NMO

GB-1659

# Parts Certificate
# GB-1659

| | |
|---|---|
| **Issued by** | **NMO** |
| **In accordance with** | The applicable requirements of Welmec Guides 7.2 and 8.8, and OIML R117-1 Edition 2007 (E). |
| **Applicant** | **Heinrichs Messtechnik GmbH**<br>**Robert-Perthel-Strasse 9**<br>**50739 Cologne**<br>**Germany** |
| **In respect of** | A family of **Coriolis mass-flow meters** tested as a separate part of a liquids other than water instrument.<br>Manufacturer: Heinrichs Messtechnik GmbH<br>Type: TMU-S### sensor with a UMC3 transmitter |
| **Characteristics** | Suitable for a liquids other than water instrument with the following characteristics:<br>Minimum rate of flow: 600 kg/hr<br>Maximum rate of flow: 700,000 kg/hr<br>Accuracy class: 0.5<br>Environment classes: M2 / E2<br>Ambient temperature range: -40 °C to +55 °C (TMU sensor)<br>-20 °C to +55 °C (UMC3 transmitter)<br>Humidity: Open, Condensing |
| **Description and documentation** | The device is described in the Descriptive Annex.<br>Documents appertaining to this Evaluation certificate are held by NMO. |
| **Remarks** | The conformity was established by testing and examinations described in the associated Evaluation Report P02148. |

**Issue Date: 06 March 2019**

**G Stones**
**Technical Manager**
***For and on behalf of the Head of Technical Services***

# Descriptive Annex

## 1 INTRODUCTION

The TMU family of Coriolis Flow Sensors, together with its associated UMC3 transmitter, are designed for the direct mass-flow measurement of gases and liquids in piping systems irrespective of their conductivity, density, temperature, pressure or viscosity.

The TMU sensor is available in sizes, ranging from Qmin = 600 kg/hr to Qmax = 700,000 kg/hr. The sensor and transmitter are connected by a special 10 cored cable and may be installed at distances of up to 200 m apart.

The UMC3 transmitter possesses two microprocessor units one for controlling the process sequence and communications and one for controlling the BE2 control unit, as well as a high-speed DSP (Digital Signal Processor) for controlling the demanding measuring tasks.

With the UMC3 transmitters BE2 control unit, which possesses an LCD display and 6 control keys, the meter can be programmed by the operator with the required parameters and desired features. The control unit microprocessor possesses its own independent program for controlling the control unit and communicates its activity directly to the main microprocessor.

Once programmed and sealed, a glass windowed lid allows for visual observation of the measurements.

## 2 DESCRIPTION

### 2.1 The TMU Mass-flow Sensor

The mass-flow sensor consists of the following components:

- A main body, which is designed with a minimum Ingress protection of IP65 to protect the internal components from damage or contamination.
- An inlet and outlet flange for connection to a piping system allowing the medium to be measured to flow in and out of the sensor where it is split into the two parallel arranged tubes for analysis.
- Two parallel arranged measuring tubes which are set into oscillation for determining the mass-flow through the sensor.
- An exciter coil powered by the associated transmitter to set and hold the measuring tubes in oscillation.
- Two pick-up coils used to capture the mass-flow proportional phase shift between the inlet and the outlet legs of the measuring tubes.
- A temperature sensor connected to one of the measuring tubes used for temperature related compensation of the sensor and medium.
- A terminal box allowing for the connection of the cable from the associated transmitter.

### 2.2 The UMC3 Transmitter

The mass-flow transmitter consists of the following components:

- An aluminium enclosure with two compartments.
- An electronic compartment with intrinsically safe electronics for the measurement, assessment and communication of the measured vales.

- A control unit with push buttons and a display for programming the parameters and features of the meter, and for visually monitoring the results.
- A terminal compartment for the connection of the cable to the sensor, the power supply and the communication outputs.

## 2.3 Operating principle

The transmitter's exciter circuit sets the measuring tubes into a vibrating back and forth motion around the flange's rotational axis. The frequency of this resonant motion is determined by the sensor's construction and by the density of the medium. The time difference between the two pick-up coil signals is directly proportional to the mass flowing through the tubes. This time difference and the frequency of resonance are measured to determine the mass-flow and density respectively. From these two values the volume flow can be determined.

The captured mass-flow value is transmitted by the transmitter via either a pulse output which may be parametrised as required, or a current output. When transmitted via pulse, a second pulse signal is also available for determining the direction of flow. This is achieved by shifting the rising edge of the pulse 90° in front or 90° behind the mass-flow pulse.

The measured density value may be transmitted using the 4 – 20 mA current output. MODBUS or HART communication interfaces are also available for communicating numerous parameters simultaneously, or for requesting information of the meter's status. The sensor can be used bi-directionally with consistent accuracy.

## 2.4 Available Devices

### 2.4.1 The UMC3 Transmitter

The transmitter is available with the two power supply versions:
- 24 VDC
- 230 VAC

### 2.4.2 The TMU Sensor –

The sensor is presently available in 8 sizes with numerous process connections. The available sensor sizes and their measurement ranges are as follows:

| | | |
|---|---|---|
| TMU-S015 | - | 600 kg/hr to 9,000 kg/hr |
| TMU-S025 | - | 1,500 kg/hr to 30,000 kg/hr |
| TMU-S040 | - | 3,000 kg/hr to 60,000 kg/hr |
| TMU-S050 | - | 4,000 kg/hr to 80,000 kg/hr |
| TMU-S080 | - | 6,000 kg/hr to 120,000 kg/hr |
| TMU-S100 | - | 10,000 kg/hr to 200,000 kg/hr |
| TMU-S150 | - | 23,500 kg/hr to 460,000 kg/hr |
| TMU-S200 | - | 35,000 kg/hr to 700,000 kg/hr |

#### 2.4.2.1 Pressure Correction

Depending on the TMU Sensor characteristics, a dynamic pressure correction by means of MID compliant pressure transmitter is required when the pressure variation in the final application has an effect of more than $^1/_5$ of the Maximum Permissible Error (MPE) for that application.

## 3 TECHNICAL DATA

**Measurand**: The meter's primary application is the measurement of mass-flow of liquids other than water. Units of measurement can be set; however, they must be set before the custody transfer stamp is set. After setting, a change of the unit is not possible. The indication of the measurand can be performed in, for mass: gr/hr, kg/hr, Tonne/hr, or volume such as: l/hr, $m^3$/hr.

**Liquid types**: The types of liquids covered by this part of the directive are for example; oils, oil by-products, chemicals, potable liquids. for applications such as; Fuel dispensers for motor vehicles, and loading and unloading of ship, rail and road tankers, ship-fuel bunkering.

### 3.1 Rated operating conditions ranges

**Ambient temperature range**:

| | |
|---|---|
| TMU sensor: | -40 °C to +55 °C. |
| UMC3 transmitter: | -20 °C to +55 °C |

(The LCD display of the UMC3 transmitter limits its ambient temperature range to -20°C)

**Liquid temperature range:**

| | |
|---|---|
| TMU Sensor: | -40°C to +260 °C |

**Operating pressure (dependant on sensor size, see table 1):**

| | |
|---|---|
| Min. | 0.5 bar |
| Max. | 175 bar |

**Density Range:**

| | |
|---|---|
| Min. | 300 kg/$m^3$ |
| Max. | 2000 kg/$m^3$ |

**Viscosity range:**

| | |
|---|---|
| Max. | 2,000 mPa |

**Ingress Protection:**

| | |
|---|---|
| Transmitter: | Min. IP65 |
| TMU Sensor: | Min. IP65 |

The meters may be used indoors or outdoors.

**Environmental Classes:**

| | |
|---|---|
| Electromagnetic Class: | E2 |
| Humidity Class: | Open, Condensing |
| Mechanical Class: | M2 |

**Accuracy class of meters:**

| | |
|---|---|
| Mass-flow, all sensor sizes: | 0.5 |
| Density, all sensor sizes: | 0.5 |
| Volume, all sensor sizes: | 0.5 |
| Temperature: | 0.5 |

In table 1 the measuring ranges of the devices covered are stated for each sensor together with the minimum measured quantities (MMQ).

**Table 1**: Flow ranges and process pressures of the sensors

| Sensor | MMQ [kg] | Qmin [kg/hr] | Qmax [kg/hr] | Max. pressure [bar] |
|---|---|---|---|---|
| TMU-S015 | 21 | 586 | 9286 | 175 |
| TMU-S025 | 50 | 1500 | 30000 | 152 |
| TMU-S040 | 103 | 3001 | 61044 | 95 |
| TMU-S050 | 140 | 4000 | 80000 | 80 |
| TMU-S080 | 202 | 5825 | 122240 | 80 |
| TMU-S100 | 350 | 10000 | 200000 | 50 |
| TMU-S150 | 750 | 22759 | 460659 | 70 |
| TMU-S200 | 1200 | 35000 | 700000 | 60 |

Where volumes are to be measured, the applicable values for Qmax, Qmin and MMQ are defined by the following equation:

Qmin volume = Qmin mass / minimum product density
Qmax volume = Qmax mass / maximum product density
MMQ volume = MMQ mass / minimum product density

Where minimum and maximum product density represents the minimum and maximum expected densities of the product to be measured.

### 3.2 Technical documentation

The Technical File is held at NMO.

### 3.3 Software

UMC3 contains two processors each with their own software, the main processor and the control unit processor, only the software of the main processor has legal metrology relevance.

The classified software of the main processor with legal metrology relevance carries the following version number and check sum which is shown during the start-up sequence when powered on:

| | |
|---|---|
| Software version number: | 3.25 |
| Check sum: | 8DCB |

Non-legally relevant software relates only to the BE2 control unit

| | |
|---|---|
| BE2 software version number: | 2.132 |

Once the “Custody Transfer Stamp” has been set, no amendments to settings or software parameters are possible.

The software of the UMC3 is classified in accordance to the WELMEC Guide 7.2 (2018) as a “Type P software without extension”.

## 4 PERIPHERAL DEVICES AND INTERFACES

### 4.1 Interfaces

The meter has the following interfaces, some of which are standard installations others optional, only installed upon request. The meter may have any combination of the following interfaces:

- Pulse outputs B1 and B2
- Status output B3
- Current output (4 – 20 / 21.6) mA
- HART Communication (optional)
- Modbus RTU (optional)
- Binary input (Custody push-button)

The transmitter has the following metrological means of communication:

- Pulse, Frequency
- 4 – 20mA current output and Modbus RTU.

### 4.2 Peripheral devices

The instrument may be connected to any peripheral device that has been issued with Parts Certificate by a Notified Body responsible for Module B under Directive 2014/32/EU and bears the CE marking of conformity to the relevant directives; or

A peripheral device without a Parts certificate may be connected under the following conditions:

- it bears the CE marking for conformity to the EMC Directive;
- it is not capable of transmitting any data or instruction into the measuring instrument, other than to release a printout, checking for correct data transmission or validation;
- it prints measurement results and other data as received from the measuring instrument without any modification or further processing; and
- it complies with the applicable requirements of Paragraph 8.1 of Annex I.

## 5 APPROVAL CONDITIONS

The certificate is issued subject to the following conditions:

### 5.1 Inscriptions

The instrument shall bear the following inscriptions:

- Manufacturer’s name, registered trade name or registered trade mark and postal address
- Parts Certificate number
- Designation or Type
- Serial Number
- Year of Manufacture

## 6 LOCATION OF SEALS AND VERIFICATION MARKS

### 6.1 Data Plate

The data plate is located on the instrument, and is secured, either by sealing or by being of a form such that it is destroyed when removed.

**6.2** The sealings must bear an official mark, which may be either:

- a mark of the manufacturer and/or manufacturer's representative, or
- an official mark of a verification officer.

### 6.3 Custody Transfer Stamp

The state of the "Custody Transfer Stamp" is requested from the software via an input pin of the microcontroller. Is the stamp state active, settings via the control unit, Modbus- or the HART® interface can no longer be initiated. Upon completion of all assessments, the "Custody Transfer Stamp" is set by applying the bridge EICHB. on the top electronic staple from position 1 – 2 to position 2 3. In custody transfer mode, merely self-test and system errors can be annulled by means of an external push button switch (Custody transfer button).

### 6.4 Transmitter

After the software stamp has been set, the lids of the transmitter are screwed onto the main enclosure. Both lids are sealed with the main body using adhesive security seal. The sticker label covers the sensors rating plate. An additional verification sticker may be adhered to the window lid of the enclosure.

### 6.5 The Sensor

#### 6.5.1 Terminal box

The lid of the sensors terminal box is screwed into position and sealed applying an adhesive security seal across the lid and the terminal boxes main body.

#### 6.5.2 Service lid

Where larger sensors are available with removable sensor lids for servicing purposes, two security seals with the minimum dimensions of 60 mm x 20 mm shall be used. The seals are attached on adjacent sides of the sensor (e.g. top and bottom or left and right side).

If the service lid is secured or welded to the main body, this security seal can be omitted.

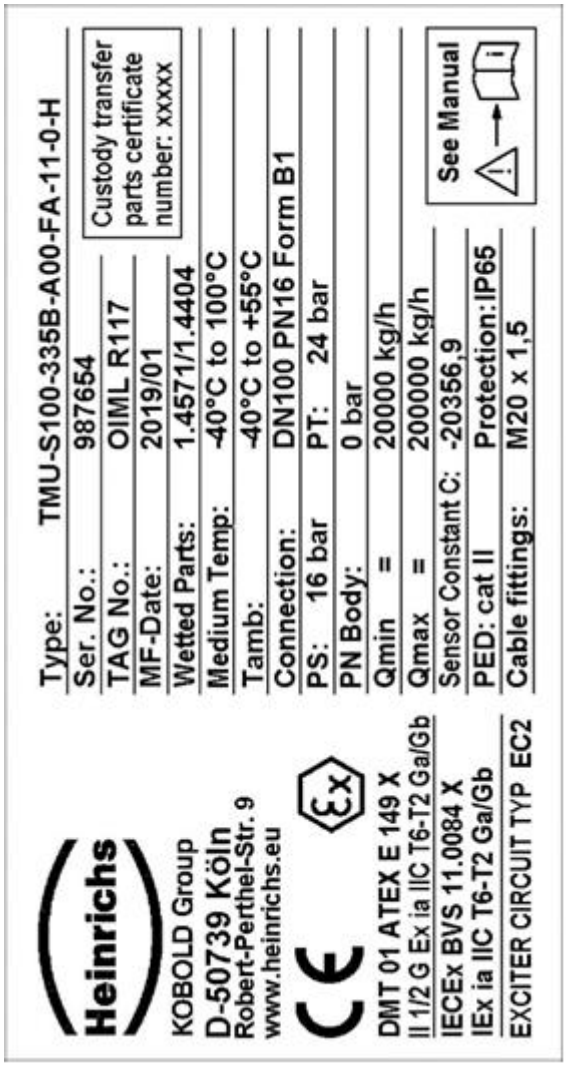
## 7 ALTERNATIVES

There are currently no alternatives.

## 8 ILLUSTRATIONS

**CERTIFICATE HISTORY**

| ISSUE NO. | DATE | DESCRIPTION |
|---|---|---|
| GB- 1659 | 06 March 2019 | Evaluation certificate first issued. |
| - | - | No revisions have been issued. |


UMC3 Ex rating plate example

TMU-S### Ex rating plate example

**Figure 1 Example of Rating Plates**

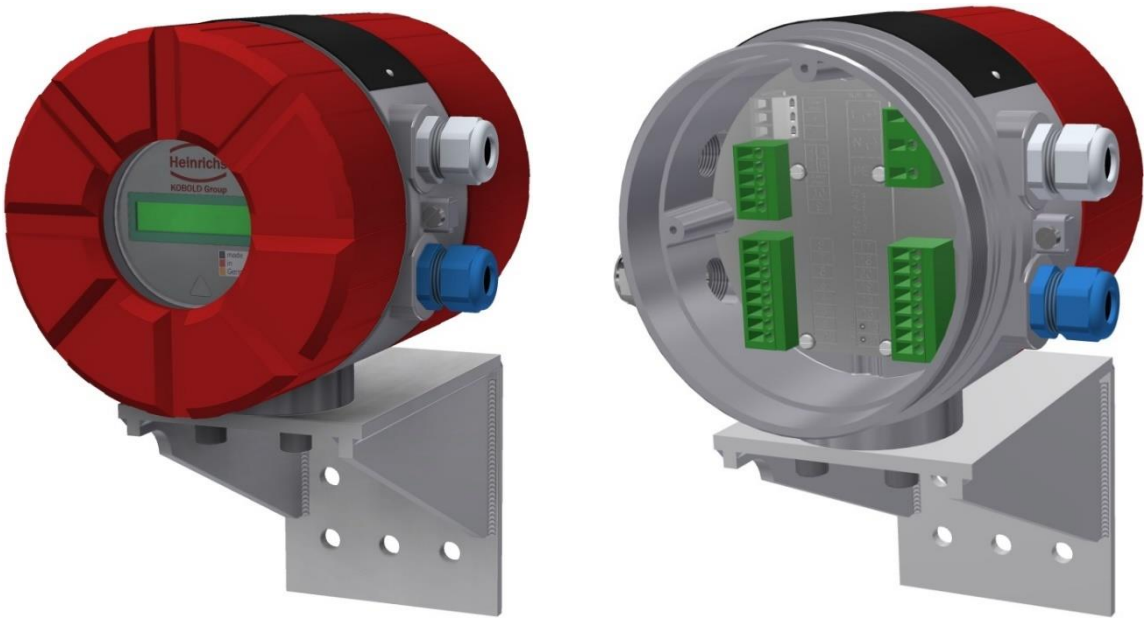


**Figure 2** **UMC3 mounted on a wall bracket**

**Figure 3** **TMU-S015 /TMU-SO25 sensor with connected cable in fully welded body**

**TMU-S040 in a square welded construction**


**Figure 4 TMU- S040 with silicon sealed construction**

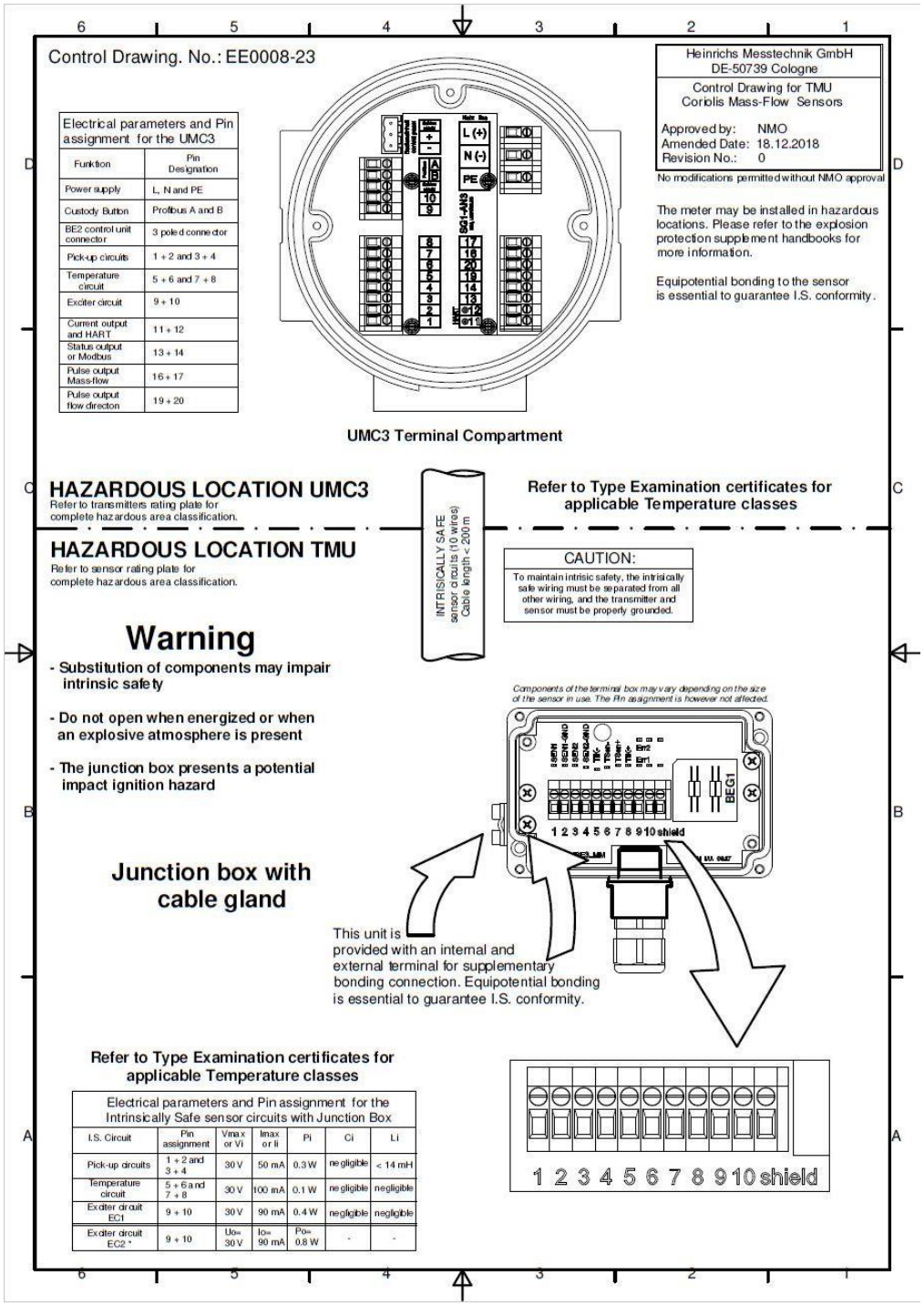



**Figure 5 Schematic installation guide of the flow-meter.**


*Image 1: Seals on the transmitter covering the lid and rating plate*

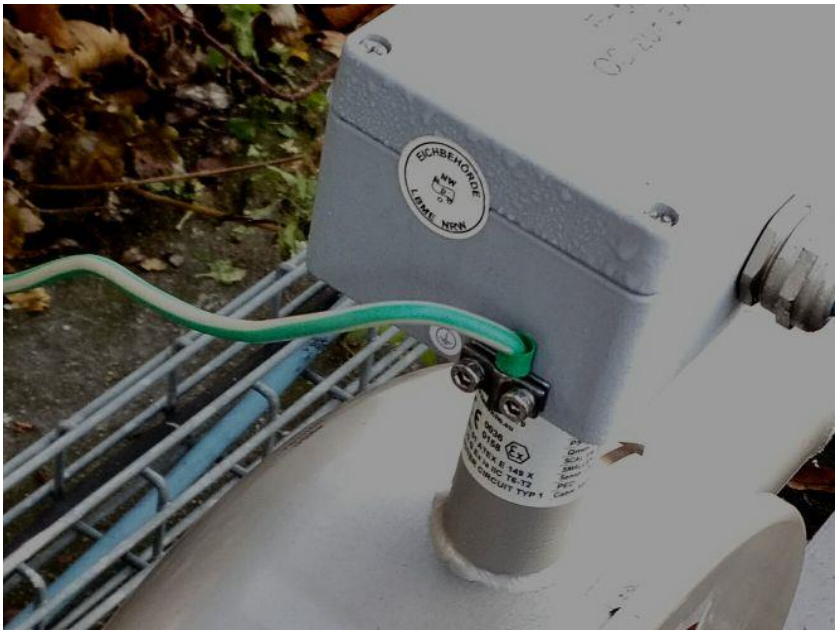



*Image 2: Seal securing the sensors terminal box lid*

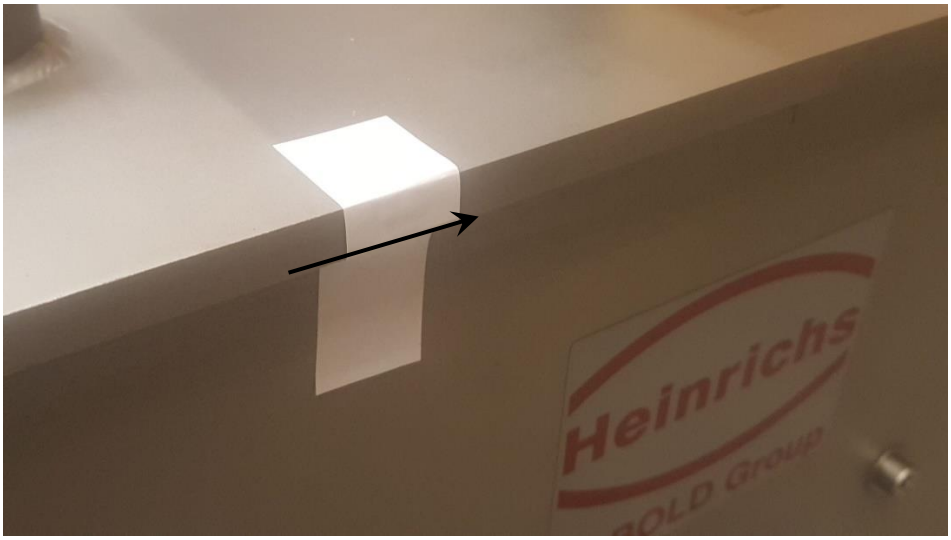




*Image 3 and 4: Seal securing the sensors removable lid*

**Figure 6 Sealing Measures**

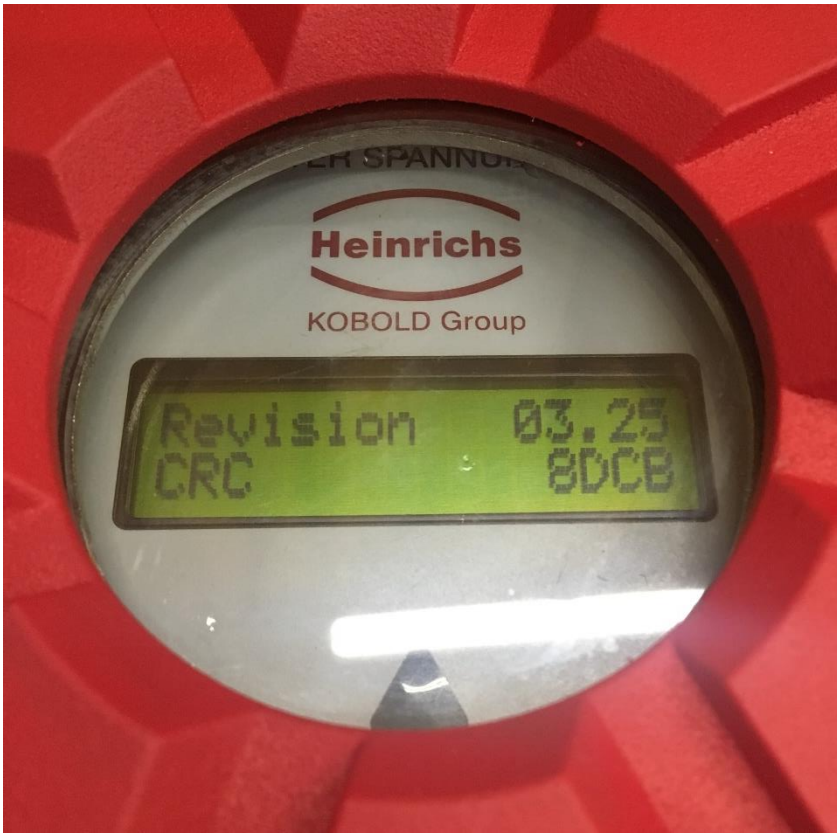



**Figure 7 Version and Checksum**