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1. Safety information

1.1. Dangers of maloperation

The **WSPS 05** underwent a safety and acceptance test based on IEC 1010-1/EN 61010 – 1 part 1. Integrated electronic and hydraulic elements serve protection purposes and ensure safe handling if used the conventional way. False operation or abuse, as well as insensitivity for the device's limits and safety instructions will result in immediate danger for the following:

- the operator's health and life,
- the **WSPS 05** and all systems it is connected to,
- the accuracy of the **WSPS 05**,
- the environment.

This manual includes information and safety instructions, which guarantee safe handling and support your devices unobjectionable condition.

Therefore it is a necessity for all people who operate, install or maintain this device to mind this manual.

1.2. Conventional use

With this **WSPS 05** you have purchased an effective diagnostic system for the saturation level of water in oil. It operates very reliable and meets the requirements of daily use. The set is recommended and tested for the use with:

Standard hydraulic oils:	HL, HLP
Triglyceride:	HETG
Aircraft hydraulics:	Mil H 5606
Synthetic ester:	HEES
Lubrication oils:	CLP

Limits:

Maximum acceptable pressure at the sensor	25 bar	(362,5 psi)
Maximum oil temperature	90° C	(194° F)
Maximum acceptable flow rate at the sensor	2 m/s	(6,5 ft/s)

The **WSPS 05** should always be operated with 12...30 V DC!

2. Operation and installation

2.1. General informations

Water in hydraulic- and lubricating oil is a fluid contamination, which has to be limited urgently due to its negative effects on the characteristics of fluids. Among other effects, it does accelerate oil aging, it causes the failure of polarizing additives, it increases the acid number and it worsens filterability. Effects for a hydraulic or lubricating system are very manifold and cause significantly increased wear, drastically increased risk of failure of components as well as malfunctions.

Important for these effects of water is whether water present in the fluid is free or emulsified, not the total amount of water. Only free water does have the dangerous chemical or biological reactivity. Therefore the detection of the presence of free or emulsified water in a hydraulic or lubricating system is of great importance.

2.2. Measuring principle

The **WSPS 05** does utilize a **capacitive sensor** for measurements.

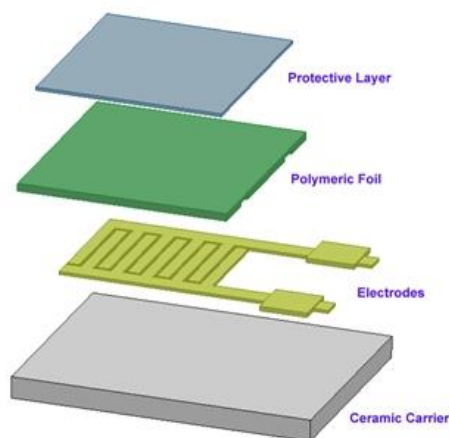
It uses polymeric foil as dielectric for interelectrode capacitance.

This foil is capable of absorbing water molecules due to its microporous structure.

This absorption causes a change in capacity of this element, which is converted into the output signal between **4 and 20 mA**.

Measurements are the **water saturation** of the fluid in **percent**, which is direct proportional to the output signal of the sensor. (see also the characteristic of the sensor in chapter 5.4)

In addition to that a temperature sensor is integrated to determine the exact temperature of the fluid while measuring.



There is a difference to the measurement of the absolute water content with the **Karl-Fischer-method**. The Karl- Fischer-method determines the total amount of free and emulsified water in **mg – water / kg – oil**.

The **WSPS 05** gives the saturation level of the fluid with water in percent.

The indication **100 %** means that the fluid is totally saturated.

Saturation values depend on the temperature!

A relation to the measured saturation values and the stated ppm (mg / kg) value according to Karl Fisher's method is ascertained by the 100 % saturation curve (100% of saturation = $f(T)$) for the measured fluid and the fluid temperature measured at the same time with the saturation.

2.1. Sensor installation

- The **WSPS 05** is intended for inline measurements.
 - Therefore the sensor should be integrated at a circulating, respectively turbulent point of the hydraulic system in order to generate reliable measurements.
 - Please make sure that maximum limits for flow rate and pressure are not exceeded.
 - The time to reach balance on the sensor can vary and depends on a number of factors, such as the oil's viscosity.
- Connect the provided cable to your monitoring and evaluation system. (see also pin assignment in chapter 5.3)
- Connect the sensor cable to the **WSPS 05** by using the plug.



⇒ The sensor is now ready for operation.

2.2. Evaluating measurements

Green range (0...70% saturation)

The presence of free water is unlikely. The water solved in the oil is not a threat!

Yellow range (70...90% saturation)

The presence of free water in small amounts is probable. Additional measurements and actions to reduce the water content are suggested.

Red range (90...100% saturation)

Water is present in its free form. It is a threat and a potential danger of the hydraulic or lubricating system.

Actions to reduce the water content in the fluid are urgently necessary!

The calculation to mg/kg (ppm)– water content is only possible with the specifically saturation characteristic.

Saturation characteristics for specific oils are available upon request.

3. Maintenance

3.1. Sensor cleaning

Cleaning the WSPS 05 is necessary from time to time, especially if the sensor is being used for different fluids.

As cleaning fluid, clean petroleum benzin or even clean Isopropanol can be used.

When cleaning the sensor, please remove the protective cap and proceed with extreme caution.



4. Calibration

4.1. Water saturation

Upon delivery of the WSPS 05 is calibrated based on defined salt solutions. It is recommended to carry out an annual examination of the calibration **by comparison with a hygrometer in air**. In case of variations > 5%, the sensor is to be sent to the manufacturer for a new calibration.

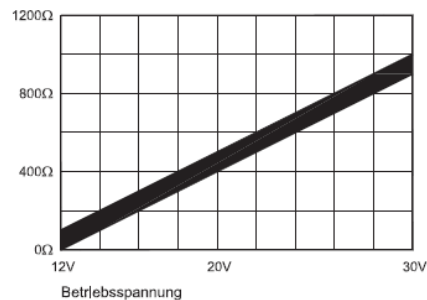
4.2. Integrated temperature sensor

Upon delivery of the WSPS 05 the integrated temperature sensor is calibrated. An annual examination of the calibration at ambient temperature is recommended using a commercially available thermometer. If a new calibration is necessary (variation of the rated value > 10%) the sensor must be sent to the manufacturer.

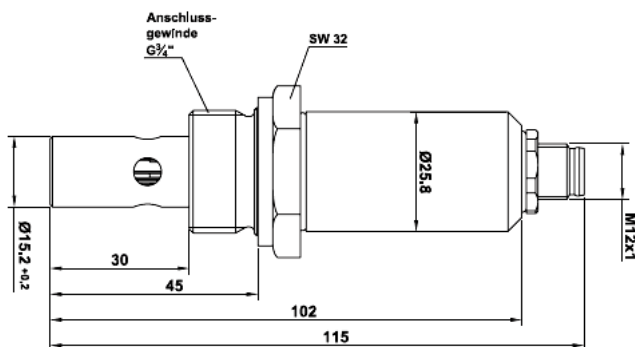
5. Appendix

5.1. Technical Data

Measuring range:	Saturation level: 0 – 100 % Temperature: - 25...+ 100 °C / - 13 °F...212 °F
Accuracy:	Saturation level: ± 2 % Temperature: ± 0,4 %
Operating pressure:	0...25 bar / 0...362,5 psi
Flow velocity:	≤ 2 m/s / 6,6 ft/s
Ambient temperature:	- 25...+ 85 °C / - 13 °F...185 °F
Temperature range of fluid:	- 40...+ 90 °C / - 40 °F...194 °F temporary + 100 °C / 212 °F
Survival temperature:	90 °C / 194 °F
Storage temperature:	-40...+100 °C / -40 °F...212 °F
Power supply:	12...30 VDC
Analogue outputs:	2 x 4...20 mA
Protection class:	IP 65
Screw thread:	G ¾
Ohmic resistance:	



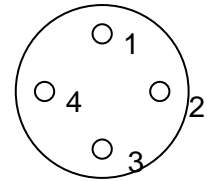
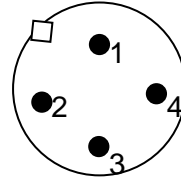
5.2. Dimensions



5.3. Pin assignment

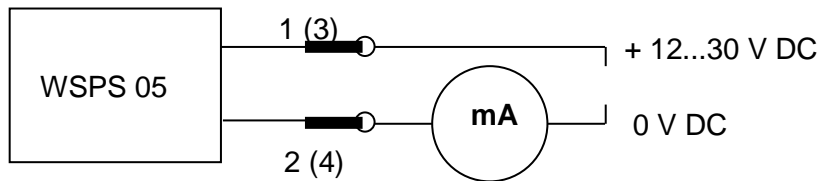
WSPS 05 - Sensor

Pin 1	+ 12...30 V DC
Pin 2	Output 4...20 mA (Saturation)
Pin 3	+ 12...30 V DC
Pin 4	Output 4...20 mA (Temperature)

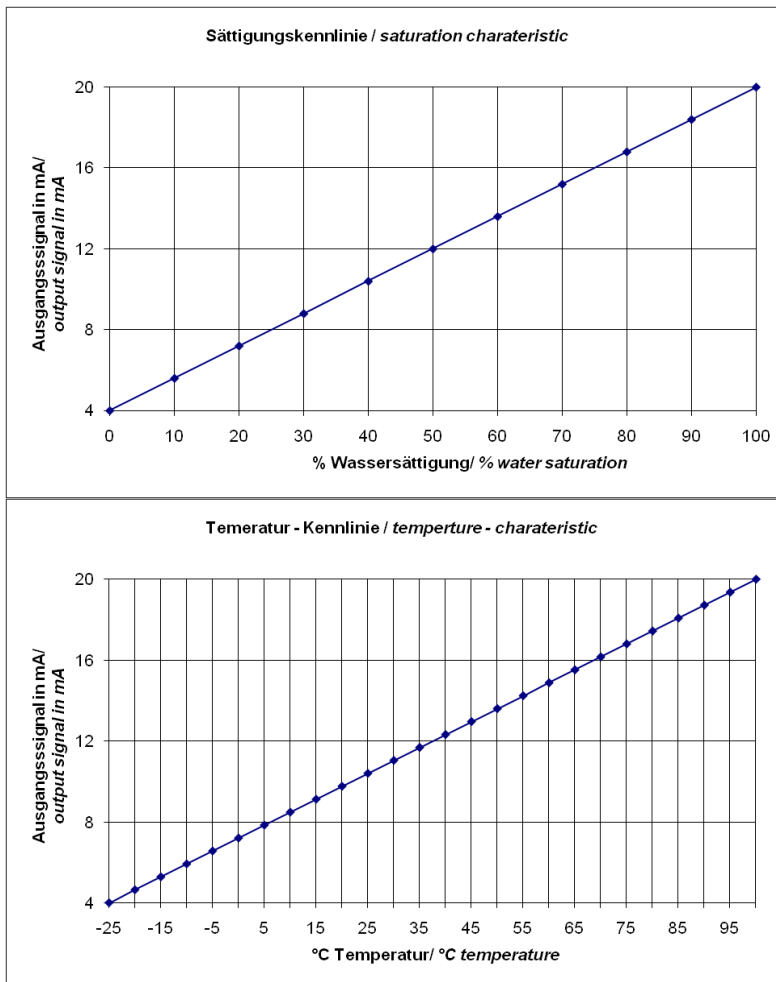


Cable color (Connection cable):

- 1: brown (+ 12...30 V DC)
- 2: white (4...20 mA) Saturation
- 3: blue (+ 12...30 V DC)
- 4: black (4...20 mA) Temperature



5.4. Sensor characteristic



5.5. Application areas - compatibility

Applicable for:

- Hydraulic oils H, HL, HLP, and HV
- Gear oils C, CL, CLP
- Motor oils, Gas oils
- MIL-H-5606 E
- Vegetable oils (HTG, Triglyceride)
- Synthetic ester (HEES)

5.6. Trouble shooting

No settings of the WSPS 05 are done by the operator.

Malfunctions, which could be eliminated by one, are limited to cleaning the sensor and checking cables for breaks.

Any other case requires sending in the WSPS 05 sensor to Eaton Technology GmbH, Altlusshheim branch in order to recover the functions. A brief description of the problem would expedite the trouble shooting and the repair process. To check your warranty or to answer questions by phone we need the serial number and the date of purchase of the instrument.

5.7. Shipment



- (1) Water sensor WSPS 05
- (2) Sensor cable, L = 5 m
- (3) Seal
- (4) Instruction manual

Article no.:

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308536
337461

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