



# Ultrasonic Flow Meter Series 6

## Q.Sonic<sup>®</sup>plus

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### Operation and Maintenance Manual

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# 1 General Information

## 1.1 About these Instructions

This manual is a complete guide to the operation and maintenance of an Ultrasonic Flow Meter (UFM) Series 6 **Q.Sonic<sup>plus</sup>** meter. This manual together with the UFM Series 6 Safety Instructions and UFM Series 6 Wiring Instructions provide essential information for safe use in compliance with and insofar applicable:

- European Directives (e.g. ATEX, PED, EMC, MID).
- International IECEx standards.
- North American FM Approvals standards.
- Canadian CSA standards.

This manual explains how to verify which certifications your flow meter complies with, based on the labelling from the ultrasonic flow meter. The manual also contains important instructions to prevent accidents and serious damage before start-up, during operation, and to maintain trouble-free operation in the safest possible way throughout the entire lifespan of the device. Before using the product read this manual carefully, familiarise yourself with the operation of the product, and strictly follow the instructions.

If you have any questions, or need further details on specific matters concerning this product, please do not hesitate to contact one of our staff members by email at [gas-mainz-quotations@honeywell.com](mailto:gas-mainz-quotations@honeywell.com) (or refer to more contact information on page 2).



### Important!

It is required to read and understand all other documentation of your meter.

⇒ **Please refer to [Appendix I – References](#) on page 77 for a complete list of resources.** Additionally, you may look online at <http://www.docuthek.com/>.

## 1.2 Limitation of Liability

This manual is based on the latest information available. It is provided subject to alterations. We reserve the right to change the construction and/or configuration of our products at any time without obligation to update previously shipped equipment.

The warranty provisions stipulated in the manufacturer's *Terms of Delivery* are applicable to the product. The manufacturer shall have no obligation if:

- Repair or replacement of equipment or parts is required through normal wear and tear, or by necessity in whole or part by catastrophe, or the fault or negligence of the purchaser;
- The equipment, or parts, have been maintained or repaired by someone other than an authorized representative of the manufacturer, or have been modified in any manner without prior express written permission of the manufacturer;
- Non-original parts are used;
- Equipment is used improperly, incorrectly, carelessly or not in line with its nature and/or purpose;
- Use of this product with unauthorized equipment or peripherals, including, but not necessarily limited to, cables, testing equipment, computers, voltage, etc.

The manufacturer is not responsible for the incidental or consequential damages resulting from the breach of any express or implied warranties, including damage to property, and to the extent permitted by law, damage for personal injury.



Read through this Operation and Maintenance manual carefully before beginning any work.

The manufacturer assumes no liability for loss and malfunctions that result from non-compliance with these instructions.



We reserve the right to make technical changes within the scope of improving performance characteristics and continuous development of the device.

Current warranty conditions in the General Terms and Conditions are available on our website:

<http://www.elster-instromet.com/en/general-terms-of-business>

## 2 Text Labelling

This manual employs consistent visual cues and standard text formats to help you easily locate and interpret information. This information will help you quickly identify relevant content.

### 2.1 Presentation of Safety and Risk Instructions

#### **Hazard Warnings**

Hazard warnings indicate hazardous situations which may result in material damage and bodily harm or even death if disregarded. Hazard warnings are described below:

#### **Safety Instructions**

Safety instructions include notes and information which if disregarded may



#### **DANGER WORD!**

Type of danger / consequences in case of non-compliance

Avoiding danger

lead to functions not working correctly or not working at all. Safety instructions are described below:



#### **Safety instruction (optional)**

Safety instruction text

#### **Tips and Recommendations**

Tips include notes and information that make it easier for the user. Tips are described below:



#### **Heading (optional)**

Hint text

### 2.1.1 Paragraph Formats

- ▶ This triangle prompts you for an action.
- ✓ This character will show you the immediate result of your action.

### Example

Multi-row examples are marked by two continuous blue lines and the keyword "Example".

### 2.1.2 Character Formats

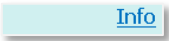


Example	Use
⇒ Refer to section 5 <a href="#">System Description</a> (p.20)	References to additional information are marked with an arrow. If the arrow refers to information within the document, these references are formatted as hyperlinks in blue font. You can go directly to the corresponding section by clicking on the blue text.
<a href="http://www.docuthek.com">www.docuthek.com</a>	Links (Hyperlink). Click to open in a browser.
	Seen on the meter screen itself; this shows a hyperlink within the meter software. You must highlight the hyperlink before it will open the next screen.
	The hyperlink (shown above) has been <b>highlighted</b> . Press the  button on the touch screen (or PC) to open the new window. Ex: Open the <b>Info</b> section.

Table 1: Character formats

### 2.1.3 Abbreviations

The following abbreviations may appear in this document:

<b>AFB</b>	<b>A</b> pplication <b>F</b> unction <b>B</b> lock
<b>ATEX</b>	<b>A</b> tmosphères <b>E</b> xplosibles; European Directive 94/9/EC on equipment and protective systems intended for use in potentially explosive atmospheres New Directive (valid 20.04.2016): 2014/34/EU
<b>CSA</b>	<b>C</b> anadian <b>S</b> tandards <b>A</b> ssociation
<b>DC</b>	<b>D</b> irect <b>C</b> urrent
<b>EC</b>	<b>E</b> uropean <b>C</b> ommunity
<b>EMC</b>	<b>E</b> lectro <b>M</b> agnetic <b>C</b> ompatibility; European EMC Directive 2004/108/EC New directive (valid 20.04.2016): 2014/30/EU
<b>HART</b>	<b>H</b> ighway <b>A</b> ddressable <b>R</b> emote <b>T</b> ransducer
<b>IECEX</b>	<b>I</b> nternational <b>E</b> lectrotechnical <b>C</b> ommission System for Certification to Standards Relating to Equipment for use in <b>E</b> xplosive Atmospheres
<b>FM</b>	<b>F</b> actory <b>M</b> utual Approvals
<b>NMi</b>	<b>N</b> ederlands <b>M</b> ee <b>t</b> instituut
<b>PED</b>	<b>P</b> ressure <b>E</b> quipment <b>D</b> irective; European Directive 97/23/EC concerning pressure equipment New Directive (valid 19.07.2016): 2014/68/EU
<b>PC</b>	<b>P</b> ersonal <b>C</b> omputer
<b>PCB</b>	<b>P</b> rinted <b>C</b> ircuit <b>B</b> oard
<b>SPU</b>	<b>S</b> ignal <b>P</b> rocessing <b>U</b> nit
<b>UFM</b>	<b>U</b> ltrasonic <b>F</b> low <b>M</b> eter

## 3 Ultrasonic Flow Meter Series 6

### 3.1 General

The UFM Series 6 Q.Sonic<sup>plus</sup> is a sophisticated, multi-path ultrasonic gas flow meter manufactured by Elster. It has been specifically designed for custody transfer measuring applications that demand a high degree of accuracy and reliability. It can be extended with an extra functionality whereby the flow meter has the possibility to convert the measured line volume to standardised volume, mass or energy.



#### **WARNING!**

**Improper use of an UFM Series 6 may not only result in unreliable performance but may lead to hazardous situations.**

Please refer to the type plates, located on the meter for the correct operating conditions. Never use the meter outside these limitations!

The Ultrasonic Flowmeter Series 6 contains 2 type plates:

- **Main plate:** Provides information on mechanical design conditions as well as flow related information such as meter factor and range
- **SPU type plate:** Provides information on applicable hazardous area approval.

Ensure the meter never operates outside the limits stated on the type plates. Any discrepancy between the type plates should be reported to Elster or your local agent immediately. ⇒ Please refer to [sectio 5.6 Labels and Nameplates](#) (p.24) for more information.

## 3.2 Applicable Standards

The Ultrasonic Flow Meter Series 6 is manufactured to be in accordance with European Directives: ATEX, PED, EMC and optionally MID.

If the meter is ordered for use at a location where European Directives are NOT mandatory, the meter can alternatively be manufactured in compliance with IECEx, FM Approval or CSA certificate for use in hazardous areas.

Applicable standards for the optional integrated flow computer functionality are: AGA8-92 DC, SGERG-88, AGA-NX19 and ISO 6976.

## 3.3 Configuration

Several pairs of transducers are mounted in pairs on the flow cell of the UFM. Each pair of transducers represents one individual measuring path. There are two measuring path types on the Q.Sonic<sup>plus</sup>: Axial (single bounce) and Swirl (double bounce). These are shown in Figure 3-1.

The Q.Sonic<sup>plus</sup> path layout consists of 2 axial paths and 4 swirl paths. This combination results in a completely symmetrical path layout, ensuring the most optimal accuracy. Figure 3-2 below shows the path layout of the Q.Sonic<sup>plus</sup>.

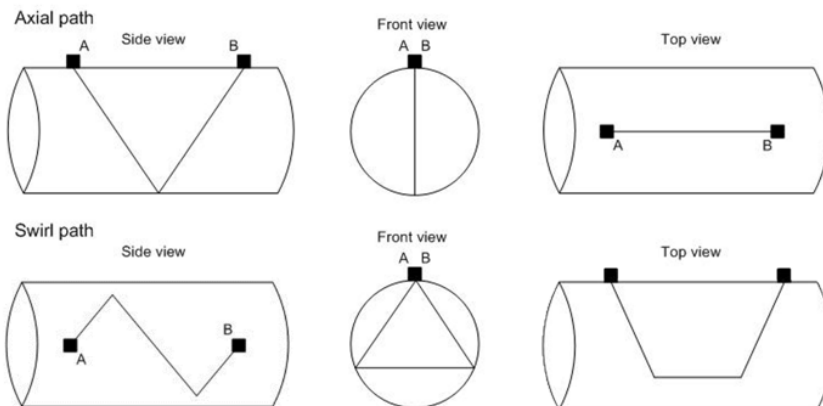
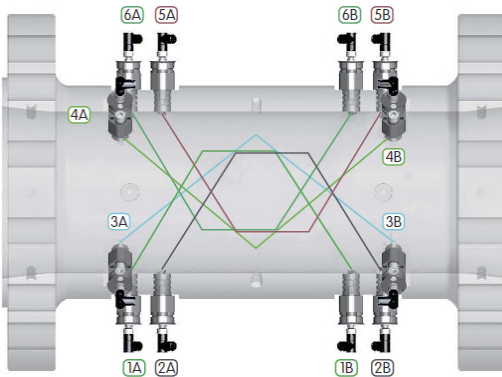


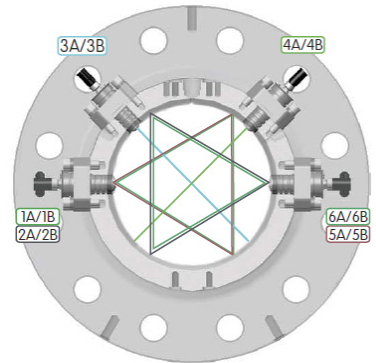
Figure 3-1: Path Types

### Q.Sonic<sup>plus</sup> Path Configuration

Top view:



Front view:



Trd. Path Nr:	Path Type:
1A / 1B	Swirl path (B1-CW*)
2A / 2B	Swirl path (B1-CCW**)
3A / 3B	Axial path (A1)
4A / 4B	Axial path (A2)
5A / 5B	Swirl path (B2-CW*)
6A / 6B	Swirl path (B2-CCW**)

\* CW: Path travels clockwise through the pipe

\*\* CCW: Path travels counterclockwise through the pipe

Figure 3-2: Path Layout Q.Sonic<sup>plus</sup>

## 3.4 Calibration

When using the UFM Series 6 Q.Sonic<sup>plus</sup> in custody transfer applications, most countries demand (by law) a calibration from a certified calibration institute supervised by an inspector of weights and measures. Examples of facilities generally used for calibrations are Euroloop in Rotterdam (NL), TransCanada Calibrations in Canada and PIGSAR GH45 or Open Grid European Dorsten (D).

If the Q.Sonic<sup>plus</sup> meter must be in accordance with MID, extra restrictions should be considered. ⇨ Please refer to section [15.4 Calibration](#) (p.74).



## 4 Theory of Operation

An ultrasonic flow meter is an inferential measurement device that consists of ultrasonic transducers that are typically located along a pipe's wall. The transducers are inserted into the piping using a gas tight mechanism. Ultrasonic pulses are alternately transmitted by one transducer and received by the other one.

Figure 4-1 shows a simple geometry of two transducers, 'A' and 'B', at a sharp angle " $\phi$ " with respect to the axis of a straight cylindrical pipe with diameter " $D$ ". Please note: the Q.Sonic<sup>plus</sup> flow meter employs reflection paths, where the acoustic pulses reflect one or more times off the pipe wall.

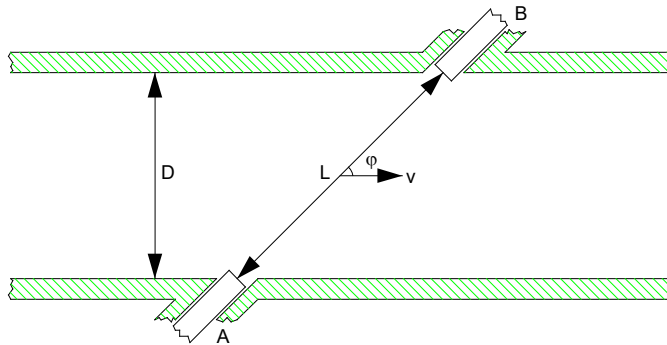


Figure 4-1: Ultrasonic Measuring Line

### 4.1 Flow Velocity Measurement

The acoustic pulses are crossing the pipe like a ferryman crossing a river. Without flow, they propagate with the same speed in both directions. If the gas in the pipe has a flow velocity different from zero, pulses travelling downstream with the flow will move faster, while those travelling upstream against the flow will move slower. Thus, the downstream travel times " $t_{ab}$ " will be shorter, while the upstream ones " $t_{ba}$ " will be longer as compared when the gas is not moving. The equation below illustrates the computation:

$$VoG_{raw_n} = \frac{L_n}{2 \cdot \cos(\varphi_n)} \cdot \left( \frac{1}{tab_n} - \frac{1}{tba_n} \right)$$

where:

- $t_{abn}$  the downstream travel time of path n.
- $t_{ban}$  the upstream travel time of path n.
- $L_n$  the straight-line length of the acoustic path between the two transducers.
- $VoG_{raw}$  is the average uncorrected (raw) gas velocity.
- $\varphi_n$  the angle between the gas flow and ultrasonic signal.

The raw gas velocity is corrected by a Reynolds flow profile correction. This correction is depending on the path type. Also, the contribution of the gas velocity of each path to the combined gas velocity is depending on the path type.

## 4.2 Correction after Calibration

After flow calibration the meter can be adjusted either through an adjust factor or through linearization. How the meter is adjusted can be visualized at the display. ⇒ Please refer to section [7.1 LED at Display](#) (p.35).

## 4.3 Volume Flow at Line Conditions

The volume flow at line conditions  $Q_{Line}$  is the (adjusted) profile-corrected gas velocity  $V_{line}$  multiplied by the internal cross section  $A$  of the flow cell:

$$\begin{aligned} Q_{line} &= V_{line} \cdot A \cdot t \\ &= V_{line} \cdot \frac{\pi \cdot D^2}{4} \cdot 3600 \left[ \frac{m^3}{h} \right] \end{aligned}$$

where:

$Q_{Line}$  the volume flow at line conditions

- $V_{line}$  the adjusted profile-corrected gas velocity
- $D$  the internal diameter of the meter
- $A$  the internal cross-section of the flow cell
- $t$  time coefficient to go from seconds to hours.

## 5 System Description

### 5.1 Flow Cell

The flow cell is the part of the UFM Series 6 that is mounted in the piping system. All components making the UFM Series 6 (SPU, transducers, type plates, temperature sensor, and optional pressure sensor) are mounted on the flow cell. Please see Figure 5-1 below.

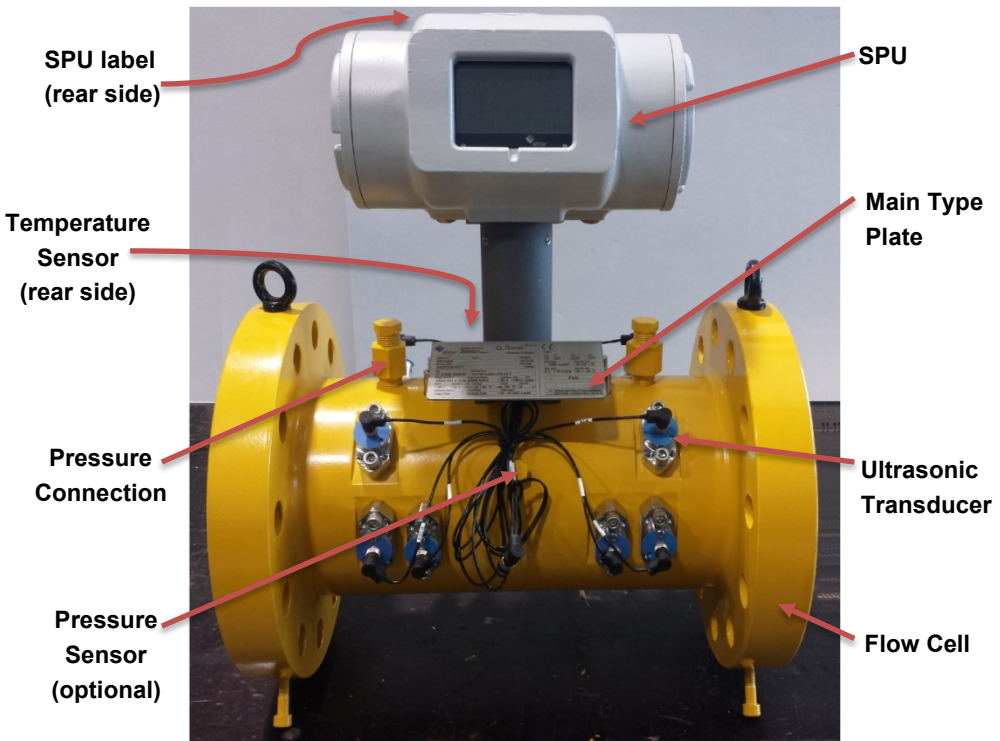


Figure 5-1: Example of an Elster Ultrasonic Gas Flow Meter

## 5.2 Signal Processing Unit

The SPU is mounted in an explosion proof housing. The box consists of two separate compartments; a main and a rear compartment (see Figure 5-2).

The main compartment can be opened from the side of the SPU and contains the main circuit boards. The main compartment also comprises intrinsically safe connections for the ultrasonic transducers and temperature and optional pressure sensors. All data processing from excitation of the transducers to calculating the flow rate is handled by the electronics in this compartment.

To prevent the box from opening by vibration, the covers on the side need to be firmly tightened and secured with the lock screw in the cover, as seen in Figure 5-2. When closing the back compartment, ensure all screws are used.

A grounding point can be seen at the bottom of the SPU. As the meter is already internally grounded, it is not necessary to use this grounding for normal operation.

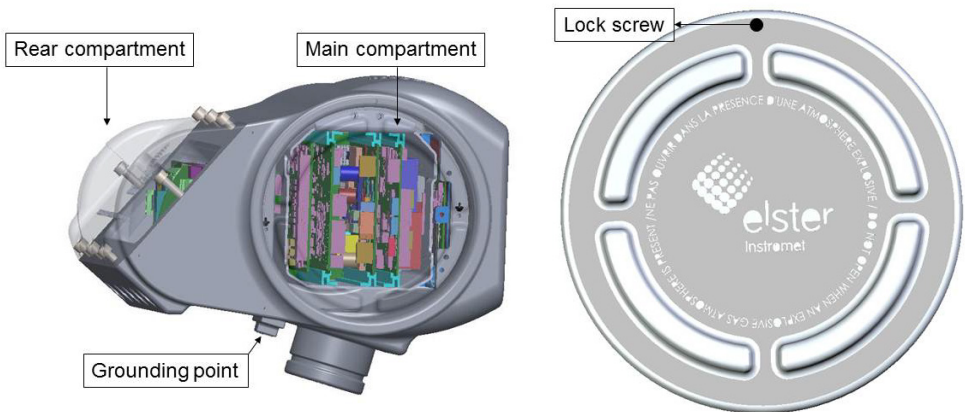


Figure 5-2: SPU Compartments and SPU Cover

The rear compartment comprises of a field terminal board used for connecting the Ultrasonic Flow Meter Series 6 to the end user's applications. For detailed information about this refer to ⇒ section [6.3 Wiring Instructions](#) (p.33).

## 5.3 Transducers

The ultrasonic signals required for the flow measurement are generated and received by ultrasonic transducers.

Piezoelectric transducers employ crystals or ceramics that are set into vibration when an alternating voltage is applied to the piezoelectric element. The vibrating element generates sound waves in the gas. Since the piezoelectric effect is reversible, the element will become electrically polarised and produce voltages related to the mechanical strain, when the crystal is distorted by the action of incident sound waves. Because the acoustic impedance of the gas is much smaller compared to the acoustic impedance of the piezoelectric element, and to maximise the acoustic efficiency, a matching layer is employed between the gas and the piezoelectric element.

The transducers used in the Ultrasonic Flow Meter Series 6 are type 'NG', see Figure 5-3. Figure 5-4 visualises the NG transducer with the mounting bracket.



Figure 5-3: NG Transducer



Figure 5-4: NG Transducer  
with Mounting Bracket

## 5.4 Flow Cell Pressure Sensor (Optional)

As an optional feature the UFM can be equipped with a pressure sensor. This pressure sensor is used for:

- Reynolds flow profile correction
- Compensation of the flow cell expansion due to gas pressure.



### **CAUTION!**

The pressure sensor is not used for volume conversion.

## 5.5 Flow Cell Temperature Sensor

The UFM is equipped with a temperature sensor. The temperature sensor is used for:

- The Reynolds flow profile correction
- Compensation of the flow cell expansion due to flow cell temperature

## 5.6 Labels and Nameplates

Nameplates and labels are used to identify the product and to provide details on the specific product. Together with the product manual it specifies how the product is certified and designed.

- The main (type) plate (see Figure 5-5, for an example of a Q.Sonic<sup>plus</sup> main plate) provides information on mechanical design conditions as well as flow related information such as meter factor and range. If the UFM has been manufactured in accordance with the Measuring Instruments Directive (MID) the related certificate reference T10335 is mentioned in the top right corner of the main plate.
- ⇒ Refer to section [15 MID Requirements](#) (p.73) for more information about MID and Environment Class specification.
- Refer to the type plate on the SPU for the applicable hazardous area approval. This could be according to ATEX, IECEx, FM or CSA. ⇒ Please refer to Figure 5-6 to Figure 5-9 for type plate examples for a Q.Sonic<sup>plus</sup> meter.

<b>Elster GmbH</b> Steinweg Str. 19-21 55292 Mainz-Kastel / Germany		<b>Q.Sonic® Plus</b> Ultrasonic Flowmeter		 0085	 YYY T10335 Accuracy class 1.0
Serial No	Tag No	Year - Month		Qmin [m³/h]	Qf [m³/h]
Purchase Order	Total Weight [kg]			Pulse Factor [imp/m³]	t amb [°C]
					min max
Size	Material Body			pressure [ barg ]	t gas [°C]
				min max	min max
Design Code Body	Design Code Flange	p. design [ barg ]	p. test [ barg ]	<b>MADE IN GERMANY</b> <b>FLOW</b>	
Inner [mm]	Connection [mm]	t storage [°C]	t design [°C]		
Ø	Ø	min max	min max	Capacity [L]	<b>READ INSTRUCTION MANUAL BEFORE OPERATING DEVICE</b>
Intended to measure	Product Group	Power supply			

Figure 5-5: Example of a Q.Sonic<sup>plus</sup> Main Plate



### 5.6.1 ATEX Certified

The explosion proof housing has the following ATEX certification information:

- Classification: Ex II 2 G Ex d ia [ia] IIB+H2 T6 Gb IP66
- $-50\text{ }^{\circ}\text{C} \leq T_{\text{amb}} \leq +60\text{ }^{\circ}\text{C}$
- ATEX markings: E II 2 G X 0044
- 0044 is the notified body number of TÜV NORD CERT GmbH
- ATEX certificate reference: DEKRA 11ATEX0170 X
- Warning: Read instruction manual before operating device.

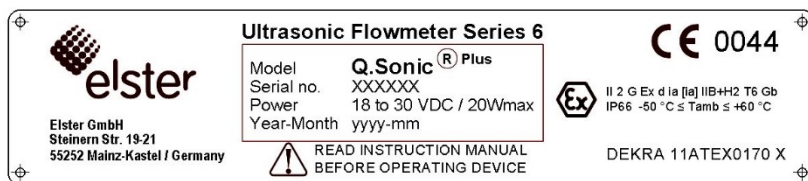


Figure 5-6: Example of an ATEX Label

### 5.6.2 IECEx Certified

The explosion proof housing has the following IECEx certification information:

- Classification: Ex d ia [ia] IIB+H2 T6 Gb IP66
- $-40\text{ }^{\circ}\text{C} \leq T_{\text{amb}} \leq +60\text{ }^{\circ}\text{C}$
- IECEx certificate reference: IECEx DEK11.0062 X
- Warning: Read instruction manual before operating device

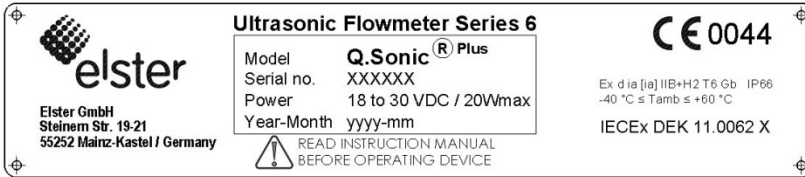


Figure 5-7: Example of an IECEx Label

### 5.6.3 FM Certified

The explosion proof housing has the following FM certification information:

- Explosion proof for Class I, Division 1, Group A, B, C and D
- Intrinsically safe for Class I, Division 1, Group A, B, C and D
- Ta = -40 °F to 140 °F (-40 °C to +60 °C), T6
- Type 4X
- “FM approved” mark
- Installation requirement: Seal fitting required within 1.5 inches of enclosure
- Warning: Read Instruction Manual (Control Drawing: 03.304.001.003.05/2) before operating device. Refer to UFM Series 6 Safety Instructions (⇒ listed in [Appendix I – References](#)) for the control drawing.

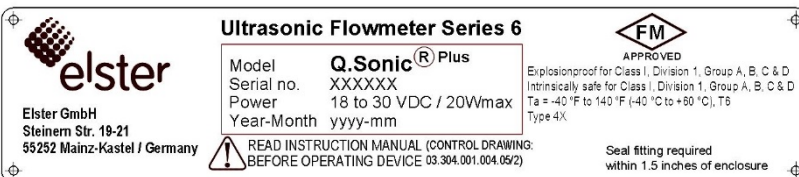


Figure 5-8: Example of an FM Label

### 5.6.4 CSA Certified

The explosion proof housing has the following CSA certification information:

- Explosion proof for Class I, Division 1, Group B, C and D T6
- Ex d ia [ia] IIB + H2 T6
- $-50\text{ }^{\circ}\text{C} \leq T_{amb} \leq +60\text{ }^{\circ}\text{C}$
- Type 4X
- IP66
- CSA 13.70001043
- Installation requirement: Seal all conduit within 1.50 inches in group B & C
- Warnings:
  - Substitution of components may impair intrinsic safety.
  - Read Instruction Manual (Control Drawing: 03.304.001.004.05/2) before operating device. Refer to UFM Series 6 Safety Instructions (listed in ⇒ [Appendix I – References](#)) for the control drawing.

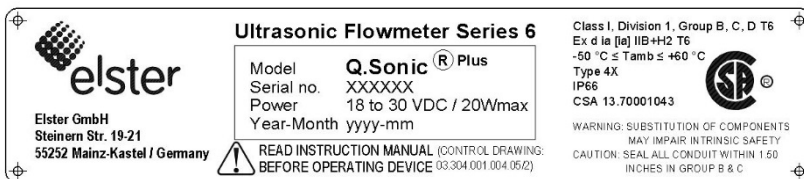


Figure 5-9: Example of a CSA Label

## 5.7 Sealing

This section describes the important sealing locations and sealing process as required by MID certificate T10335 (⇒ also refer to section [15 MID Requirements](#), p.73). Even if MID is not required it is advised to seal the UFM.

### 5.7.1 Main Plate

Figure 5-10 displays how the main plate is sealed to the flow cell:



Figure 5-10: Seal on the main plate to the flow cell

### 5.7.2 SPU

The SPU in the main compartment of the flameproof certified box is sealed in 2 locations.

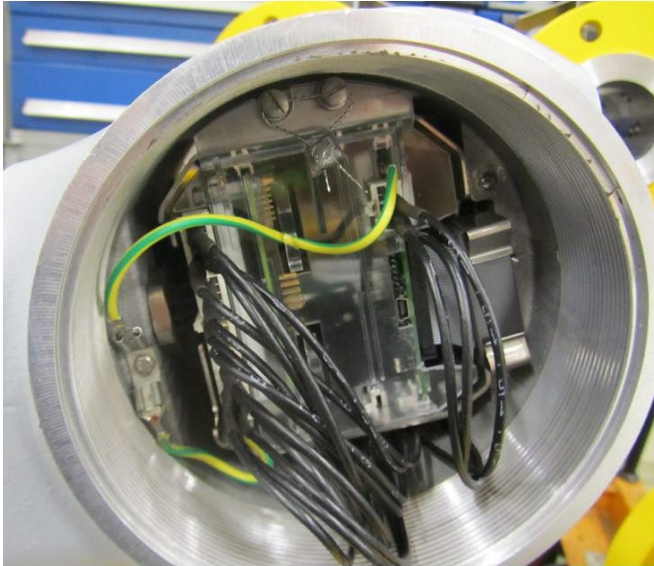


Figure 5-11: Example of a PCB sealing bracket

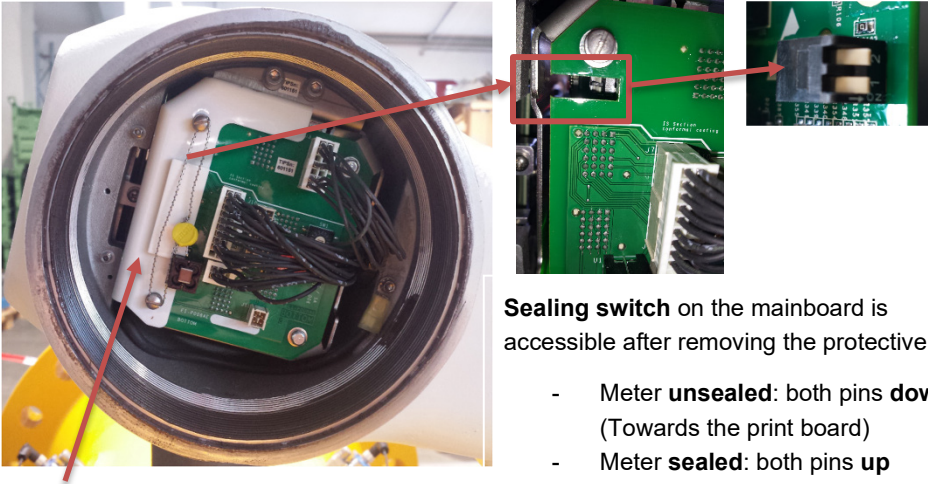
- By means of the PCB sealing bracket the SPU electronics is sealed to the flameproof certified box. Please see Figure 5-11 below.
- The meter should be protected from undesired changes in the software.

Therefore, a hardware switch is placed on the main board. This hardware switch can be reached through an opening in the back panel. The hole in the back panel is protected with a plastic cap (see Figure 5-12).

If both pins on the switch are **up**, the meter is sealed, and the parameter settings of the meter are locked from editing.

If both pins on the switch are **down**, the meter is unsealed, and parameter

settings can be altered using the software program SonicExplorer. Sealing of the switch itself should be done with the screw socket on the protective cap.



Backpanel with **Protective Cap**

(Screw sockets are used for sealing)

**Sealing switch** on the mainboard is accessible after removing the protective cap.

- Meter **unsealed**: both pins **down**  
(Towards the print board)
- Meter **sealed**: both pins **up**  
(Away from the print board)

Figure 5-12: Hardware protection on the main board

In addition to the hardware protection, access to the meter software is secured by different user access levels and password protection. ⇒ Refer to section [12 User Rights / Login](#) (p.67).

## 6 Installation and Commissioning

### 6.1 Introduction

It is very important to check the shipment of your ultrasonic flow meter equipment. A visual inspection of surfaces and flanges should be performed. In case of damage, contact Elster immediately.

As well, please verify if all the necessary documentation is available. In addition to this Operation and Maintenance manual, you also require (at bare minimum) the UFM Series 6 Safety Instructions.

Please refer to ⇒ [Appendix I – References](#) for a complete list of related documentation.

Also look at your project data to see if extra documentation is required and delivered. If documentation is missing, contact Elster or your local agent immediately.

### 6.2 Flow Cell Installation Requirements

#### 6.2.1 Installing a Meter in the Pipeline

The Ultrasonic Flow Meter Series 6 (including flow cell, transducers and SPU) is shipped in a suitable box (e.g. wooden box, cardboard box ...). Carefully disassemble the box. Remove the transport straps from the flow cell, and then move the ultrasonic flow meter (using the lifting lugs provided on the flow cell) to the installation site. Install the meter according to the end-user's company regulations and applicable local and national requirements. To ensure optimal performance of the UFM, comply with the up- and downstream spool requirements specified for your UFM (see your order documentation).

**WARNING!**

To avoid possible injury, make sure the lifting equipment is suitable for the weight of the Ultrasonic Flow Meter Series 6. Always use the lifting lugs and make sure lifting equipment is certified and shows no damage or wear.

Eyebolts must be inspected before each use and used according to the manufacturer's specification.

**Be Aware!**

Special attention needs to be taken when the UFM Series 6 Q.Sonic<sup>plus</sup> has to be installed in accordance with MID. ⇒ Please refer to section [15.5 Installation Requirements](#) (p.74).

For FM Approved and CSA Certified UFM's also see their respective Control Drawings and particular installation remarks in the UFM Series 6 Safety Instructions (⇒ listed in [Appendix I – References](#)).

## 6.2.2 Testing Installation

The flow cell is always hydrotested in-house at the correct hydrotest pressure before the transducers are installed on the ultrasonic flow meter. Herewith all welding of the flow cell is checked. When a Series 6 UFM is installed in a pipe line, it is no longer possible to hydrotest the pipeline. Water can be trapped between the housing and the transducers, causing the meter to have difficulties measuring.

Before pressurizing, check all pressure points on the meter. If necessary, remove the cover caps to have a clear view of the entire pressure point, particularly when an adapter is fitted on the meter body.



## 6.3 Wiring Instructions

All detailed information about wiring is stated in the UFM Series 6 Wiring Instructions, as well as UFM Series 6 Safety Instructions (⇒ refer to [Appendix I – References](#)). Please refer to these documents for correct wiring.

## 6.4 SPU Configuration

When the meter is installed and correctly wired, it is advisable to read out the parameter settings of the meter. If the meter has been calibrated before, the parameter set-up should be compared to the one of the calibrations.

The parameter set-up can be read with the software package SonicExplorer. Connection should be made through the Ethernet or VDSL communication, more detailed information about this matter can be found in the manual of the software packages. When discrepancies are detected; contact Elster or your local representative immediately.



### **WARNING!**

When opening the SPU (either main or rear compartment), obey the rules and regulations that apply to hazardous area operations.

## 6.5 Cold Commissioning

During cold commissioning, the meter is pressurized with a known gas composition at a known temperature and pressure, because in the case of atmospheric (low pressure) conditions, the UFM is not able to measure correctly.

A thorough functional test is performed by means of a PC and diagnostic software package (SonicExplorer). Diagnostics and status per measuring path and the zero flow can be checked, assuming there is enough pressure in the meter. A technician of Elster will, if this has been agreed, verify measurements and check the system performance.

---

## 6.6 Hot Commissioning

The hot commissioning is in most cases the last test of the UFM and can be witnessed by a representative of the client and, if required, by an inspector of weights and measures for the official sealing. Under this condition there is process gas in the pipe and a flow test is being performed. The performance, AGC Levels/Limits and zero flow are checked again. If possible, the gas flow running through the UFM will be compared to another flow meter in the line. Most UFM's are calibrated gas flow meters, so the measured value is reliable without exception. Furthermore, the interaction with the flow computer can be tested.

## 7 Operation

This section describes how the UFM Series 6 can be operated through the interactive touch screen display on the meter.

### 7.1 LED at Display

2 LEDs provide an overall status indication of the meter.

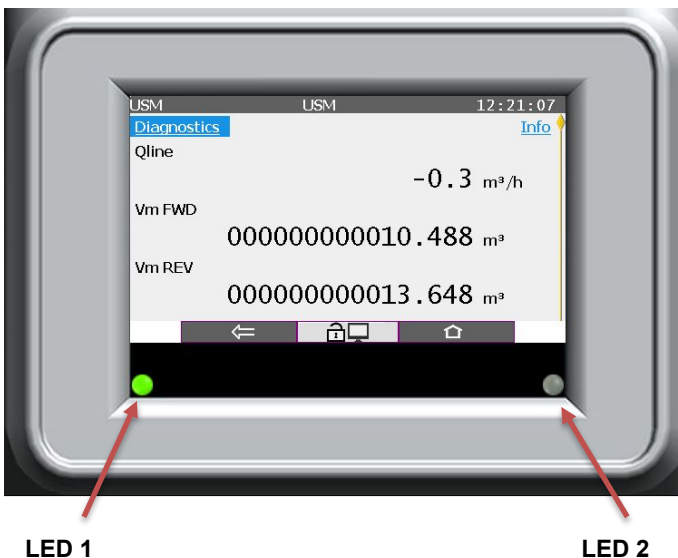


Figure 7-1: LED at Display

Power LED - LED 1 at Figure 7-1	
LED Status	Description
Off	Power is off
Green	Power is on

Table 2: Power LED

Status LED - LED 2 at Figure 7-1	
LED Status	Description
Off	Power is off or; the device is running warning and error free.
Yellow, flashing	A warning is pending that does not affect the metrology relevant functionalities.
Yellow, permanently illuminated	At least one warning that does not affect the metrology relevant functionalities was pending but has already ended. **)
Red, flashing	An error is pending that affects the metrology relevant functionalities.
Red, permanently illuminated	At least one error that affects the metrology relevant functionalities was pending but has already ended. **)

Table 3: Status LED



\*\*) The user must accept past warnings and errors at the operation panel before the colour of the status LED turns back to off, refer to section [10 Verifying Errors and Warnings](#).

## 7.2 Front Panel and Touch Display

The SPU contains an interactive touch screen display, showing the most important measurements and diagnostics (line flow, gas velocity, speed of sound, totalizers ...). It contains a touch screen with 7 touch areas (see Figure 7-2). These touch areas will disappear when not in use and reappear with a touch of the screen in one of the 7 touch areas.

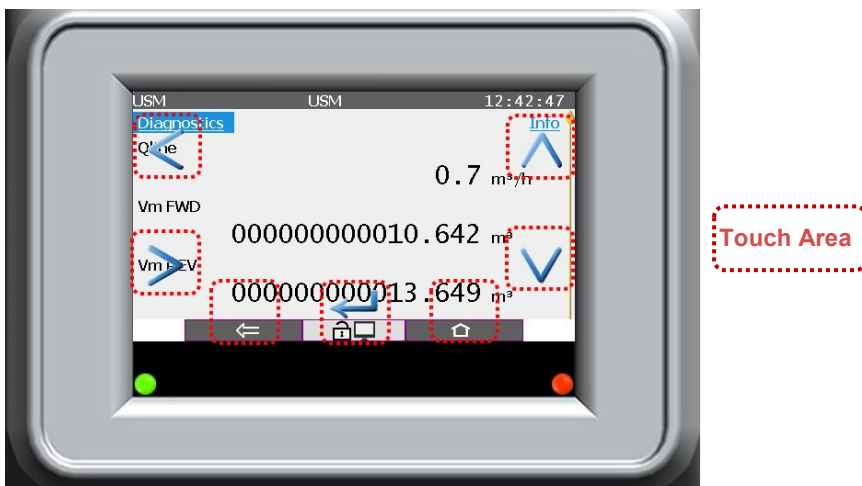



Figure 7-2: Front Panel Start display with 7 touch areas

Press the bent arrow  in the middle of the screen to select and open a highlighted menu.



### View Front Panel on your PC

It's also possible to mimic the interactive touch screen display on your PC. To do this, connect the Ethernet cable at the field terminal board (⇒ for help, refer to document: UFM Series 6 Wiring Instructions, listed in [Appendix I – References](#)). Next, go to the internet browser of the PC and type the following address: <http://xxx.xxx.xxx.xxx/frontpanel.html> (where xxx.xxx.xxx.xxx represents the IP-address of the meter).

## 7.3 Start display

The start display is shown below in Figure 7-3 and displays the following values:

- **Qline** - Gas line flow running through the meter in m<sup>3</sup>/h.
- **Vm FWD (Volume Forward)** - Total amount of gas volume passed through the meter in the positive direction.
- **Vm REV (Volume Reverse)** - Total amount of gas volume passed through the meter in the negative direction.
- **Vline** - Speed of the gas running through the meter. (Scroll down on the meter display to view)

Touch one of the 7 touch areas (as seen above in Figure 7-2) and use the arrow buttons on the right to navigate up and down.

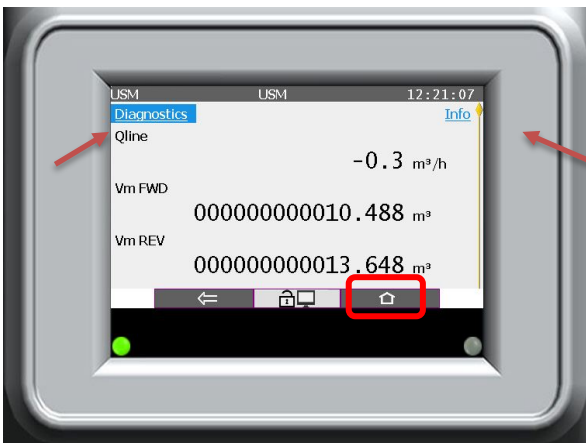


Figure 7-3: Start display/USM


Along the top of the start display page you will see the sub-menus **Diagnostics** and **Info** marked with red arrows in Figure 7-3. You must scroll to the top of the page to view or select these sub-menus. For more information on Diagnostics, as well as the two submenus from this screen, please refer to ⇨ section 7.5 Diagnostics and 7.6 Info – Analog Outputs ..., respectively. The button with the house icon is the **Home** button.

## 7.4 Functions available at Home Screen

Pressing the **Home** button from the **Start display** (as seen in Figure 7-3) will bring you to a screen as depicted below in Figure 7-4.



Figure 7-4: Home Screen and Menu

Touch the screen in one of the 7 touch areas to activate the arrows. Use the arrow buttons on the left and right to navigate and highlight an option on the screen. Press the bent arrow  in the middle of the screen to select and open a menu. When connected with the front panel through Ethernet, you can click in one of the 7 touch areas, navigate by clicking on the arrows, and click the bent arrow to select the option you desire. Below is an overview of the available options:

### 7.4.1 Language Selection



- ① Standard language setting is English. Select **Deutsch** for German language setting.

## 7.4.2 Info - Serial Numbers, Device Monitor, Network settings ...

**2**

In this menu some general important information about the meter can be found, see Figure 7-5.



Figure 7-5: Info Screen

### 7.4.2.1 Serial Numbers

There are several “serial numbers” present in the device, see Figure 7-6

- *Resource ticket* – meter serial number stored in the resource ticket
- *Customer* - serial number or name which can be chosen for easier meter identification
- *Meter body* – meter serial number, typically also on meter body
- *CPU3* - serial number of the CPU3 board (important in case of a CPU3 board replacement)



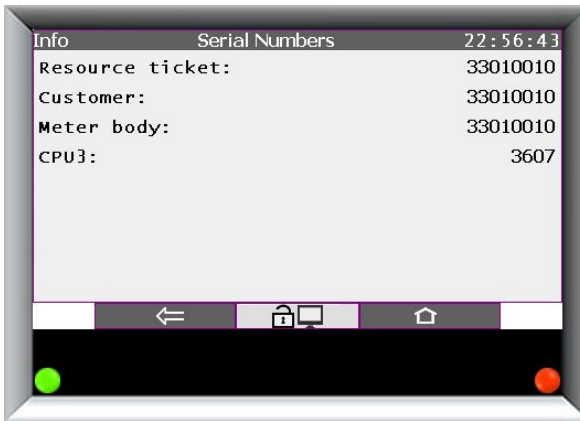
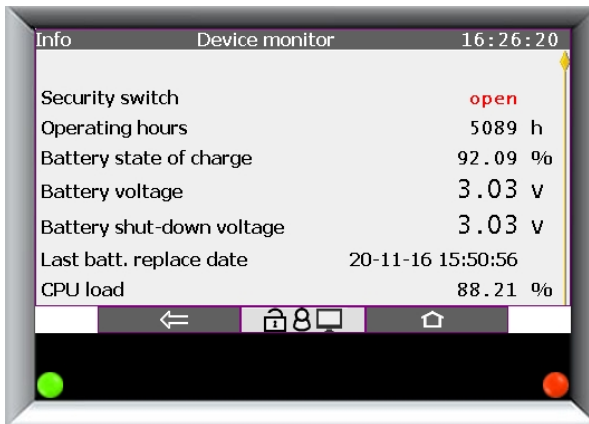


Figure 7-6

#### 7.4.2.2 Device monitor



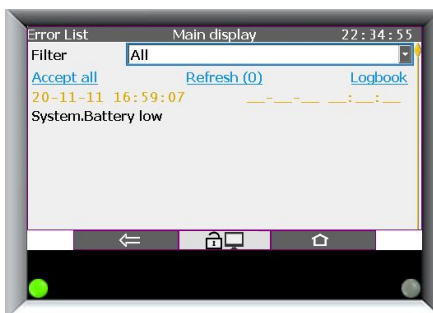
Various information about the meter can be checked in “Device Monitor”:

- **Security switch** shows the actual status of the switch: open or closed
- **Operating hours** shows the operating hours of the device

Next items provide some information about the battery status. Here you can see truly measured battery voltages:

- **Battery stat of charge** - The capacity calculation is linked to the threshold levels defined in System/Battery: (default settings: Low runtime voltage = 2.9V and Low shutdown voltage = 2.3V)
- **Battery voltage** – voltage measured during meter operation
- **Battery shut-down voltage** - voltage measured during meter shut down (voltage under load)
- **Last batt. replace date** - After replacing a battery on the mainboard of the meter the battery status needs a reset. This updates the date and time and shows the actual charge level of the battery in %.

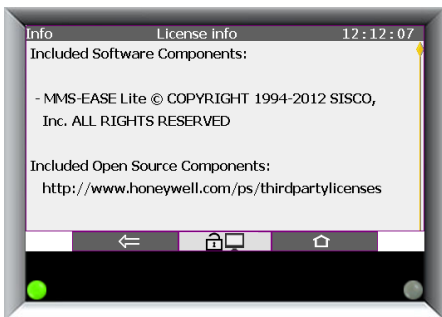
If the measured voltages fall below the defined threshold values, a warning is generated.



### 7.4.2.3 Software status

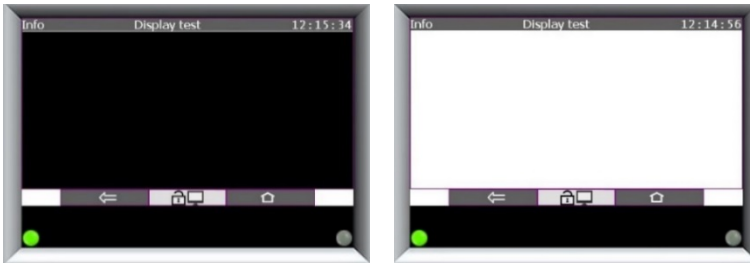
All software modules are listed here with their versions and checksums, please refer to section [9 Verifying Software Versions](#).

### 7.4.2.4 License info

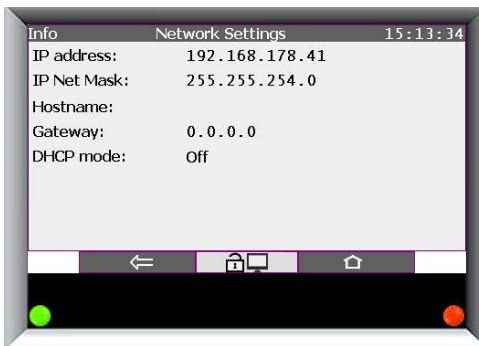


### 7.4.2.5 Display test

After selecting **Display test**, the screen will alternate between black and white. Pressing **Back** or **Home** will stop the test.



### 7.4.2.6 Network Settings



### 7.4.3 Error List



3

Here you can see a list of the most recent meter errors and warnings, for further details please refer to section [10 Verifying Errors and Warnings](#).

### 7.4.4 System – Time Service, Users ...



4

The System screen contains general system information including **Time Service** (setting the date and time), **Users** (logging in with appropriate user rights), an **Error List**, an **Audit trail**, **Intelligent measurement devices**, and **Measurement tools**. A brief description of each submenu is described below.

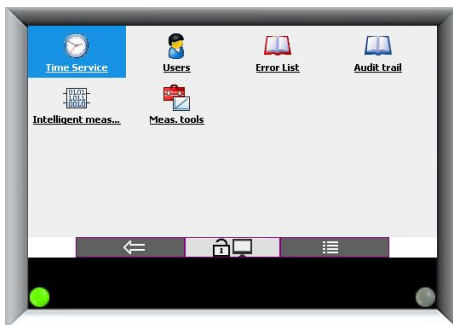



Figure 7-7: System Screen

- ▶ **Time Service** – To program the date and time of the meter:
- ▶ Highlight Date & Time (from Start Display -> Time Service)
- ▶ Press the select arrow .
- ▶ Highlight and select **Update date and time** when you have entered the correct information.
- ✓ Date and time will be updated

Please note you have the possibility to activate daylight savings time, see Figure 7-8: Update Date & Time

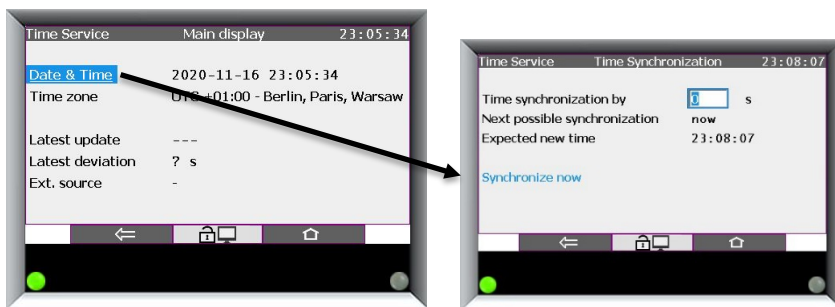


Figure 7-8: Update Date & Time

### 7.4.5 USM



**5** (QSonic plus)

This button will bring you back to the **Start Display**.

⇒ Please refer to section [7.3 Start display](#) (p.38) for more information.

### 7.4.6 Archive



**6**

With the software package SonicExplorer it is possible to set up an archive in the Series 6 Ultrasonic Flowmeters. For detailed information about the nature of the archive and its possibilities, please refer to the SonicExplorer user manual, available at <http://www.docuthek.com/>.

By choosing the right **Group** and **Channel** and selecting **Show values** it is possible to see all important data of the selected archive, see Figure 7-9: User Archives



Figure 7-9: User Archives



**3** Error List

Here you can see a list of the most recent meter errors, filtered by error type if desired. If the errors are no longer relevant, you can select **Accept all** and the errors will be accepted and removed from the list. To use the filter, scroll

### 7.4.7 Modbus



7

This menu will bring you to the Modbus protocol screen. Modbus Registers are listed on the left-hand side, with corresponding values on the right. (For example, in Figure 7-10: Modbus Screen the Modbus Register 00000 relates to the Flow Meter Identification Code. E.g. the output of 68 equates to the UFM model Q.Sonic<sup>max</sup>. 66 equates to Q.Sonic<sup>plus</sup>.)

For the descriptions of each value output and other information regarding Modbus Protocol, please see the document UFM Series 6 Modbus Protocol - listed in ⇒ [Appendix I – References](#) or available online at <http://www.docuthek.com/>

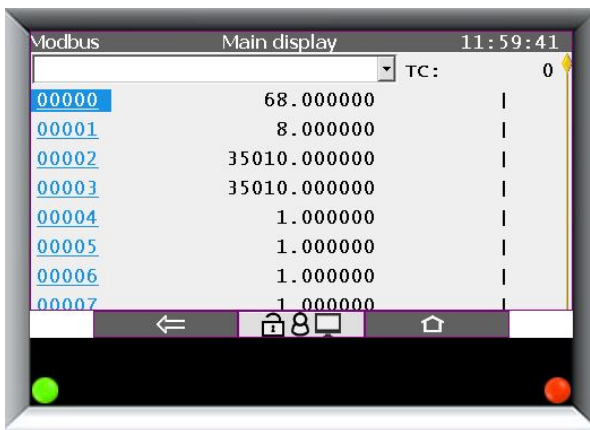



Figure 7-10: Modbus Screen

## 7.5 Diagnostics

- ▶ From the **Start display** screen, scroll to the top of the page and highlight the **Diagnostics** field in the top left-hand corner, see Figure 7-3
- ▶ Press the select arrow  to open the diagnostics screen.
- ✓ From this window it is possible to perform some easy firsthand diagnostics of the ultrasonic flow meter and its individual paths.

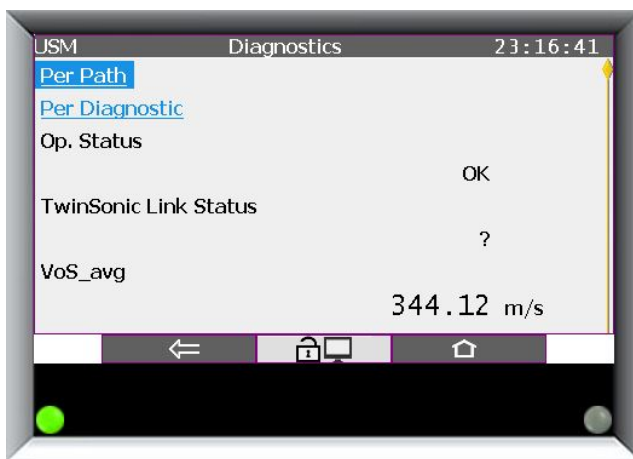


Figure 7-11: General Diagnostics Screen

The main diagnostics display shows general meter diagnostics, all of which is detailed in Table 4 (you must scroll down). You may view diagnostics in two ways:

**Per Path** (Path 1, Path 2, etc.) or

**Per Diagnostic** (SNR, Gain, VoG Raw, VoS Raw, Profile Diagnostics, Performance, and Correction Factors). This will be discussed further.

On the **Diagnostics** screen the following general items are shown:

Diagnostics	
<b>Op. Status (Operational Status)</b>	<p><b>OK:</b> Everything is working properly</p> <p><b>Reduced Acc.:</b> There are some paths which are failing, nevertheless the measurement is still suitable for custody transfer. Contact Elster or your local representative.</p> <p><b>Non fiscal:</b> There are some paths which are failing; measurement is no longer suitable for custody transfer. Contact Elster or your local representative.</p> <p><b>No Measurement:</b> all paths are failing. Contact Elster or your local representative.</p>
<b>VoS_avg</b>	Average measured Velocity of Sound of the gas.
<b>Error Volume FWD</b>	Total volume measured in forward direction, while the meter was in error mode.
<b>Error Volume REV</b>	Total volume measured in reverse direction, while the meter was in error mode.
<b>Pressure</b>	With our optional pressure sensor the live pressure can be given. If the meter is not equipped with the pressure sensor or it is not working, a pre-set value will be shown in red.
<b>Temperature</b>	With the optional temperature sensor the live temperature can be given. If the meter is not equipped with the temperature sensor or it is not working, a pre-set value will be shown in red.
<b>Density</b>	This value is calculated from the option temperature and pressure sensor. If the meter is not equipped with the pressure and/or pressure sensor or they are not working, a pre-set value will be shown in red.
<b>Viscosity</b>	This value is calculated from the optional temperature and pressure sensor. If the meter is not equipped with the pressure and/or pressure sensor or they are not working, a pre-set value will be shown in red.



Diagnostics	
<b>Internal Temperature</b>	This is the temperature measured in the SPU box on the mainboard. When the electronics are not equipped with the temperature sensor or it is not working, a pre-set value will be shown in red.

Table 4: Meter Diagnostics

As seen in [Figure 7-13: Diagnostics sub-menus](#), on the diagnostics page you may also choose from two sub-menus:

- Per Path
- Per Diagnostic

These sub-menus are shown on the top of the display and will disappear if you scroll down. Use the “up” arrow  to make them reappear.

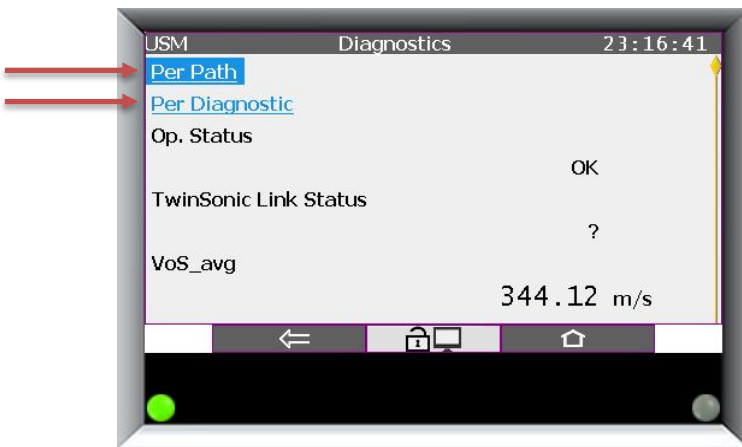
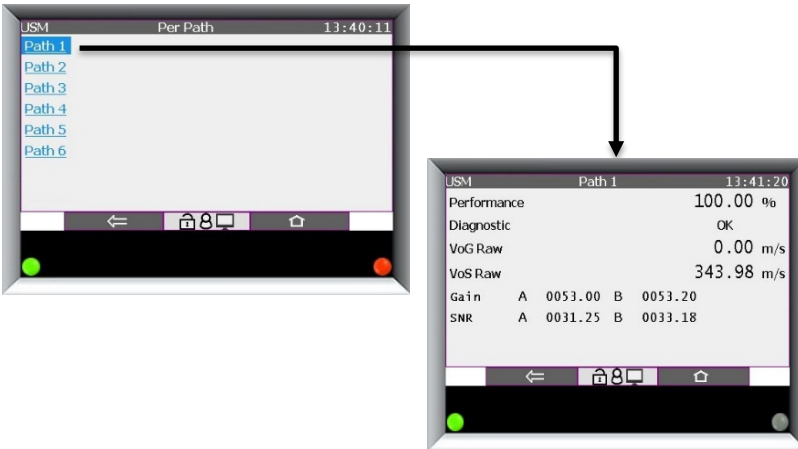


Figure 7-13: Diagnostics sub-menus

### 7.5.1 Per Path

**Per Path** provides an overview of all paths and the current performance of each individual path can be checked. By choosing an individual path, for example Path 1 has been selected in Figure 7-14. You can view the performance %, diagnostic details (by selecting the hyperlink), VoG and VoS of that path.



In case of a path in failure, you can see a detailed breakdown of the path diagnostics by further selecting the highlighted **Diagnostic** result box.

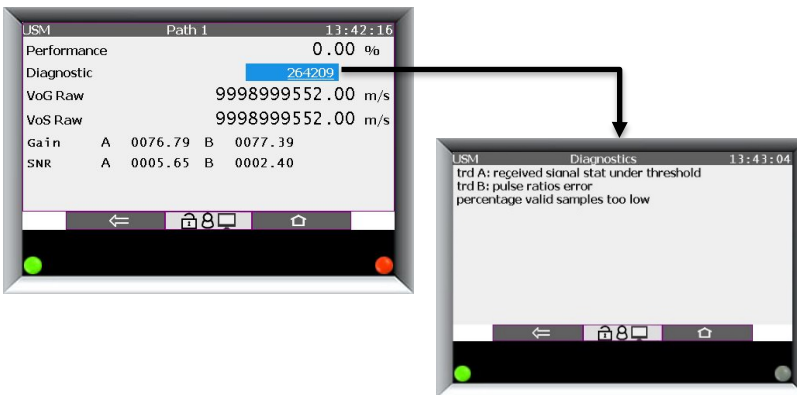


Figure 7-14: Per Path

## 7.5.2 Per Diagnostic

**Per Diagnostic** is broken down into 7 sub-sections, see [Figure 7-15](#):

- ⇒ **SNR**
- ⇒ **Gain**
- ⇒ **VoG Raw (Velocity of Gas Raw)**
- ⇒ **VoS Raw (Velocity of Sound Raw)**
- ⇒ **Profile Diagnostics**
- ⇒ **Performance**
- ⇒ **Correction Factors**

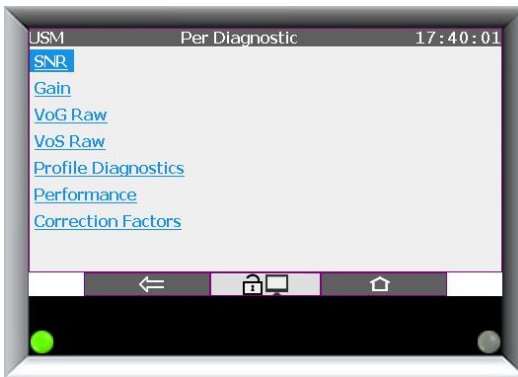


Figure 7-15: Per Diagnostic

### a) SNR & Gain values

In **SNR** and **Gain** the live values can be checked for every Transducer

USM		SNR		11:57:16
Path 1	A	0031.15	B 0030.14	
Path 2	A	0028.66	B 0028.13	
Path 3	A	0028.02	B 0028.34	
Path 4	A	0036.32	B 0040.87	
Path 5	A	0041.27	B 0039.82	
Path 6	A	0031.99	B 0024.55	

USM		Gain		11:58:05
Path 1	A	0053.20	B 0053.20	
Path 2	A	0035.40	B 0035.40	
Path 3	A	0037.20	B 0037.60	
Path 4	A	0039.80	B 0039.40	
Path 5	A	0040.80	B 0040.40	
Path 6	A	0036.80	B 0036.80	

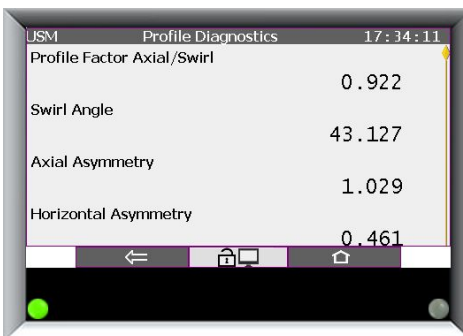
### b) VoG Raw and VoS Raw

These subsections display the raw Velocity of Gas and Velocity of Sound results.



### c) Profile Diagnostics

**Profile Diagnostics** displays an array of useful calculations including: Profile Factor Axial/Swirl, Swirl Angle, Axial Asymmetry, Horizontal Asymmetry, Reynolds Path Type A and Reynolds Path Type B.



### d) Performance

The performance screen displays the performance of each individual path, as seen in Figure 7-16. For further explanation, please refer to ⇒ [section 8.2.2 Performance](#) (p.57).

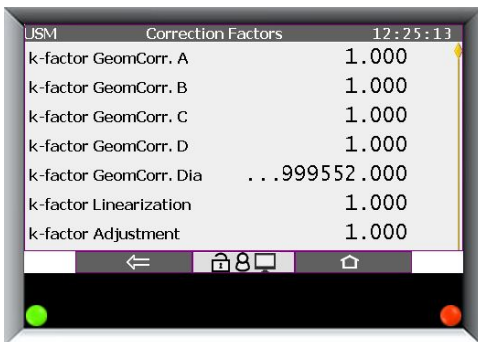


USM	Performance	17:37:13
Path 1	100.00 %	
Path 2	100.00 %	
Path 3	100.00 %	
Path 4	100.00 %	
Path 5	100.00 %	
Path 6	100.00 %	

Figure 7-16: Performance display

### e) Correction Factors

This section provides an overview of all correction factors of the meter.



USM	Correction Factors	12:25:13
k-factor GeomCorr. A	1.000	
k-factor GeomCorr. B	1.000	
k-factor GeomCorr. C	1.000	
k-factor GeomCorr. D	1.000	
k-factor GeomCorr. Dia	...99952.000	
k-factor Linearization	1.000	
k-factor Adjustment	1.000	

Figure 7-17: k-factor Geometry Correction

- k – factor Geometry Corr.** – This correction factor corrects the size of the flow cell's body, based upon the measurements of the internal pressure and temperature sensors. The factor will only be considered if the meter is equipped with the pressure and temperature sensor and when this function is enabled. Enabling should be done with the software package SonicExplorer, in Configure - Correction - Geometry

This is useful if the process conditions differ significantly from the conditions during the calibration process since both high pressure and high temperature results in an increase in the tube cross-section and a change in path lengths and angles.

- **Please Note:**

k-factor GeomCorr. **A** is for the **Axial Path** (if applicable)

k-factor GeomCorr. **B** is for the **Swirl Path**

k-factor GeomCorr. **C** is for the **Half Square Path** (if applicable)

k-factor GeomCorr. **D** is for the **Direct Path** (if applicable)

k-factor GeomCorr. **Dia** is the correction factor for the inner **diameter** for the meter body at operation conditions

- **k – factor Linearization** - When a meter is corrected after calibration through linearization, the adjust factor will be flow depending (interpolated between the calibration points). The meter can have a linearization for each flow direction. This factor shows the adjust factor calculated for the current operating flow (and direction).
- **k – factor Adjustment** - This is the factor when a meter is corrected after calibration with one single adjust factor. There can be a different adjust factor for both flow directions.  
When operating around zero flow, it possible that this factor is constantly switching from positive adjust factor to negative adjust factor.
- **Voffset Correction** - It is possible to put a fixed velocity offset in the meter. This will normally only be used on special projects. The standard for this factor is 0 m/s.

## 7.6 Info – Analog Outputs ...

With the **Info** tab on top of the **Start Display** screen some general information about the electronics and its software can be checked, please see Figure 7-18 Analog Outputs **Error! Reference source not found.** below. There are 3 submenus:

- 1) **Analog Outputs** – displays the results of the current and frequency outputs based on the user's defined values.

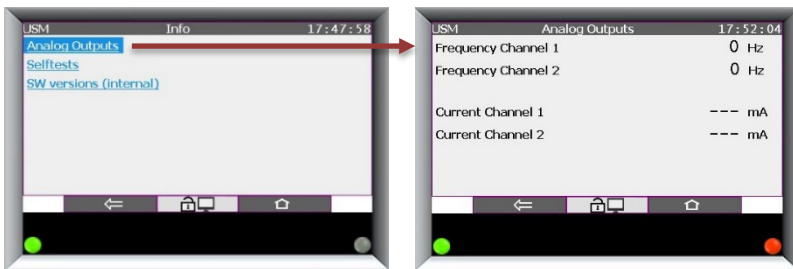


Figure 7-18 Analog Outputs

- 2) **Selftests** – Some important parts of the electronics will perform self-tests. Outcome can be **OK** or **FAIL**. If a **FAIL** is encountered, the self test should be done again. If it continues to fail, contact Honeywell or your local agent.



- 3) **SW versions (internal)** – All Flowboard software components and their versions and checksums can be checked here, refer to section 9.2 [Verifying the Flowboard Components with their Checksums](#).

## 8 Maintenance

The UFM contains no moving parts. The transducers are the only components that are in contact with the gas medium. The materials used for the transducers are resistant to the conditions that were clearly specified for the measuring instrument. As a result the transducers and the electronics are virtually maintenance free.

However, Elster recommends inspection of the UFM at regular intervals, for example weekly or monthly evaluations. In case of deterioration of the meter, appropriate measures should be taken before a serious failure occurs.

### 8.1 Collecting Data

A quick health check of the meter can be done through the **Start display** screen on the front panel. This is described in ⇒ section [7.3 Start display](#) (p.38). However, this will only provide you with meter information in its current status. For a more detailed indication of the meter's condition, Elster recommends performing a trend analysis on the meter's measured data (comparison of recent measured data with results from a past period). The software package SonicExplorer is specially designed for this purpose. More information about this software package can be obtained at Elster, your local agent, or online at <http://www.elster-instromet.com/en/sonicexplorer>. It is a recommended engineering practice to record the measured data at regular intervals.

### 8.2 Inspection of Measured Data

The following general rules provide a good basis for analysing the measured data:



### 8.2.1 Sample Rate

The process of travel time measurement for all paths is repeated several times per second. This number is called Sample Rate. Typically, this is a stable value of about 20 with a variation of -1.

The sample rate is programmable to be anything between 1 and 100Hz. However, the actual sample rate may be lower than the programmed value since, particularly with large size meters, the travel times of the ultrasonic pulses in the gas do not allow for the programmed sample rate. The UFM will then adjust the sample rate to the highest possible value. The highest possible sample rate is not necessarily the best setting for optimum performance. Although the sample rate is not critical, a value between 8 and 25 samples/second is recommended.

### 8.2.2 Performance

Performance is the pulse acceptance rate, expressed as a percentage for the pulses transmitted each second. Each transducer transmits a number of pulses each second. To be accepted as a valid received pulse by the signal processing system, each pulse must arrive within a small-time window, be of sufficient strength, and match a unique waveform signature. The percentage of accepted pulses is shown as an average value of all measuring paths, and for each individual path.

### 8.2.3 Velocity of Sound

The UFM calculates the speed of sound in the gas, based on the measured travel times and the programmed spool piece geometry. This value may be compared to the (theoretically) expected value, for example as calculated using the AGA-10 equations of state. The difference between measured and expected values can be as little as 0.25%, if gas composition, temperature, and pressure are precisely known.

### 8.2.4 Gas Velocity (Zero Flow Measurement)

When there is no flow through the meter, i.e. the block valve(s) are closed, the corrected gas velocity should randomly fluctuate between  $\pm 0.025$  m/s and average very close to zero. During a sunny day the warm walls of the

meter will cause small thermal convection currents to circulate inside the meter. The ultrasonic meter may measure these very slow currents as an increase in the random fluctuations.

### 8.2.5 Presentation of AGC-Levels and AGC-Limits

AGC limits and levels are presented in decibels (dB).

The AGC ratio (AGC-limit / AGC-level) largely depends on the meter size and application (operating pressure, amount of CO<sub>2</sub>, control valve nearby, etc.). It is preferred a high AGC ratio.

The change of the AGC ratio over time is a very useful parameter to predict the performance of the meter in the future.

### 8.2.6 Swirl Angle

If your meter is equipped with a swirl path, this value indicates the amount of swirl measured by an ultrasonic flow meter, expressed in degrees. A positive swirl angle indicates clockwise swirl, whilst a negative swirl angle indicates counterclockwise swirl. The meter operates reliably if the angle is between - 20° and +20°. If the indicated swirl angle exceeds these values, please consult Honeywell for support.

## 8.3 Exchanging Components

Different parts of the Ultrasonic Flow Meter Series 6 metering system such as transducers, electronic boards, etc. can easily be exchanged. The digital programmed pulse shape and pulse identification of the meter is always identical. Therefore, the electronic and transducer products need no adjustment. This means that re-programming or re-calibration of the meter after exchanging any identical part of the Ultrasonic Flow Meter Series 6 metering system is not necessary.

Spare parts of the Ultrasonic Flow Meter Series 6 metering system must be supplied by Elster. After exchanging parts of the Q.Sonic Series 6 metering system the present “calibration” sealing must be renewed. ⇨ Please refer to section [5.7 Sealing](#) (p.27).

**Caution!**

Before exchanging any components verify with your local metrology authority on proper procedures. It may be required that the operation needs to be witnessed by a representative of the local authority.

**WARNING!**

Exchanging of components should only be done with the same type and model; unless otherwise specified by Elster.

### 8.3.1 Pressure Sensors Exchange

The meter may be equipped with an optional pressure sensor for internal use, ⇒ refer to section [5.4 Flow Cell Pressure Sensor](#) (p.23). As the pressure sensors are specially designed for the Ultrasonic Flow Meter Series 6, they may only be exchanged with sensors from Elster.

**WARNING!**

For the pressure sensor it is mandatory to **depressurize** the line before exchanging.

### 8.3.2 Temperature Sensors Exchange

The meter is equipped with a temperature sensor for internal use (for more information ⇒ refer to section [5.5 Flow Cell Temperature Sensor](#), p.23). As the temperature sensors are specially designed for the Ultrasonic Flow Meter Series 6, they may only be exchanged with sensors from Elster.

As the temperature sensor only measures the flow cell temperature and is not in contact with the gas in the pipe, exchanging can be done under pressure.

### 8.3.3 Transducer Exchange

Each transducer is a separate component of the Ultrasonic Flow Meter Series 6 that can be exchanged independently. This can be done without degradation of the measuring properties and accuracy (thus the calibration) of the Ultrasonic Gas Flow Meter.

However, as the transducers are paired up during production, Elster always recommends changing both transducers of an acoustic path, if possible.



#### **WARNING!**

Obey the rules and regulations that apply to hazardous area operations and those with respect to custody transfer regulations (sealing).



#### **WARNING!**

Exchanging a transducer can take place when the line with the Ultrasonic Flow Meter Series 6 is **depressurized**:

Refer to specific installation instructions delivered with the transducers: Transducer Exchange at Atmospheric Conditions (⇒ listed in [Appendix I – References](#))

Optionally, exchanging a transducer can be done when the Ultrasonic Flow Meter Series 6 is **pressurized**:

A special tool is required for this: the 'Retraction tool NG Transducers'. Please familiarise yourself with the documentation regarding this special tool: Retraction tool NG transducers (⇒ listed in [Appendix I – References](#)).

- Before beginning this procedure please verify if this is allowed by the safety standards set by your company and local safety regulations. If in doubt, DO NOT remove the transducers under pressure.

### 8.3.4 SPU Exchange

Some parts of the SPU can be exchanged without issue, provided that the appropriate hardware and software versions are used. The product numbers can be found on the PCB and have the following structure xxx-xxx-xxx-xxx. The software version and its checksums can be checked through the front panel. For more information ⇒ refer to section [7.1 LED at Display](#) (p.35).

An SPU exchange will not affect the measuring characteristics and accuracy (and consequently the calibration) of the UFM. However, if the board is sealed after calibration, please contact Elster or your local representative before proceeding with the exchange.

When exchanging the SPU (or parts of the SPU), refer to the specific manual delivered with the component. Depending on the board, it could be one of the following documents:

- Ultrasonic Flow Meter Series 6 Exchanging PCB boards in TIP
- Ultrasonic Flow Meter Series 6 Exchanging Boards at the Rear Compartment of the SPU
- Both documents are listed in ⇒ [Appendix I – References](#)

## 9 Verifying Software Versions

It's possible to verify the software version with checksum for all components. This should be done with two different methods. Figure 9-1 and Figure 9-2 show the steps to complete this process.

### 9.1 Verifying Software Versions and Checksums

- ▶ If you are at the front panel, go to the Home page
- ▶ Select Info
- ▶ Go to Software Status
- ✓ A list is presented with the status of the software modules.

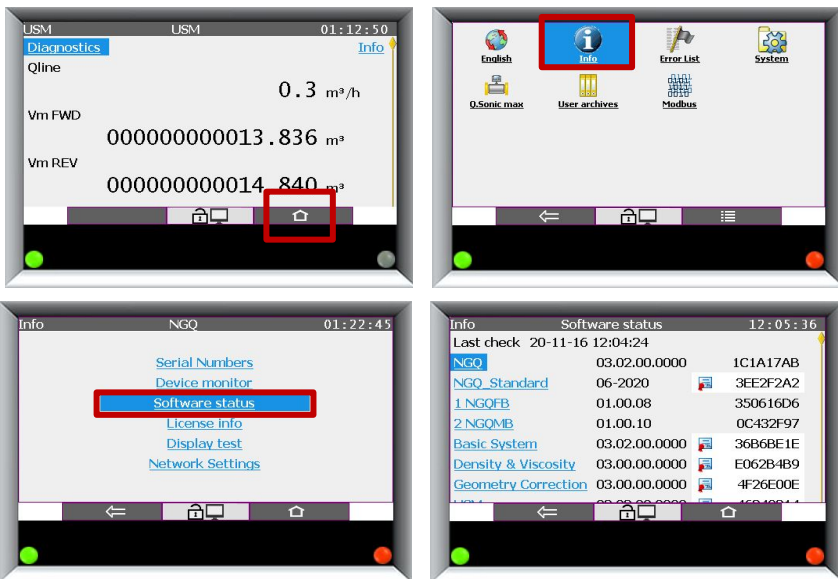
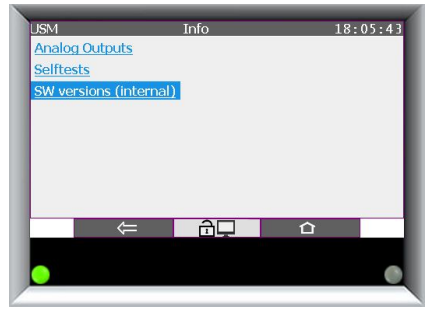
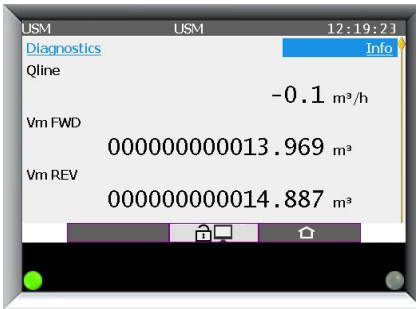


Figure 9-1: Checking software versions and checksum through the front panel

## 9.2 Verifying the Flowboard Components with their Checksums

- ▶ Go to the Start display and select **Info** (you may need to scroll to the top of the page using the up arrow in order to highlight the button)
- ▶ Go to SW Versions (Internal)



- ✓ A list of all components is displayed. Choose the one you want to check: (e.g. Bootstrap, Bootloader, **DSP**, etc.)

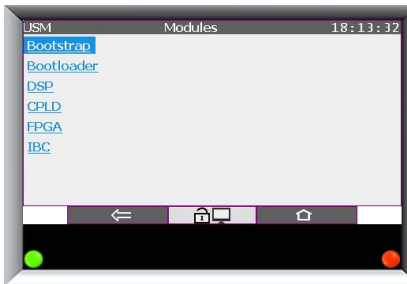


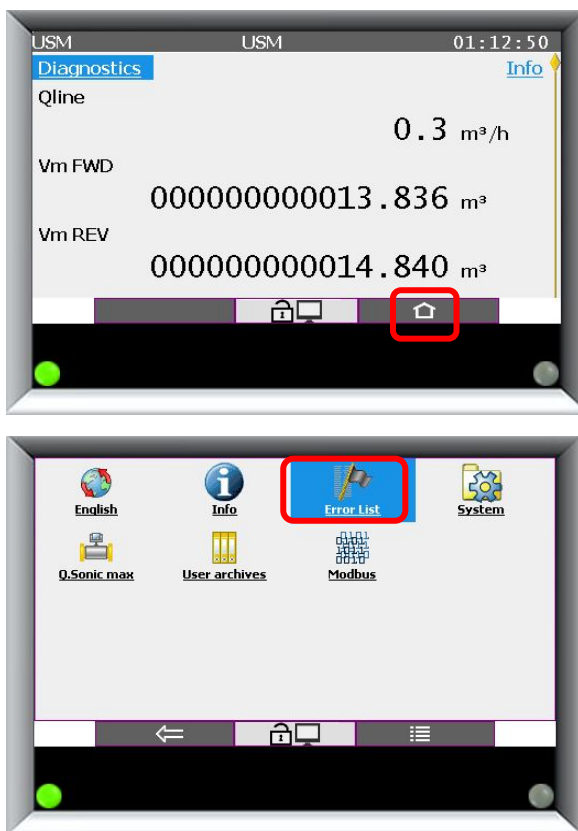
Figure 9-2: Checking Flowboard Software Versions

## 10 Verifying Errors and Warnings

The status LED on the display shows when a warning or error has taken place, ⇒ refer to section [7.1 LED at Display](#).

However, through the front panel it is possible to get more information about the errors or warnings, see [Figure 10-1](#).

- ▶ On the start display press the **Home** button
- ▶ Choose **Error List**





- ✓ A list of errors and warnings is displayed:

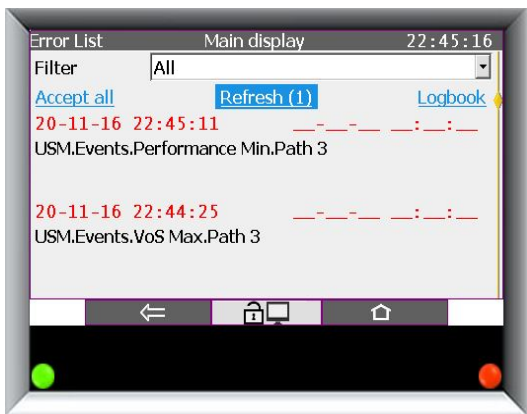
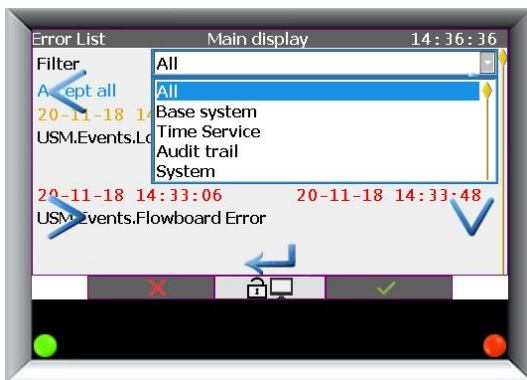


Figure 10-1: Errors & Warnings

- ▶ Press **Refresh** to update the list, if needed (check the number shown in brackets behind the Refresh button).
- ▶ If past errors or warnings are no longer relevant, you can select **Accept all** and all past errors will be accepted and removed from the list.
- ▶ Hereby they will be written in the **Logbook** of the meter and will no longer influence the status LED on the meter display. The Logbook is available on the right-hand side button.
- ▶ To use a **Filter**, scroll up and select your desired error type.



## 11 PC Software Package

For configuration and monitoring of the Ultrasonic Flow Meter Series 6 Honeywell has developed a software package called SonicExplorer. This program is specially designed to perform advanced monitoring of the Ultrasonic Flow Meter Series 6.

For more information about SonicExplorer, please check the Honeywell website. You can download the SonicExplorer Software and Manual here:

<http://www.elster-instromet.com/en/sonicexplorer>

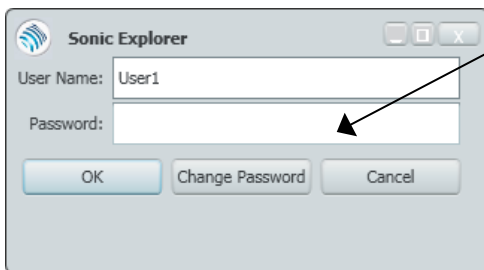
## 12 User Rights / Login

From software version 2.8 onwards user rights are implemented in the Ultrasonic Flow Meter Series 6. Access to the device with SonicExplorer is only granted after login with a password.

By default, there are three user profiles available:

- **Admin** can modify all parameters
- **User1** can modify non-fiscal parameters
- **User2** cannot modify parameters – read access only

**User1** and **User2** do not have a default password set. Just leave “Password” blank and click “OK”.



### User Admin:

- a) For meter software **version 2.8 up to 2.11**: To request an administrator password please contact Honeywell at [AfterSales@Honeywell.com](mailto:AfterSales@Honeywell.com)
- b) For meter software **version 3.1 onwards** the default administrator password is set to blank. It is highly recommended to change the default admin password after receiving the meter. It is up to the user to set a new admin password.

Remark: When changing the admin password wait a moment before login with the new password to let the meter take the new password into account.



### **Meter software version 3.1 onwards:**

Be aware that there is no admin password stored at Honeywell. The user fully owns the admin password.

In case the new admin password is getting lost please contact [Aftersales@Honeywell.com](mailto:Aftersales@Honeywell.com)

In order to regain login as admin the meter must be opened to access the electronic boards !

## 12.1 Enforce a strong password policy

There are different attacks on passwords known today, so you should follow the best practices for managing your passwords. Here are some hints, you may consider in your daily work environment:

- Always change default passwords
- Choose strong passwords

Use a combination of uppercase and lowercase letters, numbers, and special characters when assigning a password. In addition, protection increases with the password length. A strong password consists of at least 8 characters.

- Change passwords on a regular basis frequently over the operation of the system
- Change passwords immediately in case someone has tried to attack the system

## 13 Security considerations for your network

Q.Sonic Flowmeter Series VI devices are used in modern accounting infrastructures and network control technology with the task of gathering and transmitting process flow information for fiscal clearing such as operational flow and volume directly on the process level in a gas metering application. Such a connection represents a significant security risk and therefore careful consideration must be given to the design.



### **Report a security issue to Honeywell!**

As soon as you encounter a possible security gap of a Honeywell product, please report it directly to Honeywell.

### 13.1 Preventing unauthorized external access using a firewall

To reduce the risk to your network, we highly recommend including a firewall solution or some other mechanism to limit the network traffic between the (external) central accounting center resp. control station and the (internal) network of the gas measuring plant in a target manner.

In addition, Q.Sonic Flowmeter devices should only be installed in the measuring plant where access control is guaranteed, i.e. where protective measures are taken to prevent unauthorized persons from gaining physical access to the device (while using a dedicated VPN channel).

Furthermore, we recommend allowing protocols and ports only which are used for data exchange with the external network, e.g. by adding these to the white list of the firewall and allow data exchange with trusted participants only ( ⇔ protocol details see Table Table 8.1 Applicable protocols in detail).

To avoid a (temporary) shutdown of the LAN interface due to an unintended packet overload, limit the packet rate to a value you expect during normal operation.

Protocol	Default Port	Description
MMS	102 <sup>[1]</sup>	Manufacturing Messaging Specification (according to ISO standard 9506) enables communication between enSuite, SonicExplorer and Q.Sonic Flowmeter.
Modbus TCP	502	Protocol for data exchange of user-defined registers between FlowComputer devices (e.g. enCore FC1 Modbus AFB and “intelligent protocols” (GC, USM)) via a standard TCP/IP network

Table 8.1 Applicable protocols in detail

[1] Typically, port 3782 is used instead of port 102 for secure communication. For reasons of downward compatibility, enCore/Q.Sonic devices use the standard port 102.

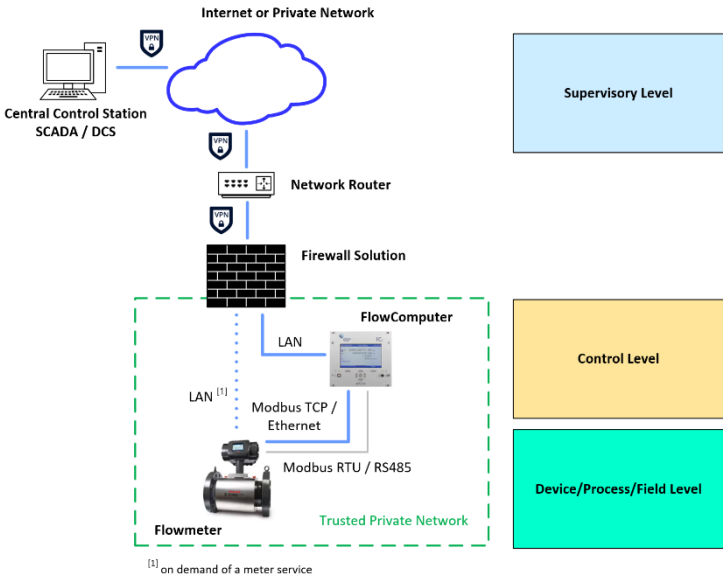


Figure 8.2 Secure network topology using a VPN connection for metering data exchange (example)

## 13.2 Security for data in transit

Data in transit means the data flow on demand that is transferred between a Q.Sonic Flowmeter device and e.g. a control station or a Flow Computer device in a public or trusted network or between Q.Sonic meter and enSuite or SonicExplorer e.g. when transferring data during parameterization of the meter in commissioning.

The communication between the Q.Sonic meter and enSuite or SonicExplorer is carried out via MMS. Other protocols, e.g. Modbus - transmit data partly in plain text.



### **Use encrypted VPN connection**

We recommend using a VPN connection whenever you need a secure data connection in case there is no secure protocol supported for data transmission.

In a VPN, data is transferred between two or more participants in encrypted form.

For this reason, a VPN connection is recommended, for example, for mobile access to a Flowmeter, access to the private network or for data communication via different systems.

## 14 Shipping and Storage

As the Ultrasonic Flow Meter Series 6 is a delicate instrument, care should be taken to carefully handle and store the flow meter in a proper way. Improper handling, shipping, or storing may void its warranty.

The Ultrasonic Flow Meter Series 6 should be stored in indoor conditions, with a low humidity (5% - 95% non-condensing); storage temperature should remain between -20 °C and +60 °C (long term storage temperature: between 0 °C - +60 °C). Please refer to our UFM Series 6 Shipping and Storage Manual (⇒ listed in [Appendix I – References](#)) for more detailed information.



## 15 MID Requirements

### 15.1 General

This section is only applicable when the Ultrasonic Flow Meter Series 6 Q.Sonic<sup>plus</sup> needs to be in accordance with European Directive 2004/22/EC \*) on measuring instruments (MID) as stated in EC-type Examination Certificate T10335.

The Ultrasonic Flow Meter Series 6 can be used legally for fiscal metering based on European Directive 2004/22/EC \*) , Annex MI-002.

The Ultrasonic Flowmeter Series 6 Q.Sonic<sup>plus</sup> is compliant with Environment Class M1 / E2

\*) New European Directive valid from 20.04.2016: 2014/32/EU

### 15.2 EC Declaration of Conformity

Elster ultrasonic gas flow meters are manufactured in accordance with applicable directives, e.g.:

- Pressure Equipment Directive (PED)
- Equipment and Protective systems intended for use in potential Explosive Atmospheres (ATEX) Directive
- Electro Magnetic Compatibility (EMC) Directive
- Measuring Instruments Directive (MID)

In compliance with the applicable directives the meters are supplied with the CE mark and the EC Declaration of Conformity. This declaration is part of your flow meter documentation since it also contains important details of your flow meter (e.g. PED category, ATEX markings).

## 15.3 Sealing

A MID compliant meter shall be sealed. ⇒ Refer to section [5.7 Sealing](#) (p.27) for more information.

## 15.4 Calibration

A MID compliant meter is accompanied by a copy of the EC Declaration of Conformity stating compliance with Measuring Instruments Directive 2004/22/EC \*) Annex MI-002, based on:

- EC-Type examination certificate T10335 according MID Annex B and
- A certificate of conformity from a Notified Body according to MID Annex F.

\*) New European Directive valid from 20.04.2016: 2014/32/EU

## 15.5 Installation Requirements

Special attention needs to be taken so that the UFM Series 6 meter and its in- and outlet spools are mounted according to EC examination Certificate T10335 (last valid version).

Note that parameters stated in certificate T10335 may indicate a limit or limits of a range. The values and ranges applicable to your flow meter may be different.

The UFM needs to be powered by an Uninterruptible Power Supply (UPS).

⇒ Please also refer to section [6 Installation and Commissioning](#) (p.31).

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## Appendix I – References

All references below can be obtained from Elster. Additionally, most references are available online at: <http://www.docuthek.com/>.

- [1]** MID Certificate T10335 (last valid version)  
Doc. No.: T10335\_certificate
  
- [2]** UFM Series 6 Q.Sonic<sup>plus</sup> Operation and Maintenance Manual  
SAP Ref.: 73023467  
Doc. No.: 10000050188 (last valid revision)
  
- [3]** UFM Series 6 CheckSonic Operation and Maintenance Manual  
SAP Ref.: 73023471  
Doc. No.: 10000050192 (last valid revision)
  
- [4]** UFM Series 6 Q.Sonic<sup>max</sup> Operation and Maintenance Manual  
SAP Ref.: 73023477  
Doc. No.: 10000051506 (last valid revision)
  
- [5]** UFM Series 6 Wiring Instructions  
SAP Ref.: 73023470  
Doc. No.: 10000050191 (last valid revision)
  
- [6]** UFM Series 6 Shipping and Storage Manual  
SAP Ref.: 73023469  
Doc. No.: 10000050190 (last valid revision)
  
- [7]** UFM Series 6 Safety Instructions  
SAP Ref.: 73023465  
Doc. No.: 10000050186 (last valid revision)

- [8]**     UFM Series 6 Modbus Protocol  
SAP Ref.:     73023466  
Doc. No.:     10000050187 (last valid revision)
  
- [9]**     UFM Series 6 Transducer Exchange at Atmospheric Conditions  
SAP Ref.:     73023472  
Doc. No.:     03.200.001.001/02/2 (last valid revision)
  
- [10]**   Retraction Tool NG Transducers  
SAP Ref.:     73023473  
Doc. No.:     03.203.101.001.02/2 (last valid revision)
  
- [11]**   UFM Series 6 Exchanging PCB boards in TIP  
SAP Ref.:     73023474  
Doc. No.:     03.303.101.000.02/2 (last valid revision)
  
- [12]**   UFM Series 6 Exchanging Boards at the Rear Compartment of  
the SPU  
SAP Ref.:     73023475  
Doc. No.:     03.302.101.000.02/2 (last valid revision)
  
- [13]**   External VDSL Range Extender User Manual  
SAP Ref.:     73023483  
Doc. No.:     10000050357 (last valid revision)
  
- [14]**   UFM Series 6 SonicExplorer Software Application Manual  
SAP Ref.:     73023308  
Doc. No.:     10000050563 (last valid revision)