

HYDAC

INTERNATIONAL

FCU 1310 CAT

FluidControl Unit

Operating and Maintenance Instructions

English (translation of original instructions)

Valid from firmware versions V 2.00 up

Document No.: 3583929b



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All details are subject to technical modifications.

Technical specifications are subject to change without notice.

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Preface

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

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

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

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

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

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We look forward to receiving your input.

“Putting experience into practice”

Technical Support

Contact our technical sales department if you have any questions on our product. When contacting us, please always include the model/type designation, serial no. and part-no. of the product:

Fax: ++49 (0) 6897 / 509 - 846

E-mail: filtersystems@hydac.com

Modifications to the Product

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 may mean that the information in the operating instructions is no longer applicable or adequate.

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

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

Warranty

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

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

Using the Documentation



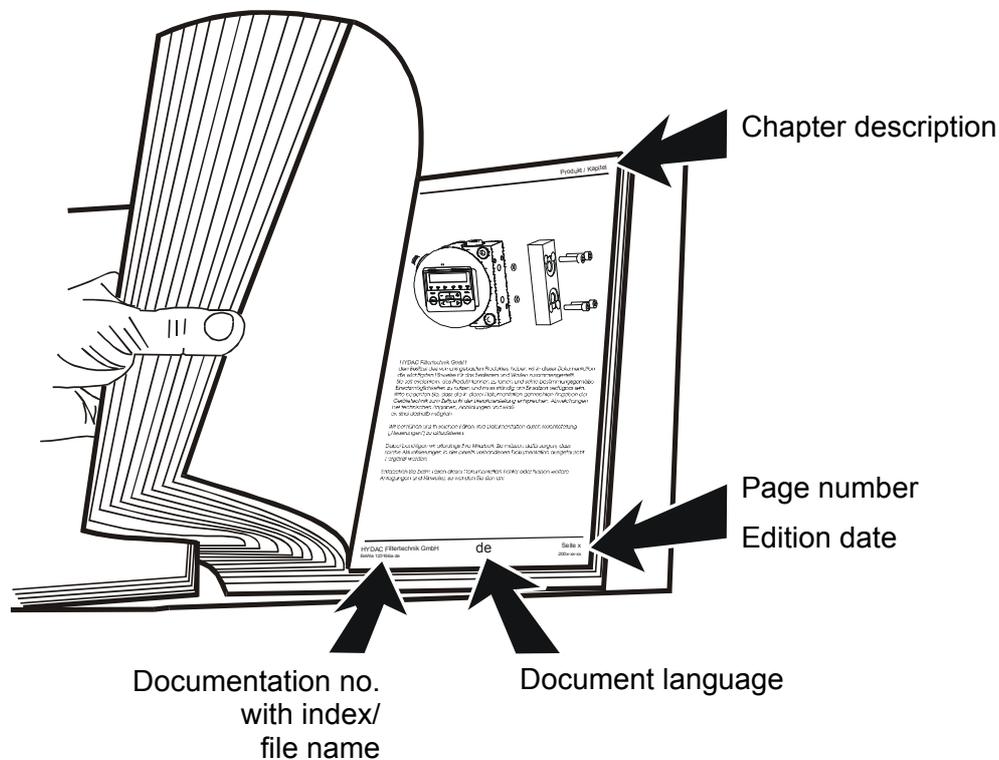
Note that the method described for locating specific information does not release you from your responsibility of carefully reading these instructions prior to starting the unit up for the first time and at regular intervals in the future.

What do I want to know?

I determine which topic I am looking for.

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

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



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

General Safety Precautions

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

Obligations and Liability

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

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

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

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

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

The FCU is only to be used as follows:

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

Immediately remedy any malfunctions that might impair safety.

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

Explanation of Symbols and Warnings, etc.

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



DANGER denotes situations which can lead to death if safety precautions are not observed.



WARNING denotes situations which can lead to death if safety precautions are not observed.



CAUTION denotes situations which can lead to severe injuries if safety precautions are not observed.



NOTICE denotes situations which can lead to property damage if instructions are not followed.

Proper/Designated Use

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

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

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

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

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

Improper Use or Use Deviating from Intended Use

Improper use may result in hazards like the following:

- Use of the FCU 1310 for permanent monitoring (i.e. continuous operation)
- Improper connection of the FCU pressure or return hoses.
- It is not permitted to operate the FCU1310 on a measurement point where the pressure exceeds 345 bar.
- Operation of the FCU on board networks without central "Load Dump" fuse.

Informal Safety Precautions

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

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

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

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

The product is to be checked once a day for visible external damage and for the proper functioning of the safety devices.

	 WARNING
	<p>Hydraulic systems are under pressure</p> <p>Danger of bodily injury</p> <p>► Depressurize the system before performing any work on it.</p>

What to Do in Case of Emergency

In the event of an emergency, disconnect the FCU from the power supply and from the hydraulic system.

Training and Instruction of Personnel

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

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

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

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

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

Activity	Individuals	Individuals undergoing training	Individuals with technical training/engineering background	Electricians	Supervisor with the appropriate authority
Packing Transportation		X	X		X
Commissioning			X	X	X
Operation		X	X	X	X
Troubleshooting/ locating the source of malfunction			X	X	X
Remedying of mechanical faults			X		X
Remedying of electrical faults				X	X
Maintenance		X	X	X	X
Repair work					X
Decommissioning/storage		X	X	X	X

Maintenance, Servicing and Troubleshooting

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

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

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

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

Modifications to the FCU

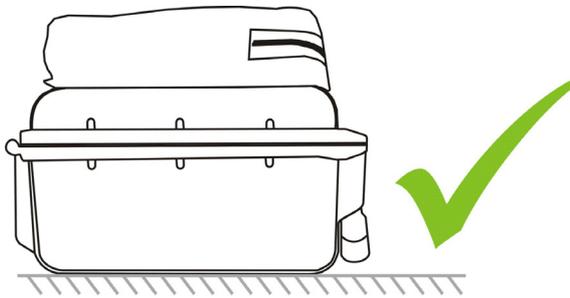
Do not make any modifications (design modifications, extensions) to the FCU without the prior consent of the manufacturer.

Any modifications require written permission from HYDAC FILTER SYSTEMS GMBH.

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

Transporting the FCU

Transport the FCU only when it is closed position; carry it flat or by the handle.



Storing the FCU

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

Before putting the FCU into storage, it must be completely drained and flushed. See page 64. for details on flushing the FCU.

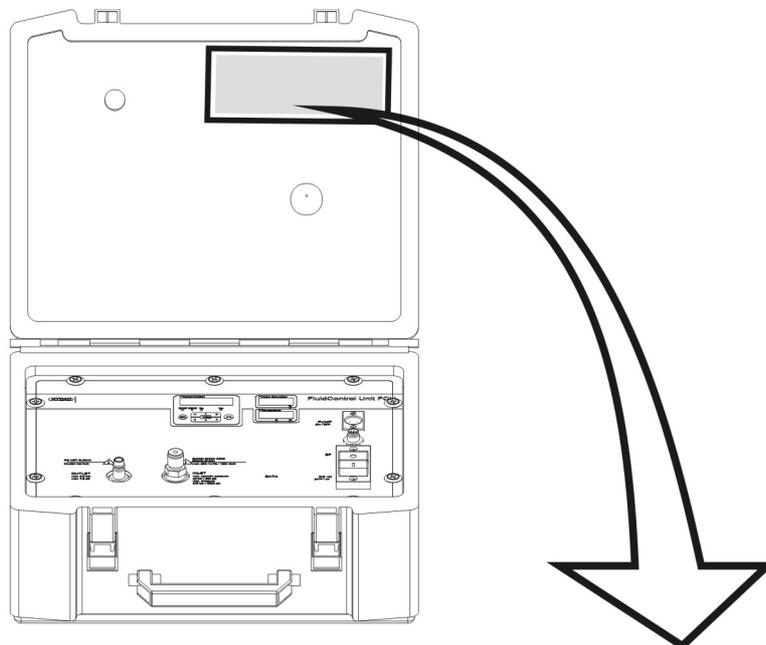
Observe the conditions required for storage.

Storage temperature: -40 ... +80°C / -40 ... +176°F

Relative humidity: max. 90%, non-condensing

Decoding the model code label

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



HYDAC Made in Germany		HYDAC FILTER SYSTEMS GMBH D-66280 Sulzbach/Saar www.hydac.com		CE	
FluidControlUnit P/N: 3572875		Model: FCU1310-4-U-AS-1/-CAT S/N: 0002S01831K0000001		Date: 10/43	
Flow rate:	30...300 ml/min	Pressures:	Temperatures:	Power: 100 W	
Weight :	13 kg	In: 0...45 bar	Oil: 0 ... 70 °C	Voltage: 24 VDC	
Viscosity range:	10...350 mm ² /s	0...650 psi	32 ... 158 °F	Current: 4 A	
	45...1622 Sus	Out: 0...0.5 bar	Ambient: 0 ... 45 °C		
For hydraulic oils up to ISO VG 68		0...7.5 psi	32 ... 113 °F		

See page 88. for more details on the model code.

Checking the Scope of Delivery

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

The following items are supplied:

Item	Qty	Description
1	1	FluidControl Unit 1310, including attachable bag
2	1	Power supply, primary: 90-240 V AC / secondary: 24 V DC, 5 A
3	4	Connection cable (Europe, USA/Canada, UK, Australia, Japan)
4	1	INLET suction hose, open end, clear-transparent, L = 0.3 m (11.81 inch)
5	1	INLET high pressure hose with test connector type 1620, color: clear-transparent, length = 2 m
6	1	OUTLET return hose, transparent, L = 1 m
7	1	Operating and Maintenance Instructions
8	1	Certificate of calibration
9	1	CD-ROM with FluMoS Software
10	1	Pocket for documents
11	1	USB stick with operating and maintenance instructions (PDF file) in additional languages
12	1	Power cord 24V DC
13	1	Battery adaptor
-	1	Spare fuse 8A (for power card 24 V DC)
-	1	"Getting started" guide



What the FCU 1310 can do

The FCU 1310 is a portable service unit for hydraulic systems for intermittent measurement of the particulate contamination, the moisture content in % saturation and the temperature of the fluid.

The integral pump and hoses supplied can be used on:

- Control circuits
- Pressure circuits
- non-pressurized tanks

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

The internal data memory enables measurements to be recorded together with a time-stamp.

The USB interface can be used to copy all measurements to a USB memory stick, for subsequent evaluation on a PC the fluid monitoring software FluMoS Light.

Additional features include:

- Optical measurement of the degree of solid particle contamination
- Capacitive measurement of the relative humidity in % saturation.
- Resistive measurement of the temperature
- Applicable for hydraulic fluids (up to ISO VG 68) 10 ... 350 mm²/s / 16 ... 1622 Sus
- Automatic measurement and display of cleanliness ratings in accordance with:
 - ISO 4406:1987; NAS 1638
 - ISO 4406:1999; SAE AS 4059 (D)
- Measurement accuracy +/- ½ ISO code in the calibrated range
- Supply voltage of 24 V DC / 4 A for operation on mobile machine on-board power supplies
- Network adapter 90 - 240 V AC / 24 V DC 5 A included in the scope of delivery
- Operating pressure without high-pressure adapter max. 45 bar / max. 650 psi, Operating pressure with high-pressure adapter (accessories) max. 345 bar / max. 5000 psi
- Integrated pump for the automatic control of oil flow

Restrictions on the use of the FCU 1310**NOTICE****Impermissible operating conditions**

The FCU will be destroyed

- ▶ Use the FCU with mineral oils or mineral oil-based raffinates whose flash point is higher than 55°C/131°F.
- ▶ Observe the permissible viscosity range (up to ISO VG 68):
10 ... 350 mm²/s or 46 ... 1622 SUS
- ▶ Only operate the FCU 1310 for brief periods of time (S4 to DIN EN 60034 / VDE 0530).
- ▶ When the pump has been operating for 30 minutes, shut off the FCU 1310 for at least 10 minutes to cool down.

NOTICE**Connection of the FCU to board networks**

The FCU will be destroyed

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

Counting particles in the FCU 1310

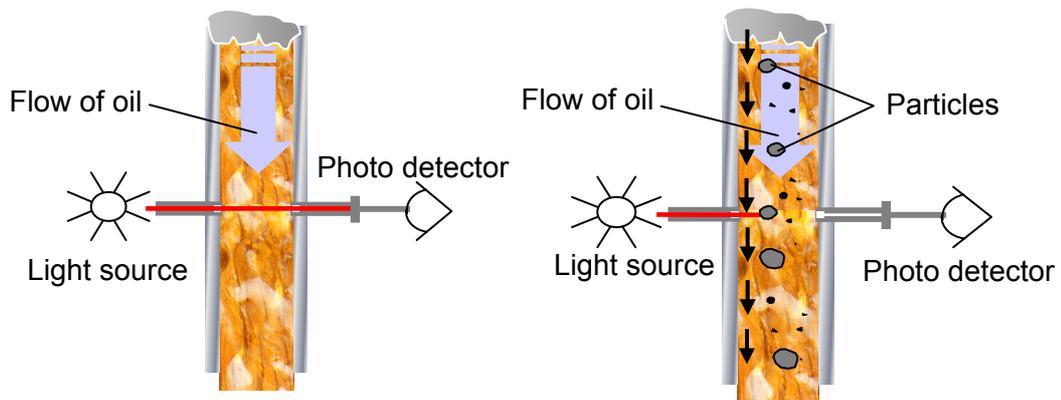
The measuring principle of the light blockade procedure is shown in simplified form in the following sketch.

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

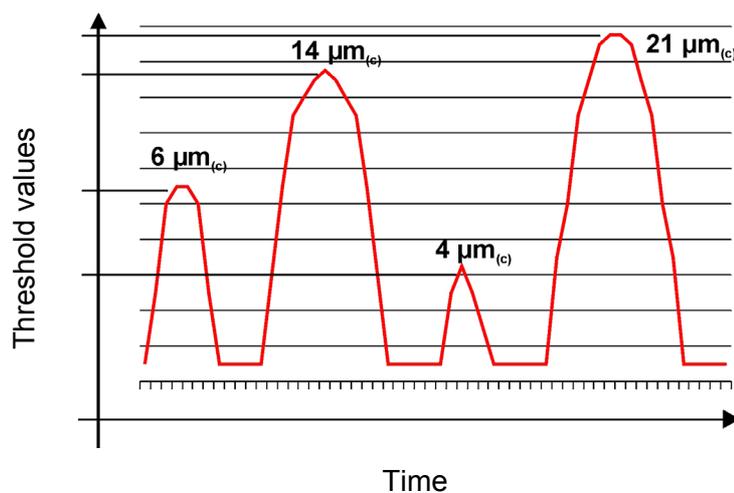
This shadow causes a change in the electrical signal generated by the photo detector. This change makes it possible to determine the size of the shadow cast by the particle and thus to gauge the size of the particle itself.

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

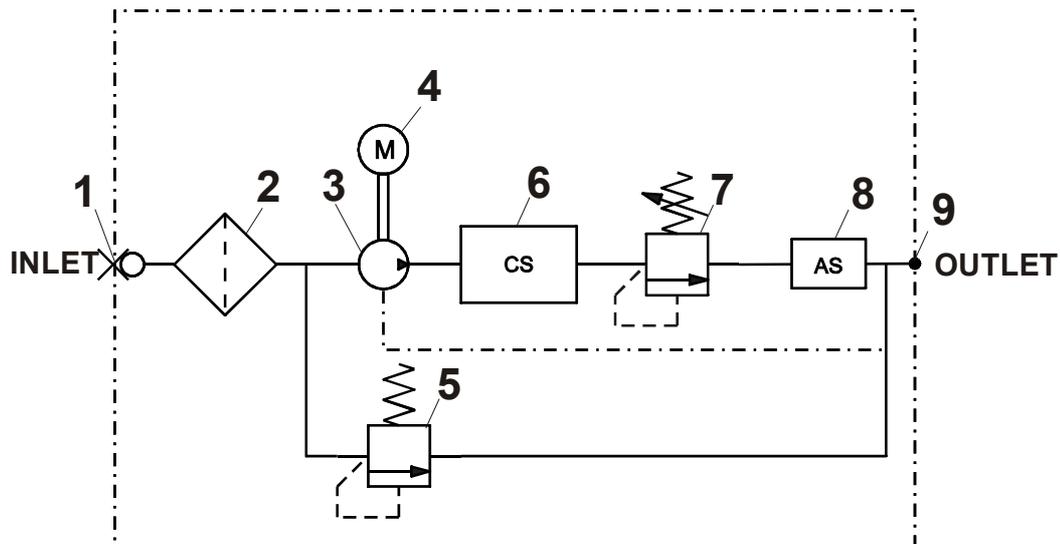
The disruption factors of this measurement principle are foreign fluids and small gas bubbles that lead to refractions, thus causing them to be counted as particles as well.



Each of the signal peaks corresponds to the shadow cast by one particle. The signal height or amplitude reflects the particle size. Thresholds are used to classify the particle sizes >2 , >5 , >15 , $>25 \mu\text{m}$ or >4 , >6 , >14 , $>21 \mu\text{m}_{(c)}$.



How the FCU 1310 functions



From the oil source (either a pressure port or a bottle sample), a continuous oil current is established through the INLET (1) connector by an electrically controlled gear pump (3).

A suction screen (2) protects the pump from coarse contamination.

The oil current to be analyzed flows through an optical sensor (6). The contaminant particles contained in the oil current cause the light beam to be darkened in a pulse-like manner. An electronic evaluation module classifies and counts these measurement signals according to particle diameter. The evaluation module continuously computes the SAE or ISO cleanliness classes. It computes for the reference volume of 100 ml based on the measurement signals of the optical sensor.

A defined pressure is generated in the oil flow via a counter balance valve (7). This serves to minimize air bubbles in the system, which could skew the measurement results.

The pressure relief valve (5) protects the pump and the measuring cell from excessive pressure.

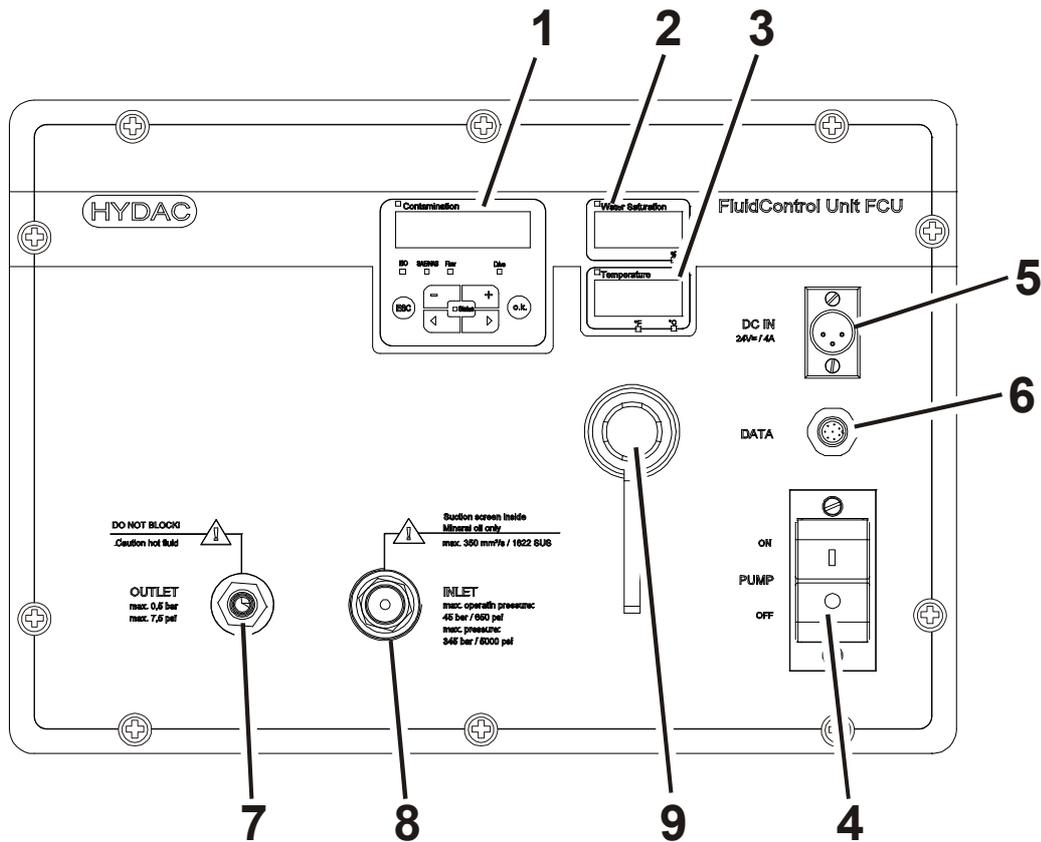
The oil current leaves the OUTLET (9) connector and must be routed by the return-flow hose to a non-pressurized tank.

The electronic evaluation module monitors:

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

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

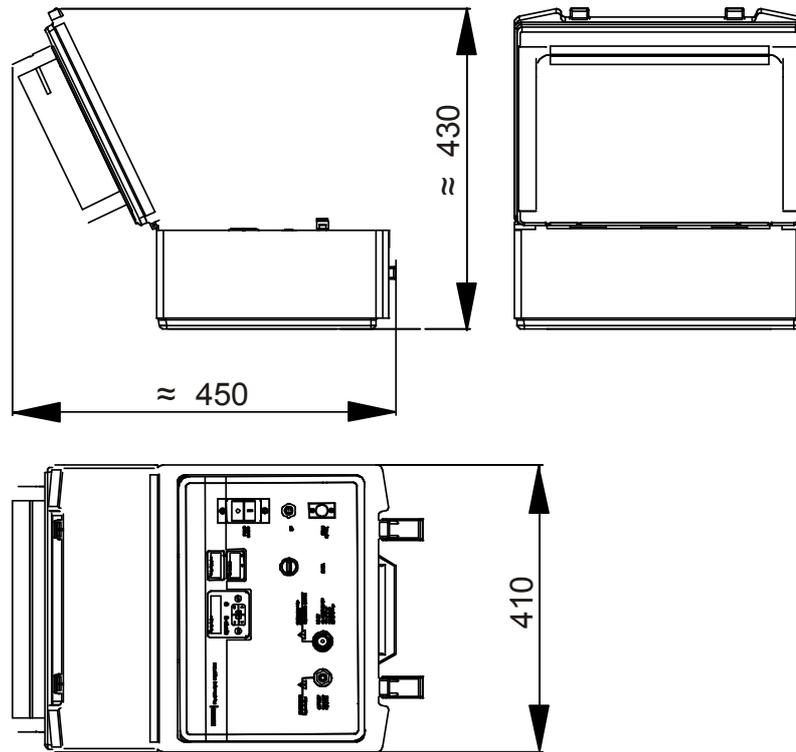
User interface of the FCU 1310



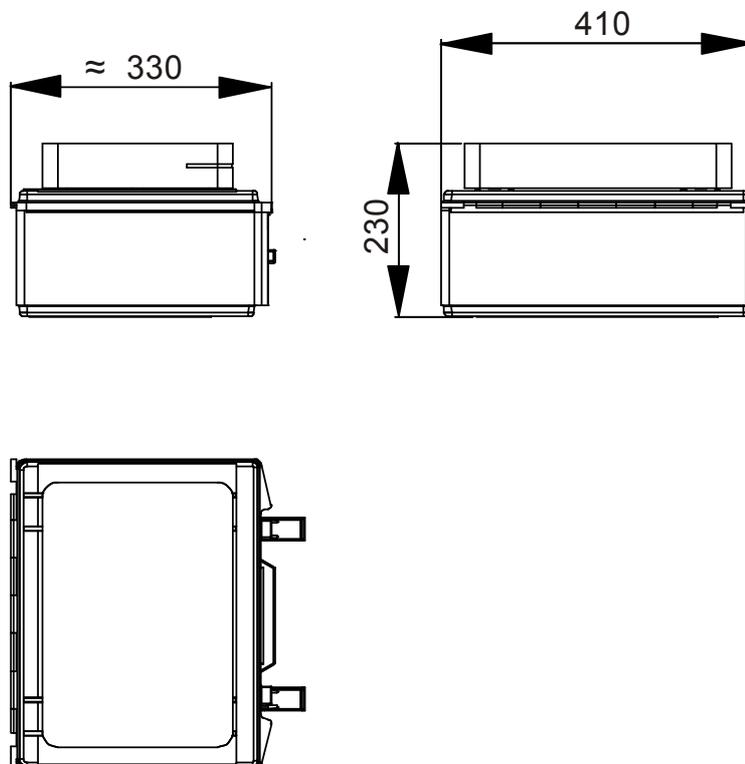
Item	Designation
1	Display of "ISO, SAE/NAS, Flow, Drive" with keypad
2	Display of the percentage "water saturation"
3	"Fluid temperature" display
4	ON / OFF switch for the internal pump
5	Supply voltage 24 V DC
6	Data interface (DATA)
7	OUTLET port
8	INLET connection, Type 1604
9	USB interface with cover

Dimensions of the FCU 1310

FCU open:

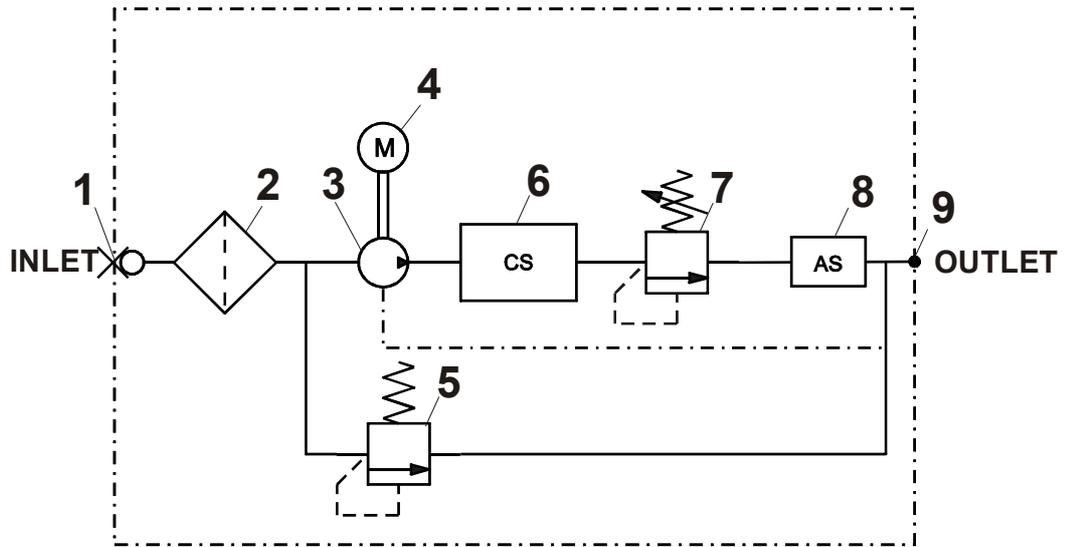


FCU closed:



All dimensions in mm.

Hydraulic diagram



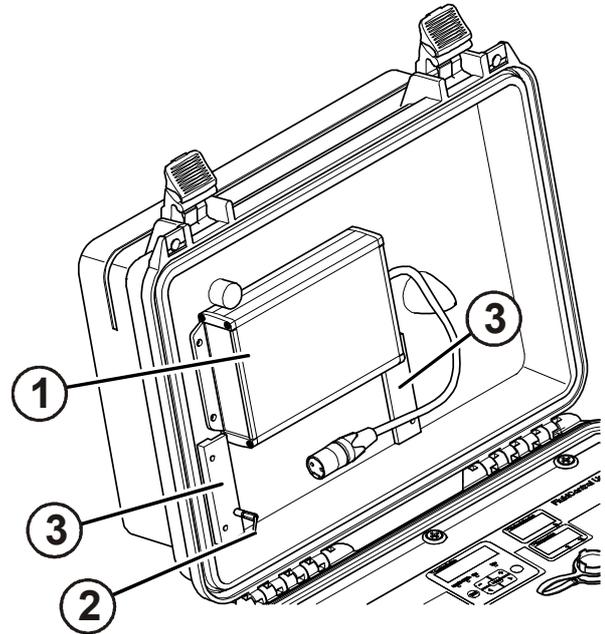
Item	Designation
1	INLET, test connector type 1604
2	Suction screen, 400 µm
3	Gear pump
4	Electric motor
5	pressure relief valve
6	ContaminationSensor Unit
7	Counter balance valve
8	AquaSensor AS 1000
9	OUTLET, DN7 Quick coupling nipple

Using the BatteryPack (accessory)

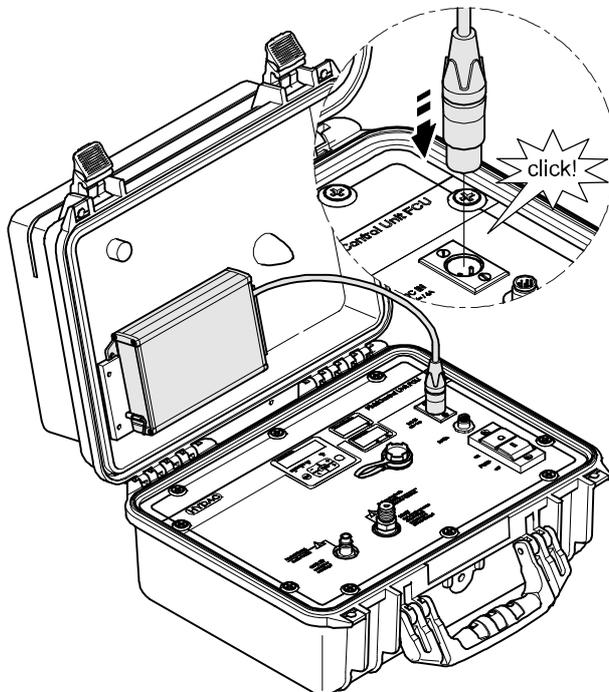
With the BatteryPack, which is available as an accessory, you can make the FCU independent of the electrical supply network.

For technical details on the BatteryPack, see its instruction brochure.

With the locking pin (2), the BatteryPack (1) is held securely in the mounting rails (3) during transport.

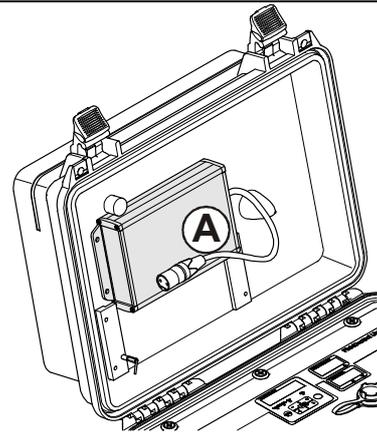


For operation with the BatteryPack, fit the connector into the FCU socket labeled "DC IN".

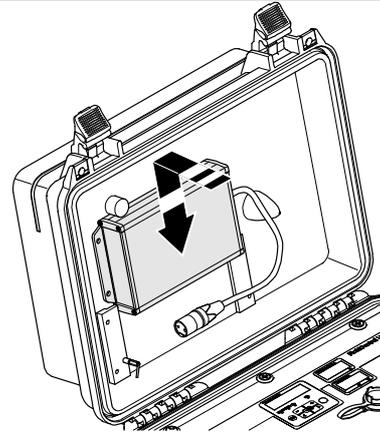


To fit the BatteryPack into its holder, proceed as follows:

1. Remove the connector (A) from the socket on the BatteryPack.



2. Slide the BatteryPack into the mounting rails from above.

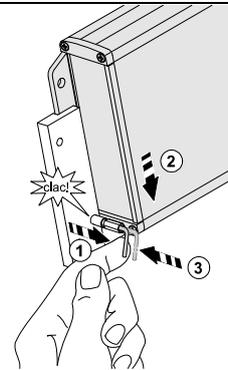


3. Pull the locking pin (1)

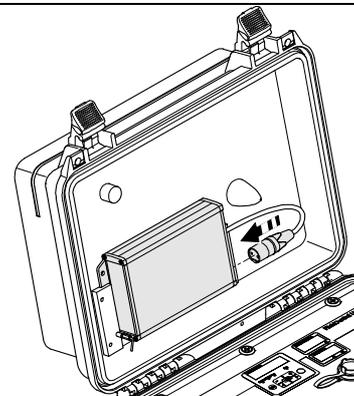
Slide the BatteryPack down until it touches the lower stop in the guide rails (2)

Release the locking pin (3). A spring will return the locking pin to its original position, thus securing the BatteryPack.

Check that the BatteryPack is firmly seated.

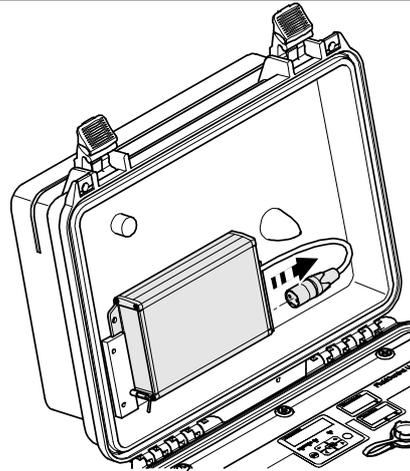


4. Insert the connector into the socket on the BatteryPack.



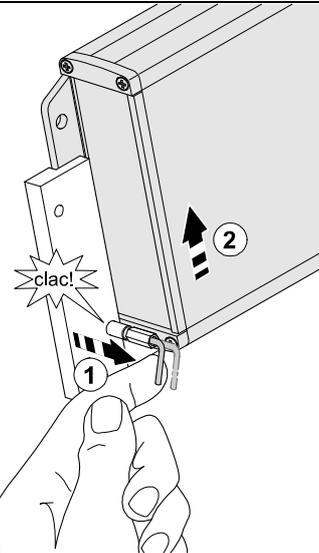
To remove it, proceed as follows:

1. Remove the connector from the socket.



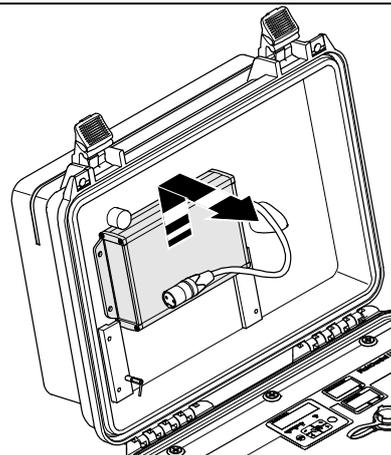
2. Pull the locking pin out to release the BatteryPack (1).

Slide the BatteryPack upwards (2).



3. Pull the BatteryPack up and out of the mounting rails.

Then insert the connector back into the socket on the BatteryPack.



Preparing the FCU for measurement

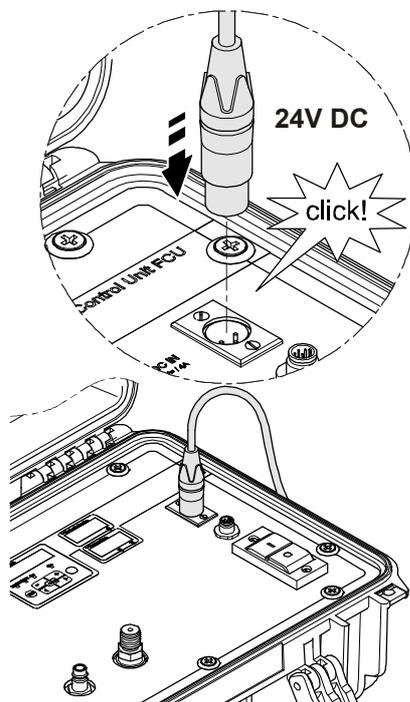
Before operation, the FCU must first be hydraulically and electrically connected, as described below.

Connecting/disconnecting the FCU electrically

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

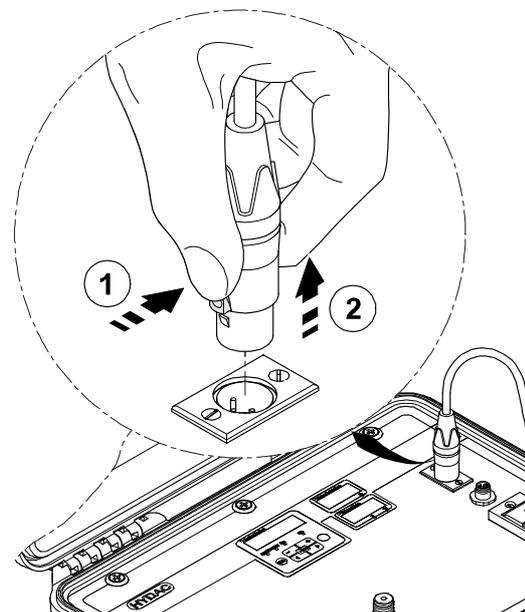
1. After the unit is plugged in, HYDAC FCU 1### appears in moving letters, followed by the firmware version, which appears for 2 seconds.
2. The internal sensors will then be checked.
The display will show $\bar{2}$ *SENS OK* as well as the sensor firmware.
3. The self-test with countdown follows: *WAIT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

To insert the connector



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

To remove the connector



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

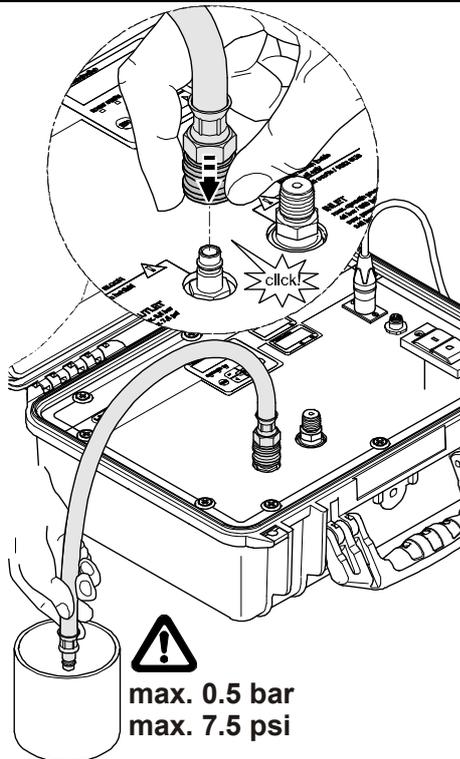
Connecting/disconnecting the OUTLET hose

NOTICE

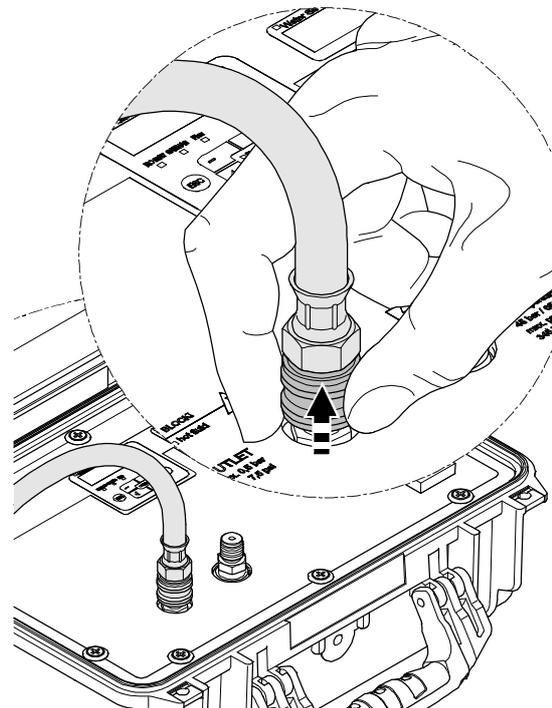
If the OUTLET connection is closed or blocked

The FCU will be damaged.

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



Plug in return hose



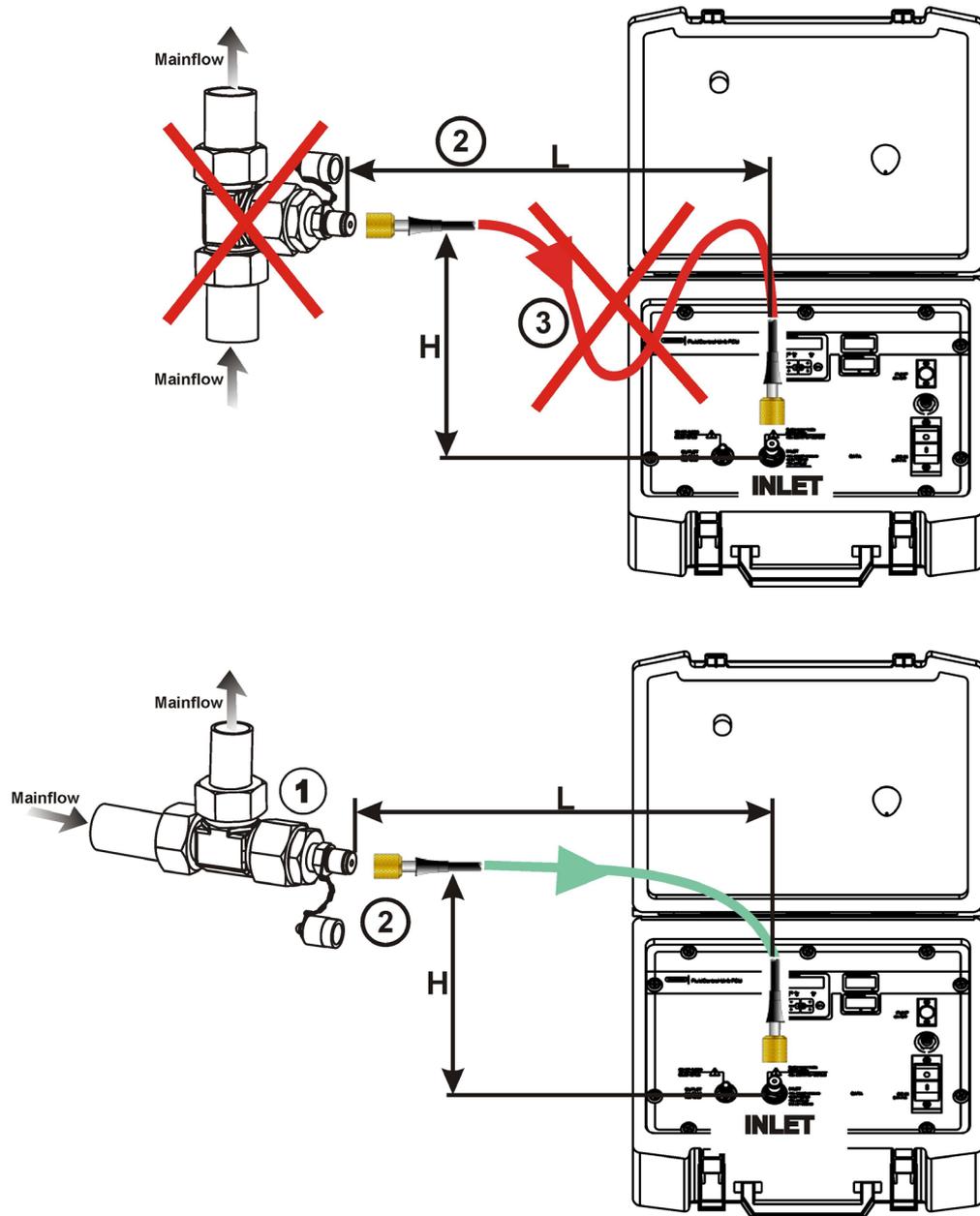
Take off return hose

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

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

Selecting the measurement point

- ① Select the measurement location so that the sample measured comes from a turbulent location, with a good flow. For example on a pipe bend. This ensures that a typical sample is analyzed.
- ② After installing the FCU in the vicinity of the measurement location, avoid:
 - delayed measurement results
 - sedimentation (deposition of particles in the line).
- ③ While installing the INLET hose, make sure that no siphon results.



Select the measurement method according to the pressure involved

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

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

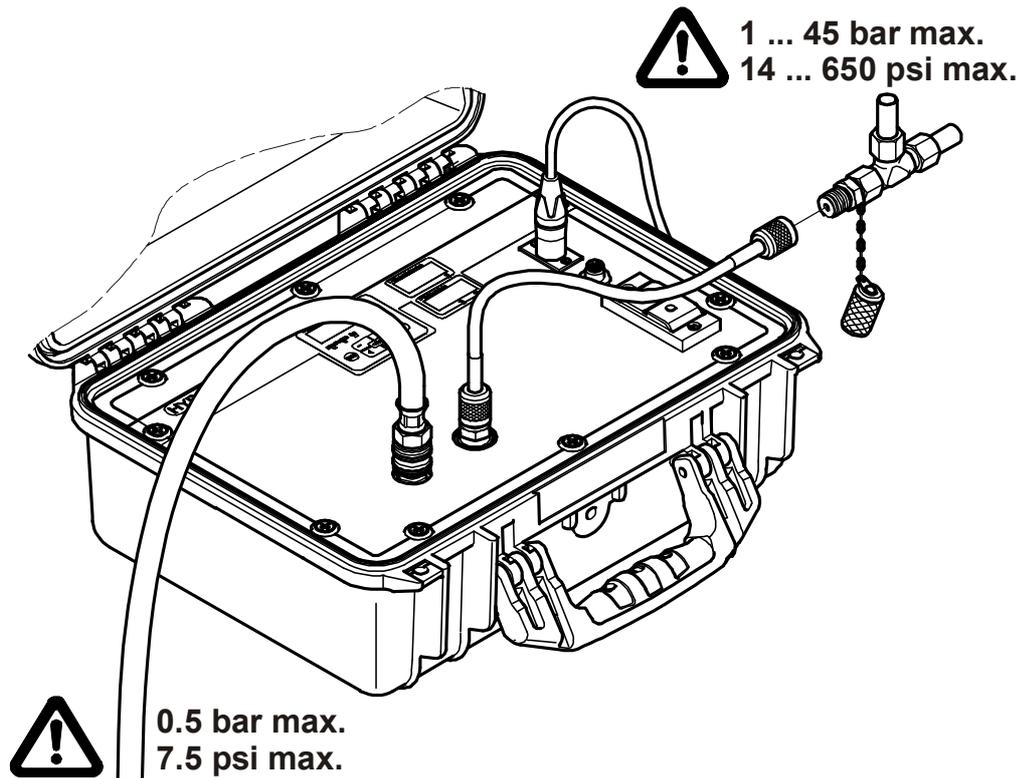
Pressure at the measurement site.	Measurement method	Details are on page
0 bar 0 psi	Measuring from unpressurized containers	37
1 ... 45 bar 14 ... 650 psi	Measuring up to max. 45 bar	31
15 ... 345 bar 217 ... 5000 psi	Measuring with high pressure adaptor in the range 15 to 345 bar	34

Measuring up to max. 45 bar / 650 psi

	! WARNING
	<p>Hydraulic systems are under pressure</p> <p>Danger of bodily injury</p> <ul style="list-style-type: none">▶ The system must be depressurized before starting work on it.▶ If the pressurized connection is connected to the hydraulic system, oil will flow through the FCU.▶ Make sure that the specified sequence is followed.
NOTICE	
<p>If the operating pressure exceeds 45 bar / 650 psi</p> <p>The excess pressure will be discharged via the OUTLET connection.</p> <ul style="list-style-type: none">▶ Never seal the OUTLET connection.▶ Put the free end of the OUTLET return hose into an unpressurized container.▶ When operating the FCU, always observe the permissible operating pressure.▶ The FCU 1310 can withstand pressures up to 345 bar / 5000 psi.	

Required hoses

- OUTLET return hose
- High-pressure hose

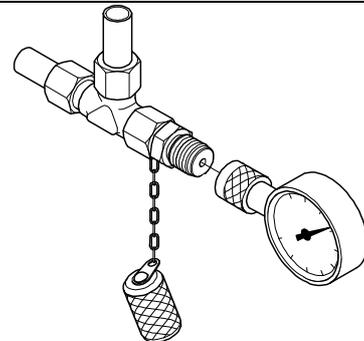


Make sure that the following sequence is observed:

1. Go through the steps in chapter "Preparing the FCU for measurement" on pages 27 to 30.
2. Check the pressure at the measurement point. The pressure there must be in the range from 1...45 bar / 14 ... 650 psi.

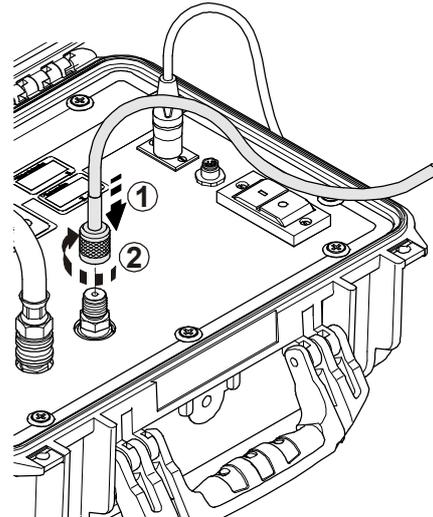


If the pressure exceeds 45 bar / 650 psi, use the high-pressure adapter (see page 34).

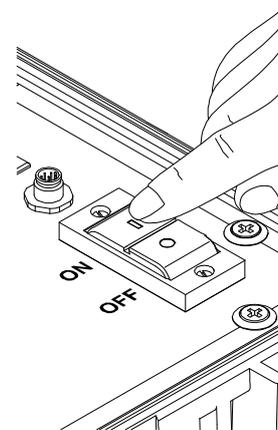


3. Connect the INLET pressure hose (black) to the INLET port (1) of the FCU.

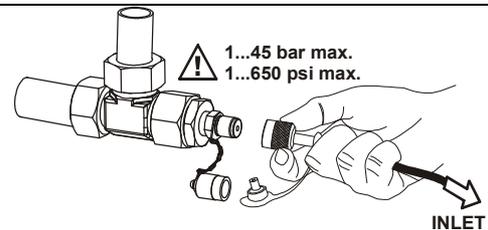
Screw the measurement coupling clockwise (2) onto the connection and screw it finger tight.



4. Switch on the internal pump.



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



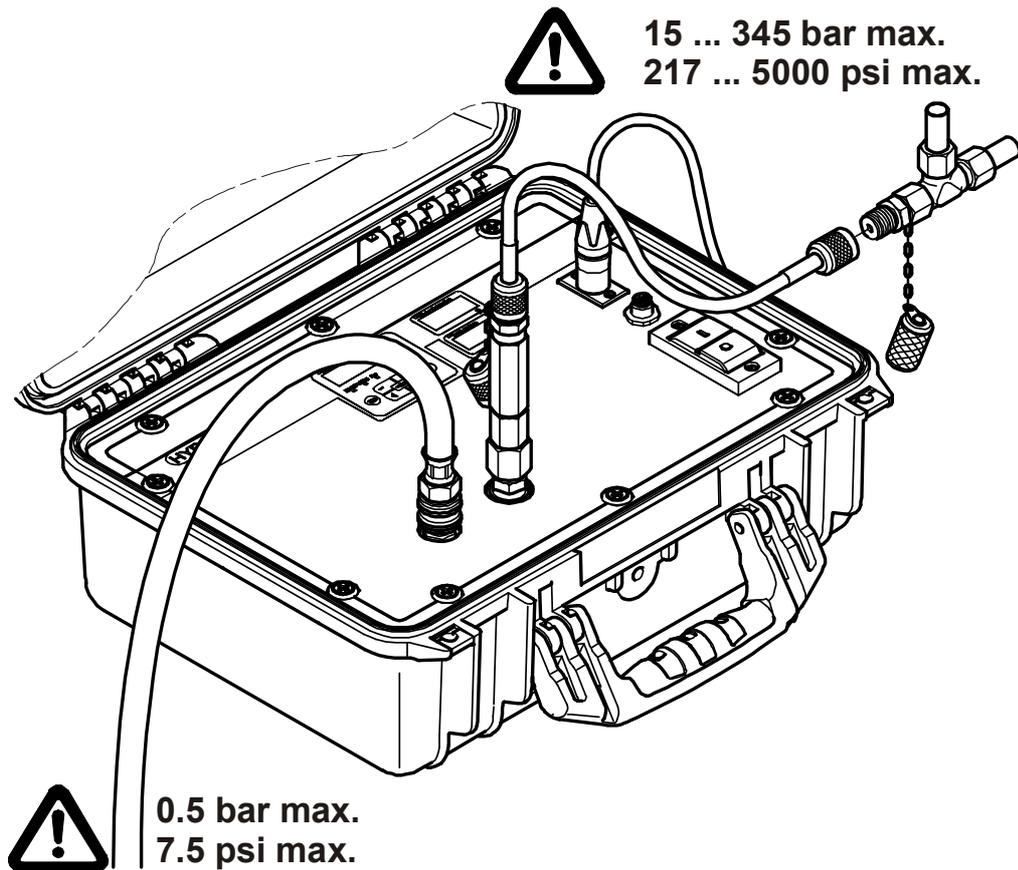
6. The hydraulic installation of the FCU is now complete.
7. The FCU will start with the measurement.

Measuring with high pressure adaptor in the range 15 to 345 bar / 217 to 5000 psi

	! WARNING
	<p>Hydraulic systems are under pressure</p> <p>Danger of bodily injury</p> <ul style="list-style-type: none">▶ The system must be depressurized before starting work on it.▶ If the pressurized connection is connected to the hydraulic system, oil will flow through the FCU.▶ Make sure that the specified sequence is followed.
NOTICE	
<p>If the operating pressure exceeds 345 bar / 5000 psi</p> <p>The excess pressure will be discharged via the OUTLET connection.</p> <ul style="list-style-type: none">▶ Never seal the OUTLET connection.▶ Put the free end of the OUTLET return hose into an unpressurized container.▶ When operating the FCU, always observe the permissible operating pressure.▶ The FCU 1310 can withstand pressures up to 345 bar / 5000 psi.	

Required hoses / adapters:

- OUTLET return hose
- High-pressure adapter (accessories)
- High-pressure hose

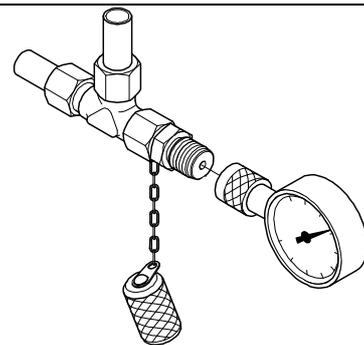


Make sure that the following sequence is observed:

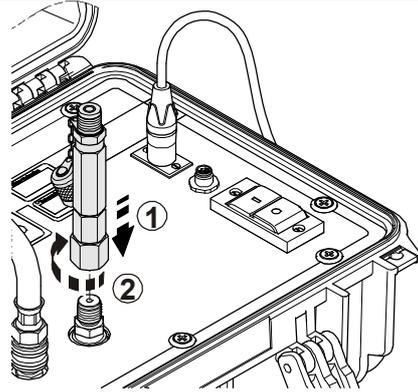
1. Go through the steps in chapter "Preparing the FCU for measurement" on pages 27 to 30.
2. Check the pressure at the measurement point. The pressure there must be in the range from 15 ... 345 bar / 217 ... 5000 psi.



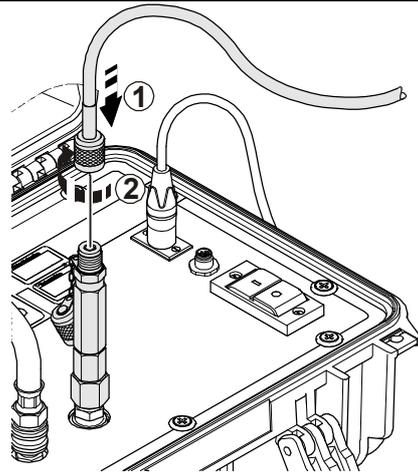
If the pressure exceeds 345 bar, you may not use the FCU 1310. Use some other measurement point.



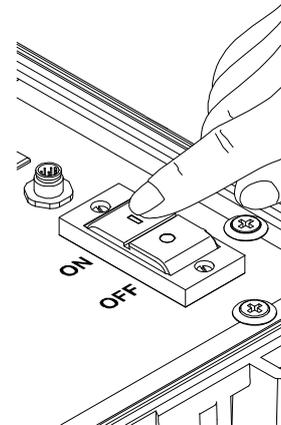
3. Screw the high pressure adapter onto the FCU's INLET connection.



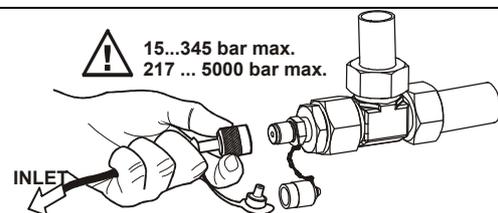
4. Connect the high pressure hose to the high pressure adapter.



5. Switch on the internal pump.



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

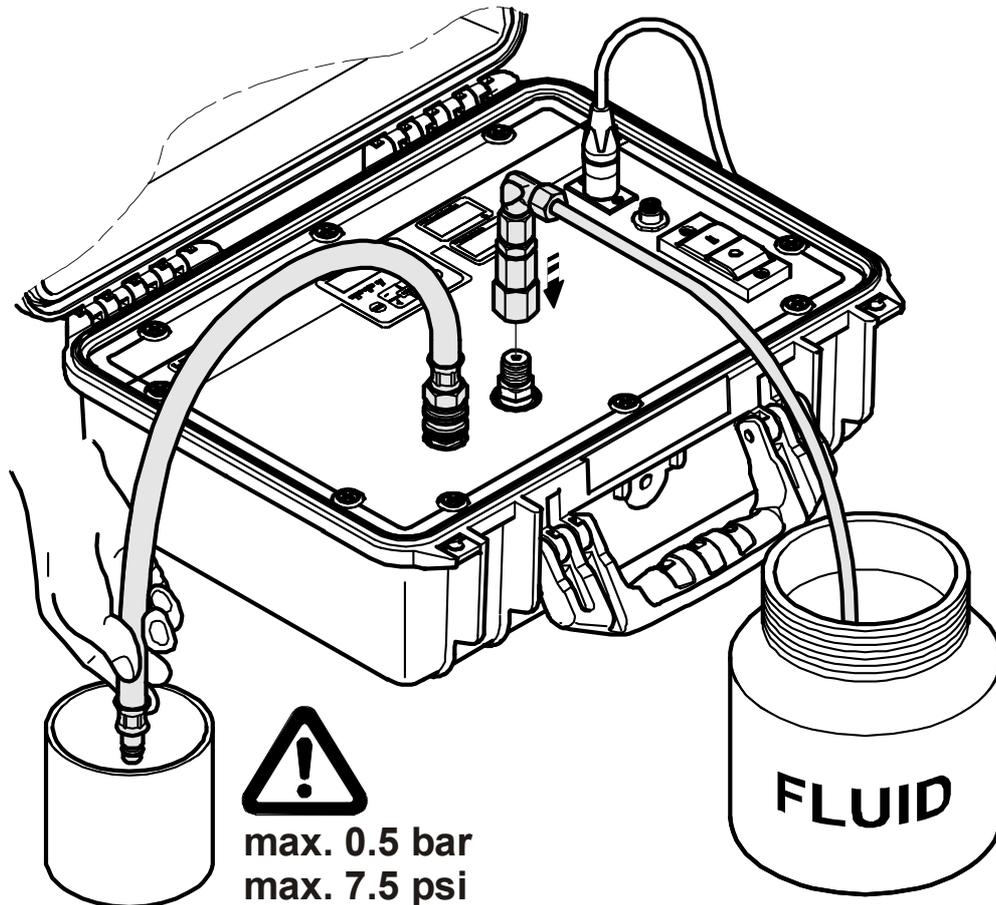


7. The hydraulic installation of the FCU is now complete.
8. The FCU will start with the measurement.

Measuring from unpressurized containers

Required hoses

- OUTLET return hose
- Suction hose



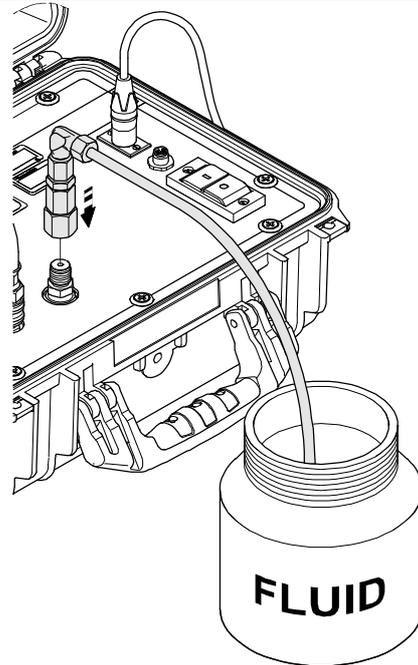
To guarantee valid and direct measurements, the FCU must be primed. To do this, you need approximately 120 ml of oil to completely fill the hydraulic circuit inside the FCU and INLET hose.

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

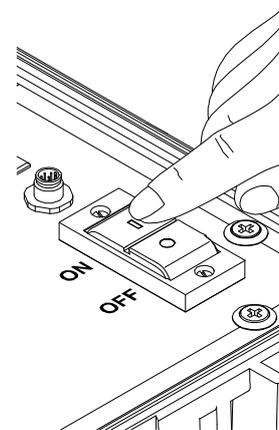
For an initial test without priming the FCU and hoses, you need at least 300 ml of fluid.

Make sure that the following sequence is observed:

1. Go through the steps in chapter "Preparing the FCU for measurement" on pages 27 to 30.
2. Connect the suction hose (transparent) to the FCU INLET.
Put the other end of the transparent suction hose into an unpressurized container.



3. The hydraulic installation of the FCU is now complete.
4. Switch on the internal pump.



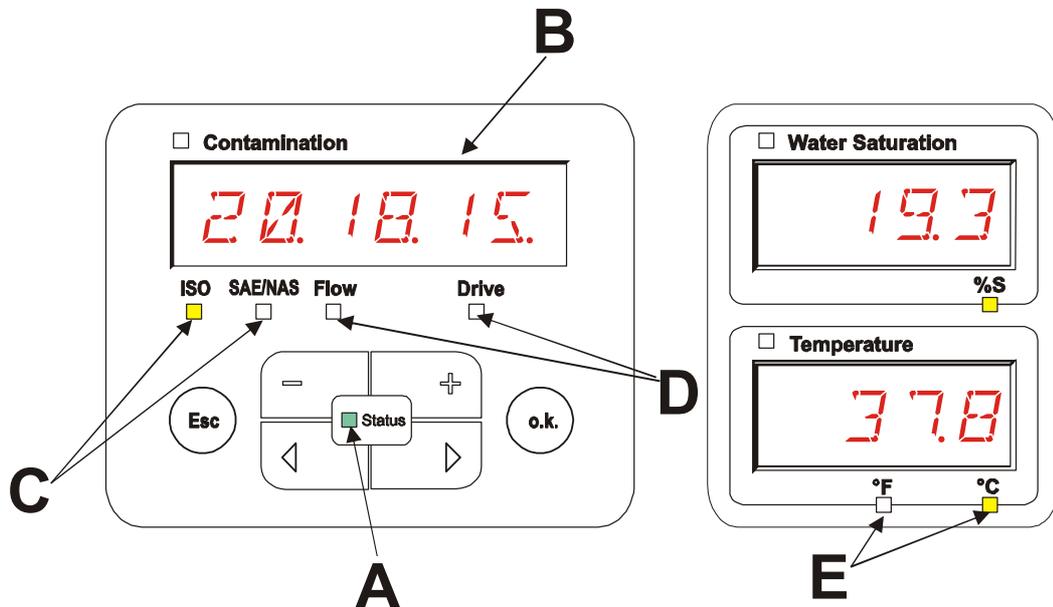
5. The FCU will start with the measurement.

Operating the FCU

If the FCU is powered up, then it can be used and parameters can be set.

In the following, the individual controls and their use are described.

Display and keypad elements



Item	LED	Designation
A	Status	Status display (see page 73 for details).
B	Display	Consists of a 6-digit display and shows the selected measured values.
C	Measured variable	This indicates which measurement is currently being shown in the display e.g. ISO / SAE/NAS .
D	Service variable	Indicates which of the service variables are shown in the display e.g. Flow / Drive .
E	Unit (of measurement)	The units of the fluid temperature display can be set to °C or °F

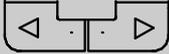
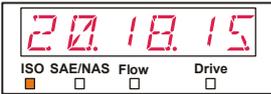
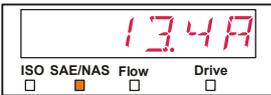
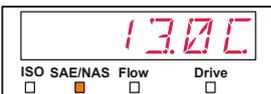
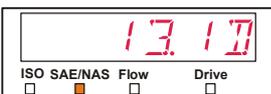
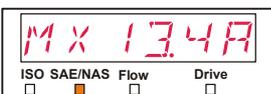
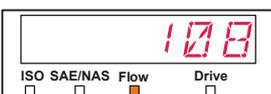
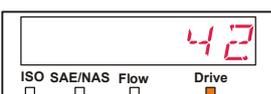
The keyboard consists of six buttons. These buttons are used to operate the FCU and to navigate through the menus (hierarchically structured).

Keypad	Description
	<ul style="list-style-type: none"> - One level lower - Confirmation of changed value (lowest level) - confirm when changes are to be saved or canceled (top level)
	<ul style="list-style-type: none"> - One level higher - no value change
	<ul style="list-style-type: none"> - Change values at the lowest levels (if you are at the lowest menu level, the display will flash)
	<ul style="list-style-type: none"> - scroll through display - Scroll through menu - select digit

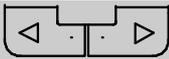
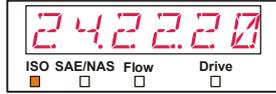
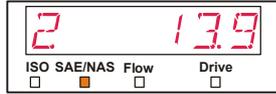
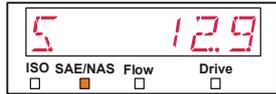
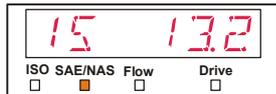
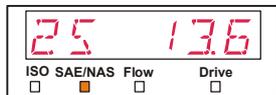
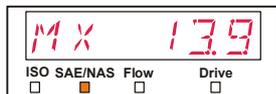
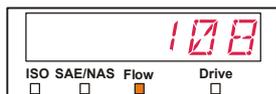
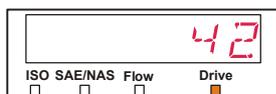
Clicking through the display

According to the calibration type (*CALIB*) in the power up menu, the following displays can be clicked through with the  buttons.

ISO.SAE display

	Display	Description
		3-digit ISO code
		SAE class A
		SAE class B
		SAE class C
		SAE class D
		SAE Max.
		Flow rate in ml/min
		LED current in %

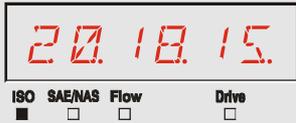
ISO.NAS display

	Display	Description
		3-digit ISO code
		2-5 µm channel NAS
		5-15 µm channel NAS
		15-25 µm channel NAS
		> 25 µm channel NAS
		NAS Max.
		Flow rate in ml/min
		LED current in %

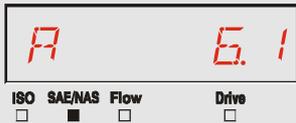
Measured variables

The measurements provide you with information about the purity of the oil in the system concerned. The measurement variables are calibrated. They indicate a measured value with an accuracy of +/- 1/2 ISO codes.

Measured variable "ISO"

Display	Description
	<p>The measured value is updated depending on the set measuring time. Display of the 3-digit ISO code.</p> <p>Example: ISO code 20.18.15</p>

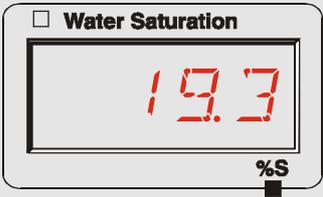
Measured variable "SAE"

Display	Description
	<p>The measured value is updated depending on the set measuring time. Display of a channel in the SAE class.</p> <p>Example: SAE class, channel A = 6.1</p>

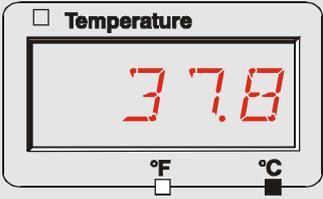
Measured variable "NAS"

Display	Description
	<p>The measured value is updated depending on the set measuring time. Display of a channel in the NAS class.</p> <p>Example: NAS class, channel 15-25 = 13.2 µm</p>

Measured variable "Water saturation"

Display	Description
	<p>The integrated AquaSensor continuously measures the saturation. The measurement is shown on the display as the relative water content of the fluid, expressed as percentage saturation.</p> <p>Example: 19.3% relative humidity</p>

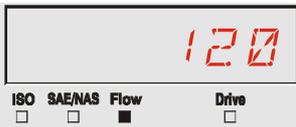
Measured variable "Temperature"

Display	Description
 <p>The screenshot shows a digital display with the number '37.8' in red. Above the display is a checkbox labeled 'Temperature'. Below the display are two unit selection options: '°F' with an unchecked checkbox and '°C' with a checked checkbox.</p>	<p>The integrated AquaSensor continuously measures the fluid temperature. The output as Celsius °C or Fahrenheit °F can be selected under TP.UNIT on page 53. Example: Temperature = 37.8°C</p>

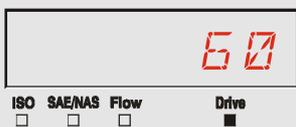
Service variables

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

Service variables "Flow"

Display	Description
 <p>The screenshot shows a digital display with the number '120' in red. Below the display are four unit selection options: 'ISO' (unchecked), 'SAE/NAS' (unchecked), 'Flow' (checked), and 'Drive' (unchecked).</p>	<p>Here, you can see the averaged flow through the contamination sensor unit. Example: Flow rate = 120 ml/min</p>

Service variables "Drive"

Display	Description
 <p>The screenshot shows a digital display with the number '60' in red. Below the display are four unit selection options: 'ISO' (unchecked), 'SAE/NAS' (unchecked), 'Flow' (unchecked), and 'Drive' (checked).</p>	<p>Display of the light source efficiency (1-100%) with which the ContaminationSensor unit currently works. Example: Light source efficiency = 60%</p>

FCU configuration menus

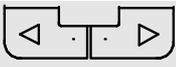
The sensor has two operating levels with corresponding menus.

Menus	Description	Details are on page
Power Up Menu	The basic settings for the FCU	45
Measuring Menu	Settings for the recording and storing of the measurements and naming the measurement points.	50

Power Up Menu

In this menu, the basic settings for the operation of the FCU are made.

Selection	To do
Start the power up menu.	Press any button and hold it down while switching on the supply voltage
Exit the power up menu without saving.	Scroll to <i>CANCEL</i> and press  , or the option will be selected automatically after 30 seconds
Exit the power up menu after saving.	Scroll to <i>SAVE</i> and press 

Power Up	Description	For details, see page:
		
<i>DATE</i>	Set the system date	46
<i>ADDRESS</i>	Set bus address	46
<i>DELMEM</i>	Delete the records	47
<i>MTIME</i>	Set measuring time	47
<i>CALIB</i>	Select the calibration	48
<i>DEFAULT</i>	Reset to factory defaults	48
<i>CANCEL</i>	Discard changes and exit	49
<i>SAVE</i>	Save changes and exit	49

Press  to change to a sub-menu.

DAT.TIM – date / time

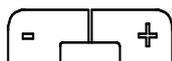
In this option you can set or alter the system date / time.

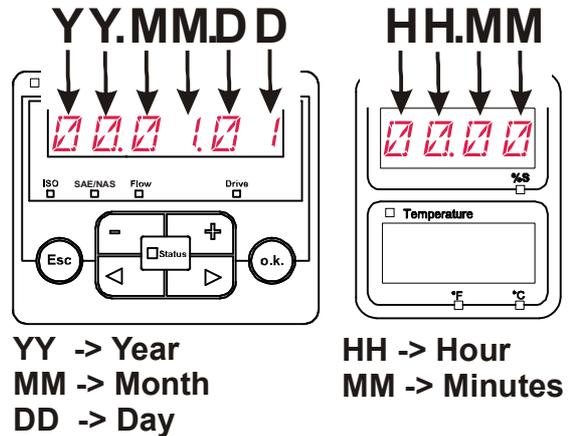
If the date has never been set, or if the battery is flat , the system date will be 2000-01-01 and the time will be 00:00.

The date format is YY.MM.DD => year / year / month / month / day / day.

The time uses 24 hour format HH.MM => hour / hour / minute / minute.

Use the following buttons to set the date and time:

-  To change digit
-  To change the value
-  To confirm the change
-  Cancel and back

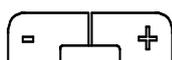


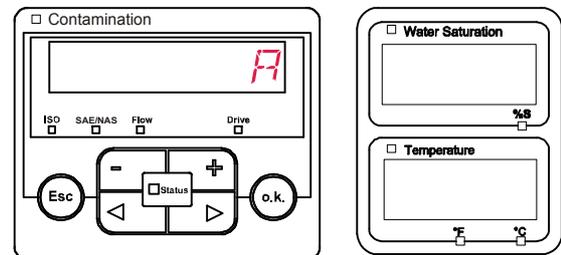
ADRESS - Bus address

With "ADRESS", you set the bus address to transmit the measurements over the data interface, using the HSI protocol.

There are 26 bus addresses available, from A - Z. Please note that each address may occur only once on any bus.

Use the following buttons to set the address:

-  To change digit
-  To change the value
-  To confirm the change
-  Cancel and back



The factory setting of the bus address is: A

DEL.MEM – Delete Memory

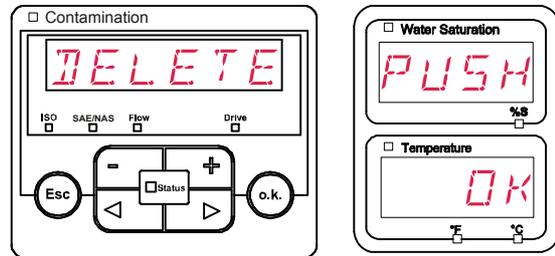
Here, you permanently delete all of the measurement records in the internal memory.



Before deletion, back up all of the measurement records on the USB memory stick.

Push the following buttons to:

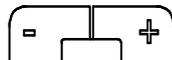
-  Confirm deletion
-  Cancel and back

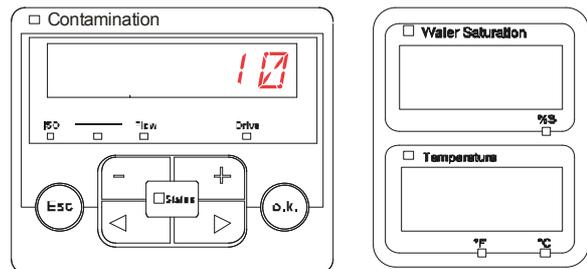


M.TIME – Measurement Time

Here, you set the duration of the measurement. Select the duration in the range from 10 to 300 seconds. This value is factory set to 20 seconds. Upon delivery, the measuring time is set to 10 seconds.

Use the following buttons to set the duration of the measurement.

-  To change digit
-  To change the value
-  To confirm the change
-  Cancel and back



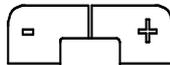
CALIB – Select calibration type

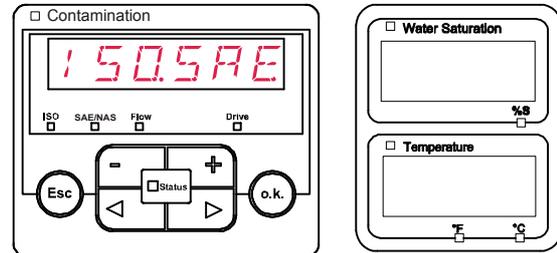
Under CALIB, select the desired calibration type, either ISO.SAE or ISO.NAS.

The calibration type ISO.SAE is based on ISO4406:1999 / SAE.

The calibration type ISO.NAS is based on ISO4406:1987 / NAS.

Use the following buttons:

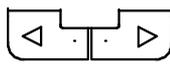
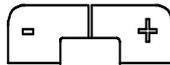
-  To change between the types of calibration
-  To confirm the change
-  Cancel and back

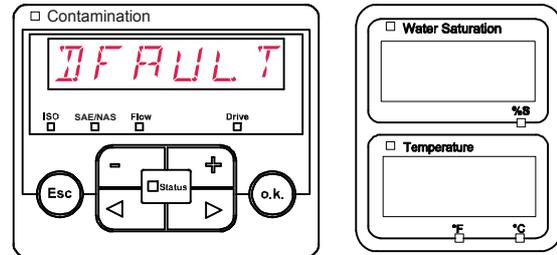


DFAULT – reset to factory settings

DEFAULT resets the FCU back to factory settings. For the factory settings, see page 86.

Use the following buttons:

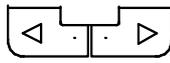
-  Change to the next option in the menu
-  Has no function
-  To confirm the change
-  Cancel and back

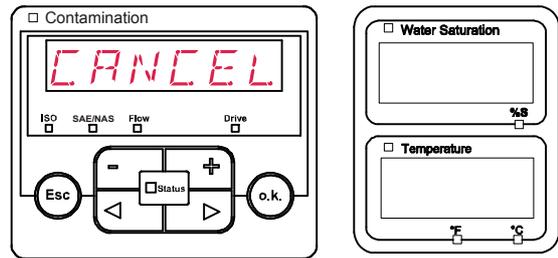


CANCEL

CANCEL discards all changes and exits the popup menu.

Use the following buttons:

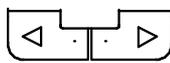
-  Change to the next option in the menu
-  Confirm
-  Cancel and back

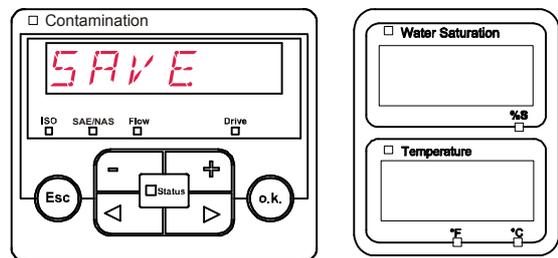


SAVE – store data

SAVE stores all of your changes and exits the popup menu.

Use the following buttons:

-  Change to the next option in the menu
-  Confirm
-  Cancel and back



Measuring Menu

The measuring menu allows you to change settings during operation.

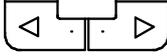
Selection	To do
Start the measuring menu	Press the  button
Exit the measuring menu without saving	Scroll to <i>CANCEL</i> and press  or wait for 30 seconds with no further action and the FCU will automatically switch to display mode.
Save and exit the measuring menu	Scroll to <i>SAVE</i> and press 

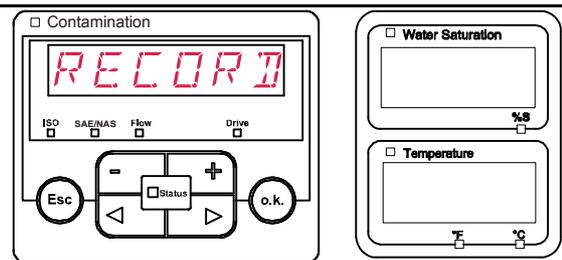
Measuring Menu:	Description	For details, see page
	<i>RECORD</i>	Record measurements 50
	<i>MEMORY</i>	Show free memory 51
	<i>EMPNT</i>	Change measurement location name 52
	<i>TPUNIT</i>	Change temperature units 53
	<i>CANCEL</i>	Discard changes and exit 53
	<i>SAVE</i>	Save changes and exit 53

RECORD - recording measurements

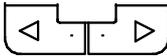
With this option you define under which of the 20 available measurement points the records should be saved.

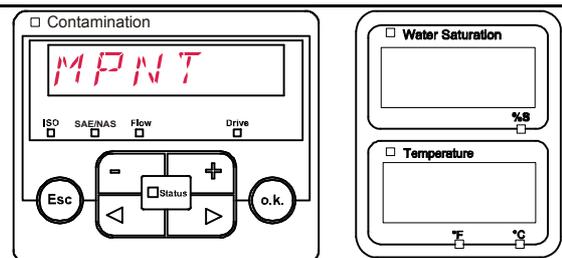
Use the following buttons:

-  Change to the next option in the menu
-  Confirm
-  Cancel and back



Use the following buttons:

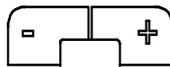
-  Change the selection
-  Confirm
-  Cancel and back

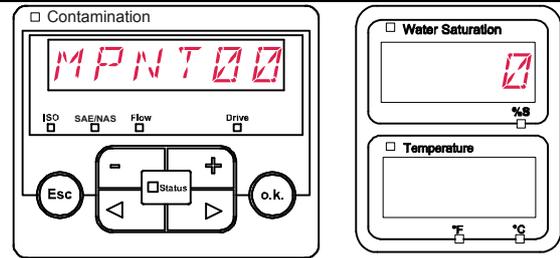


MNPT makes up to 20 freely definable measurement points available. On delivery, the measurement points are set to MNPT00 to MNPT19.

You can change these names at will, as described under ED.MNPT.

Use the following buttons:

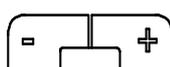
-  Change to the next measurement point
-  To confirm the change
-  Cancel and back

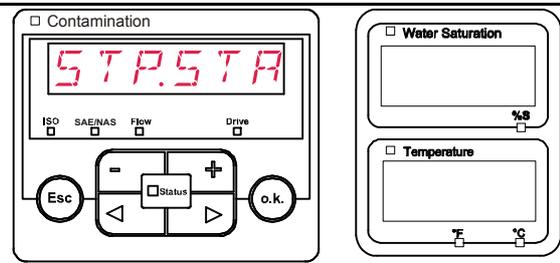


Select STP.STA to create a new file in the internal FCU memory, under which you can create new measurement points. Press  and the display will jump to SAVE.

Confirm again by pressing .

Use the following buttons:

-  Change the selection
-  Confirm
-  Cancel and back



MEMORY – display free memory

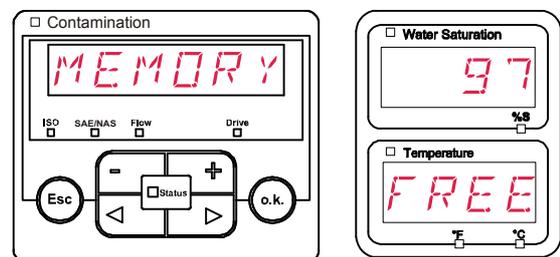
Under MEMORY, you check the current free internal memory capacity of the FCU in %. If there is no more memory available, no measurement records can be saved.

Save measurement records that you have already read out as described on page 56. Then delete those records in the internal memory with DEL.MEM as described on page 47.

For example: 97% free memory.

Use the following buttons:

-  To confirm the change
-  Cancel and back

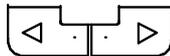


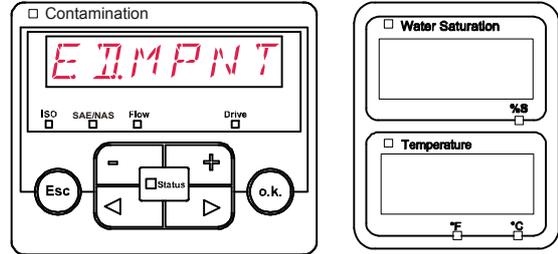
ED.MPNT – Change the name of measurement points

Under ED.MPNT you can modify the names of the measurement points to meet your requirements.

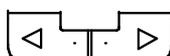
You only have 6 characters available for the name. For example TEST01, DIGGER, CRANE etc.

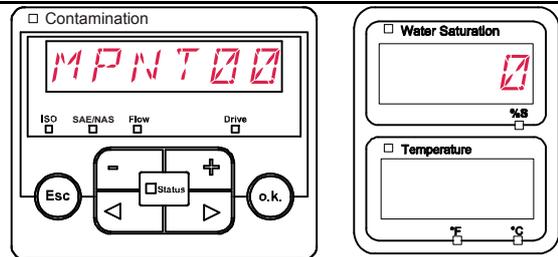
Use the following buttons:

-  Change to the next option in the menu
-  To confirm the change
-  Cancel and back

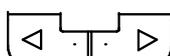


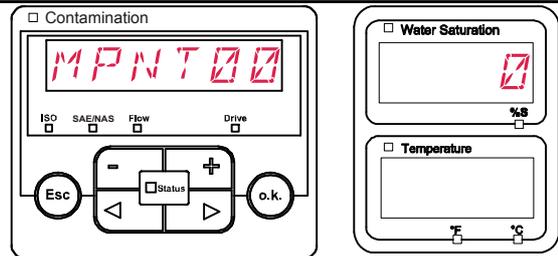
Use the following buttons:

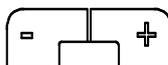
-  Change to the next measurement point
-  To confirm the change
-  Cancel and back



Use the following buttons:

-  Select another character
-  Change the current character
-  To confirm the change
-  Cancel and back



The following characters will appear, when the  button is pressed, wrapping around at the end.

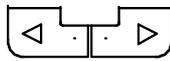


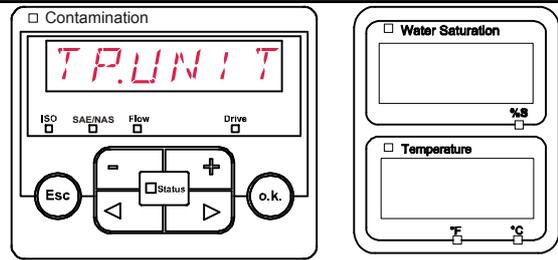
The empty space is located between 9 and A and can be adjusted only from the 6th position to the left. This means that you can enter a name with less than 6 characters.

TP.UNIT – change the temperature units °C / °F

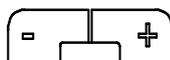
Under TP.UNIT you set the units to display the fluid temperature. You have the choice between Celsius °C and Fahrenheit °F.

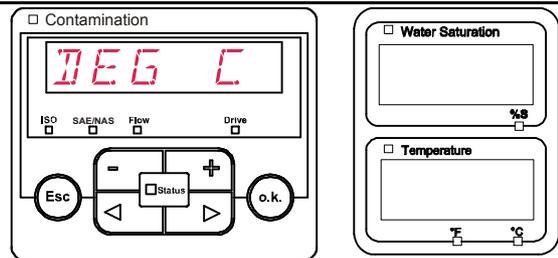
Use the following buttons:

-  Change to the next option in the menu
-  Confirm
-  Cancel and back



Use the following buttons:

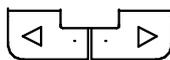
-  Change the selection
-  Confirm
-  Cancel and back

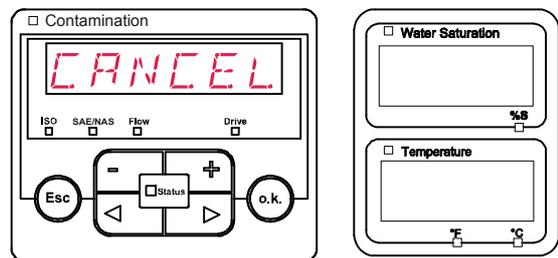


CANCEL

With CANCEL, you discard all changes and exit the measuring menu.

Use the following buttons:

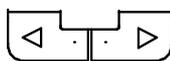
-  Change to the next option in the menu
-  Confirm
-  Cancel and back

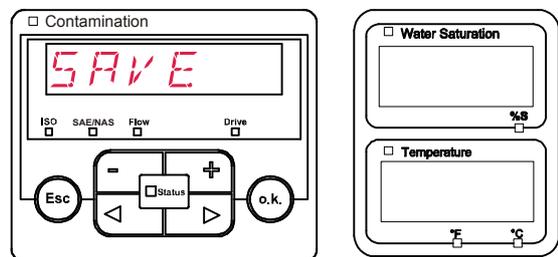


SAVE - save data

With SAVE, you store all changes and exit the measuring menu.

Use the following buttons:

-  Change to the next option in the menu
-  Confirm
-  Cancel and back



Performing a measurement

1. Check all the hydraulic and electrical connections to the FCU.
2. Now press the green "Pump ON" switch.
3. The pump feeds oil to be analyzed through the FCU.
After the set measurement duration, the result will be shown on the display, and the status LED will light up green, steadily.

Interpreting of measurement values

The analyst shall report the HIGHEST (DIRTIEST) of the three ISO Codes (within +/- 1) that the FCU1310 produces as a final result.

Restrictions pertaining to use

NOTICE

Impermissible operating conditions

The FCU will be damaged

- ▶ Only use the FCU with mineral oils or mineral oil-based raffinates.
- ▶ Observe the permissible viscosity range: 10 – 350 mm²/s or 46 – 1622 SUS (ISO VG 68)
- ▶ Only operate the FCU 1310 for brief periods of time (S4 to DIN EN 60034 / VDE 0530).
- ▶ After 30 minutes of operation, turn off the FCU 1310 for at least 10 minutes to cool down.

Internal measurement memory

All measurements are kept in internal memory, with a reference to the measurement point, until deliberately deleted by using the DEL.MEM function.

The internal memory has a capacity of > 30000 lines = measurement records.

To hit the capacity limit of the internal memory, it is theoretically necessary, with a measurement interval of 20 seconds (factory set), to run the FCU for 7 days, 24 hours per day.

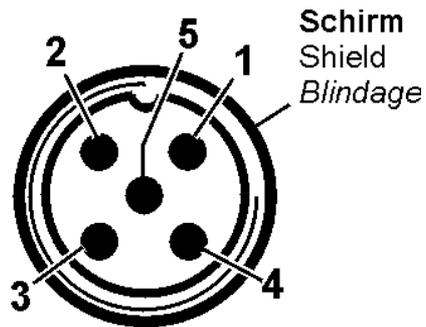
To transfer the data, the target system (e.g. PC or USB stick) has to have at least 10 MB of capacity free.

DATA - interface

The FCU has a DATA interface to transfer the measurement data. The FCU communicates over this using the HSI protocol.

Pins used on the DATA interface (HYDAC Sensor Interface – HSI)

The HSI interface has connection plug M12x1, 5-pole, in accordance with DIN VDE 0627.



Pin	Assignment
1	Not connected
2	Not connected
3	Not connected
4	GND
5	HSI

USB interface

Copying measurements onto a USB data stick

Compatibility with other USB memory sticks cannot be guaranteed as the FCU communicates directly with the microprocessor. This means that communication errors can't be corrected in software, as on a PC with an operating system.

We recommend using the HYDAC USB memory stick, which we successfully tested for many PC/operating system combinations.

On page 89, you will find an overview of additional tested USB sticks.

We accept no liability for the functionality and compatibility of the USB memory stick with your system. We do not offer support or replacements in this case.



(looks something like this)

For HYDAC part-no., see page 78, chapter "Accessories".

Saved measurements can be copied on the USB memory stick supplied with the unit. After copying to the USB stick, the data still exists in the internal memory.

During the download, no measurement data are stored in the internal memory. After another download, the measuring data for the duration of the download are missing.

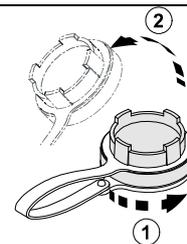
You have to explicitly delete the data in the internal memory of the FCU. See the DEL.MEM menu option on page 47.

Before using the USB stick for the first time, we recommend that you format it. To do that, insert it into a free USB port on your PC. Then change to the file manager (e.g. Explorer) and format the stick in FAT32 format. You will find details of this in the documentation of your operating system.

There must be at least 10 MB of free memory available on the USB stick.

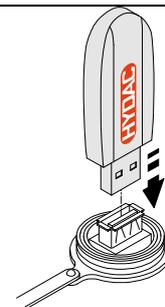
To save your measurements on the USB stick, proceed as follows:

1. Open the cover to the USB connection by turning it anticlockwise (1) and then lifting it (2).

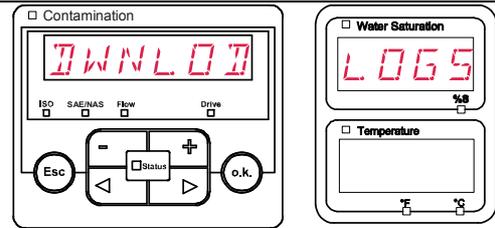


2. Insert the USB memory stick into the socket. Note that the stick only fits one way around.

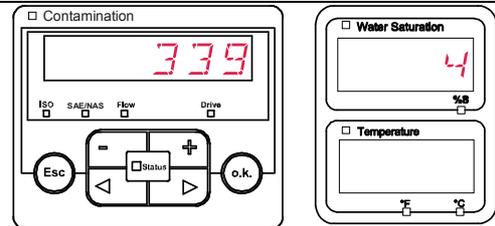
It must be easy to insert the USB stick into the socket.



3. After inserting the USB memory stick, the FCU will detect it and immediately start copying the measurement data.

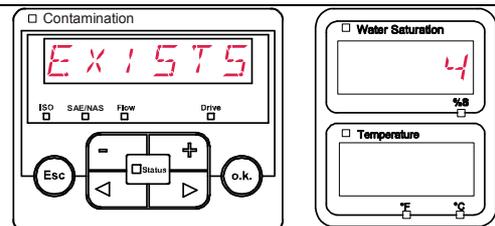


4. In the "Contamination" display, you can see the number of measurement records to be copied (e.g. 339)



The "Water saturation" display shows the number of records to be viewed (e.g. 4).

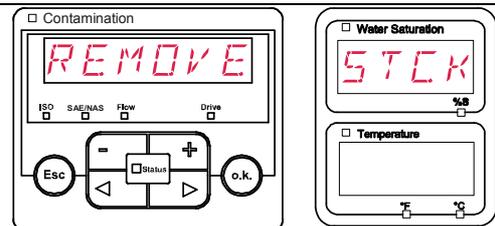
5. If the FCU detects existing records on the USB memory stick, the following message will appear on the display.



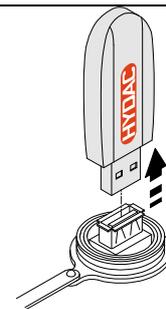
Example: The FCU has found the record number 4 on the USB memory stick.

This function is especially suited to the synchronization of the copied data with the FCU's internal memory. The existing records will be displayed.

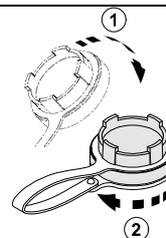
6. After successfully copying the records, the following message will appear on the display.



7. Now remove the USB memory stick from the socket by gently pulling it upwards.

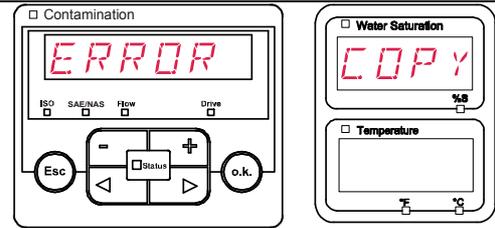


8. Close the cover to the USB connection (1) by turning it clockwise (2).



Data transmission failed - "ERROR COPY"

If a fault occurs during the copy procedure, or if you remove the USB memory stick from the socket before the procedure is complete, the following message will be output on the display.



To remedy faults, proceed as follows:

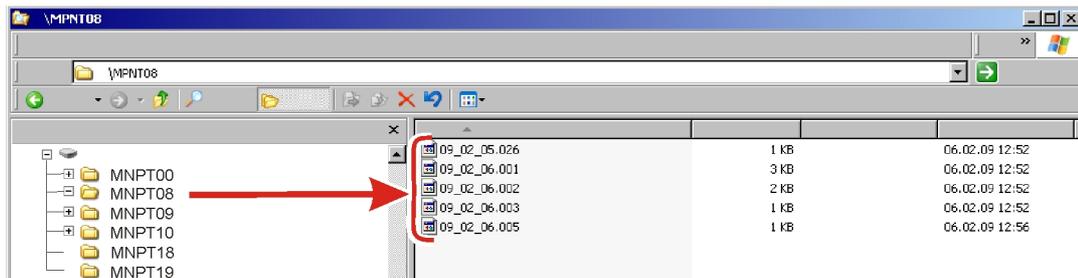
Step	Description
1.	Insert the USB memory stick in your PC and delete all data.
2.	Put the USB stick back in the FCU USB socket. The download will start automatically.
3.	->a. If the error recurs -> go to step 4. ->b. If the error does not recur -> go to step 11.
4.	Insert the USB stick in your PC and reformat it.
5.	Put the USB stick back in the FCU USB socket. The download will start automatically.
6.	->a. If the error recurs -> go to step 7. ->b. If the error does not recur -> go to step 11.
7.	Use another compatible USB memory stick (see page 89).
8.	Put the USB stick back in the FCU USB socket. The download will start automatically.
9.	->a. If the error recurs -> go to step 10. ->b. If the error does not recur -> go to step 11.
10.	Contact the HYDAC service department.
11.	The download has been successfully completed

Evaluating stored records

The measurement records read out of the FCU and stored on the USB memory stick are defined as follows.

Directories to store the records by measurement points

If measurements are to be stored under a measurement point MNPT, the FCU will automatically produce a directory for this measurement point and will put the record there.



Record file names

The file names of the measurement records consist of date YY -> year, MM -> month, DD -> day, as well as an incremental number.

09 _ 02 _ 05 . 026

YY _ MM _ DD . incremental number

A new record is created:

- on request by STA.STP
- after a restart of the FCU (see page 76)
- after the data is downloaded to the USB stick

For each new record, the incremental number is increased by one.

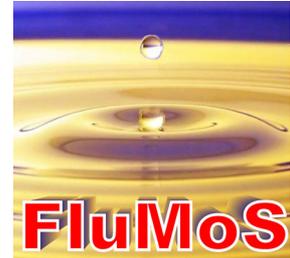
Measurement value readouts with FluMoS

The fluid monitoring software FluMoS serves to read the measurements from the FCU 1310. From version 1.30 of FluMos Light, it is possible to display and evaluate the data on the USB memory stick.

FluMoS light is available as freeware on the CD included in the delivery or as a download.

Link to the download:

<http://www.hydac.de/de-de/service/download/software/software-download/servicetechnik.html>

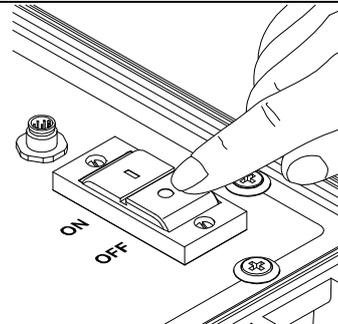


Preparing the FCU for transport

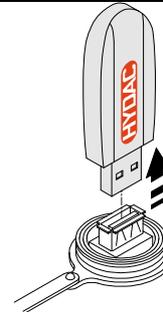
	 CAUTION
	<p>Hot fluid at the OUTLET</p> <p>Danger of burns</p> <p>► Before removing the OUTLET hose from the FCU, allow it to cool off.</p>

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

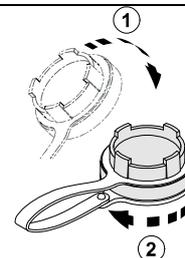
1. Use the switch to turn the internal pump off.



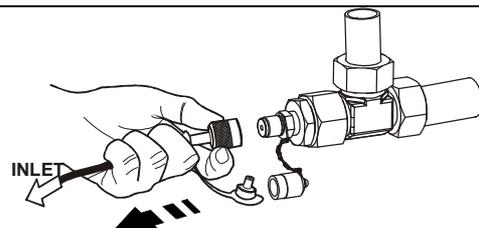
2. Remove the USB stick, should it be inserted.



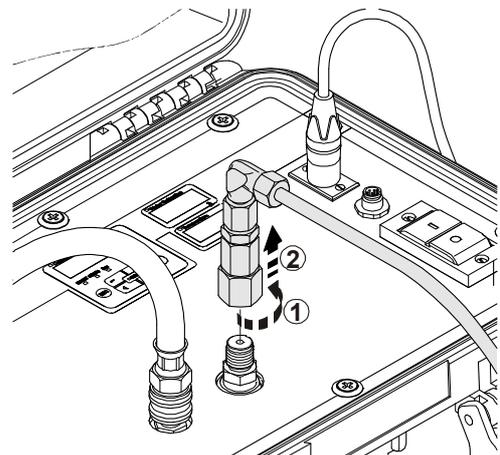
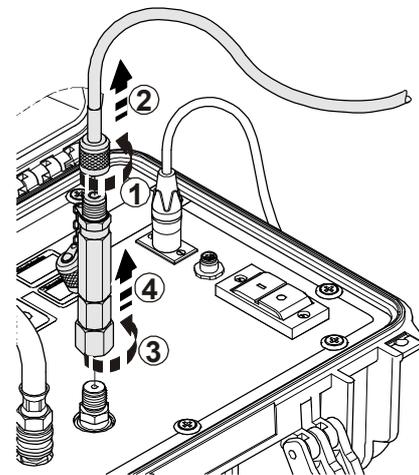
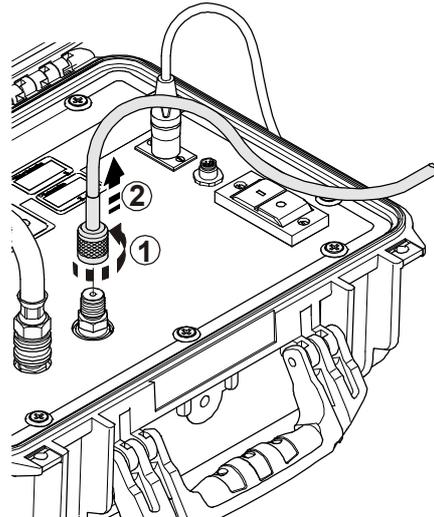
3. Close the USB socket with the corresponding cover.



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



5. Remove the hose by turning the connector to the FCU INLET connection anticlockwise.



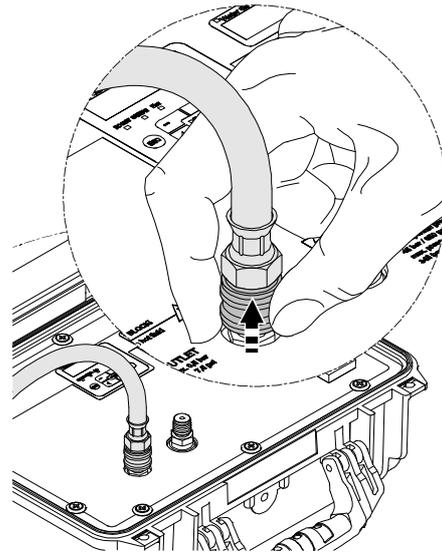
6. Undo the quick-action coupling on the OUTLET hose by lifting the outer ring.



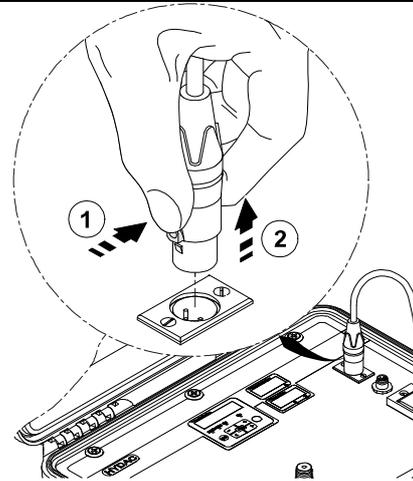
Empty the hose into an unpressurized container.

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

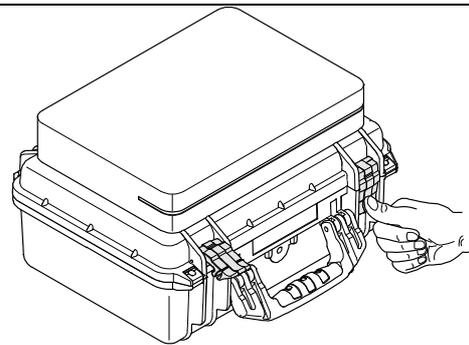
After emptying it, join the two ends of the hose together. In this way you can ensure that no more fluid will leak from the hose during transport.



7. Release the catch (1) and then pull the socket out of the connector (2).



8. Close the FCU using both catches. The catches must audibly engage.



9. Stow the hose and the power supply in the bag.
10. The FCU is ready for transport.

Performing maintenance

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

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

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

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

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

Cleaning the FCU

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

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

Rinsing the FCU

NOTICE

Impermissible flushing media

The FCU will be destroyed

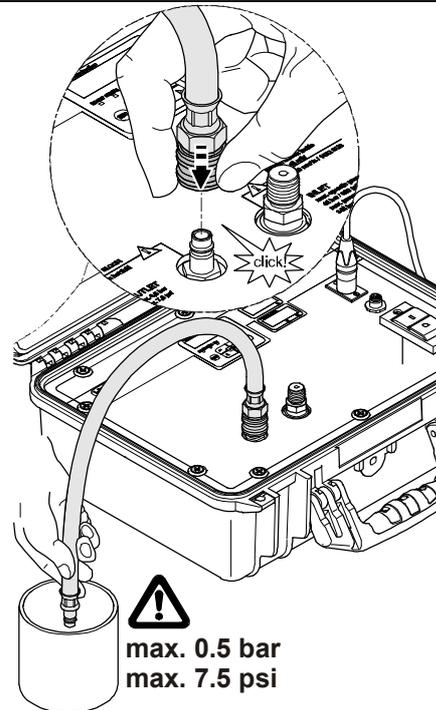
- ▶ Flush the FCU with low-viscosity mineral oils or mineral oil-based raffinates (e.g. diesel) whose flash point is higher than 55°C/131°F.
- ▶ Mineral turpentine or other degreasing media are not allowed.

Flush the FCU 1310 after each use, but at least daily, with cleaned mineral oil.

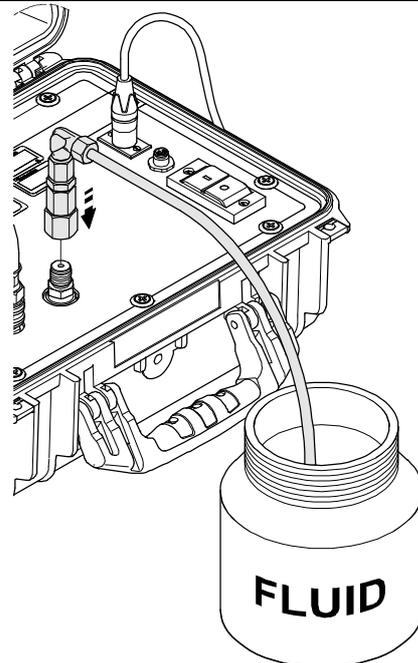
Rinse the FCU immediately if you measure unfiltered oil or oil with a viscosity > 200 mm²/s or if the readings seem unusually high or low.

Flush the FCU as described below:

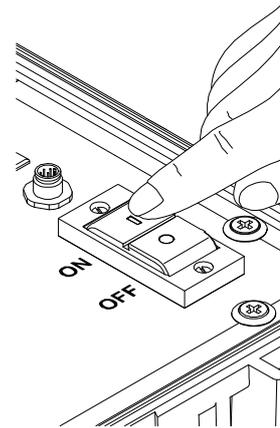
1. Put approx. 0.5 liters of filtered oil into a clean container.
2. Connect the OUTLET return hose to the FCU and put the free end into a container for the used fluid.



3. Attach the suction hose to the FCU INLET connection.
Put the free end of the suction hose into the container with the filtered oil.

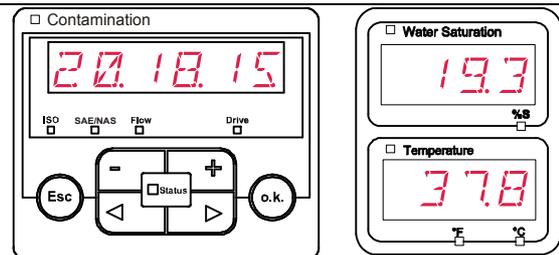


4. Use the switch on the FCU to turn its pump on.

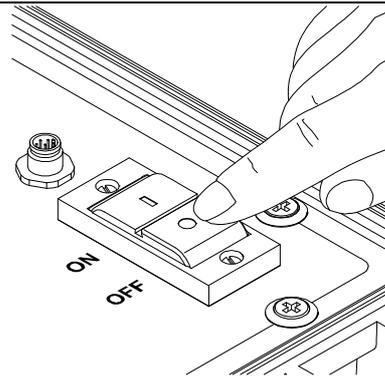


5. Cleanliness values will be displayed during the flushing procedure.

These measurements are not correct, but should decrease during the flushing procedure.



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



7. The FCU is ready for operation.

Clean the suction strainer.**NOTICE****Operation without a suction strainer**

The FCU pump can be damaged

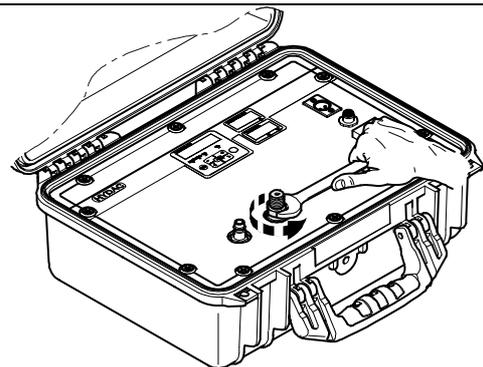
- ▶ Never use the FCU without a suction screen.
- ▶ Clean the suction strainer regularly.

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

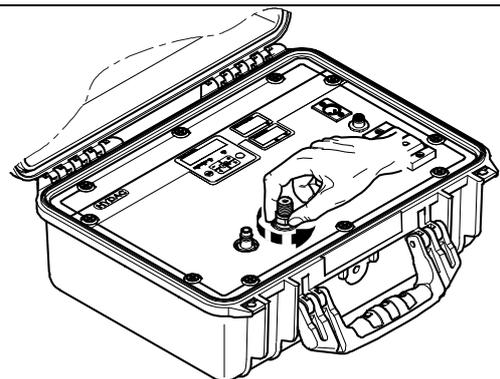
Clean the suction strainer regularly. If the FCU is blocked or there is no flow through, clean the suction screen immediately.

To check/clean the sieve, proceed as follows:

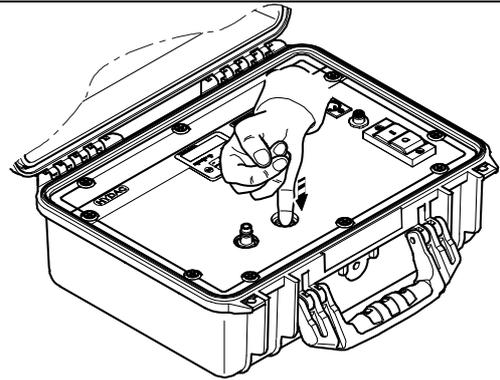
1. Remove all of the hydraulic and electrical connections to the FCU.
2. Loosen the inlet connector, with a 19 mm wrench, turning it anticlockwise.



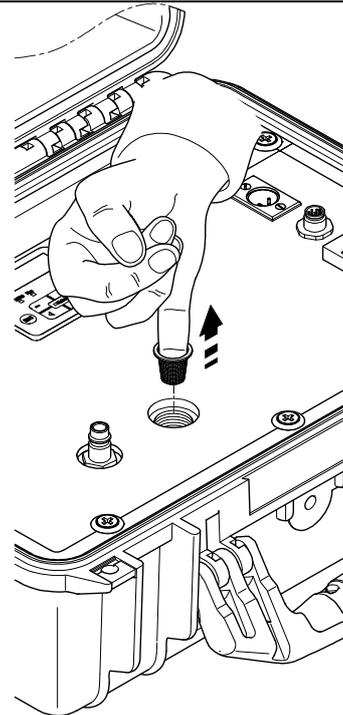
3. Unscrew the INLET connector manually, turning it anticlockwise.



4. Insert a finger in the opening ...



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

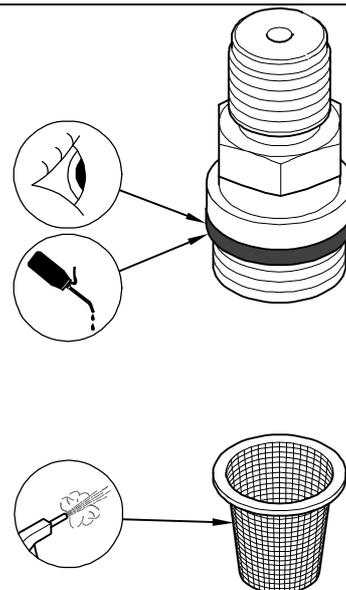


6. Clean the sieve by blowing it out with compressed air.

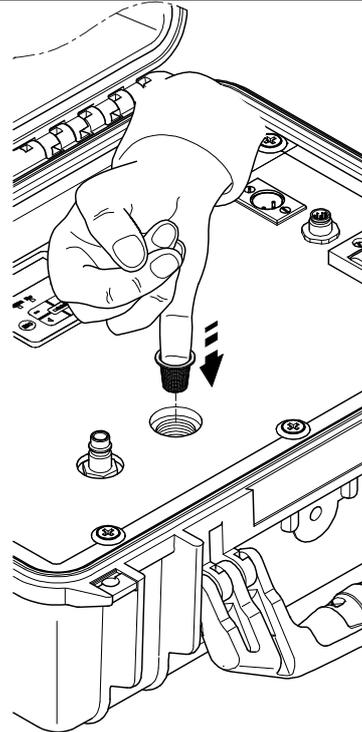
Before reassembly, check that the sealing ring for the connector is undamaged.

Replace it if necessary.

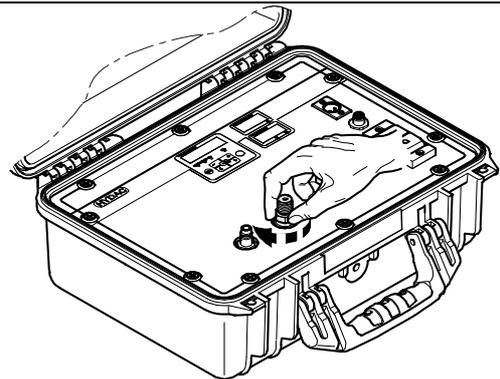
Before screwing it in place, wet the sealing ring (C) with some hydraulic fluid.



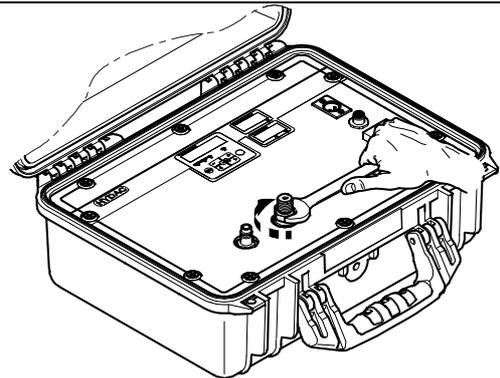
-
7. Put the sieve back into the opening.



-
8. Manually screw the INLET connector in clockwise.



-
9. Using a 19 mm wrench, tighten the INLET connector, turning it clockwise.
Note the maximum torque of 25 Nm.

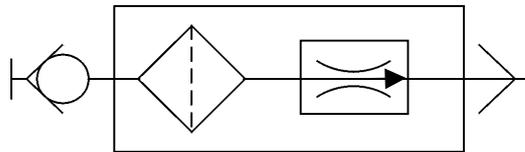


Checking the high pressure adaptor

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

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

If the necessary flow rate is not reached, you must check the sieve in the adaptor and clean it.

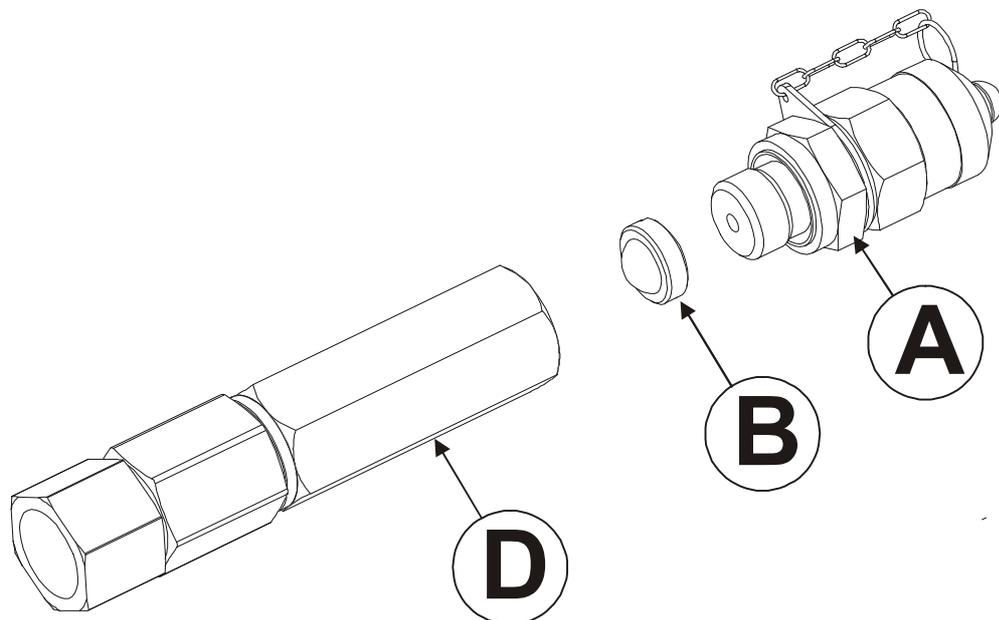


Cleaning / changing the sieve in the high pressure adapter**NOTICE****Operation without a sieve**

The FCU pump can be damaged

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

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



Remove the measurement coupling (A) from the threaded joint (D) with a 22 mm open-jaw wrench, anticlockwise. Then unscrew the sieve (B) anticlockwise with a screwdriver or the special tool (see accessories list 78).

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

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

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

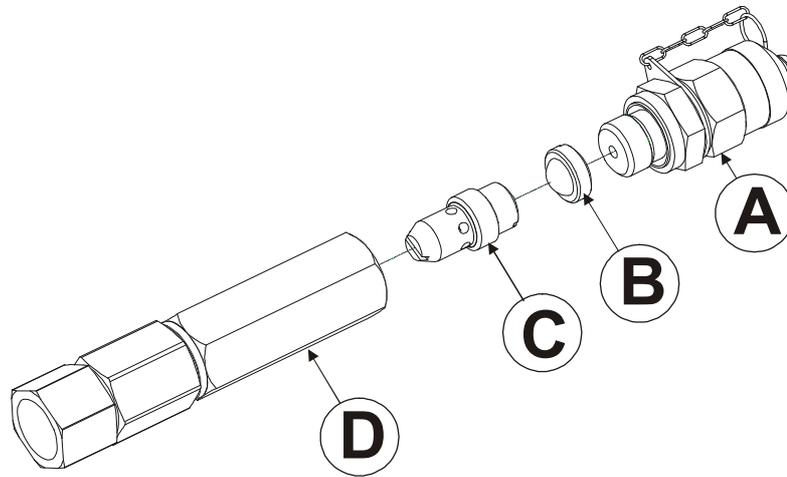
Turn the coupling (A) in a clockwise direction and tighten to 25 Nm.

Cleaning / changing the strainer in the high pressure adapter**NOTICE****Wrong installation of the flow control valve**

Flow control valve is not working

- ▶ Pay attention to the direction of flow when installing the flow control valve.

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



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

Now unscrew the sieve (B) anticlockwise, with a screwdriver or the special tool (see accessories list on page 78).

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

Also unscrew the flow control valve (C) anticlockwise with a screwdriver or the special tool (see accessories list on page 78).

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

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

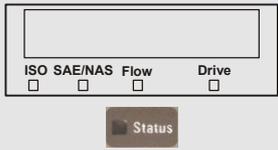
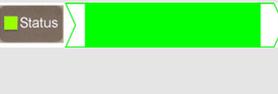
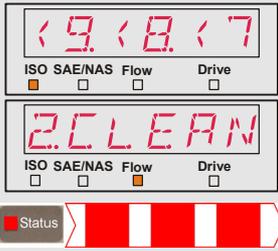
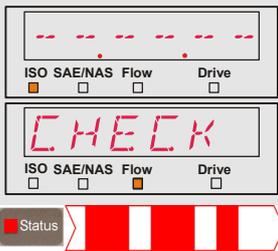
Then check the sealing ring on the coupling (A) for damage. Replace it if necessary.

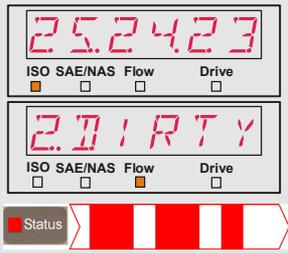
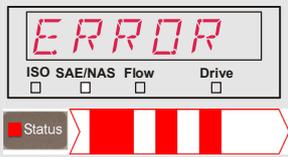
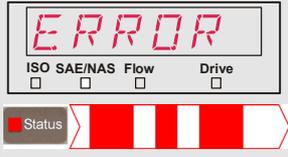
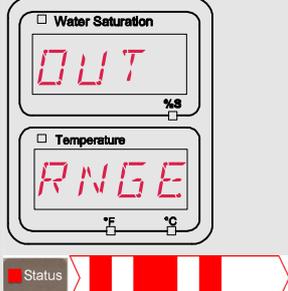
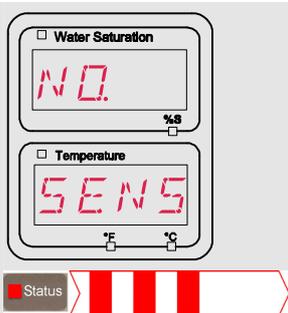
Turn the coupling (A) in a clockwise direction and tighten to 25 Nm.

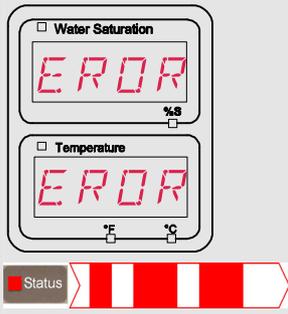
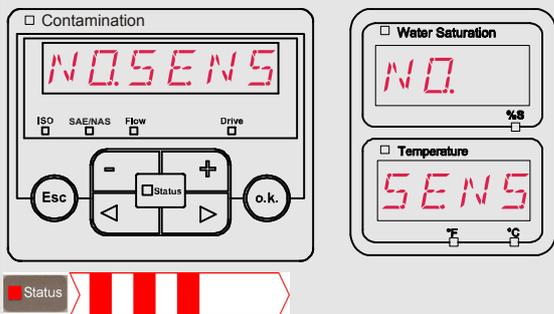
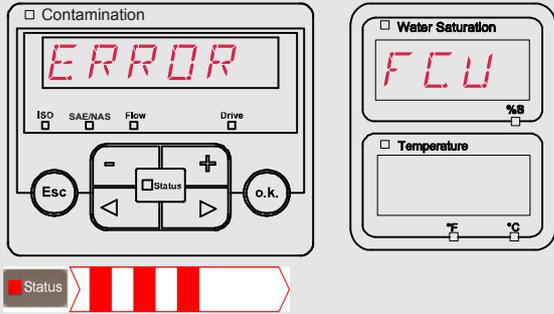
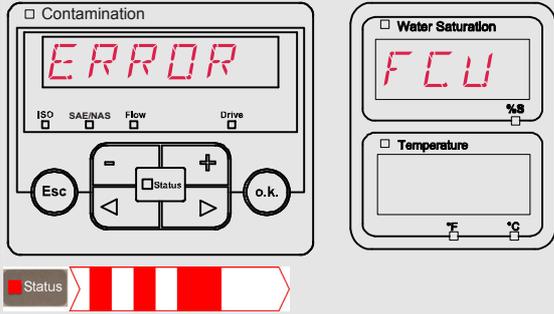
FCU status messages / error messages

The following error codes are possible. You will find these error codes in the measurement file.

Fault Code	Description	
0	Ready	=> Sensor / equipment is working
2	Minor fault / warning	=> Sensor / equipment continues to work A warning that is automatically reset by the FCU.
3	Moderate fault	=> Sensor / equipment status us "fault" Restart the FCU by switching it off and then on again.
4	Serious fault	=> The sensor or equipment is faulty. Contact the HYDAC service department.

LED	Display flashing code	Status	To do	Fault Code
-		FCU no digits displayed no function	Check the power supply to the FCU. Contact the HYDAC service department.	-
Green		FCU ready for operation	You can make further measurements.	0
Red		The FCU is below its measurement range < ISO 9/8/7. It is currently not possible to determine the cleanliness of the oil or its flow rate.	You can make further measurements.	2
Red		It is not possible to determine the flow rate. The FCU is in an undefined state.	Switch the pump on. Wait for a few measurement cycles until measured values are again shown.	2

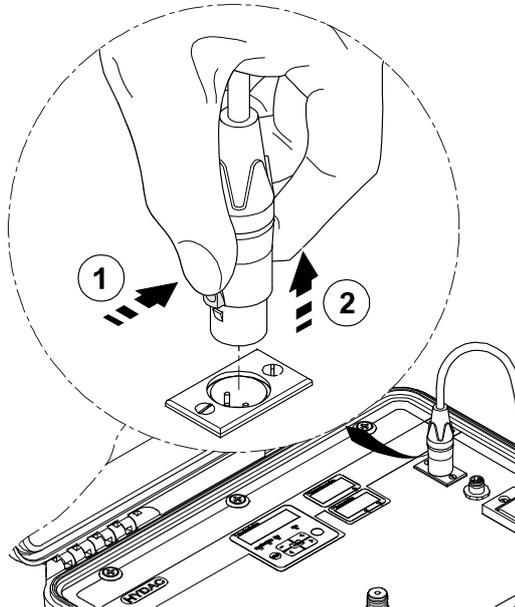
LED	Display flashing code	Status	To do	Fault Code
Red	 <p>The display shows '25.24.23' and 'DIRTY'. Below the display are indicators for ISO SAE/NAS, Flow, and Drive. A status bar at the bottom shows a red and white striped pattern.</p>	<p>The FCU is above its range of measurement > ISO 25/24/23. It is currently not possible to determine the cleanliness of the oil or its flow rate.</p>	<p>Filter the oil to improve its cleanliness.</p>	2
Red	 <p>The display shows 'NO SENS'. Below the display are indicators for ISO SAE/NAS, Flow, and Drive. A status bar at the bottom shows a red and white striped pattern.</p>	<p>No ContaminationSensor is attached.</p>	<p>Switch the FCU off and then on again. If the fault recurs, contact HYDAC service department.</p>	3
Red	 <p>The display shows 'ERROR'. Below the display are indicators for ISO SAE/NAS, Flow, and Drive. A status bar at the bottom shows a red and white striped pattern.</p>	<p>The ContaminationSensor is causing a moderate fault.</p>	<p>Switch the FCU off. If the fault recurs, contact HYDAC service department.</p>	3
Red	 <p>The display shows 'ERROR'. Below the display are indicators for ISO SAE/NAS, Flow, and Drive. A status bar at the bottom shows a red and white striped pattern.</p>	<p>The ContaminationSensor is causing a major fault.</p>	<p>Contact the HYDAC service department.</p>	4
Red	 <p>The display shows 'OUT' and 'RNGE'. Above 'OUT' is 'Water Saturation' and below 'RNGE' is 'Temperature'. A status bar at the bottom shows a red and white striped pattern.</p>	<p>The AquaSensor is outside of its measurement range.</p>	<p>Wait for a few more measurement cycles.</p>	2
Red	 <p>The display shows 'NO.' and 'SENS'. Above 'NO.' is 'Water Saturation' and below 'SENS' is 'Temperature'. A status bar at the bottom shows a red and white striped pattern.</p>	<p>No AquaSensor is connected.</p>	<p>Switch the FCU off and then on again. If the fault recurs, contact HYDAC service department.</p>	3

LED	Display flashing code	Status	To do	Fault Code
Red		The AquaSensor is causing a moderate fault.	Switch the FCU off and then on again. If the fault recurs, contact HYDAC service department.	3
LED	Display flashing code	Status / To do	Fault Code	
Red		No sensors are attached to the FCU. / Switch the FCU off and then on again. If the fault recurs, contact HYDAC service department.	3	
Red		The FCU has a moderate fault. / Switch the FCU off and then on again. If the fault recurs, contact HYDAC service department.	3	
Red		The FCU has a major fault. / Contact the HYDAC service department.	4	

Restart / Resetting the FCU

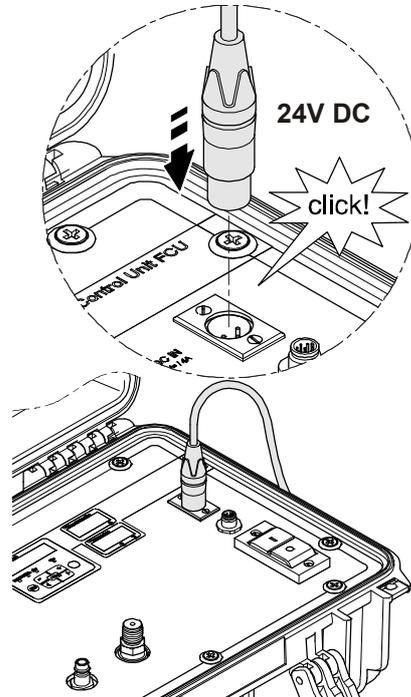
To reset the FCU, remove the power supply to the FCU for 10 seconds.

To remove the connector



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

To insert the connector



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

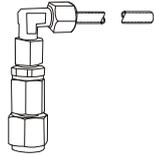
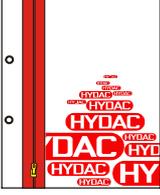
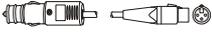
Disposing of the FCU

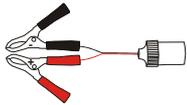
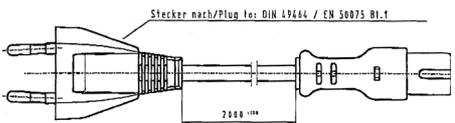
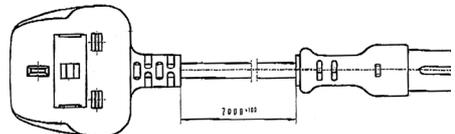
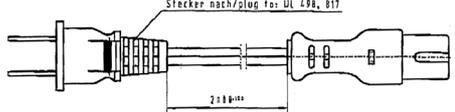
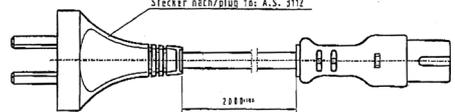
Dispose of the packaging material as appropriate for your area.

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

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

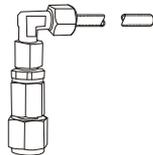
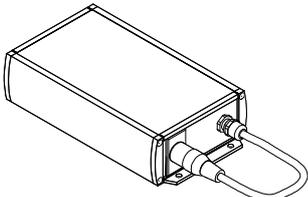
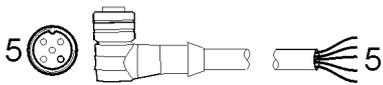
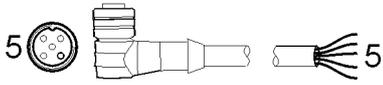
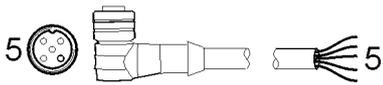
Spare Parts List

Part no.	Description:	Figure
349150	INLET high pressure hose with screwed joint, for measurement point type 1620, color: black, L = 2 m (78.74 inch)	
3297276	INLET suction hose with open end, color: clear-transparent, Length = 0.3 m (11.8 inch)	
3300054	OUTLET return hose, open end, transparent, length = 1 m	
278475	Suction strainer, 400 µm (for INLET port)	
607755	Seal ring for INLET test point union (Ø 21 mm, according to DIN3869)	
3455429	Cover seal for case	
3335656	Attachable bag for hoses, cables and accessories	
3442973	USB Memory stick	
3377173	Document folder for Operating and Maintenance instructions / Calibration certificate	
3583929	Operation and Maintenance Instructions FCU1310 CAT (this document)	
3546511	FCU "Getting started" guide	
3306236	12V/24V DC cable with universal plug, including 8A fuse, Length = 10 m (393.7 inches)	
6052824	Fuse 8 A for universal plug (Ø 6 x 25 mm, according to DIN 72581)	

Part no.	Description:	Figure
6051653	Battery adaptor for 12V/24V DC with coupling for universal plug, Length = 0.3 m (11.8 inches)	
Part no.	Description:	Figure
6059933	Power adaptor (without power cord) primary: 100-240 V AC secondary: 24 V DC, 5A, cable with 3-pole plug, Length = 1.6 m (62.99 inch)	
6008448	Connection cable for power adaptor European plug, Length = 2 m (78.74 inch)	 Stecker nach/Plug for: DIN 49444 / EN 50075 B1.1 2000 mm
6008447	Connection cable for power adaptor plug for England (UK), Length = 2 m (78.74 inch)	 2000 mm
6008446	Connection cable for power adaptor plug for USA, Length = 2 m (78.74 inch)	 Stecker nach/Plug for: UL 498, 817 2000 mm
6008449	Connection cable for power adaptor plug for Australia (AUS), Length = 2 m (78.74 inch)	 Stecker nach/Plug for: A.S. 3112 2000 mm

Accessories for the FCU

Part no.	Description:	Figure
3443253	FieldVerification Start-Up Kit	
3443249	FieldVerification Kit	

Part no.	Description:	Figure
349151	OUTLET return hose, open end, transparent, length = 2 m	
3325744	INLET suction hose with open end, color: clear-transparent, Length = 1.5 m (59.06 inch)	
3364502	High pressure adapter, complete	
3152786	Suction strainer, 400 µm for high pressure adapter	
710389	Flow control valve for high pressure adapter	
3209986	Tool to change the flow control valve in the high pressure adapter	
3442973	USB Memory stick	
3504605	BatteryPack, 24 V DC / 4500 mAh	
3524138	12V/24V DC cable with universal plug, including 8A fuse, Length = 1 m (39.37 inches)	
6019455	Connection cable, screened, with 5-pole connector, socket plug, bent, open, length 2 m (ZBE 08S-02)	
6019456	Connection cable, screened, with 5-pole elbow female connector, open cable end, length 5 m (ZBE 08S-05)	
6023102	Connection cable, screened, with 5-pole connector socket plug, bent, open cable end, length 10 m (ZBE 08S-10)	
6040851	Connection cable with 5-way female connector <-> 5-way male connector Length 2 m (ZBE 30-02)	

Part no.	Description:	Figure
6053924	Connection cable with 5-way female connector <-> 5-way male connector Length 3 m (ZBE 30-03)	
6040852	Connection cable with 5-way female connector <-> 5-way male connector Length 5 m (ZBE 30-05)	

*) available on request

Overview - ISO 4406 / SAE AS 4059 and NAS 1638 classes

ISO 4406:1999

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

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

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

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

ISO 4406 table

Allocation of particle counts to cleanliness codes:

Class	Number of particles / 100 ml		Class	Number of particles / 100 ml	
	More than	Up to (and including)		More than	Up to (and including)
0	0	1	15	16,000	32,000
1	1	2	16	32,000	64,000
2	2	4	17	64,000	130,000
3	4	8	18	130,000	250,000
4	8	16	19	250,000	500,000
5	16	32	20	500,000	1,000,000
6	32	64	21	1,000,000	2,000,000
7	64	130	22	2,000,000	4,000,000
8	130	250	23	4,000,000	8,000,000
9	250	500	24	8,000,000	16,000,000
10	500	1,000	25	16,000,000	32,000,000
11	1,000	2,000	26	32,000,000	64,000,000
12	2,000	4,000	27	64,000,000	130,000,000
13	4,000	8,000	28	130,000,000	250,000,000
14	8,000	16,000			

Note: increasing the measurement reference by 1 causes the particle count to double.

Example: ISO code 18 / 15 / 11 means:

Cleanliness class	Particle count / 100 ml	Size ranges
18	130,000 – 250,000	> 4 μm ^(c)
15	16,000 – 32,000	> 6 μm ^(c)
11	1,000 – 2,000	> 14 μm ^(c)

Are in 100 ml of the analyzed sample.

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

	“old” ISO 4406:1987	“new” ISO 4406:1999	
Size ranges	> 5 μm > 15 μm	> 4 μm ^(c) > 6 μm ^(c) > 14 μm ^(c)	
Dimension determined	Longest dimension of a particle	Diameter of the area-equivalent circle ISO 11171:1999	
Test dust	ACFTD dust	1-10 μm ultra fine fraction	ISO 12103-1A1
		SAE Fine, AC Fine	ISO 12103-1A2
		SAE 5-80 μm ISO MTD Calibration dust for particle counters	ISO 12103-1A3
		SAE Coarse Coarse fraction	ISO 12103-1A4
Comparable size ranges	Old ACFTD calibration	Comparable ACFTD dusts	New NIST calibration
	----- 5 μm 15 μm	< 1 μm 4.3 μm 15.5 μm	4 μm ^(c) 6 μm ^(c) 14 μm ^(c)

SAE AS 4059

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

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

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

SAE AS 4059 table

		Maximum particle count / 100 ml					
Size ISO 4402		> 1 µm	> 5 µm	> 15 µm	> 25 µm	> 50 µm	> 100 µm
Size ISO 11171		> 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
Classes	000	195	76	14	3	1	0
	00	390	152	27	5	1	0
	0	780	304	54	10	2	0
	1	1,560	609	109	20	4	1
	2	3,120	1,220	217	39	7	1
	3	6,250	2,430	432	76	13	2
	4	12,500	4,860	864	152	26	4
	5	25,000	9,730	1,730	306	53	8
	6	50,000	19,500	3,460	612	106	16
	7	100,000	38,900	6,920	1,220	212	32
	8	200,000	77,900	13,900	2,450	424	64
	9	400,000	156,000	27,700	4,900	848	128
	10	800,000	311,000	55,400	9,800	1,700	256
11	1,600,000	623,000	111,000	19,600	3,390	512	
12	3,200,000	1,250,000	222,000	39,200	6,780	1,020	

Cleanliness codes according to SAE

Absolute particle count larger than a defined particle size

Example: cleanliness class to AS 4059:6

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

Cleanliness class to AS 4059:6B

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

6 B = max. 19,500 particles > 5 µm in size

Specifying a cleanliness class for each particle size

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

Cleanliness class	Particle count / 100 ml
Size A (> 1 µm / > 4 µm _(c))	100,000
Size B (> 5 µm / > 6 µm _(c))	38,900
Size C (> 15 µm / > 14 µm _(c))	3460
Size D (> 25 µm / > 21 µm _(c))	306

Specifying the highest cleanliness code measured

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

The 6 A – F specification requires a particle count in size ranges A – F.

The respective particle concentration of cleanliness code 6 may not be exceeded in any of these ranges.

NAS 1638

Like ISO 4406, NAS 1638 describes particle concentrations in liquids. The analysis methods can be applied in the same manner as ISO 4406:1999.

In contrast to ISO 4406, certain particle ranges are counted in NAS 1638 and attributed to measurement references.

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

Cleanliness class	Maximum particle count / 100 ml					
	2 to 5 µm	5 to 15 µm	15 to 25 µm	25 to 50 µm	50 to 100 µm	> 100 µm
00	625	125	22	4	1	0
0	1,250	250	44	8	2	0
1	2,500	500	88	16	3	1
2	5,000	1,000	178	32	6	1
3	10,000	2,000	356	64	11	2
4	20,000	4,000	712	128	22	4
5	40,000	8,000	1,425	253	45	8
6	80,000	16,000	2,850	506	90	16
7	160,000	32,000	5,700	1,012	180	32
8	320,000	64,000	11,400	2,025	360	64
9	640,000	128,000	22,800	4,050	720	128
10	1,280,000	256,000	45,600	8,100	1,440	256
11	2,560,000	512,000	91,200	16,200	2,880	512
12	5,120,000	1,024,000	182,400	32,400	5,760	1,024
13	10,240,000	2,048,000	364,800	64,800	11,520	2,048
14	20,480,000	4,096,000	729,000	129,600	23,040	4,096

Increasing the class by 1 causes the particle count to double on average.

Calibrating the FCU

Recalibrate the FCU according to ISO 9000 standard.

We recommend a recalibration of the FCU at least every 3 years.

Customer Service

Current contacts for product support/customer service, repair and spare parts can always be found on our website at www.hydac.com.

For calibration, contact one of the following HYDAC national subsidiaries:

Germany

HYDAC Service GmbH
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 Fax: +55 - 11 - 4393.6617
 E-mail: hydac@hydac.com.br
 Homepage: www.hydac.com.br

Factory default settings

If the "DEFAULT" function is used for a reset, the following settings will be changed to the values shown:

Power Up Menu	Valu	For details, see page:
<i>RADDRESS</i>	<i>R</i>	46
<i>M.TIME</i>	<i>20</i>	47
<i>CALIB</i>	<i>150.SPE</i>	48

The names of the measurement locations as well as all other settings are not affected by the reset.

Upon delivery, the measuring time is set to 10 seconds.

Technical data

ContaminationSensor	
Self-diagnosis	continuously with error indication via status LED and display
Display	LED, 6 / 4 / 4 digits, in 17 segment format
Measured values for solid particle contamination	ISO code / SAE class / NAS class
Measured values for fluid temperature	-25 ... 100°C / -13 ... 212°F
Measured values for water saturation	0 ... 100 %
Meas. range	Display ISO classes min. 9/8/7 ... max. ISO 25/24/23 Calibrated in the range ISO 13/11/10 - ISO 23/21/18
Accuracy	CS: $\pm 1/2$ ISO-Code AS: $\leq \pm 3\%$ over the entire measurement range
Service Display	Flow / Drive
Measuring time programmable	10 ... 300 Seconds
Hydraulic data	
Suitable Fluids	Mineral oil
Hydraulic Connectors	
INLET:	Test connector type 1604
OUTLET:	DN7 nipple socket
INLET operating pressure without high-pressure adapter	-0,5 ... 45 bar / 0 ... 650 psi
With high pressure adaptor	15 ... 345 bar / 217 ... 5000 psi
OUTLET operating pressure	0 ... 0,5 bar max. / 0 ... 7,5 psi max.
Measurement flow rate:	30 ... 300 ml/min (viscosity dependent)
Permissible viscosity range	10 ... 350 mm ² /s / 46 ... 1622 Sus (for hydraulic oil up to ISO VG 68)
Maximal suction height	1 m
INLET suction hose	DN4, open-end, color: clear-transparent, Length = 0.3 m
INLET high-pressure hose	DN4 with screw connection for test point 1620,

ContaminationSensor	
	color: black, Length = 2 m (78.74 inch)
OUTLET return hose	DN7, open-end, color: clear-transparent, Length = 1 m
Electrical data	
Supply voltage	24 V DC, $\pm 20\%$, residual ripple $\leq 10\%$
Power consumption / electricity	100 W max. / 4 A max.
IP class	IP 50 (open, in operation) IP 67 (closed)
Protection class	III (low voltage protection)
General data	
Material of sealings	FPM
Fluid temperature range	0° ... +70° C / 32° ... 158° F
Ambient temperature range	0° ... +45° C / 32° ... 113° F
Storage temperature range	-40° ... +80 C / -40° ... 176° F
Relative humidity	max. 90%, non-condensing
Weight	~ 13 kg

Model Code

	FCU	1	3	1	0	-	4	-	U	-	AS	-	1
Product													
FCU	=	FluidControl Unit											
Series													
1	=	1000 series, 4 particle size channels											
Contamination code													
3	=	ISO4406:1987; NAS 1638 ISO4406:1999; SAE AS4059 (D)											
Housing													
1	=	for portable use (plastic case with a bag)											
Fluids													
0	=	petroleum-based											
Options													
4	=	with integrated pump											
Supply voltage													
U	=	24 V DC											
Integrated Sensor													
AS	=	AquaSensor AS 1000 series											
Power supply adapter													
1	=	100 ... 240 V AC / 50/60 Hz / 1 phase / 5000 mA (Europe, USA/Canada, UK, Australia, Japan)											

Compatible USB sticks - overview

In the following, you will find an overview of the USB memory sticks which HYDAC have tested with the FCU 1310 for compatibility, writing speed and stability in operation.

Manufacturer, name	Type	European Article Number (EAN)	Compatible with FCU 1310	Write speed	Stability
HYDAC (from the delivery)			✓	➔	⬆
SanDisk 2GB Cruzer Micro	SDCZ4-2048-E11	619659023034	✓	⬆	⬆
Emtec Flash Drive USB 2.0 1GB	EKMMD1GC150B	3126170043658	✓	➔	➔
Hama Piko Business 1GB	00090845	4007249908452	✓	⬆	⬇
Silicon Power 2GB Ultima-II	SP002GBUF2M01V1S	4710700395035	✓	⬆	⬆
Platinum ultra high performance 2GB		4027927775046	✓	⬆	➔
CnMemory USB-Stick 2GB	85114_2GB	4040348851144	✓	⬆	⬆
Freecom Data Bar 1GB	29321 / 1GB	4021801293213	✓	➔	➔
Intenso USBDRIVE 1GB		4034303006397	✓	➔	⬇
PNY attaché premium 4GB	P-FD4GBA2M7-BX	3536401508618	✓	⬆	⬇
Sony Microvault Click 2GB	USM2GL	027242737105	✓	⬆	➔
Sony Microvault Click 2GB	USM2GLX	027242737204	✓	⬆	➔
Transcend JetFlash T5 2GB	TS2GJFT5T	0760557814030	✓	⬆	⬇
TDK Trans-IT 2GB	UFD-2GBUEBBL	4902030780036	✓	⬆	⬆
ExcelStor Gstor Mini 8GB	GSMS7008	6935758606102	✓	➔	➔
CnMemory Micro X 512MB			✓	⬆	⬆
Transcend JetFlash V30 8GB			✓	⬆	⬆
Kingston Traveler Mini Slim 2GB	DTMSB/2GB	740617131956	✗		
SanDisk 2GB Cruzer Micro	SDCZ6-2048-E11WT	619659025724	✗		
Emtec Flash Drive USB 2.0 1GB	EKMMD1GM200EM	3126170058126	✗		

Explanation:

✓	Compatible with the FCU 1310	⬆	Excellent
✗	Not compatible with the FCU 1310	⬆	Good
		➔	Ok
		⬇	Bad

EC declaration of conformity



FILTER SYSTEMS

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EC declaration of conformity

FS / 20 / 09

No.

We hereby declare that the following designated product, on the basis of its design and construction, and in the version which we have brought to market, corresponds to the fundamental safety and health requirements contained in the standards listed below.

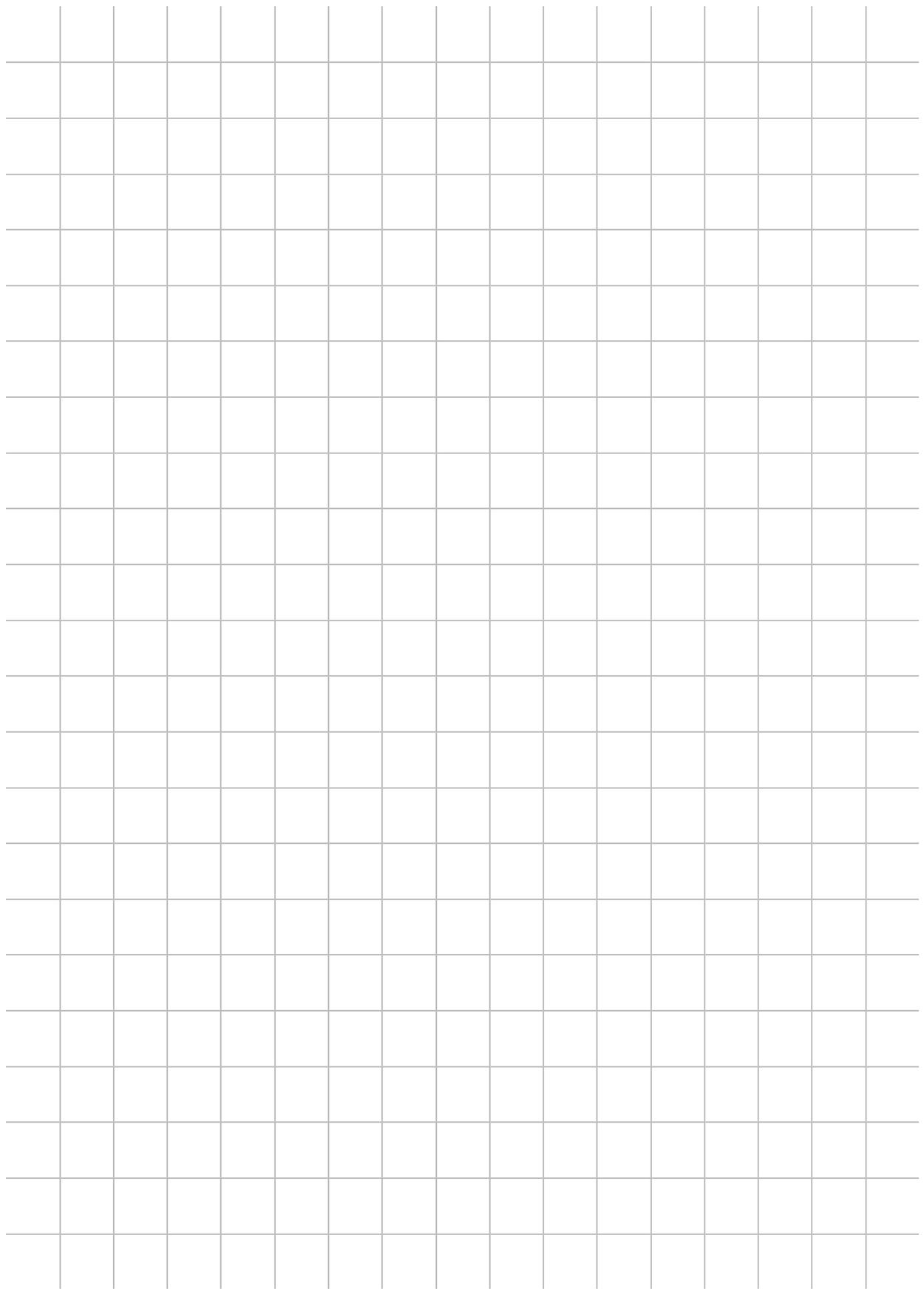
Any modification of this product that is not coordinated with us in writing will cause this declaration to lose its validity.

Designation	FluidControl Unit
Type	FCU1000 Series
Part no.	-
Serial-no.	-
EMC Guideline	2004/108/EC EN 55022; EN 61000-3-2; EN 6100-3-3; EN 6100-4-2 bis 61000-4-6; EN 61000-4-11
EU Machinery Directiv	2006/42/EC
EU Electrical Equipment Regulations	2006/95/EC

2009-12-01	Thorsten Trier	
Date	Name	(CE-authorized person)

Executive director:
Mathias Dieter, Dipl.Kfm. Wolfgang Haerin g
Registered seat of company: 66280 Sulzbach / Saar - Germany
Registry Court: Saarbrücken, HRB 17216
Value added tax identification number : DE 815001609
Tax number : 040/110/50773

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