WIO200
Water in oil sensor

User manual Rev. 1.15

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APPROVALS: ISO 9001, ISO 14001, ISO 13485, IRIS, IEC 61340-51 & IPC-A-610 CLASS 3

TABLE OF CONTENTS

INTRODUCTION

This datasheet provides technical data regarding the WIO (water in oil) sensor system. The system consist of a WIO Sensor, terminal box and cables. The WIO Sensor is an insitu sensor which measures water content in lubrication oils on ship engine or similar. The Terminal box connects the sensor to power supply and to the ships surveillance system. The supplied cables are for connection between the WIO Sensor and the Terminal box

SAFETY ADVICE

For your safety

The *WIO-200* (WIO) was designed as water in oil monitoring system, with a relay switch-off function.

Before use please read the instruction manual and carefully store it in a safe place. Install and operate the device only after reading and comprehending the instruction manual, and after you are familiar with the valid rules on work safety and accident prevention.

Please use the device only as specified. For this purpose please also note the values in section “Technical data”.

During transport, storage and operation please adhere to the conditions listed in “Technical data”.

Please observe all warning signs listed in other sections of this manual. These signs are clearly highlighted!

IMPORTANT

Only qualified personnel may assemble start-up and maintain the unit when it is in a zero voltage state. Only qualified electricians may work on electrical installations.

IMPORTANT

The connection and instruction manual contains information that enables the proper and efficient use of the WIO monitoring system. PAJ SYSTEMTEKNIK is not liable for damage caused be improper use of this device. This manual is an integral part of the basic knowledge necessary for proper use of the system.

PAJ SYSTEMTEKNIK reserves the right to alter its products without prior notice.

Copying and using the instruction manual for other purposes is only allowed with the acceptance from PAJ SYSTEMTEKNIK.

PAJ SYSTEMTEKNIK accepts no responsibility for possible errors and deficiencies in brochures, catalogues and other printed material.

PAJ SYSTEMTEKNIK guarantees correct function as well as fulfillment of the safety requirements only when connections are made in accordance with instructions.

Safety observations

The comments about safety in this document will not discuss safety observations of individual machine parts where safety devices (usually safety relays) are applied.

Here the respective instruction manuals will be referenced! This document merely describes how to establish a WIO and how to start it up.

WARNING

The monitoring system during machine operation cannot be guaranteed if the system is connected incorrectly or not used as specified. This may lead to fatal injuries. Interventions and changes to the WIO monitoring system are not permitted, unless they are explicitly described in this instruction manual or be written from PAJ Systemteknik.

The regional legal regulations and conditions of the liability insurance of the employer must be maintained.

IMPORTANT

Area of application

The WIO monitoring system is usually used in engines were a WIO will monitor the water content in lubricant oil.

The advantage of this monitoring system is the simple 4-20 mA interface and the two relays indicating alarms.

FUNCTION

Short description of the function

PAJ SYSTEMTEKNIK has developed a water in oil (WIO) monitoring system. The fundamental idea of the WIO system is to easily and continuously monitor the water activity (a_w) in oil. The output is converted into a standard 4-20 mA output.

The system also includes two relays indicating when too much water is present in the system. Default alarm values are set to 0,5 a_w (high alarm) and 0,9 a_w (high high alarm)

WARNING

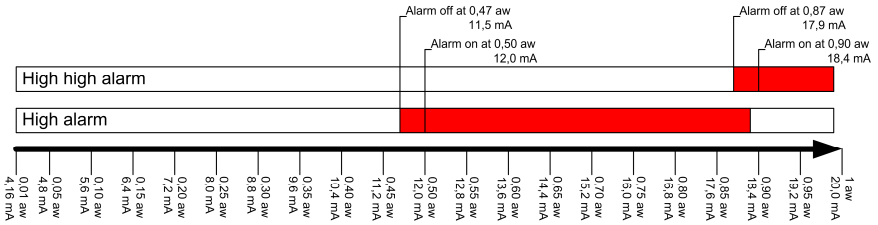
Do not use the sensor or relays to automatically enable/turn on or disable/shut down engine. The decision to enable/turn on or disable/shut down an engine, based on the sensor data, must be taken by proper trained crew personnel, not by the sensor system.

NORMAL OPERATION

Water activity (aw) provides the relative availability of water in oil where pure oil has an activity of zero and oil saturated with distilled water has an activity of exactly one. Under normal operation the WIO200 continuously supplies an output analogue signal of 4 to 20 mA corresponding to 0.01 to 1.00 aw. Alarm indications with 0.03 aw hysteresis via 2 relays are provided for each sensor. These alarm values were specified upon ordering can be found on the sensor serial label.

Default alarm values are 0,5 aw and 0,9 aw. Assumes these alarm values:

High alarm on at 0,50 aw (12 mA).
High alarm off at 0,47 aw (11,5 mA)
High high alarm on at 0,90 aw (18,4 mA).
High high alarm off at 0,87 aw (17,9 mA).
High high alarm will disable high alarm, thus only one alarm can be active.



FAILURE INDICATION

Internal function failure will be indicated by activating both alarm relays at the same time, or indicated as defined in the NAMUR NE43.

Internal failures includes:

- Sensor reading out of range.
- Sensor reading CRC error.
- Unstable Sensor reading.

NAMUR NE43 is a German fault detection standard for 4-20mA analogue signals. It allows the user to know if there is a fault within the instrument, by sending analogue signal below 4mA and/or above 20mA. In accordance with NAMUR NE, the failure is indicated if:

- Fault indicated by analogue output =<2,0 mA

SELF TEST FOR ALARM FUNCTIONS

On the WIO Sensor there is a button for testing the alarm functions. By pushing the button for 5 sec the high alarm relay turns on, and by pushing the button for 10 sec the high high alarm turns on. The alarms turn off 5 sec after they are activated.

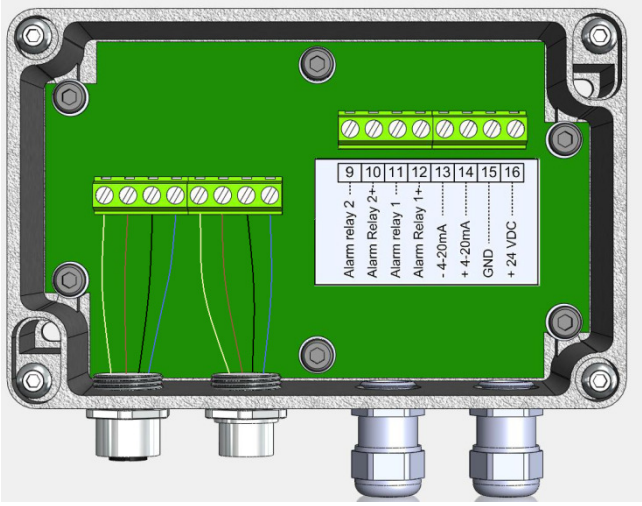
Test Button	Mode	Output Relay	Analogue Output
Un-pressed	Normal operation	Normal	Normal
Pressed >5 sec	Test of high alarm	Relay 1 high Relay 2 low	Normal
Pressed >10 sec	Test of high high alarm	Relay 1 low Relay 2 high	Normal

INSTALLATION

IMPORTANT

Only qualified personnel may assemble and maintain the unit. Only qualified personel may install the unit.

Screw in probe with ISO 228-1 G ¾" thread pressure-tight directly in the centre of the oil pipe where the measurement is to take place. The threads should be sealed with Loctite® 271. The sensor should be mounted with max. 35 Nm momentum. Connect the cables from the WIO sensor to the Terminal box.



To sensor Power and Alarms

IMPORTANT

Only qualified personnel may assemble start-up and maintain the terminal box(es) when it is in a zero voltage state. Only qualified electricians may work on electrical installations.

Install +24 VDC and GND into the terminal box and connect the 4-20 mA to an external device if needed. Connect the relay to external device if needed.

Last connect the cables from the Terminal box to the sensor.

IMPORTANT

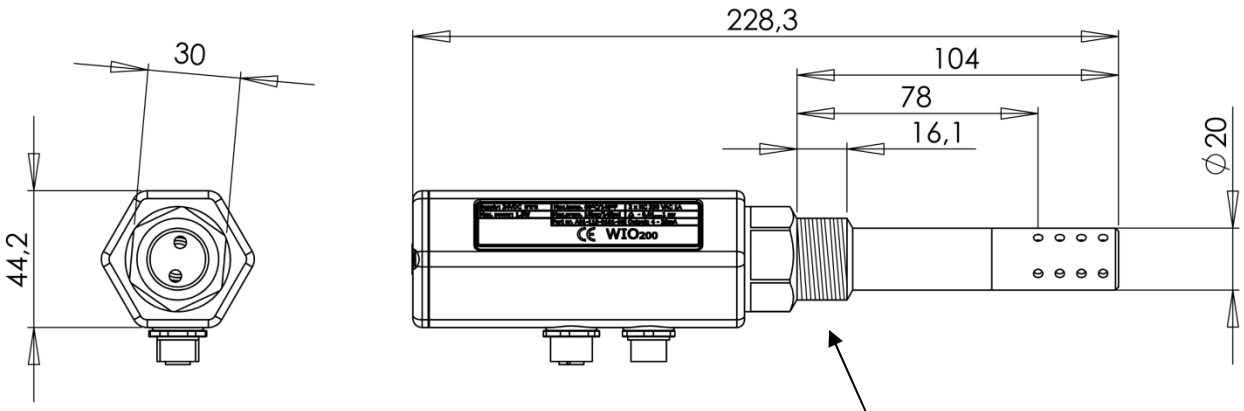
It is allowed (but not necessary on all terminal boxes) to connect screw terminal 13 "-4-20 mA" to screw terminal 15 "GND", thus creating common ground for the output and the power.

IMPORTANT

Terminal boxes with Displays (PPM, % H2O). Screw terminal pin 13 and 14 must be connected to external equipment. If these 2 pins are not connected to external equipment they must be short circuited, otherwise the equipment will show incorrect numbers.

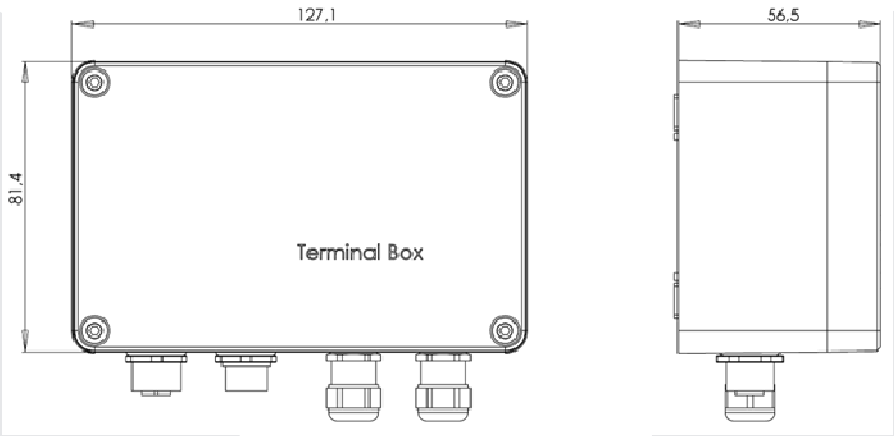
DIAGRAMS

Dimensions (in mm):



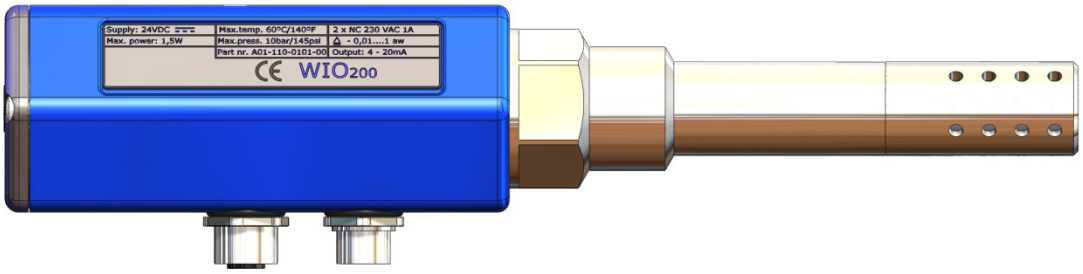
Sensor dimensions in mm

ISO 228-1 G ¾" Thread



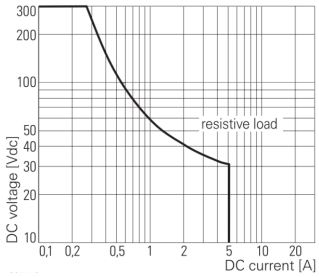
Terminal Box dimensions in mm (all versions)

TECHNICAL SENSOR DATA



Output	
Analogue output	4 – 20 mA (galvanic isolated)
Max. Load (analogue output)	< 500Ω[1]
Measurement Range (4 – 20 mA)	0,01 – 1,00 a_w
Accuracy (0,05-0,95 a_w)	± 0,03 a_w
Accuracy (outside 0,05-0,95 a_w)	± 0,05 a_w
Resolution	< 0,004 a_w
Input	
Supply nominal voltage	24V DC ± 20%
Max. residual voltage ripple	10%
Maximum Load current	58 mA + output load current
Max. Power input	< 2,4 VA
Relays	
Contact arrangement	Normally Open (N-O)
Rated voltage	250 VAC
Max. switching voltage	400VAC
Rated current	5A
Breaking capacity max.	1250VA

[1] This specification is under the assumption that the number of Terminal boxes with Display attached to the WIO is maximum one. If more Terminal boxes with Display are to be connected, then call PAJ for advice.

Max. DC Load breaking capacity	
Relay 1	*„HA alarm“*
Relay 2	*„HHA alarm“*
Default HA alarm	0,50 a_w
Default HHA alarm	0,90 a_w
Media for measurement	
Lubrication oil	Grade SAE 30/TBN 5-10
Max. Oil temperature	85°C
Max. Oil pressure	40 Bar
Response times	
Delay before valid data from start-up	< 30 s
Delay before valid data from installation (first use)	10 minutes
Device Failure Indication	
Analogue output	< 2 mA
Manual test	
Press sensor button for 5 seconds	HA Alarm turns on for 5 seconds
Press sensor button for 10 seconds	HHA Alarm turns on for 5 seconds
Miscellaneous	
Ambient Temperature, running / storage	0 - +85°C / -30 - +85°C
Relative humidity for running and storage	10% up to 95%, no condensation
Re calibration	Recommended with max 3 years interval
Warranty	2 years
Cables	Shielded cables, 2 meter, PG9 plugs
Approvals	
Germanischer Loyd	Cert. no 75 956 – 09 HH.
Enclosure	
Weight	626 grams (1,38 Lbs.)
Connection (mechanical)	ISO 228-1 G ¾ male thread.
Enclosure material	Stainless Steel
Protective type	IP66

TECHNICAL DATA TERMINAL BOX

IMPORTANT

The Terminal box is supply power to the WIO sensor and outputs 4-20 mA including alarm relays from the sensor.

Enclosure	
Weight	626 grams (1,38 Lbs.)
Connection (mechanical)	2 x PG9 connectors (male + female)
Enclosure material	Aluminimum
Protective type	IP66
Warranty	2 years
Order	
Order number	A01-110-0102-00

TECHNICAL DATA TERMINAL DISPLAY BOX

IMPORTANT

The Terminal box is supply power to the WIO sensor and outputs 4-20 mA including alarm relays from the sensor.

The display is an indication of the water level in the oil. Display can be shipped as PPM (H20), % (H20) or aw

IMPORTANT

Upon ordering a PPM (H20), % (H20) display the customer must specify the water saturation point in PPM of the used oil at the preferred working temperature of the oil. The saturation point is typically between 3000-10000 PPM. Alternatively the customer can ship 10 liters of oil to PAJ for inspection including specification of the working oil temperature.

WARNING

All displays will show from positive values when operating properly. If a negative value is present the Terminal box might have been installed incorrectly.

Enclosure	
Weight	626 grams (1,38 Lbs.)
Connection (mechanical)	2 x PG9 connectors (male + female)
Enclosure material	Aluminimum
Protective type	IP66
Warranty	2 years

Display version - a_w (water activity)	
Accuracy (0,05-0,95 a_w)	± 0,03 aw
Resolution	<0,004 aw
Order No.	Call
Display version - PPM (H_20)	
Accuracy (0,05-0,95 a_w)	30%
Resolution	10 ppm
Order No.	A01-110-0104-00
Display version – % (H_20)	
Accuracy (0,05-0,95 a_w)	30%
Resolution	10 ppm
Order No.	A01-110-0106-00

EC-DECLARATION OF CONFORMITY

A01-110-0101-00

PAJ SYSTEMTEKNIK, Grundtvigs Allé 163, DK-6400 Sønderborg, Denmark
Manufactor

Declare under our sole responsibility that the product:
unit identification: **WIO200**
product classification: **Water In Oil measuring instrument**
is a safety tested component according to EC Guideline:

2004/108/EC Electromagnetic compatibility
2006/95/EC Low voltage directive

to which this declaration relates is in conformity with the following standard(s) or other normative documents(s):

IEC 61326-1:2006-11-03, EN 61010-1:2001, EN 60529 Edition 2.1 2001-02,
IEC 60068-1:1988, IEC 60068-2-2:2007, IEC 60068-2-1:2007, IEC 60068-2-30:2005,
IEC 60068-2-6:2007, IEC 61000-4-16:1998-01, IEC 61000-4-6:2007, IEC 61000-4-3:2006,
IEC 61000-4-5:2005, IEC 61000-4-2:2001, IEC 61000-4-4:2004

The described product corresponds to the following European Directives:

2004/108/EC Electromagnetic compatibility
2006/95/EC Low voltage directive

Consistency of a production sample device with the marked product in accordance with the Directives No:

2004/108/EC Electromagnetic compatibility
2006/95/EC Low voltage directive

Notified agency/Address:

Germanischer Lloyd AG Head Office
Deputy Head of Department
Automation, Navigation and Communication (MC-EA)
Vorsetzen 35
D-20459 Hamburg/Germany

75 956 – 09 HH
Certification number

2009-11-30
Date of issue

The marked product is consistent with the examined production sample device.

Technical documentation:

Jacob M. Heder Msc.E.E

Grundtvigs Allé 163 • DK-6400 Sønderborg • Tel: +45 74 43 71 81 • E-Mail: paj@paj.dk

Sønderborg, 15.04.2011
Date of issue

Poul Jessen, Managing Director
Name and signature

Type Approval Certificate

Germanischer Lloyd

This is to certify that the undernoted product(s) has/have been tested in accordance with the relevant requirements of the GL Type Approval System.

Certificate No.	**7595609 HH**
Company	**PAJ Systemteknik** **Grundtvigs Allé 163** **6400 Sonderborg, DENMARK**
Product Description	**Water in Oil Monitor**
Type	**WIO200**
Environmental Category	**D, EMC 2**
Technical Data / Range of Application	**Sensor which measures water content in lubrication oils on ship engine** **Condition Monitoring Component (according to GL I-1-17, Section 2, D.2.)** **WIO Sensor system nr: A01-110-0100-00** **Consists of:** **- WIO Sensor nr: A01-110-0101-00** **- Terminal Box nr: A01-110-0102-00** **- Sensor cables 2 pcs. Order nr: A01-110-0103-00** **The technical specification is shown on page 2.** **Software Version 111197-810 Rev 1.00**
Test Standard	**Guidelines for the Performance of Type Approvals Chapter 2, Edition 2003**
Documents	**Test report : 2009-02260 EMC, 2009-01456, 2009-01456R2LM, 2009-02373** **111197-900 WIO Sensor Specifications Rev.1.00, Datasheet 111197-902 Rev.1.00** **Software Questionaire according to requirement class 3, dated 28.09.2009**
Remarks	**Rules GL I-1-17 to be observed for Condition Monitoring (CM). Alarm settings have to be specified by engine manufacturer if sensor is used for CM.**
Valid until	**2014-11-29**

Page **1** of **2**

Type Approval Symbol GL

File No. **I.A.10**

Hamburg, 2009-11-30

Germanischer Lloyd Jürgen Wittburg Marco Rinkel

This certificate is issued on the basis of "Regulations for the Performance of Type Tests, Part 0, Procedure".

Internet Publication: GL-Approvals

Type Approval Certificate

Germanischer Lloyd

This is to certify that the undernoted product(s) has/have been tested in accordance with the relevant requirements of the GL Type Approval System.

Certificate No. **7595609 HH**

Technical Specification:

Measuring range: 0,01 to 1,00 aw water content.
Accuracy: ±0,03 aw for the range 0...1 aw water content
Resolution: Minimum 0,01 aw water content.
Analogue output: 4 to 20 mA (galvanic isolated) 0,01 to 1 aw water content linear
Max. Load (analogue outp.) < 500Ohm
Alarm indications. Alarm indication via 2 x Alarm relays (NC).
Media for measurement: Lubrication oil: Grade SAE 30/TBN 5-10
Service temperature of media: 10 to 60 °C.
Pressure range: 0 to 10 bar

Valid until **2014-11-29**

Page **2** of **2**

Type Approval Symbol

File No. **I.A.10**

Hamburg, 2009-11-30

Germanischer Lloyd Jürgen Wittburg Marco Rinkel

This certificate is issued on the basis of "Regulations for the Performance of Type Tests, Part 0, Procedure".

Internet Publication: GL-Approvals

ORDERING INFORMATION

Order item no:

WIO system Standard	Order nr:	A01-110-0100-00
WIO system w/display (PPM)	Order nr:	A01-110-0107-00
WIO system w/display (% H2O)	Order nr:	A01-110-0105-00

WIO system Standard consists of :

WIO Sensor	Order nr:	A01-110-0101-00
Terminal Box	Order nr:	A01-110-0102-00
Sensor cables 2 pcs.	Order nr:	A01-110-0103-00
Manual	Order nr:	D80-105-0008-00
Test certificate	Order nr:	Serial number on the sensor

WIO system w/display (PPM) consists of (*1):

WIO Sensor	Order nr:	A01-110-0101-00
Terminal Box w/display (PPM)	Order nr:	A01-110-0104-00
Sensor cables 2 pcs.	Order nr:	A01-110-0103-00
Manual	Order nr:	D80-105-0008-00
Test certificate	Order nr:	Serial number on the sensor

WIO system w/display (% H2O) consists of (*1):

WIO Sensor	Order nr:	A01-110-0101-00
Terminal Box w/display (% H2O)	Order nr:	A01-110-0106-00
Sensor cables 2 pcs.	Order nr:	A01-110-0103-00
Manual	Order nr:	D80-105-0008-00
Test certificate	Order nr:	Serial number on the sensor

*1 Customer must specify water saturation level in PPM in the oil used and at working temperature and oil pressure in Bar; alternatively the customer can ship 10 litres of oil to PAJ for inspection including specification of the working oil temperature and oil pressure in Bar

COMPANY INFORMATION

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Tel: (0045) 74437181
Mail: paj@paj.dk

Instruction manual en 111197-920 Rev. 1.15