


# Electronic Water Sensor (EWS)
# for the measurement of free water in Jet Fuel

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|---|---|---|
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# 1 About this document

## 1.1 Revision history

| Rev. | Date of Release | Firmware Version | Comment |
|---|---|---|---|
| 1 | 2025/09/01 | | First release |
| 2 | 2026/03/17 | | Chapter 2 Safety instructions |
| 3 | 2026/03/31 | | chapter 8.1 Runtime mode wording |

## 1.2 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

## 1.3 Warning symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

**i** NOTE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.


This symbol alerts you to possible faults which can end in explosion. They can cause serious damage to the instrument or to persons if ignored.

# 2 Safety Instructions

This section must be read and understood before any installation, commissioning, operation, maintenance, or disposal of the device. Failure to follow these instructions may result in serious injury, explosion, equipment damage, or loss of certification.

## 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

In case of any doubts, please directly contact FAUDI Aviation GmbH, the authorized Distributor or Service organisation.

The AFGUARD® XII sensor, formerly called AFGUARD® is Ex-certified by **DEKRA Exam in Bochum**, an authorized company for official approval of explosive hazardous equipment in Germany.
Installation and operation of the analyser must be carried out in accordance to the conditions in the Ex-Certificate. Only if such conditions are followed, can the reliability of operation in hazardous areas be guaranteed.

## 2.2 General Safety

| | |
|---|---|
| ⚠ WARNING | Only trained and authorised personnel may install, operate, and maintain the sensor. |
| ⚠ CAUTION | Use the device only for the measurement of free water in jet fuel as described in this manual. Any other use is improper and unsafe. |
| **i** NOTE | Keep this manual accessible to all personnel working with the sensor. |

## 2.3 Electrical Safety

| | |
|---|---|
| ⚠ DANGER | Disconnect the power supply before installation, maintenance, or cleaning. Verify absence of voltage. |
| ⚠ DANGER | The sensor must only be connected and operated when it is installed and grounded. Failure to do so may result in damage. |
| ⚠ WARNING | Install protective grounding according to local codes or VDE 0100. |
| ⚠ CAUTION | Use only manufacturer-approved cables and connectors. Protect all connections from dust, moisture, and mechanical stress. |
| **i** NOTE | Route cables away from heat sources, moving parts, and strong electromagnetic fields. |

## 2.4 Explosion Hazard Protection

| | |
|---|---|
| ⚠ WARNING | The sensor is intrinsically safe according to:<br>- IEC 60079-11:2023 Ed. 7<br>- EN IEC 60079-0:2018 Ed. 7.0<br>Certified for: Group II, Gas, Category 1, IIC, T4, EPL Ga<br>Ambient temperature: –30 °C ≤ Ta ≤ +60 °C. |
| ⚠ DANGER | **Observe the Specific Conditions of Use ('X') as stated in the IECEx/ATEX certificate:**<br>**Installation in EPL Ga zones must prevent ignition sources from impact or friction, even in rare faults.** |
| ⚠ DANGER | Any modifications to the enclosure, including stickers or painting, may result in loss of explosion protection |
| ⚠ CAUTION | Any modification or repair using non-approved parts voids the Ex-Certificate. |

## 2.5 Mechanical Safety

| | |
|---|---|
| ⚠ WARNING | Mount the sensor securely to avoid vibration, impact, or displacement. |
| ⚠ CAUTION | Do not use the housing as a handle or step. Protect from falling objects and shocks. |
| **i** NOTE | Ensure all process connections are tight and pressure-proof. |

## 2.6 Process Safety

| | |
|---|---|
| ⚠ WARNING | Operate only within specified process pressure and temperature. |
| ⚠ DANGER | If installed in systems with hazardous media, ensure safe depressurisation before removal. |
| ⚠ CAUTION | Wear suitable personal protective equipment when handling process components. |

## 2.7 Environmental Protection

| | |
|---|---|
| ⚠ CAUTION | Install in weather-protected locations; avoid direct sunlight, rain, and icing. |
| ⚠ CAUTION | IP67 protection is guaranteed only when the dedicated cable and connector are in place. |
| ⚠ CAUTION | Do not use high-pressure or steam cleaners. |

## 2.8 Maintenance & Calibration

| | |
|---|---|
| ⚠ WARNING | Maintenance, inspection, and calibration must be carried out only by authorised personnel. |
| ⚠ DANGER | Do not open the housing. The approval of the Ex-Certificate expires. |
| ⚠ CAUTION | Clean only with approved agents; avoid aggressive solvents. |
| **i** NOTE | Keep sensing surfaces clean for accurate measurement. |

## 2.9 Faults & Repairs

| | |
|---|---|
| ⚠ WARNING | Remove the device from service immediately if damaged or malfunctioning. |
| ⚠ CAUTION | Mark defective equipment clearly to prevent accidental use. |
| ⚠ CAUTION | Repairs not described in this manual must be carried out by FAUDI Aviation GmbH or authorised partners. |

## 2.10 Return Procedure

| | |
|---|---|
| **i** NOTE | Clean the device before shipping, use original packaging if possible. |
| ⚠ CAUTION | Include a completed 'Declaration of Decontamination' — repairs without it will not be processed. |
| **i** NOTE | Contact FAUDI Aviation shipping department before dispatch for correct shipping documents. |

## 2.11 Disposal

| | |
|---|---|
| ⚠ WARNING | Dispose of the device according to local hazardous waste regulations, waste electrical and electronic equipment. |
| ⚠ CAUTION | Electronic components must not be discarded with household waste. |
| **i** NOTE | If contaminated with hazardous media, treat as special waste. |

## 2.12 Designated use

The AFGUARD® sensor is specifically designed for the continuous measurement of free water content in jet fuel. It provides reliable and accurate monitoring to ensure fuel quality and safety.

Typical applications include:

- Measuring free water content at the inlet of refuelling units and filter water separators.
- Measuring free water content at the outlet of filter water separators.
- Measuring free water content at the inlet and outlet of filter vessels, particularly at the outlet of Dirt Defence Filters in accordance with JIG Bulletin 130.

The manufacturer is not liable for damages resulting from improper or unintended use of the AFGUARD® sensor.

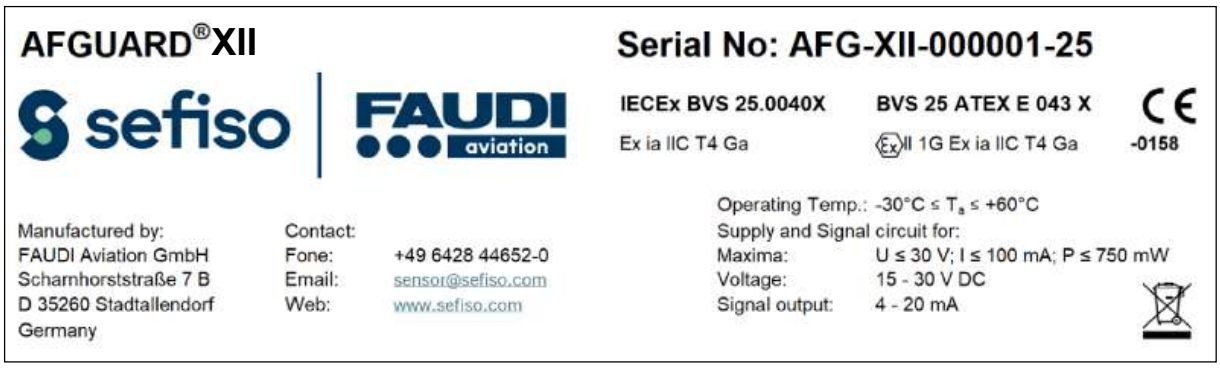
# 3 Identification

## 3.1 Product structure

The Series No. is the distinctive feature that distinguishes the AFGUARD® from one other. It is born according to the following attributes: **AFG**-xxxxx-******-yy

| | |
|---|---|
| AFG | AFGUARD® |
| xxxxx | Type of use<br>XII – 12 months operating time |
| ****** | Serial no. |
| yy | Year of production (25 = 2025) |

## 3.2 Nameplate




Example: Nameplate of a AFGUARD® sensor with a operating time of 12 months

It is prohibited to commission the equipment if the nameplate is no longer legible or is completely missing. Take organizational measures to ensure, that the nameplate and possible affixed prohibition, or instruction labels on the equipment are kept legible!

| | |
|---|---|
| ⚠ DANGER | If the nameplate or housing is painted or damaged, the device must no longer be used in explosive hazardous areas. |

## 3.3 Scope of delivery

The following items are included in the delivery:

- AFGUARD®
- Optical protection sleeve on the AFGUARD® (remove before installation)
- 2 mm and 1.5 mm sealings
- Operating manual
- Calibration protocol
- Label – next exchange date
- Product Information and Usage Agreement
- ~~Information about the voucher process~~

If you have any questions, please ask your local supplier or distributor.

# 4 Installation and dismantling

## 4.1 Incoming acceptance, transport, and storage

- Make sure the packaging is undamaged!
- Inform the supplier about any damage to the packaging.
- Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
- Inform the supplier about any damage to the delivery contents. Keep all damaged products until the matter has been settled.
- Check that the scope of delivery is complete and agrees with your order and the shipping.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").

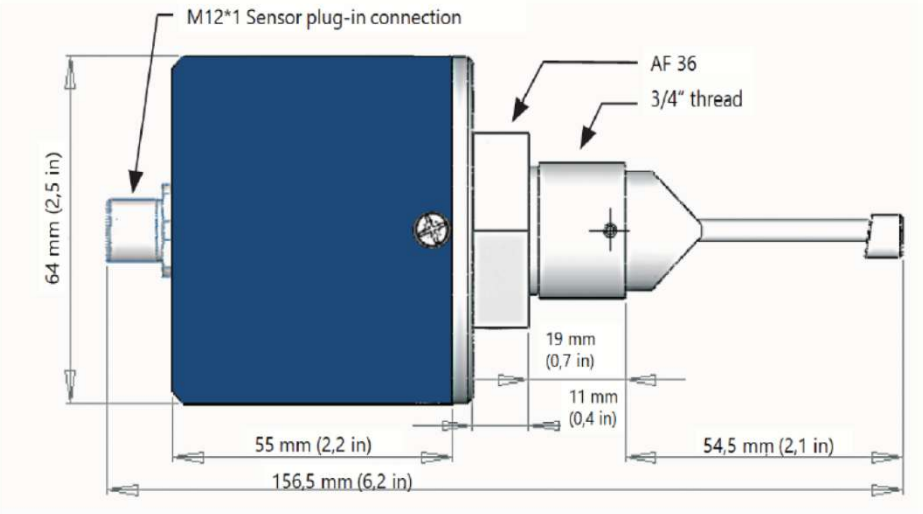
If you have any questions, please contact your supplier or your assigned sales centre.

## 4.2 Installation

The AFGUARD® is an optical measuring device designed for field applications under rough conditions. The optical path (glass rod, mirror) is specifically adjusted to the application.

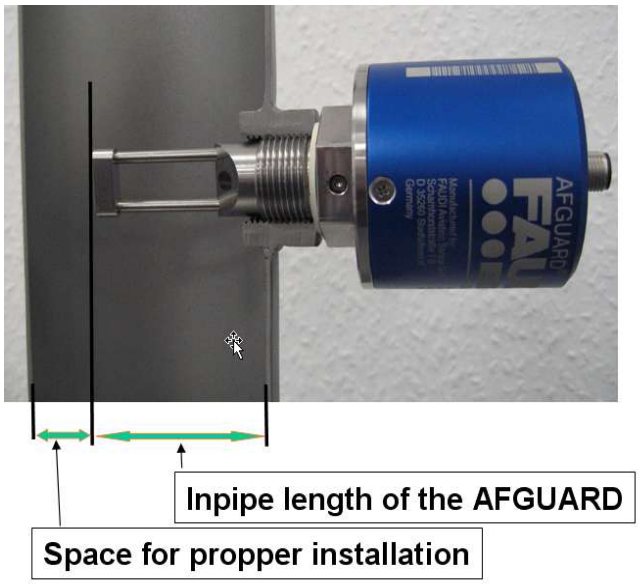
| | |
|---|---|
| ⚠ DANGER | **Observe the Specific Conditions of Use ('X') as stated in the IECEx/ATEX certificate:**<br>**Installation in EPL Ga zones must prevent ignition sources from impact or friction, even in rare faults.** |
| ⚠ CAUTION | - Do not touch the optics or mirror to avoid damaging it.<br>- Avoid direct contact with hard or sharp edges.<br>- Do not touch optical parts with unprotected hands.<br>- Handle with care when applying force.<br>- Recommended tightening torque: **50 Nm** (use AFGUARD® spanner).<br>- Handle the connection cable carefully — avoid mechanical stress or sharp bending.<br>- Protect the cable against "getting caught" |

### 4.2.1 Dimensions



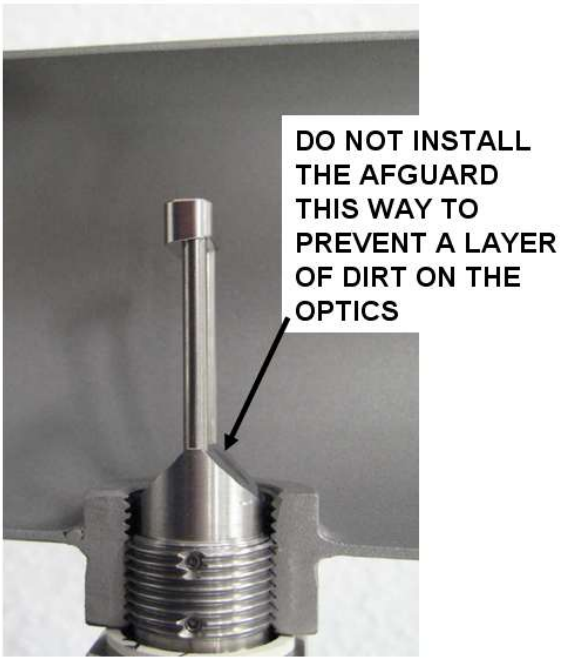
### 4.2.2 Mounting Position

The AFGUARD® must be mounted **horizontally**. Also check the drawing on page 10. Do not mount the AFGUARD® upside down. Make sure that there is enough space inside the pipe to prevent contact between the rear wall and the mirror during assembly – space for proper installation.









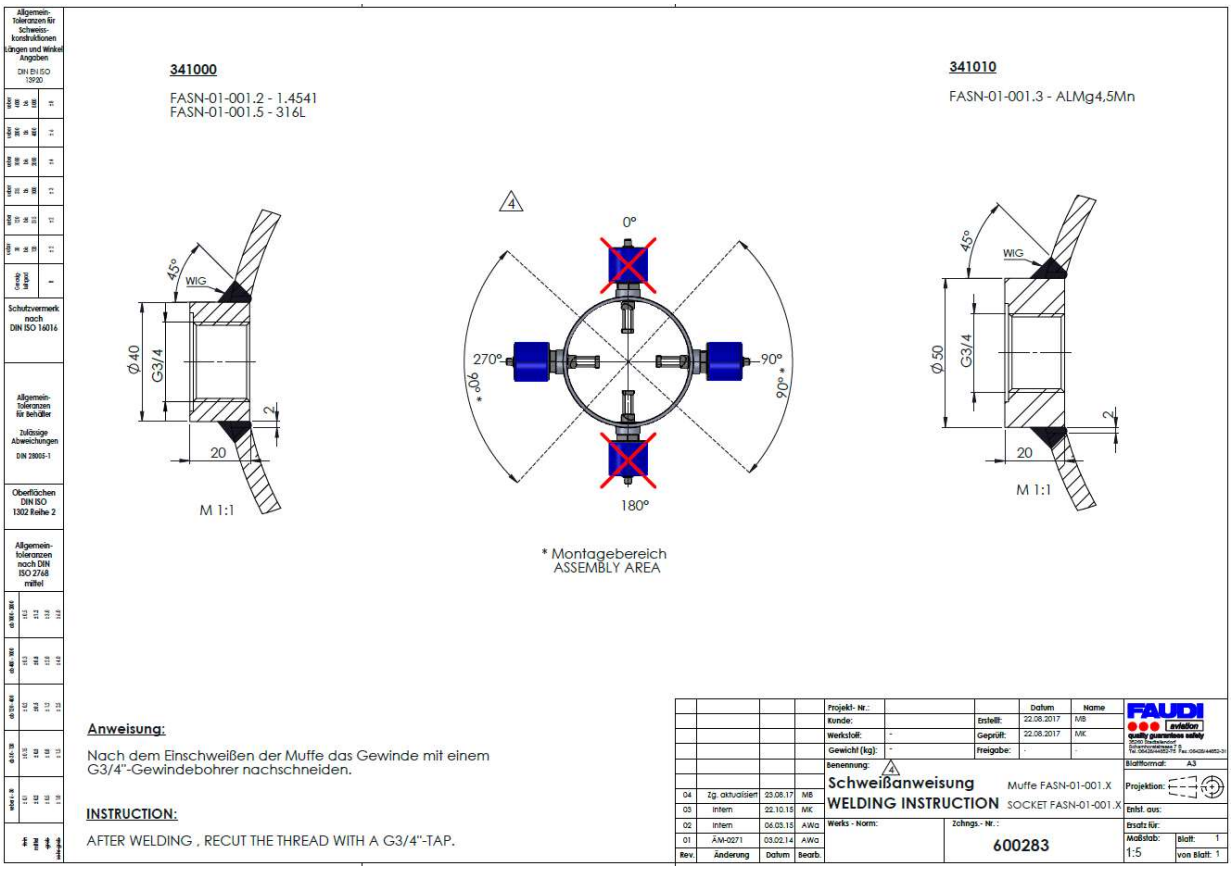

Gravity

⚠ CAUTION Use the AFGUARD® in the right mounting position. Any other use is improper and unsafe.

### 4.2.3 Threads Installation

The AFGUARD® uses special threads to be weld into the pipe section. Threads are available in Stainless steel and Aluminium. Ensure to only use FAUDI-Aviation threads as they have been specially designed for that purpose. Standard threads do not work with the AFGUARD®.

Welding instructions are part of each socket delivery.

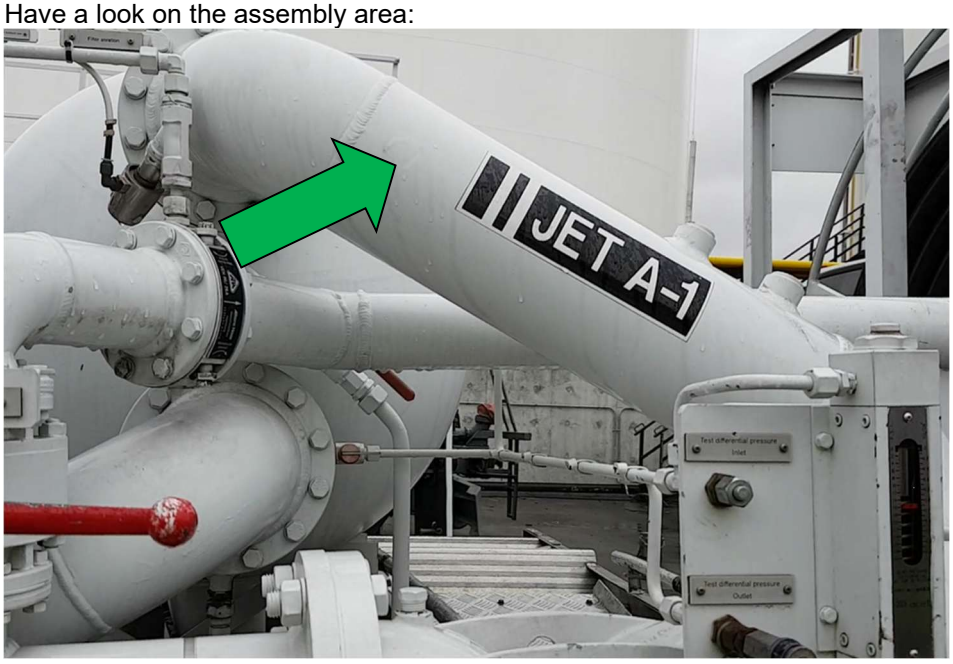



Make sure that the AFGUARD® and related assemblies are secured safely and vibration-free. FAUDI Aviation would be happy to provide a good, picturized guideline on how to select a proper place for the installation of the AFGUARD®. Installation itself should be carried out by trained technicians, most probably by Trained Installers or Certified Installers.

| | |
|---|---|
| **i** NOTE | Select the installation location so that there is easy access for future checks and service work. |

### 4.2.4 Procedure for proper AFGUARD® installation

**Step 1:** Select the best place for installation in the effluent pipe section.
Have a look on the assembly area:




**Step 2:** ⚠ DANGER Drain the pipe section and ensure depressurisation.

**Step 3:** Disconnect the pipe section from the vessel and clean the pipe section from flammable fluids.

**Step 4:** Drill the hole for the AFGUARD® socket.
Drilling tools:
HSS 45mm cylindrical saw for a hand drill
AFGUARD® stainless steel socket
FAUDI article number: 600355
HSS 54mm cylindrical saw a hand drill
AFGUARD® aluminum socket
FAUDI article number: 600356
Please pay close attention to the welding instru



**Step 5:** Weld the special AFGUARD® socket into the pipe section





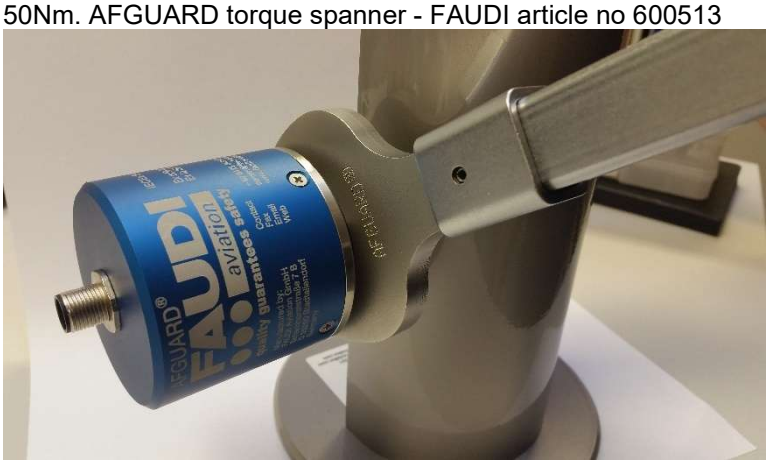
**Step 6:** After welding, it is recommended to thread the socket with a G3/4”-thread cutter.



**Step 7:** Proceed a pressure test to ensure the required PN rating of the pipe section.

**Step 8:** Reassemble the pipe section (ensure to use good working seals).

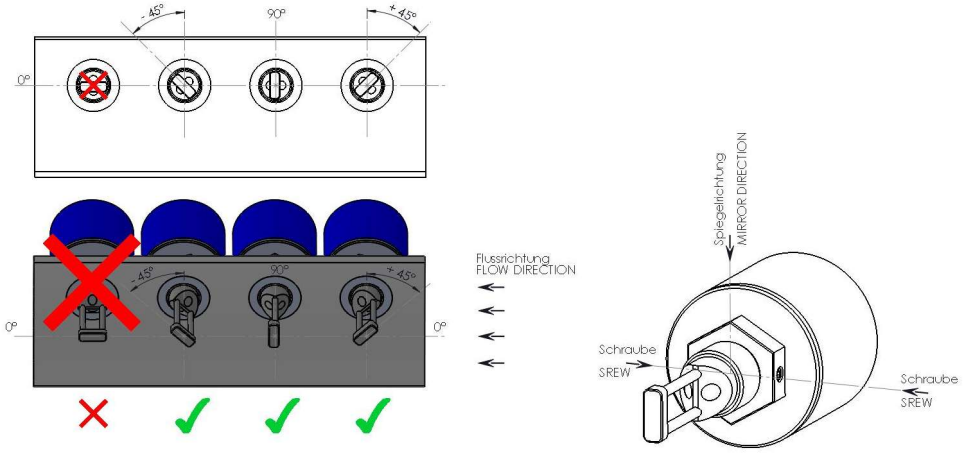
**Step 9:** Install the AFGUARD® in the socket with one of the provided special KLINGERSIL-sealings. Start with the 2 mm one and check the AFGUARD orientation in the pipe section. If not adequate – replace it with the 1.5mm one.
Use the special AFGUARD® torque spanner to achieve the recommended torque of 50Nm. AFGUARD torque spanner - FAUDI article no 600513




**Step 10:** Connect the AFGUARD® to the control system of the truck / tank farm by using the blue two wire cable.
For hazardous area use, please ensure to only use the AFGUARD® together with a suitable barrier with power supply.

### 4.2.5 AFGUARD orientation in the pipe section

AFGUARD® is capable of detecting different droplet size distributions. Especially for bigger droplets, AFGUARD® orientation in the pipe section is of major importance. Therefore, we recommend installing the AFGUARD according the following image:



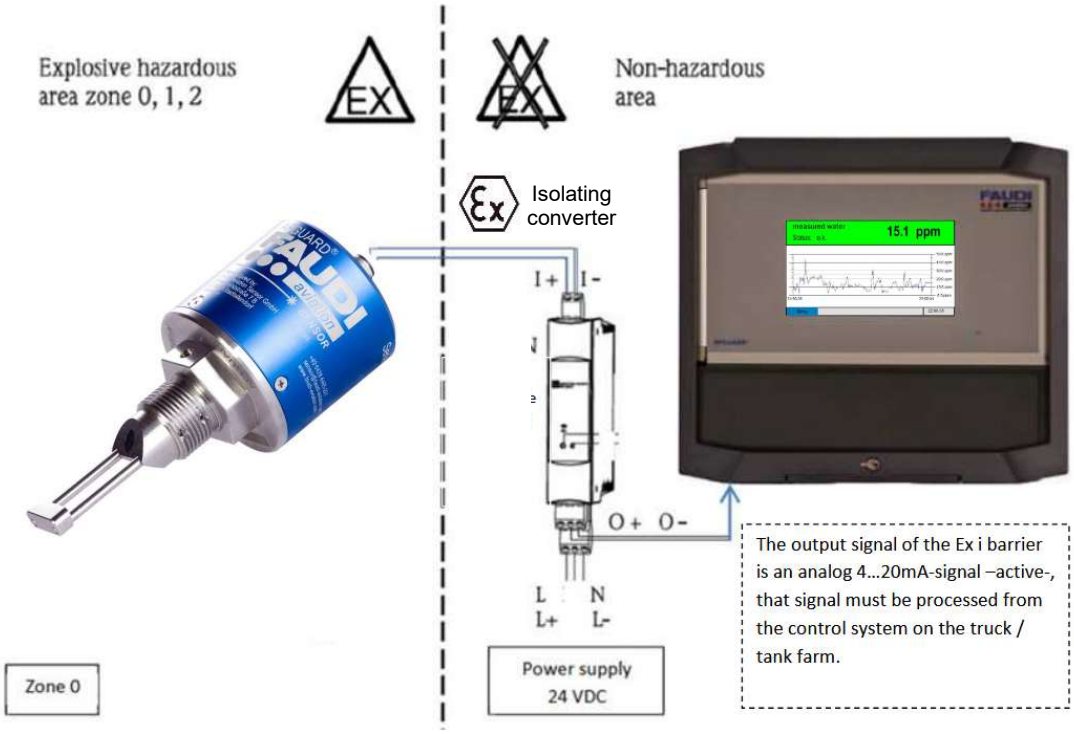

Orientation of AFGUARD® could be achieved using one of the supplied sealings. Start with the 2 mm sealing to get an idea about the AFGUARD orientation (using the AFGUARD® spanner). If insufficient, replace with the 1.5 mm sealing.

| ⚠ CAUTION | Use the AFGUARD® in the right orientation. Any other use is improper and unsafe. |
|---|---|

## 4.3 Electrical connection

A complete measuring system comprises at least:

- The AFGUARD® sensor
- Two-wire cable connection with plug connector.
- Isolating converter with transmitter supply.
- Control system (PLC, CCS-Silver or CCS-Gold)




### 4.3.1 Isolating converter with transmitter supply 4 to 20 mA signal (inherent safe)

FAUDI Aviation highly recommends the use of isolating converters with transmitter supply. Especially for use in hazardous areas, the use of inherent safe isolating converters is mandatory. Protection class should be "ia" IIC. Other protection classes may be individually evaluated and adapted by the operator.

| | |
|---|---|
| ⚠ DANGER | An isolating converter is required for use the AFGUARD® in an explosive hazardous area. |

### 4.3.2 Proof of intrinsic safety for the interconnection of simple electrical circuitry Ex i

When using the AFGUARD® in combination with an isolating converter (sometimes with additional equipment such as displays), it must be verified that all components may be used together in compliance with intrinsic safety requirements. This check must be completed **before installation**. If in doubt, contact FAUDI Aviation GmbH.

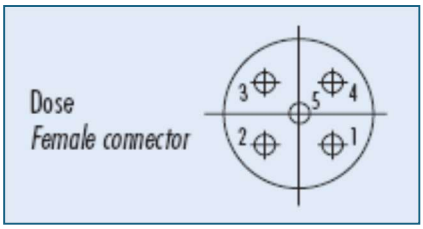
| | |
|---|---|
| ⚠ DANGER | This inspection affects explosion protection and must be carried out by trained personnel |

**Example:** Combination of AFGUARD (Ex ia IIC) together with MACX MCR-EX-SL-RPSSI-I (Phoenix Contact)

| AFGUARD Zone 0 Ex ia IIC | | | MACX MCR-EX-SL-RPSSI-I Ex ia IIC (Data from August 2025) | | | |
|---|---|---|---|---|---|---|
| | Data | Proof of intrinsic safety | | Data | | Remarks |
| $U_i$ | 30 V | ≥ | $U_0$ | 25,2 | V | comply |
| $I_i$ | 100 mA | ≥ | $I_0$ | 93 | mA | comply |
| $P_i$ | 750 mW | ≥ | $P_0$ | 587 | mW | comply |
| $L_i+L_c$ | | ≤ | $L_0$ | 3 | mH | $L_i$ negligible |
| $C_i+C_c$ | | ≤ | $C_0$ | 107 | nF | $C_i$ negligible |
| cable data according to EN 60079-14, 12.2.2.2 | | | | | | |
| $L_C$ | 1 | µH/m | results in | 3000 | m | length of cable |
| $C_C$ | 200 | pF/m | results in | 535 | m | length of cable |
| Use the result with shorter cable length | | | | | | |
| max. cable length | | | | 535 | m | acc. EN 60079-14 |

## 4.4 Wireing / Cable

FAUDI Aviation delivers 15 m of two-wired cable with isolated plug adapter M12x1. The cable can only be shortened by authorized technical personnel It is recommended to use the cable specified by FAUDI Aviation GmbH.




1: Power supply (brown)
2: NC
3: NC
4: 4...20mA signal (blue)
5: NC

| | |
|---|---|
| ⚠ WARNING | Please take care of possible electrostatic charges on the outer surface of the cable. The cable may only be cleaned by using a damp cloth. |
| ⚠ WARNING | Ensure that there is no voltage at the power cable before beginning connection |

## 4.5 Installation examples

1. Handle the AFGUARD® only by the housing when removing it from the packaging.
2. Remove the optical protection cover.
3. Place the correct sealing (1.5 mm or 2 mm) over the sensor thread.
4. Screw the sensor into the fitting.
5. Tighten manually, then apply **50 Nm torque** using the AFGURD® spanner.
6. Check the sealing and the AFGUARD orientation (chapter 3.2.5) .
7. Adjust the cable to avoid stress or sharp bends.
8. Connect the cable to the appropriate terminals via the recommended isolating converter.
9. Connect the plug to the sensor socket.

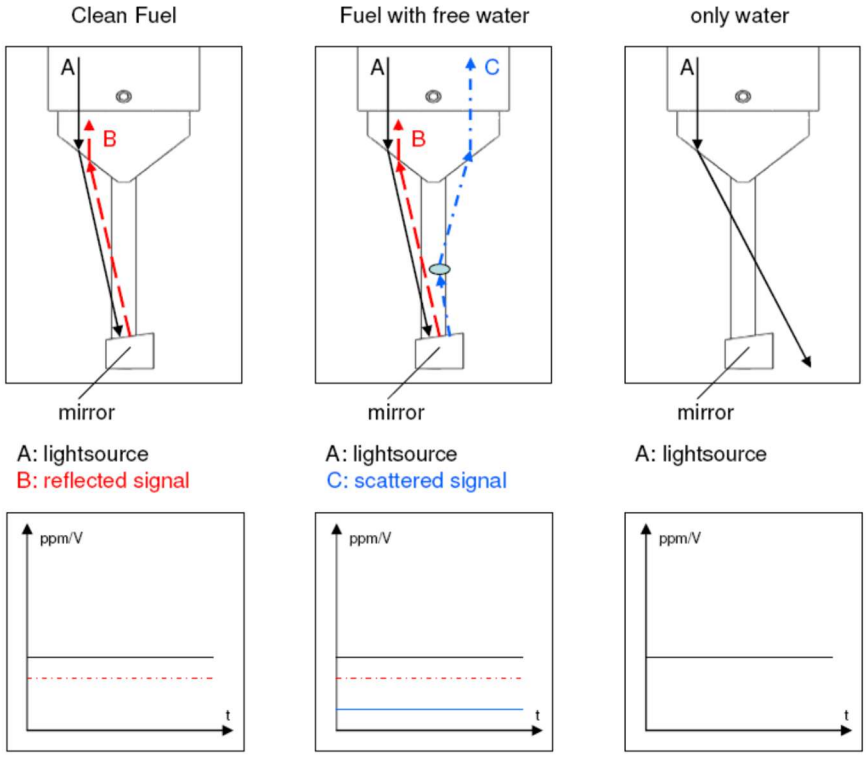
## 4.6 Check of Correct Assembly

- Verify the correct mounting position.
- Check torque (50 Nm) and sealing.
- Ensure correct sensor alignment.
- Route cable downward or horizontally to prevent water ingress.
- Avoid stress on the cable.

## 4.7 Dismantling

1. Switch off power and depressurize/empty the pipeline.
2. Disconnect the sensor plug.
3. Unscrew the sensor.
4. Remove the sealing.
5. Install a blind plug (with sealing) if needed.
6. Clean and inspect the sensor.
7. If returning for service, fill in the decontamination declaration (see chapter 12).
8. Use the original packaging for storage/transport.

## 4.8 Mode of Operation




The AFGUARD® is an inline Sensor to detect the content of free water phases in Jet Fuel. The principle of measuring can be described as refraction index bases IR scattered light effect.

**Clean Fuel:** Pulsed IR light – (Transmitter A) leaves the optics under defined refraction index, passing through the Jet Fuel until the mirror is reached, being reflected, and going back to the optics where the signal intensity is being measured. The difference between transmitted and received light intensity will be handled for:

- Internal adjustment, for example if there is some debris on the optics or the mirror caused by dirt in the Jet Fuel.
- Self Check of electronics.
- As long as there is no free water in the measuring zone, there will be no scattered light.

**Fuel with free water:** Free water in Jet Fuel as fine dispersed second phase will be detected as scattered light by receiver C. During the whole process, the self-checking functionality of the electronics is ongoing.

**Only water (water slug):** If there is a water slug phase, the refraction index will change. This results in another angle of light beam leaving the optics (A). Under this principle, it is easy to differentiate between Jet Fuel and water. Additionally, AVGAS and Gas phases could be determined.

| **i** NOTE | The AFGUARD® can detect gas phases like air bubbles. This can irritate the measurement signal as it interferes with the free water content. |
|---|---|

## 4.9 Signal output

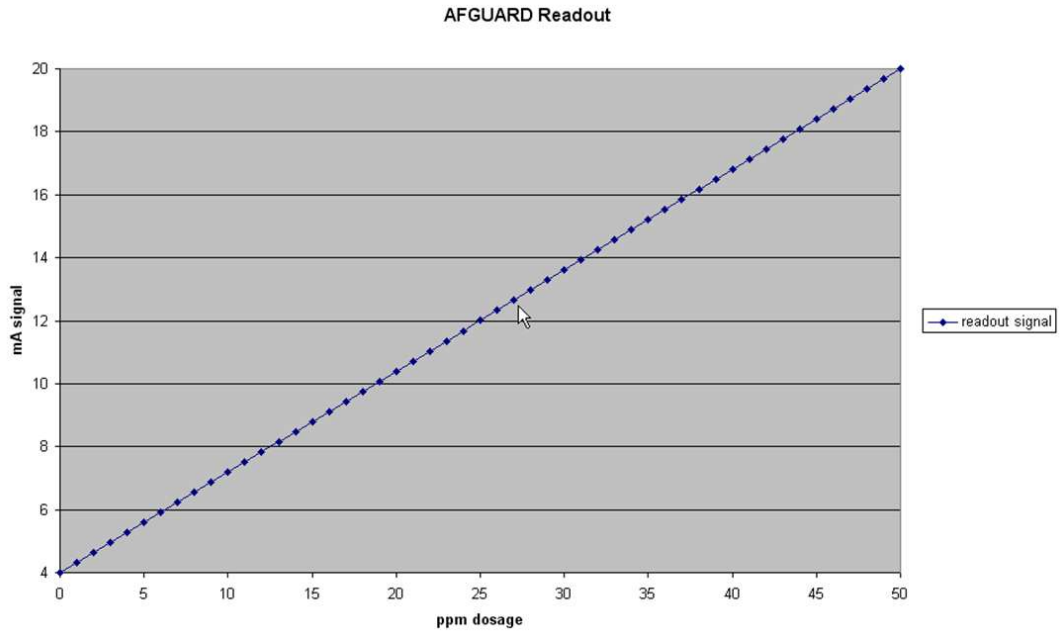
The signal output of the AFGUARD® is 4 to 20 mA as according to worldwide standards. Additionally, the AFGUARD® gives out a lower and upper signal:

| | | |
|---|---|---|
| < 3.6 | mA: | Fault indication (cable break, electronics failure) |
| 4 to 20 | mA: | Measurement range 0 to 50 ppm |
| > 20.2 | mA: | Water slug, Gas phases or sensor failure |

## 4.10 Calibration

In case there are no special requirements made for designated use of the AFGUARD®, the AFGUARD® leaves the factory calibrated for 0 to 50 ppm Jet A1. Other calibration curves could be asked for if needed.

**Signal output** (AFGUARD® readout curve depending on calibration status)**:**

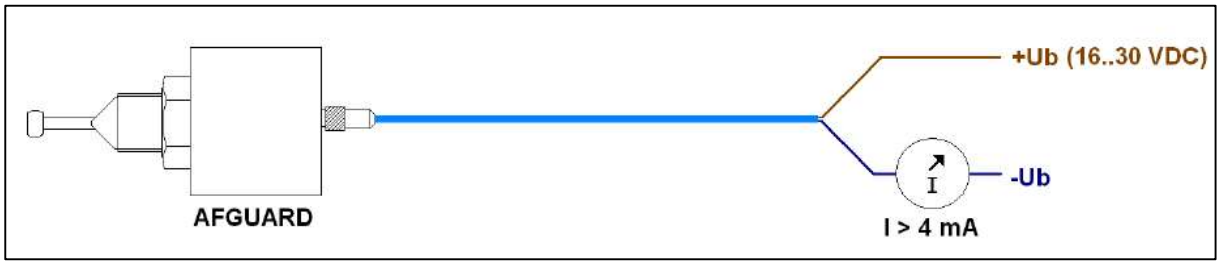


# 5 Commissioning

Before first commissioning, check if:

- the sensor is correctly installed.
- the electrical connection is correct
- Everything was carried out by trained specialists as per the regulations currently in force.

## 5.1 Check of installation and function




Picture for Installation and functioning check

The following procedure is recommended to check the functionality of the AFGUARD® if there is no response during installation and start up.

1. Keep a digital current meter ready for use.
2. Connect the AFGUARD with supply voltage in the range between 16 VDC and 30VDC
   brown = +Ub
   blue = –Ub
3. Connect the digital current meter at the 4 to 20 mA outlet (blue cable) against –Ub
4. Check the output signal (electrical current):
   No signal: Cable / Connector damaged – check if the cable is broken
   < 3,6 mA: Self check / Sensor electronic damaged
   4…20 mA: AFGUARD® submerged in Jet Fuel
   > 20,2 mA: AFGUARD® in Air or submerged in Water

# 6 Loop check

FAUDI developed a special device to check the loop behind the AFGUARD to ensure that critical signals from the AFGUARD will be handled as required.

A loop test protocol for the periodic check of the loop behind the EWS can be provided on request.

Loop test protocol using the AFGUARD loop tester

- FAUDI part no: 600514 reflecting JIG requirements
- FAUDI part no: 600754 reflecting A4A requirements

Test protocol for AFGUARD® installation with .....

ok

**Requirements: System must be powered on, loop tester installed instead of AFGUARD®**

**Pre test (no button pressed)**

Function test for 4 mA base signal of AFGUARD® sensor
➡ No further interaction (do not press any function button)
Output 4 mA or 0 ppm ☐

**Test 1: Fail safe test AFGUARD -> signal output << 4 mA – blue lamp off**
Function test for NAMUR 1
Press F1:
Output: Immediate reply (LED F1 constantly on) – blue lamp should be off (no blinking) ☐

**Test 2: Warning level -> signal output representing > 15 ppm – slow blinking blue lamp**
Function test for warning level
Press F2 for warning level (15 ppm < water level < 30 ppm)
Output: LED blinking -> after _10__ seconds LED constantly on - blue lamp slowly blinking ☐

**Test 3: Alarm level -> signal output representing > 30 ppm – fast blinking blue lamp**
Function test for alarm level
Press F3 for alarm level (water level > 30 ppm)
Output: LED blinking -> after _10__ seconds LED constantly on ☐

**Test 4: Water slug indication -> signal output >> 20 mA – fast blinking blue lamp**
Function test for water slug indication
Press F4 for water slug (water level >> 50 ppm)
Output: LED blinking -> after _5__ seconds LED constantly on ☐

**Test 5: AFGUARD broken wire -> no mA signal – blue lamp off**
Disconnect the AFGUARD cable – blue lamp should be off (no blinking) ☐

**Remarks:**

Part of the loop test protocol

# 7 Maintenance

## 7.1 Cleaning of the AFGUARD®

The sensor has a functional coating that makes it very unlikely that optical surfaces are contaminated. Caution is advised when touching the functional layer.

The sensor intelligence will detect and compensate minor deviations.
Should severe measuring deviations occur during operation, we recommend dismounting the sensor and cleaning the optical path:

- Surfaces of glass elements of the sender and receiver, as well as the mirror.
- Please use only soft, fuzz-free cloths, to avoid any damage to the optical path, such as scratches or brush marks.

# 8 Operational lifetime of AFGUARD® XII

## 8.1 Runtime Limitation and User Acceptance

### 8.1.1 General

This sensor is equipped with an **internal runtime control system** that limits the operational lifetime of the device after commissioning.

The runtime limitation is an **intended and integral functional characteristic** of the sensor.

### 8.1.2 Activation of the Runtime System

The internal runtime system is **activated automatically upon the first connection of the sensor to a power source**.

From this moment, the runtime countdown starts and **cannot be reset, paused, or reversed**.

### 8.1.3 Operational Limitation

After a period of **12 months from initial activation**, the sensor will:

- automatically and permanently cease operation, and
- no longer provide valid measurement signals or functionality.

This behavior is independent of operating conditions, duty cycle, or actual usage time.

### 8.1.4 Acceptance by User Action

Prior to commissioning, the sensor is equipped with a **protective cap and an attached warning notice** informing the user of the runtime limitation.

By **removing the protective cap** and **putting the sensor into operation**, the user:

- confirms that they have been clearly informed of the runtime limitation, and
- **explicitly accepts** the described time-limited operational behavior of the sensor.

The removal of the protective cap constitutes a **deliberate and unambiguous acceptance by user action** of the runtime-limited functionality.

#### 8.1.5 Intended Use

Operation of the sensor beyond the specified runtime period is **not possible** and is **outside the scope of intended use**.

The manufacturer assumes that the user has taken the runtime limitation into account when planning installation, operation, and maintenance intervals.

#### 8.1.6 Important Notice

Failure to observe the runtime limitation does not constitute a defect or malfunction of the sensor.

The runtime limitation is a **defined product feature** and does not affect compliance with applicable technical specifications during the valid operational period.

## 8.2 Installation work and operational Conditions

- **Delivery Condition**
  The sensor is delivered in an inactive standby mode.
- Activation
  Standby mode is automatically deactivated once the sensor is connected to a power source.
- Installation Grace Period
  To ensure that the sensor's 12-month operational timer is not unintentionally triggered during installation activities — such as sensor replacement, commissioning of a new vehicle, or other service work — the device includes an internal initialization sequence of approximately 4 hours.
  - If the sensor is disconnected from the power source before the 4-hour period elapses, the 12-month operational timer will not start.
  - If the 4-hour period is exceeded while the sensor remains connected to a power source, the internal activation timer will begin automatically, starting the 12-month operational period.
- Power Requirements
  The 4-hour installation period requires that the sensor be connected to a power source. After this installation period has elapsed, the device continues to count its operational time internally and no longer requires an external power source for its internal timer.

### Automatic Deactivation

After reaching a total of 12 months of operational time, the sensor will automatically cease to function, regardless of whether it has been in active use or idle during that period. This design ensures measurement reliability and compliance with the manufacturer's calibration specifications.

**Replacement Recommendation**
It is strongly recommended to use the provided replacement label. The label should be marked with the month and year of the planned replacement date and affixed to the rear of the sensor housing (connector side). This ensures clear visibility of the next scheduled replacement date, helping to prevent unplanned downtime and ensuring measurement accuracy.

## 8.3 Firmware on AFGUARD®

AFGUARD® runs a firmware which must be in line with the requirements defined in JIG statements. The actual firmware to be conformant to JIG 130 is firmware 1.19.

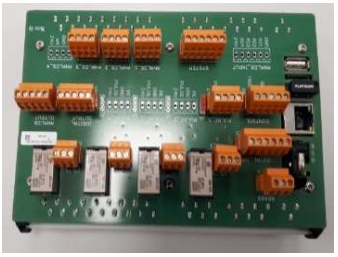
If you are not sure about your actual firmware status – please look at the latest calibration report of your AFGUARD® or contact your FAUDI-Aviation service organisation.

| | |
|---|---|
| REMARKS | SOFTWARE 20_08_19<br>FIRMWARE 01.19<br>P2 Jet A-1 |

For further information regarding AFGUARD XII life time period or recertification / recalibration for regular AFGUARD sensors, please contact your local FAUDI Aviation sales contact.

# 9 Accessories

To make installation as easy as possible, FAUDI Aviation GmbH recommends the use of the below mentioned devices.

| | |
|---|---|
| AFGUARD® cable<br><br>Order reference: 511301<br>Description: 2-wire AFGUARD® cable with a M12-Plug |  |
| CCS (Contamination Control System)<br><br>Order reference: 750000<br>Description: CCS Silver<br><br>Or<br>Order reference 730000<br>Description: CCS Gold<br><br>Gold and silver are linked with: AFGUARD® (120500), Barrier 1 channel (600517), blue LED warning light (600361), SLUGGUARD® (600306), external key switch (600087)<br><br>The CCS is developed to process, in combination with the AFGUARD, the actual free water contamination in fuel. It relays outputs to switch alarms and warnings according to the latest specifications. Logged data can be stored on memory sticks or be sent out to connected SCADA system. | <br> |
| Barrier 1 channel<br><br>Order reference: 600517<br>Description: Barrier, 1-Channel, EX I, Zone 2<br><br>Linked with: AFGUARD® (120500)<br>Quantity: 1<br><br>PHOENIX barrier - Ex i with power supply and input signal conditioner:<br>-Transmits supplied or active 0/4 - 20mA signals from the hazardous area to a load (active or passive) in the safe area<br>-Electrical isolation<br>-SIL 2 according to IEC 61508<br>-With screw connection |  |

| | |
|---|---|
| LED warning light<br><br>Order reference: 600361<br>Description: Blue LED warning light 24 V DC IP66<br><br>Linked with: Contamination Control System Silver (740000)<br><br>Light indicator according to JIG bulletin 110 to indicate warning and or alarm situation in case of critical levels of free water. |  |
| AFGUARD® loop tester<br><br>Order reference: 600514<br>Description: AFGUARD® Loop Tester<br><br>Linked with: AFGUARD® (120500)<br><br>Loop tester to periodically test the loop of the AFGUARD installation according to JIG requirements. |  |
| AFGUARD® torque spanner<br><br>Order reference: 600513<br>Description: AFGUARD® Torque Spanner<br><br>To install the AFGUARD sensor with the right torque setting of 50 Nm. |  |
| External key switch<br><br>Order reference: 600087<br>Description: External key switch<br><br>External key switch to reset the warning and alarm levels of the Contamination Control System, non-Ex variant, IP66. |  |

## 9.1 Installation accessories

Optional torque wrench with spanner inserts SW36
Optional ¾" sleeve for welding into pipelines (aluminium/stainless steel)
Spare gaskets for 3/4" sleeve connection.

# 10 Trouble-shooting

## 10.1 Trouble-shooting instructions

See chapter 14 issues and solutions.

## 10.2 Sensor checks

Caution!
Only authorised and trained personnel may test the AFGUARD®!

## 10.3 Spare parts

Sealing
Cable with Sensor plug
Hard case for storage and transport
Protection sleeve for the optics

## 10.4 Return

If the device requires repair, please send it cleaned to the sales centre responsible. Please use the original packaging, if possible.
Please enclose the completed "Declaration of Decontamination" (download or copy the page of chapter 15 of these Operating Instructions) with the packaging and the transportation documents.
No repair will be carried out without the completed "Declaration of Decontamination"!

## 10.5 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.
Please observe local regulations.

# 11 Technical Data

## 11.1 Input

| | |
|---|---|
| Measured value | Free water [ppm]<br>Water slug; Gas phases, |
| Measuring range | 0 … 50 ppm<br>Other ranges on request |

## 11.2 Ambient conditions

| | |
|---|---|
| Storage temperature | - 40 °C … + 75 °C |
| Operating temperature | - 30 °C … + 60 °C |
| Rel. humidity | 10 % … 90 % |
| Ingress protection<br>acc. EN 60529 | IP 67 |

## 11.3 Performance and parameter

**Supply and signal circuit intended to a 4 to 20 mA current loop:**

| | | |
|---|---|---|
| Voltage | U | 15…30 V |
| Current | I | 3,8 … 20,2 mA |
| Max. Power | Pmax | U x 20,2 mA |

**Optical radiation**

| | | |
|---|---|---|
| Wave length | | 840 nm ≤ f ≤ 1050 nm |
| Optical power | | ≤ 12 mW |
| Irradiation intensity | | ≤ 1,025 mW/mm² |
| Light pulse-Energy | | ≤ 40 µJ |

**Ambient conditions and Explosion group and Temperature class**

2014/34/EU (ATEX) : Ⓔx II 1G Ex ia IIC T4 Ga
IECEx Scheme: Ex ia IIC T4 Ga

| | | |
|---|---|---|
| Voltage | $U_i$ | 30 V DC |
| Current | $I_i$ | 100 mA |
| Power | $P_i$ | 750 mW |
| Ambient temperature | | -30 °C ≤ $T_a$ ≤ 60 °C |
| Explosion group | | IIC |
| Temperature class | | T4 (135°C) |
| Type of Protection | Intrinsically savety level | ia |
| Equipment Protection Level | | Ga |
| Gas athmospheres | | Zone 0 |

## 11.4 Process conditions

| | |
|---|---|
| Operating pressure | Max. 10 / 16 bar,<br>no vacuum |
| Process Temperature | - 30 °C … + 60 °C |
| Process medium | Kerosene, Jetfuel, |

## 11.5 Layout

| | | |
|---|---|---|
| Design, Dimensions | See chapter 4.2.1 | |
| Weight | Sensor hazardous approved: | ca. 1 kg |
| Materials<br>(in contact with medium) | Sensor head:<br>Glass rod:<br>Sealing: | SS 1.4301<br>optical Glass<br>Klingersiel<br>FKM intern |
| Process connections: | Thread:<br>Length of thread:<br>Wrench size:<br>Torque setting: | G3/4“<br>25 mm<br>AF 36 mm<br>50 Nm |
| Cable connection | Sensor plug:<br>Length: | M12<br>15 m |
| Temperature compensation | Internal | |

## 11.6 Reliability prediction

**Zuverlässigkeitsberechnung (Reliability Prediction)**

| | |
|---|---|
| **Typenbezeichnung:** | AFGUARD® |
| Material Nummer: | 220500 |
| Status: | Serie |
| Betriebstemperatur [°C] | 40 |
| Betriebsspannungsbereich [VDC] | 16 - 30 |
| **Berechnungsgrundlage:** | EN ISO 13849-1:2015 |
| Berechnungsmethode | Part Count |
| MTTF(d)-Komponenten (Worst Case) | Faktor 10 |
| 50% gefahrbringende Fehler | Faktor 0.5 |
| Umgebungstemperatur [°C] | 40 |
| Betriebsbedingungen | Nennbelastung |
| MTTF-Basiswerte (übrige Komponenten) | MIL-HDBK 217F, Notice 2 / RDF 2000 |
| Umgebungsbedingungen | Ground mobile, 40°C |
| Bedingung | konstante Ausfallrate |

| **Total:** | **Worst Case** |
|---|---|
| Mean time to dangerous failure $MTTF_d$ [Jahre] | > 42 (without regular checks) |
| Mean time to dangerous failure $MTTF_d$ (based on yearly checks) | > 84 (yearly check) |
| Mean time to dangerous failure $MTTF_d$ [Stunden, h] | > 736134 |
| Wahrscheinlichkeit eines gefährlichen Ausfalles je Stunde [1/h] | < 1.36E-06 |

Hinweise:
- Die Werte der angewendeten EN-ISO-Berechnungsmethode beziehen sich auf Worst Case Betrachtungen, sind jedoch um ca. Faktor 2 besser als nach Berechnung gemäß MIL-HDBK-217.
- Typische Werte können unter Berücksichtigung des effektiven Einsatzes deutlich besser sein.
- Der resultierende MTTF(d)-Wert beurteilt nicht die Sicherheit des Produktes, sondern ist lediglich eine Berechnung resp. Abschätzung der zufälligen Fehler, welche sich auf Grund von zufälligen Hardwareausfällen ergeben, als Ergebnis der begrenzten Zuverlässigkeit von Hardwarebauteilen.

## 11.7 FMEA

Final Report, Revision 1, Issue Date: February 1, 2021 -> download from JIG server available

## 11.8 CE-Konformitätserklärung – EC Declaration of conformity

To be provided on request

# 12 Issues and solutions

| Question | Solution |
|---|---|
| Is the connector to be inserted compliant with explosion proof specifications? | Connectors for use with "Intrinsically safe" ("ia/ib") initiator types do not necessarily have to be Ex-certified, because the energy of the ex-i circuit is limited to a point avoiding any ignitive sparks. (Limitation of short circuit current and open-circuit voltage) |
| Is there no blue ex- i proof cable to be used with ex-proof intrinsically safe electric circuit? | For ignition protection type, an "intrinsically safe" ("ia/ib") cable, marked blue, is generally required. Since the entire market does not offer plastic coated cables with a surface resistance of < $10^9$ Ω, the cable is to be wiped only with a damp cloth considering possible electrostatic charge. |
| Should a sensor cable for special use/requirements be used? | For connector M 12X1, a cable socket with a connection via user specific cable, 4 $mm^2$ to 8 $mm^2$ cross section, can be used. |
| Is the AFGUARD® sensitive to extraneous light? | Yes, the sensor optic should not be exposed to light (>10 Lux). Therefore, installation into a sight glass is not possible. |
| How does the sensor detect the difference between water and jet fuel? | The principle of the AFGUARD® is based on an optical process, relying on the refraction index of the medium to be examined. The refraction index of Jet Fuel and water strongly diverge from each other. Water results in an optical bypass of the mirror. |
| Can AFGUARD® differentiate between clean water and jet fuel? | Yes. |
| What is the output signal? | The output signal of the AFGUARD® is a so-called standard signal of 4 to 20 mA. As an example, for a measuring range of 0 to 50 ppm, this means having an output current of 4 mA = 0 ppm and 20 mA = 50 ppm. The signal measuring span of 16 mA is distributed linearly to the measuring range. |
| How can I assure that the AFGUARD® is properly installed/positioned? | The marking near the SW36 screw nut should be pointing to the direction of the flow. |
| Can the non-explosion proof AFGUARD® also be used in areas susceptible to explosions (Ex zones)? | This is the operator's decision. We, FAUDI Aviation GmbH, will only recommend the use of hazardous area approved equipment for use in hazardous zones. |
| Which explosive areas (ex-zones) do I have, and where are they? | The operator is responsible for allocating zones, as well as for deciding which sensor technology to be used (plant safety regulations). We, FAUDI Aviation GmbH, can only offer assistance in the decision process. |
| Which documents do I need for obtaining operation approval? | -.- |
| Who may install the AFGUARD®? | This is the operator's decision (plant safety regulations).<br>We recommend installation only by authorized personnel with the proper certification regarding explosion proof installations. |
| How often does the AFGUARD® require calibration? | Our recommendation is:<br>Once per year. The operator may, based on experience with the sensor, shorten the intervals. |

| | |
|---|---|
| Is FAUDI Aviation able to deliver electronic accessories like intrinsically safe barriers, hazardous area approved displays or data loggers? | Yes – FAUDI Aviation developed electronic bundles to make life and operation easier. Delivery conditions and pricing for electronic devices can be requested through your local sales contact. |
| Do you have the possibility to address alarms? | The AFGUARD® itself only gives out a linear signal readout that represents the amount of free water with regard to the calibration of the sensor. This readout signal could be used together with additional electronic devices to address alarms such as optical or acoustical signals, or relays to stop the process. |
| Where do I need to place the intrinsically safe barrier? | Intrinsically safe barriers should be installed in safe areas. Please refer to the manuals provided with each electronic device. |
| Is the AFGUARD able to see particulate matter? | Yes – but the AFGUARD® is not calibrated to give out correct values related to particulate matter. It is more or less a volume-based signal that should be multiplied with the density of particulate matter to have an idea of the mass. |

# 13 Declaration of Decontamination

## Declaration of Decontamination
Electronic Sensor

Due to legal regulations and for the safety of our employees and operating equipment, we require this "Declaration of Decontamination" with your signature before your order can be processed. Please enclose the fully completed declaration with the equipment and shipping documents in any case. If necessary, also enclose safety data sheets and / or special instructions for action.

Shipping Address: FAUDI Aviation GmbH
Scharnhorstraße 7B
35260 Stadtallendorf
Germany

Type of Device / Sensor:

Serial No.:

Medium / Concentration:

Chemical Notation:

Description:

Reason for Return:

Company Data:

Company:

Contact Person:

Street:

Address:

Telephone:

Fax:

E-Mail:

Your Order No.:

Place:

Date:

Signature:

**FAUDI Aviation GmbH**
Scharnhorststraße 7B
35260 Stadtallendorf
Germany

Phone: +49 6428 44652-570
Fax: +49 6428 44652-223
Email: contact@faudi-aviation.com

Rev. 1.0
**www.faudi-aviation.com**

# 14 Product Information and Usage Agreement

## 14.1 Purpose and Functionality

This AFGUARD XII, hereinafter referred to as sensor, is designed, based on many years of field experience, to deliver accurate measurement results for a maximum operational period of 12 months following activation. Extended operation beyond this period may result in increased measurement inaccuracies.
For safety, compliance, and performance reasons, the AFGUARD XII is configured and programmed to cease functioning automatically after 12 months of operational time.

## 14.2 Operational Conditions

- Delivery Condition
  The sensor is delivered in an inactive standby mode.
- Activation
  Standby mode is automatically deactivated once the sensor is connected to a power source.
- Installation Grace Period
  To ensure that the sensor's 12-month operational timer is not unintentionally triggered during installation activities — such as sensor replacement, commissioning of a new vehicle, or other service work — the device includes an internal initialization sequence of approximately 4 hours.
  - If the sensor is disconnected from the power source before the 4-hour period elapses, the 12-month operational timer will not start.
  If the 4-hour period is exceeded while the sensor remains connected to a power source, the internal activation timer will begin automatically, starting the 12-month operational period.
- Power Requirements
  The 4-hour installation period requires that the sensor be connected to a power source. After this installation period has elapsed, the device continues to count its operational time internally and no longer requires an external power source for its internal timer.

## 14.3 Automatic Deactivation

After reaching a total of 12 months of operational time, the sensor will automatically cease to function, regardless of whether it has been in active use or idle during that period. This design ensures measurement reliability and compliance with the manufacturer's calibration specifications.

## 14.4 Replacement Recommendation

It is strongly recommended to use the provided replacement label. The label should be marked with the month and year of the planned replacement date and affixed to the rear of the sensor housing (connector side). This ensures clear visibility of the next scheduled replacement date, helping to prevent unplanned downtime and ensuring measurement accuracy.
Disclaimer
By installing and using this sensor, the user acknowledges and agrees to the above operational conditions and accepts responsibility for timely replacement at or before the end of the 12-month operational period. The manufacturer assumes no liability for any inaccuracies, malfunctions, or damages resulting from use beyond the specified operational lifetime.

# 15 Information about the voucher process

**General Terms and Conditions clause: Take-back and reimbursement system**

## 15.1 Take-back offer after the end of the product's service life

After the end of the product's service life as guaranteed by the manufacturer, customers have the option of returning the product to the manufacturer for environmentally friendly recycling.

## 15.2 Right of return

Returns are only possible after prior registration using the online form provided by the manufacturer. The customer must provide the date of purchase, product name, serial number, and proof of purchase (e.g., copy of invoice). After the information has been checked, the customer will receive a return number.

## 15.3 Return shipment

The return shipment must be made within 14 calendar days of receiving the return number. Shipping is at the expense and risk of the customer and must be sent exclusively to the collection point specified by the manufacturer. The product must be returned complete, free of adhesions, and in the original or equivalent transport packaging.

## 15.4 Inspection and acceptance

The manufacturer will check the completeness and identity of the returned product. Products that are damaged, incomplete, or received without a valid return number will not be reimbursed and may be returned at the customer's expense or disposed of properly.

## 15.5 Reimbursement

For each product that is properly returned and inspected, the customer will receive reimbursement in the form of a non-transferable purchase voucher for the purchase of a new product from the manufacturer. The value of the voucher is a maximum of EUR 150 per product. The voucher will be sent digitally only, is not redeemable for cash, and expires three (3) months after issuance.

## 15.6 Exclusion

Returns are excluded if the product is no longer in its original condition, has been modified by the customer, or has been misused.

## 15.7 Miscellaneous

The customer's statutory warranty and return rights remain unaffected by this.