Service Measuring Set
CX197
Operating Instructions

Version 1.2 EN
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1. SAFETY

1.1 General safety and warning information

- Heed the valid regulations for accident protection and environmental protection.

- Heed the safety regulations and provisions of the country in which the product is used/applied.

- Use HYDROTECHNIK GmbH products only if they are in technically perfect condition.

- Heed all instructions on the product.

- People who install, operate, uninstall or maintain HYDROTECHNIK GmbH products may not be under the influence of alcohol or other drugs or medications that influence their ability to react.

- Use only accessory and spare parts approved by the manufacturer in order to exclude danger to people due to unsuitable spare parts.

- Adhere to the technical data and environmental conditions specified in the product documentation.

- If in safety-relevant applications unsuitable products are installed or use, unintended operating conditions can arise in the application, which can cause personal injury or property damage. Therefore, only use a product in safety-relevant applications if these are explicitly specified and permitted in the product documentation.

- You may only start the product up if it has been determined that the end product (for example, a machine or system) in which the HYDROTECHNIK GmbH products are installed complies with the country-specific provisions, safety regulations, and standards of the application.
**Dangerous electrical voltage**

- Never cut, damage or modify the power pack cables or place things on it.
- Never touch the power pack with wet or moist hands.
- Only connect the power pack to power supplies for which it is suited,
- Unplug the power cable from the outlet during a thunderstorm.
- Unplug the power cable if you detect smoke or there is an odor, or if the power cable is damaged.
- Ensure sufficient grounding of your system. Inadequate grounding may cause incorrect measurements.

**Caution**

**Laser**

The particle counter contains a laser, which with proper use is classified as a Class 1 laser according to DIN EN 60825-1:2001-11. The accessible laser beam is not dangerous under reasonably foreseeable conditions.

- For Class 1 laser equipment, in the upper performance range, blinding, compromising of color vision, and disruptions cannot be excluded.
- Do not remove any covers or panels.
1.2 Notes about use of the CX197 Measuring Block

- Connect the pressure and tank lines of the measuring block in the correct sequence.

- Heed the maximum permissible pressure range.

- If the measuring block is operated with hot medium, there is a risk of burning when touching the block.

- Consider when deaerating that skin contact with hot oil can cause burns. Adjust the oil pressure so that as little oil as possible escapes.

- The measuring block should be securely fastened in a suitable place so that falling off and damage to the sensors is prevented.

- Handle the measuring block and measurement technology properly.

- In case of escape or spilling of hydraulic fluid, contamination of the environment and ground water must be prevented. Use oil binders to bind escaped hydraulic oil.

- During installation, pay attention to cleanliness in order to prevent foreign bodies such as metal chips or fibres from cleaning cloths from getting into the hydraulic lines and causing wear and malfunctions in the product.

- Before start-up, check whether all hydraulic and mechanical connections are connected and tight, and ensure that all gaskets and seals of the plug connections are inserted correctly and undamaged.

- Do not use hemp as a sealant.

1.3 Information about the use of sensors and cables

- Protect the sensors from exceeding the allowed power range, mechanical overload and incorrect pin assignment.

- Never expose the instrument to excessive heat or moisture and observe the technical data.

- Never submerge the sensors in water or other liquids. Never let liquids come into the instrument.

- Never open the instruments.
• Avoid strong magnetic fields. Keep the sensors away from electric motors or other devices that generate electromagnetic fields. Strong magnetic fields may cause malfunctions and influence measurement values.

• Prevent the formation of condensation. If condensation has formed, let the instrument acclimate before you switch it on. Otherwise it can be damaged.

2. BASICS

2.1 Scope

This operation manual applies for the Service Measuring Set CX197. It is intended for the operator of this measurement set, that means the person who works with the instrument. This is not a technical manual. Please contact our customer service in case you have questions that go beyond the contents of this manual.

2.2 Copyright

The instrument and this manual are protected by copyright. Reproduction without license will be prosecuted. All rights reserved to this manual; this includes the reproduction and/or duplication in any conceivable form, e.g. by photocopying, printing, on any data recording media or in translated form. Reproduction of this manual is only permitted with a written approval of HYDROTECHNIK GmbH.

The technical state at the time of delivery of the instrument and the manual is decisive if no other information is given. We reserve the right to make technical changes without special announcement. Earlier manuals are no longer valid. The general conditions of sale and delivery of HYDROTECHNIK GmbH apply.
2.3 Limitation of liability

We guarantee the faultless functioning of our product in accordance with our advertising, the product information we publish and this manual. Additional product properties are not assured. We assume no liability for efficiency and perfect function if the product is used for a different purpose than the one(s) described in the “Intended use” chapter.

Compensation claims are generally excluded, except if intention or gross negligence by HYDROTECHNIK GmbH is proven or if assured product features are not provided.

If the product is used in environments for which it is not suited or that do not meet the technical standard, we are not responsible for the consequences. We assume no liability for damage to installations and systems in the surroundings of the product that is caused by a fault of the product or an error in this manual. We are not responsible for the violation of patents and/or other rights of third persons outside the Federal Republic of Germany.

We are not liable for damage that results from improper operation and non-compliance with the instructions in this manual. We are not liable for lost profits and for consequential damages that arise from non-compliance with safety and warning information. We assume no liability for damage that results from the use of accessories and/or wearing parts that were not delivered and/or approved by HYDROTECHNIK GmbH.

The products of HYDROTECHNIK GmbH are designed for a long service life. They represent the state of the art and technology and their functions have been checked individually before delivery. The electrical and mechanical design corresponds to current standards and regulations. HYDROTECHNIK GmbH is constantly conducting product and market research for the further development and enhancement of its products.

In case of faults and/or technical problems, please contact HYDROTECHNIK GmbH’s customer service. We can assure you that we will take immediate measures. HYDROTECHNIK GmbH’s warranty conditions apply; we will be glad to send you these on request.

2.4 Intended use

The CX197 measurement set consists of a measuring block that is equipped with a Patrick particle monitor, a CV100 viscosity sensor, and a CM100 moisture sensor, which can also be read out separately. The CX197 measurement set is also equipped with a power pack, CAN data cable, and two connection cables. It serves to monitor the oil condition and temporal change of the oil in stationary and mobile hydraulic systems. The Service Measuring Set CX197 is used with hydraulic oils and other mineral-based oils.
Together with the MultiSystem 5060Plus and MultiSystem 5070, measurement data from various systems can be evaluated and change in the oil condition depicted. Thanks to this information, failures can be prevented and service work planned optimally. Minimess® 1620 test points enable connection to a hydraulic system.

2.5 Warranty

In accordance with our general warranty conditions, we guarantee the condition without defects of this Service Measuring Set CX197 for a duration of twelve months. Wearing parts and storage batteries are excluded from this warranty. The warranty becomes void if repair work or interventions are executed by unauthorized persons.

Within the warranty period we will repair damage or defects that are caused by a manufacturing fault insofar as they are reported to us immediately after their discovery, but no later than twelve months after delivery. The warranty service is at our option either free repair of defective parts or replacement with sound parts. Please send the instruments for which you are making a warranty claim postage-paid and with a copy of the invoice or the delivery slip to HYDROTECHNIK customer service. You can find the address at the end of this manual.

2.6 Customer obligations

The operating authority of this product has to assure, that only persons who

- know the regulations concerning occupational safety and accident prevention
- have been instructed in the operation of this measurement instrument
- have read and understood all of this manual

are able to use and operate this measurement instrument. Persons who operate this instrument are obliged to

- obey all occupational safety and accident prevention regulations
- read this manual completely, especially the safety instructions in the first chapter.
2.7 Authorized personnel

Persons are considered to be authorized if they have a professional education, technical experience, knowledge of the relevant standards and regulations and if they are able to estimate their duties and recognize possible danger at an early time.

Operators of the CX197 measurement set

Persons are considered to be authorized if they have been instructed in the operation of the measurement instrument and have read and understood this manual completely.

Personnel for installation and maintenance

Persons are considered to be authorized if they have been trained in all aspects of the measurement instrument and have read and understood this manual completely.

3. DESCRIPTION OF THE SERVICE MEASURING SET CX197

3.1 General

The CX197 measurement set combined with the Hydrotechnik MultiSystem 5060Plus or MultiSystem 5070 serves to monitor and measure changes in the properties of hydraulic fluid and lubricants. The appropriate measurement values can be recorded periodically on systems and machines and saved with the measurement instrument in a measurement value database for the appropriate measurement point. By analysing the data, it is possible to evaluate, through the oil change, deviation from set values and the exceeding of limit values.

Furthermore, it is possible to check whether the correct viscosity class is set, whether particle contamination is critical or whether the formation of free water threatens due to excessive humidity content. This can detect or even prevent looming damage at an early stage. This offers the opportunity to prevent severe machine faults and consequential damage by taking suitable measures and to extend maintenance and oil change intervals. By monitoring lubricants, it is also possible to detect oil change and oil top-ups and therefore to document system maintenance performed properly and the use of the prescribed lubricant quality.

The measuring section records the following physical oil variables:
Since the viscosity and relative permittivity depend heavily on the temperature, these variables are calculated for a fixed reference temperature of 40°C. For the analysis of a system, the measurement point is created in the measurement instrument and assigned an oil type from an oil database.

3.2 Dimensions of the measuring block

The dimensions of the block are evident on the technical drawing:

![Diagram of the measuring block](image)

*Figure 1: Dimensions of the measuring section with sensors*
Table 1: Components of the measuring block

<table>
<thead>
<tr>
<th>Component</th>
<th>Number</th>
<th>Function</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring block</td>
<td>1</td>
<td>Mounting of the sensors</td>
<td>3402-CX10-D100-200</td>
</tr>
<tr>
<td>MINIMESS® test point</td>
<td>5</td>
<td>Connection to oil circuit, deaeration of the system</td>
<td>2103-01-18.00N</td>
</tr>
<tr>
<td>Direct connection</td>
<td>1</td>
<td>Serves to hold the particle monitor</td>
<td>2103-07-41.62N</td>
</tr>
<tr>
<td>Bursting disk</td>
<td>1</td>
<td>Protection of the sensors against damage</td>
<td>880C-00-00.02</td>
</tr>
<tr>
<td>Current regulating valve</td>
<td>1</td>
<td>Serves to reduce incoming system pressure to &lt;10 bar</td>
<td>8803-08-00.01</td>
</tr>
<tr>
<td>Sieve</td>
<td>1</td>
<td>Filtering of coarse contaminants in the oil</td>
<td>8806-01-06.01</td>
</tr>
</tbody>
</table>

3.3 Description of the Service Measuring Set CX197

This section describes and labels the scope of delivery of the Service Measuring Set CX197:

![Image of the Service Measuring Set CX197]

Figure 2: Scope of delivery of the Service Measuring Set CX197
4. START-UP OF THE MEASUREMENT SECTION

The following figure depicts the connected measuring section. This section will describe the start-up in more detail.

Figure 3: Connections of the measuring section
START-UP OF THE MEASUREMENT SECTION

A: Supply (pressure connection)  D: Connection to the deaeration
B: Connection to sensors  E: Return (tank connection)
C: Connection to measurement instrument or CAN sensors

4.1 Connection to a hydraulic system

The measuring section has no pump of its own, which is why it is installed in the pressure line. The symbols P and T with an arrow are engraved on the front side of the block. The arrows on the block indicates the flow direction of the medium. The symbol P stands for pressure side and T for tank side (see Figure 3). The supply or pressure line is connected to A. The return or tank line is connected to E.

![Figure 4: Printing on the measuring block (pictograms)](image)

The pictograms on the front side of the measuring block indicate the sequence for how the CS197 measuring section must be connected to a hydraulic system. For this, the return line must be connected first; its oil pressure is below 20 bar. In a second step, the pressure line with a maximum pressure of 420 Bar is connected.

**Warning**

Connection of the measuring block

First connect the return line, then the pressure line. If the pressure on the measuring block exceeds 45 bar, the bursting disk will tear and fluid will escape on the underside.

If the measuring block is connected to a high-pressure line up to 420 bar, pay attention that the pressure in the return line (tank line) is not greater than 20 bar.
4.1.1 Installation in the pressure line

The installation of the CX197 measuring section in the pressure line to the left Figure 5 is recommended. Here, it can be connected directly to a Minimess® test point with the included lines. Alternatively, in a hydraulic system, two connections can be selected, between which there is a pressure difference of at least 2 bar (Figure 5 right). The flow on the measuring block can be checked on the Patrick particle monitor (after current feed to the sensor). To do this, use the arrow key in the menu, and select: SENSOR PARAM. / SET FLOW. The filling of the bar reflects the flow between 50 and 400 ml/min.

4.1.2 Installation in the return line

If it is possible to establish a pressure of at least 2 bar in the return line (e.g. with a pressurized check valve), then the CX197 measuring section can also be installed there.
4.2 Deaerating the measuring block

Before the first measurements can be made, the block must be deaerated. Proceed as follows:

- Connect the measuring block as described in Chapter 4.1. The flow rate should be at least 50 ml/min.

- Now connect a MINIMESS® hose to the MINIMESS® test point between the particle monitor and the moisture sensor.

- During deaeration, the measuring block can be moved a little in order to remove all air bubbles from the block.

**Warning**

Risk of burning

Consider when deaerating that skin contact with hot oil can cause burns. Adjust the oil pressure so that as little oil as possible escapes.

4.3 Connection of the sensors

Figure 3 depicts the connected measuring section. Figure 7 shows the CAN data line together with the power pack and data line. Proceed as follows:

- Connect sensors with the included CAN cable (point A, Figure 7)

- Connect plug of the CAN cable (point B, Figure 7) to CAN system or measurement instrument (MS5060Plus or MS5070)

- If the measuring section should be supplied independently with current, the plug on the CAN data line (point B, Figure 7) is connected to the socket of the power pack (point C, Figure 7). Then the plug on the power pack (point D, Figure 7) serves for the data line of the CAN bus.
Communication of the sensors with the measuring section occurs via the data line of the CAN connection cable. For this, connect the connection line of the CAN connection cable or the data cable of the connected power pack to a CAN bus or a measurement instrument (Multisystem 5060Plus or Multisystem 5070).

The bus system for communication of the sensors with the measurement instrument uses CANOpen. For this, the sensors must be set to this bus system. If this is not the case, then this configuration is described in detail in the operating manuals for the individual sensors.

In principle, it is also possible to use the individual sensors on the connected measuring section via serial interface (RS232), CANOpen or current output. The sensors offer additional possibilities for this (such as continuous measurement with teach-in phase and the determination of oil parameters). For additional information and instructions, see the operating manuals for the sensors in question.

Note

Power supply

The measurement instrument’s rechargeable battery is only sufficient for a limited time. For longer supply of the sensors, either connect the measurement instrument’s power pack or operate the sensors with the included power pack. To do this, connect the power pack with the three-way CAN cable.
5. USE OF THE MEASURING SET CX197 WITH A MULTISYSTEM MEASUREMENT INSTRUMENT

The CX197 measurement set can be operated directly with a hand-held MultiSystem 5060Plus or MultiSystem 5070. Starting with Version 6.9, the MultiSystem 5060Plus supports the CX197 measurement set. If your measurement instrument has earlier firmware, you can simply update the instrument via the Hydrotechnik software “Hydrocenter” (download via the homepage: Hydrotechnik.com).

As described in Chapter 4.3, connect the data cable to the 8-pin CAN connection on the measurement instrument. Note that the power output on the measurement instrument is activated if the measurement instrument’s sensors should be supplied with current. The CAN interface must also be activated on the measurement instrument (see operation manual for the MultiSystem 5060Plus or MultiSystem 5070).

Figure 8: Service Measuring Set CX197 connected to a MultiSystem measurement instrument
Two use cases can be distinguished for the CX197 measurement set:

- Short-term service use with a short-term state measurement of the measurement values (Chapter 5.1)
- And longer monitoring use with a longer state observation of the measurement values (Chapter 5.2).

### 5.1 Service use of the CX197 measurement set

#### 5.1.1 Selection of the special application for MultiSystem 5060Plus

With the menu key, you can use the menu guidance to access the main menu, where the function “Measuring section CX197” is available under “Special applications.” Use the Enter key (ENT) to select the menu.

Figure 9: Menu guidance to the main menu of the CX197 measuring section for the MultiSystem 5060Plus
5.1.2 Selection of the special application for MultiSystem 5070

The structure of the main menu on the MultiSystem 5070 measurement instrument (Home) is similar to that of the MultiSystem 5060Plus. Use the menu key from the main menu and navigate to the “Extras” / “Special Applications” folder on the menu to where the “Measuring section CX197” and “Oil Condition” menu are found.

5.1.3 Operator guidance on the Multisystem measurement instrument

The “CX197 measuring section” is structured the same way for both measurement instrument types. The interface is depicted in Figure 11. On the window, the three sensors of the measuring section are displayed with a symbolic LED indicator, which functions as a traffic light.
On the lower part of the display in the blue field is the selected metering (test) point with indication of whether the sensors are connected to and detected by the measurement instrument (online mode) or whether measurement is in offline mode. Here, the last saved measurement of the metering point is used for evaluation.

The indicator depicts the state of the sensor at last measurement. Possible conditions are listed in the table below.

Table 2: Possible condition indications on the main menu of the CX197 measuring section

<table>
<thead>
<tr>
<th>Color coding</th>
<th>Symbol</th>
<th>Sensor condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>☐</td>
<td>No measurement values</td>
</tr>
<tr>
<td>Green</td>
<td>☑</td>
<td>State OK</td>
</tr>
<tr>
<td>Yellow</td>
<td>☠</td>
<td>Warning: Abnormality in measurement values</td>
</tr>
<tr>
<td>Red</td>
<td>☞</td>
<td>Warning: Limit value exceeded</td>
</tr>
</tbody>
</table>

The condition of the sensor on which the measurement value is measured is displayed on the main menu. Here, for example, it can happen that the indicator for a moisture sensor is red even though the rel. humidity does not indicate any abnormalities. However, since the permittivity is also measured with this sensor, its condition is also incorporated into the indicator. For detailed information about the trigger, see the Condition menu under F5 “DETAIL” (see Chapter 5.1.8). This menu is where the evaluation and analysis of the measurement take place.
## 5.1.3.1: Online connection via CAN bus

With the F3 key (“SCAN”) on the measurement instrument, the channels on the CAN bus system are searched for connected sensors. If the sensors are detected, then the state of the measurement point changes to “ONLINE”.

## 5.1.4 Measurement menu of the CX197 measuring section

With the F2 key “Measure” on the main menu, you access the measurement menu depicted in Figure 12.

![Measurement menu of the “Measuring section CX197” function](image)

### Figure 12: Measurement menu of the “Measuring section CX197” function

On this menu, only the metering point can be selected with the cursor. The “Oil type” and “Measure. values” lines are only informational fields that display the selected oil type and number of measurement values. If you are in offline mode, then only the F1 function “SHOW” is listed in the blue quick-access field. Here, you can access the display of the measurement values via the measurement value table. If a measuring section is connected and detected (online mode),

---

### Note

**Updating the condition indicator**

The indicator and evaluation under the “DETAIL” menu always refer to the last saved measurement. If you would like to update the display on the connected measurement point, then you must save a measurement under F2 “Measure” (described in detail in Chapter 4.2).
then a measurement is made and saved with F5 “SAVE”. After that, the number of measurement values in the display increases by 1.

5.1.5 Selection of the measurement point

If you press “ENT” (Enter), you can access the selection of the metering point (Figure 13 left). Here, the metering points are listed; they can be selected with “ENT”. For the selected metering point, now measurements can be taken or existing values observed in offline mode on the main and condition menus. The number of measurements is in brackets next to the name of the metering point.

By pressing the F2 key (“EDIT”), you can edit the metering point (Figure 13 right). Here, you can create/change the name, select the oil from a database, and specify the limits. The limit values are specified with default values and can be changed at any time.

![Figure 13: left: Metering point selection; right: EDIT menu of the metering point](image)
If on the Edit menu of the metering point selection (Figure 13 right) you select the oil type with the Enter key, then you can access the oil database that is depicted in Figure 14.

Here, you can select a defined oil (001-037) or create your own oil starting with storage number 038 with its parameters. Oils 001-006 are common oils of a brand. Oils numbered 007 to 037 describe oil types with their properties. Here, for example, oil type 009 describes an HLP type (mineral oil) that contains zinc with viscosity of 22 mm²/s at 40°C.

If, starting with storage number 038, you use the F2 key (“EDIT”) to create your own oil, you can access the menu depicted in Figure 15. You can define the oil parameters here:

- Viscosity at 40°C ($\nu_{40}$)
- Viscosity at 100°C ($\nu_{100}$)
- Density at 15°C
- Pour point
- Permittivity at 40°C ($\varepsilon_{40}$)

**Note**

**Parameters for “own oil”**

For the oil analysis, only the parameters viscosity at 40°C, viscosity at 100°C and permittivity at 40°C are required. The viscosity specifications are included in most oil data sheets. For the selection of the permittivity, a green help window is displayed, as depicted on the right in Figure 15, as soon as the cursor is on the field. Here, the unitless value of the permittivity of a particular oil type is suggested.
For hydraulic fluids based on mineral oils (H, HL, HLP, HV, HVLP, HLPD), the permittivity at 40°C is between 2.0 and 2.4.

### 5.1.6 Display of the measurement values

If you are on the Measurement menu (Figure 12), you can use the F1 key ("DISP") to access the measurement value table. The saved measurement data for each metering point is stored here. Display is in the form of a table. The table consists of 8 windows, whose number are displayed in brackets in the yellow field. You can toggle between these windows by pressing right and left keys on the measurement instrument keyboard. The records reflect the number of measurements.
The first three windows store the direct measurement values for a particular time stamp. The fourth window displays the oil that was selected for the measurement with the oil parameters. Windows 5-8 display the limits set at the time of measurement.

With the F1 key “DELETE”, you can delete individual measurements; with the F3 key “RESET”, you can delete all measurements for the metering point by resetting the table.

If you are in online mode, then you will see the “SAVE” function next to the F5 key; you can use it to record a new measurement value.

**5.1.7 Transfer of the measurement data**

It is possible to export the saved measurement values into the measurement value table with the hand-held measurement instrument. Here, the measurement values are saved in a text file on a USB stick. This way, the data can be transferred to a PC and the measurement data can be evaluated graphically.

To start the data export, go to the main menu and press the F4 key (“USTICK”) under “Memory” in the blue field. The mode is set to “Save” and the data type “CX197 Series (TXT)” is selected. Then, under “Selection” you can select the metering point whose measurement value table is saved under the same name on the USB stick.
5.1.8 Evaluation of the measurements

If you are back on the main menu (Figure 11), then use the F5 key “DETAIL” to access the oil condition menu depicted in Figure 17. There is a condition assessment on this menu, which displays warnings with an indicator (traffic light display) or calculates deviations in the oil condition.

![Figure 17: Oil condition menu](image)

On the Condition menu, the four points (oil condition, oil moisture, particle contamination, and oil temperature) are selected with the Enter key.

**Oil condition:**

If you open the first element “Oil condition,” the window depicted in Figure 18 appears. Here, the deviation from the set value must be specified in the first block. The percentage deviation from the data sheet value or the self-defined oil value is displayed here. The traffic light control turns yellow as soon one of the two differences (v40 or ε40) is greater than 7% and less than 20%. If the difference is more than 20%, then the traffic light turns red. If the difference is less than 7%, the traffic light is green.

The same color control is used in the next block “Changing of the measuring.” Here, however, the percent deviation of the last measurement value from the first measurement value is calculated. This way, you can see how much the oil has changed during operation.

The lower indicators “Limits v, v40” and “Limits ε, ε 40” turn red if the set limits are exceeded.
Oil humidity:

If you select the “Oil humidity” element from the Condition menu, a window opens (Figure 19), on which three indicators show whether the relative oil humidity is greater than 50%, 75% or greater than 95%.

Particle contamination:

For particle analysis, three indicators are listed, which are depicted in Figure 20:

- Particle contamination: This indicator turns red if a measurement value exceeds the limit value set under Limits
- Measurement values present: Here you can see whether measurement values are being sent by the particle monitor or if there is a communication problem

- Flow rate control: If the flow rate is set too high or too low, this indicator turns red

![Image of Particle contamination on the "Oil condition" menu](image1)

*Figure 20: Particle contamination on the “Oil condition” menu*

**Oil temperature:**

If under Oil temperature you press Enter, then a traffic light control indicates whether the set limits for the oil temperature are underrun or exceeded.

![Image of Oil temperature on the "Oil condition" menu](image2)

*Figure 21: Oil temperature on the “Oil condition” menu*
5.2 System monitoring and condition observation

5.2.1 Selection of the special “Oil Condition Sensors” application

Thanks to the additional “Oil Condition Sensors” menu (for the MultiSystem 5070 “Oil condition”) under the “Special applications” menu element, the individual sensors can be configured and placed on the measurement instrument's display (see Figure 9 and Figure 10).

For stationary use, the sensors can be programmed with a particular interval saving so that they make measurements independently. Thanks to the integrated memory combined with stored algorithms, the measurement values are evaluated so that they provide an oil condition analysis specifying the oil age and remaining service life.

The respective sensors run through a training phase in this stationary function, in which the oil parameters themselves are determined. Here, at different temperatures, they determine the oil property. Changes to these properties are visible in a condition evaluation.

![Oil Condition Sensors](image)

*Figure 22: Additional menu Oil Condition Sensors*

The menu is structured so that all sensors are equipped with a traffic light indicator. The indicator display shows the condition of the sensor. The sensor condition is depicted in the table below:
5.2.2 Operator guidance on the Multisystem measurement instrument

Operation of this menu begins with the querying of the sensors that are connected to the CAN bus with the “F3” key: SCAN. Connected sensors are indicated by the filled-out indicator.

The “F5” key: DETAIL opens the condition indicator for the sensor. Here, the measurement data is processed and displayed evaluated in the traffic light display described above. Conditions in this sub-function, which produce a measurement value (such as e.g. temperature or moisture content), can be displayed with the “F2” key: ACT/LM together with the set limits. Furthermore, you can see additional details about the conditions by pressing the “F5” button: DETAIL again for the selected condition.

If you select Enter (“ENT”) on a sensor, you access the Sensor menu. Here, you can set the display, storage interval, and transfer of various parameters to the sensor.

For all oil condition sensors except for the particle monitor, the “READ” function appears on the “F4” key. This way, the sensor is read out again and the current measurement values are taken over for the condition assessment. If you move from the particle monitor to the condition indicator, a message will appear that you should not disconnect the particle monitor from the measurement instrument. With confirmation, the instruments are adjusted so that measurement values are sent automatically at short intervals by the particle monitor and taken over in the measurement instrument.

5.2.3 Programming of measurement channels for the view

The “F2” key: PROG stands for the automatic programming of the measurement channels. As soon as the sensor is selected, the channels can be activated with the “PROG” function. If you press the F2 key, an hourglass
appears. After the hourglass disappears, the channels are initialized and measurement values can be displayed on the indicator.

On the sensor menu (ENT for the sensor in question), channels of the supported measurement values can be selected manually and placed on the display.

### 5.2.4 The particle monitor

The Sensor menu for the particle monitor looks like this:

![Particle counter PATRICK (1/2)](image1)

You can select the elements for the main display manually here. Furthermore, you can select the Node ID and purity class (ISO 4406:99, SAE AS4059E, NAS 1638, GOST 17216)

If you press the right arrow key, you access the next menu, where you can set the measurement and wait times for the internal storage (Figure 23, right).

For the particle monitor, the condition indicator reflects the current measurement and condition data. With "F3": HISTOR you can read out the particle monitor's internal memory and store and display it in the measurement instrument. Furthermore, a transfer to a PC is possible with the tool "Hydrocom 6." This tool allows graphic display or export of the data in a text or .CSV file.
Alternatively, the particle monitor can also be connected directly to a PC (online or reading out of the memory) with Hydrocom 6 with the USB CAN adapter (part no.: 8824-T4-02.00). In addition, the power pack (part no.: 8812-00-00.36) and the Y-adapter (part no.: 8808-50-01.03) are required.

5.2.5 Moisture sensor

If you press the “ENT” key on the moisture sensor, the Sensor menu opens, where the channels and Node ID can be assigned manually. If you press the right arrow key, you access the second window of the Sensor menu, which is depicted in Figure 25.
In addition to the setting of the “Save interval”, it is possible to send the values under the points of “Fresh Oil” and “Limits” to the sensor that they are used in the condition evaluation.

With the “F1” key: SEND, the values are sent to the connected sensor.

The “F2” key: SAVE and “F3”: LOAD serve to store the values input locally on the measurement instrument. (This can be useful if the same parameters should be transferred to several sensors.)

If you press the “F4” key: NEWOIL, the training phase of the sensor is reset and it begins again.

---

**Note**

**Password query for resetting parameters**

Changing the password under “NEWOIL” requires a password. It is set at the factory with 1234. Resetting the training phase under “F4”: NEWOIL also requires a password, which is set as 123456.

---

### 5.2.5.1 Condition: “Sensor condition”

If you press the “F5” button: DETAILS on the “Oil condition sensors” menu (Figure 22) for the moisture sensor, you access the condition menu of the sensor (Figure 26, left).

On the Condition menu, the measurement values and parameters are evaluated. The traffic light indicator is used again. With another press of the “F5”: key: DETAIL, you receive additional information about the condition (Figure 26, right).
5.2.5.2 Condition: “Oil type”

Here, the measurement values and the oil values are compared. If oil type is selected, then with a press of the “F2” button, the ACT/LM function (ACTUAL/limit values) appears. Here, measurement values and set limit values are displayed.

Figure 27: Evaluation of the oil type

Figure 28: ACTUAL value and set limit values for condition evaluation “oil type”
Figure 28 Displays the values “conductivity” at 40°C ($\sigma_{40}$) and permittivity at 40°C ($\epsilon_{40}$) as ACTUAL values. These measurement values flow into the condition assessment of the oil type.

5.2.5.3 Condition: “Oil aging process”

For the oil aging process, there are details about the plausibility of measurement and exceeding of limits. Furthermore, it is indicated here whether an oil change is advised.

On this menu, it is also possible to select the F2 key “ACT/LM”.

Figure 30: ACTUAL value and set limit values for condition evaluation “oil aging process”
The abbreviations stand for:

- **OAP**: Oil aging process (in %)
- **OA**: Oil age
- **RL**: Remaining service life
- **RRL**: Remaining service life with reset
- **RLF**: Factor of the remaining service life

### 5.2.5.4 Oil temperature

On the condition menu for the oil temperature, only F2 “ACT/LM” can be selected. Here, the measured temperature and limit values are displayed.

![Figure 31: ACTUAL/limit display of the oil temperature](image)

### 5.2.5.5 Filling level

With the moisture sensor, the “Filling level” condition is also displayed on the condition menu. This indicator refers to whether the sensor is in the air or in the oil.
This sub-menu indicates whether the water content in the oil is in the critical range. For this, the measurement value can also be displayed directly below the ACT/LM function (F2):
5.2.6 Filling level sensor

By pressing the “ENT” key on the filling level sensor, the Sensor menu opens. The “Filling level sensor” function is structured like the moisture sensors, with the additional specification of the filling level in % on the Condition menu. The sensor measures the same parameters that are described in Chapter 5.2.5. Now, however, the “filling level” condition is activated. On the Condition menu, under “F2”: ACT/LM, you can call up the filling level in percent.

5.2.7 Viscosity sensor

By pressing the “ENT” key on the viscosity sensor, the Sensor menu that is displayed in Figure 35 opens.

On the first Sensor menu, you can set the Node ID of the sensor and channels for activation.

By pressing right, you can access the second page of the Sensor menu. In addition to setting the save interval, with the elements “NEWOIL” and “LOAD”, you can send the values to the sensor that are used in the condition evaluation.
With the “F1” key: SEND, the values are sent to the connected sensor. The “F2” key: SAVE and “F3”: LOAD serve only to store the values input locally on the measurement instrument. (This can be useful if the same parameters should be transferred to several sensors.)

If you press the “F4” key: NEWOIL, the training phase of the sensor is reset and it begins again.

---

**Note**

**Password query for resetting parameters**

Changing the password under “NEWOIL” requires a password. It is set at the factory with 1234. Resetting the training phase under “F4”: NEWOIL also requires a password, which is set as 123456.

If you press the “F5” button: DETAILS on the “Oil condition sensors” menu (Figure 22 here) for the viscosity sensor, you access the condition menu of the sensor (Figure 36).

On the Condition menu, the measurement values and parameters are evaluated. You will once again see the traffic light display that is described in Table 3. With another press of the “F5”: key: DETAIL, you receive additional information about the condition.
The description of the details of the menu elements is the same as for the moisture sensors (Chapter 5.2.5.1 - 5.2.5.5), but for the additional element “Water content” for the moisture sensor. From the ACTUAL values for the viscosity sensor, now the viscosity and the viscosity at 40°C can be read off.

With the viscosity sensor, the “Filling level” condition is also displayed. This indicator refers to whether the sensor is in the air or in the oil.

### 5.2.8 Wear sensor

By pressing the “ENT” key on the wear sensor, the Sensor menu that is displayed in Figure 22 opens.

The wear sensor distinguishes itself from other sensors on the Sensor menu through the variable that relies on the number of ferromagnetic particles attracted. The two sensor menus are displayed in the figure.
Figure 37: left: Sensor menu wear sensor page 1; right: Sensor menu wear sensor page 2

The Condition menu of the wear sensor, which can be accessed on the menu for the oil level sensors under “F5”: DETAIL, looks as follows:

Figure 38: Condition menu for the wear sensor
6. Interpretation of measurement results

Oil analysis with the CX197 measuring section does not replace oil analysis in the laboratory. It serves only as an indication of deviations, change of measurement values, and derivation from set values. With the particle monitor, you can get information about the degree of contamination of the oil with foreign particles and the moisture sensor indicates the moisture content of the oil directly. Through these statements alone, no recommendation can be made as to whether the oil in a system should be checked and changed or whether the oil measurement values have hardly changed and so whether maintenance work can be performed later.

The oil condition is a variable formed from many parameters. Limit values for specific oil parameters depend on the use in question, e.g. the components and materials used. The type and speed of oil parameter change, in turn, depends on the application, the specific system load, and the pressure applied or lubricant used. It is therefore not possible to define universally valid limit values for individual parameters.
7. Service and accessories

7.1 Cleaning and maintenance

The outside of the CX197 measuring section can be cleaned with a damp cloth. If the CX197 measuring section was used previously with a contaminated or a different, incompatible oil type, the oil in the measuring block and in the lines must be removed. Then it is recommended that you perform a flushing procedure.

⚠️ Caution

Damage to the instrument is possible!

Switch the instrument off and disconnect from the power supply BEFORE starting to clean. This prevents the risk of a short-circuit, and thereby possible damage to the device.

⚠️ Caution

Damage to the instrument is possible!

Do not use any aggressive cleaning materials, solvents, or similar chemicals when cleaning the measuring section or the sensors. The consequence could be damage to the sensor elements and therefore could affect the measurement results.

The Service Measuring Set CX197 works maintenance-free. However, it is still essential to have the sensors recalibrated regularly. If the device is used frequently, we recommend recalibrating it every 12 months. Have the CX197 measuring section with the “Patrick”, “CV100” and “CM100” sensors calibrated by the manufacturer. Hydrotechnik maintains a capable calibration laboratory. Please contact our service at:

Tel.: +49 6431 4004-555
E-mail: service@hydrotechnik.com
### 7.2 Accessories and spare parts

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<td>3402-CX10-D100-000</td>
<td>Measurement set with case, cable, connection lines, and power pack</td>
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<table>
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<th>Description</th>
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<td>3402-CM10-G926C0-000</td>
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<td>3160-00-76.00</td>
<td>Patrick</td>
<td>Particle monitor</td>
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<td>3160-A0-79.00</td>
<td>MultiSystem 5060 Plus</td>
<td>Hand-held measurement instrument</td>
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<tr>
<td>3160-00-82.00</td>
<td>MultiSystem 5070</td>
<td>Hand-held measurement instrument</td>
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<td>S110-AC-AC-0100N</td>
<td>Minimess® measurement hose DN2-63 MPa, 1m</td>
<td>Connection to the measuring block</td>
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<tr>
<td>8812-00-00.39</td>
<td>Power pack M12 x 1; 8-pin connector, with data line for measurement instrument and country plug adapters</td>
<td>Power supply</td>
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<td>8824-TB-00.00</td>
<td>CAN 3-way connection cable</td>
<td>CAN connection cable MS5060+ / sensors</td>
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For the use of individual sensors:

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<td>Interface cable M12 x 1; Plug; 8-pin / D-SU B connector; 9-pin</td>
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<td>8808-50-01.03</td>
<td>Y-distributor M12 8-pin; connector, plug, connector</td>
<td>Required with the interface cable “8824-T7-00.00”</td>
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Notes
Notes