Operation manual
Water in Oil detection system
Monitoring box MPU010

Read this manual prior to performing any task!

Operation manual

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Supplemental directives

Contents of this manual

This manual contains specifications for transport, installation, operation, maintenance, and troubleshooting of the Water-in-oil measuring system monitoring box MPU010 (subsequently referred to as “device”).

Prior to beginning any work, personnel must have carefully read through and understood this manual. The manual is an integral part of the device and must be stored in the immediate vicinity of the device so that it is always accessible to personnel.

A prerequisite for safe working is the observance of all safety instructions and handling instructions stated in this manual.

Furthermore, the local accident prevention provisions and general safety regulations also apply for the area of application of the device.

Figures in this manual serve to provide a basic understanding and can differ from the actual version.

Copyright

Additional applicable documents

Documents of Dr. E. Horn GmbH & Co. KG

- Drawing of the device
- Parameter list

Documents of other manufacturers

In addition to this manual, the manuals included in the delivery for the in- stalled components also apply. The instructions they contain – especially the safety instructions – must be observed.

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1 SAFETY

1.1 EXPLANATION OF SYMBOLS

Safety instructions

Safety instructions in this manual are indicated by symbols. The safety instructions are introduced by signal words, which express the scale of the hazard.

⚠ DANGER

This combination of symbol and signal word indicates an immediately dangerous situation that could lead to death or serious injuries if it is not avoided.

⚠ WARNING

This combination of symbol and signal word indicates a potentially dangerous situation that could lead to death or serious injuries if it is not avoided.

⚠ CAUTION

This combination of symbol and signal word indicates a potentially dangerous situation that could lead to minor injuries if it is not avoided.

NOTICE

This combination of symbol and signal word indicates a situation that could lead to property damage or harm to the environment if it is not avoided.

Safety instructions within handling instructions

Safety instructions can refer to certain individual handling instructions. Such safety instructions are embedded in the handling instruction so that readability is not disturbed when carrying out the activity. The signal words described above are used.
Example:

Release screw.

⚠ CAUTION! Pinching hazard in the cover!

Close the cover carefully.

Tighten screw.

Tips and recommendations

This symbol indicates useful tips and recommendations as well as information for efficient and trouble-free operation.

Markings

To highlight handling instructions, results, lists, references and other elements, this manual employs the following markings

⇨ Results of action steps

↳ References to sections in this manual and other applicable document

– Lists without a specified sequence

“Menu” Menus of the web interface

1.2 Intended use

Use

This device is designed and constructed exclusively for the intended use described here.

The water-in-oil detection system is intended exclusively for the installation in engines.
The device is used for measuring and monitoring the concentration of dissolved water in the engine lubrication oil.
↺ Chapter 12 “Technical data” on page 67
Proper use also includes the observance of all information within this manual.

Foreseeable misuse

Any usage of the device that is other than or beyond the intended use is considered misuse and can lead to dangerous situations.
Foreseeable misuse includes:

Setting up or operating the device in a potentially explosive atmosphere.

Use of the device with connected loads that do not match the specifications.

Use of the device with a wrong power supply.

Unauthorized modifications, extensions, or conversions of the device.

⚠ WARNING

Danger posed by misuse!

– **Do not undertake any unauthorized modifications, extensions, or conversions on the device.**

Misuse of the device can lead to dangerous situations.

1.3 Residual risks

The device has been designed according to the latest technological standards and safety requirements.
Nevertheless, residual risks remain, which require cautious handling.
The following lists the residual risks and the appropriate conduct and measures they require.

1.4 BASIC HAZARDS AT THE WORKPLACE

Running engine

⚠ WARNING

Danger of death due to running engines!

- **Prior to all work, switch off the motor and secure it against being switched on again.**

Starting the motor while working on or inside the motor may lead to serious or fatal injuries.

Opened housings

⚠ WARNING

Danger of explosion with housing opened in dangerous atmospheres!

- **Do not open the housing in a dangerous atmosphere if the device is switched on.**

If a dangerous atmosphere is present, the housing may not be opened when the device is switched on, since this would pose an explosion hazard.

Working at greater heights

⚠ WARNING

Risk of falls and injury when working at greater heights!

- **Use suitable fall protection equipment.**
- **Only use climbing aids that have a solid stand and provide adequate support.**

Working at greater heights and while standing on climbing aids poses a risk of falls and injury.

Strong vibrations

⚠ WARNING

Risk of injury from strong vibrations!

- **Do not disable vibration dampers.**
- **Avoid entering the area of the vibrations during operation.**

Exposure to strong vibrations for extended periods can lead to considerable injuries and chronic health damage.

Noise

⚠ WARNING

Hearing impairment due to excessive noise!

- **Wear hearing protection.**
- **Only remain in the danger zone as long as necessary.**

The noise level occurring in the work area can cause severe hearing impairment.

Sharp corners or edges

⚠ CAUTION

Risk of injury on sharp corners or edges!

- **Wear the prescribed personal protective equipment when working.**

Sharp corners and edges can lead to skin cuts and abrasions.

Dirt and objects left lying around

⚠ CAUTION

Risk of injury due to dirt and objects left lying around!

Always keep the work area clean.

Remove no longer required objects from the work area, especially near the floor.

- **Mark unavoidable tripping hazards with yellow/black marking tape.**

Dirt and objects left lying around pose a slipping and tripping hazard. A fall could cause injuries.

1.4.1 Dangers posed by electricity

Electrical current

⚠ DANGER

Danger of death due to electrical current!

- **Have work on the electrical system performed only by electricians.**
- **If the insulation is damaged, immediately switch off the voltage supply and have this repaired.**
- **Prior to starting work on energized parts of electrical systems and equipment, establish a voltage-free state and ensure this state is maintained for the duration of the work. Observe the safety rules:**
  - **Switch off.**
  - **Secure against reactivation.**
  - **Verify a voltage-free state.**
  - **Carry out grounding and short-circuiting.**
  - **Provide protection from adjacent live parts.**
  - **Never bypass or disable fuses. When replacing fuses, observe the correct amperage.**
  - **Keep moisture away from voltage-conducting parts. This could lead to a short circuit.**

Contact with live parts poses an immediate danger of death from electric shock. Damaged insulation or individual components can be life-threatening.

1.4.2 Dangers posed by heat

Hot surfaces

⚠ WARNING

Risk of injury due to hot surfaces!

- **Allow components to cool down to the ambient temperature before touching them.**
- **Wear protective gloves.**

Contact with hot components can lead to severe burns.

Hot operating materials

⚠ WARNING

Risk of injury due to hot operating materials!

- **When performing any work with operating materials, always wear heat-resistant work clothing and protective gloves.**

Prior to any work with operating materials, check whether they are hot. If necessary, allow them to cool down.

Operating materials can reach high temperatures during operation. Skin contact with hot operating materials can cause severe scalding.

1.4.3 Dangers posed by chemicals

Motor oil and fuel

⚠ WARNING

Risk of fire due to motor oil and fuel!

- **Do not light any open flames when working on the motor.**
- **Do not smoke.**
- **Remove oil and fuel residues from the motor and floor.**

Fumes from oil and fuel can ignite if they come into contact with the ignition source.

Highly flammable materials

⚠ WARNING

Risk of fire due to highly flammable materials!

- **Do not smoke in the area of the device. Refrain from contact with open lights, flames, or sources of ignition of any type.**
- **Have a suitable fire extinguishing agent ready.**
- **Immediately report any suspicious materials, liquids, or gases to your supervisor.**
- **In the event of a fire, stop work at once. Leave the scene of the fire and alert the fire department.**

Highly flammable materials, liquids, and gases can ignite and cause severe or fatal injuries. Dangerous fumes can be released when chemical substances are burned. Dust deposits can swirl up and form an explosive mixture with the ambient air.

Flammable mixtures in the surroundings

⚠ WARNING

Danger of explosion in the case of flammable mixtures in the surroundings!

When flammable mixtures are present in the atmosphere, explosions can occur.

Oil under pressure

⚠ WARNING

Risk of injury due to oil under pressure!

- **Never open pressurized pipelines.**
- **Prior to starting work, completely depressurize pipelines.**
- **Have defective parts repaired.**

If lines or machine components are defective, oil under pressure can escape. This can lead to serious injuries.

1.5 PERSONNEL QUALIFICATIONS

Inadequate qualifications

⚠ WARNING

Inadequate qualifications can result in fatalities.

- **Have all activities carried out only by persons who possess the qualifications stated in the individual chapters.**
- **In case of doubt, address the individuals in question and direct them to exit the danger zone and work area.**
- **Halt the work as long as inadequately qualified persons are at the device.**

Allowing an inadequately qualified person to perform work on the device poses a life-threatening danger. Considerable property damage could also occur.

Requirements of personnel

Staff should be made up exclusively of persons who can be expected to carry out their work reliably. Persons whose responsiveness is affected, e.g., by drugs, alcohol, or medicines, are not authorized.

Observe the locally applicable regulations relating to age and profession.

List of qualifications

The various tasks described in this manual have different requirements regarding the personnel qualifications for those assigned to perform them.

Installation specialist

The installation specialist can perform the following work independently:

- Carrying out maintenance work on the mechanical components
- Disassembling the device

Installation specialists are specially instructed regarding the environment in which they work and are familiar with the relevant standards and regulations.
They are aware of the fundamental hazards at the workplace, particularly in regard to working at heights, and know which additional safety precautions must be taken.
Only persons who – based on their knowledge and experience as well as awareness of the relevant regulations – are able to perform the tasks assigned to them and independently recognize and avoid possible hazards, may be appointed as installation specialists.

Instructed person

Instructed persons have been verifiably instructed by the operating company in a briefing about the tasks assigned to them and the possible dangers posed by improper conduct.
Instructed persons are able to perform this work professionally and safely.
Instructed persons are authorized for the following activities:

- Switching on the device
- Switching off the device
- Performing a manual test (push-button)

Licensed electricians

Licensed electricians are, based on their training, knowledge and experience, able to safely perform work on electrical and electronic components and low-voltage networks (< 1000 V AC). Licensed electricians avoid hazards that could endanger themselves or others, or damage material assets, by implementing measures for hazard avoidance in their activities based on the locally applicable regulations and requirements for handling electrical and electronic products and components.
In particular, licensed electricians possess knowledge of the following, which can be verified at the electrical equipment's site of use on an accredited certificate:

- Special hazards in handling voltage-conducting components (e.g., arcing).
- Disconnection of network segments and components
- Verifying a voltage-free state
- Reading and comprehension of circuit diagrams
- Function and setup of low-voltage networks
- Safe handling of measuring and testing equipment for electrical and electronic components
- Operator specifications for establishing and verifying a voltage-free state Appropriate dimensioning of cross-sections of conductors and ground contacts

Licensed electricians are, due to their verifiable expertise regarding the above, able to perform the following activities without endangering themselves or others:

- On-site isolation and disconnection
- Verifying a voltage-free state
- Mechanical connection of electrical equipment
- Electrical connection of electrical equipment
- Checking the functionality and proper connection of the electrical equipment
- Certain repair activities

Trained maintenance personnel

Trained maintenance personnel possess professional experience in the area of special maintenance and repair tasks on the device.
In particular, trained maintenance personnel have knowledge of the following:

- Technical handling of the machine
- Dangers that can be posed by the machine
- Procedures for special maintenance tasks and the dangers which they can pose

Trained maintenance personnel are therefore able to carry out the work assigned to them and to independently recognize possible dangers and avoid them. Trained maintenance personnel are specially instructed regarding the machine's work environment and the operator has informed them of the dangers.

Transport specialist

The transport specialist has been trained in the use of cranes or industrial lift trucks. This specialist is able to select appropriate load handling and lifting tackle and apply it properly. Based on this knowledge, the specialist can independently recognize possible dangers during movement of transport components and avoid them.

1.6 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment serves to protect persons from safety and health risks during work.
While performing various work, personnel must wear their personal protective equipment as specifically indicated in the individual sections of this manual. Explanation:

Hearing protection

Hearing protection serves to protect against hearing damage due to exposure to noise.

Industrial safety helmet

Industrial safety helmets protect the head from falling objects, swinging loads, and impacts on fixed stationary objects.

Protective gloves

Protective gloves serve to protect hands from chafing, abrasions, punctures, or deeper wounds as well as from contact with hot surfaces.

Protective work clothing

Protective work clothing is close-fitting work attire with a low resistance to tearing, narrow sleeves, and no protrusions.

Puncture-resistant safety shoes

Safety shoes protect the feet from crushing, falling parts, and slipping on slippery surfaces.

Safety goggles

Safety goggles serve to protect the eyes from flying parts and spurting liquids.

Safety harness

The safety harness serves as protection against falls in the case of increased danger of falling. This situation occurs when certain height differences are exceeded, and the work site is not secured by a railing.
Attach the safety harness so that the safety rope is connected to the harness as well as to a fixed attachment point. If necessary, provide fall impact absorbers.
Safety harnesses may only be used by persons specially instructed in their use.

Illegible signage

⚠ WARNING

Danger of death due to illegible signage!

- **Always maintain stickers and signs in legible condition.**
- **Replace damaged stickers and signs immediately.**

Over time, stickers and signs can become soiled or otherwise illegible, so that hazards are not detected, and the required operating instructions cannot be followed. This poses a risk of fatalities.

Grounding

This symbol indicates that the product must be grounded prior to being put into operation.

Do not submerge in water

This symbol indicates that the sensor is not to be submerged into water, because then the capability to measure humidity is eliminated until completely dried which might take several days.

1.8 Safety devices

Non-functioning safety devices

⚠ WARNING

Non-functioning safety devices!

- **Prior to starting work, check whether all safety devices are undamaged, functional, and correctly installed.**
- **Only operate the device with fully installed safety devices.**
- **Only disable or bypass safety devices in the exceptional cases that have been described in this manual.**

If safety devices are damaged, not functioning or disabled, this poses the danger of severe injuries or death.

1.9 SIGNAL LEDS

LED behavior

The LEDs show the operating, error, and alarm status of the device:

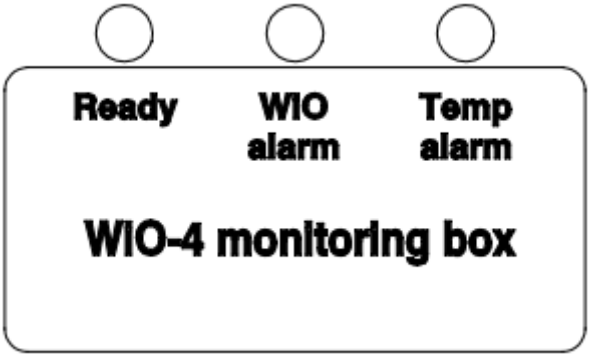


Figure 1 MPU010 LED Indicators

Under normal circumstances, the “Ready” LED is continuously green and the “WiO alarm” LED and the “Temp alarm LED” are off.

Fault indication

When a fault is detected, the “Ready” LED is off and the “Ready” relay will change its status. Please see Chapter 6.1 “Status of operation and action” on page 41 for further information.

1.10 GROUND CONNECTION

Contact voltages and ignition sparks

⚠ WARNING

Danger of death due to contact voltages and sparks!

– **Prior to initial commissioning, connect device to the local potential equalization and check that this functions properly.**

Missing or defective potential equalization can result in contact voltages and sparks. This poses the danger of severe injuries or death.

The ground connection of the device serves in conducting electrical currents into the ground (potential equalization) to prevent sparks and contact voltages when an error occurs.

1.11 Conduct in the event of fire outbreak or accidents

Preventive measures

- Always be prepared for fires and accidents.
- Store first aid equipment (first aid kit, blankets, etc.) and fire extinguishers that are functional immediately within reach.
- Ensure that personnel are familiar with the accident signaling devices, first aid kit, and rescue equipment.
- Keep access routes for rescue vehicles clear.

Measures in the event of fire outbreak or accidents

- Immediately trigger an emergency stop using the emergency stop device.
- If your own safety is not endangered, bring the person(s) in question out of the danger zone.
- If necessary, initiate first aid measures.
- Alert the fire department and/or emergency services.
- In the event of a fire outbreak: If your own safety is not endangered, attempt to extinguish the fire using the fire extinguishers until firefighters arrive on the scene.
- Inform supervisors on-site.
- Keep access routes for rescue vehicles clear.
- Provide information to rescue vehicles.

1.12 Responsibility of the operator

Operator

The operator is defined as the person operating the device for business or commercial purposes, or who allows others to use/employ the device, and who during operation bears the legal product responsibility for the protection of the user, of personnel, or of third parties.

Obligations of the operator

The device is used in the commercial sector. The operator of the device is therefore subject to legal obligations regarding occupational safety.
In addition to the safety instructions in this manual, the regulations for safety, accident prevention, and environmental protection valid for the device's area of application must be observed.
In particular, the following applies:

- The operator must familiarize himself with the applicable occupational health and safety regulations and determine in a risk assessment any hazards arising from the special operating conditions at the usage location of the device. The operator must implement this in the form of operating instructions for the operation of the device.
- During the entire lifetime of the device, the operator must check whether the operating instructions created conform with the latest technical standards, and if necessary, revise them.
- The operator must ensure that all persons handling the device have read and understood this manual, and that they possess the required qualifications for the individual tasks. Furthermore, the operator must train personnel at regular intervals and inform them of the dangers and how to behave in an emergency.
- The operator must clearly regulate and define the responsibilities for installation, operation, troubleshooting, maintenance, and cleaning.
- The operator must provide personnel with the required protective equipment and advise them that it is mandatory to wear the required protective equipment.
- The operator must observe the locally applicable fire protection ordinances.
- The operator must ensure that the area of the device and its surroundings are sufficiently lit.
- The operator is responsible for maintaining the device in a technically flawless condition.
- ***Therefore, the following applies:***
  - The operator must ensure that the maintenance intervals described in this manual are adhered to.
  - The operator must have all safety devices regularly checked for proper function and completeness.

OSHA

The Occupational Safety and Health Act of 1970 states that a safe workplace must always be made available for the performance of work. For this, the operator must ensure that the machine is checked and operated in accordance with applicable commercial, industrial, local, state and federal laws, standards, and directives.

1.13 Replacement parts

Incorrect replacement parts

⚠ WARNING

Risk of injury due to incorrect replacement parts!

- **Use only original replacement parts made by Dr. E. Horn GmbH & Co. KG, or replacement parts that have been approved by Dr. E. Horn GmbH & Co. KG.**
- **Order replacement parts only through the customer service of Dr. E. Horn GmbH & Co. KG.**

The use of incorrect or defective replacement parts can pose dangers as well as cause damage, malfunctions, or total failure.

1.14 Environmental protection

Environmentally hazardous materials

NOTICE

Harm to the environment due to incorrect handling of environmentally hazardous materials!

- **Always observe the instructions stated below for handling and disposing of environmentally hazardous materials.**
- **In case of doubt, request information from local authorities or specialist disposal companies.**
- **Observe safety data sheets and instructions**

If environmentally hazardous materials are incorrectly handled, in particular through improper disposal, this could result in considerable harm to the environment.

Observe the following instructions for environmental protection when engaging in maintenance work:

Electrical and electronic components

Electrical and electronic components may contain toxic substances. These components must be collected separately and handed over to municipal collection points or disposed of by a specialist company.

Lubricants

Lubricants such as grease and oil contain toxic substances that should not be allowed to penetrate into the environment. Their disposal must occur through a specialist disposal company.

2 TOOLS

Materials

The described activities require the following materials:

- Cleaning agent
- Cleaning cloths

Tools

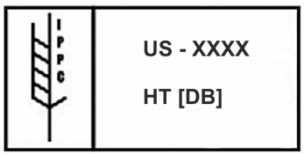
The described activities require the following standard tools:

- Fork/box wrench set
- Allen wrench set
- Screwdriver set

3 TRANSPORT, PACKAGING, AND STORAGE

3.1 SYMBOLS ON THE PACKAGING

IPPC symbol



International symbol for the handling status of packaging materials made of wood:

- **US** Country abbreviation (e.g., USA)
- **XXXX** Registration no. of the wood supplier
- **HT** Heat treatment
- **DB** Debarked

Up

The arrow points of the symbol identify the top of the packaging piece. They must always point upward; otherwise the content may be damaged.

Protect against moisture and wetness

Protect packing piece from wet conditions and keep it dry.

Additional symbols and instructions may be present on the packaging materials. Always observe these.

3.2 DELIVERY

Transport inspection

Check the delivery for completeness and transport damage immediately upon receipt.

If there is any visible exterior transport damage, proceed as follows:

- Do not accept the delivery or accept it only with reservations.
- Make a note of the scope of the damage on the transport documents or on the delivery note of the carrier.
- Submit a complaint.

Submit a complaint for every defect as soon as it is detected. Compensation claims will only be accepted within the applicable reclamation periods.

3.3 PACKAGING

The individual packages are packed according to the expected transport conditions. Exclusively environmentally sound materials are used for the packaging. The packaging is designed to protect the individual components from transport damage, corrosion, and other damage until they are installed. For this reason, do not destroy the packaging and only remove it shortly prior to the installation.

Incorrect disposal

NOTICE

Harm to the environment due to incorrect disposal!

- **Dispose of packaging materials in an environmentally sound manner that is in conformance with locally applicable waste disposal regulations.**

If applicable, contract a specialist company to handle the disposal.

In many cases, packaging materials can be processed and reused. Incorrect disposal of packaging materials can pose hazards to the environment.

3.4 STORAGE

- Store packages under the following conditions:
- Do not store outdoors.
- Store in a dry and dust-free area.
- Do not expose to aggressive media.
- Avoid salt-laden atmospheres.
- Avoid mechanical vibrations.
- Storage temperature: -20 to 85 °C
- Relative air humidity: max. 90%

When storing for periods longer than 3 months, regularly check the general condition of all parts of the packaging. If necessary, renew or replace the preservation.

In certain cases, there are instructions on the packages regarding their storage that go beyond the requirements mentioned above. Observe these accordingly.

4 WATER-IN-OIL-IDENTIFICATION SYSTEM WIO4 FOR STANDALONE INSTALLATION

4.1 WORKING PRINCIPLE AND INSTALLATION REQUIREMENTS

The sensor is based on using a capacitor to measure the absorption of water in oil. The physical measured value is the so called “Water activity” value „AW”.

Oil has the ability to hold a certain amount of dissolved water. The maximum water amount oil can hold is called “saturation point”. Above the “saturation point” free water will fall out which can cause corrosion inside of the engine. The “saturation point” is influenced by temperature and other different factors like the composition of oil mineral or synthetic, formulation of additives and will change during the lifetime of the oil.

Normally, at site, the water in oil content is measured by a Water in Oil test kit. These kits can only measure the percentage of oil in water normally based on room temperature which supplies no information of the saturation of the oil by water!

The Water in Oil Sensor (FRG00035-x-xxx) is not measuring free water or emulsion, which is detectable by regular Water in Oil test kits. It measures the absolute water content in oil.

The context between humidity and „AW” is x AW * 100 = x % humidity. The PAV (Pre alarm value) of 0.5 AW means 50 % of humidity, while the MAV (Main alarm value) of 0.9 AW means 90 % of humidity. More than 100 % (or 1.0 AW) means free water, from this point regular Water-in-Oil-test kits begin to measure. If the system shows main alarm, the value is higher than 90 % (oil is saturated to 90 % by water).

The alarm levels of PAV and MAV are adjustable via the web interface of the device.

If the AMS (Alarm Monitoring System) allows a connection of 4…20mA for the water content and oil temperature, an analog output is available, too. The limit values for the alarm levels, by using the analog outputs, can be set by the customer in the MPU010.

The sensor starts its measurement after power on and compares its factory calibration with the existing lube oil in the system.

In addition to the capability to measure the water activity the system also measures the actual temperature of the oil. Depending on the sensor that will result in a measurement up to 125 °C.

The system consists of sensors FRG00035-x-xxx and a monitoring box MPU010 with different cable glands. Optionally a MUX010-I-x can be used to connect multiple FRG00035-I-x sensors to one MPU010-I-x.

Opening of a sensor

⚠ CAUTION

Opening of a sensor immediately expires warranty and destroys it.

Cleaning of the sensor

NOTICE

No cleaning of the sensor is needed.

Dissolved air humidity

NOTICE

It is possible that after a longer time of no operation of the engine, alarm is given, because oil has dissolved air humidity. It needs some time of running the engine and oil separators before a limit of less than 0.5 AW is reached.

Sensor pollution

NOTICE

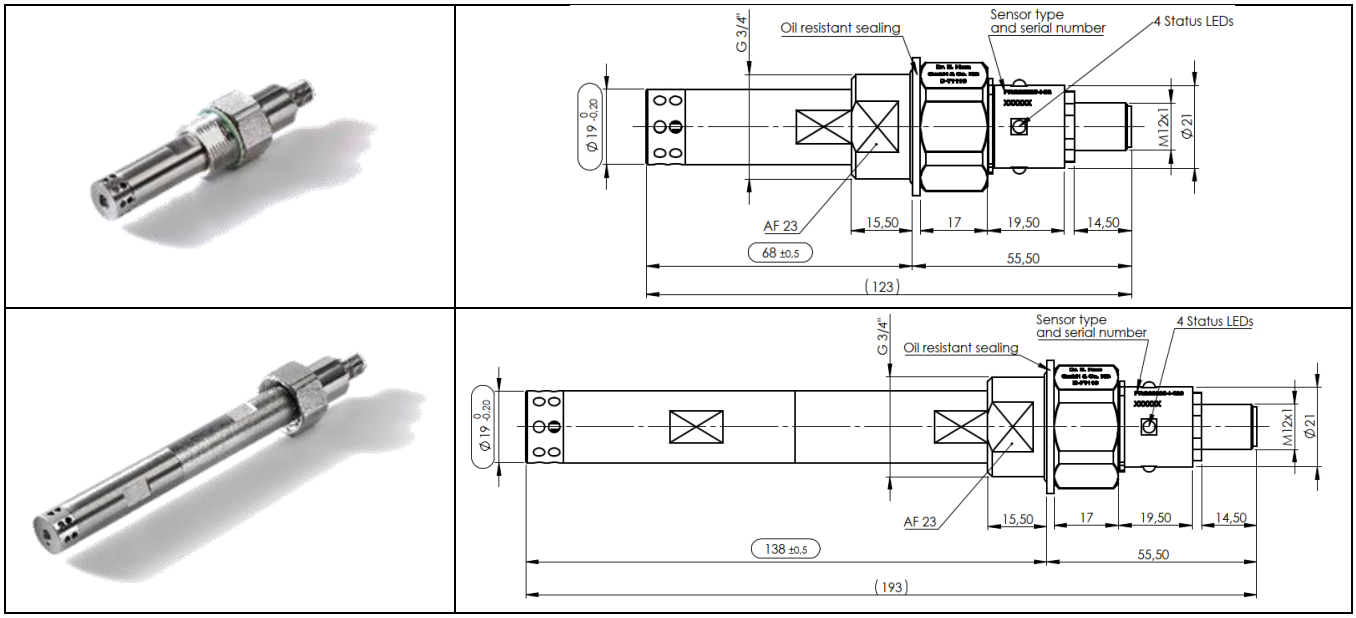
Gaseous chemicals such as volatile organic compounds (VOCs) are known to pollute the sensitive layer of the humidity sensor element. If such pollutants are present in the surrounding atmosphere of the sensor, they diffuse into the polymer where they occupy spaces reserved for water molecules.
This process often results in lower humidity readings. Please give the sensor some time (several hours) for adjustment after changing its location.

4.2 Available Sensors

Ordering Number	**FRG00035-I-68-125 or FRG00035-I-138-125**
Operating temperature	-25…+125 °C
Accuracy of humidity measurement	±3 % within -25…+85 °C
Pressure resistance against medium	10 bar
Protection degree	IP67
Power supply	5 VDC
Current consumption	< 10 mA
Polarity protection	Yes
Cable length	Max. 50 m
Output	I²C
Other	Length: from nut to end of sensor 68 mm or 138 mm (others on request) Nut with inner or outer thread G ¾ (through adapter)

The sensors are available in different lengths:

Picture	**Drawing with length**



4.3 AVAILABLE MONITORING BOXES MPU010

The monitoring boxes are available in 2 different versions. Both versions have an M12 connector for Ethernet connection in common.

	MPU010-I-K small cable glands, I²C	**MPU010-I-G large cable glands, I²C**
Power supply	18…32 VDC, max. permissible ripple ≤ 5 %, Protected by automatic fuse	
Power consumption	~10 W	
Polarity protection	yes	
Operating temperature	-25…+85 °C	
Storage temperature	-25…+85 °C	
Relative humidity	< 90 %, non-condensing	
Protection degree	IP 67	
EMC-standard	DIN EN 55016 and DIN EN 55022, safety rules acc. EN 61000-4, -6 rules for type approval test acc. GL	
Connection to PE	Copper mesh band	
Cable glands	M12 for sensor, cable dia. 5-6.5 mm M12 for relays, cable dia. 5-6.5 mm M12 for analog outputs, cable dia. 5-6.5 mm M12 for power supply, cable dia. 5-6.5 mm	M12 for sensor, cable dia. 5-6.5 mm M25 for power, cable dia. 12.5-20.5 mm M25 for relays and analog output, cable dia. 12.5-20.5 mm
Sensor interface	I²C	
Alarm relays	PAV, MAV, Ready	
Photo-MOS outputs	< 60 VDC, 500 mA (Short Circuit Protected, free configurable)	

User interface	3 LED, analog output, web page over ethernet, CAN
Configuration	web page over ethernet
Analog output	current output or voltage output (details configurable: 4-20 mA or 0-10 VDC, others on request), galvanic isolated, user selectable, 4096 steps
Current output burden	max. 1200 Ω
Linearity	≤ ±0.15 % of final value
Reaction time	> 300 ms, adjustable
Ethernet	Transmission rate max. 100 Mbit/s for parameter settings and display, galvanic isolated, IP-Address adjustable
CAN	Transmission rate 20 kBaud…1 MBaud; Node ID adjustable 1…127 CANopen-protocol for parameter settings and display, galvanic isolated

4.3.1 MPU010-I-K

Figure 2 MPU010-I-K

Figure 3 The connection to the AMS is available via 3 M12 cable glands (Power supply, analog out and alarm relay). The fourth cable gland is the sensor connection. On the right side the M12 ethernet connection.

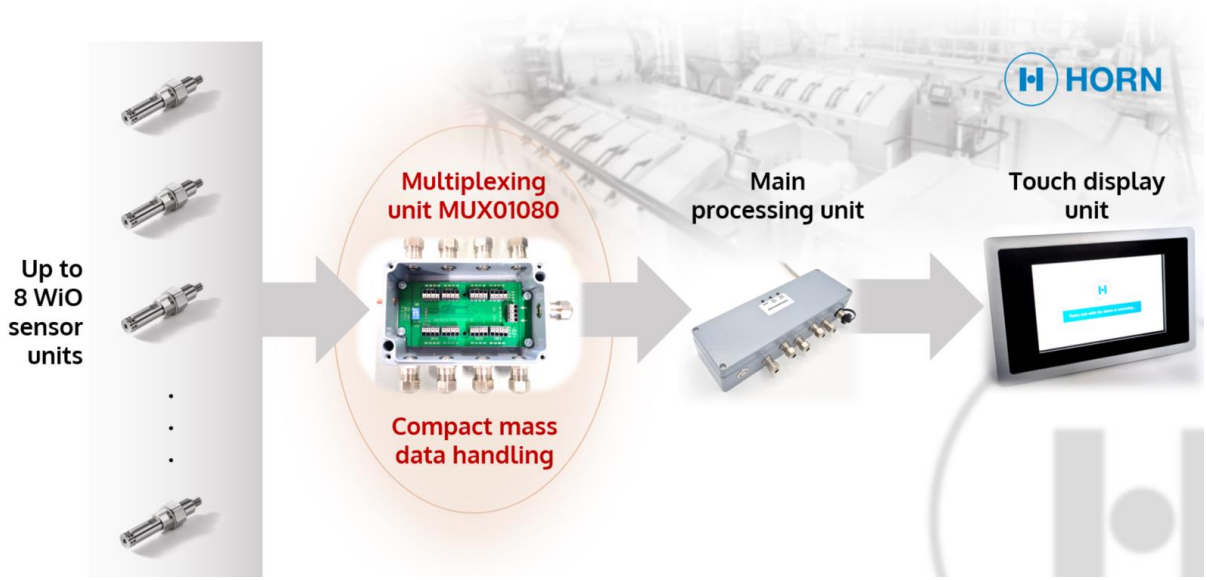
4.3.2 MPU010-I-G

Figure 4 MPU010-I-G

Figure 5 The connection to the AMS is available via 2 M25 cable glands (Power supply, Analog out & alarm relay). The third cable gland is the sensor connection. On the right side the M12 ethernet connection.

4.4 AVAILABLE MULTIPLEXER BOX MUX010

With the class-approved Multiplex unit MUX010x, up to 8 Water in Oil sensors can be monitored simultaneously while maintaining the same level of data performance. Communication throughout this network is secured by I²C protocol. Users benefit from the lean architecture of the sensor system with just one central Main Processing Unit (MPU010x) instead of an equal number of individual sensors and MPU's. Material costs and expenses for installation and commissioning are significantly reduced:



	MUX01080 **small cable glands, I²C**
Power supply	5 VDC, provided by MPU010Ix
Power consumption	~0.5 W
Polarity protection	yes
Operating temperature	-25…+85 °C
Storage temperature	-25…+85 °C
Relative humidity	< 90 %, non-condensing
Protection degree	IP 67
EMC-standard	DIN EN 55016 and DIN EN 55022, safety rules acc. EN 61000-4, -6 rules for type approval test acc. GL
Connection to PE	Copper mesh band
Cable glands	M12 for sensor, cable dia. 5-6.5 mm M12 for MPU010, cable dia. 5-6.5 mm
Sensor interface	I²C

4.5 Available Indicators

Analog Indicators for displaying of measuring result for local installation options, WIO I_{out} for “Water activity”, value “AW” (left) and Temperature “°C” (right)

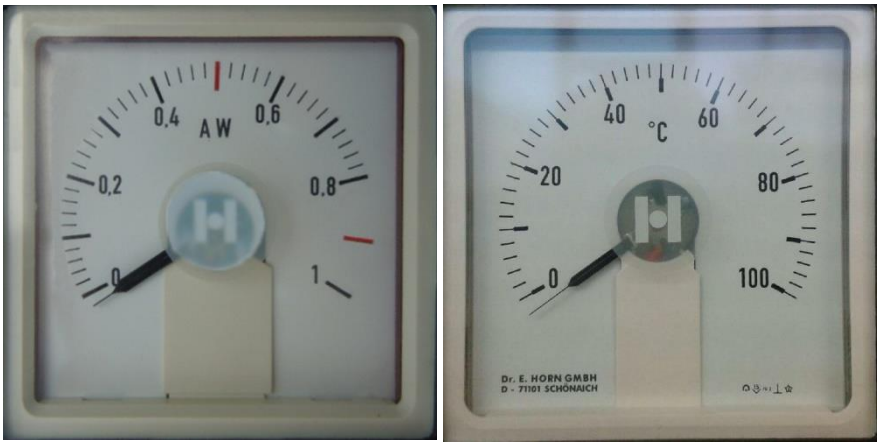
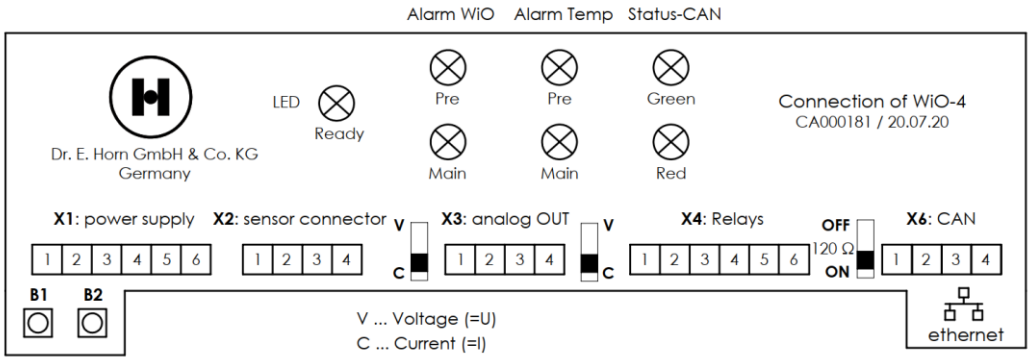


Figure 6 Devices EA 96x96 can be connected to pin X3.1..X3.4

The temperature indicator is also available with 125 °C end value.

4.6 Internal connectors of the monitoring box MPU010

The following wiring schema shows a schematic assembly of the components inside the MPU010 – LEDs, connectors, switches and button.



X1: power supply (max. 2,5 mm²)	**X2**: sensor connector (max. 1,5 mm²)	**X3**: analog OUT (max. 1,5 mm²)	**X4**: Relays (max. 1,5 mm²)	**X6**: CAN (max. 1,5 mm²)
1 main +18 ... 32 V DC	1 BN power sensor	1 WiO-OUT +	1 pre-alarm +	1 CAN_GND
2 main 0 V DC	2 WH SCL	2 WiO-OUT -	2 pre-alarm -	2 CAN_L
3 PE / GND	3 BK SDA	3 Temp-OUT +	3 main-alarm +	3 CAN_SHLD
4 bak +18 ... 32 V DC	4 BL GND	4 Temp-OUT -	4 main-alarm -	4 CAN_H
5 bak 0 V DC			5 reserve-alarm +	
6 PE / GND			6 reserve-alarm -	

Figure 7 Connection diagram of MPU010

Unplugged connector

⚠ WARNING

Danger due to an unplugged connector in dangerous atmospheres!

- **Do not disconnect the connector in dangerous atmospheres.**

Unplugging the connector in dangerous atmospheres poses a risk of explosions.

X1 Power supply

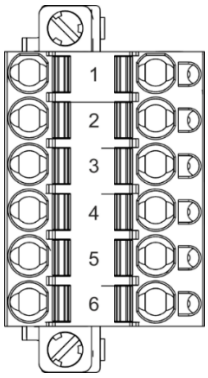


Figure 8 Connector X1

Connector X1 is used for the power supply (clamping area up to 2.5 mm²).

Pin no.	Description
X1/1	Main supply 24 V DC
X1/2	Main supply 0 V
X1/3	Grounding
X1/4	Backup supply 24 V DC
X1/5	Backup supply 0 V
X1/6	Grounding

If no backup power supply is available, connect pins X1/1 and X1/4. Connect also X1/3 and X1/6.

X2 Sensor connector

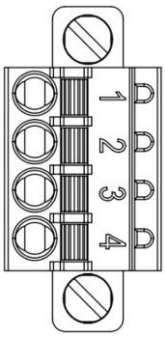


Figure 9 Connector X2

Connector X2 is used to connect the sensor FRG00035-I or a MUX010x (clamping area up to 1.5 mm²).

Pin no.	Description
X2/1	+5 V
X2/2	SCL
X2/3	SDA
X2/4	0 V

X3 Analog outputs

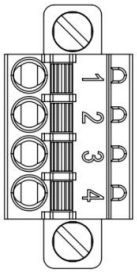


Figure 10 Connector X3

Connector X3 is used for the analog output (clamping area up to 1.5 mm²).

Pin no.	Description
X3/1	WiO-out +
X3/2	WiO-out -
X3/3	Temp-out +
X3/4	Temp-out -

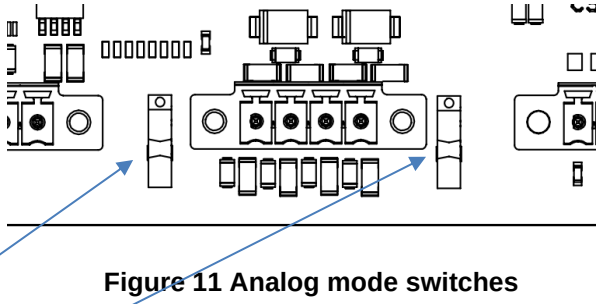


Figure 11 Analog mode switches

S310 switch to switch between 4-20 mA output and 0…10 V for water in oil value and S360 to switch output for temperature value

X4 Relays

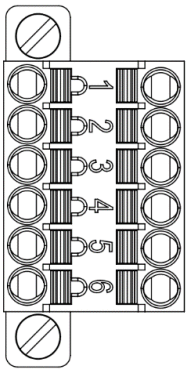


Figure 12 Connector X4

Connector X4 is used for the connection of the relays (clamping area up to 1.5 mm²).

Pin no.	Description
X4/1	Pre alarm +
X4/2	Pre alarm -
X4/3	Main alarm +
X4/4	Main alarm -
X4/5	Reserve relay +
X4/6	Reserve relay -

X6 CAN

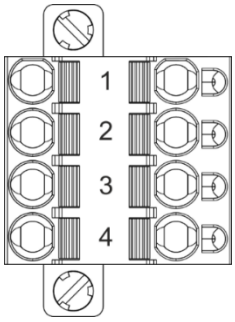
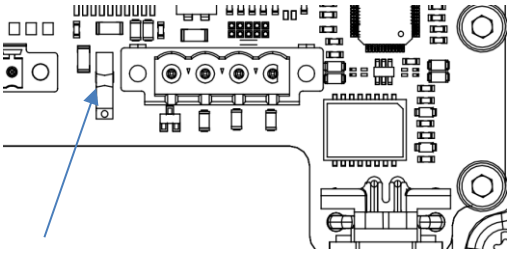


Figure 13 Connector X6

Connector X6 transfers the CAN bus signals (clamping area up to 2.5 mm²).
The device has a galvanically isolated CAN bus interface for external data exchange.
The parameters P70 – P78 (”7.6.4 List of available parameters” on page 50) are relevant for the configuration of the CAN bus.

Pin no.	Description
X6/1	CAN ground
X6/2	CAN “low”
X6/3	Ground
X6/4	CAN “high”

The “CANopen” protocol is supported on the CAN bus.



If the device is the last CAN node on the network, the termination switch S250 for 120 Ohm must be set to “On” to use the resistor.

X284 Ethernet connector

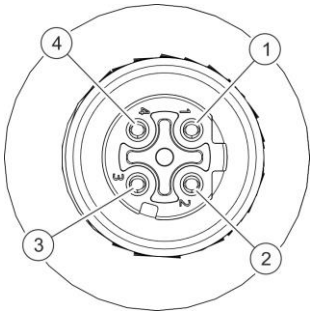


Figure 14 Connector X284

Connector X284 (M12, D-coded) establishes the Ethernet connection.
The connection is located on the right side of the housing.

Pin no.	Description
X284/1	Transmitter TX+
X284/2	Receiver RX+
X284/3	Transmitter TX-
X284/4	Receiver RX-

4.7 INTERNAL CONNECTORS OF THE MULTIPLEXER BOX MUX01080

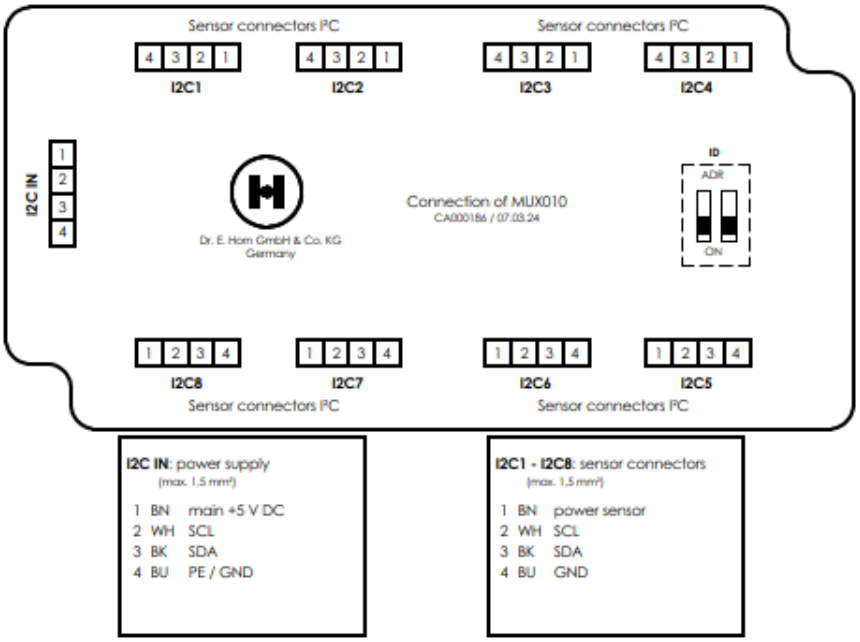


Figure 15 Connection diagram of MUX01080

I2C IN

Connector I2C IN is used to connect the MUX01080 to the MPU010-I-x sensor connector

Pin no.	Description	Cable color
1	+5 V DC supply	Brown
2	SCL	White
3	SDA	Black
4	GND	Blue

The state of the ID switch is irrelevant for operation in this setup.

I2C1 – I2C8

The connector I2C1 – I2C8 are used as connectors of FRG00035-I sensors.

Pin no.	Description	Cable color
1	+5 V DC supply	Brown
2	SCL	White
3	SDA	Black
4	GND	Blue

5 INSTALLATION AND STARTUP

5.1 SAFETY DURING INSTALLATION

Opened housing

⚠ WARNING

Danger of explosion with housing opened in dangerous atmospheres!

- **Do not open the housing in a dangerous atmosphere if the device is switched on.**

If a dangerous atmosphere is present, the housing may not be opened when the device is switched on, since this would pose an explosion hazard.

5.2 INSTALLATION OF THE WATER-IN-OIL-SENSOR FRG00035-XX

Lube oil pressure

⚠ WARNING

High pressurized oil can result in severe injuries.

- **Prior to initial commissioning, switch off the engine and its lube oil pump and check that this functions properly**

Prerequisite

Personnel:	Installation specialist
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Protective gloves
	Industrial safety helmet
	Safety harness

Overview

To install the device, proceed as follows:

- Switch off the engine and its lube oil pump
- Establish a suitable connection in the on-site oil pipeline.
- Insert operator-supplied seals.
- Insert the sensor in the recess.
- Fasten the sensor with the sensor-integrated nut.
  - ⇨ The sensor is installed.

The sensor must be inserted in the inlet pressure line close to the main engine.
For sensor installation in the inlet pressure line of the lube oil pipe a G¾” thread nozzle is needed.

Take care that the length of the sensor fits the diameter of the lube oil pipe.

Mounting

NOTICE

Use a new seal when replacing the sensor.

NOTICE

Max. torque to tighten the sensor is 50 Nm

NOTICE

Please use Loctite® no.545 for mounting on the thread.

5.2.1 FRG00035-I-68 installation in lube oil pipe

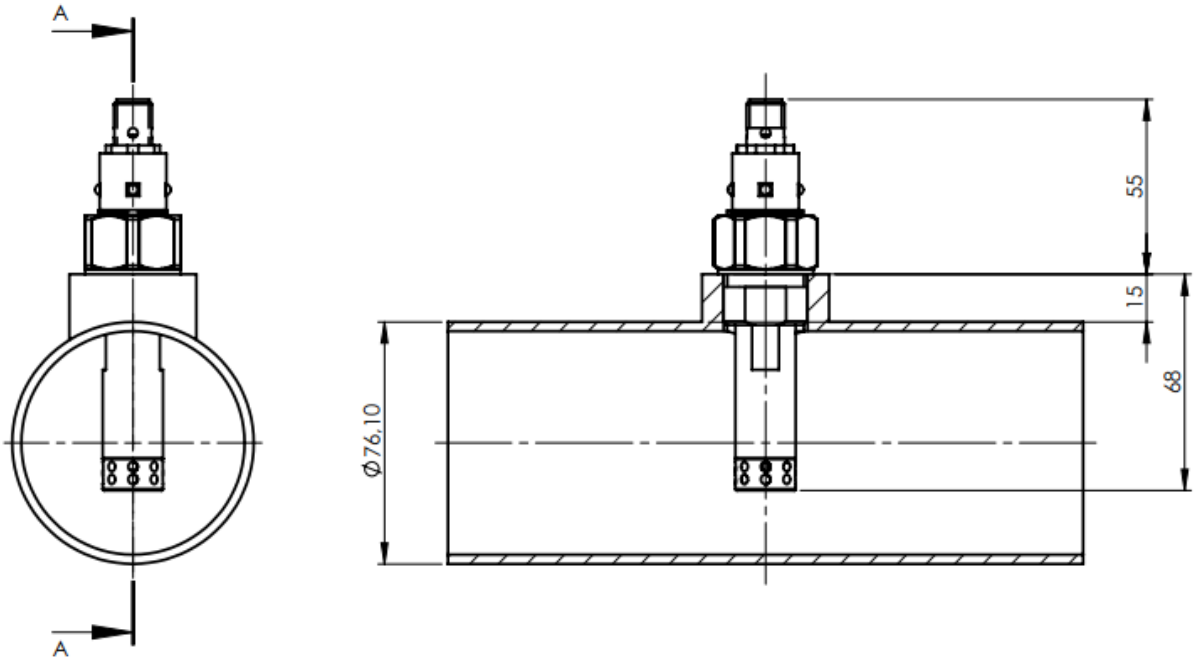


Figure 16 FRG00035-I-68

5.2.2 FRG00035-I-138 installation in lube oil pipe

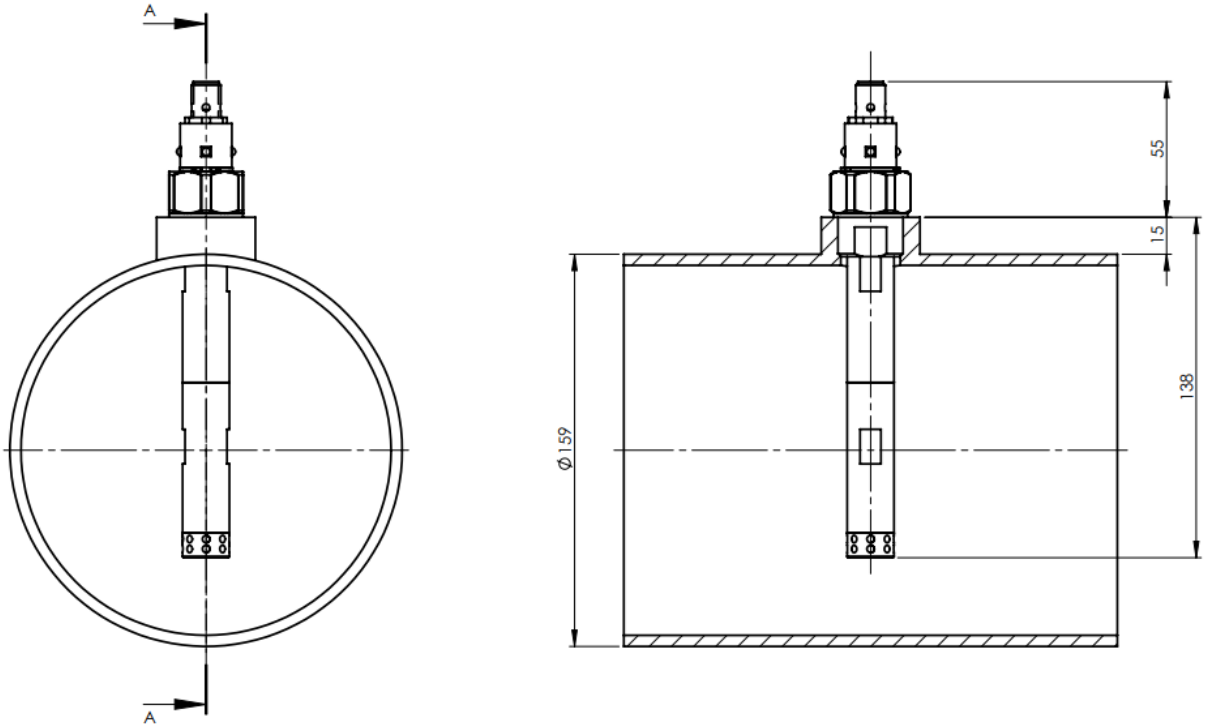


Figure 17 FRG00035-I-138

5.3 Connecting the sensor to the monitoring box

Incorrect connection

⚠ WARNING

Risk of property damage due to incorrect connection!

- ***Connect the sensor to the connection of the monitoring box in conformance with DIN EN IEC 60900 VDE 0682-201:2019-04 and/or IEC61558.***
- **The sensor can be damaged if it is incorrectly connected**

Prerequisite

Personnel:	Licensed electricians
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Protective gloves
	Industrial safety helmet
	Safety harness
Sensor:	The sensor is installed in the lube oil pipe

Cable

For connection between the sensor and the monitoring box, please use the connection cable type KSG03252-15 or similar with appropriate length.
For connection between a MUX010 and the monitoring box, please use the connection cable LT0604A0.
The cable plug nut must relate to the socket of the sensor head.

NOTICE

Please pay attention to the internal plug nose of the cable plug and insert the plug carefully into the thread socket of the sensor head.

NOTICE

Tighten the plug by hand, not with a plier or similar device.

⚠ CAUTION

5.4 Connecting the sensor to the MUX010

Ports

If connecting multiple sensors to a MPU010x via a MUX010x make sure to use the ports counting from 1 to 8.

E.g. when using 4 sensors use the ports 1 – 4.

The actual connection is done like the direct connection described above.

5.5 MONITORING BOX MPU010

The monitoring box must be placed within an appropriate distance to the sensor (see technical parameter of your sensor).

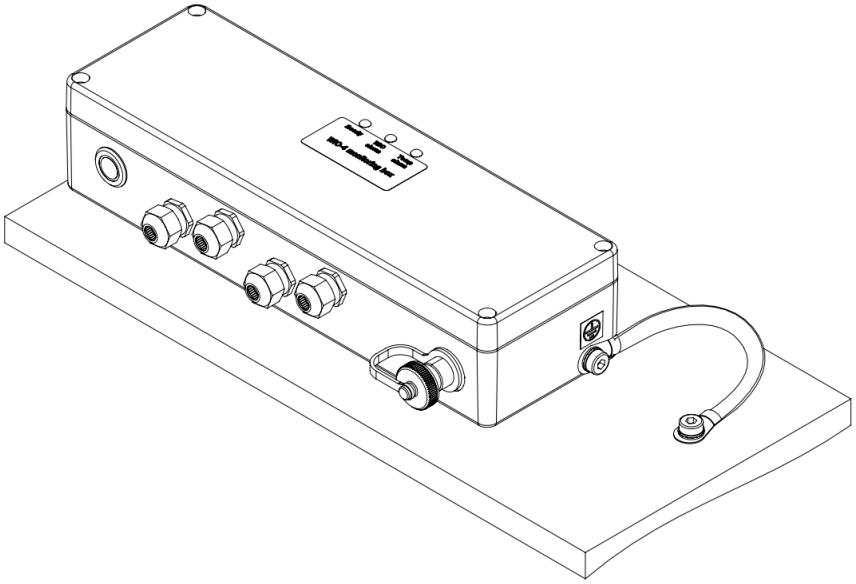


Figure 18 Mounted MPU010

The monitoring box must be mounted in a position which allows a free view to the LEDs on the top of the housing as well as access to the test button and cable glands.

After removal of the cover of the monitoring box, the other side of the connection cable can be inserted into the connection terminals X2.1 … X2.4. For details, please see “4.6 Internal connectors of the monitoring box MPU010”.

Internal wiring

NOTICE

The internal wiring in the connection box is already made ex-factory.

5.5.1 Grounding the MPU010

Contact voltages and ignition sparks

⚠ WARNING

Danger of death due to contact voltages and sparks!

Missing or defective potential equalization can result in contact voltages and sparks. This poses the danger of severe injuries or death.

– **Prior to initial commissioning, connect device to the local potential equalization and check that this functions properly.**

Prerequisite

Personnel:	Licensed electricians
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Protective gloves
	Industrial safety helmet
Monitoring Box:	The monitoring box is installed

Grounding

To ground the device, proceed as follows:

– Remove the paint under the connection point of the PE screw to get a metallic surface!
– To guarantee proper EMC protection, the housing must be connected with a flexible copper mesh strap to the engine ground.
– Make sure that the shielding is connected to the cable gland and that the connection is tight.

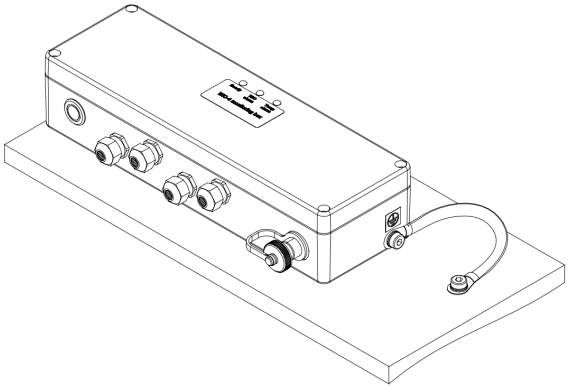


Figure 19 Grounding the device

MUX010x

Apply the same grounding steps for an optionally installed MUX010x

5.6 REPLACEMENT OF A SENSOR

Lube oil pressure

⚠ WARNING

High pressurized oil can result in severe injuries.

- **Prior to replacing, switch off the engine and its lube oil pump and check that this functions properly**

Prerequisite

Personnel:	Installation specialist
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Protective gloves
	Industrial safety helmet
	Safety harness

Overview

To replace the sensor, proceed as follows:

- Switch off the engine and its lube oil pump
- Disconnect the sensor cable type KSG03252-15 or similar
- Unscrew / disconnect sensor
- Replace sensor with the same type – a type modification will destroy sensor and monitoring box

Mounting

NOTICE

Use a new seal when replacing the sensor.

NOTICE

Max. torque to tighten the sensor is 50 Nm

NOTICE

Please use Loctite® no.545 for mounting on the thread.

6 CONCEPT OF USAGE

6.1 STATUS OF OPERATION AND ACTION

Normal status

In normal status, there are no errors or alarms present. In normal status, data regarding Water-in-oil-value and oil temperature are available.
All these data are process data and are visible on the home page of the web interface.
If no action is taken on the web interface, the continuous operation of the green “Ready/Failure” LED indicates normal operation.

Error status

Error status indicates that error messages are present. Error and alarm status can be active simultaneously.
All error messages are visible as error codes on the home page of the web interface.
The type of error is shown on the web interface.

Alarm status

In alarm status, alarm messages are present. Error and alarm status can be active simultaneously.
All alarm messages are visible as alarm codes on the home page of the web interface.
The type of alarm can be determined through the type of the “Alarm”-LED and is also shown on the web interface.

PAV / Pre alarm

If the engine crankcase doors had been opened or the lube oil pump had been switched OFF, and sensor at its place of installation might be at that high air humidity in the engine room, the sensor gives alarm.
This alarm must go off after lube oil pump starts.

NOTICE

It may take up to 24hrs with running lube oil purifier to separate the water from the oil and to set back the pre alarm value (PAV) to normal.
Before removing the sensor because of alarm, please wait for this time to allow the drain-off of the water from the lube oil.
⇨Wait 24 hours before taking further actions

MAV / Main alarm

If the engine crankcase doors had not been opened, but after engine start gets a water alarm, most probably an inrush of water into the lube oil system causing this alarm. Check water level inside compensation tank and check oil with the on-board oil analyzing kit.

⚠ WARNING

⇨**Shut off the engine**

Actual value

Please observe the web page or the analog output, which gives you actual information about the water content of the lubrication oil.

6.2 NETWORK CONNECTION

Connect the device via industrial Ethernet cable type KSG09011-5 (length 5 m, other lengths on request) with your network.

Use a browser of your choice to display the web interface of the device. The system is tested with Microsoft Edge and Google Chrome. Other browsers will work too but might behave unexpected.

Direct connection

If you connect it directly with your computer setup your Ethernet port to automatically assign an IP address and wait for 1 minute. After 1 minute, you can access the device's web interface by pointing your browser to its link-local address "horn-wio4-0" (if you have multiple devices in your network, you can modify the number).

Network with DHCP Server

If you connect the device to a network, where a DHCP-Server is running, you have to check your DHCP-Server for the IP address assigned to the device or use the device's hostname ("horn-wio4-0") to display the web interface.

Individual setup

NOTICE

Please see chapter "7.6.9 Network configuration" for detailed instructions on how to setup the network interface.

6.3 PASSWORD PROTECTION AND USER ROLE

Password protection

The web interface is password-protected to prevent unauthorized persons from making entries and changes to configuration data.
For this, various user roles are distinguished.
The respective access rights are coupled to the user roles. The access rights are linked to each user role with a password level. The higher the password level, the more far-reaching the settings that can be undertaken with the corresponding user role.

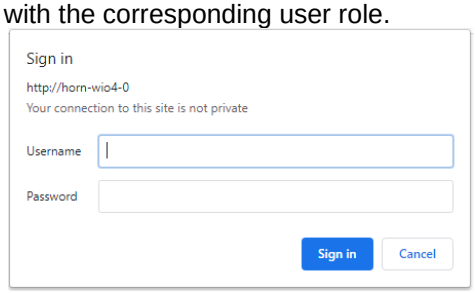


Figure 20 Login prompt

NOTICE

Not all pages are accessible for every user or role.

After username and password have been entered, access rights of the corresponding user role are enabled.
Access to the web interface is dependent on the following access levels:

- User (no username, no password)
- Service (username: Service, special password)
- Admin (manufacturer; username: Admin, another special password)

Passwords are disclosed while commissioning.

6.4 STRUCTURE OF THE WEB INTERFACE

After login, the following web page is shown:

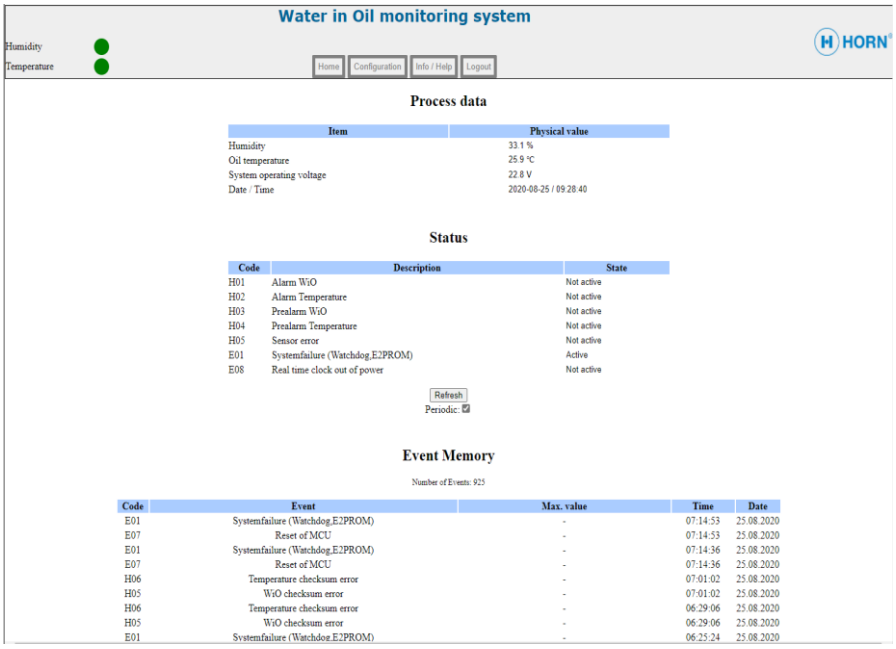


Figure 21 Structure of the web interface

This web page shows the actual process data, the alarm status, and the events in the event memory as well as buttons to access other pages.

If multiple sensors are connected via a MUX010x all sensor data is displayed here.

7 Details of Operation

7.1 Safety during operation

Improper operation

⚠ WARNING

Risk of injury due to improper operation!

Perform all operating steps according to the information in this manual.

Prior to starting work, check that all covers, and safety devices are installed and functioning correctly.

Never disable safety devices during operation.

Keep the work area clean and orderly. Components and tools that are loosely stacked on one another or left lying round can cause accidents.

Improper operation can lead to serious injuries or property damage.

7.2 Start operation

Prerequisite

Personnel:	Instructed person
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Protective gloves
	Industrial safety helmet
	Hearing protection

Installation has been completed

To switch on the device, proceed as follows:

– Switch on the power supply to the MPU010.
  ⇨The Ready-LED should become illuminated after about 10 seconds.

7.3 LOGIN

Please use the following combination to get access to parameter editing in the web interface:

Prerequisite

Personnel: Trained maintenance personnel

The device is switched on

Login

To log into the web interface, proceed as follows:

- Call up the web interface with Microsoft Edge or Google Chrome. Alternatively, use any other browser. This could, however, cause problems such as interpretation of commas and decimal points (meaning values with commas could not be entered)
- Open the address “http://horn-wio4-0” in your browser.
  In case you have changed the devices’ Network ID you have to open the corresponding webpage. Alternatively, you can open the web interface by pointing your browser to the devices’ IP-Address. Make sure you use the “http” protocol, the “https” protocol is not supported.

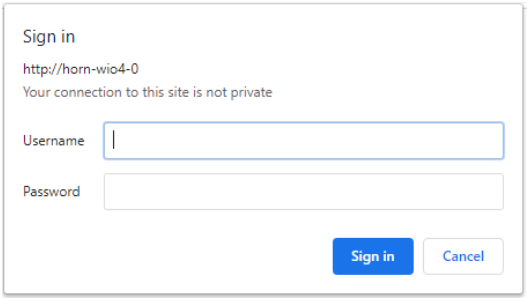


Figure 22 Login

- Enter the username and password and confirm by pressing *“Enter”*.

  ⇨If username and password are correct, the user is logged in. Otherwise he is rejected.

7.4 HOME

The web interface's homepage displays various information about the device.

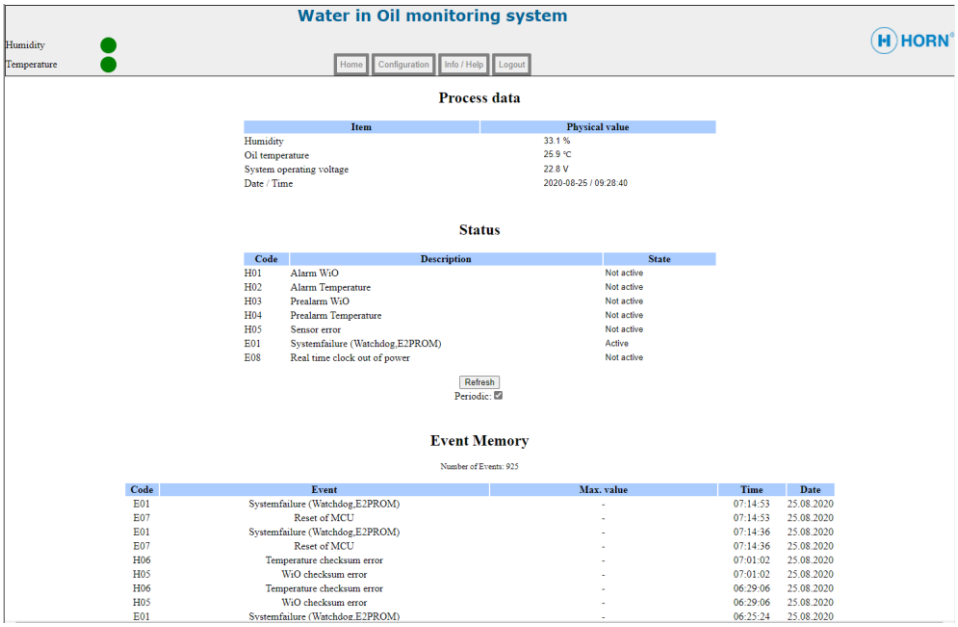


Figure 23 Web Interface – Home

The process data show besides humidity, temperature, operating voltage also the actual date and time. In case they deviate from the real time please use the clock configuration function to adjust date and time to have a valid reference to events in the memory.

The 2 circles in the upper left corner show immediately the actual status of a humidity/temperature alarm – when yellow, a pre alarm is active, when red – a main alarm is active.

Further parts of the web interface are password protected.

If you enter no credentials at all you can access the web interface in view mode only.

If multiple sensors are connected via a MUX010x all sensor data is displayed here.

7.5 SAVING THE ERROR AND EVENT LIST

Prerequisite

Personnel: Trained maintenance personnel

- The device is switched on
- The user is logged into the web interface

Saving

To save errors and events, proceed as follows:

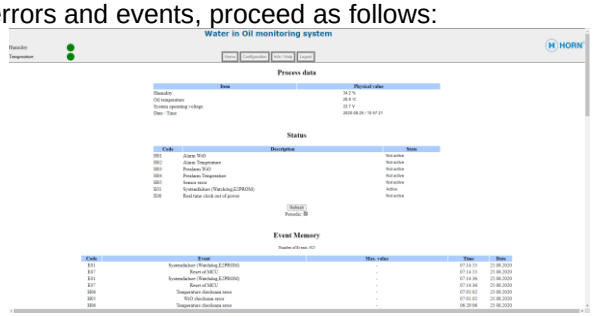


Figure 24 Web Interface - Event list

Right-click on the errors and events list.

⇨ A context menu opens.

Click on *"Save as"*.

⇨ The *"Save as"* window opens.

Enter a filename, select storage location, and confirm with *"Save"*.

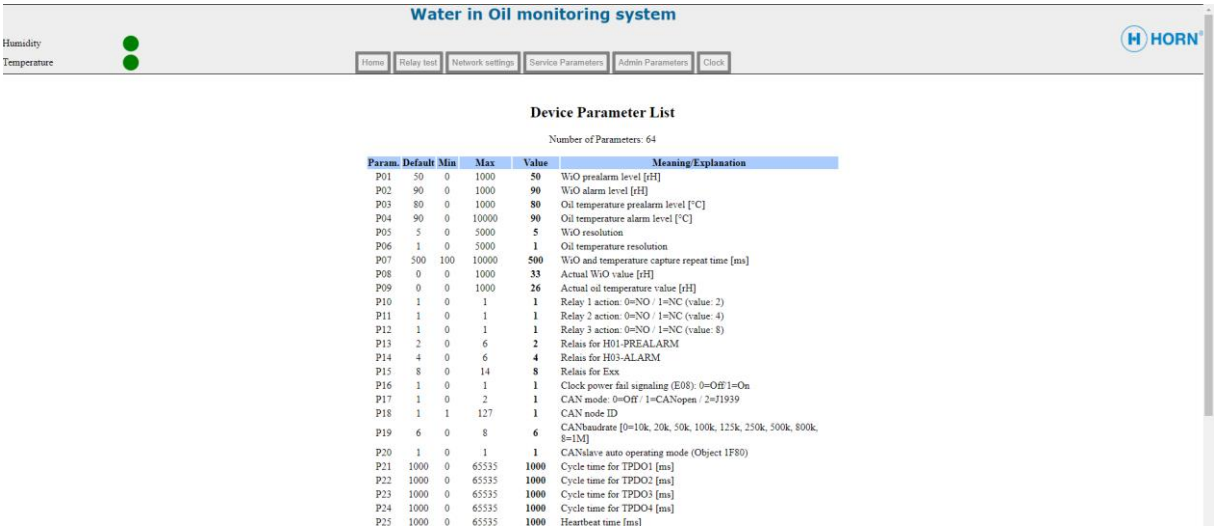
⇨ The errors and events list are saved.

7.6 CONFIGURATION OF THE MPU010

The configuration can be viewed and changed with the Admin- or Service-access, which was given to you during the installation of the system by handing out your login credentials.

7.6.1 Parameter list

To get an overview of all stored parameters the "Parameter list" webpage can be used.



Param.	Default	Min	Max	Value	Meaning/Explanation
P01	50	0	1000	**50**	WiO prealarm level [rH]
P02	90	0	1000	**90**	WiO alarm level [rH]
P03	80	0	1000	**80**	Oil temperature prealarm level [°C]
P04	90	0	10000	**90**	Oil temperature alarm level [°C]
P05	5	0	5000	**5**	WiO resolution
P06	1	0	5000	**1**	Oil temperature resolution
P07	500	100	10000	**500**	WiO and temperature capture repeat time [ms]
P08	0	0	1000	**33**	Actual WiO value [rH]
P09	0	0	1000	**26**	Actual oil temperature value [rH]
P10	1	0	1	**1**	Relay 1 action: 0=NO / 1=NC (value: 2)
P11	1	0	1	**1**	Relay 2 action: 0=NO / 1=NC (value: 4)
P12	1	0	1	**1**	Relay 3 action: 0=NO / 1=NC (value: 8)
P13	2	0	6	**2**	Relais for H01-PREALARM
P14	4	0	6	**4**	Relais for H03-ALARM
P15	8	0	14	**8**	Relais for Exx
P16	1	0	1	**1**	Clock power fail signaling (E08): 0=Off/1=On
P17	1	0	2	**1**	CAN mode: 0=Off / 1=CANopen / 2=J1939
P18	1	1	127	**1**	CAN node ID
P19	6	0	8	**6**	CANbaudrate [0=10k, 20k, 50k, 100k, 125k, 250k, 500k, 800k, 8=1M]
P20	1	0	1	**1**	CANslave auto operating mode (Object 1F80)
P21	1000	0	65535	**1000**	Cycle time for TPDO1 [ms]
P22	1000	0	65535	**1000**	Cycle time for TPDO2 [ms]
P23	1000	0	65535	**1000**	Cycle time for TPDO3 [ms]
P24	1000	0	65535	**1000**	Cycle time for TPDO4 [ms]
P25	1000	0	65535	**1000**	Heartbeat time [ms]

Figure 25 Web Interface - Parameter list

(the actual parameters might differ from this image on different software versions)

7.6.2 Service Parameters

The “Service Parameters” webpage gives access to different parameters like

- Sensor count
- Analog output configuration
- Alarm levels
- Relay mappings
- Sampling rate
- CAN baud rate

For a complete list of parameters please have a look at the parameter list below.

7.6.3 Setting parameters

Incorrect parameter values

⚠ WARNING

Danger due to incorrect parameter values!

- **After entering parameter values, always check that they are correct.**

The device does not check the entered values. Incorrect values can lead to destruction of the motor and endanger human lives.

Prerequisite

Personnel: Trained maintenance personnel

- The device is switched on
- The user is logged into the web interface

Setting of parameters

The actual values can be entered in the column “Value.”
To set the parameters, proceed as follows:

- Click on “Service Parameters” (Fig. 13/13) or “Basic Parameters” (Fig. 13/12) in the menu bar.

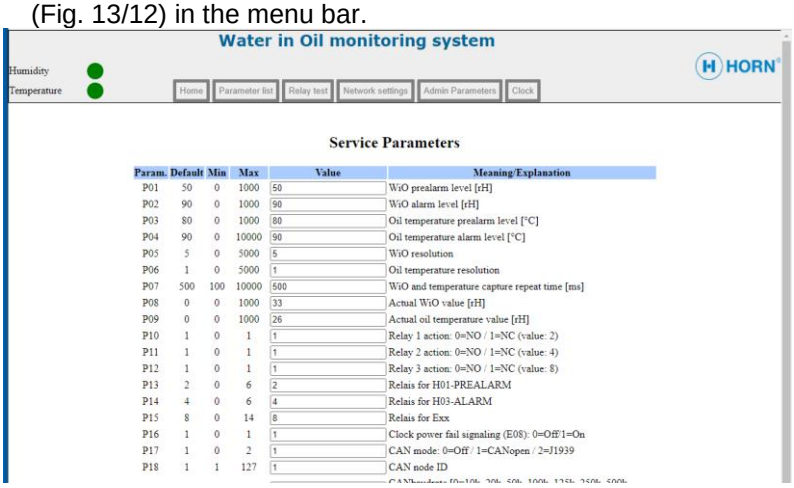


Figure 26 Web Interface – Service parameters

⇨ The corresponding page opens.

- Enter the parameter values in the respective lines.
- Click on *“Set”* to save the inputs.

⇨ The parameters are adjusted.

After the input of parameters in the web interface, the device performs a restart, which is essentially handled as a “switching on.”

7.6.4 List of available parameters

Pxx no.	Default	Min	Max	Meaning / explanation
P01	50	5	99	WiO pre alarm level [rH]
P02	90	5	99	WiO main alarm level [rH]
P03	80	5	124	Oil temperature pre alarm level [°C]
P04	90	5	124	Oil temperature main alarm level [°C]
P05	5	1	10	WiO resolution
P06	3	1	10	Oil temperature resolution
P07	1000	500	10000	WiO and temperature capture repeat time [ms]
P08	0	0	8	Count of sensors attached (via multiplexer). 0: direct connected, 1-8: Sensor count
P09	0	0	8	Sensor used for analog output (1-8). 0:Max value of all sensors.
P10	1	0	1	Relay 1 action: 0=NO / 1=NC (value: 2)
P11	1	0	1	Relay 2 action: 0=NO / 1=NC (value: 4)
P12	1	0	1	Relay 3 action: 0=NO / 1=NC (value: 8)
P13	2	0	14	Relay for H01-PREALARM
P14	4	0	14	Relay for H03-ALARM
P15	8	0	14	Relay for Exx
P16	1	0	1	Clock power fail signaling (E08): 0=Off/1=On
P17	1	0	2	CAN mode: 0=Off / 1=CANopen / 2=J1939
P18	1	1	127	CAN node ID
P19	6	0	8	CAN baud rate [0=10k, 20k, 50k, 100k, 125k, 250k, 500k, 800k, 8=1M]
P20	1	0	1	CAN slave auto operating mode (Object 1F80)
P21	1000	0	65535	Cycle time for TPDO1 [ms]
P22	1000	0	65535	Cycle time for TPDO2 [ms]
P23	1000	0	65535	Cycle time for TPDO3 [ms]
P24	1000	0	65535	Cycle time for TPDO4 [ms]
P25	1000	0	65535	Heartbeat time [ms]
P26	30	0	100	Measurement-Buffer length
P27	100	100	8389599	Number of displayed events
P28	0	0	100	WiO value at low analog out
P29	100	0	100	WiO value at high analog out
P30	0	0	125	Oil temperature value at low analog out
P31	100	0	125	Oil temperature value at high analog out
P32	0	0	0	Unit temperature (0=Celsius)
P33	0	0	3	Analog output mode WIO (0:4-20 mA; 1:0-20 mA; 2:0-5 V; 3:0-10 V)
P34	0	0	3	Analog output mode Oil temperature (0:4-20 mA; 1:0-20 mA; 2:0-5 V; 3:0-10 V)

7.6.5 Selecting relays

⚠ WARNING

Make sure you set the error event to a relay that is connected to the alarm management system (AMS). Otherwise you will not get informed if there is an error event with the device and might run your engine unprotected.

The parameters P13–P15 control, which relay is activated by which event.

Prerequisite

Personnel: Trained maintenance personnel

Selecting relays

To determine one of the parameters P13–P15, proceed as follows:

– Take the configuration value from the table and enter it in the “Service parameters” list.

Example: P13 is to activate relay 1 → The setting for P13 is 2 (relay 1).

– If the operator’s alarm system needs more than one relay to be activated in the event of an alarm, add configuration values accordingly.

Example: P13 is to activate relays 1 and 3 → The setting for P13 is 2 (relay 1) + 8 (relay 3) = 10.

⇨The relays are selected, and the parameters are determined in P13–P15

7.6.6 Setting up sensor inputs

Make sure to select the right sensor count on P8 or a sensor count of 0 when connecting the sensor directly

A directly connected sensor will work even if the parameter is set to 1.

7.6.7 Setting up analog outputs

Make sure to select the right analog output mode and sensor source when setting up the analog outputs.

Setup the analog output mode by using the parameters P33 and P34.

Make sure to setup the analog output mode switches S310 and S360 on the PCB accordingly.

Selecting sensor source

Use parameter 9 to determine the sensor that should be used as source for the analog output.

Setting parameter 9 to 0 will output the maximum value of all setup sensors. Using another value will output the measurement value of the selected sensor at the analog output.

7.6.8 Admin parameters

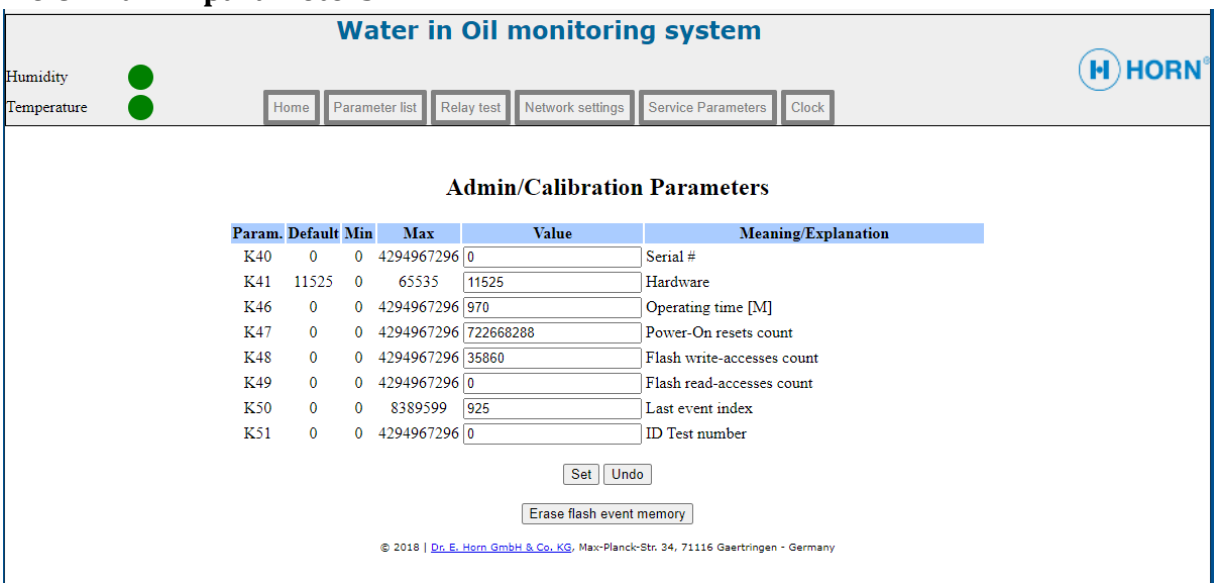


Figure 27 Web Interface – Admin parameters

Admin parameters are only configurable by the manufacturer. This picture is only shown for complete information.

7.6.9 Network configuration

You can setup the device's network settings on the "Network Settings" webpage to fit to your network (e.g. in case you do not have a DHCP-Server running and want to setup a static IP)

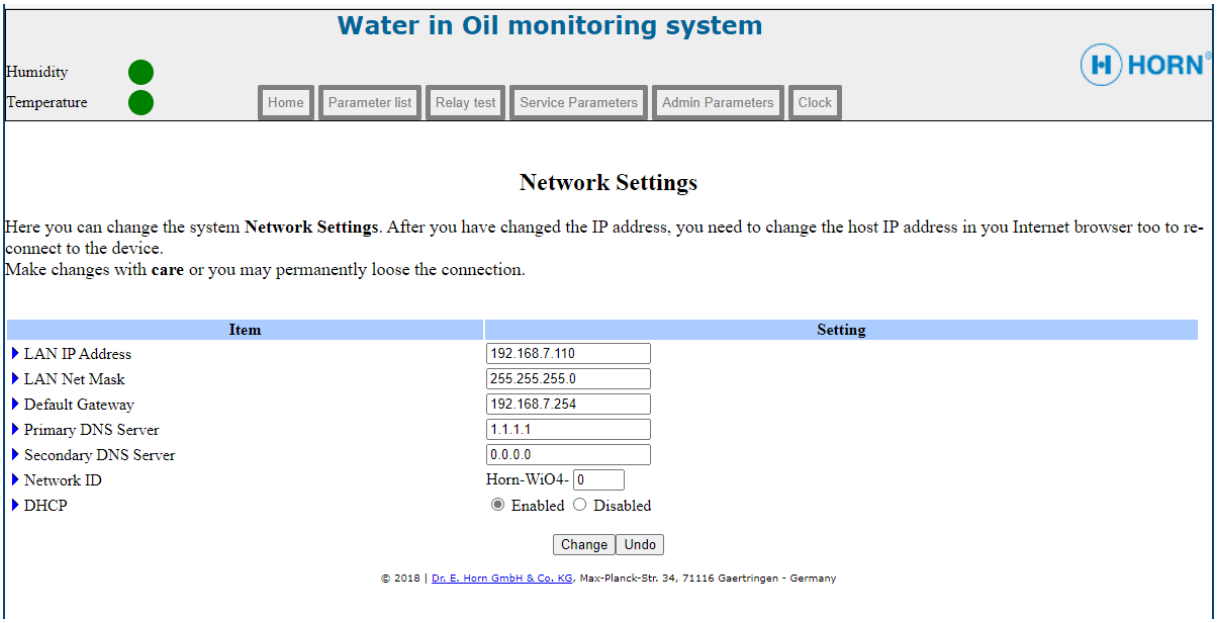


Figure 28 Web Interface – Network settings

7.6.10 Connecting the network

Prerequisite

Personnel:	Licensed electricians
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
	The device is grounded

Connecting the device to the local area network (LAN)

To connect the device to the local area network, proceed as follows:

– Connect the device to the operator's network using an Ethernet cable (M12 connector, code D) at connector X284.
  ⇨ The device is connected to the network.

Connecting the device to the network with DHCP server

To connect the device to a network that is running with a DHCP server, proceed as follows:

– Connect the device to the operator's network using an Ethernet cable (M12 connector, code D) at connector X284.
– Check the DHCP server for the IP address to which the device is assigned.
  ⇨ The device is connected to the network.

Connecting the device directly on the PC

To connect the device directly on a PC, proceed as follows:

– Connect the device to the PC using an Ethernet cable (M12 connector, code D) at connector X284.
– Set up the Ethernet connection so that an IP address is automatically assigned
– Wait at least 60 seconds.
  ⇨The device is connected directly on the PC.

In case it is a direct connection between PC and MPU010, the operating system defines a so-called auto config address in the range of 169.254.x.y.

7.6.11 Changing the IP address or network ID

Prerequisite

Personnel:	Trained maintenance personnel
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
	The device is grounded
	The user is logged into the web interface

Open settings webpage

To change the network settings, open the *"Network Settings"* webpage as follows:

– Click on "Configuration", then on *„Network Settings"* in the menu bar.

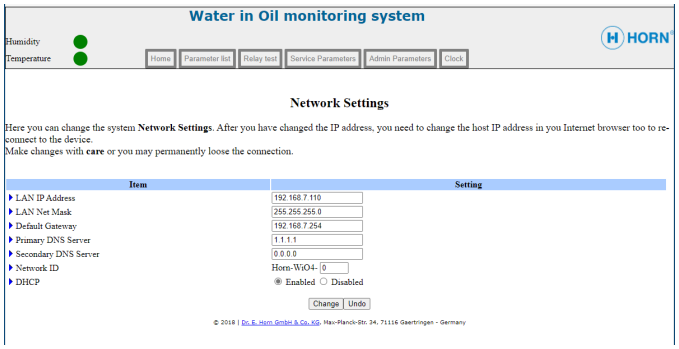


Figure 29 Web Interface – Network settings

⇨The *"Network Settings"* page opens.
Carefully double-check the changes; otherwise the connection could be lost.

Change IP address

– Change the IP address and the other data to the way you want.
– Disable the DHCP option
– Press *"Change"*

Change network ID

In case there are multiple devices in the same network their network IDs need to be adjusted.

– Change the network ID to an ID that was not yet used int the network.
– Press "Change"

Change DHCP mode

– Enable or disable the DHCP option to your liking
– Press *"Change"*

Reopen webpage

To connect the device again, change the change the IP address or hostname in the browser.
If the current IP address is unknown and the device is not in DHCP mode, press the Reset button on the circuit board until the green LED is no longer lit.
Then the device will restart with active DHCP mode.

NOTICE

7.6.12 Clock setup

After a long period without power supply (approx. 2 days) the internal clock should be checked and readjusted on the “Clock” webpage. A sign of missing internal power supply for the battery is a year “2050” of the shown date.

Prerequisite

Personnel:	Trained maintenance personnel
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
	The device is grounded
	The user is logged into the web interface

NOTICE

After the installation or following a lengthier period without power (approx. 2 days), the clock must be checked.
If error E08 appears on the home page, the clock must be set.
To set the clock, proceed as follows:

– Click on “Configuration”, then on *“Clock”* in the menu bar.

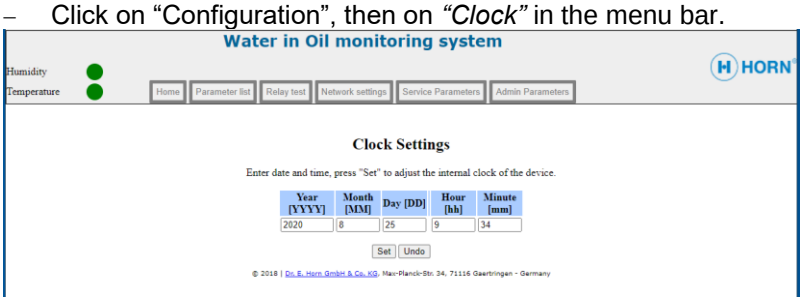


Figure 30 Web Interface – Clock settings

⇨The *“Clock Setting”* view appears.

– Enter the date and time in the corresponding fields.
– Confirm the input with *“Set”*.
⇨ The date and time are set.

NOTICE

The date is always adjusted to the entered value, even if the entered value is in the future. Therefore, check whether the inputs are correct.

If error E08 was displayed on the home page, it disappears after the system has been running for some time.

7.6.13 Relay test

To perform correct function of the system all existing communication channels should be tested. Therefore, the relay test can be executed through the web page.

Danger to the engine

⚠ WARNING

Danger to the engine!

During the relay test the engine is not protected because of the manual switching of the relays.

Therefore, please switch off the engine before the test.

Prerequisite

Personnel:	Licensed electricians
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Hearing protection
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
	The device is grounded
	The user is logged into the web interface

Test the relays

To test the relays, proceed as follows:

– Click on “Configuration” and then *„Relay test”* (**Fehler! V erweisquelle konnte nicht gefunden werden.**/5) in the menu bar.

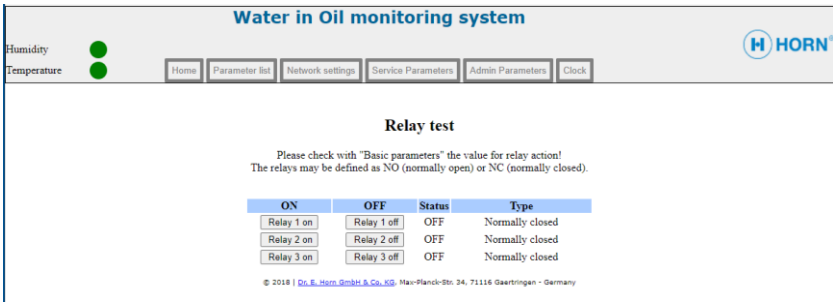


Figure 31 Web Interface – Relay test

⇨ The *“Relay test”* page opens.

Three relays are displayed on the page with their status and type

– Compare the values of the relay actions with the basic parameters.

The relay type can either be defined as “NO” (normally open) or “NC” (normally closed).

– For all relays, press *“Relay x on ”*.

The relay test switches the relays according to the corresponding parameters. The switching is independent of the external status of the device.

When performing the test, note the connected alarms in the higher-level alarm management system (AMS).

If the relay type is set to “normally open,” the relay ON/OFF switching is opposite: in other words, *“Relay on”* sets the status to “OFF” and *“Relay off”* sets the status to “ON.”

After exiting this page, the selected relays revert to the normal status according to the setting.

⇨ The relays have been tested.

7.6.14 Relay operation table of monitoring box MPU010

The relay settings can be configured via the web interface. The relays can be configured to work as “normally open” or to work as “normally closed”. That means, that in “normally open”-state the contacts are open – to activate the relay the contact will be closed.

Pxx no.	Default	Min	Max	Meaning / explanation
P10	1	0	1	Relay 1 action: 0=NO / 1=NC (value: 2)
P11	1	0	1	Relay 2 action: 0=NO / 1=NC (value: 4)
P12	1	0	1	Relay 3 action: 0=NO / 1=NC (value: 8)
P13	2	0	14	Relay for H01-PREALARM
P14	4	0	14	Relay for H03-ALARM
P15	8	0	14	Relay for Exx

Parameter 10 to 12 will handle this state.

With parameter 13 to 15 you can define which relay will handle which state.

The default configuration is shown in the table below.

Relay 1 “Pre alarm” X4.1 & X4.2	**Status**
Closed	Water content and Temperature < PAV
Open	Water content or Temperature > PAV → PRE alarm
Relay 2 “Main alarm” X4.3 & X4.4	**Status**
Closed	Water content and Temperature < MAV
Open	Water content or Temperature > MAV → MAIN alarm
Relay 3 “Res relay” X4.5 & X4.6	**Status**
Closed	System is ready
Open	Fault or sensor not connected

NOTICE

Usually, the relay outputs are connected to the Alarm Monitoring System (AMS).

Operator / The yard is responsible for the alarm settings of the AMS.

7.6.15 Logging out from the web interface

Prerequisite

Personnel:	Trained maintenance personnel
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
	The device is grounded
	The user is logged into the web interface

To log the user out of the web interface, proceed as follows:

– Click on *“Logout”* in the menu bar

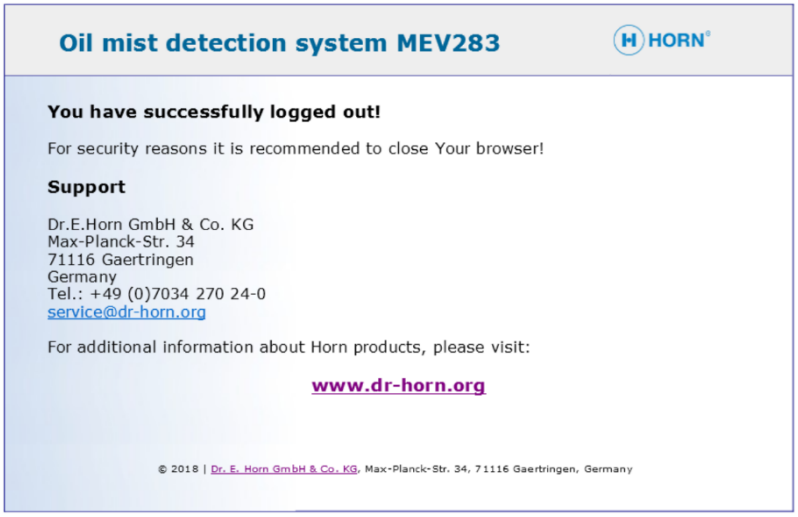


Figure 32 Web Interface – Logout page

⇨ The *“Logout”* page opens.

– Close your browser.

⇨ The user is logged out.

⚠ WARNING

Closing the browser is essential to the security, because your browser might allow you to return with the “Back”-Button of the browser to the previous page – so you would be back in the application with your user rights.

7.7 STOP OPERATION

Danger to the engine

⚠ WARNING

Danger to the engine!

After the device is switched off, you have no continuous information about the water content of the oil as well as no information about the oil temperature.

After several days, the internal power supply to the clock will be empty and the date and time will be lost.

Prerequisite

Personnel:	Instructed person
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
Engine	The engine is at a standstill.

Power off

To switch off the device, proceed as follows:

– Disconnect device from the voltage supply.
  ⇨ The device is switched off.

8 MAINTENANCE

8.1 SAFETY DURING MAINTENANCE

Unauthorized reactivation

DANGER

Danger of death due to unauthorized reactivation!

– **Always secure switched-off energy supplies against reactivation.**

If switched-off energy supplies are switched back on without authorization, this poses a fatal hazard to persons working on the device.

Improperly performed maintenance work

WARNING

Risk of injury due to improperly performed maintenance work!

Prior to starting work, ensure that adequate freedom of movement for assembly is available.

Ensure that the assembly area is clean and orderly. Components and tools that are loosely stacked on one another or left lying round can cause accidents.

If components were removed, install all fastening elements again while paying attention to proper assembly and observing the specified screw tightening torques.

Improper maintenance can lead to serious injuries or property damage.

Incorrect replacement parts

WARNING

Danger due to use of incorrect replacement parts!

Use original replacement parts exclusively.

Use of incorrect replacement parts or parts not approved by the manufacturer can lead to substantial property damage or complete failure of the device. This could also endanger human lives.

Do not submerge in water

The sensor is not to be submerged into water, because then the capability to measure humidity is eliminated until completely dried which might take several days.

8.2 PERFORMING A WATER IN OIL TEST

Danger to the engine

⚠ WARNING

Danger to the engine!

During the water in oil test the engine is not protected because of the manual switching of the relays.

Therefore, please switch off the engine before the test.

Prerequisite

Personnel:	Trained maintenance personnel
Protective equipment:	Protective work clothing
	Puncture-resistant safety shoes
	Hearing protection
	Protective gloves
	Industrial safety helmet
Monitoring Box:	The monitoring box is installed
	The device is connected to the power supply
	The device is grounded

Perform the water in oil test

The sections below describe the maintenance tasks that must be carried out for optimal and trouble-free operation of the device. The prescribed time intervals must be observed.

For questions regarding maintenance work and maintenance intervals, contact customer service.

To trigger the water-in-oil-test, proceed as follows:

– Hold the “water-in-oil-test” button pressed for ~3 seconds until the LED ring of the button lights up red.

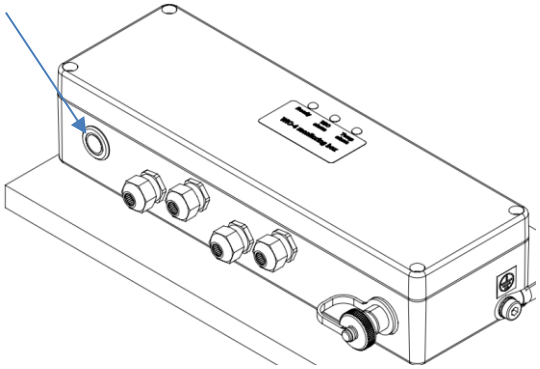


Figure 33 Water-in-oil test button

⇨The device will perform a water in oil test with the following sequence:

- Disable all alarms for 5 s
- Initiate a water in oil pre alarm for 5 s
- Enable a water in oil main alarm for 5 s
- Enable a temperature pre alarm for 5 s
- Enable a temperature main alarm for 5 s
- Disable the ready state for 5 s

⇨The device will return to normal operation after this sequence

8.3 AFTER MAINTENANCE

Remove any dirt from the work area of the device.

Check that disassembled components are properly mounted again, removed covers have been reattached, and all safety devices are functional again.

Gather any tools and operating materials that were required and remove them from the work area of the device.

9 TROUBLESHOOTING

9.1 SAFETY DURING TROUBLESHOOTING

Unauthorized reactivation

⚠ DANGER

Danger of death due to unauthorized reactivation!

Always secure switched-off energy supplies against reactivation.

If switched-off energy supplies are switched back on without authorization, this poses a fatal hazard to persons working on the device.

Incorrect troubleshooting

⚠ WARNING

Risk of injury due to incorrect troubleshooting!

Have work regarding troubleshooting carried out only by qualified personnel.

Only carry out the troubleshooting measures described in this manual.

Prior to starting work, ensure that adequate freedom of movement for assembly is available and that the assembly area is tidy.

If troubleshooting measures are performed improperly, serious injuries and considerable property damage could result.

9.2 PROCEDURE IN THE EVENT OF FAULTS

Faults leading to dangerous situations

If a fault presents a recognizable danger for persons or could result in property damage, proceed as follows:

– Shut down the device.
– Inform your supervisor of the fault.

Faults that do not lead to dangerous situations

If a fault is present that prevents further operation of the device without prior intervention, proceed as follows:

– Check whether the fault can be remedied based on the fault message that was issued.
– Check whether the fault table provides any additional helpful information.

Remedy the fault or assign suitably qualified personnel do so.

9.3 FAULT INDICATIONS

Error outputs

The warnings and error codes are output via the following components:

- CAN
- Ethernet
- Signal LEDs (Chapter 1.9 “Signal LEDs” on page 18)
- Information on the web interface

9.3.1 Signal LEDs

Error outputs

For information on the signal LEDs ↻ Chapter 1.9 “Signal LEDs” on page 18.

9.4 INFORMATION ON THE WEB INTERFACE

Alarm codes

H01	Main alarm WiO
H02	Main alarm Temperature
H03	Pre alarm WiO
H04	Pre alarm Temperature
H05	Sensor error

Error codes

E01	The watchdog function detected a problem in the software or in the EPROM checksum.
E08	The real time clock of the MPU010 is out of power – the system has been not connected to power for several days. Please adjust the clock!

9.5 TROUBLESHOOTING GUIDE

Fault description	Cause	Remedy	Personnel
The device does not measure any values, no LEDs light up	The device is off.	Switch on the device.	Instructed person
The READY LED / relay has no function	The sensor is disconnected	Connect sensor	Trained maintenance personnel
	The sensor is defect	Replace sensor	Trained maintenance personnel
	The MUX010 is disconnected	Connect MUX010	Trained maintenance personnel
	A sensor is not connected to the MUX010	Connect the sensor to the MXU010	Trained maintenance personnel
	The MUX010 is defect	Replace MUX010	Trained maintenance personnel
Date and time are incorrect.	Error E08 is displayed on the web interface.	Set the date and time	Instructed person
The analog output analog output is not correct.	The analog output mode switch is set to the wrong position	Check analog output switch. If necessary, send the device in for repair.	Licensed electricians
	The analog output mode is setup wrong in the web interface	Check the analog output mode parameters in the web interface	Instructed person
	The analog output limits are setup wrong in the web interface	Check the analog output limit parameters in the web interface	Instructed person
	The analog output source is setup wrong in the web interface	Check the analog output source parameter in the web interface	Instructed person

10 REMOVE FROM USAGE

After use

Once the device has reached the end of its useful life, it must be disassembled and disposed of in an environmentally sound manner.

Prior to disassembly

Switch off the device and secure it against being switched on again.

Physically disconnect the entire electricity supply from the device.

Disconnecting from the network

Disconnect the Ethernet connection. To do this, remove the cable in connector X284.

Disconnect the power connection. To do this, remove the cable in connector X1.

Removing device

Remove the operator-supplied screws from the device.

Remove the device from the recess of the on-site pipeline.

Remove the operator-supplied seals.

Seal the connection in the on-site pipeline with a pipe end.

⇨ The device is removed.

11 DISPOSAL

Incorrect disposal

NOTICE

Harm to the environment due to incorrect disposal!

Have electrical scrap, electronic components, lubricants, and other auxiliary materials disposed of only by authorized specialist companies.

In case of doubt regarding environmentally sound disposal, request information from local authorities or specialist disposal companies.

Incorrect disposal can pose hazards to the environment.

Constituent parts of the device

If no return or disposal agreement was made, send the dismantled constituent parts to a recycling center:

- Scrap metals.
- Recycle plastic elements and circuit board.
- Dispose of remaining components sorted according to material.

Constituent parts of the device designated with the adjacent symbol should never be disposed of as regular household waste. Disposal of these components may only be performed by locally authorized specialist companies.

12 TECHNICAL DATA

12.1 DIMENSIONS AND WEIGHTS

Dimensions

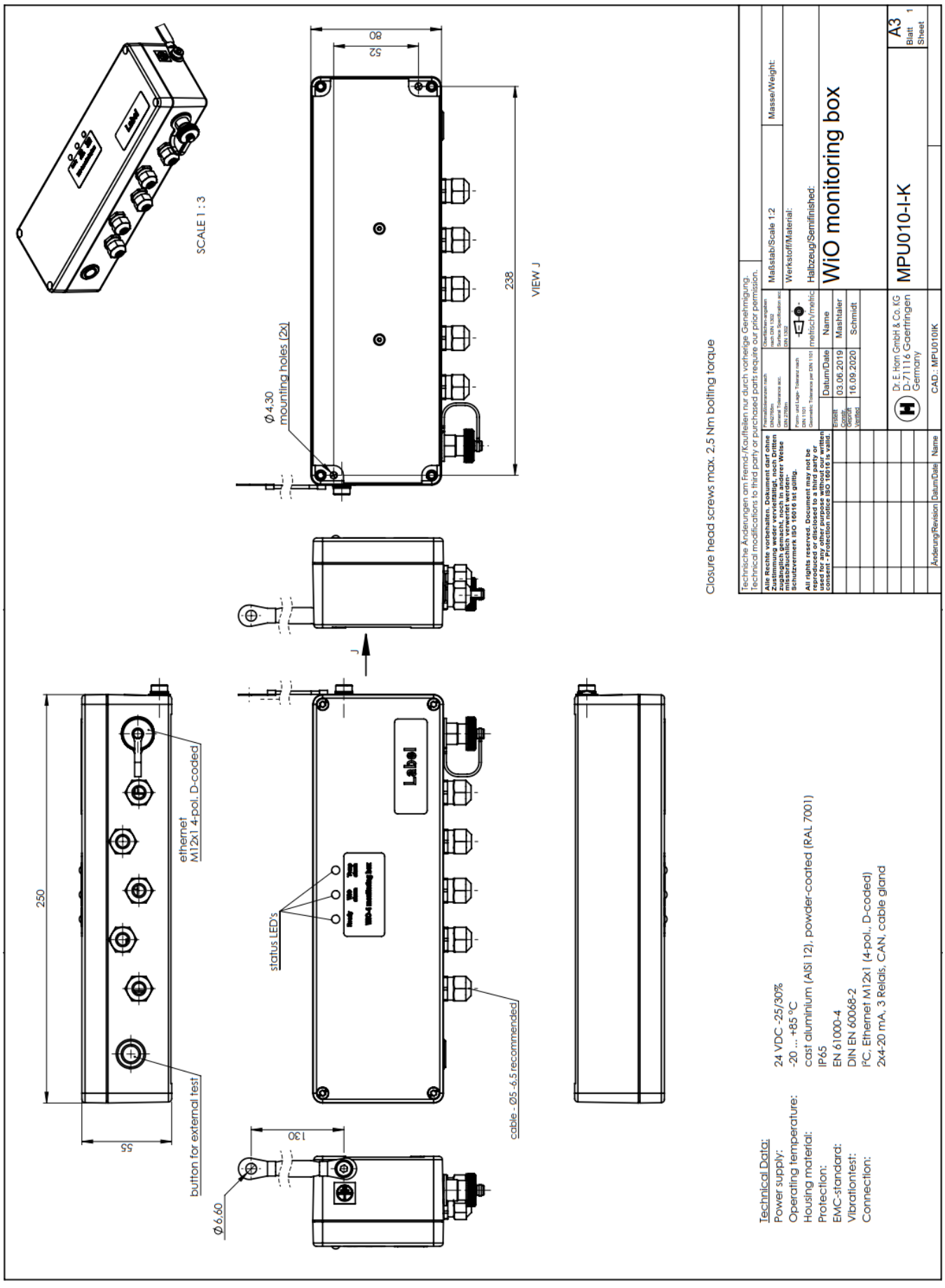
Dimensions see drawing below (additional applicable documents)

Weight

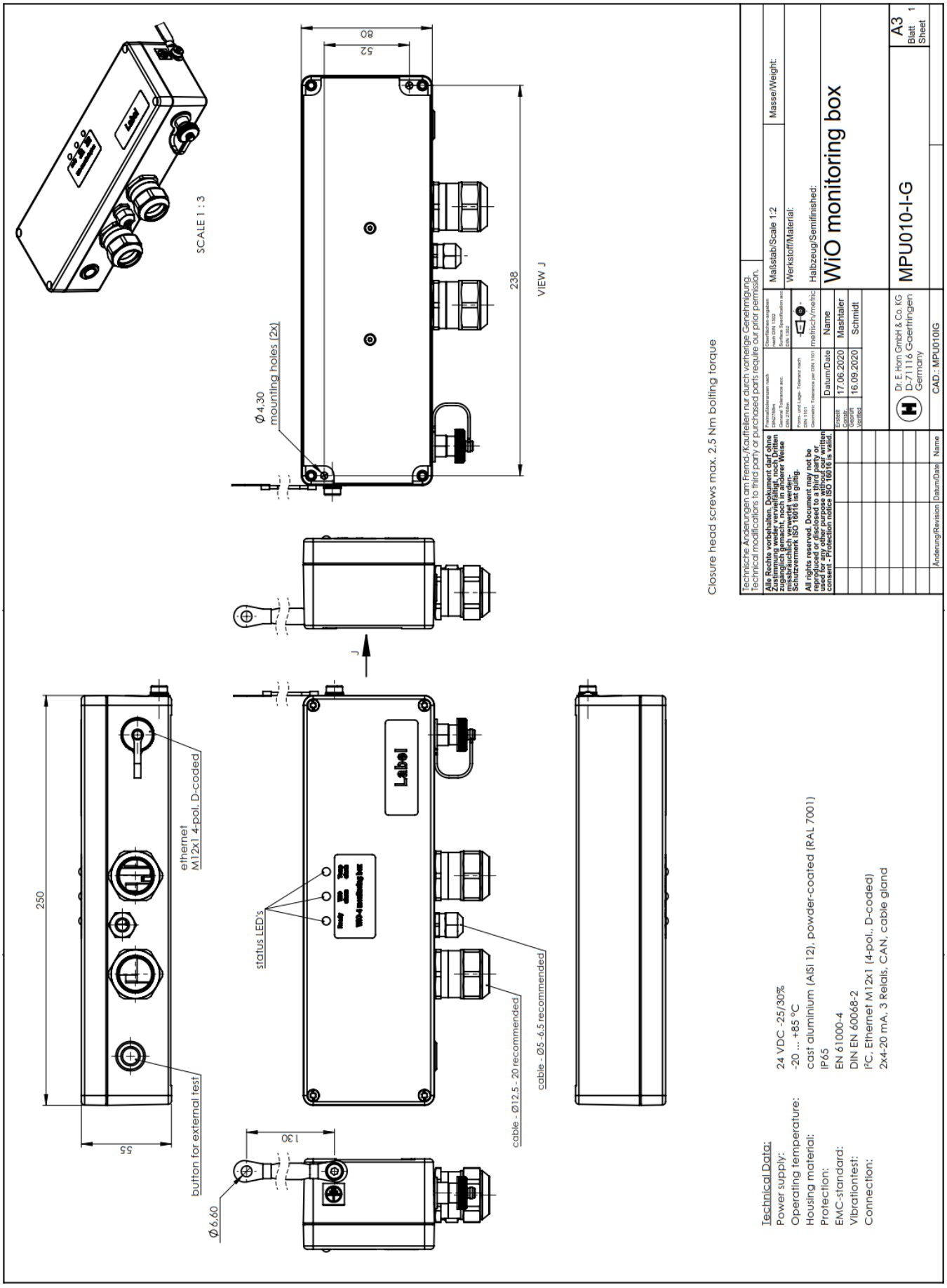
Device	Weight (approx.)
Sensor length 68 mm	0.5 Kg
Sensor length 138 mm	0.6 Kg
MPU010	1.5 Kg
MUX01080	0.5 Kg

12.2 DRAWINGS

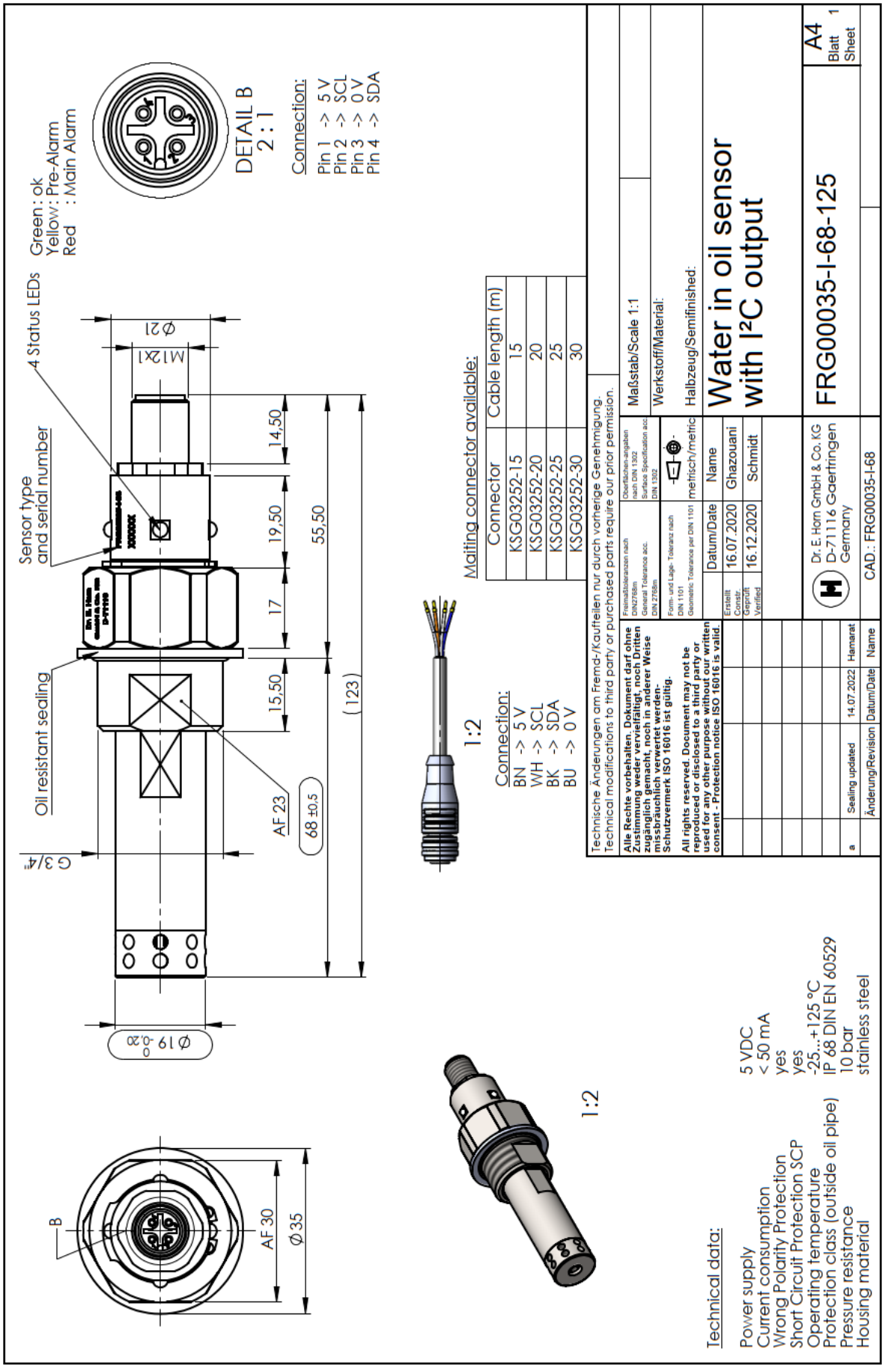
12.2.1 MPU010-I-K



12.2.2 MPU010-I-G



12.2.3 FRG00035-I-68-125



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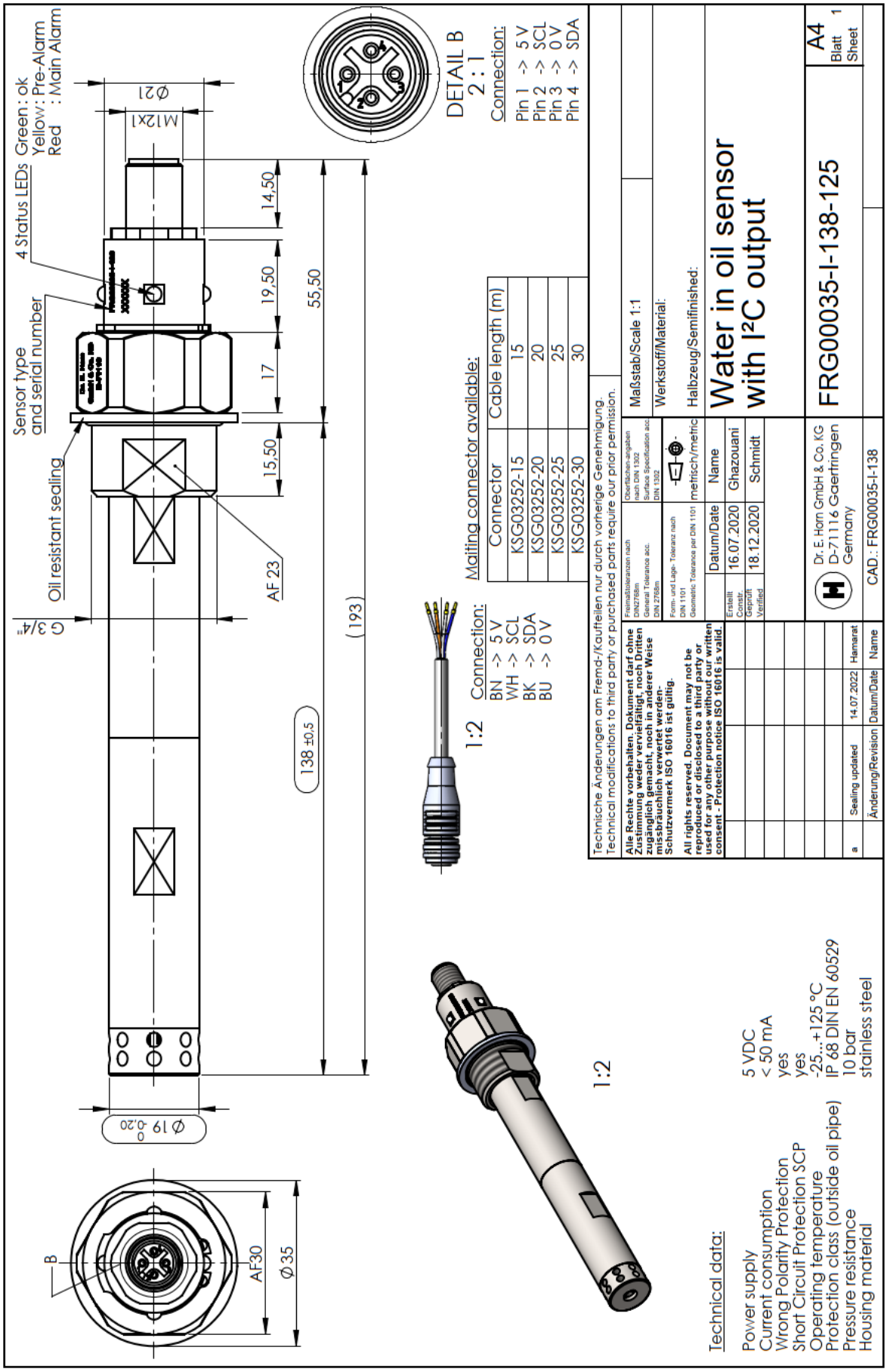

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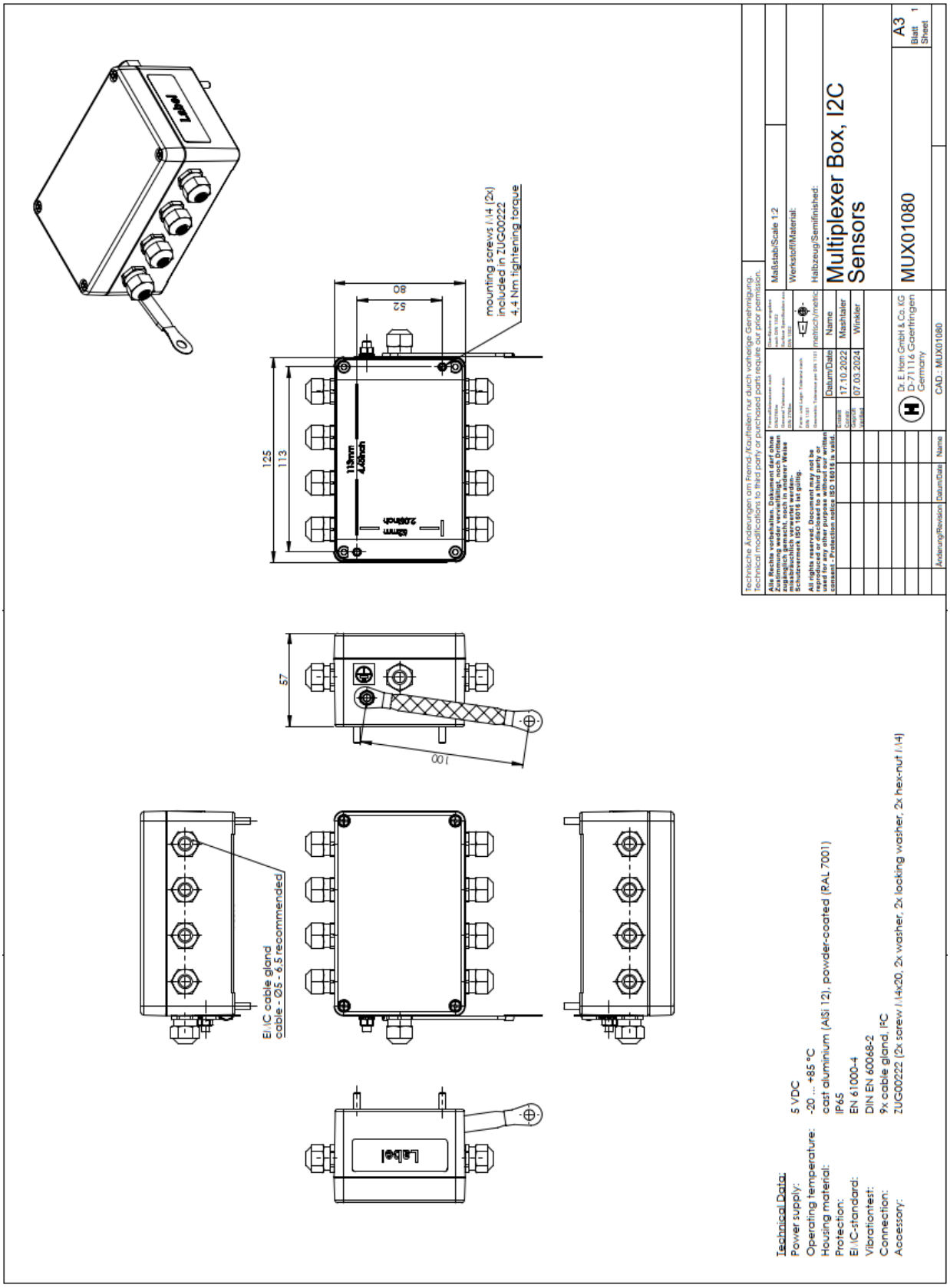

12.3 EMC STANDARD

Fulfilled standards

Specification	Value
Generics no.	EN 55016 and EN 55022
Safety regulations	acc. to EN 61000-4, -6
Rules for type checking	acc. to DNV GL

12.4 CERTIFICATES

Available certificates

The following certificates are available for the device

- DNV GL

Other certificates available on request.

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