

ENGINEERING KIT

D-Flow Technology offers a concept providing customers the tools to develop an accurate, low power and cost-effective ultrasonic flow meter. D-Flow provides the key components and know-how for application-specific flow meters for both liquids and gases. Both single- and multi path meter solutions are possible.

Included in the engineering kit

- D-Flow ASICs in MQFP44 package
- Support by phone and e-mail
- Documentation of the D-Flow ASIC
- Schematic of an evaluation PCB-board
- Bill of material of the evaluation board
- Software to the evaluation board
- Optional liquid/gas transducers

APPLICATIONS

Beside the basic measurement of the up- and downstream transit times, D-Flow's technology can for example be used in following applications:

- Flow measurement
- Level measurement
- Speed of sound measurement
- Concentration measurement
- Distance measurement

EVALUATION METERS

D-Flow has developed a wide range of evaluation meters for different applications. A selection of these are displayed at the end of this document. Accuracy plots are also displayed.



COMPANY INFO

D-Flow is a knowledge-based company that specializes in ultrasound technology, mainly for flow measurement. Our knowledge is based on 20 years of research in ultrasonics and flow measurement technology. For further information, please visit www.d-flow.com.

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GENERAL DESCRIPTION

The D-Flow UFO ASIC is designed to be a low power electronic module for use in ultrasonic flow meters. It can also be used for other purposes, such as level measurement, speed of sound measurement and media analysis. The UFO ASIC starts, maintains and terminates a sing-around loop of ultrasonic pulses. It measures the time period of a specified number of sing-around loops. The UFO ASIC connects to the CPU as a general I/O circuit. The UFO is controlled using a number of 8 bit I/O registers.

The D-Flow ASIC is available in a MQFP 44 package.

FEATURES

- Enables a low cost total solution by few and low cost external components
- There are two low power modes; power-cycling and sleep mode.
- In low powered applications, the low power modes enables 10 year battery lifetime.
- Typically < 5 ps time resolution using sing-around averaging
- 300 ps or better single shot time resolution
- Optional 3V or 5V I/O communication
- Automatic input gain setting

SYSTEM BLOCK DIAGRAM

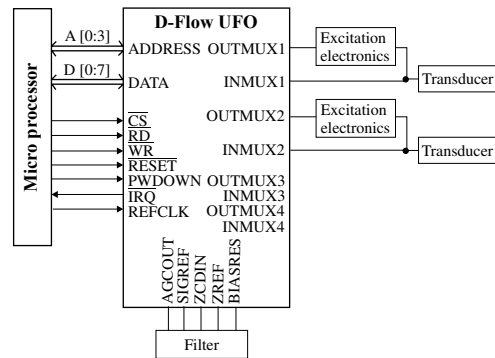


Figure 1: System block diagram

UFO ASIC BLOCK DIAGRAM

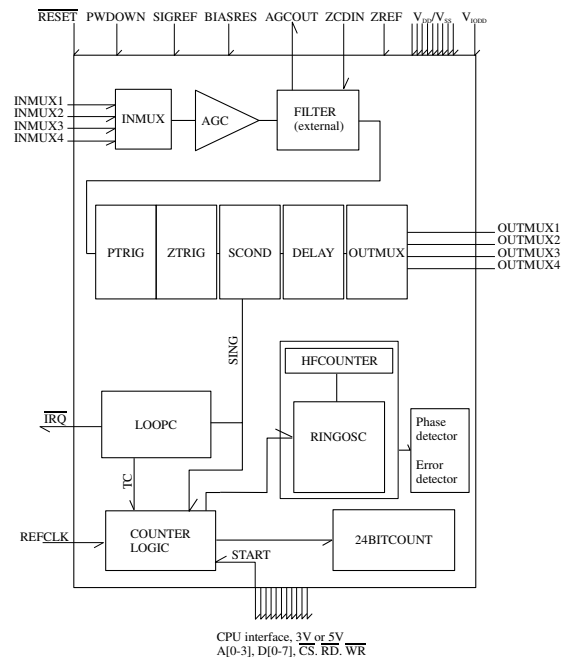


Figure 2: UFO ASIC block diagram

LIQUID TRANSDUCER

The D-Flow ultrasonic liquid transducers are specially designed for flow measurement using the ring around method. The piezo-based 4 MHz transducers are made of PEEK thermoplastic. The transducer is designed to have a high frequency broad banded signal to give a large first flank to trigger on. The cost-effective solution makes them suitable for high volume applications. The PEEK thermoplastic is approved for both medical and industrial applications and therefore suitable for a wide range of flow measurement applications.

GAS TRANSDUCER

D-Flow can offer our customers a selection of ultrasonic transducers for use with our ASIC. D-Flow's suppliers of gas transducers have the ability to accommodate small and high volume applications world wide.

APPLICATIONS

D-Flow's liquid transducers are used in the water evaluation meters, shown at the end of this document.

Our know-how for developing transducers is gained from our earlier flow measurement applications and can be transferred to many other applications. Therefore, D-Flow can offer you development and manufacturing of transducers for your application. We custom-design your transducers to fit the specific requirements of your application.

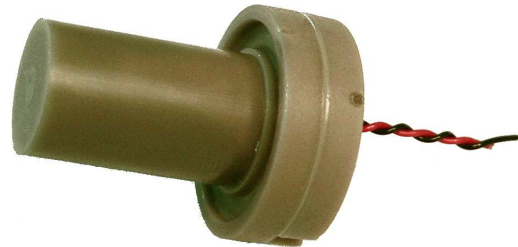


Figure 3: 4MHz liquid transducer, \varnothing 10mm

SYSTEM ECHO RESPONSE

A typical system echo response from a 4MHz liquid transducer is presented below.

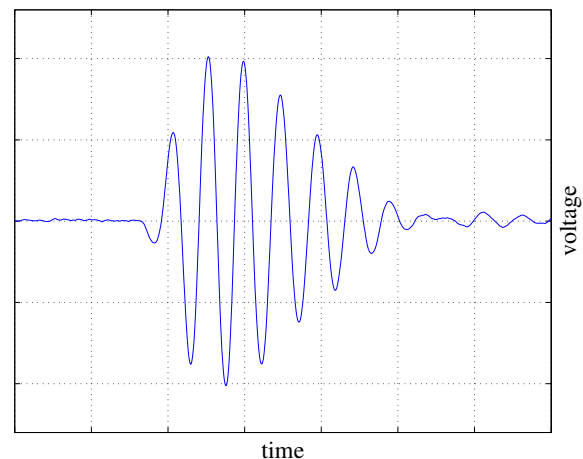


Figure 4: Typical system echo response

SINGLE PATH WATER METER - $Q_p 0.5$

The evaluation meter is designed for use in medical applications. Our competitive technology offers accuracy at very small flowrates, low maintenance and small headloss.

The EN 1434-1 specification regarding maximum allowed errors for class-2 meters are shown as a reference to the evaluation meter.

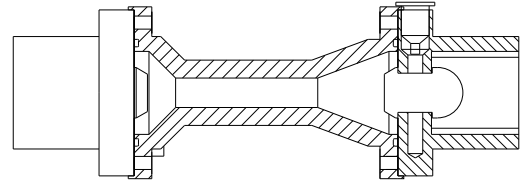
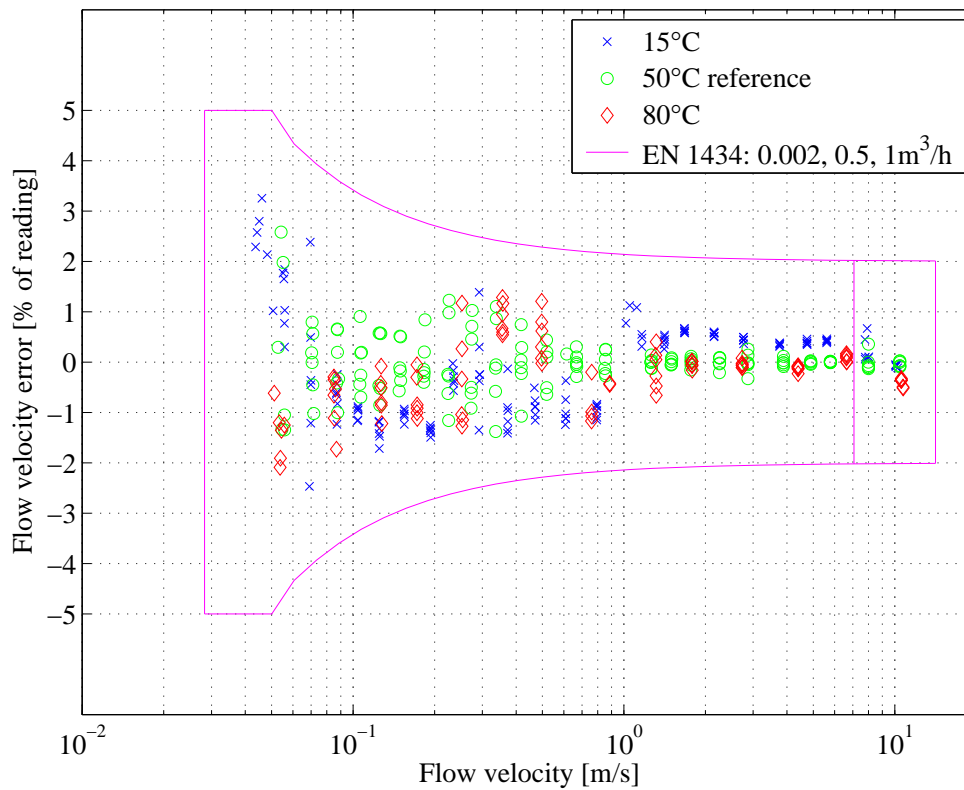


Figure 5: In-line flow tube design, \varnothing 5mm



All flow rates are repeated six times at three temperatures, 15°C, 50°C and 80°C. The bias error is stated as the percentage difference between the reading from the calibration facility and the flow meter. The Y-axis of the figure displays percentage error and the X-axis displays the flow rate. The EN 1434 specification in a 1:250 flow range is also shown in the figure. The flow meter is calibrated at 50°C.

SINGLE PATH WATER METER - $Q_p1.5$

The evaluation meter is designed for use in district heating applications. Our competitive technology offers accuracy in a large dynamic range, low maintenance and small headloss.

The EN 1434-1 specification regarding maximum allowed errors for class-2 meters are shown as a reference to the evaluation meter.

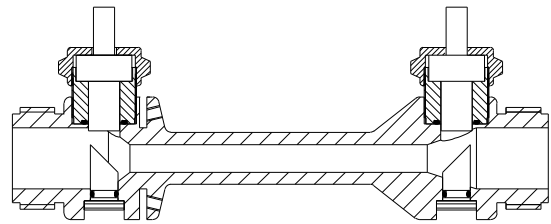
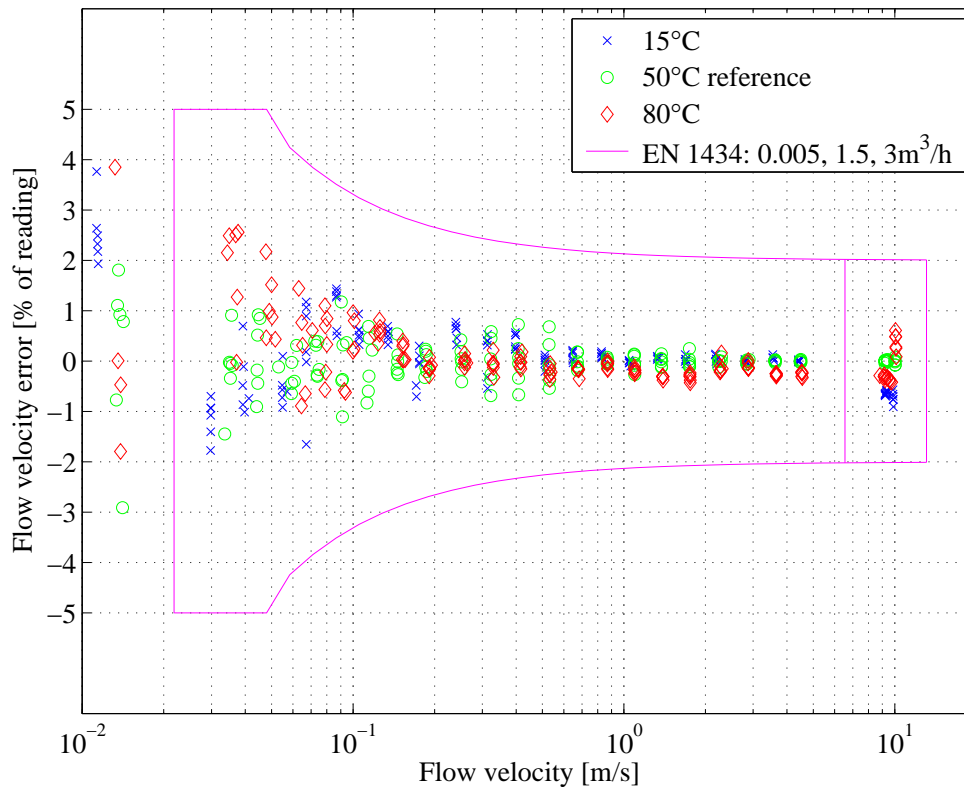


Figure 6: Flow tube design with mirrors, \varnothing 9mm



All flow rates are repeated six times at three temperatures, 15°C, 50°C and 80°C. The bias error is stated as the percentage difference between the reading from the calibration facility and the flow meter. The Y-axis of the figure displays percentage error and the X-axis displays the flow rate. The EN 1434 specification in a 1:300 flow range is also shown in the figure. The flow meter is calibrated at 50°C.

SINGLE PATH WATER METER - Q_p6

The evaluation meter is designed for use in district heating applications. Our competitive technology offers accuracy in a large dynamic range, low maintenance and small headloss.

The EN 1434-1 specification regarding maximum allowed errors for class-2 meters are shown as a reference to the evaluation meter.

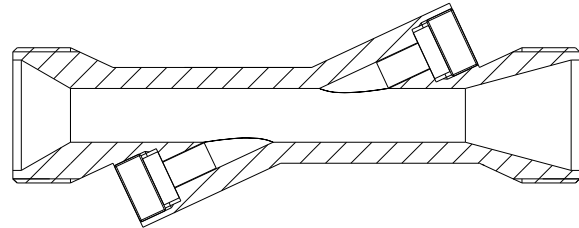
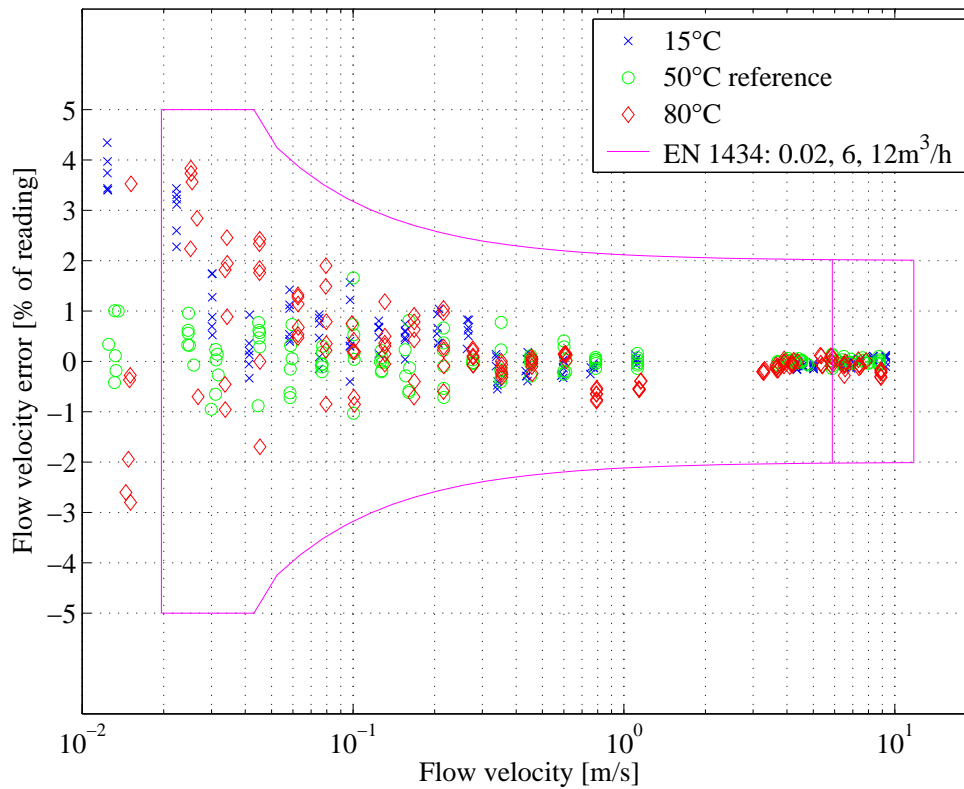


Figure 7: Diagonal flow tube design, Ø 19mm



All flow rates are repeated six times at three temperatures, 15°C, 50°C and 80°C. The bias error is stated as the percentage difference between the reading from the calibration facility and the flow meter. The Y-axis of the figure displays percentage error and the X-axis displays the flow rate. The EN 1434 specification in a 1:300 flow range is also shown in the figure. The flow meter is calibrated at 50°C.

SINGLE PATH GAS METER - $Q_{max} 50$

The evaluation meter is designed for use in natural gas applications. Our competitive technology offers accuracy in a large dynamic range, low maintenance and small headloss.

The ENV 14236:2002 specification regarding maximum allowed errors are shown as a reference to the evaluation meter.

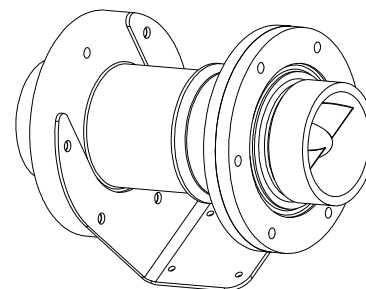
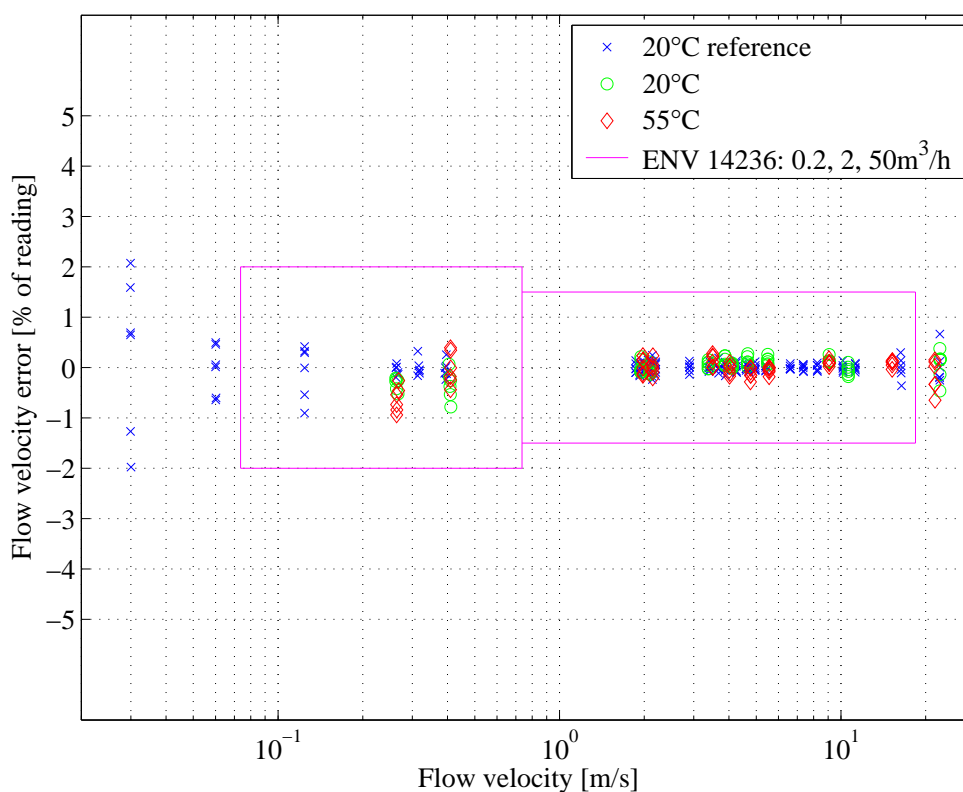


Figure 8: In-line flow tube design, $\varnothing 31\text{mm}$



All flow rates are repeated six times at two temperatures, 20°C and 55°C. The bias error is stated as the percentage difference between the reading from the calibration facility and the flow meter. The Y-axis of the figure displays percentage error and the X-axis displays the flow rate. A flow range of 1:100 are also shown in the figure. The flow meter is calibrated at 20°C.