Technical Note
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Multi-Fluid Measurements Using Vortex Flowmeters

MULTI-FLUID MEASUREMENT

Multi-fluid measurement is defined as the ability of a single meter to measure more than one separate homogeneous fluid (liquids and/or gases) without changing the meter configuration. Multi-fluid is different than multi-phase, which is a liquid/gas mixture. Both multi-fluid and multi-phase applications can present flow measurement problems for vortex flowmeters. Typical flow measurements for the Rosemount vortex flowmeter are in single-phase fluid measurements such as steam, water, natural gas, etc. The meter is typically sized to measure that particular fluid. The meter is also configured for that specific application. For the Rosemount 8800D Vortex, part of the application specific configuration is setting the digital filters to optimize the noise immunity. The optimum filter configuration is determined by the fluid (liquid or gas), line size, density, and flow range.

There are several applications that involve measuring two or more fluids (gases and/or liquids) in the same line without changing the configuration of the flowmeter. The Rosemount Vortex flowmeter has been able to provide a successful measurement in these applications, but the meter needs be configured specifically for each situation.This paper discusses the considerations that need to be addressed for these applications and how to configure the meter.

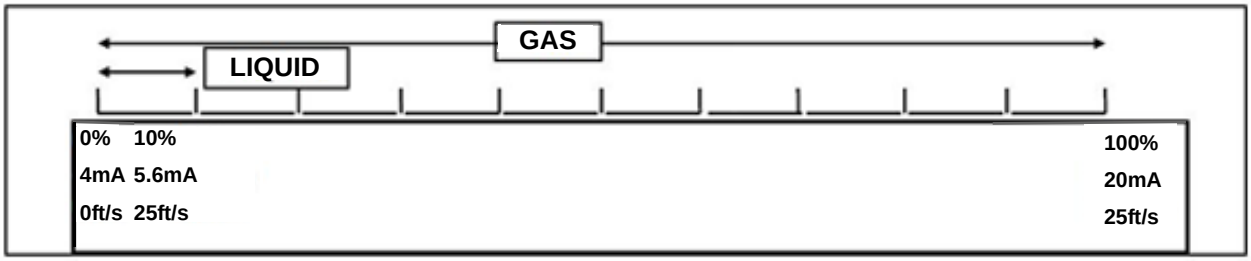
SIZING

The initial consideration is sizing. As in all vortex applications, the flowmeter size must be able to measure all of the various fluids over the desired flow ranges. Since the particular size of each meter has flow limitations, some compromises may be necessary. Each fluid application must be sized using the Instrument Toolkit™ program to determine the applicability for each fluid flow.

SIGNAL OUTPUT

Up to three outputs are available from the Rosemount 8800D Vortex transmitter to represent flow, 4-20 mA analog, pulse, and HART® (digital) communications. For multi-fluid measurement, where the fluids are all liquids or all gases, the outputs can be used just as in single-fluid measurement. When measuring liquid and gas with a single configuration, the appropriate output must be selected more carefully. The flow velocity for liquids is typically 1/10th the flow velocity of gases. As shown in Figure 1, the analog output span of the liquid flow measurement is limited when both fluid flows are represented by the same scale.

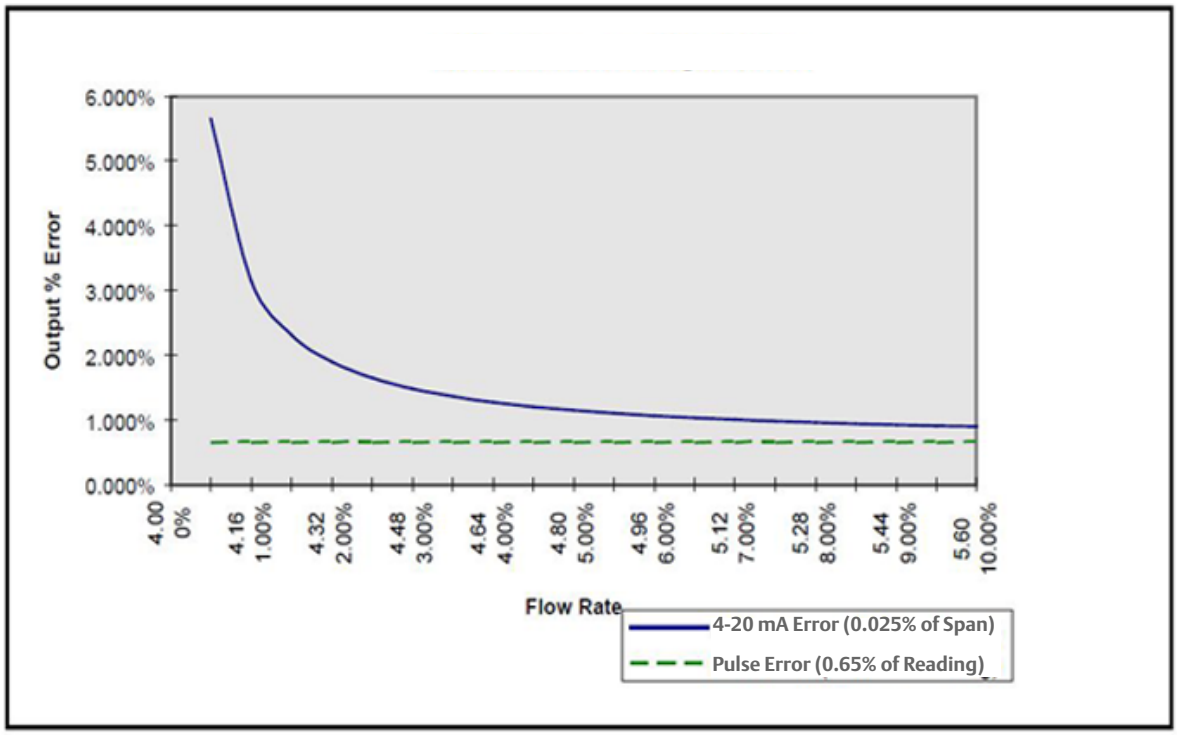
Figure 1. Analog Output Range for Multi-Fluid Flow Measurement



The 4-20 mA output span for liquid measurement is only 1.6 mA in the above example. Figure 2 below shows this 1.6 mA span for liquids and that the 4-20 mA error increases as it approaches zero flow. The best results when using the 4-20 mA output can be obtained by:

- Measuring high liquid flow rates
- Reducing 4-20 mA span (measure lower gas flow rates)
- Using 4-20 mA output for liquid measurement and pulse output for gas measurement

Figure 2. 4-20 mA Output Error and Digital Error for Liquid Flow Measurement



Pulse output provides an advantage over the 4-20 mA output in that the resolution of the pulse output remains constant over the flow range and therefore is more accurate over the entire span. The pulse output is the preferred method for measuring wide spans as in the liquid/gas multi-fluid measurement. The HART output is a digital value which is also unaffected by the span of the vortex meter. This digital output is limited only by the baud rate of the device.

CONFIGURATION

The last consideration is the meter configuration. The selected flow units need to be consistent over all of the fluids measured so a general flow unit needs to be chosen. The fluid type should be set for Gas/Steam and the Low Flow Cutoff (LFC) digital filter setting should be adjusted down to measure the minimum liquid flow. Lastly, the Trigger Level (TL) digital filter setting may need to be adjusted based on the expected range of gas densities.

In summary, the Rosemount 8800D Vortex flowmeter can successfully measure multi-fluid flow applications with the following considerations:

1. Proper sizing for all of the fluid flows
2. Output scaling and selection
3. Special configuration requirements:

    Flow units – Volumetric or Velocity (i.e. ACFM or ft/sec)

    Fluid type – Gas/Steam

    LFC – Lowered enough for liquid velocity

    Trigger Level – 4

It is recommended that each application be reviewed with your Emerson Process Management representative to ensure that the optimum configuration is chosen.

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