

A look into the future:

## Sonic Explorer – a smart software assistant for ultrasonic gas meters

As technology marches forward, it is only natural that measurement instrumentation continues to evolve into smarter semiautonomous devices. Who would have thought 20 years ago that a car could advise you to apply the brakes if an obstacle becomes too close when you are drowsy or falling asleep, or even park itself in a tight parking spot. These features are the work of clever software and hardware developers who continue to push the envelope of artificial intelligence.

In today's high-tech world, even an ultrasonic transit time flow meter cannot escape progress. In the gas custody transfer measurement world, the ultimate quest is to know that the measurement device is healthy and is operating within established and acceptable accuracy limits, even under the influence of varying process conditions. Any time the custody of a commodity such as natural gas changes hands, the billing or measurement of it must comply with applicable rules and regulations. To achieve a respected level of measurement accuracy, it is only natural that an ultrasonic custody transfer flow meter is first calibrated at an established and accredited flow calibration facility. The only downside of a calibration facility is that it is not the real world.

In principle, the calibration facility and its equipment enjoy well defined and monitored process conditions. In other words, the calibration facility is as ideal as it can get in the real world. The moment a calibration is finished and the measurement device is transported and installed at a metering facility, slowly but immediately the flow meter begins its inevitable change from the ideal conditions seen at the calibration lab. Even in pipeline-quality natural gas, erroneous foreign materials can be found and are transported with the flow. Over time, some of these materials form deposits on the flow metering device, beginning ever so slightly to compromise its calibration status that was verified at the laboratory.

It is the quest of the user to have tools to be able to assess the health and performance of the flow metering device with the least amount of physical effort. Removing the flow meter for visual inspection, which is time-consuming, costly and non-productive for the business, should no longer be required for instance. Sonic Explorer is just such a tool that allows the user to ascertain the health and performance of their device in situ, enabling them to make informed decisions about maintenance or other tasks related to the ultrasonic flow meter.

Sonic Explorer operates on three levels of man-machine interaction. The Start

window (Fig. 1) is a simple graphic user interface that shows the most vital measurement results and a pictorial of the meter body with a traffic light indication. Even for a non ultrasonic meter expert, the indication is simple and concise. If the traffic light indication is green, all is good and the meter is working within all prescribed limits. If the indication is amber, the meter is entering a warning state, where some



Fig. 1

of the critical operational parameters could force an outage or measurement loss. Lastly, if the traffic light indication is red, the flow meter has suffered a fault and is unable to meet its objective as a custody transfer device. It is the incorporation of intelligence behind the traffic light system that allows the user ample time to take steps before a forced outage of the measurement device occurs. In addition, various flow profiles can be displayed using different flow ratios. This visualization function is yet another handy tool to assess possible out-of-normal occurrences. The second level of the user interface allows the operator to drill down to a bar graph based indication prorating all the critical operational diagnostic values and calculated diagnostic values that control the measurement.

The bar graphs reveal more detail and the shaded regions indicating the range limits allow the user to assess the exact status of each diagnostic value relative to its preset limits. The traffic light indication system remains part of the theme such that each bar graph incorporates the tri-coloured scheme. A quick visual inspection tells the user which bars of the graph are within their limits, indicated by green (Fig. 2).

“send”. The customer service pack contains all the relevant data that would be collected by any top notch Elster service engineer if he were on site, but without him actually being there. An off-site analysis of the data can take place almost immediately and aid the user with a resolution or preventive action.

The third level of Sonic Explorer covers the Service aspect that gives the user or the service engineer a quick overview of the diagnostic data as it is occurring. In the Service module, diagnostic data is not

the functionality of an ultrasonic meter. Sonic Explorer allows for the conversion of acoustic signals into a frequency spectrum. The frequency spectrum highlights the frequency and amplitude of the acoustic signal being used for measurement as well as the frequency and amplitude of noise if present in the system. For the first time, the ambiguity regarding noise affecting the performance of an ultrasonic meter is completely removed by calculating and visualizing the frequencies in near-real time.



Fig. 2



Fig. 3

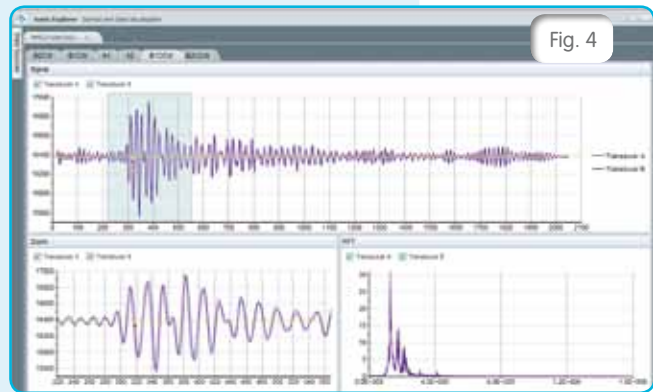


Fig. 4

One very unique feature of Sonic Explorer is the “Create Customer Service Pack” button. When this button is clicked, Sonic Explorer collects a 3-minute log of the entire state of the ultrasonic flow meter including the device configuration, a present diagnostic snapshot, a pass/fail report, all diagnostic values as well as analyses of all acoustic signals and the noise spectrum. The “Create Customer Service Pack” function then zips the files into one compressed folder, opens the default e-mail client, attaches the file, inserts the Elster support address as recipient and waits for the operator to click

only displayed in a tabular numeric format but also as short-term line graphs (Fig. 3). The Service view presents a very quick and instantaneous summary of the general meter operation and status. The second layer of the Service view allows the user to visualize the physical acoustic signals being used for measurement (Fig. 4).

In most cases, this level of detail is only relevant for the service engineer, but Elster has added a feature that goes way beyond typical signal processing. In some applications, either from the beginning or over time, presence of noise can interfere with

Sonic Explorer is a powerful tool that allows users to work comfortably with the family of Q.Sonic custody transfer meters and allows them to feel confident that the instrument is operating properly or that help is available at the click of a button. 2011 is only the beginning of the Elster Sonic Explorer and the new Q.Sonic<sup>plus</sup>, with far-reaching goals in terms of artificial intelligence and system autonomy. Perhaps one day in the near future, Sonic Explorer will even be able to warn the operator that he is getting drowsy.