CONDITIONING LONG LIFE

ZILA

Mounting and operating instructions

Lub-6

Oil-quality sensor

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1. Scope of delivery

- Oil-quality sensor Lub-6
- PIN adapter (plug)
- Mounting and instructions

2. General information

Read these installation instructions carefully before using the ZILA oil-quality sensor. Follow the instructions. Keep these mounting instructions in a safe place for future use.

2.1. Installation staff

Assembly, commissioning, electrical connection must only be carried out by qualified staff.

Repairs may only be carried out by qualified electricians.

Operate the device only with the specified voltage.

Modification and conversion of the device is not permitted and releases ZILA GmbH from any warranty and liability.

3. Product description

It is a sensor which is suitable for online monitoring of the oil quality under the mentioned conditions of use and environment. The oil condition is measured using the NDIR (non-dispersive infrared technology) optical measuring principle and can be evaluated using digital interfaces and PC software. The sensor is configured at the factory depending on the application.

The sensor is located in a stainless steel housing and is integrated into the oil circuit via M10x1 screw connections. In addition, the robust design is suitable for direct mounting on the machine and system. The operating voltage is 18...36 V DC.

4. Product features

4.1. Measuring principle

The integrated measuring system consists of a multi-channel infrared measuring cell with associated electronics and periphery. Based on IR absorption, the oil chemistry is measured and processed on individual spectral bands to determine the oil's chemical composition.

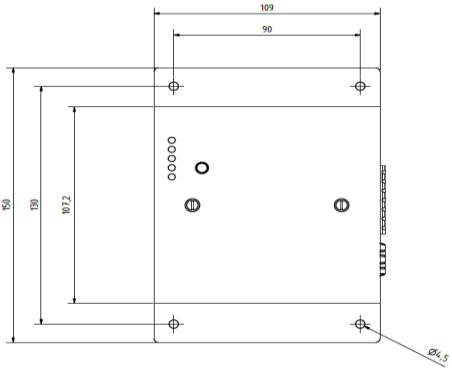
Up to 6 parameters can be determined simultaneously in one system. Which of the following parameters these are is specified by the user before delivery:

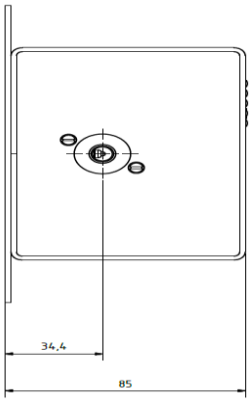
- Oxidation
- Additive content (phenols)
- Ethylene - Glycol
- Water content
- Nitration
- Sulfation
- TAN, TBN
- Soot content

4.2. Technical data

Characteristics	
Operating voltage	18…36 V DC max. current consumption 320 mA @18V
Design	Stainless steel
Operating conditions	
Operating temperature	0 °C to +70 °C
max. operating pressure	10 bar (optionally 30 bar)
Storage temperature	-40 °C to +85 °C
Digital I/O Ports	
Digital Input	1x digital in 18…36 V (10 mA max.)
Digital Output	4x digital out 18…36 V (5 mA max.)
Ethernet Port	
10/100 Mbit/s Ethernet with standard RJ-45 LAN 10/100 Base-T connector	
Communication via manufacturer-independent Busprotocol ModBus TCP	

4.3. Dimensions





All figures in mm

5. Communication

There are two ways to communicate with the sensor:

- Web interface
- ModBus-TCP

Five minutes after switching on the instrument, the first measurement is carried out with the standard settings.

If the measurements are to be carried out with a different setup, the user has the option of carrying out this configuration within these five minutes. Afterwards you have to wait until the measurement is finished.

During this time, the sensor can also receive TCP or digital input measurement requests.

During the measurement time, communication with the device via the web interface or the ModBus TCP is not possible.

5.1. Types of measurement

The device supports different types of measurement. When reading out the measurement data, the respective measurement type is specified for each measurement point

type 0: Measurement after defined time interval from web interface

type 1: First measurement after switching on the device

type 2: TCP start trigger for starting the measurement, then continued with defined time interval (type 0)

type 3: TCP trigger measurement to start measurement at any trigger signal (**Attention:** at least 10 minutes are required between two measurements)

type 4: Start trigger via digital input signal for starting the measurement, then continued with defined time interval (type 0)

type 5: Trigger measurement via digital input signal to start a measurement at any trigger signal (**Attention:** at least 10 minutes are required between two measurements)

type 6: Hard trigger measurement. If type 3 and type 5 are selected and no trigger signal is applied, the system starts a measurement after two days automatically.

type 7: reserved

type 8: reserved

type 9: Due to too large oil temperature changes, the measurement is discarted and instead the previous measurment is record until a stable temperature is reached again. After reaching the stable mode the device resumes its normal operation.

type 10: Due to an internal device error the record is duplicated with the previous measurement records. A new measurement is carried out every 10 minutes (for max. 5-times). If no stable state is reached, the device switches to the device error state (red LED is permanently on).

5.2. Configuration web interface

The configuration of the sensor and the transfer of the measurement data is done via the web browser Google Chrome or Mozilla Firefox of the PC. Proceed as follows:

- Set the PC to IP address **192.168.0.100** or another IP address in the same subnet, but not **192.168.0.102**, because it is the default sensor IP adress if not changed
- Connect the Ethernet cable between the sensor and the PC (**note the firewall setting!**).
- Enter the IP address of the sensor in the browser (**192.168.0.102/index.html**).

The following window opens:

Symbols and description:

Symbol	Description
	**Device information**
	**Instrument settings** **Device test**
	**Measured values and thresholds** Setting the limit values, then transfer changes to the device
	**Alarm and Modifications**
	**Imprint**
	**Device status OK**
	**New measurement necessary** Too large temperature change or internal device error (type 9 or type 10)
	**Device status incorrect**
	**Memory status**
	**Device name and description** Input, then transfer changes to the device
	**System time**
	**User management** Creating or changing password-protected profiles
	**IP configuration** Enter the new sensor IP address (192.168.0.x | x=0...254), then transfer the changes and restart the device
	**Last oil change** Updating time or date, then transfer changes to the device
	**Last measurement**
	**Measuring interval** Setting the interval time, then transfer chamnges to the device
	**Digital I/O configuration** (see 5.2.2.) Use the sliders for LED and output testing
	**TCP Measurement** Setting the measurement type then transfer changes to the device and press „start measurement“
	**Parameter Limits** Setting the thresholds, then transfer changes to the device
	**Oil condition OK**
	**Oil condition medium**
	**Oil condition critical**

	**Transfer changes to the device**
	**Save measured values** **S**ave current measurement data in .txt file
	**Load all measurements** Display of measurement results in graphical form
	**Delete all measurements**

5.2.1. LED status

LED #1	**Sensor status** OFF: No error Flashing slowly: Measurement Flashing quickly: Full memory Red: Device error
LED #2-4	**Output 2-4** - **Parameter monitoring** Red: Threshold value exceeded - **Messaktivität** Red: Measurement active
LED #5	**Power status** Green: Device ON

5.2.2. Digital I/O configuration

Input	- Deactivated - Dedicated event - Start synchronous measurement after start trigger signal (type 4) - Trigger measurement (type 5)
Output 1	Device status (error status)
Output 2-4	- Deactivated - Measurement activities - Monitoring of single parameters - Monitoring all thresholds

5.3. ModBus TCP

The ModBus protocol is based on a master/slave or client/server structure and is part of the IEC 61158 standard. For communication, the device is connected to a PC or a controller via Ethernet cable. The device and PC are located in the same subnet (**192.168.0**.xx).

5.3.1. Supported data types in ModBus TCP

The following data types are supported by the device:

Data type	Size	Type of
Discrete Inputs	1 bit	Read only
Holding Registers	16 bit unsigned	Read/Write (with exceptions)
Input Registers	16 bit signed registers	Read only

5.3.2. Supported functions

The following ModBus TCP functions are supported by the device:

Function Name	Code	Hex
Read Discrete Inputs	02	0x02
Read Holding Registers	03	0x03
Read Input Registers	04	0x04
Write Single Registers	06	0x06
Write Multiple Registers	16	0x10

5.3.3. Supported exception codes

The following ModBus TCP exception codes are supported by the device:

Exception Code	Description
01	**Unknown function**. The received message is not a valid action for the addressed device
02	**Unknown data address.** The address referred to in the "Function-dependent data" section of the message is not valid in the addressed device
03	**Unknown data value.** The value referenced at the addressed device location is not within the valid range
04	**Failure of a slave device.** The addressed device could not process a valid message due to a bad device condition

5.3.4. Registers

Functions that are read or written by the device are mapped as follows to **11** discrete inputs, **39** hold registers and **9** input registers:

Discrete Input Number	Address	Description
Discrete Input 1	0x0000	Measurement status (**0** if no measurment is in progress)
Discrete Input 2	0x0001	Internal memory status (**1** if memory is full, otherwise **0**)
Discrete Input 3	0x0002	TP channels have exceeded the threshold values **0**: No threshold exceeded **1**: One or more channels have exceeded the threshold values
Discrete Input 4	0x0003	TP 1.1 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded
Discrete Input 5	0x0004	TP 1.2 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded
Discrete Input 6	0x0005	TP 1.3 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded
Discrete Input 7	0x0006	TP 1.4 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded

Discrete Input 8	0x0007	TP 2.1 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded
Discrete Input 9	0x0008	TP 2.2 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded
Discrete Input 10	0x0009	TP 2.3 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded
Discrete Input 11	0x000A	TP 2.4 has exceeded the threshold **0**: Threshold not exceeded **1**: Threshold exceeded

Holding Register Number	**Address**	**Description**
Holding Register 1 *	0x0000	TP 1.1 (raw value 1 or reference value)
Holding Register 2 *	0x0001	TP 1.2 (raw value 2)
Holding Register 3 *	0x0002	TP 1.3 (raw value 3)
Holding Register 4 *	0x0003	TP 1.4 (raw value 4)
Holding Register 5 *	0x0004	TP 2.1 (raw value 5 or reference value)
Holding Register 6 *	0x0005	TP 2.2 (raw value 6)
Holding Register 7 *	0x0006	TP 2.3 (raw value 7)
Holding Register 8 *	0x0007	TP 2.4 (raw value 8)
Holding Register 9 *	0x0008	TP 1.1 (Absorptionswert)
Holding Register 10 *	0x0009	TP 1.2 (absorbance value)
Holding Register 11 *	0x000A	TP 1.3 (absorbance value)
Holding Register 12 *	0x000B	TP 1.4 (absorbance value)
Holding Register 13 *	0x000C	TP 2.1 (absorbance value)
Holding Register 14 *	0x000D	TP 2.2 (absorbance value)
Holding Register 15 *	0x000E	TP 2.3 (absorbance value)
Holding Register 16 *	0x000F	TP 2.4 (absorbance value)
Holding Register 17 *	0x0010	Read type of measurement (type 0 to type 6)
Holding Register 18	0x0011	Last measurement (year)
Holding Register 19	0x0012	Last measurement (month)
Holding Register 20	0x0013	Last measurement (day)
Holding Register 21	0x0014	Last measurement (hour)
Holding Register 22	0x0015	Last measurement (minute)
Holding Register 23	0x0016	Last measurement (second)
Holding Register 24 *	0x0017	Measurement Interval [minute]

Holding Register 25 *	0x0018	Number of cycles
Holding Register 26 *	0x0019	Cycle time [seconds] [1/Hz]
Holding Register 27 *	0x001A	Channel 1 min. power
Holding Register 28 *	0x001B	Channel 1 max. power
Holding Register 29 *	0x001C	Channel 2 min. power
Holding Register 30 *	0x001D	Channel 2 max. power
Holding Register 31	0x001E	Last oil change (year)
Holding Register 32	0x001F	Last oil change (month)
Holding Register 33	0x0020	Last oil change (day)
Holding Register 34	0x0021	Last oil change (hour)
Holding Register 35	0x0022	Last oil change (minute)
Holding Register 36	0x0023	Last oil change (second)
Holding Register 37	0x0024	Read/Write TCP measurement **0**: TCP measurement deactivated **1**: Synchronous measurement after TCP start trigger signal **2**: TCP trigger measurement
Holding Register 38 *	0x0025	Serial number
Holding Register 39*	0x0026	Firmware version

Input Register Number	**Adress**	**Description**
Input Register 1	0x0000	NTC_IR1 (temperature optical detector 1 [°C])
Input Register 2	0x0001	NTC_IR2 (temperature optical detector 2 [°C])
Input Register 3	0x0002	PT1000 (temperature oil [°C])
Input Register 4	0x0003	1. Byte IP address
Input Register 5	0x0004	2. Byte IP address
Input Register 6	0x0005	3. Byte IP address
Input Register 7	0x0006	4. Byte IP address
Input Register 8	0x0007	Memory usage [%]
Input Register 9	0x0008	Error status **0**: No error **1**: IR-Error **2**: Full memory **3**: Others

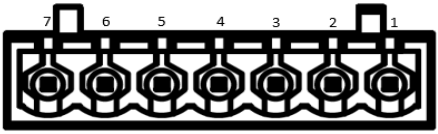
Explanations:

- The values of the hold registers 1-17 should be divided by 1,000. For example, if the value of holding register 1 is 10351, this corresponds to a value of 10.351 for TP1.1.
- The values of Holding Registers 27-30 should be divided by 100.
- Holding registers with asterisks (*) (holding register 1-16, holding register 24-30 and holding register 38,39) are intended to be read-only.

- The values of input registers 1-3 should be divided by 10. If the value read by input register 2 is 705, this corresponds to a temperature of NTC_IR2 = 70.5 degrees Celsius.
- MODBUS TCP of the device supports communication with a maximum of five active connections simultaneously. A new message replaces the oldest message of the previous five.

6. Electrical connections

Pin assignment:



Connection	Description	PIN
+Vcc	Operating voltage	1
GND	Ground	2
Digital Input	Configurable	3
Digital Output 4	Configurable	4
Digital Output 3	Configurable	5
Digital Output 2	Configurable	6
Digital Output 1	Device status (error status)	7

7. Mounting and comissioning

7.1. Mounting

The sensor should be integrated into the pipe of the oil circuit in the plant. The specified ambient conditions (pressure < 10 (30) bar, temperature < +70 °C) must be observed. For optimum operation, larger temperature fluctuations in the fluid should be avoided during a measurement.

If the plant is later equipped with the sensor system, a pipe must be separated and the sensor installed in between. A bypass connection is recommended for higher volume flows.

Since the sensor represents a narrow point (0.2 x 5 mm over a depth of 30 mm), it must be ensured that oil flow through the sensor is guaranteed.
In the default setting, a new measured value is recorded every 2h. This value can also be changed if required. In any case, however, the oil in the measuring pipe must be replaced by the oil flow within this time.

The power supply of 18...36 V must be guaranteed. When the device is connected to the power supply, the user will notice the green power LED is on, and other red LEDs will be on for three seconds. **A query of the data is only possible via LAN cable**. Therefore, the sensor should be equipped with a LAN cable which is routed to an accessible location.

On the front side of the sensor, holes with an M10x1 female thread are provided for the process connections. The sensor can be integrated into the process via two screw-in fittings with seals.

7.2. Comissioning

Since the oil condition sensor Lub-6 is a sensitive measuring instrument, it is recommended to handle the instrument carefully.

Before installation and commissioning, check whether the ambient conditions are suitable for the use of the instrument.

Make sure that the sensor is connected correctly and that the power supply is switched on.

8. Maintenance

Thanks to NDIR technology, the Lub-6 oil condition sensor is largely maintenance-free.

In order to ensure continuous operation, care should be taken to ensure that a permanent oil flow takes place in the measuring cell.

Every oil or every type of oil has its own spectral characteristics. If you switch to a different type of oil, this could also mean changing the internal absorption filters.

8.1. Factory Reset

A factory reset is possible. Therefore please contact ZILA GmbH.

9. Equipment and support

The sensor is currently still in the testing phase.

For questions about this product please use the given contact possibilities.

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