronic evaluation module (4) classifies and counts these measurement signals according to particle diameter. The evaluation module (4) continuously computes the cleanliness classes for the reference volume of 100° ml based on the measurement signals of the optical sensor.

A defined pressure is generated in the oil flow via a counter balance valve (10). This serves to minimize air bubbles in the system, which could skew the measurement results.

The pressure relief valve (14) protects the pump and the measuring cell from excessive pressure.

The oil current leaves the OUTLET connector and must be routed by the return-flow hose to a depressurized tank.

The electronic evaluation module monitors:

- the functioning of the particle sensor
- the oil flow
- the power supply voltage

When a malfunction occurs, an error message automatically appears in the display and interrupts the measurement. The evaluation module will recognize when the cause of error has been corrected, and the unit will reset automatically and resume the measurement operation.
### User interface of the FCU 1210

**Item** | **Name** | **Details**  
--- | --- | ---  
1 | Display and keyboard | For operation details see page 37  
2 | Pump ON / OFF switch | Switches the internal pump on / off  
3 | Power supply connector 24 V DC |  
4 | OUTLET connector |  
5 | INLET connector with suction screen | Clean the suction screen (see chapter 48)
Dimensions of the FCU 1210

- Width: 340 mm (13.4 inch)
- Height: 300 mm (11.8 inch)
- Depth: 220 mm (8.7 inch)
Hydraulic diagram

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Test connector (INLET)</td>
</tr>
<tr>
<td>2</td>
<td>Suction screen, 400 µm</td>
</tr>
<tr>
<td>3</td>
<td>Electric motor</td>
</tr>
<tr>
<td>4</td>
<td>Gear pump</td>
</tr>
<tr>
<td>5</td>
<td>ContaminationSensor</td>
</tr>
<tr>
<td>6</td>
<td>Counter balance valve</td>
</tr>
<tr>
<td>7</td>
<td>Differential pressure relief valve</td>
</tr>
<tr>
<td>8</td>
<td>Quick coupling nipple (OUTLET)</td>
</tr>
</tbody>
</table>
Using the BatteryPack (accessory)

With the BatteryPack, which is available as an accessory, you can make the FCU independent of the electrical supply network.

For technical details on the BatteryPack, see its instruction brochure.
Preparing the FCU for measurement

Before operation, the FCU must first be hydraulically and electrically connected, as described below.

Connecting/disconnecting the FCU electrically

The FCU has a 3-way plug to connect to a 24 VDC power supply. Insert the 3-pole connector from the power supply (included in the FCU delivery) into this. Plug the power supply into the main electricity supply.

1. After the unit is plugged in, HYDAC FCU 1### appears in moving letters, followed by the firmware version, which appears for 2 seconds.
2. Next the internal sensor is tested.
3. The self-test with countdown follows: \textit{WAIT 99} to \textit{WAIT 0}.
3. The FCU is now ready.
4. As long as the pump is not running and no fluid is being pumped, the status LED will flash red, and the display will show \textit{CHECK}. This means that there is no oil flow.

To insert the connector

Insert the connector into the socket until it audibly snaps in.

To remove the connector

Press the catch on the connector (1) and then pull the connector out (2).
Connecting/disconnecting the OUTLET hose

**NOTICE**

If the OUTLET connection is closed or blocked

The FCU will be damaged.

- Never seal the OUTLET connection.
- Put the free end of the OUTLET return hose into an unpressurized container.

---

Fit the quick-action coupling on the OUTLET return hose to the nipple. Make sure that the coupling audibly snaps into place. Make sure that the quick-action coupling is firmly seated.

Put the other end of the OUTLET return hose into an unpressurized container.
Selecting the measurement point

1. Select the measurement location so that the sample measured comes from a turbulent location, with a good flow. For example on a pipe bend. This ensures that a typical sample is analyzed.

2. After installing the FCU in the vicinity of the measurement location, avoid:
   - delayed measurement results
   - sedimentation (deposition of particles in the line).

3. While installing the INLET hose, make sure that no siphon results.
Select the measurement method according to the pressure involved

After you have selected the measurement location according to the above-mentioned criteria, determine what the operating pressure is at that location.

Select the measurement method that is suitable for the pressure at the measurement point.

<table>
<thead>
<tr>
<th>Pressure at the measurement site</th>
<th>Measurement method</th>
<th>Details are on page</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 bar 0 psi</td>
<td>Measuring from unpressurized containers</td>
<td>35</td>
</tr>
<tr>
<td>1 – 45 bar 14 ... 650 psi</td>
<td>Measure up to max. 45 bar</td>
<td>29</td>
</tr>
<tr>
<td>15 – 345 bar 217 ... 5000 psi</td>
<td>Measuring at 15 ... 345 bar</td>
<td>32</td>
</tr>
</tbody>
</table>
Measure up to max. 45 bar / max. 650 psi

**WARNING**

Hydraulic systems are under pressure

Bodily injury

- The system must be depressurized before starting work on it.
- If the pressurized connection is connected to the hydraulic system, oil will flow through the FCU.
- Make sure that the specified sequence is followed.

**NOTICE**

If the operating pressure exceeds 45 bar / 650 psi

The excess pressure will be discharged via the OUTLET connection.

- Never seal the OUTLET connection.
- Put the free end of the OUTLET return hose into an unpressurized container.
- When operating the FCU, always observe the permissible operating pressure.
- The FCU 1000 can withstand pressures up to 345 bar / 5000 psi.

Required hoses

- OUTLET return hose
- High-pressure hose
To guarantee valid and direct measurements, the FCU must be primed. To do this, you need approximately 120 ml of oil to completely fill the hydraulic circuit inside the FCU and INLET hose.

If the FCU is not primed, an air-oil mixture will flow through the FCU at the start of measurement. The air-oil mixture will be interpreted

For an initial test without priming the FCU and hoses, you need at least 300 ml of fluid.

Make sure that the following sequence is observed:

1. Go through the steps in chapter "Preparing the FCU for measurement" on pages 25 to 28.

2. Check the pressure at the measurement point. The pressure there must be in the range from 1 ... 45 bar / 14 ... 650 psi.

If the pressure exceeds 45 bar / 650 psi, use the high-pressure adapter (see page 32).
3. Connect the INLET pressure hose (black) to the INLET port (1) of the FCU.
   Screw the measurement coupling clockwise (2) onto the connection and screw it finger tight.

4. Switch on the internal pump.

5. Conclude by connecting the other end of the INLET pressure hose to the measurement port of the system.

6. The hydraulic installation of the FCU is complete.

7. The FCU will start with the measurement.
Measuring at 15 ... 345 bar / 217 ... 5000 psi

Use the high-pressure adapter for measuring from 15 ... 345 bar / 217 ... 5000 psi. You can find this in the accessories list on page 58.

**WARNING**

*Hydraulic systems are under pressure*

- Bodily injury
  - The system must be depressurized before starting work on it.
  - If the pressurized connection is connected to the hydraulic system, oil will flow through the FCU.
  - Make sure that the specified sequence is followed.

**NOTICE**

*If the operating pressure exceeds 345 bar / 5000 psi*

The excess pressure will be discharged via the OUTLET connection.

- Never seal the OUTLET connection.
- Put the free end of the OUTLET return hose into an unpressurized container.
- When operating the FCU, always observe the permissible operating pressure.
- The FCU 1000 can withstand pressures up to 345 bar / 5000 psi.

Required hoses / adapters:
- OUTLET return hose
- High-pressure adapter (accessories)
- High-pressure hose
To guarantee valid and direct measurements, the FCU must be primed. To do this, you need approximately 120 ml of oil to completely fill the hydraulic circuit inside the FCU and INLET hose.

If the FCU is not primed, an air-oil mixture will flow through the FCU at the start of measurement. The air-oil mixture will be interpreted.

For an initial test without priming the FCU and hoses, you need at least 300 ml of fluid.

Make sure that the following sequence is observed:

1. Go through the steps in chapter "Preparing the FCU for measurement" on pages 25 to 28.

2. Check the pressure at the measurement point. The pressure there must be in the range from 15 ... 345 bar / 217 ... 5000 psi.

   If the pressure exceeds 345 bar, you may not use the FCU 1000. Use some other measurement point.
3. Screw the high pressure adapter onto the FCU's INLET connection.

4. Connect the high pressure hose to the high pressure adapter.

5. Switch on the internal pump.

6. Connect the other end of the high pressure hose to the measurement point of the hydraulic system.

7. The hydraulic installation of the FCU is now complete.

8. The FCU will start with the measurement.
Measuring from unpressurized containers

Required hoses
- OUTLET return hose
- Suction hose

To guarantee valid and direct measurements, the FCU must be primed. To do this, you need approximately 120 ml of oil to completely fill the hydraulic circuit inside the FCU and INLET hose.

If the FCU is not primed, an air-oil mixture will flow through the FCU at the start of measurement. The air-oil mixture will be interpreted

For an initial test without priming the FCU and hoses, you need at least 300 ml of fluid.
Make sure that the following sequence is observed:

1. Go through the steps in chapter “Preparing the FCU for measurement” on pages 25 to 28.

2. Connect the suction hose (transparent) to the FCU INLET.
   Put the other end of the transparent suction hose into an unpressurized container.

3. The hydraulic installation of the FCU is complete.

4. Switch on the internal pump.

5. The FCU will start with the measurement.
Operating the FCU

If the FCU is powered up, then it can be used.
In the following, the individual controls and their use are described.

Display and keypad elements

<table>
<thead>
<tr>
<th>Item</th>
<th>LED</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Display</td>
<td>Consists of six digits and shows the measured values.</td>
</tr>
<tr>
<td>B</td>
<td>Displayed variable</td>
<td>Indicates the displayed variable of the display value, e.g.: ISO / SAE / Flow / Out / Drive / Temp</td>
</tr>
<tr>
<td>C</td>
<td>Status</td>
<td>Indicates the status of the FCU (see page 54)</td>
</tr>
</tbody>
</table>

The keyboard consists of two keys. These keys are used to scroll through the variables to be displayed.

<table>
<thead>
<tr>
<th>Keyboard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For scrolling through the variables</td>
</tr>
</tbody>
</table>
Clicking through the display

Click through the displays by pressing the buttons.

ISO.SAE display

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.10.15</td>
<td>3-digit ISO code</td>
</tr>
<tr>
<td>13.4A</td>
<td>SAE class A</td>
</tr>
<tr>
<td>12.6B</td>
<td>SAE class B</td>
</tr>
<tr>
<td>13.0C</td>
<td>SAE class C</td>
</tr>
<tr>
<td>13.1D</td>
<td>SAE class D</td>
</tr>
<tr>
<td>MX 13.4A</td>
<td>SAE Max.</td>
</tr>
<tr>
<td>108</td>
<td>Flow rate in ml/min</td>
</tr>
<tr>
<td>42</td>
<td>LED current in %</td>
</tr>
<tr>
<td>37.8</td>
<td>Temperature in °C or °F</td>
</tr>
</tbody>
</table>
Measured variables

The measurements provide you with information about the purity of the oil in the system concerned. The measurement variables are calibrated. They indicate a measured value with an accuracy of +/- 1 ISO codes.

Measured variable "ISO"

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="201815" /></td>
<td>The measured value is updated depending on the set measuring time. Display of the 3-digit ISO code. Example: ISO code 20.18.15</td>
</tr>
</tbody>
</table>

Measured variable "SAE"

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="134A" /></td>
<td>The measured value is updated depending on the set measuring time. Display of a channel in the SAE class. Example: SAE class, channel A = 13.4</td>
</tr>
</tbody>
</table>

Service variables

These values give you information about the determined flow and the light source power within the FCU. The service variables are not calibrated.

Service variables "Flow"

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="108" /></td>
<td>Here, you can see the averaged flow through the contamination sensor unit. Example: Flow rate = 108 ml/min</td>
</tr>
</tbody>
</table>

Service variables "Drive"

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="42" /></td>
<td>Display of the light source efficiency (1-100%) with which the ContaminationSensor unit currently works. Example: Light source efficiency = 42%</td>
</tr>
</tbody>
</table>
Service variable "Temperature"

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Display" /></td>
<td>The fluid temperature is measured indirectly via the housing. Example: Temperature = 37.8°C</td>
</tr>
</tbody>
</table>

Display FREEZE

This function makes it possible for you to call up the last 20 displayed values on the display.

The active display is then frozen in the set MTIME cycle.

The display FREEZE function is based on a volatile memory and means that the values can be called up only as long as the CS is supplied with power and the sensor is in display FREEZE.

The measured values are automatically numbered, whereby the highest incremental number represents the last measured value. That means that when the memory is full (20 measured values), the value 20 is the most recent and the value 1 is the oldest.

If the memory exceeds 20 display values, the oldest entry will be overwritten.

Activate display FREEZE

To activate or deactivate the history memory FREEZE, press both keys simultaneously.

The FREEZE function starts with the display of the most recent measured value.

<table>
<thead>
<tr>
<th>Buttons</th>
<th>The following appears in the display (1 sec)</th>
<th>&lt;--&gt;</th>
<th>The following appears in the display (3 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Up/Down" /></td>
<td><img src="image" alt="Display" /></td>
<td>20.</td>
<td><img src="image" alt="Display" /></td>
</tr>
<tr>
<td><img src="image" alt="Up/Down" /></td>
<td><img src="image" alt="Display" /></td>
<td>19</td>
<td><img src="image" alt="Display" /></td>
</tr>
</tbody>
</table>
Deactivate display FREEZE

If FREEZE is set to MANUAL in the PowerUp menu:

Press both buttons simultaneously to return to the current display.

The display switches to the preset display. All values present in the FREEZE memory are deleted.

If FREEZE is set to TIMEOUT in the PowerUp menu:

You are returned automatically to the current display after 10 times the value for MTIME, or manually by pressing both arrow keys simultaneously.

The factory setting of MTIME is 60 seconds * 10 = 600 seconds = 10 minutes.
Preparing the FCU for transport

To prepare the FCU for transport, observe the following sequence:

1. Use the switch to turn the internal pump off.

2. First undo the end of the high-pressure INLET hose that is at the measurement point of the hydraulic system.

3. Remove the hose by turning the connector to the FCU INLET connection anticlockwise.
4. Undo the quick-action coupling on the OUTLET hose by lifting the outer ring.

⚠️ Empty the hose into an unpressurized container.

To let air into the hose, open it by using a thin object to press in the check valve on the quick-action coupling. This means that the fluid can then quickly drain out of the hose.

After emptying it, join the two ends of the hose together. In this way you can ensure that no more fluid will leak from the hose during transport.

7. Release the catch (1) and then pull the socket out of the connector (2).
8. Close the FCU using both catches.  
The catches must audibly engage.

9. Stow the hose and the power supply in 
the bag.

10. The FCU is ready for transport.
Performing maintenance

At the latest, conduct the required configuration maintenance and inspection work every six months, otherwise, whenever an error message or malfunction makes it necessary.

All operating media are to be protected in case the product is accidentally started up.

When performing any maintenance, servicing, inspection or repair work, disconnect the FCU from the power supply and ensure that it cannot be switched back on inadvertently.

Always check the product to see that it functions properly when performing maintenance and servicing work.

All fittings which have been removed must be checked to ensure that they have been properly secured.

Cleaning the FCU

Clean the control panel with a clean, moist cloth. Do not use any chemical cleaning agent as these may damage the film attached to the surface of the FCU.

You can clean the outside of the closed FCU with a wet cloth.

Rinsing the FCU

NOTICE

Impermissible flushing media

The FCU will be destroyed

► Flush the FCU only with low-viscosity mineral oils or mineral oil-based raffinates (e.g. diesel) with a flash point > 55°C / 131°F.

► Mineral turpentine or other degreasing media are not allowed.

Flush the FCU after each use, but at least daily, with cleaned mineral oil.

The FCU must be flushed as soon as:

- unfiltered oil, or oil with 50 W or higher viscosity has been tested.
- the measurements seem to be unusually high or low.
Flush the FCU as described below:

1. Put approx. 0.5 liters of filtered oil into a clean container.

2. Connect the OUTLET return hose to the FCU and put the free end into a container for the used fluid.

3. Attach the suction hose to the FCU INLET connection.
   Put the free end of the suction hose into the container with the filtered oil.
4. **Use the switch on the FCU to turn its pump on.**

5. **Cleanliness values will be displayed during the flushing procedure.**
   
   These measurements are not correct, but should decrease during the flushing procedure.

6. **Once the 0.5 liters have been sucked up, switch off the pump.**

7. **The FCU is ready for operation.**
Clean the suction strainer.

**NOTICE**

**Operation without a suction screen**

The FCU pump can be damaged

► Never use the FCU without a suction screen.
► Clean the suction screen regularly.

The sieve is fitted under the INLET connector and protects the pump from contamination by coarse particles.

Clean the suction screen regularly. If the FCU is blocked or there is no flow through, clean the suction screen immediately.

To check/clean the sieve, proceed as follows:

1. Remove all of the hydraulic and electrical connections to the FCU.

2. Loosen the inlet connector, with a 19 mm wrench, turning it anticlockwise.

3. Unscrew the INLET connector manually, turning it anticlockwise.
4. Insert a finger in the opening ...

5. ... and pull out the suction screen upwards.

6. Clean the sieve by blowing it out with compressed air.

Before reassembly, check that the sealing ring for the connector is undamaged.

Replace it if necessary.

Before screwing it in place, wet the sealing ring (C) with some hydraulic fluid.
7. Put the sieve back into the opening.

8. Manually screw the INLET connector in clockwise.

9. Using a 19 mm wrench, tighten the INLET connector, turning it clockwise. Note the maximum torque of 25 Nm.
Checking the high pressure adapter (accessories)

In the high pressure adapter there is a 400 µm sieve to protect the flow control valve. Clean this sieve at least every 6 months, or more frequently if heavy soiling makes it necessary.

The flow rate through the high pressure adapter is regulated to approx. 0.55 ... 0.7 l/min.

If the necessary flow rate is not reached, you must check the sieve in the adapter and clean it.
Cleaning / changing the sieve in the high pressure adapter

**NOTICE**

Operation without a sieve

The FCU pump can be damaged

- Never use the high-pressure adapter without a sieve.
- Clean the suction screen regularly

The sieve (B) in the high pressure adapter must be cleaned regularly

Remove the measurement coupling (A) from the threaded joint (D) with a 22 mm open-jaw wrench, anticlockwise. Then unscrew the sieve (B) anticlockwise with a screwdriver or the special tool (see accessories list 58).

Clean sieve (B) and then blow it out with compressed air.

To fit the sieve (B), screw it in, clockwise, to union (D) using a screwdriver or the special tool.

Then check the sealing ring on the coupling (A) for damage and replace if necessary.

Turn the coupling (A) in a clockwise direction and tighten to 25 Nm.
Cleaning / changing the strainer in the high pressure adapter

NOTICE

Wrong installation of the flow control valve

Flow control valve is not working
► Pay attention to the direction of flow when installing the flow control valve.

The flow control valve regulates the flow to approx. 0.55 ... 0.7 l/min. If the necessary flow rate is not achieved through the high-pressure adapter, then the flow control valve will have to be cleaned or replaced.

Remove coupling (A) using a 22 mm open-jaw wrench turning it anticlockwise out of the screw fitting (D).

Now unscrew the sieve (B) anticlockwise, with a screwdriver or the special tool (see accessories list on page 58).

Clean sieve (B) and then blow it out with compressed air.

Also unscrew the flow control valve (C) anticlockwise with a screwdriver or the special tool (see accessories list on page 58).

To install the new flow control valve (C), screw it firmly clockwise into the union (D) with a screwdriver or the special tool.

Screw the sieve (B) clockwise into union (D) using a screwdriver or the special tool.

Then check the sealing ring on the coupling (A) for damage. Replace it if necessary.

Turn the coupling (A) in a clockwise direction and tighten to 25 Nm.
**FCU status messages / error messages**

The following error messages are possible:

<table>
<thead>
<tr>
<th>LED color</th>
<th>Display / status blink code</th>
<th>FCU status</th>
<th>To do</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>FCU no digits displayed</td>
<td>no function</td>
<td>Check the power supply to the FCU. Contact the HYDAC service department.</td>
</tr>
<tr>
<td>Green</td>
<td>FCU ready for operation</td>
<td></td>
<td>You can make further measurements.</td>
</tr>
<tr>
<td>Red</td>
<td>Oil flow too low</td>
<td></td>
<td>Check that the flow is between 30 … 300 ml/min, as permitted. Check whether the pump is running and if the INLET connection is attached Check/clean the suction screen.</td>
</tr>
<tr>
<td>Red</td>
<td>Oil flow too high</td>
<td></td>
<td>Check that the flow is between 30 … 300 ml/min, as permitted. Check whether the pump is running and if the INLET connection is attached Check/clean the suction screen. Reduce the inlet pressure.</td>
</tr>
<tr>
<td>Red</td>
<td>Flow specification not</td>
<td>possible</td>
<td>Check that the flow is between 30 … 300 ml/min, as permitted. Reduce the inlet pressure.</td>
</tr>
</tbody>
</table>

**Exceptions Errors**

<table>
<thead>
<tr>
<th>LED</th>
<th>Blink code / Display</th>
<th>FCU status</th>
<th>To do</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td>Blink code / Display</td>
<td>FCU status</td>
<td>To do</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>Red</td>
<td>Sensor LED is obscured</td>
<td>There may be foam in the measurement cell - rinse the FCU. Contact HYDAC</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Firmware error</td>
<td>Perform a reset of the FCU or contact HYDAC.</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>General system error</td>
<td>Perform a reset of the FCU or contact HYDAC.</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Error during automatic adjustment</td>
<td>Check the flow. Perform a reset of the FCU or contact HYDAC.</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Error in the measurement cell</td>
<td>Perform a reset of the FCU or contact HYDAC.</td>
<td></td>
</tr>
</tbody>
</table>
**Resetting the FCU**

To reset the FCU, remove the power supply to the FCU for 10 seconds.

Press the catch on the connector (1) and then pull the connector out (2).

To remove the connector

Insert the connector into the socket until it audibly snaps in.

To insert the connector

**Disposing of the FCU**

Dispose of the packaging material as appropriate for your area.

When decommissioning and/or disposing of the unit, observe all local guidelines and regulations pertaining to occupational safety and environmental protection. This applies in particular to the oil in the unit, components covered with oil and electronical components.

After disassembling the unit and separating the various materials, reuse them or dispose of them properly in accordance with local regulations.
## Spare Parts List

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>349150</td>
<td>INLET high pressure hose with screwed joint, for measurement point type 1620, color: black, L = 2 m</td>
<td><img src="image1.png" alt="INLET high pressure hose with screwed joint" /></td>
</tr>
<tr>
<td>3297276</td>
<td>INLET suction hose with open end, color: transparent, Length = 0.3 m</td>
<td><img src="image2.png" alt="INLET suction hose with open end" /></td>
</tr>
<tr>
<td>3300054</td>
<td>OUTLET return hose with open end, transparent, length = 1 m / 39.37 inch</td>
<td><img src="image3.png" alt="OUTLET return hose with open end" /></td>
</tr>
<tr>
<td>278475</td>
<td>Suction strainer, 400 µm (for INLET port)</td>
<td><img src="image4.png" alt="Suction strainer" /></td>
</tr>
<tr>
<td>607755</td>
<td>Seal ring for INLET test point union (Ø 21 mm, according to DIN3869)</td>
<td><img src="image5.png" alt="Seal ring" /></td>
</tr>
<tr>
<td>6059933</td>
<td>Power adapter (without power cord) primary: 100-240 V AC secondary: 24 V DC, 5A, cable with 3-pole plug, Length = 1.6 m</td>
<td><img src="image6.png" alt="Power adapter" /></td>
</tr>
<tr>
<td>6008448</td>
<td>Connection cable for power adapter European plug, Length = 2 m</td>
<td><img src="image7.png" alt="Connection cable for power adapter" /></td>
</tr>
<tr>
<td>6008447</td>
<td>Connection cable for power adapter plug for England (UK), Length = 2 m</td>
<td><img src="image8.png" alt="Connection cable for power adapter plug" /></td>
</tr>
<tr>
<td>6008446</td>
<td>Connection cable for power adapter plug for USA, Length = 2 m</td>
<td><img src="image9.png" alt="Connection cable for power adapter plug" /></td>
</tr>
<tr>
<td>6008449</td>
<td>Connection cable for power adapter plug for Australia (AUS), Length = 2 m</td>
<td><img src="image10.png" alt="Connection cable for power adapter plug" /></td>
</tr>
<tr>
<td>3304697</td>
<td>Attachable bag for hoses, cables and accessories</td>
<td><img src="image11.png" alt="Attachable bag" /></td>
</tr>
<tr>
<td>3303676</td>
<td>Self-adhesive document folder for Operating and Maintenance instructions/Calibration certificate</td>
<td><img src="image12.png" alt="Self-adhesive document folder" /></td>
</tr>
</tbody>
</table>
### FCU1210 Spare Parts List

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<table>
<thead>
<tr>
<th>Part no.</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>3377173</td>
<td>Document folder for Operating and Maintenance instructions / Calibration certificate</td>
<td></td>
</tr>
<tr>
<td>3278229</td>
<td>Operation and Maintenance Instructions (this document)</td>
<td></td>
</tr>
</tbody>
</table>

### Accessories for the FCU

<table>
<thead>
<tr>
<th>Part no.</th>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>3325744</td>
<td>INLET suction hose with open end, color: transparent, Length = 1.5 m</td>
<td></td>
</tr>
<tr>
<td>349151</td>
<td>OUTLET return hose, open end, transparent, length = 2 m</td>
<td></td>
</tr>
<tr>
<td>3306236</td>
<td>12V/24V DC cable with universal plug, including 8A fuse, Length = 10 m</td>
<td></td>
</tr>
<tr>
<td>3524138</td>
<td>12V/24V DC cable with universal plug, including 8A fuse, Length = 2 m</td>
<td></td>
</tr>
<tr>
<td>6052824</td>
<td>Fuse 8 A for universal plug (Ø 6 x 25 mm, according to DIN 72581)</td>
<td></td>
</tr>
<tr>
<td>6051653</td>
<td>Battery adapter for 12V/24V DC with coupling for universal plug, Length = 0.3 m</td>
<td></td>
</tr>
<tr>
<td>3504605</td>
<td>BatteryPack, 24 V DC / 4500 mAh</td>
<td></td>
</tr>
<tr>
<td>Part no.</td>
<td>Description</td>
<td>Figure</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3364502</td>
<td>High pressure adapter, complete</td>
<td><img src="image1.jpg" alt="High pressure adapter" /></td>
</tr>
<tr>
<td>3152786</td>
<td>Suction strainer, 400 µm for high pressure adapter</td>
<td><img src="image2.jpg" alt="Suction strainer" /></td>
</tr>
<tr>
<td>710389</td>
<td>Flow control valve for high pressure adapter</td>
<td><img src="image3.jpg" alt="Flow control valve" /></td>
</tr>
<tr>
<td>3209986</td>
<td>Tool to change the flow control valve in the high pressure adapter</td>
<td><img src="image4.jpg" alt="Tool to change flow control valve" /></td>
</tr>
</tbody>
</table>

*) available on request
Overview - ISO 4406 / SAE AS 4059 and NAS 1638 classes

ISO 4406:1999

In ISO 4406:1999, particle counts are determined cumulatively, i.e. > 4 μm(c), >6 μm(c) and >14 μm(c) (manually by filtering the fluid through an analysis membrane or automatically using particle counters) and allocated to measurement references.

The goal of allocating particle counts to references is to facilitate the assessment of fluid cleanliness ratings.

In 1999 the "old" ISO 4406:1987 was revised and the size ranges of the particle sizes undergoing analysis redefined. The counting method and calibration were also changed.

This is important for the user in his everyday work: even though the measurement references of the particles undergoing analysis have changed, the cleanliness code will change only in individual cases. When drafting the "new" ISO 4406:1999 it was ensured that not all the existing cleanliness provisions for systems had to be changed.

ISO 4406 table

Allocation of particle counts to cleanliness classes:

<table>
<thead>
<tr>
<th>Class</th>
<th>More than 0</th>
<th>Up to (and including) 1</th>
<th>Class</th>
<th>More than 15</th>
<th>Up to (and including) 32,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>15</td>
<td>16,000</td>
<td>32,000</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>16</td>
<td>32,000</td>
<td>64,000</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>17</td>
<td>64,000</td>
<td>130,000</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>8</td>
<td>18</td>
<td>130,000</td>
<td>250,000</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>16</td>
<td>19</td>
<td>250,000</td>
<td>500,000</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>32</td>
<td>20</td>
<td>500,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
<td>64</td>
<td>21</td>
<td>1,000,000</td>
<td>2,000,000</td>
</tr>
<tr>
<td>7</td>
<td>64</td>
<td>130</td>
<td>22</td>
<td>2,000,000</td>
<td>4,000,000</td>
</tr>
<tr>
<td>8</td>
<td>130</td>
<td>250</td>
<td>23</td>
<td>4,000,000</td>
<td>8,000,000</td>
</tr>
<tr>
<td>9</td>
<td>250</td>
<td>500</td>
<td>24</td>
<td>8,000,000</td>
<td>16,000,000</td>
</tr>
<tr>
<td>10</td>
<td>500</td>
<td>1,000</td>
<td>25</td>
<td>16,000,000</td>
<td>32,000,000</td>
</tr>
<tr>
<td>11</td>
<td>1,000</td>
<td>2,000</td>
<td>26</td>
<td>32,000,000</td>
<td>64,000,000</td>
</tr>
<tr>
<td>12</td>
<td>2,000</td>
<td>4,000</td>
<td>27</td>
<td>64,000,000</td>
<td>130,000,000</td>
</tr>
<tr>
<td>13</td>
<td>4,000</td>
<td>8,000</td>
<td>28</td>
<td>130,000,000</td>
<td>250,000,000</td>
</tr>
<tr>
<td>14</td>
<td>8,000</td>
<td>16,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Note: increasing the measurement reference by 1 causes the particle count to double.

Example: ISO class 18 / 15 / 11 means:

<table>
<thead>
<tr>
<th>Cleanliness class</th>
<th>Particle count / 100 ml</th>
<th>Size ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>130,000 – 250,000</td>
<td>&gt; 4 µm (c)</td>
</tr>
<tr>
<td>15</td>
<td>16,000 – 32,000</td>
<td>&gt; 6 µm (c)</td>
</tr>
<tr>
<td>11</td>
<td>1,000 – 2,000</td>
<td>&gt; 14 µm (c)</td>
</tr>
</tbody>
</table>

Are in 100 ml of the analyzed sample.

Overview of the differences between ISO 4406:1987 and ISO 4406:1999

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Size ranges</td>
<td>&gt; 5 µm</td>
<td>&gt; 4 µm (c)</td>
</tr>
<tr>
<td></td>
<td>&gt; 15 µm</td>
<td>&gt; 6 µm (c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 14 µm (c)</td>
</tr>
<tr>
<td></td>
<td>Longest dimension of a particle</td>
<td>Diameter of the area-equivalent circle ISO 11171:1999</td>
</tr>
<tr>
<td>Test dust</td>
<td>ACFTD dust</td>
<td>1-10 µm ultra fine fraction ISO 12103-1A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAE Fine, AC Fine   ISO 12103-1A2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAE 5-80 µm ISO MTD Calibration dust for particle counters ISO 12103-1A3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAE Coarse Coarse fraction ISO 12103-1A4</td>
</tr>
<tr>
<td>Comparable size ranges</td>
<td>Old ACFTD calibration</td>
<td>Comparable ACFTD dusts New NIST calibration</td>
</tr>
<tr>
<td></td>
<td>-----</td>
<td>&lt; 1 µm</td>
</tr>
<tr>
<td></td>
<td>5 µm</td>
<td>4 µm (c)</td>
</tr>
<tr>
<td></td>
<td>15 µm</td>
<td>6 µm (c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 µm (c)</td>
</tr>
</tbody>
</table>
SAE AS 4059

Like ISO 4406, SAE AS 4059 describes particle concentrations in liquids. The analysis methods can be applied in the same manner as ISO 4406:1999.

The SAE cleanliness classes are based on particle size, number and distribution. The particle size determined depends on the measurement process and calibration; consequently the particle sizes are labeled with letters (A-F).

The following table shows the cleanliness in relation to the particle concentration determined.

**SAE AS 4059 table**

<table>
<thead>
<tr>
<th>Size ISO 4402</th>
<th>&gt; 1 µm</th>
<th>&gt; 5 µm</th>
<th>&gt; 15 µm</th>
<th>&gt; 25 µm</th>
<th>&gt; 50 µm</th>
<th>&gt; 100 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size ISO 11171</td>
<td>&gt; 4 µm(c)</td>
<td>&gt; 6 µm(c)</td>
<td>&gt; 14 µm(c)</td>
<td>&gt; 21 µm(c)</td>
<td>&gt; 38 µm(c)</td>
<td>&gt; 70 µm(c)</td>
</tr>
<tr>
<td>Size Code</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>000</td>
<td>195</td>
<td>76</td>
<td>14</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>00</td>
<td>390</td>
<td>152</td>
<td>27</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>780</td>
<td>304</td>
<td>54</td>
<td>10</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1,560</td>
<td>609</td>
<td>109</td>
<td>20</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3,120</td>
<td>1,220</td>
<td>217</td>
<td>39</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>6,250</td>
<td>2,430</td>
<td>432</td>
<td>76</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>12,500</td>
<td>4,860</td>
<td>864</td>
<td>152</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>25,000</td>
<td>9,730</td>
<td>1,730</td>
<td>306</td>
<td>53</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>50,000</td>
<td>19,500</td>
<td>3,460</td>
<td>612</td>
<td>106</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>100,000</td>
<td>38,900</td>
<td>6,920</td>
<td>1,220</td>
<td>212</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>200,000</td>
<td>77,900</td>
<td>13,900</td>
<td>2,450</td>
<td>424</td>
<td>64</td>
</tr>
<tr>
<td>9</td>
<td>400,000</td>
<td>156,000</td>
<td>27,700</td>
<td>4,900</td>
<td>848</td>
<td>128</td>
</tr>
<tr>
<td>10</td>
<td>800,000</td>
<td>311,000</td>
<td>55,400</td>
<td>9,800</td>
<td>1,700</td>
<td>256</td>
</tr>
<tr>
<td>11</td>
<td>1,600,000</td>
<td>623,000</td>
<td>111,000</td>
<td>19,600</td>
<td>3,390</td>
<td>512</td>
</tr>
<tr>
<td>12</td>
<td>3,200,000</td>
<td>1,250,000</td>
<td>222,000</td>
<td>39,200</td>
<td>6,780</td>
<td>1,020</td>
</tr>
</tbody>
</table>

**Cleanliness classes according to SAE**

**Absolute particle count larger than a defined particle size**

Example: cleanliness class to AS 4059:6

The maximum permissible particle count in the individual size ranges is shown in the table in boldface.

Cleanliness class to AS 4059:6B

Size B particles may not exceed the maximum number indicated for code 6

6 B = max. 19,500 particles > 5 µm in size
Specifying a cleanliness class for each particle size

Example: cleanliness class to AS 4059:  7 A / 7 B / 6 C / 5 D

<table>
<thead>
<tr>
<th>Cleanliness class</th>
<th>Particle count / 100 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size A ( &gt; 1 µm / &gt; 4 µm(c))</td>
<td>100,000</td>
</tr>
<tr>
<td>Size B ( &gt; 5 µm / &gt; 6 µm(c))</td>
<td>38,900</td>
</tr>
<tr>
<td>Size C ( &gt; 15 µm / &gt; 14 µm(c))</td>
<td>3460</td>
</tr>
<tr>
<td>Size D ( &gt; 25 µm / &gt; 21 µm(c))</td>
<td>306</td>
</tr>
</tbody>
</table>

Specifying the highest cleanliness class measured

Example: Cleanliness class according to AS 4059  6 A – F

The 6 A – F specification requires a particle count in size ranges A – F. The respective particle concentration of cleanliness code 6 may not be exceeded in any of these ranges.

Calibrating the FCU

Recalibrate the FCU according to ISO 9000 standard.
We recommend a recalibration of the FCU at least every 3 years.

Customer service

Shipping address for calibration and repair:

Germany
HYDAC Service GmbH
Product Support, Werk 10
66128 Saarbrücken, Germany
Telephone: ++49 (0) 6897 509 883
Fax: ++49 (0) 6897 509 324
E-mail: service@hydac.com

USA
HYDAC Technology Corporation, HYCON Division
2260 City Line Road
USA-Bethlehem, PA 18017
P.O. Box 22050
USA-Lehigh Valley, PA 18002-2050
Telephone: +1 (0) 610 266 0100
Fax: +1 - 610 - 2 31-04 45
E-mail: sales@hydacusa.com
Internet: www.hydacusa.com

Australia

HYDAC Pty. Ltd.
109 Dohertys Road
P.O. Box 224
AUS-3025 Altona North
Telephone: +61 - 3 - 92 72 89 00
Fax: +61 - 3 - 93 69 89 12
E-mail: info@hydac.com.au
Brazil

HYDAC TECNOLOGIA LTDA
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CEP 09852-060
Cooperativa
BR- São Bernardo do Campo – SÃO PAULO
Telephone: +55 - 11 - 4393.6600
Fax: +55 - 11 - 4393.6617
E-mail: hydac@hydac.com.br
Homepage www.hydac.com.br

China

HYDAC TECHNOLOGY (SHANGHAI) LIMITED
28 Zhongpin Lu
Shanghai Minhang Economic &
Technological Development Zone
SHANGHAI 200245; P.R. CHINA
Telephone: (0086) 21/64 63 35 10
Fax: (0086) 21/64 30 02 57
E-mail: hydacsh@hydac.com.cn
### Technical data

<table>
<thead>
<tr>
<th>ContaminationSensor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-diagnosis</td>
<td>continuously with error indication via status LED and display</td>
</tr>
<tr>
<td>Display</td>
<td>LED, 6 digits, in 17 segment format each</td>
</tr>
<tr>
<td>Measured values for solid particle contamination</td>
<td>ISO code / SAE class</td>
</tr>
<tr>
<td>Measurement range</td>
<td>Display ISO classes min. 9/8/7 … max. ISO 25/24/23</td>
</tr>
<tr>
<td></td>
<td>Calibrated in the range ISO 13/11/10 - ISO 23/21/18</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 1 ISO code</td>
</tr>
<tr>
<td>Service Display</td>
<td>Flow / drive / temperature</td>
</tr>
<tr>
<td>Measuring time</td>
<td>30 seconds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydraulic data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable Fluids</td>
<td>Mineral oil</td>
</tr>
<tr>
<td>Hydraulic Connectors</td>
<td></td>
</tr>
<tr>
<td>INLET:</td>
<td>Test connector type 1604</td>
</tr>
<tr>
<td>OUTLET:</td>
<td>DN7 nipple socket</td>
</tr>
<tr>
<td>INLET operating pressure</td>
<td>-0.5 … 45 bar / 0 … 650 psi</td>
</tr>
<tr>
<td>OUTLET operating pressure</td>
<td>0 … 0.5 bar max. / 0 … 7.5 psi max.</td>
</tr>
<tr>
<td>Measurement flow rate:</td>
<td>30 … 300 ml/min (viscosity dependent)</td>
</tr>
<tr>
<td>Permissible viscosity range</td>
<td>10 … 350 mm²/s / 46 … 1622 Sus</td>
</tr>
<tr>
<td>Maximal suction height</td>
<td>1 m / 39.37 inch</td>
</tr>
<tr>
<td>INLET suction hose</td>
<td>DN4, open-end, color: transparent, Length = 0.3 m / 11.81 inch</td>
</tr>
<tr>
<td>INLET high-pressure hose</td>
<td>DN4 with screw connection for test point 1620, color: black, length = 2 m / 78.74 inch</td>
</tr>
<tr>
<td>OUTLET return hose</td>
<td>DN7, open-end, color: transparent, Length = 1 m / 39.37 inch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>24 V DC, ± 20%, residual ripple ≤ 10%</td>
</tr>
<tr>
<td>Power consumption / electricity</td>
<td>100 W max. / 4 A max.</td>
</tr>
</tbody>
</table>
### Electrical data

| IP class          | IP 50 (in Operation)  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IP 67 (closed)</td>
</tr>
<tr>
<td>Protection class</td>
<td>III (low voltage protection)</td>
</tr>
</tbody>
</table>

### General data

<table>
<thead>
<tr>
<th>Material of sealings</th>
<th>FPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid temperature range</td>
<td>0° ... +70° C / 32° ... 158° F</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>0° ... +45° C / 32° ... 113° F</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-40° ... +80° C / -40° ... 176° F</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>max. 90%, non-condensing</td>
</tr>
<tr>
<td>Weight</td>
<td>≈ 9 kg</td>
</tr>
</tbody>
</table>
## Model Code

<table>
<thead>
<tr>
<th>Product</th>
<th>FCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>1</td>
</tr>
<tr>
<td>Contamination code</td>
<td>2</td>
</tr>
<tr>
<td>Housing</td>
<td>1</td>
</tr>
<tr>
<td>Fluids</td>
<td>0</td>
</tr>
<tr>
<td>Options</td>
<td>4</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>U</td>
</tr>
<tr>
<td>Power supply adapter</td>
<td>z</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1000 series, 4 particle size channels</td>
</tr>
<tr>
<td>2</td>
<td>ISO4406:1999; SAE AS4059 (D)</td>
</tr>
<tr>
<td>1</td>
<td>for portable use (plastic case with a bag)</td>
</tr>
<tr>
<td>0</td>
<td>based on mineral oil</td>
</tr>
<tr>
<td>4</td>
<td>with integrated pump</td>
</tr>
<tr>
<td>U</td>
<td>24 V DC</td>
</tr>
<tr>
<td>z</td>
<td>Without</td>
</tr>
<tr>
<td>1</td>
<td>100 ... 240 V AC / 50/60 Hz / 1 phase / 5000 mA</td>
</tr>
<tr>
<td></td>
<td>(Europe, USA/Canada, UK, Australia, Japan)</td>
</tr>
</tbody>
</table>
EC declaration of conformity

<table>
<thead>
<tr>
<th>Name</th>
<th>FluidControl Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>FCU1000 Series</td>
</tr>
<tr>
<td>Part no.</td>
<td>-</td>
</tr>
<tr>
<td>Serial no.</td>
<td>-</td>
</tr>
<tr>
<td>EU Machinery Directive</td>
<td>2006/42/EG</td>
</tr>
<tr>
<td>EU Electrical Equipment Regulations</td>
<td>2006/95/EG</td>
</tr>
<tr>
<td>EMC Guideline</td>
<td>2004/108/EG</td>
</tr>
</tbody>
</table>

2009-12-01 Thorsten Trier

(CE-authorized person)
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