Powering Business Worldwide

OCM 01

Oil Condition Monitor

Particle counting + Water saturation + Viscosity + Temperature + Rel. Dielectricity

Instruction manual
Version 1.7

Serial-no. OCM 01: .....

Serial-no. PFS 01: …….

Version valid from: 30.05.2012

Index

1. Safety information

1.1. Signal glossary

- Every nonobservance of safety instructions in this manual implies various risks and endangerment of life and the physical condition of the operator. The notices are marked with the following **signal words:**

⚠ DANGER ***DANGER*** induces a dangerous situation which **causes dead** or **bad injuries** in case of nonobservance.

⚠ WARNING ***WARNING*** induces a dangerous situation which can **cause dead** or **bad injuries** in case of nonobservance.

⚠ CAUTION ***CAUTION*** induces, together with the danger symbol, a dangerous situation which can **cause light or medium heavy injuries** in case of nonobservance.

- Every nonobservance of safety instructions in this manual, which does not cause injuries but destruction of the system and its operability are marked with the following signal word:

NOTICE ***NOTICE*** describes the correct way of handling the device.

The above signal words can be combined with the safety symbols or the warning symbols.

 General danger

 Danger caused by electricity

 Danger for the environment

1.2. Dangers of maloperation

The OCM 01 underwent a safety inspection. The integrated electric and hydraulic safety elements ensure safe operation if the device is used as it is intended.

⚠ WARNING

In cases of maloperation or abuse, as well as in cases of ignoring the application limits and safety regulations, the following threats can occur regarding the:

- Life or physical condition of the operator; 
- The **OCM 01** device, as well as connected machines and systems; 
- The accuracy of measurements made by the **OCM 01**; 
- The environment. 

⚠ WARNING

Therefore, it is necessary that everybody having to do with the operation and the maintenance of the unit strictly follows this instruction manual!

1.3. Intented applications

The OCM 01 is a mobile diagnostic system which enables the user to evaluate the ageing condition of oil in hydraulic and lubricating systems by measuring the particle contamination, the saturation of water in oil, the temperature, the viscosity and the relative dielectricity.

The particle size distribution is being shown in contamination classes according to ISO 4406:99, NAS 1638 and SAE AS 4059.

Resulting out of measured saturation and temperature values, the theoretical water content in ppm (mg/kg) is being calculated and displayed for selected fluids.

By knowing these important oil level parameters the user is able to evaluate the precise condition of the system and to initiate actions promptly and cost-saving before major failures can occur.

The unit is suitable for pressure, as well as for suction operation, i.e. it can be connected to a pressure line by a minimess connection or absorb fluids which are to be analyzed by using an integrated suction pump.
The OCM 01 can also be used for the analysis of foamed oils, like they appear in gears.

Limitation of use
The device is exclusively adequate for on-line applications in hydraulic and lubricating systems within the following limitations:

- Supply operation pressure: p = -0,2…40 bar (-2,9…580 PSI) (viscosity dependent)
- Viscosity range: ν = 1…780 mm²/s (4,46…3615,3 SUS)
- Temperature range of the oil: 0…70 °C (32…158°F)
- Ambient temperature range: 0…50 °C (32…122°F)

The regular function of the OCM 01 and the warranty of safety are guaranteed only if it is used with INTERNORMEN Technology GmbH provided and allowed accessories.

- For measurements oil has to be extracted from the examined system.
- **⚠ CAUTION**  Before connecting the OCM 01 to the system make sure, that the oil discharged out of the OCM 01 gets caught up in a tank afterwards. The oil must not get to the environment or the canalization!

⚠ DANGER   **No unauthorised modifications or changes are allowed at the OCM 01!**

NOTICE **The terms and conditions stated in the maintenance manual have to be followed strictly!**

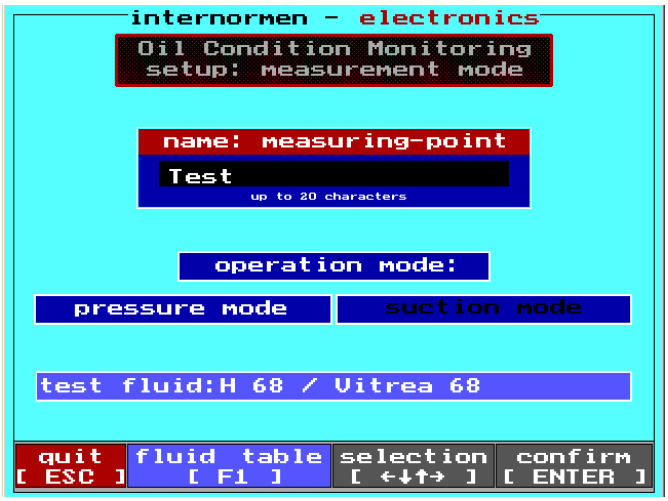
2. Short instruction for measurements conducted by the OCM 01

- Connect the **oil discharge hose** (transparent plastic hose) with the **[OUTLET PORT]** of the OCM 01 by using the quick-lock coupling (both-way blocked) and put its end into an oil tank. The oil tank has to catch up non-stop oil during the whole operation time, so make sure that it is big enough or exchange it punctually! It is also possible to lead the discharge oil straight back into the tank of the examined system.

  ⚠ CAUTION **But never connect it into a pressurized line!!**

- **Measuring in pressure mode (max. 40 bar / *max. 580 PSI)*:**
  - Connect one side of the high pressure measuring hose (minimess connections: M16 x 2) with the OCM 01 on the measurement connection **[PRESSURE PORT]**.
  - Connect the second connection of the high pressure measuring hose with the hydraulic or lubricating system.
- **Measuring in suction mode (-0,2…0,2 bar / *-2,9…2,9 PSI)*:**
  - Connect the suction hose (transparent plastic hose) with the **[SUCTION PORT]** of the OCM 01 by using the quick-lock coupling.
  - Inserting of the suction hose in a reservoir. **NOTICE** minimum distance from the reservoir bottom, walls and fluid surface: 15 cm!
- Electrical setting-up operation:
  - Connection of the power supply unit (90…230 V, 50/ 60 Hz) with the OCM 01 and switch on by using the main switch [**ON**]. (*the green control diode shines)*
- Wait until the main menu appears.

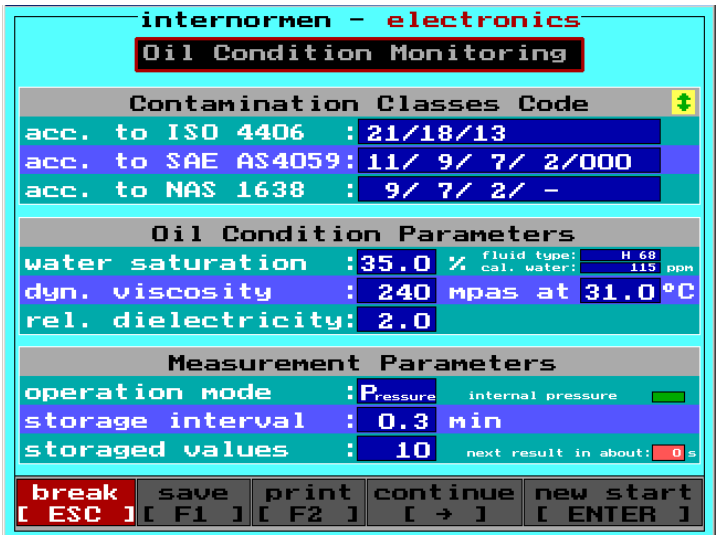
- Select "**measurement"** by using the [↑↓] – keys and confirm with [**ENTER**].



- Input the name by using the key pad.
- Change to the operation mode by using the [↑↓]-keys.
- Use the [← →] - keys for selecting the operation mode (pressure or suction mode)
- Select the used fluid with [**F1**] to display the ppm- water content.
- [**ENTER**] to confirm the selection.

- Available functions are highlighted white.
- [**ENTER**] to start the measurements.
  (The first measurement is preceded by an automatic flushing.)

NOTICE **Don't switch on before the return line is connected to the [OUTLET PORT]**! (Otherwise destruction of the sensors will occur as a result of very high pressure)



⇒ displaying of the first measurement **after 20 s**.

- Finish the measurements with [**ESC**].

  ⇒ Wait until the current measurement has been finished.

  ⇒ Visible at the display as 0s and
  stop of the measurements.

- [**F1**] Saving the last measurement at the permanent data storage.
- [**F2**] Printout the last displayed measurement.
- [→] – key for to **continue** the measurements.
- [**ENTER**] to start **new measurement**.
- [**ESC**] to go back to the previous menu.

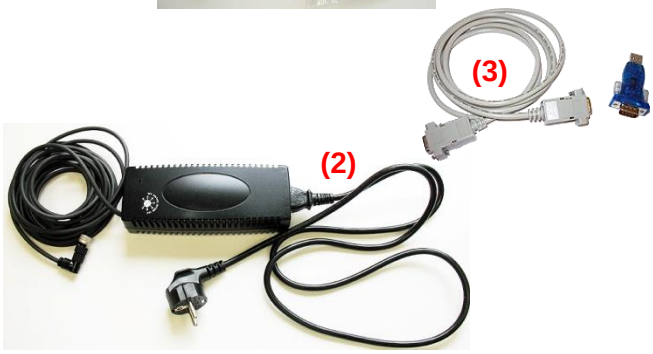
- With [**ESC**] back to the main menu.

NOTICE **To assure constant mode of operation of the unit and the accuracy of measurement results it is recommendable to perform a flushing of the OCM 01 with cleaned mineral oil (filtrated H22) for some minutes after finishing the measurements.**

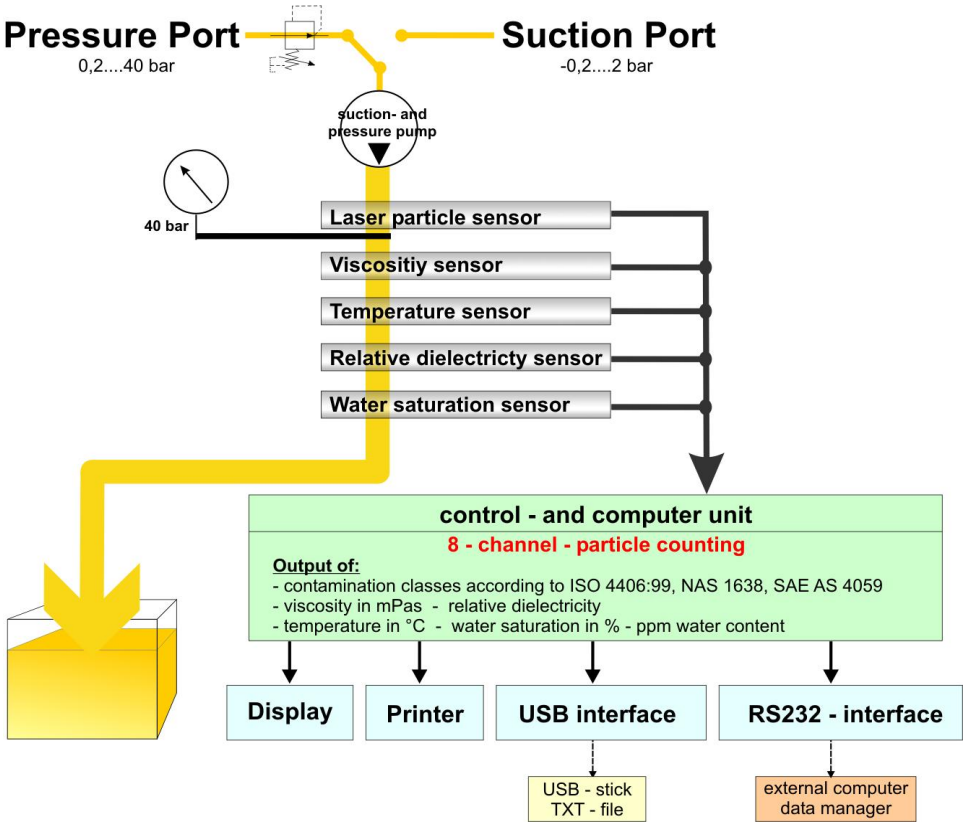
3. Operation and installation

3.1. Setup

The OCM 01 consists of the equipment case (1), the external power supply (2), the RS232 – interface cable inclusive the USB – plug adaptor (3), high pressure measuring hose (minimess hose) (4), the suction hose and the return hose (5).



3.1.1. Principle setup



3.2. General information

External factors have a huge and extensive influence on the lubricant during operation. External factors are for example forces, energies and interactions with other materials. Pressure and shear stress belong to the force effects, energy influences are the supply and the removal of heat (high temperature amplitudes). A lubricant gets in contact with gases (air, nitrous gases or sulphur dioxid), liquids (water, external liquids like detergents, dissolver etc.) and solid matters (metals, ceramics, synthetic material parts and sealing materials).
The contamination outcomes are very versatile for the hydraulic and lubricating system and cause a significantly higher abrasion, an increase of the failure risk of components as well as malfunctions.
Based on its construction, the OCM 01 fulfils all the necessary requirements for continuous monitoring and condition analysis of hydraulic and lubricating systems (also for foamed oils, like they appear in gears).

<u>The OCM 01 has following functions:</u>

- Particle counting by a laser sensor for hydraulic and lubrication oils.
- Exact evaluation of contamination classes according to ISO 4406:99, NAS 1638 and SAE AS 4059.
- Fast, easy and reliable on-line measurements of water saturation in oil, viscosity, temperature and relative dielectricity.
  - Saturation of water in oil (0 … 100%)
  - Viscosity (0,8 … 700 mPas)
  - Temperature (0 … 70 °C)
  - Relative dielectricity (1 … 10).
    (see also the technical data at chapter 6.1)
- Calculation and output of the theoretical water content in ppm (mg/kg) based on fluid specific saturation curves.
- Display of all measurement values on a LCD display.
- Trend indication of the contamination level during measurements.
- Output of current measurement values by a RS232-interface.
- Output of current measurement values by using a thermal printer.
- Internal storage of measurements in a temporary and/or a permanent data storage. (Storage capacity of 2 x 100 measurements.)
- Output of saved measurement files by USB-interface on the USB-stick.
- Output of saved measurement data by a RS232 – interface.
  Data management using an external computer and the LabVIEW Data Manager Software (export in MS EXCEL).

3.3. Connection to the hydraulic or lubricating system

- The OCM 01 can be handled in a **suction** as well as in a **pressure operating mode**.

- Connections from the left to the right: Suction port, pressure port and outlet port for the return line.

3.3.1. Connection into the pressure operating mode (max. 40 bar)

- Connect the return hose (transparent plastic hose) using the quick lock coupling (two-sided locking) with the **[OUTLET PORT]** of the OCM 01 and transfer it to an oil collecting tank.

⚠ CAUTION

  - The oil collecting tank must be dimensioned according to the time needed to perform the operation. Otherwise it has to be provided for an in time replacement with an empty tank.
  - A recirculation to the tank of the system which is to be analyzed is also possible.
  - Use only the provided hoses with two-sided shut-off and the quick lock couplings! Otherwise an opening of the barrier and a flow or a return flow of the fluid is not possible!
  - **Never connect the recirculation to a pressurized line!**

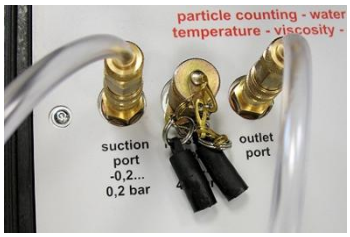
- In the **pressure operating mode** the provided high pressure hose (minimess hose) is being connected with the OCM 01 - **[PRESSURE PORT]** and the hydraulic system.

3.3.2. Connection into the suction operating mode (min. -0, 2 bar)

- Connect the return hose (transparent plastic hose) using the quick lock coupling (two-sided locking) with the **[OUTLET PORT]** of the OCM 01 and transfer it to an oil collecting tank.

⚠ CAUTION

- The oil collecting tank must be dimensioned according to the time needed to perform the operation. Otherwise it has to be provided for an in time replacement with an empty tank.
- A recirculation to the tank of the system which is to be analyzed is also possible.
- Use only the provided hoses with two-sided shut-off and the quick lock couplings! Otherwise an opening of the barrier and a flow or a return flow of the fluid is not possible!
- **Never connect the recirculation to a pressurized line!**

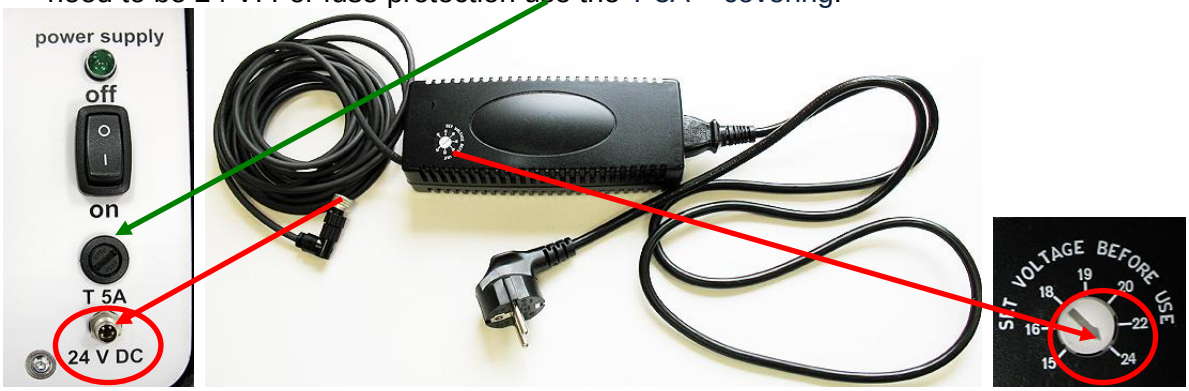


- In the **suction operating mode** the provided suction hose (transparent PVC-hose) is being connected with the **[SUCTION PORT]** of the OCM 01 using the quick lock coupling (two-sided locking).
- The hose has to be inserted into the tank.

NOTICE Pay attention to create a distance of minimum 15 cm from the tank bottom and the tank walls, so that no coarse particles which are sedimented in the tank get absorbed and choke the sensor system.

3.4. Electrical connection

- The operating voltage of the OCM 01 is 24 V DC.
- To create the necessary operating voltage, connect the OCM 01 using the provided external 24 V – power supply. **⚠ WARNING** Pay attention that the setup of the power supply need to be 24 V. For fuse protection use the T 5A – covering.



- Switch on the OCM 01 with the “power supply“– switch to ON. (visible by the green control diode).

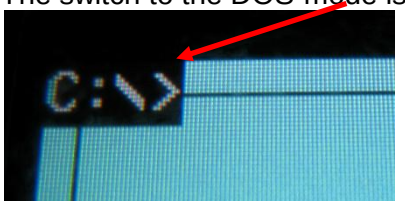
3.5. Usage of the OCM 01 software

After connecting the necessary hoses, power and switching on the OCM 01, the unit is ready for operation. The green control diode lights and the main menu appears on the display, which can be operated by using the key pad.
The OCM 01 is, customer specific, equipped with the English or German menu display.
An implementation of the measurement in the other language is possible at any time by finishing the current program and starting the desired program.

3.5.1. Changing the operator language

- Change of the current operator language by finishing the program at the main menu.
- Leave the main menu with the [**ESC**] – key and switch to the DOS-mode with [**ENTER**].

- The switch to the DOS-mode is indicated on top left now.



- Enter the desired program by using the key pad.

- Following programs are available:

O11e.exe	English real version
O01e.exe	English demo version
O11d.exe	German real version
O01d.exe	German demo version

NOTICE **The demo version is operating in the same way as the real version. Instead of real measurements the computer simulates the counting and the results. You can use all functions as regular. The electro-hydraulic functions are out of operating mode!**

3.5.2. Key pad

Keys for device and menu control:

Arrow keys	for menu control
ESC	one step back in the menu
ENTER	confirm enter
F1 – F6	function keys

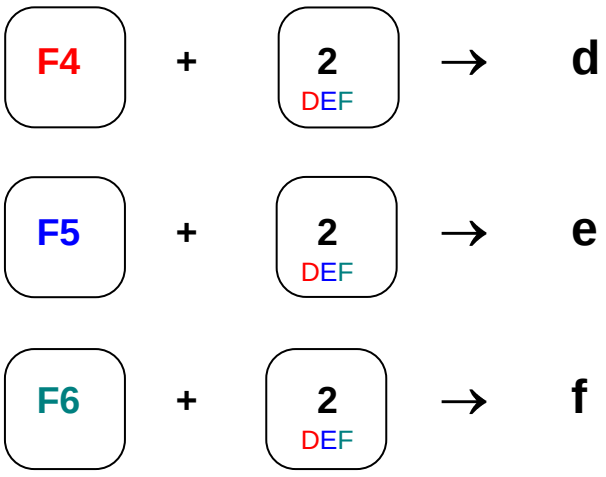
Keys for menu control:

Numbers
Letters
F3/ F4/ F5/ F6

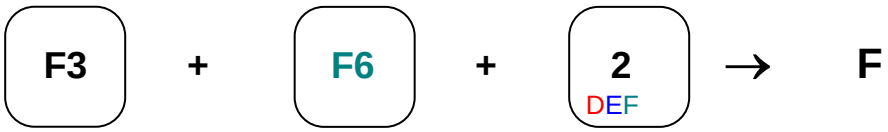
Explanation of functions – entering numbers and letters

- Double key configuration, i.e. numbers and letters are arranged at the same keys.
- By pressing the “number/letter“ key, only the according number is used.
- For using letters it is necessary to press the function keys additionally, i.e.
  - First press and hold [F4] (red), [F5] (blue) or [F6] (green) plus the number key according to the letter which is intended to be used.

Example:

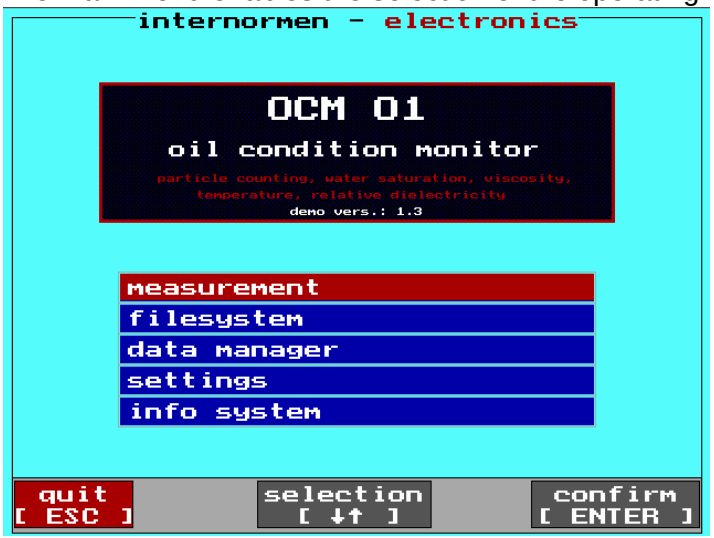


Capital letters:
Usually everything is written in lower case. For capital letters the key [**F3**] has to be additionally used.



3.5.3. Main menu

At the start of the OCM 01 wait for the starting routine and for the main menu to be indicated at the display.
The main menu enables the selection of the operating functions which the OCM 01 offers.



Function selection:
Select the desired function with the [↑↓] – keys. The selected function is highlighted red. Confirm the selection with [**ENTER**].

Measurement
Performance of the measurements in pressure or suction operating mode

Filesystem
Administration of the measurement data which are saved in the permanent or the temporary storage

Data manager
For transferring the saved data files using the RS232 – interface or the USB – interface

Settings:
Adjustment menu for print formats, storage intervals, data sort, temperature units as well as date and time

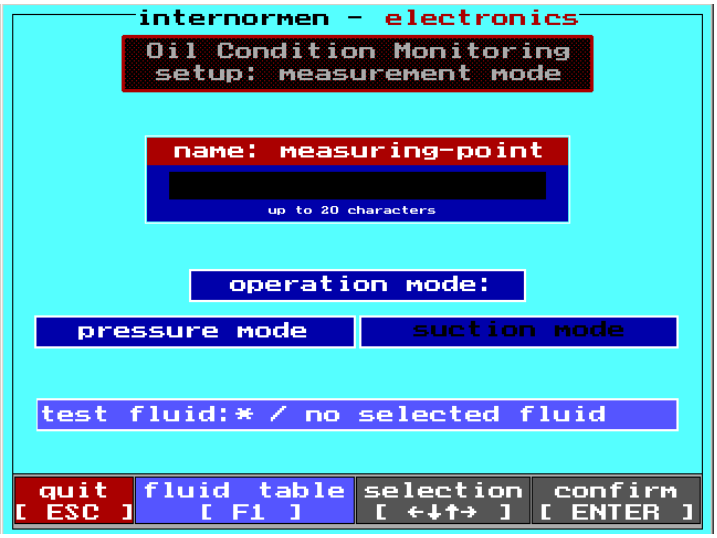
Info system
Information recall of the short instruction, contamination class lists according to ISO 4406:99, NAS 1638 and SAE AS 4059

3.5.3.1. Measurement

For measurement in the according operating mode (according to the hydraulic connection, see chapter 3.4.).

Following parameters are entered in the setup menu **“measurement mode“**:

- Entry of the measuring point
- Selection of the operation mode
- Selection of the test fluid



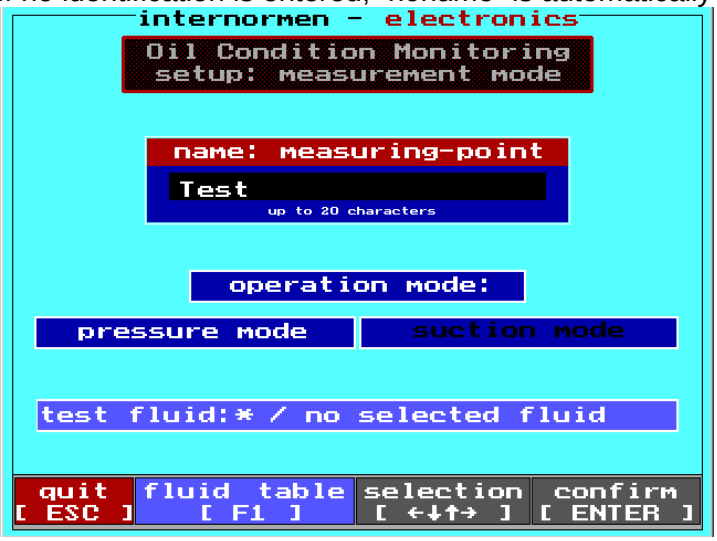
- Select the desired function with the [↑↓] – keys. The selected function is highlighted red.
- Confirm the selection with [**ENTER**].
- [**F1**] Display of the fluid selection index.
- [**ESC**] back to the main menu.

Measuring point:

After opening the mode **“measurement“**, this function is automatically been selected and highlighted red. Enter the name of your measuring point by using the key pad. (See chapter 3.5.2) In case of typing errors press the [**DEL**] – key. The maximum capacity is 20 signs.

Always use the same name for the same measuring point, so that the stored data can be systematized within the data file system. Every event gets automatically a new index in the data file system, also the current date and time of the current measurement is stored. Measurements are displayed depending on the selection of the data sorting (date or alphabetic).

If no identification is entered, “noname” is automatically used.



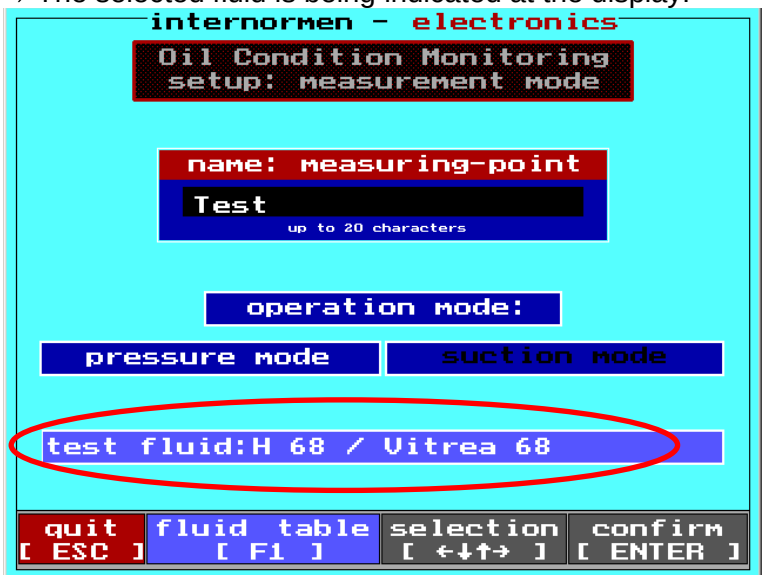
By using the [↑↓] – keys switch to the “**operation mode”**.
⇨ The selected mode is highlighted red.

Operating mode:
Select the operating mode using the [← →] - keys (pressure mode or suction mode). The selected operating mode appears white.

Test fluid:
For the additional display of the existing theoretical ppm water content during the measurements, the type of oil to be measured must be selected.
In case of selecting “measurement mode“, “test fluid: * / no fluid“ is automatically indicated and during the measurements only the water saturation in % is issued.

The selection of the used fluid from the fluid index is performed by using the [**F1**] – key.

Select the fluid using the [↑↓] – keys (selection is highlighted red) and confirm with [**ENTER**] ⇒ Automatically change to the previous menu.
⇒ The selected fluid is being indicated at the display.

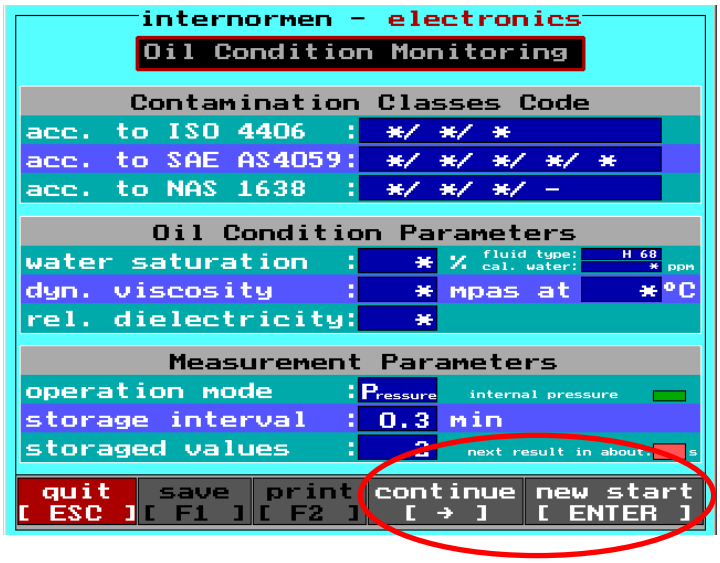


After entering all for the measurement necessary parameters change with [**ENTER**] to the menu “oil condition monitoring“.

3.5.3.1.1. Oil condition monitoring

This mode is meant for:

- Starting the measurements,
- Stopping the measurements,
- Display of the measurement data,
- Saving and
- Printing the measurement data.

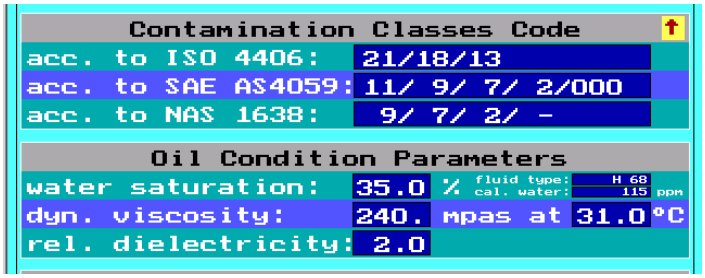


NOTICE **Don’t switch on before the return line is connected to the [OUTLET PORT]**! (Otherwise destruction of the sensors will occur as a result of very high pressure)

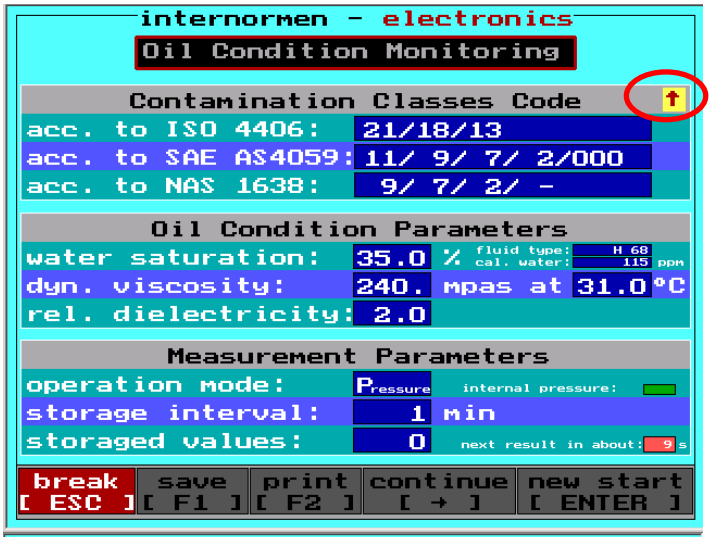
New start with [**ENTER**] ⇨
All existing saved measurements were deleted before start the measuring.

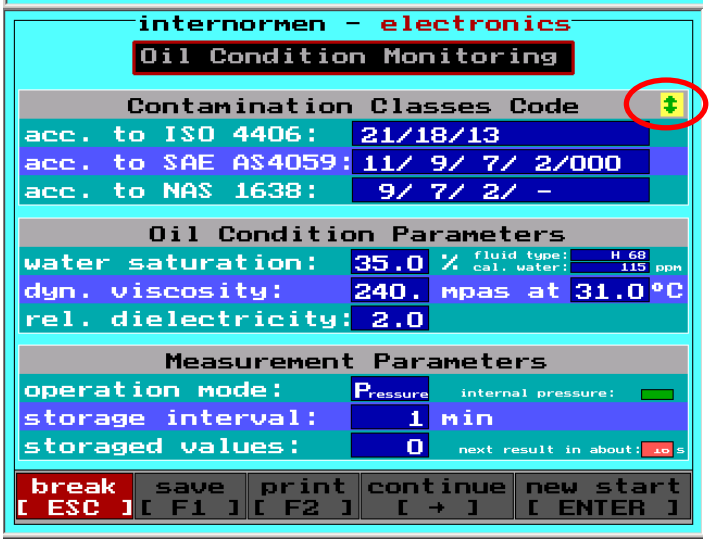
Start with [→] effects the continuation of the measurements.
⇨ New measurements are saved after the existing data files in the data system according the chosen data storage interval.

An automatic flushing starts before the first measurement is displayed.



⇒ The measurements are displayed **after 20 s.**



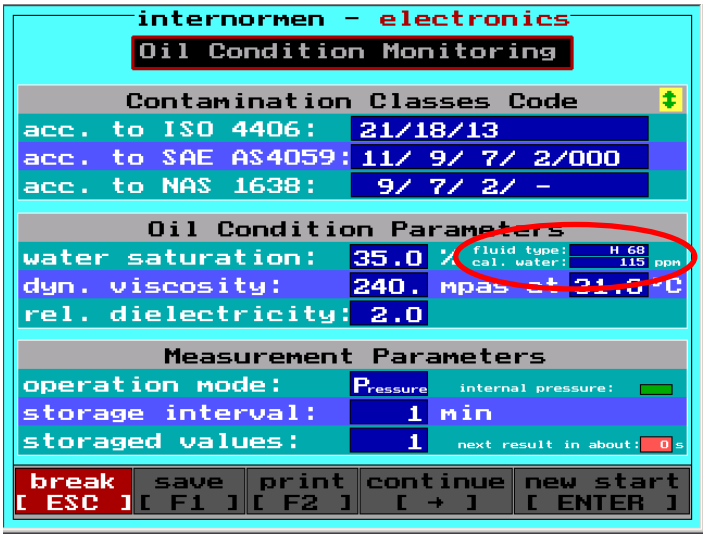


During the measurements the balance of the particle quantity is being indicated by different colours:

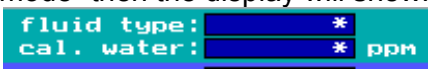
↑ **Increase of the particle quantity > 2 %**

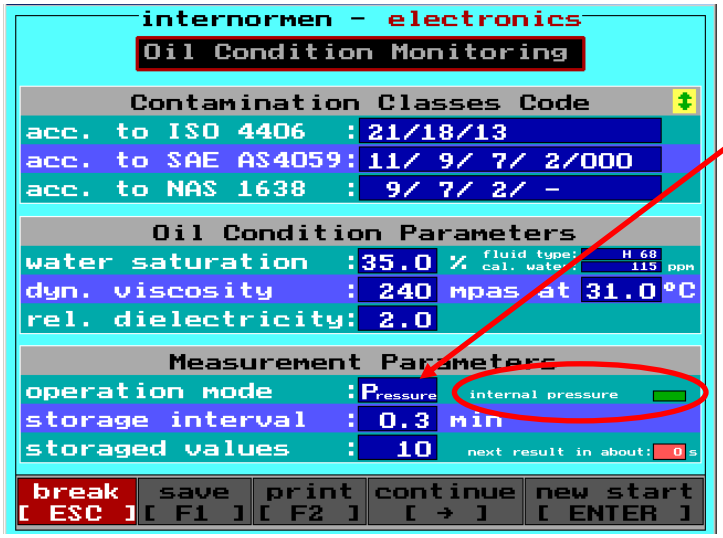
↕ **Particle quantity in balance ± 2 %**

↓ **Decrease of the particle quantity < 2 %**



The selection of the fluid type and the ppm-water content is displayed, except in cases where no selection has been made in „measurement mode“ then the display will show:

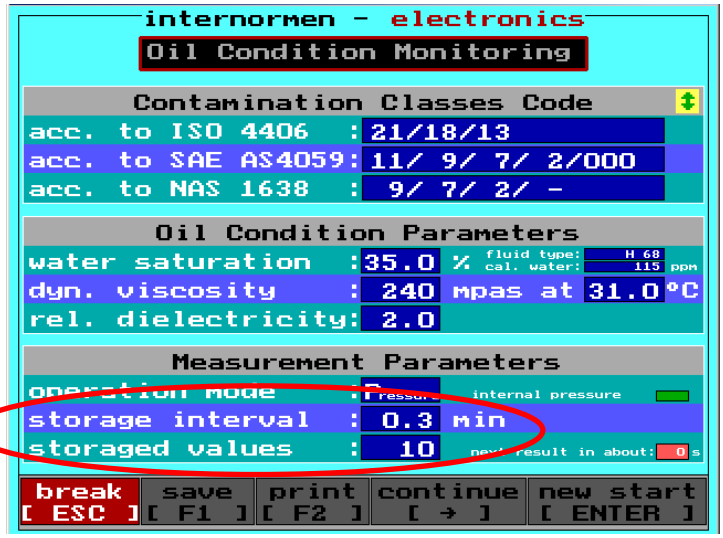




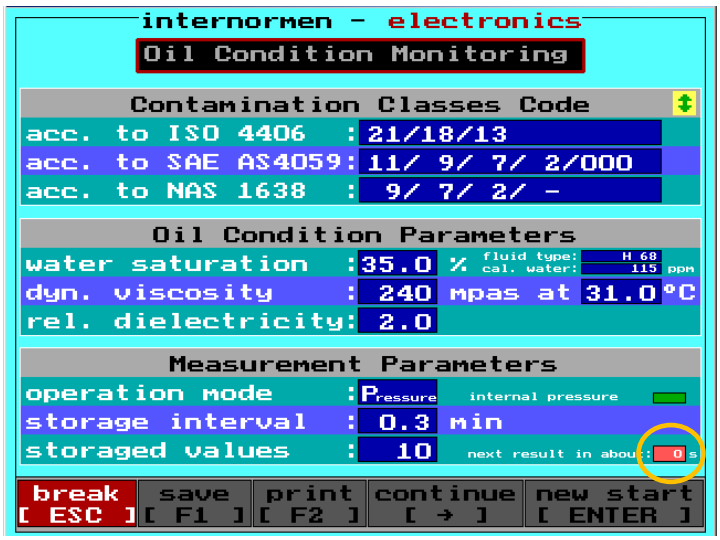
The selected operating mode is indicated in “Measurement Parameters“.

Also the internal pressure of the OCM 01 is indicated by different colours:

Grey:	**0 – 1 bar**
Yellow:	**1 – 35 bar**
Green:	**35 – 48 bar**
Red:	**> 48 bar**

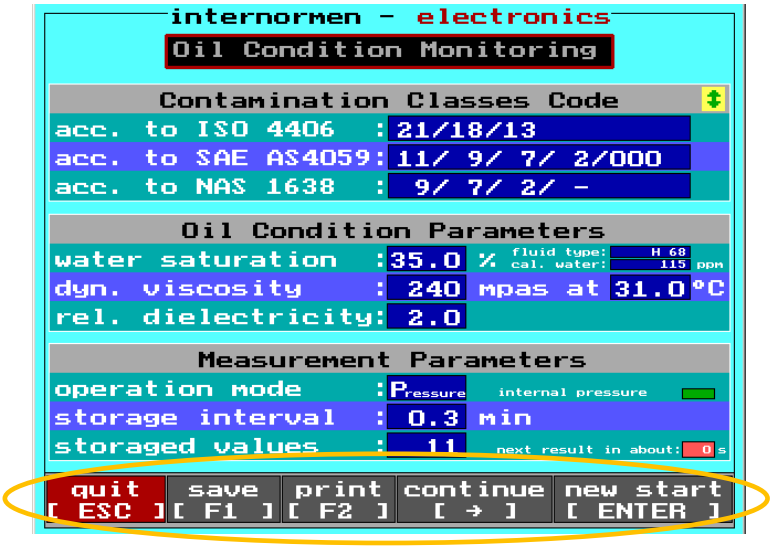


The selected storage interval and the quantity of the temporary saved measurements are also indicated in “Measurement Parameters”, if a storage interval has been defined before the start of the measurements. (see chapter 3.5.3.4.2)



The measurements (every 20 s) are continued until they get stopped with [**ESC**].

The interruption takes place after the end of the current measurement – visible at the display. (0 s and functions which are highlighted white)



- After that the last measurement can be
  printed by using [**F2**],
  saved in the **permanent data** storage by using [**F1**]. (see chapter 3.5.3.2.1)

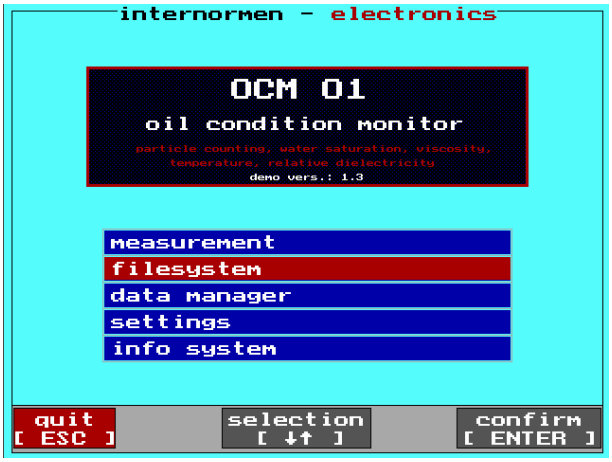
- With
  [→] effects the **continuation of the measurements** and the saving of the measurements at the temporary data storage. The new measurements are added to the existing data at the temporary data storage (see also chapter 3.5.3.2.2).

  [**ENTER**] a new start is made. **The temporary data storage is completely deleted and afterwards new written!!** (see also chapter 3.5.3.2.2)

  [**ESC**] back to the previous menu (setup: measurement mode)

- Furthermore the measurements are continuously shown by the RS232 – interface during the measurement procedure and can be displayed and read by a communication software like MS HyperTerminal or the provided Data Manager Software (under Terminal) (see also chapter 0).

3.5.3.2. File system



Using this menu point the permanent and the temporary stored measurement data can be accessed, printed and deleted.

3.5.3.2.1. Permanent data storage

- The measurements in the permanent data storage persist until they are deleted manually or the maximum quantity of the storage data is exceeded.
    - **Max. 100** measurements can be **saved** in the permanent data storage. Thereafter, at each subsequent measurement the data, that stands on the first place in the permanent strorage according to the selected data sorting (chapter 3.5.3.4.2.3), is being deleted and overwritten by new data.
      ⇨ **First out - Last in**.
      Selection of
        - data sorting „date“, then the file with the oldest date is deleted.
        - data sorting „name“, then the files were deleted in the alphabetic order. (see also chapter 3.5.3.4.2.3)

    - The deletion of single measurements effects with [F1] in the “File System“. (see below)

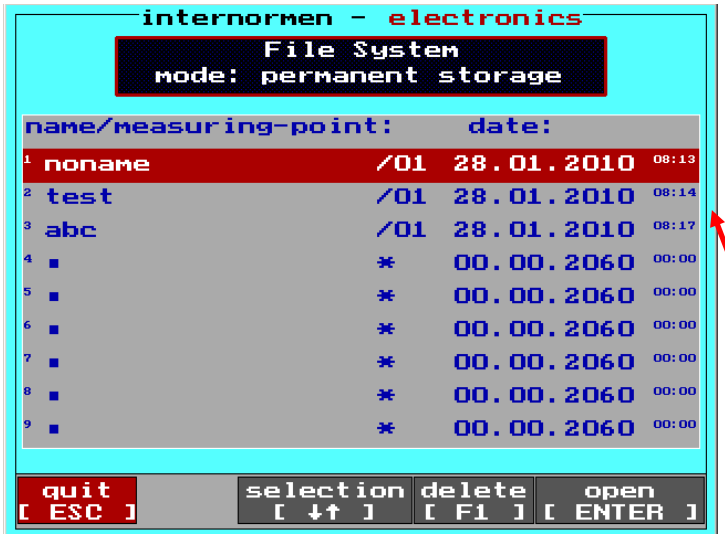
    - The deletion of the complete data set from the measured data storage effects at the mode “settings“ –“delete files“ and is irreversible (see chapter 3.5.3.4.5)!

- The permanently saved measurements can be forwarded to an external computer using the RS232 – interface and administrated by the provided Data Manager software and transferred to MS EXCEL. (see chapter 3.5.3.3.1).

    - And / or transferred, as a TXT – file using the USB – interface to USB – stick (memory capacity:<2 GB, FAT:16) (see chapter 3.5.3.3.2)

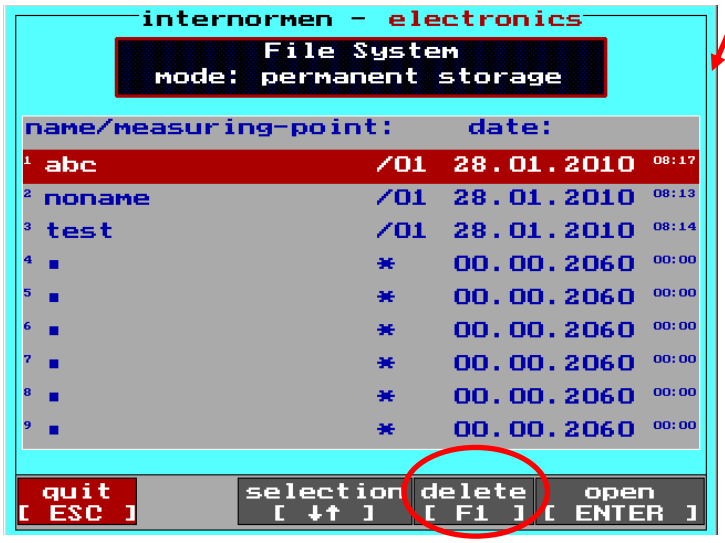
- Select the storage mode of the measured data with the [↑↓] – keys and confirm with [**ENTER**].

  ⇨ The selected menu point is highlighted red.



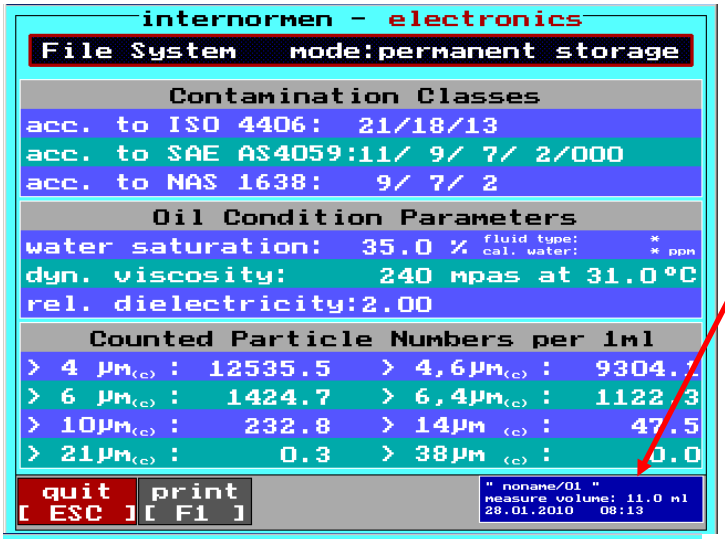
- Depending on the mode “settings / storage settings” (see chapter 3.5.3.4.2), the permanently saved files will be arranged and indicated according to:

  Date
  or
  Name.

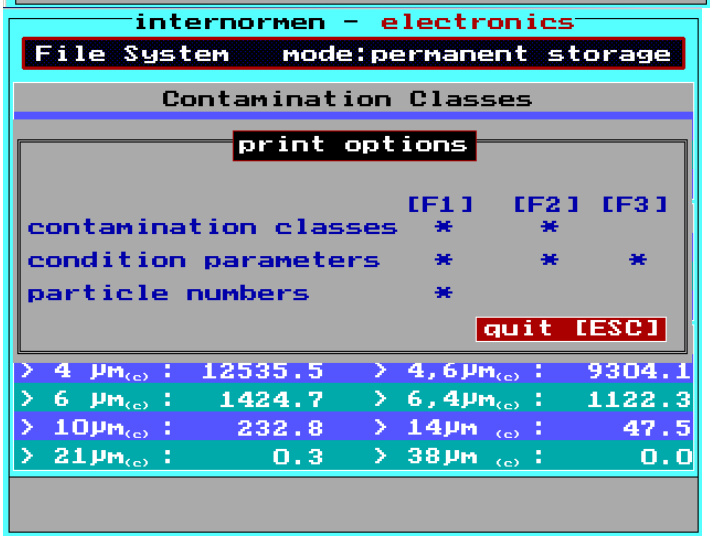


- The saved measurements can be selected with the [↑↓] – keys and deleted from the data storage with [**F1**]. (**Irreversible!**)

- Select the saved measurement with the [↑↓] – keys and open the data set with [**ENTER**].



- Display of measuring point, - date, -time, -volume.



- The measured data can be printed with [**F1**].

  ⇨ Selection of the print options. Print notation selectable by using the key [F1] or [F2] or [F3]. Afterwards back with [ESC].

- With [**ESC**] back to the previous menu.

- Again [**ESC**] to go back to the menu “File System“.

3.5.3.2.2. Temporary data storage

- In order to save data within the temporary data storage, a storage interval must be defined for this application in the mode “settings“(see chapter 3.5.3.4.2). Measurements are saved at the internal temporary data storage according to the defined storage interval.

Storage interval in minutes	Storage
0,3	of every measurement.
> 0,3	the average of the measurements from this period. ⇒ No display of the average in [Measurement Mode].
✸	no measurements.

- The measurements in the temporary data storage persist until they are deleted manually or the maximum quantity of the storage data is exceeded.
    - Max. 100 measurements can be saved in the temporary data storage. Thereafter, at each subsequent measurement the data, that stands on the first place in the temporary storage according to the selected data sorting (chapter 3.5.3.4.2.3), is being deleted and overwritten by new data. ⇨ **First out - Last in**.
      Selection of
        - data sorting „date“, then the file with the oldest date is deleted.
        - data sorting „name“, then the files were deleted in the alphabetic order.
          (see also chapter 3.5.3.4.2.3**Fehler! Verweisquelle konnte nicht gefunden erden.**)

    - In [measurement mode – oil condition monitoring] selection of

new start	Deletion, which is irreversible, of the complete data set saved in the temporary data storage!! (see chapter 3.5.3.1.1)
continue	Continuance of the measurements and saving according to the storage interval in the temporary data storage. (see chapter 3.5.3.1.1)

    - The deletion of single measurements effects with [F1] at “File System“. (see next page)

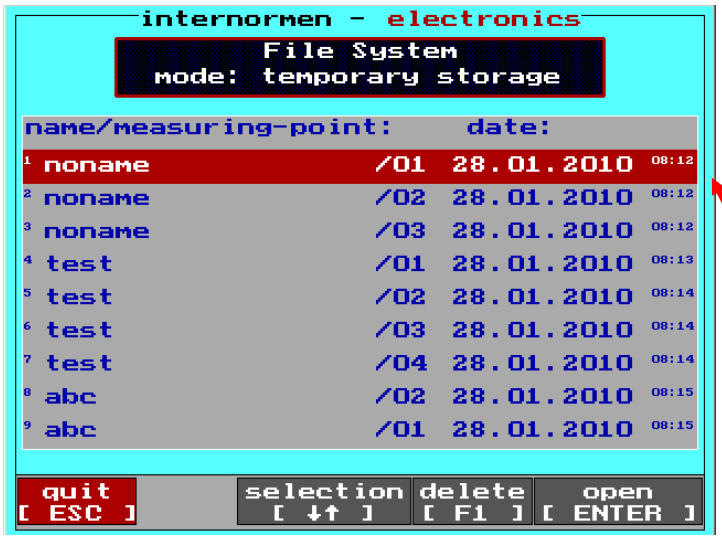
    - The deletion of the complete data set from the measurement data storage effects at the mode "settings“ –“delete files“ and is irreversible (see chapter 3.5.3.4.5)

- The temporary saved measurements can be forwarded to an external computer using the RS232 – interface and to be handled and administrated by the provided Data Manager software and transferred to MS Excel.

    - And / or transferred as a TXT – file using the USB – interface, to USB – stick (memory capacity:<2 GB, FAT:16) (see chapter 3.5.3.3.2)

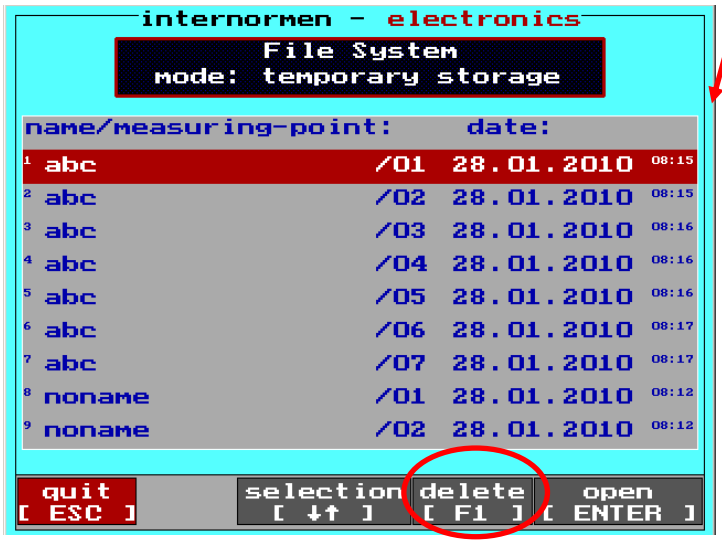
- Select the storage mode of the measured data with the [↑↓] – keys and confirm with [**ENTER**].

  ⇨ The selected menu point is highlighted red.



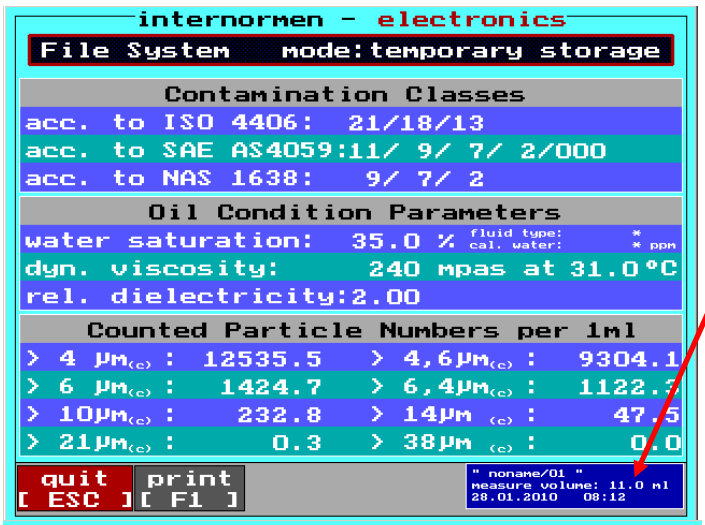
- Depending on the mode “settings / storage settings” (see chapter 3.5.3.4.2), the temporary saved files will be arranged and indicated according to:

  Date
  or
  Name.

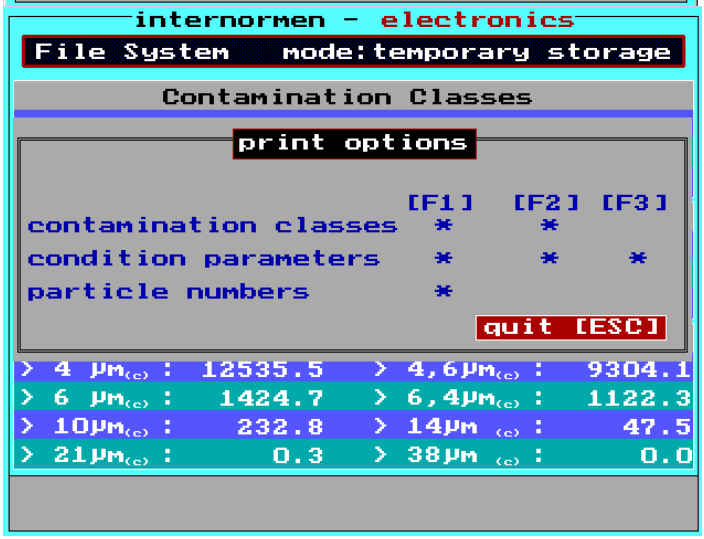


- The saved measurements can be selected with the [↑↓] – keys and deleted from the data storage with [**F1**]. (**Irreversible!**)

- Select the saved measurement with the [↑↓] – keys and open the data set with [**ENTER**].



- Display of measuring point, -date, -time, -volume.



- The measured data can be printed with [**F1**].

  ⇨ Selection of the print options. Print notation selectable by using the key [F1] or [F2] or [F3]. Afterwards back with [ESC].

- With [**ESC**] back to the previous menu.

- With [**ESC**] back to the menu “File System“.
- Again [**ESC**] to go back to the main menu.

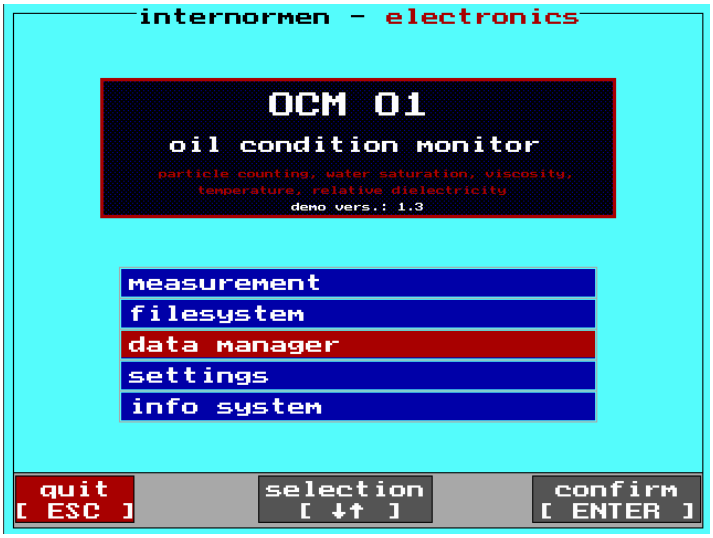
3.5.3.3. Data manager

In this mode the saved measurement results from the OCM 01 can be transferred to an external computer. The data transfer to an external computer effects by the RS232 - interface and the provided RS232 - interface cable and can be displayed and administrated using the Data Manager software or another evaluation software.
During the measurement, the current measurement data and the volume flow are available and presentable by using the Data Manager software or a terminal software like MS HyperTerminal.
A transfer of the permanent and temporary storage data by USB effects by USB-stick, and data are transferred as TXT – Files.

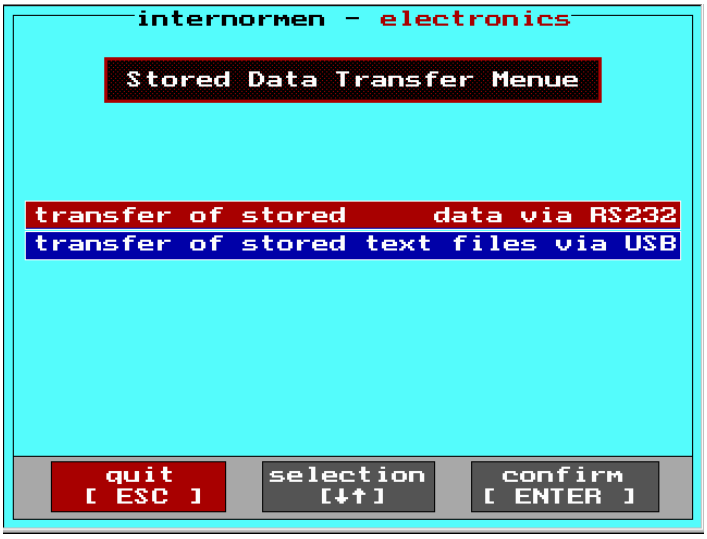
3.5.3.3.1. Transfer of the saved data by RS232

Transfer of the permanent and temporary storage measurement data by the RS232 - interface using the Data Manager software.

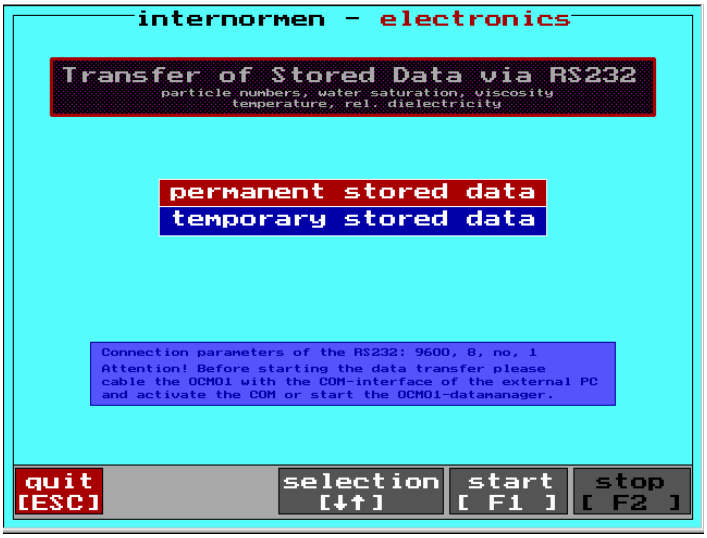
- Connect the OCM 01 with the external PC using the RS232 – interface cable.



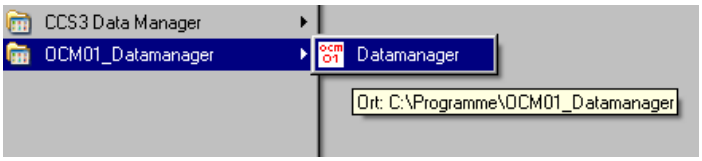
- With the [↑↓] – keys select in the main menu of the OCM 01 the mode "**data manager**" and confirm with **[ENTER].**



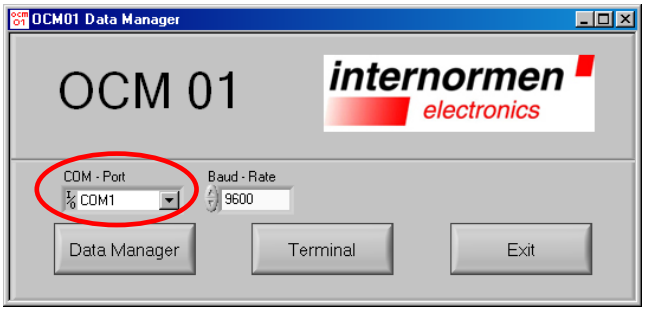
- With the [↑↓] – keys switch to the menu for data transfer of the saved values by using the RS232-interface.



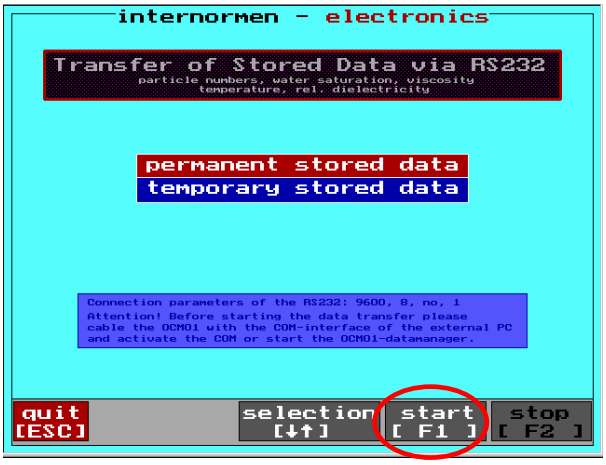
- Select with the [↑↓] – keys which stored data (permanent or temporary) are to be transferred.

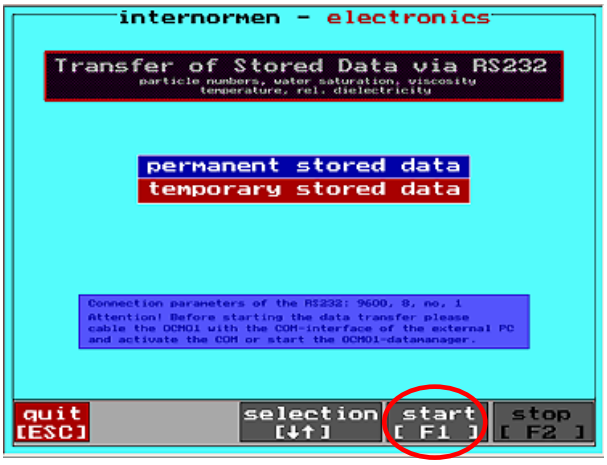


- Access the installed Data Manager software at the external computer. (One-time installation of the Data Manager Software see chapter 3.8.)



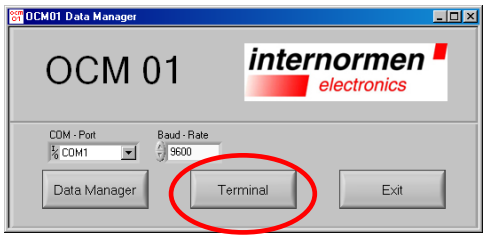
- Select the COM - Port at the main menu of the Data Manager. Pay attention that the selected COM – Port is consistent with the COM – Port indication of the computer. (see in Windows at the device manager in data links “COM and LPT1”)

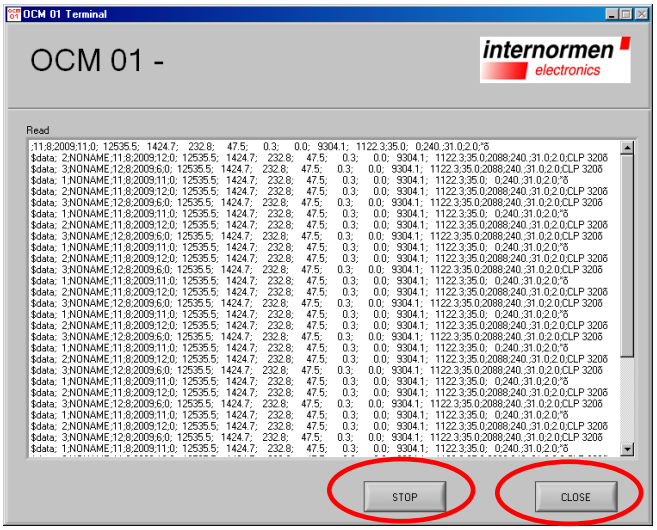




- Start of the transfer to the OCM 01 by using [**F1**].
  Depending on the selection the permanent stored data or as well the temporary stored data are periodically provided.
  After the transfer the provision cycle gets finished with [**F2**] at the OCM 01.

- Checking the connection between the OCM 01 and the external computer by using the button “**Terminal**” at the **main menu of the Data Manager software**.

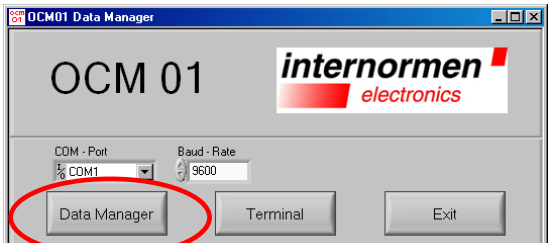


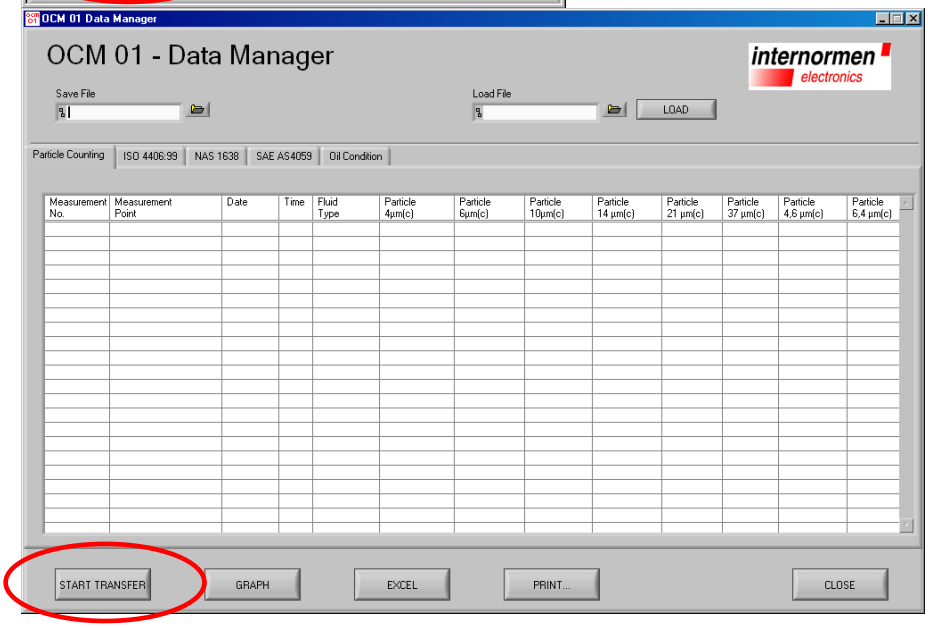


  - **If an empty terminal window appears, the correct COM-Port has to be selected and after this the connection has to be checked again.**

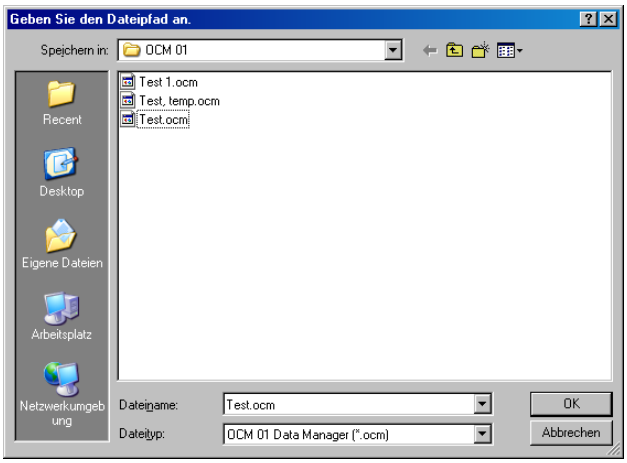
  - The inspection can be stopped with **“STOP“** and brought back to the main menu of the Data Manager with **“CLOSE“**.

- Clicking the button **"Data Manager"** allows the data transmission and the processing of the transmitted values.

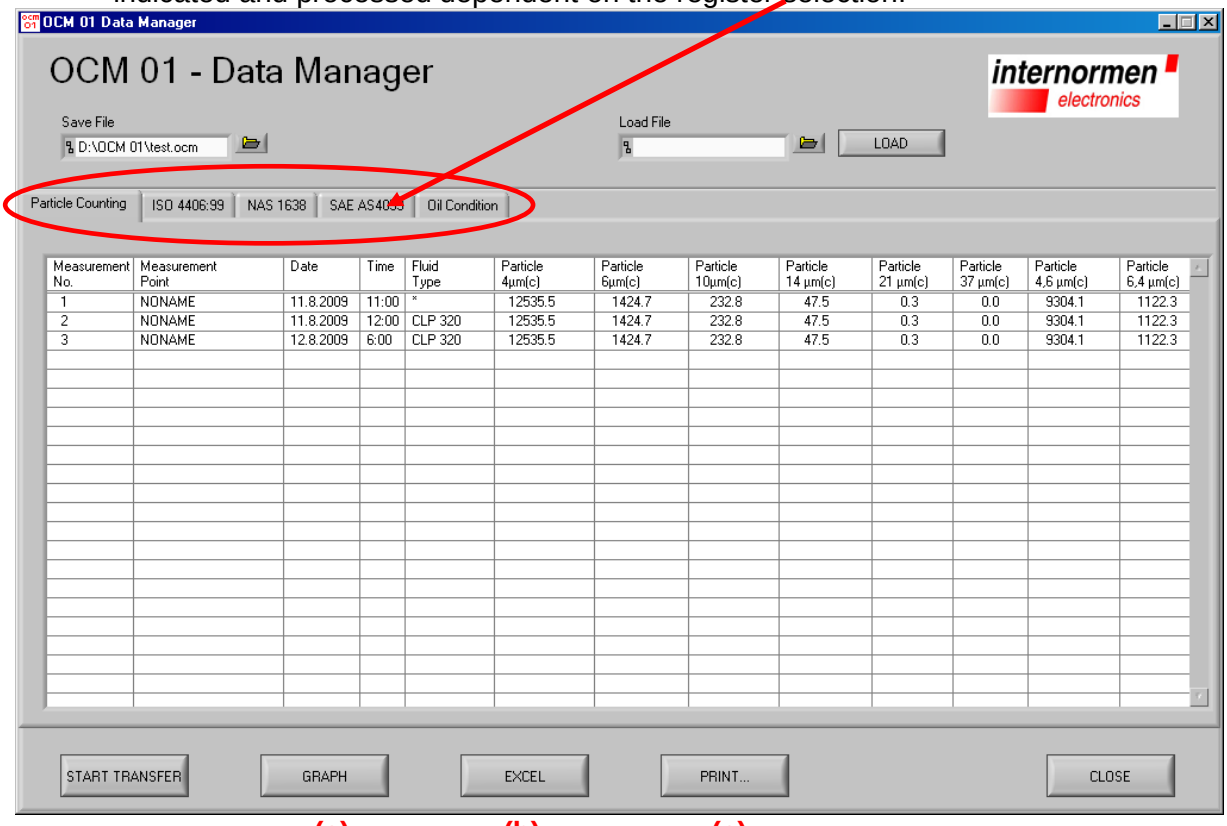




- Start of the data transfer by using the button **“START TRANSFER“.**
  - Select the data path and indicate the file name for the measurements which should be saved.



- After that the data transfer starts
  - The counted particles, ISO 4406:99, NAS 1638, SAE AS 4059, oil condition can be indicated and processed dependent on the register selection.



(a) (b) (c)

<u>The transferred data can be:</u>

(a) presented graphically

(b) exported in a MS Excel chart

(c) printed as a report

a) For graphic presentation use the button "**GRAPH**".
Depending on the presentation modes, which have been selected in the Data Manager menu, these are presented graphically.

For example:

Selection: ISO 4406:99

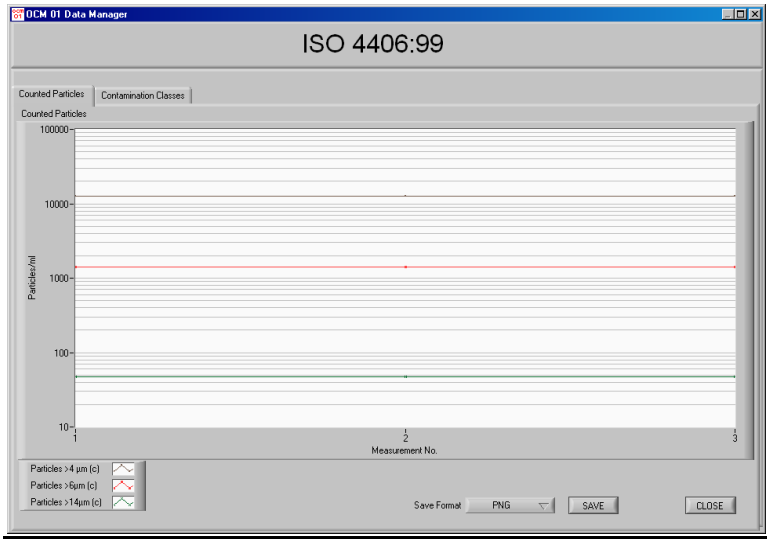


Diagram of the counted particles/ 1 ml

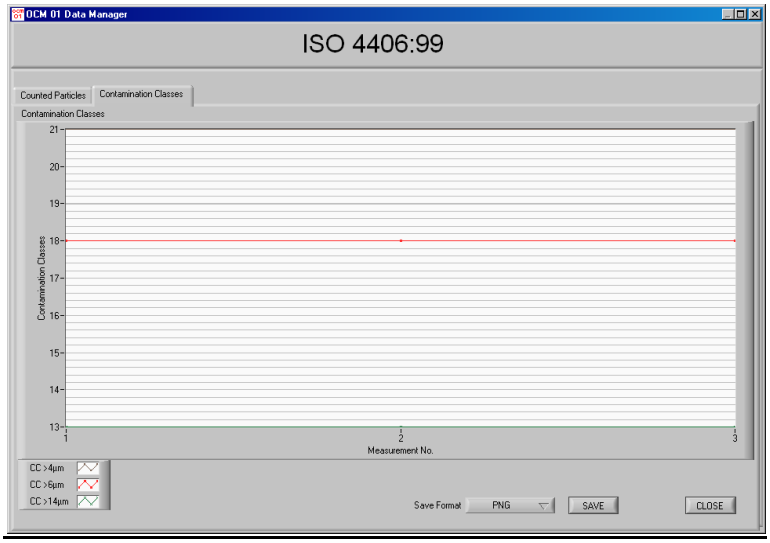
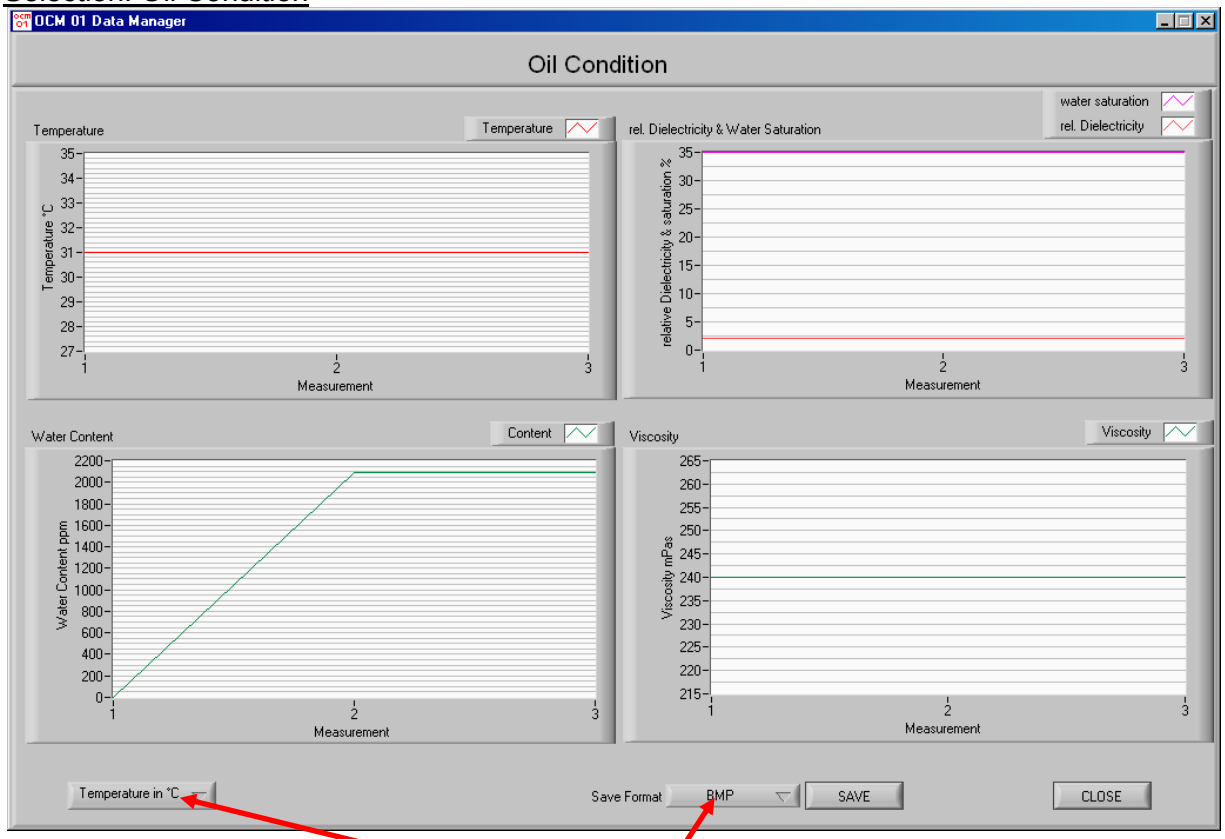


Diagram of the contamination class according to ISO 4406:99

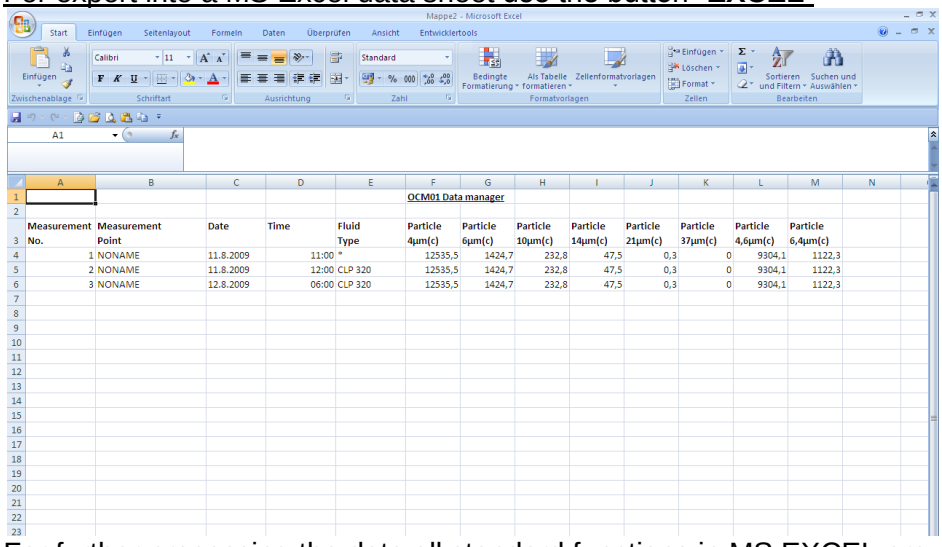
Selection: Oil Condition



- Selection of the temperature unit.
- The graphs can be saved as PNG- or BMP – file.

Back to the previous menu by using **"CLOSE"**.

b) For export into a MS Excel data sheet use the button "**EXCEL**"

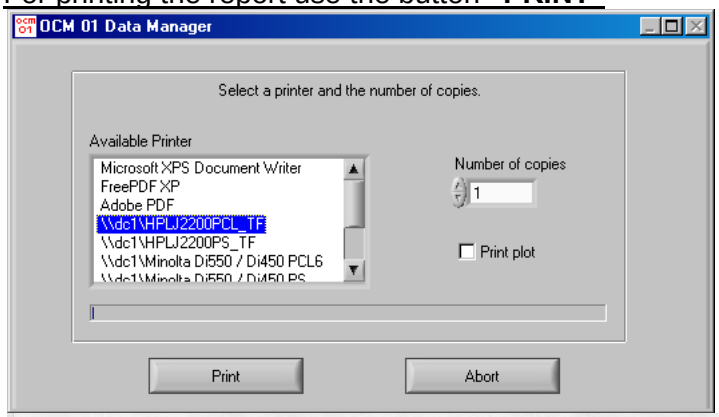


OCM01 Data manager

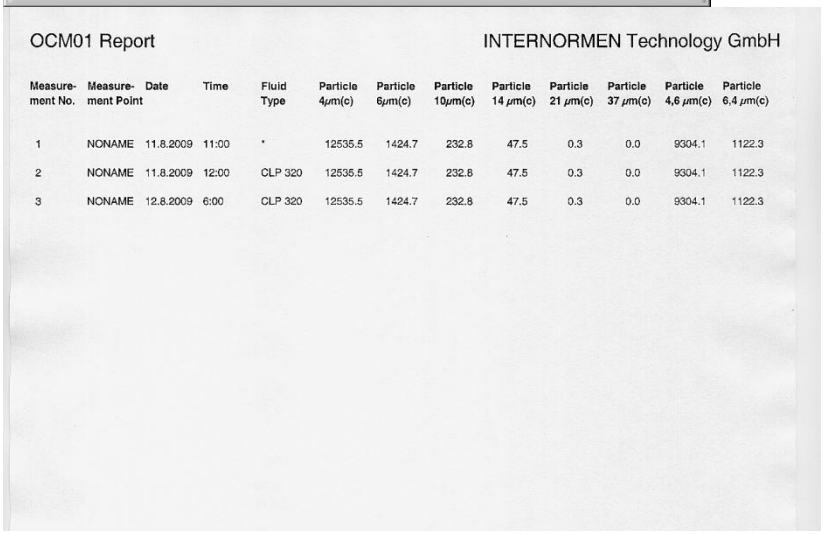
Measurement No.	Measurement Point	Date	Time	Fluid Type	Particle 4µm(c)	Particle 6µm(c)	Particle 10µm(c)	Particle 14µm(c)	Particle 21µm(c)	Particle 37µm(c)	Particle 4,6µm(c)	Particle 6,4µm(c)
1	NONAME	11.8.2009	11:00	*	12535,5	1424,7	232,8	47,5	0,3	0	9304,1	1122,3
2	NONAME	11.8.2009	12:00	CLP 320	12535,5	1424,7	232,8	47,5	0,3	0	9304,1	1122,3
3	NONAME	12.8.2009	06:00	CLP 320	12535,5	1424,7	232,8	47,5	0,3	0	9304,1	1122,3

For further processing the data all standard functions in MS EXCEL are available.

c) For printing the report use the button **“PRINT”**

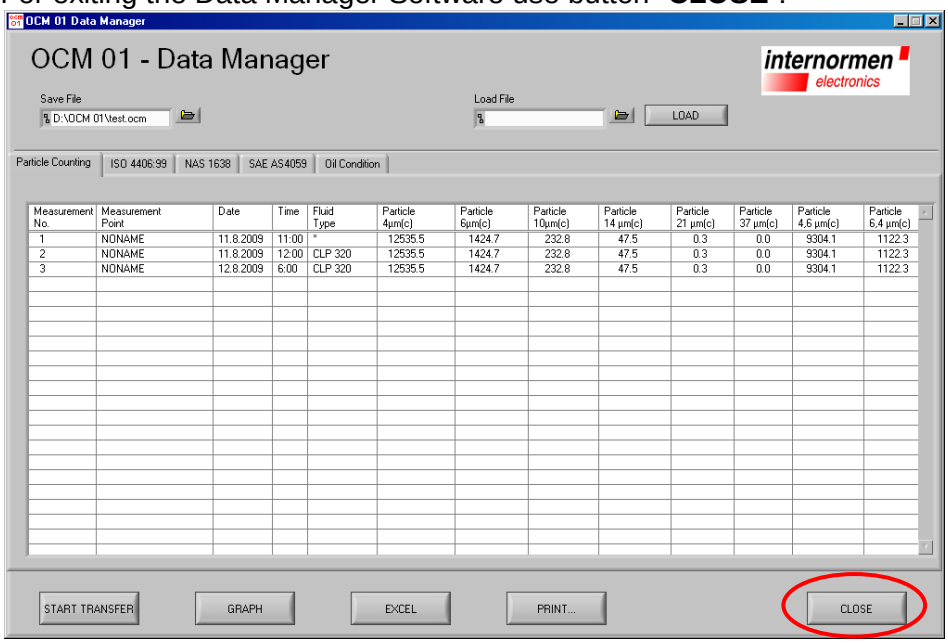


- Selection of the printer.



- Report printing.

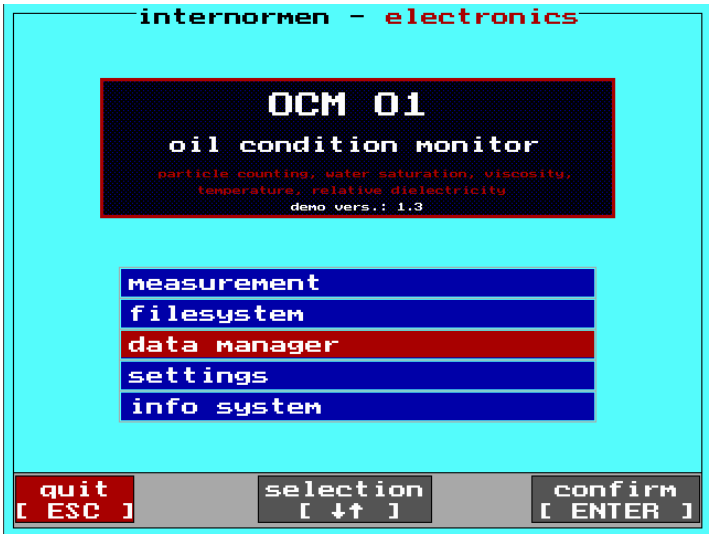
- For exiting the Data Manager Software use button “**CLOSE**“.



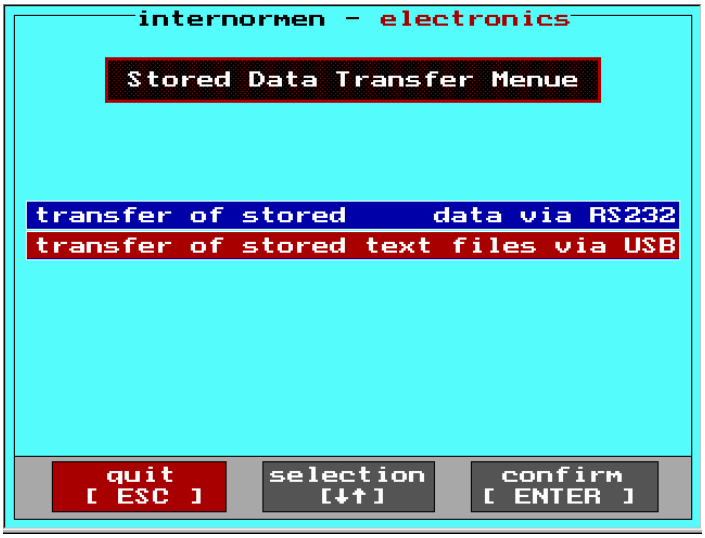
3.5.3.3.2. Data transfer of the saved TXT-files via USB

Transfer of the permanent and temporary saved measuring data on **USB – stick (memory capacity: < 2 GB, FAT 16).**

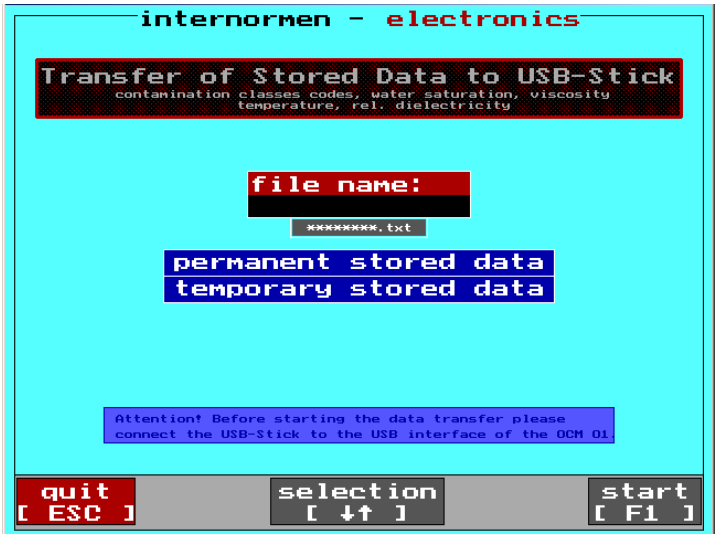
- **Load the main menu and then** insert the USB – stick in the USB-connection port at the OCM 01.
  NOTICE Otherwise the stick got a wrong initialization ⇨ no data transfer and eventually crash of the device!!



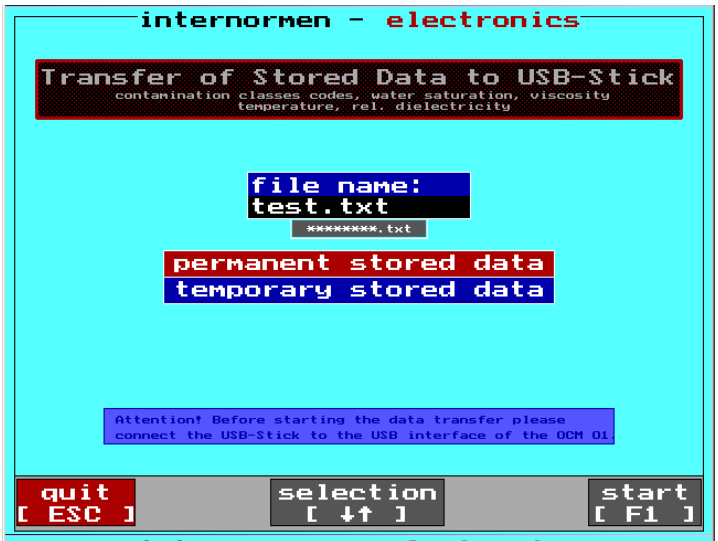
- At the main menu of the OCM 01 select the menu "**data manager**" with the [↑↓] – keys and confirm with [**ENTER**].



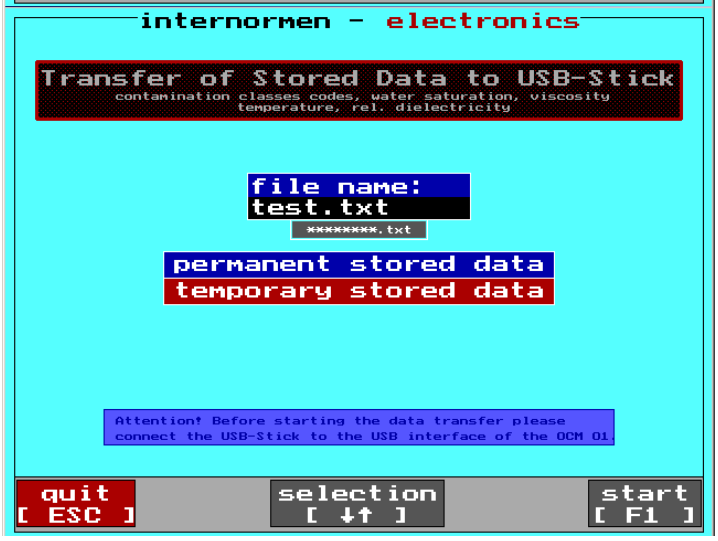
- With the [↑↓] – keys switch to the menu of the stored TXT-Files via USB.



- Input of a name as **“file name: “**.
- **Pay attention: with the file name the file format (.txt) has to be indicated, too.**
  For example: test.txt

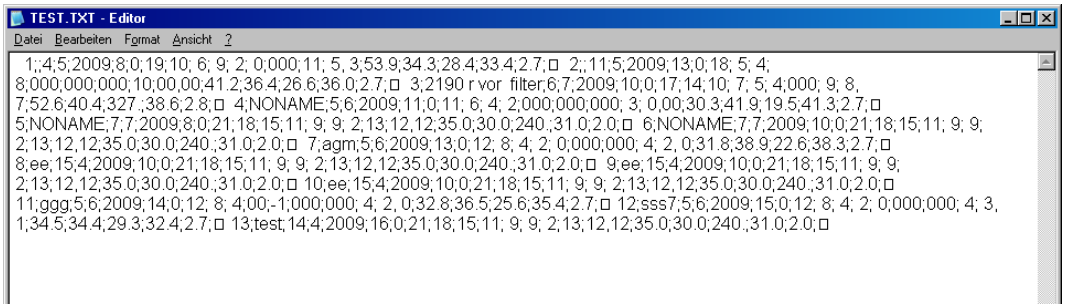


- Select data which are to be transferred with the [↑↓] – keys.
  ⇨ The selection is highlighted red.



- Start the data transfer with [**F1**].

The text file is generated, storaged on the USB-stick and can be indicated by using a text editor.



3.5.3.3.3. Continuous transfer of the current measurement values

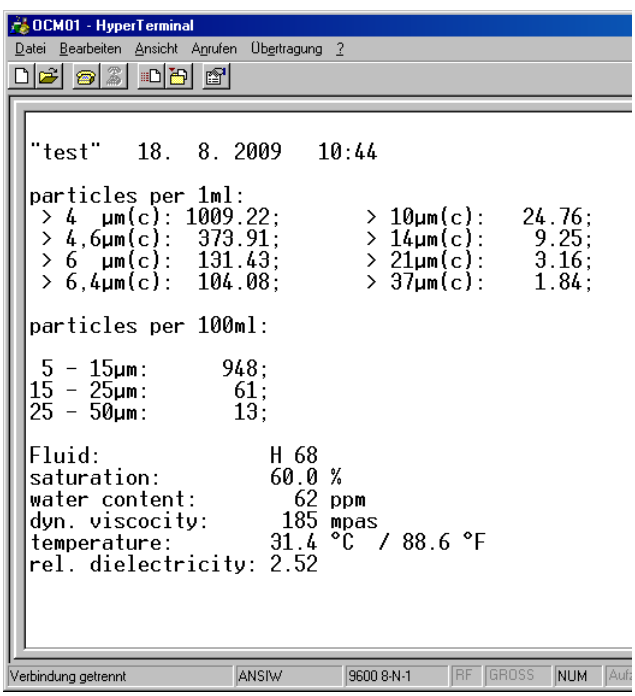
During the measurements, the actual measured values can be continuously transferred from the OCM 01 to an external computer. In order to do so, the OCM 01 has to be connected to the external computer by using the RS232-interface cable. The output results can be displayed on the computer by a communication program (“HyperTerminal by Microsoft”) or "Terminal" of the Data Manager software.

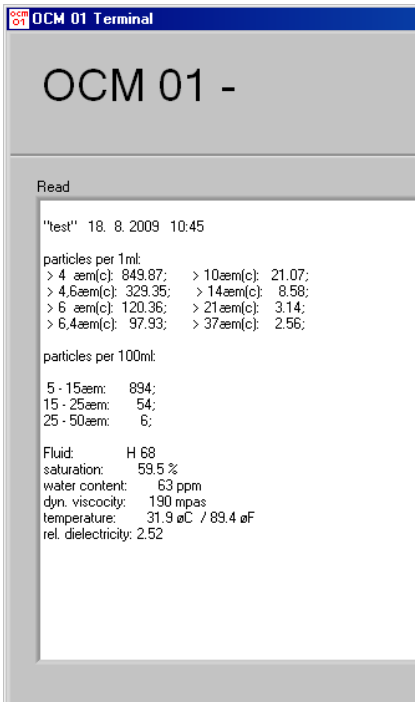
3.5.3.3.3.1. HyperTerminal

The HyperTerminal is a communication program, which is starting with the version 2.0, provided with the Windows operating system. The HyperTerminal connections can be made between a computer and a measuring unit, which are connected by serial interfaces (for example between a computer and the OCM 01). In Windows Vista, HyperTerminal is no longer included but can be supplemented by a download on the homepage of the company Hilgraeve. **Installation of HyperTerminal see chapter 3.7.**

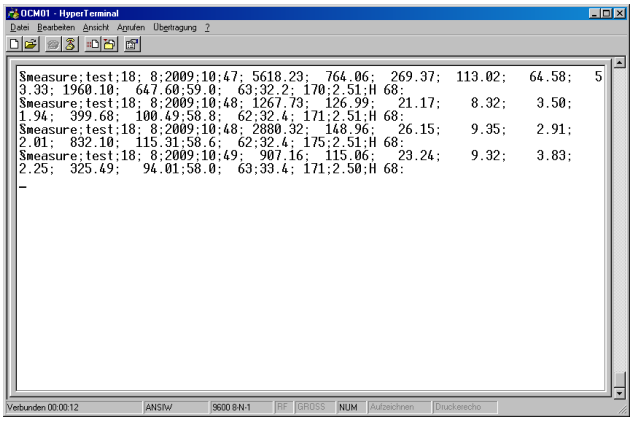
3.5.3.3.3.2. Procedure

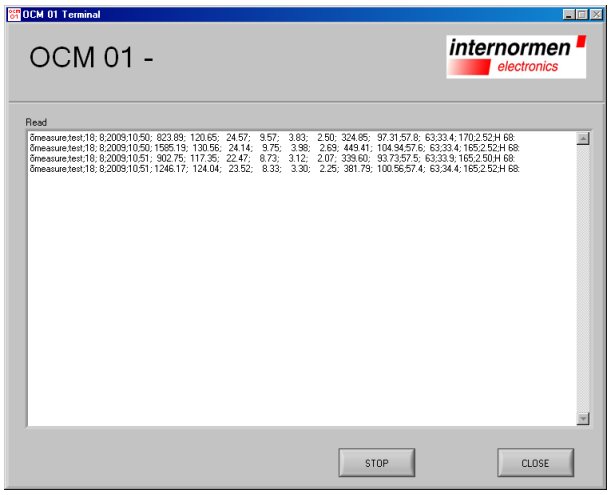
- Connect the OCM 01 with the external computer (RS232).
- Select “**measurement**“ in the main menu of the OCM 01 and confirm.
- Select the operating mode (suction mode or pressure mode).
- Start the measuring mode in the OCM 01by using “**enter**“.
- The current measured data are cyclic provided at the RS232-interface and are displayed in the terminal program according to the [settings] defined notation (see chapter 3.5.3.4.3) after a few seconds.





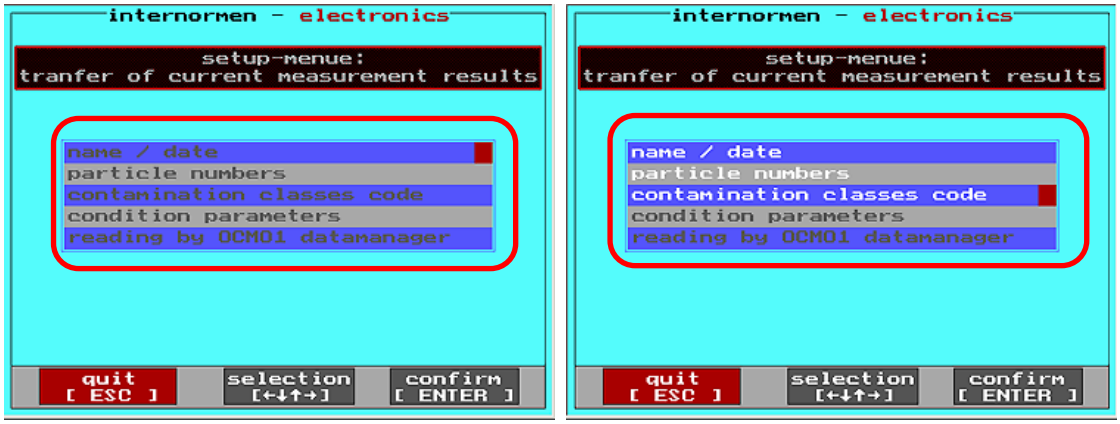
Notation if in [settings – current values output RS232]
selection of single parameters.





Notation if in [settings – current values output RS232]
selection of “reading by OCM 01 data manager”.

<u>Attention:</u> No transfer of the data if in [settings] under [Current values output RS232] no selection has been made! Minimum 1 parameter needs to be selected (visible as white font) (see chapter 3.5.3.4.3, too)



3.5.3.3.3.3. Protocol of the continuous data transfer

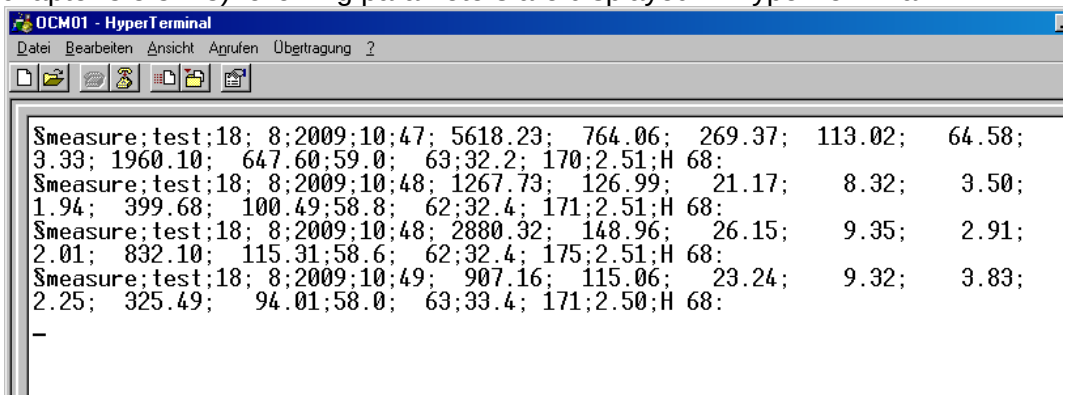
The data telegrams are generally constructed as follows:

$cmd(;par;par)*

$	Marks the beginning of a data telegram
cmd	Instruction
;	Separator
par	Parameter for the instruction

Measurement results are displayed dependent on the selected notation as follows:

a) If "**reading by OCM 01 data manager**" has been selected in the "**settings**"-menu (see chapter 3.5.3.4.3) following parameters are displayed in HyperTerminal:



$measure;P;dd;mm;yyyy;HH;MM;a.aa;b.bb;c.cc;d.dd;e.ee;f.ff;g.gg;i.ii;ww.w;pp;tt.t;v.vv;d.dd;F:

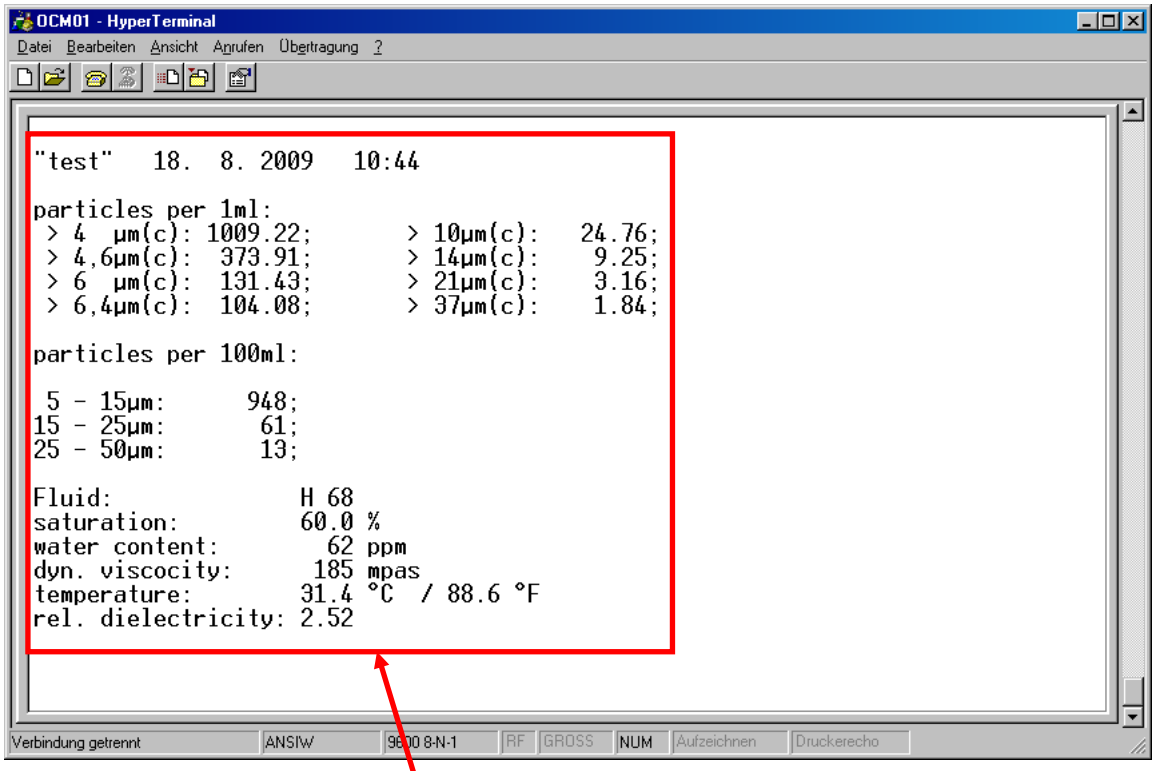
Meaning:

$measure: Display of the begin of a new data field
P: Measuring point indication
dd: Day (Date)
mm: Month (Date)
yyyy: Year (Date)
HH: Hour (Time)
MM: Minute (Time)
a.aa: Particles per 1 ml (≥ 4 µm)

b.bb: Particles per 1 ml (≥ 6 µm)
c.cc: Particles per 1 ml (≥10 µm)
d.dd: Particles per 1 ml (≥ 14 µm)
e.ee: Particles per 1 ml (≥ 21 µm)
f.ff: Particles per 1 ml (≥ 37 µm)
g.gg: Particles per 1 ml (≥ 4, 6 µm)
i.ii: Particles per 1 ml (≥ 6, 4 µm)
ww.w: Water saturation (%)
pp: ppm water content
tt.t: Temperature (°C/ °F)
vv.v: Viscosity (mPas)
d.dd: Dielectricity
F: Kind of fluid
: Indicates the end of a data field.

b) In case of selecting separate parameters in the menu "**settings**" (see chapter 3.5.3.4.3, too) only the selected parameters will be displayed in HyperTerminal:

Example: Selection of **name/ date, particle numbers, condition parameters**



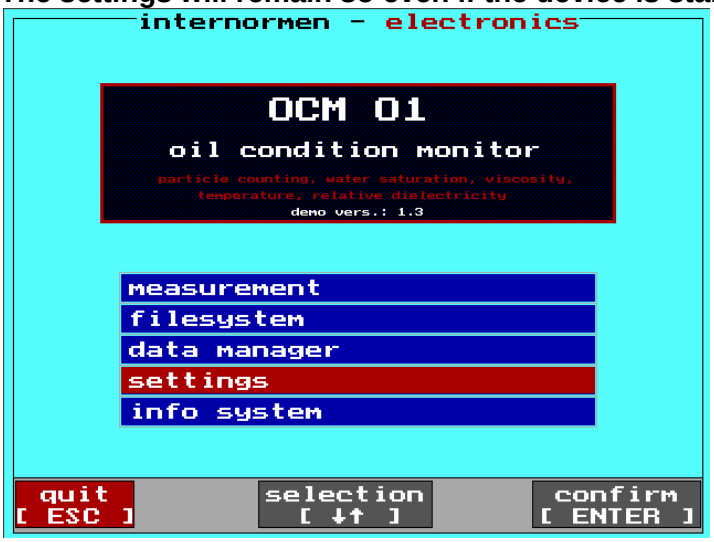
- Measurement values are indicated in a **report format**,
  here: measuring point, date, time,
  particles / 1 ml and particles/ 100 ml
  kind of fluid, water saturation in % and ppm water content
  dynamic viscosity in mPas,
  temperature in °C and °F,
  relative dielectricity.

3.5.3.4. Settings

The following settings can be made in this mode:

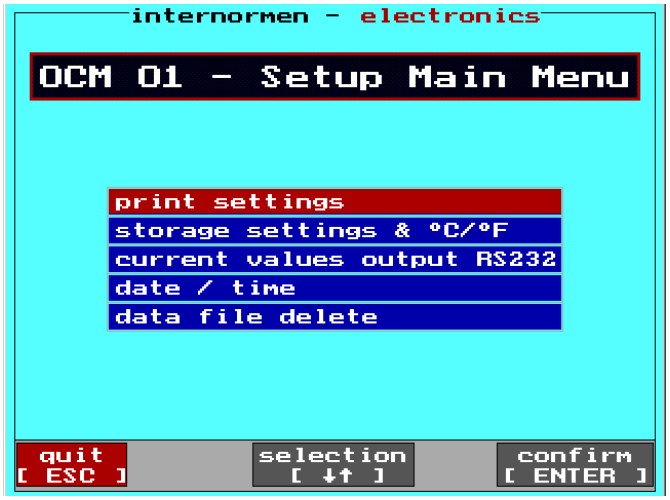
- Printer settings,
- Storage settings,
- Data sorting,
- Selection of the temperature unit (°C/ °F),
- Parameter selection of the current output values at the RS232 - interface,
- Changes of date and time,
- Deletion of data files.

The settings will remain so even if the device is started again (new start)!

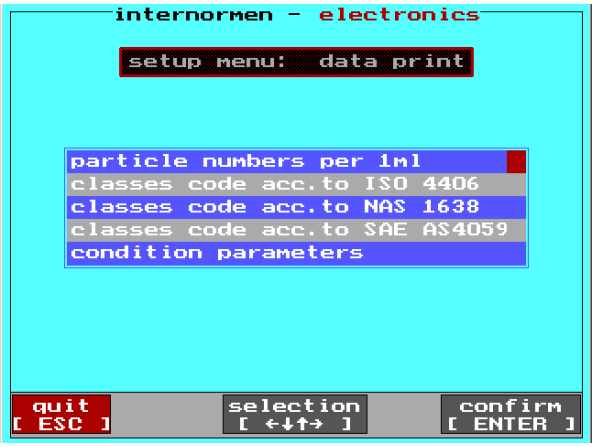


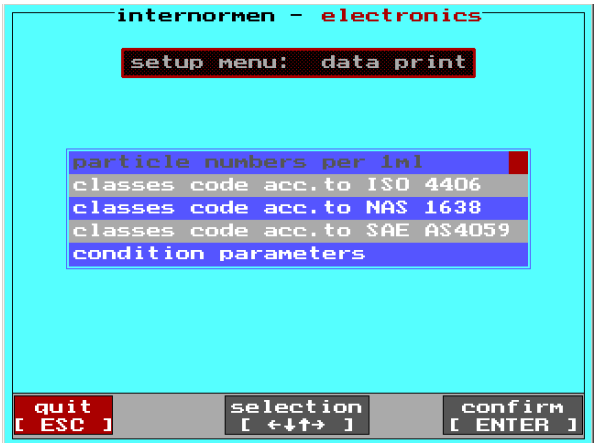
- In the main menu of the OCM 01 select the menu **"settings"** with the [↑↓] – keys and confirm with [**ENTER**].

3.5.3.4.1. Print settings



- With the [↑↓] – keys switch to the menu print "settings" and confirm with [**ENTER**].





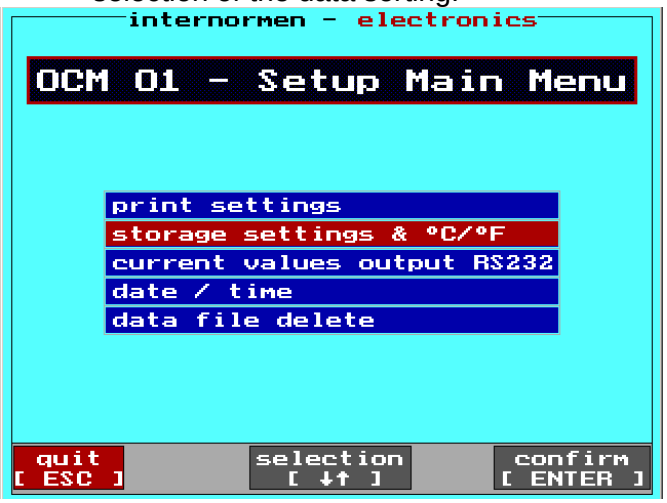
- Select with the [↑↓] and the [← →] – keys, which parameter is to be printed. The selected parameter appears white.

- Confirm selection with [**ENTER**], when all parameters are set. An automatically alteration into the previous menu effects.

3.5.3.4.2. Storage interval, data sorting and temperature unit

This mode is meant for:

- definition of the storage settings,
- selection of the temperature unit,
- selection of the data sorting.

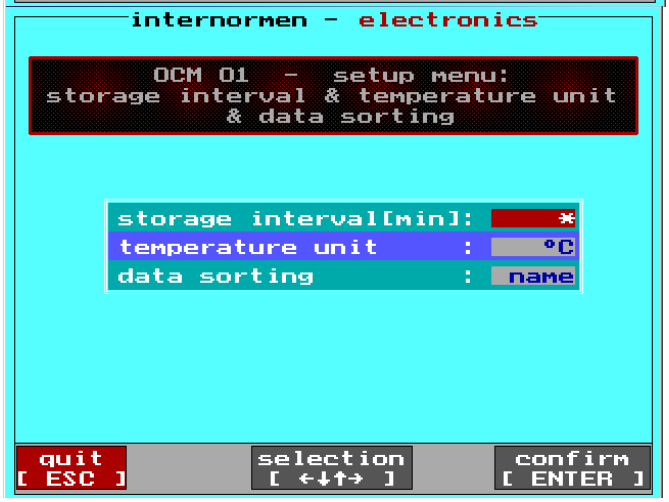


- With the [↑↓] – keys switch to the menu “storage settings & °C/ °F“ and confirm with [**ENTER**].

3.5.3.4.2.1. Storage interval

Definition of the storage interval for the current value.

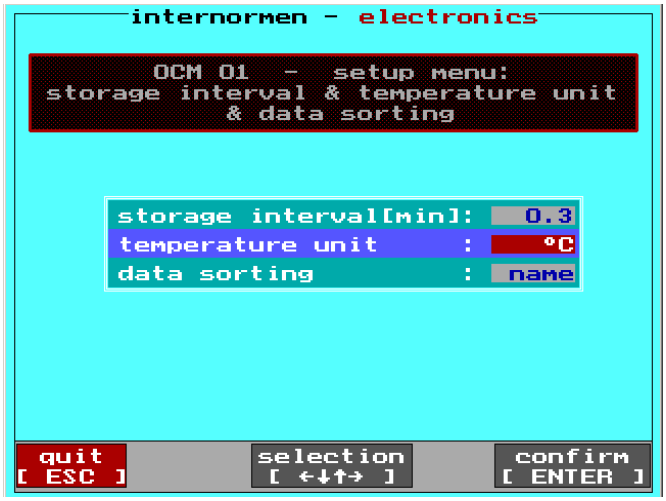
- With the [↑↓] – keys select the parameter to be changed. The selected parameter is indicated highlighted red.
- Select the storage interval with the [← →] – keys.
- <u>Possible storage interval:</u>
  0,3 – 2400 minutes.



- In case of selecting ✸ no storaging of the measurement values in the temporary data storage will be made.

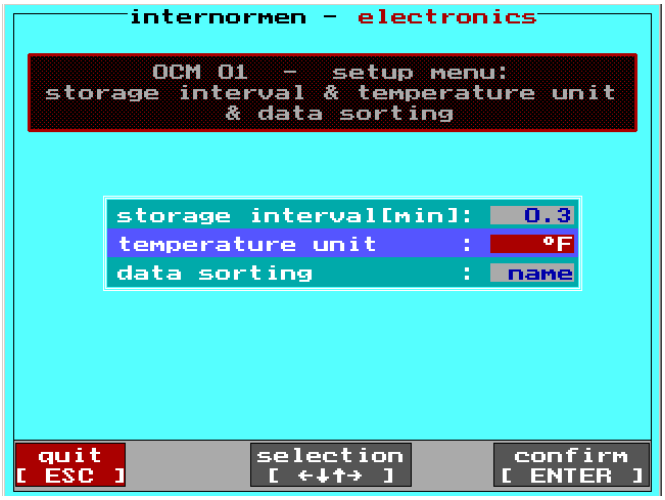
- Confirm selection with [**ENTER**]

3.5.3.4.2.2. Selection of the temperature unit °C or °F



- Select the parameter which is supposed to be changed with the [↑↓] – keys.

  ⇨ Selected parameter is highlighted red.

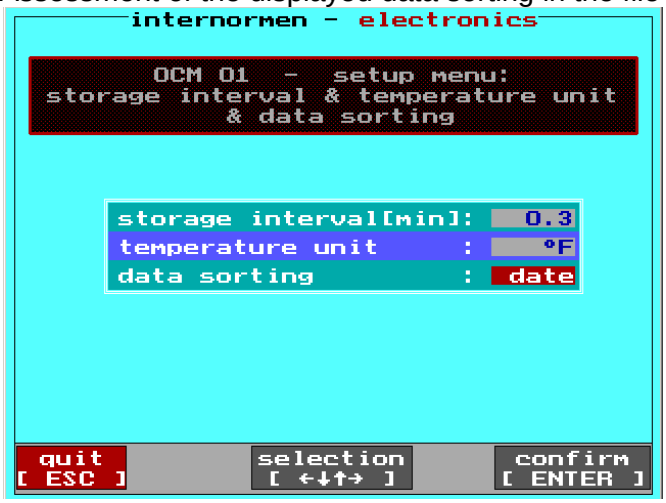


- Select the temperature unit (°C or °F) with the [← →] – keys.
- Confirm the selection with [**ENTER**].

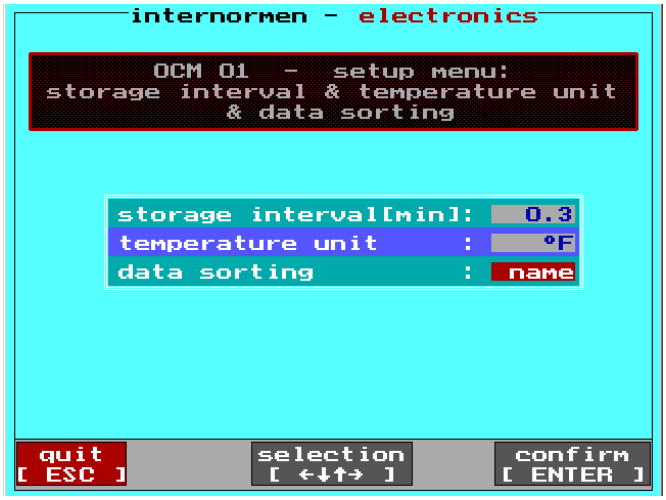
With [**ESC**] back to the previous menu.

3.5.3.4.2.3. Data sorting

Assessment of the displayed data sorting in the file system.



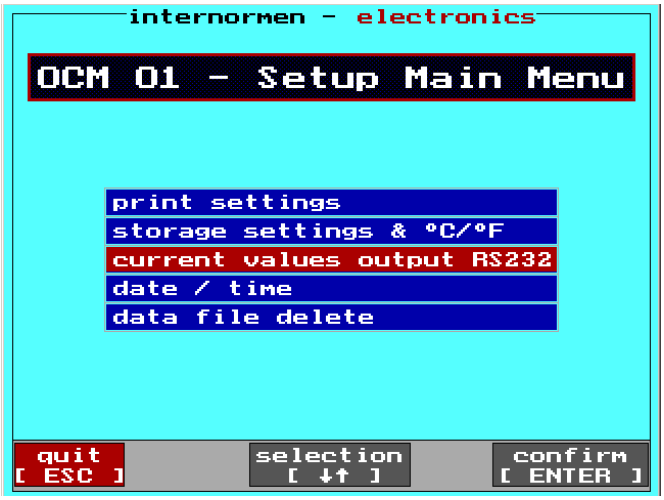
- Select the parameter which is supposed to be changed with the [↑↓] – keys.
- Selected parameter is highlighted red.



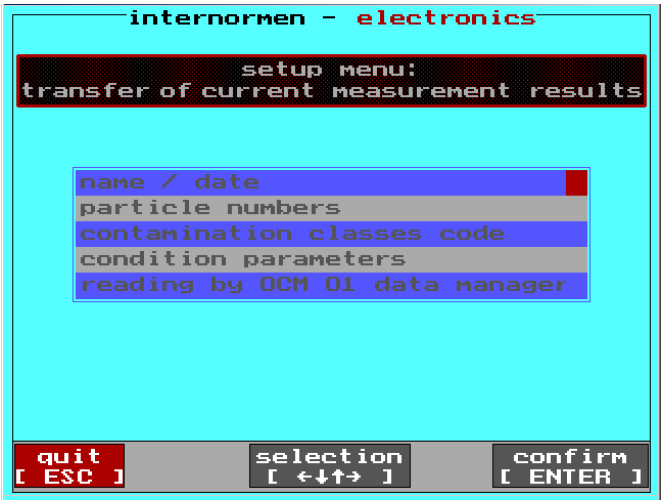
- Select the kind of data sorting (date or name) with the [← →] – keys.
- Confirm the selection with [**ENTER**].

3.5.3.4.3. Current values output RS232

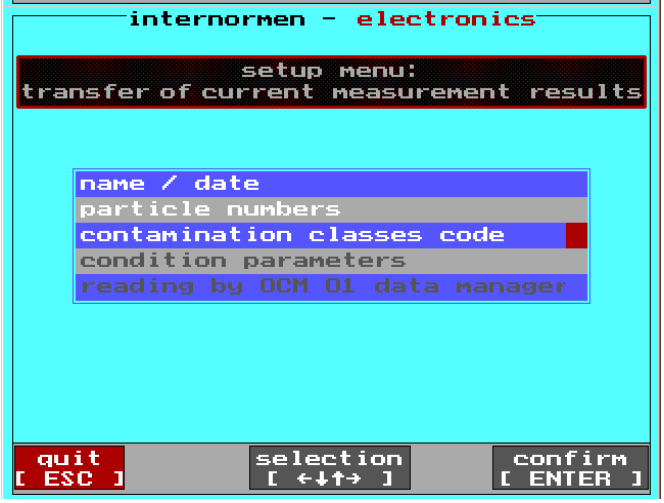
This mode is meant for setting the way in which the current output values will be shown by the RS232-interface.



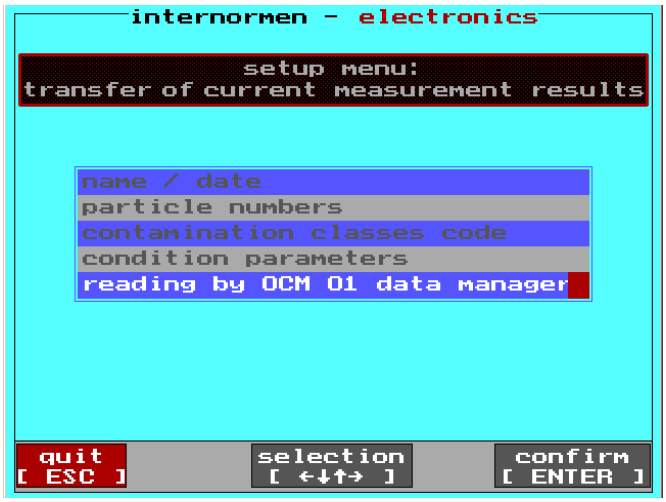
- With the [↑↓] – keys switch to the menu ”current values output RS232“ and confirm with [**ENTER**].



- Select with the [↑↓] and the [← →] – keys, which parameters are to be shown by the RS232-interface.



- The selected parameters appears white.



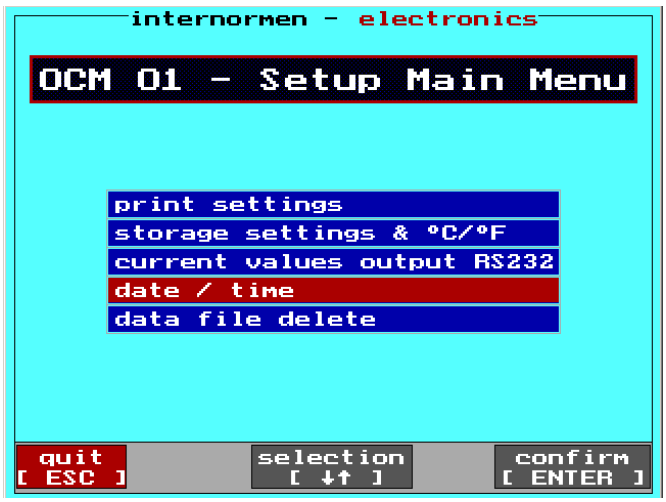
- If “reading by OCM 01 datamanager” has been selected the measured values are displayed in the form in which they are defined in the Data Manager.

- After all parameters are set, confirm the selection with [**ENTER**].
  ⇒ An automatic alteration to the previous menu will occur.

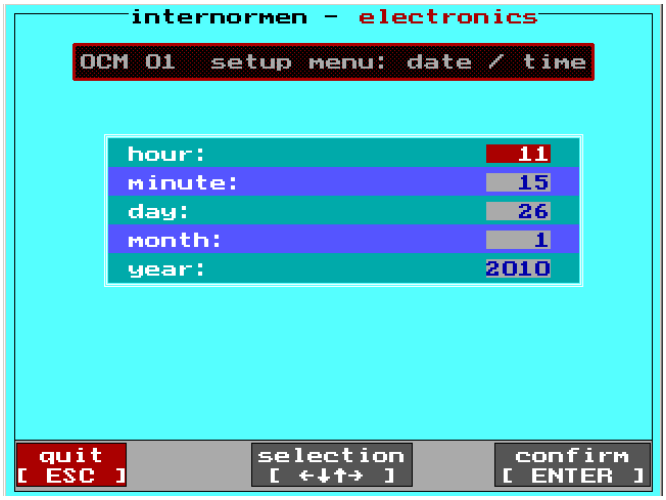
3.5.3.4.4. Date/ time

- This function is meant for setting the real time clock integrated within the device. Through the battery backup it continues to run even if the power supply is switched off.

- Day, month, hour and minute are separately adaptable and are getting transferred to the real time clock.



- With the [↑↓] – keys switch to the menu ”date / time“ and confirm with [**ENTER**].

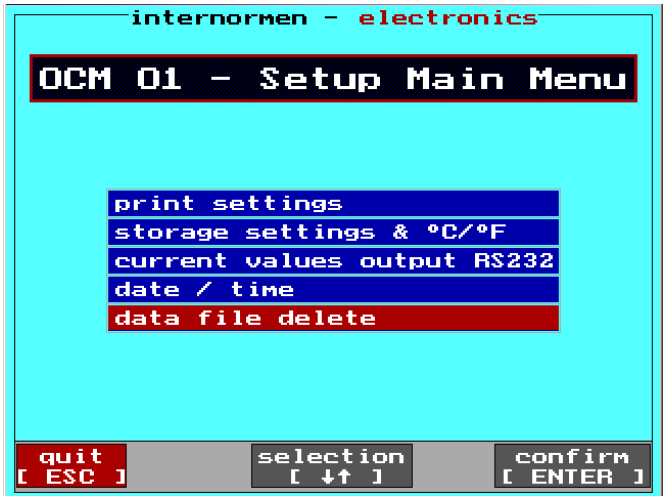


- Select the parameter to be changed with the [↑↓] – keys.
- The selected parameter is highlighted red.
- Set the parameter with the [← →] – keys to the current date and / or time.

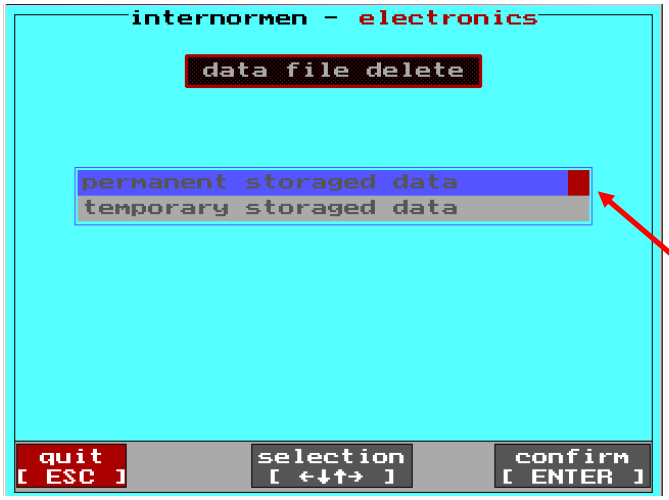
- After all parameters are set, confirm the selection with [**ENTER**].
  ⇒ An automatic alteration to the previous menu will occur.

3.5.3.4.5. Delete files

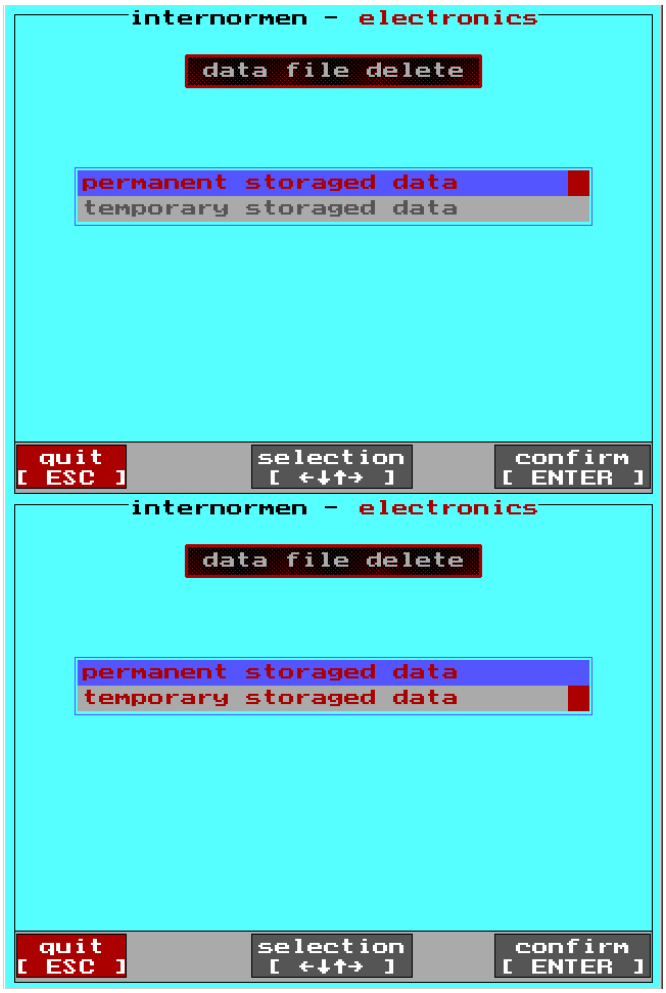
The **deletion of all data from the measurement value storage** is made by using this function **and is irreversible!**



- With the [↑↓] – keys switch to the menu “delete files“ and confirm with [**ENTER**].



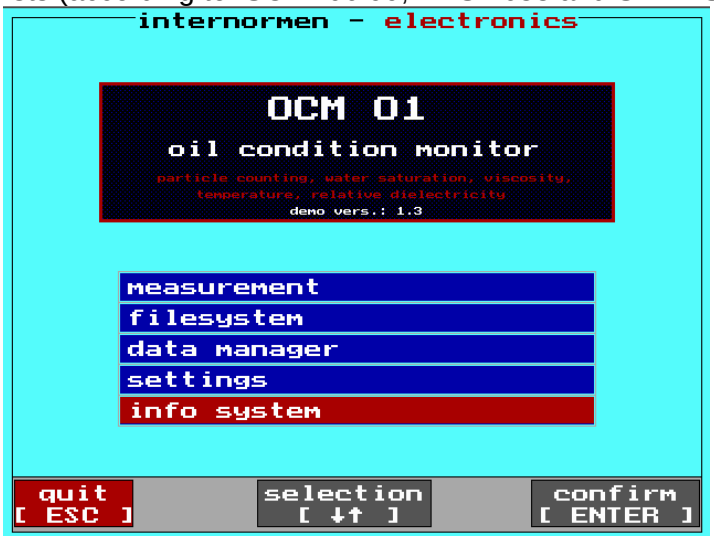
- Select with the [↑↓] – keys the kind of data which has to be deleted (permanent and/ or temporary stored data).
  ⇒ The selected parameter is marked red.



- Select the kind of data which has to be deleted with the [← →] – keys.
  ⇒ Selection is displayed in red font.
- Confirm the selection with [**ENTER**].
- With [**ESC**] back to the previous menu.

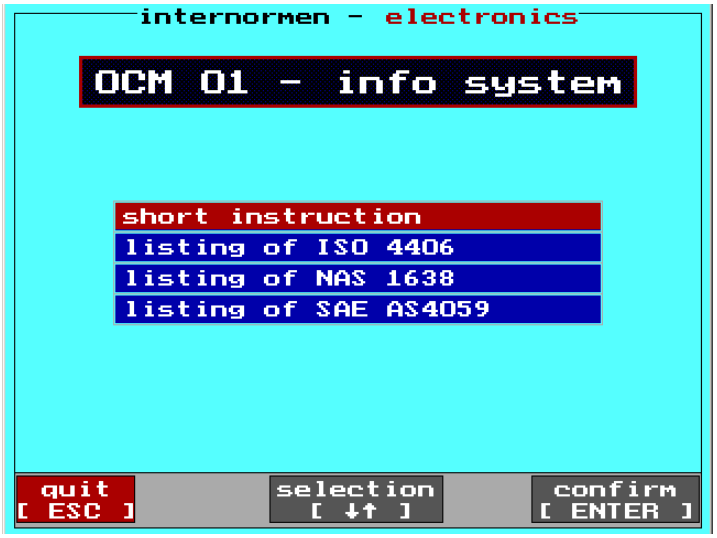
3.5.3.5. Info system

Within the info system, a short instruction for operating the OCM 01 and contamination class lists (according to ISO 4406:99, NAS 1638 and SAE AS 4059) are saved.

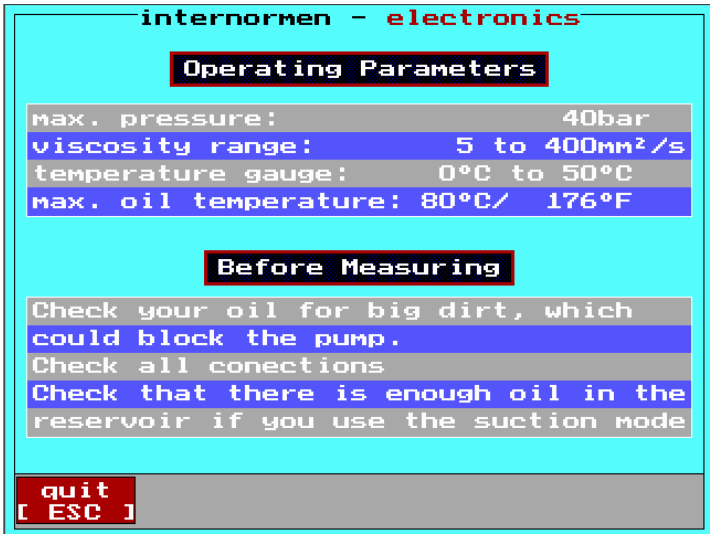


- With the [↑↓] – keys switch to the menu “info system“ and confirm with [**ENTER**].

3.5.3.5.1. Short instruction

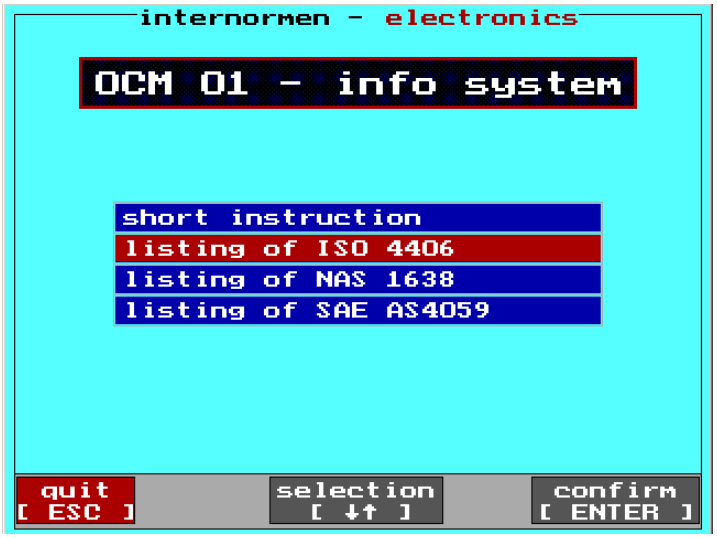


- Selection with the [↑↓] – keys and confirmation with [**ENTER**].
  ⇒ Selected menu point is highlighted red.



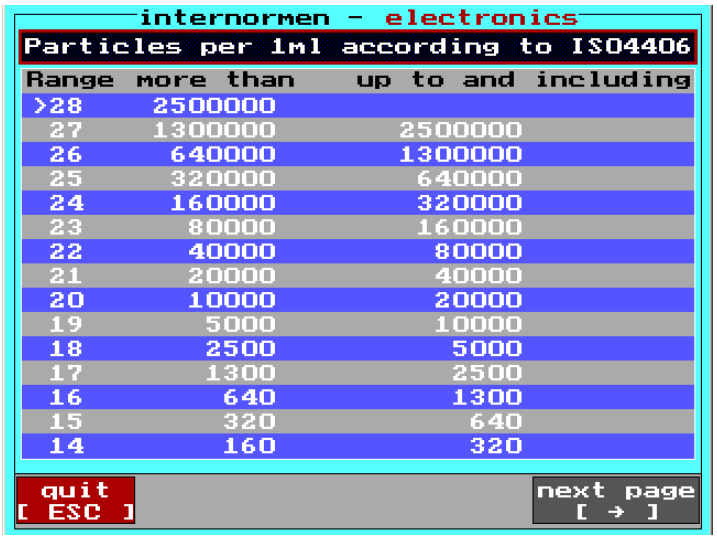
- Display of the operation parameters and what has to be taken care of before measuring.
- Back to the previous menu with [**ESC**].

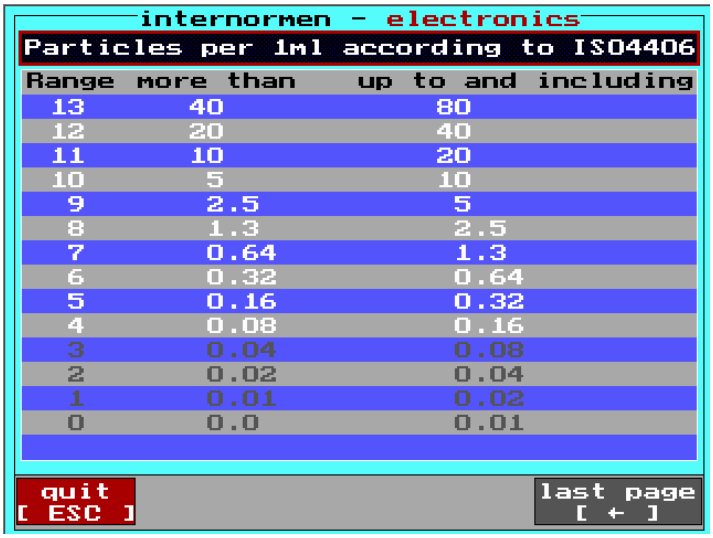
3.5.3.5.2. Listing of ISO 4406:99



- Selection with the [↑↓] – keys and confirmation with [**ENTER**].

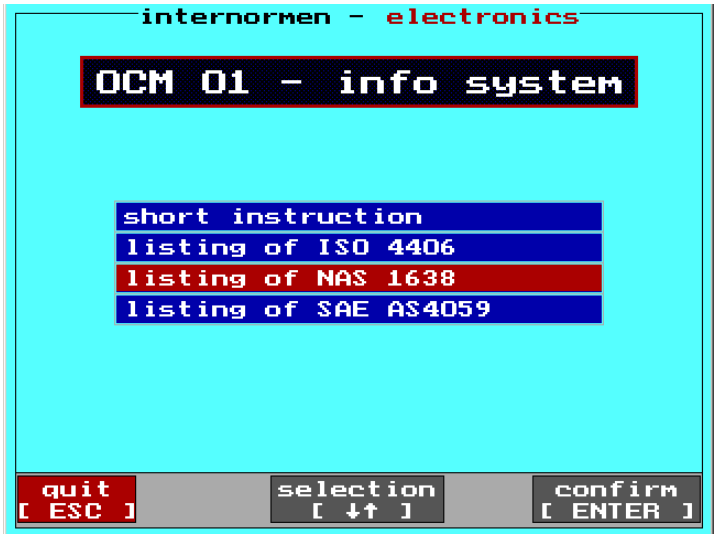
  ⇒ Selected menu point is highlighted red.



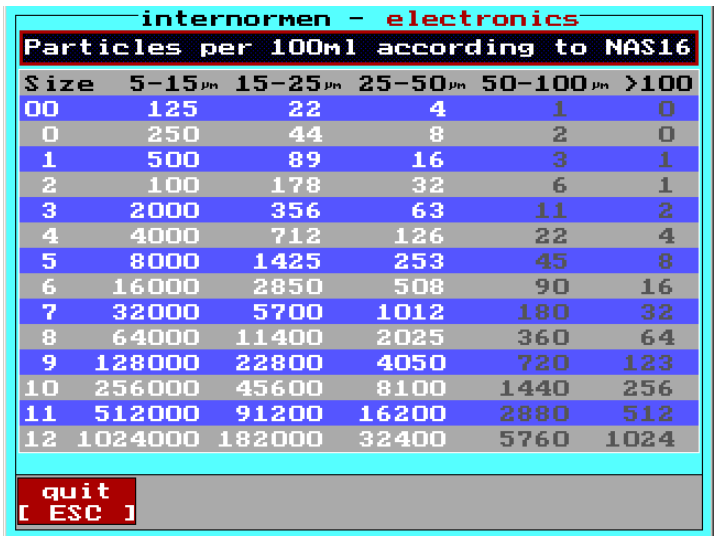


- Display of the contamination classes list according to ISO 4406:99.
- Changing to the next side with [→] and with [←] back to the last page.
- With [**ESC**] back to the previous menu.

3.5.3.5.3. Listing of NAS 1638

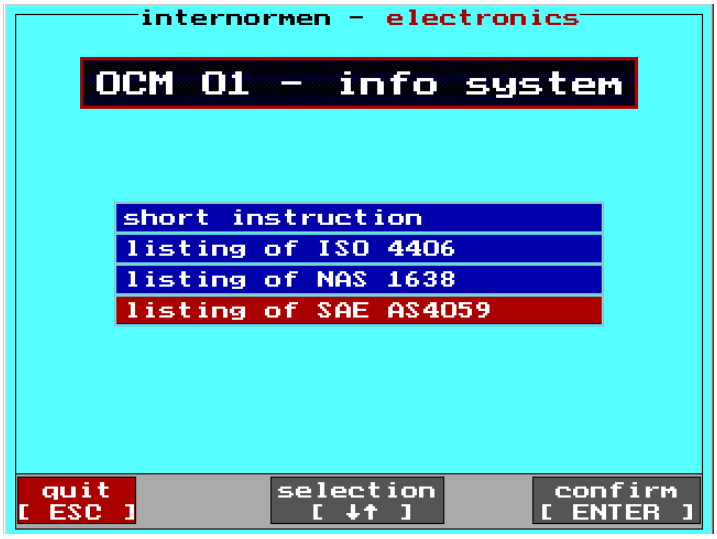


- Selection with the [↑↓] – keys and confirmation with [**ENTER**]. Selected menu point is highlighted red.

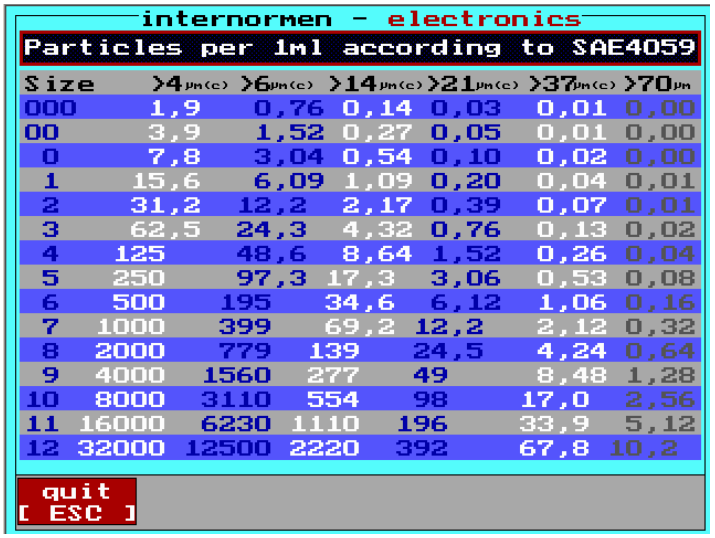


- Display of the contamination classes according to NAS 1638.
- With [**ESC**] back to the previous menu.

3.5.3.5.4. Listing of SAE AS 4059



- Selection with the [↑↓] – keys and confirmation with [**ENTER**]. Selected menu point is highlighted red.



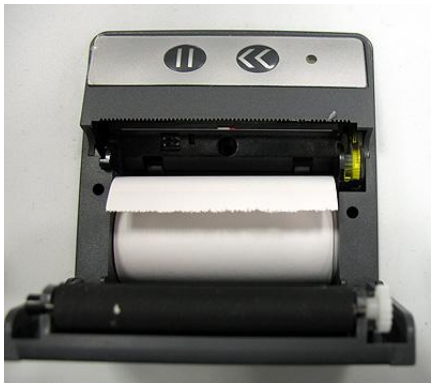
- Display of the contamination classes according to SAE AS 4059.
- With [**ESC**] back to the previous menu.

3.6. Printer

3.6.1. Input of new paper scrolls

- Open the front side of the printer and remove the empty scroll.



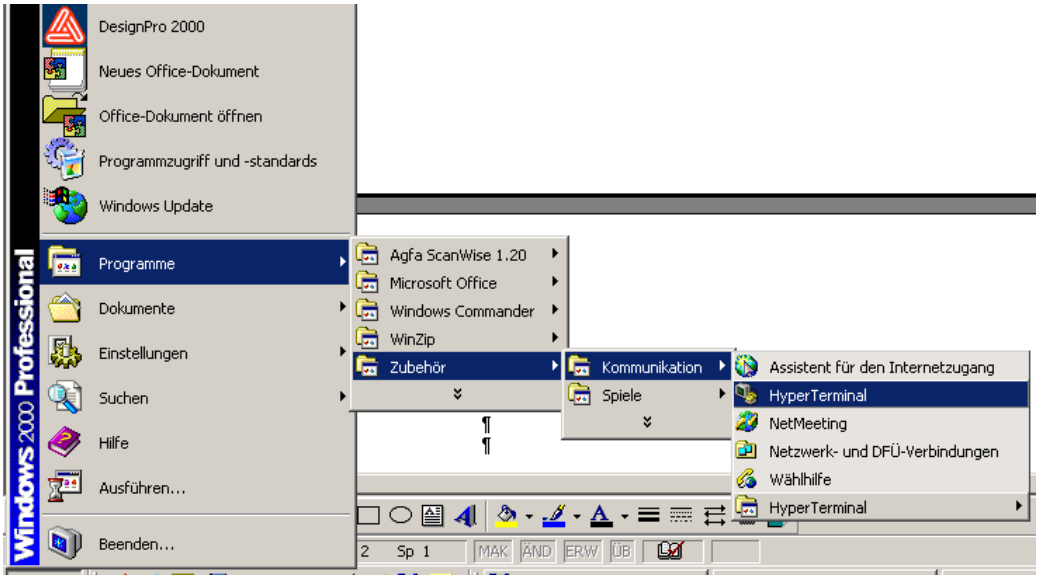


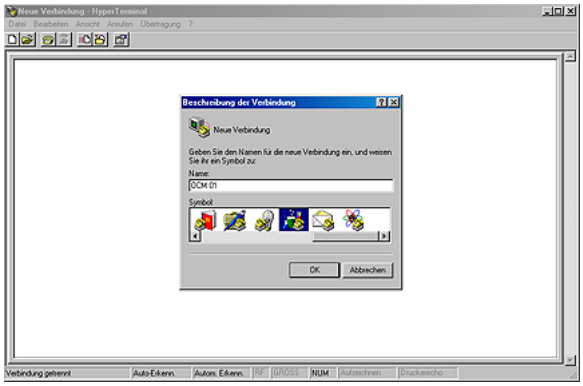
- Place a new scroll in.

- Close the cover of the printer.


3.7. Set up of the HyperTerminal

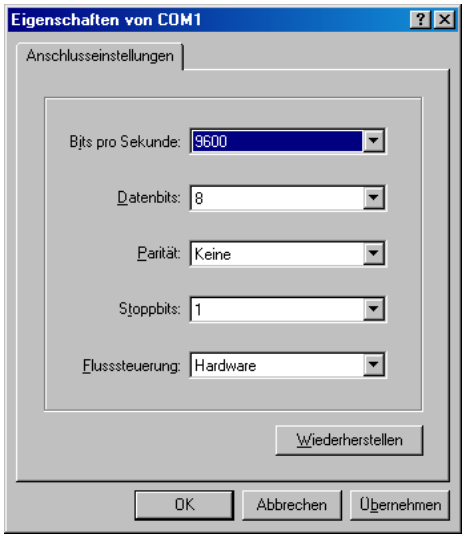
- **One time set up** of the HyperTerminal:
  START / PROGRAMS / ACCESSORIES / COMMUNICATION / HYPERTERMINAL





- Select a symbol, enter any name (for example OCM 01) and confirm with OK.

- Select COM-port interface.



- Set up the transfer conditions at the computer as follows:

Bits per second:	9600 Bits
Data bits:	8
Parity:	none
Stop bits:	1
Flow control:	hardware or none

3.8. Installation of the Data Manager Software at an external computer

The OCM 01 DATA MANAGER software was especially developed for the OCM 01 and is provided on the included CD-ROM.
The **one-time installation** of the Data Manager Software from the CD-ROM to the external computer is necessary. The Data Manager enables the data transfer to a MS Excel data sheet.

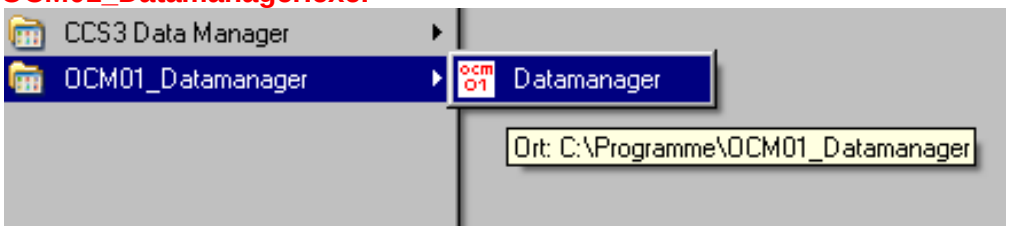
3.8.1. One-time program installation

- Execute OCM 01 – Data Manager program installation (**setup.exe)** from the provided CD-ROM. The setup.exe is located in the following folder on the CD-ROM: **setup\ Volume\ setup.exe**

- Execute the installation as instructed and wait until the installation has been completely finished.

- In the Windows - START-menu the folder “OCM01_Datamanager“ will be generated. In this folder the Data Manager program **“OCM 01 Datamanager.exe”** is saved.

- Start of the datamanager program from an external PC with:
OCM01_Datamanager.exe.



3.9. OCM 01- software update (filelink)

To install a new program version at the OCM 01 the DOS-program ***filelink*** is needed. You will find this program at the provided Data Manager – CD-ROM. Please install this program at the computer which is intended for the data transfer.

Data transfer:

- Switch on the OCM 01.
- Leave the main menu with [ESC].

- Start the ***filelink*** program with [**F1**].
- Access the first site with [**ENTER**].
- Select ***slave*** and confirm.
- **Allow the system to overwrite the old data.**
- Connect the OCM 01 and the computer through the RS232 – interface cable.
- Start the computer in the DOS- mode.
- Copy the new OCM 01 - program into the same path where the ***filelink.exe*** is saved.
- Start ***filelink.exe*** at the computer.
- Confirm the first site with [**ENTER**].
- Select the main menu and confirm.
- Check the current settings. The correct serial access is necessary (COM1 or COM2) and the baud rate must be adjusted at 115200. If necessary correct the settings. Go back to the previous monitor.
- Confirm the Master Mode.
- Select the new program for the OCM 01 on the left side (on PC) and mark the according files with [SPACE] or mouse click (left mouse key).
- Copy the files to the OCM 01 with [**ALT**] + [**C**].
- Wait until all files are copied.
- If all files are copied, leave the ***filelink*** program at the computer and switch of the OCM 01 with the main switch.
- You can restart the OCM 01 regular with the main switch (ON) now.

4. Evaluation of measurement results

4.1. Water sensor

4.1.1. Display in % water saturation

- If no kind of fluid was selected, only the water saturation in % is being displayed.

(0...70% Saturation)
The presence of free water is unlikely. A danger of dissolved water in oil does **not** exist!

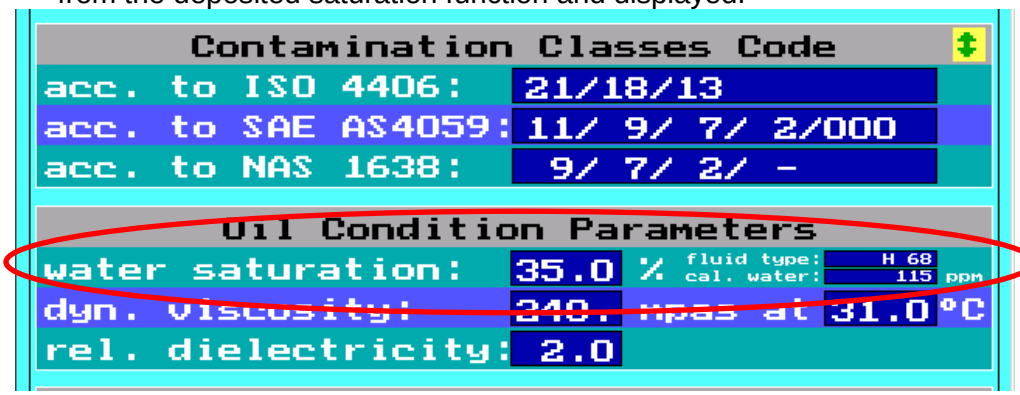
(70...90% Saturation)
The presence of free water is **likely** in a low volume. The initiation of actions to reduce the water content can be recommended!

(90...100% Saturation)
There is water in free form and is therefore a potential danger for the hydraulic and lubricating system.
The initiation of actions to reduce the water content in the fluid is urgently necessary!

A **conversion** in **mg/kg** (ppm) – water content is only **possible** with an **especially for this fluid generated saturation characteristic line.**
Saturation characteristic lines for special oils can be provided on request.

4.1.2. Display of the fluid type and ppm water content

- If a fluid type is selected, the ppm water content **for this fluid is automatically** calculated from the deposited saturation function and displayed.

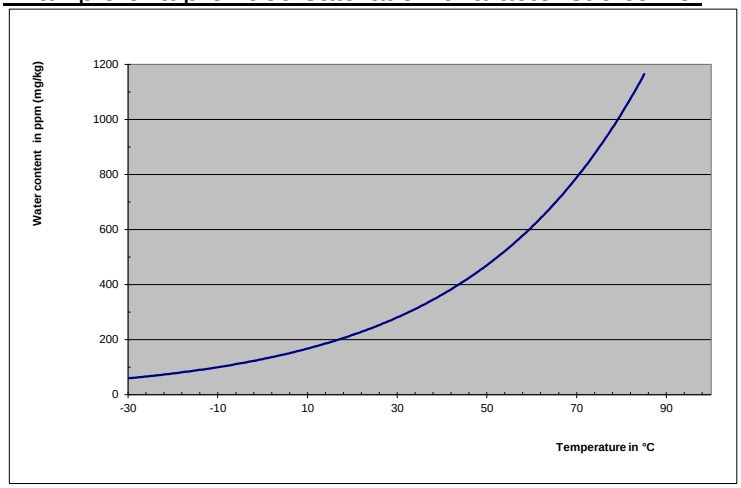


The relation to the detected saturation values and the data, after Karl Fischer method accounted ppm (mg/kg), is calculated evaluated by the detected and deposited 100% saturation curve (100% saturation = f(T)) and the simultaneously measured fluid temperature and is indicated at the display.

Attention: **It is essential to select the correct kind of oil, or the display of the water content will not be equivalent with the effective value for this fluid.**
(See fluid chart in chapter 3.5.3.1)

Saturation characteristic curves for special oils can be created and implemented by ***INTERNORMEN Technology GmbH***. (Add-on program)

Example of a provided saturation characteristic curve:



5. Calibration

- The laser sensor is calibrated according to ISO 11171 with ISO MTD – fluid and is delivered with a calibration certificate.
- The water sensor and the multifunction sensor are calibrated on delivery as well.

- **NOTICE** The validity of the calibration certificate is 12 month.

- **⚠ CAUTION** ***INTERNORMEN*** recommends a calibration interval of one year. For the secondary calibration the OCM 01 is to be resent to ***INTERNORMEN Technology GmbH*** in Altlußheim or another authorised ***INTERNORMEN*** - lab.

- The calibration and maintenance package for the OCM 01 contains the following benefits:
  - maintenance of the device,
  - control of consumption items,
  - a function test of the sensors,
  - calibration with a calibration certificate,
  - 24 hours functioning test.

6. Appendix

6.1. Technical data

6.1.1. OCM 01 – operating parameters

⚠ WARNING

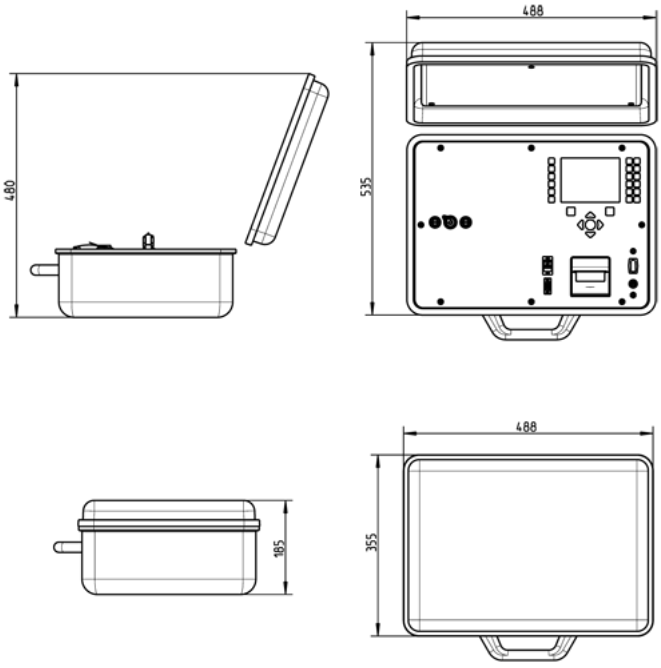
Voltage supply:	90...230 V, 50/ 60 Hz	
Pressure operating range:	-0,2...40 bar	*/ -2,9…580 PSI*
Viscosity range:	1...780 mm²/s	*/ 4,64…3615,3 SUS*
Max. permitted oil temperature:	0…70 °C	*/ 32…158 °F*
Ambient temperature:	0…50 °C	*/ 32…122 °F*
Protection class:	IP 67 (with closed cover)	

6.1.2. OCM 01 – Measurement parameters

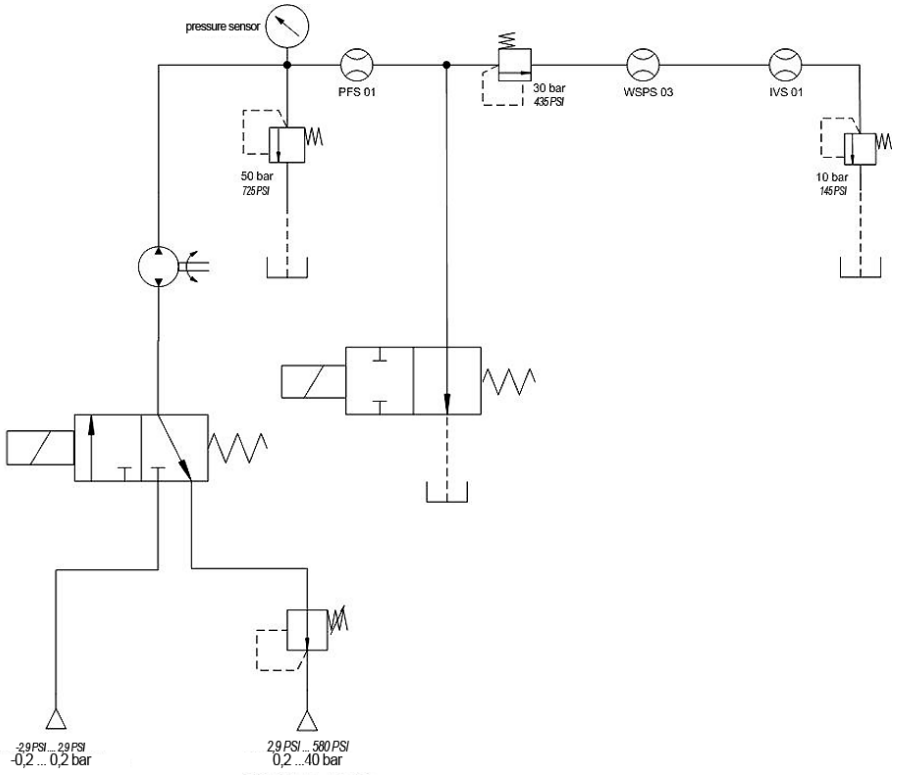
NOTICE

Particle counting according to ISO 4406:99, NAS 1638, SAE AS 4059
Automatical particle counting in 8 channels:
4,0 $\mu m_{(c)}$, 4,6 $\mu m_{(c)}$, 6,0 $\mu m_{(c)}$, 6,4 $\mu m_{(c)}$, 10 $\mu m_{(c)}$, 14 $\mu m_{(c)}$, 21 $\mu m_{(c)}$, 37 $\mu m_{(c)}$

Coincidence barrier:	10.000 particle / ml				
Calibration:	ISO MTD in oil (ISO 11171:2000)				
Measuring accuracy:	± 1 (contamination classes)				
Water saturation:	0...100 %				
Temperature:	0…70°C */ 32…158 °F*				
Dynamic viscosity:	0,8...700 mPas				
Relative dielectricity constant:	1...10				
imensions (mm):	l	x	b	x	h
	488	x	355	x	185
Weight:	13,3 kg				



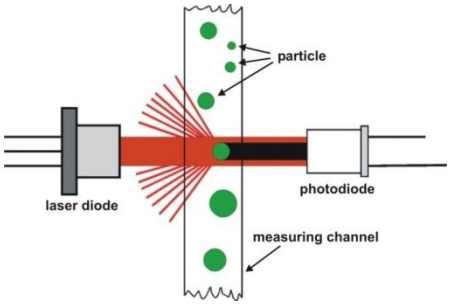
6.2. Hydraulic plan

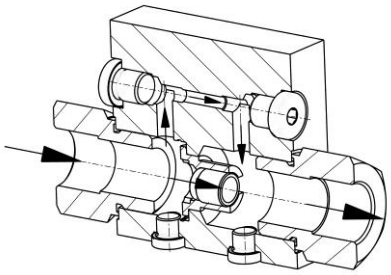


6.3. Measurement principle

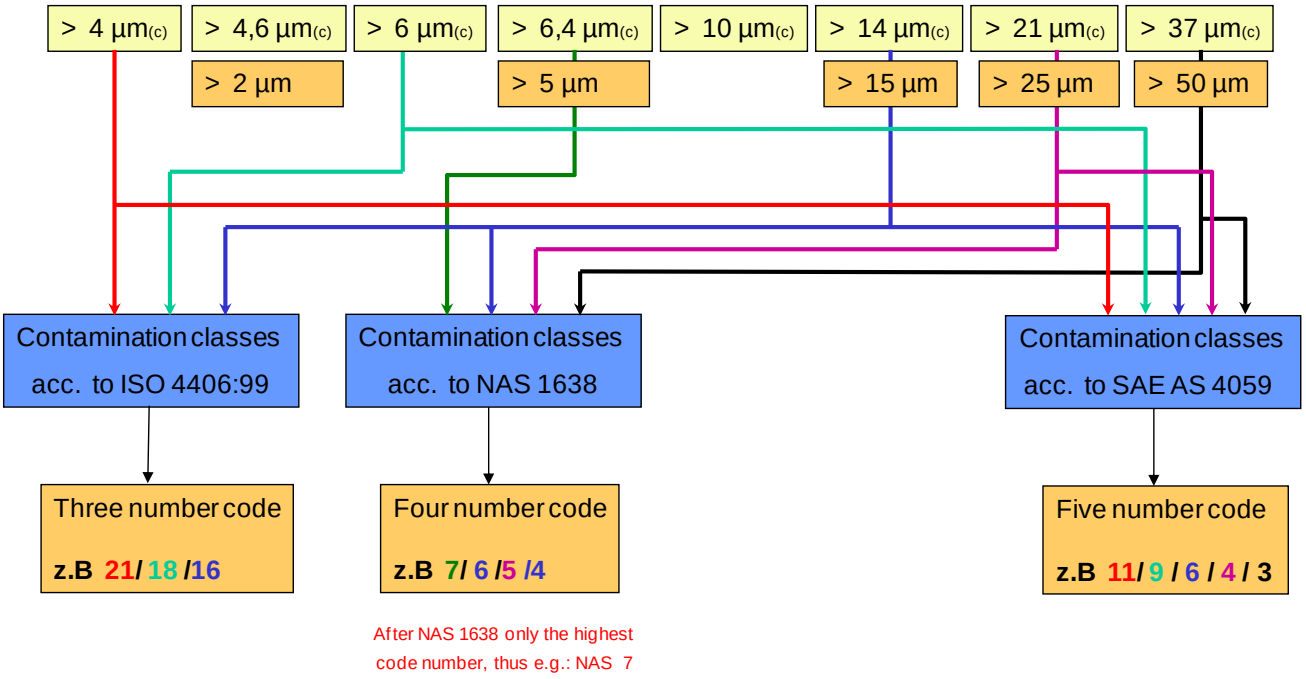
6.3.1. Laser sensor – PFS 01

The PFS 01 consists of two sensor elements: the laser sensor for particle counting and the thermal flow sensor for volume flow measurements.
The PFS 01 operates based on the by-pass flow principle. Using a counter balance valve, a partial flow is lead through the flow sensor and laser particle counting sensor.
The counted particles per volume unit and particle concentrations for these following particle sizes are determined: > 4 µm $_{(c)}$, > 6 µm$_{(c)}$, > 14 µm$_{(c)}$, > 21 µm$_{(c)}$ or > 6,4 µm$_{(c)}$, > 14 µm$_{(c)}$, > 21 µm$_{(c)}$, > 37 µm$_{(c)}$. Results can be displayed according to ISO 4406:99, SAE AS 4059 respectively NAS 1638. The sensor integrated in the PFS operates based on the light gate principle and is calibrated with ISO MTD according to ISO 11171:2000.





6.3.1.1. 8 – channel particle counting

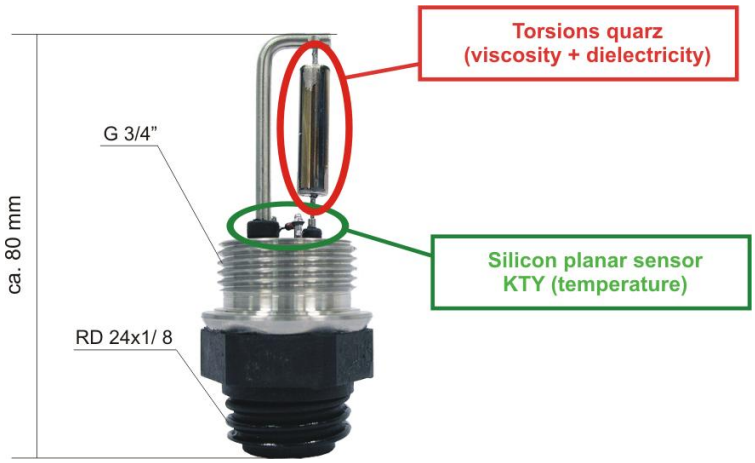


6.3.2. Multifunction sensor – IVS 01

The integrated multifunction sensor IVS 01 is used for measurement of:

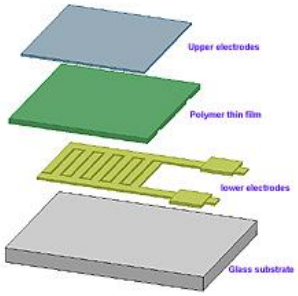
- dynamic viscosity
- relative dielectricity constant
- temperature in °C or °F.

The application is based on a **piezoelectric crystal** in the form of a **torsional oscillator** for viscosity measurements. A motion of the sensor is caused by an alternating electrical field applied on the oscillator, so that the surrounding oil **is sheared**. On the other hand the movement is prevented by the external force (**shear stress**) of the fluid. This causes the electrical response of the sensor. The **dynamic viscosity** is determined from the **shift of the resonance frequency** and **amplitude changes of the signal** to the resonant frequency in air.



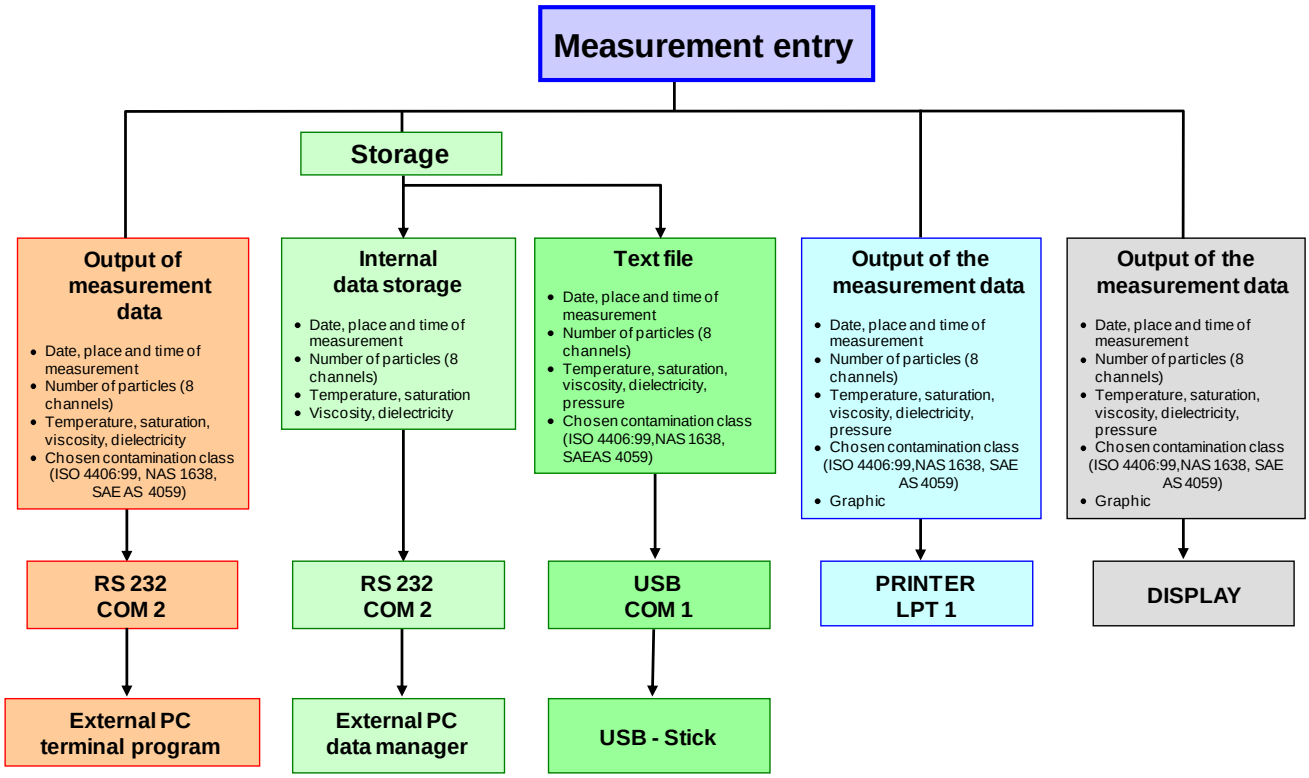
6.3.3. Water sensor – WSPS 03

The **WSPS 03** is a **capacitive sensor**. As a dielectric between two electrodes a polymer film is used, which is able to absorb water molecules and so to change the capacity of the sensor element. This capacity is changed in a sensor output signal of **4… 20 mA**. As a measurement output the **saturation condition** (water saturation) of the fluid is displayed in **percent.**



In addition, a temperature sensor is installed for precise temperature measurement of the fluid during the measurement.
On the opposite to the absolute water content determination by the **Karl Fischer method**, in which the total mass fraction of free water and bound **water in mg / kg of oil** is stated, the **WSPS 03** evaluates the saturation condition of the fluid with water in percent. The specification **100%** stands for a complete saturation of the fluid. The saturation values are temperature dependent!
A relation to the detected saturation values and the data, after the Karl Fischer method accounted ppm (mg/kg), is calculated by the detected and deposited 100% saturation curve (100% saturation = f(T)) and the simultaneously measured fluid temperature, and is indicated at the display.

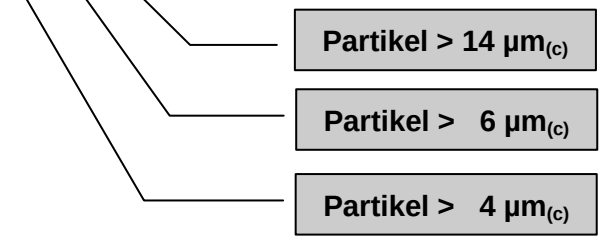
6.4. Overview of the data storage and measurement results



6.5. Cleanliness classes according to ISO 4406:99

According to ISO 4406 (year 1999) the number of particles sized > 4 $\mu m_{(c)}$, > 6 $\mu m_{(c)}$ and > 14 $\mu m_{(c)}$ is being used to determine the cleanliness class. The determination of the cleanliness class doesn't depend on the particle size.

Example of presenting: **20 / 16 / 12**



Analysis volume: 1 ml

Cleanliness class	Number of particles	Up to and including
26	320000	640000
25	160000	320000
24	80000	160000
23	40000	80000
22	20000	40000
21	10000	20000
20	5000	10000
19	2500	5000
18	1300	2500
17	640	1300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2,5	5
8	1,3	2,5
7	0,6	1,3
6	0,3	0,6

6.6. Cleanliness classes according to NAS 1638

Analysis volume: 100 ml

Particle number x 10^3

Class	5 - 15 µm	15 - 25 µm	25 - 50 µm	50 - 100 µm	> 100 µm
00	0,125	0,022	0,004	0,001	0
0	0,250	0,044	0,008	0,002	0
1	0,5	0,089	0,016	0,003	0,001
2	1	0,178	0,032	0,006	0,001
3	2	0,356	0,063	0,011	0,002
4	4	0,712	0,126	0,022	0,004
5	8	1,425	0,253	0,045	0,008
6	16	2,85	0,506	0,090	0,016
7	32	5,7	1,012	0,18	0,032
8	64	11,40	2,025	0,36	0,064
9	128	22,8	4,05	0,72	0,128
10	256	45,6	8,1	1,44	0,256
11	512	91,2	16,2	2,88	0,512
12	1024	182,4	32,4	5,76	1,024

6.7. Cleanliness classes according to SAE AS 4059

Analysis volume: 100 ml

	Particle per 100 ml					
Size, ISO 11171 Calibration or Electron Microscope	**> 4 µm (c)**	**> 6 µm (c)**	**> 14 µm (c)**	**> 21 µm (c)**	**> 38 µm (c)**	**> 70 µm (c)**
Size Code	**A**	**B**	**C**	**D**	**E**	**F**
000	195	76	14	3	1	0
00	390	152	27	5	1	0
0	780	304	54	10	2	0
1	1560	609	109	20	4	1
2	3120	1220	217	39	7	1
3	6250	2430	432	76	13	2
4	12500	4860	864	152	26	4
5	25000	9730	1730	306	53	8
6	50000	19500	3460	612	106	16
7	100000	38900	6920	1220	212	32
8	200000	77900	13900	2450	424	64
9	400000	156000	27700	4900	848	128
10	800000	311000	55400	9800	1700	256
11	1600000	623000	111000	19600	3390	512
12	3200000	1250000	222000	39200	6780	1020

6.8. Fields of application – compatibility

Applicable for: NOTICE

- hydraulic oils H, HL, HLP, and HV
- gear oils C, CL, CLP
- motor oils, gas oils
- MIL-H-5606 E
- vegetable based oils (HTG, triglycerides)
- synthetic esters (HEES)

6.9. Trouble shooting

No settings of the OCM 01 are done by the operator.
Malfunctions, which could be eliminated by the operator, are limited to checking cables for brakes.

NOTICE Any other case requires sending the OCM 01 to INTERNORMEN Technology GmbH in order to recover the functions.
A brief description of the problem would expedite the trouble shooting and the repair process. To check your warranty and to answer questions by phone we need the serial number and the date of purchase of the instrument.

6.10. Shipment

		article no.:
(1)	OCM 01 complete	335990
(2)	Power supply unit, inclusive power cable	335909
(3)	RS232 – interface cable	314462
(4)	RS232 – adaptor plug to USB	336300
(5)	High pressure hose	313742
(6)	PVC – hose DR. 8x1	316875
(7)	Quick connector Rectus 21K KO08 MPX	335908
(8)	4 rolls print-out paper	335920
(9)	Data manager CD	327284
(10)	Instruction manual	336298
(11)	Calibration certificate	after annual maintenance/ calibration at INTERNORMEN Technology GmbH

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