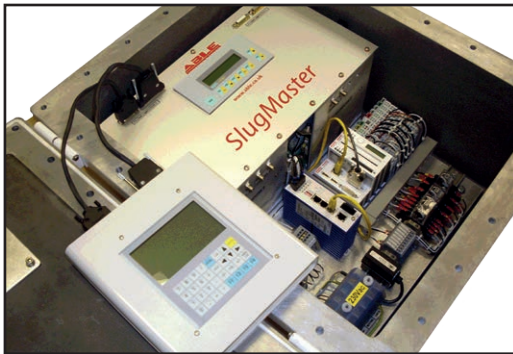


# SLUGMASTER DATASHEET

# SlugMaster®

## Dual Technology Ultrasonic Flow Metering System



The world's first intelligent dual ultrasonic flow metering system available in dedicated or portable versions

Independent primary and secondary ultrasonic transmission technologies are used to consistently measure flow

Patented wide beam DERF time of flight and Fast Fourier Transform technology – non intrusive, clamp-on design

Innovative voting logic intelligently selects the most suitable technology based on process conditions

### Application

When oil is pumped over a considerable distance, usually between the wellhead and installation, often large pockets of gas or congealed oil will build up at elevated points in the pipeline. As the velocity in the pipeline increases, the gas pockets and congealed oil is dislodged and flows towards the platform or processing unit.

At this point, a slug catcher is typically employed to vent off the gas and remove the congealed oil for processing. Accurate flow measurement of the oil from the outlet of the slug catcher is vital for allocation and billing purposes.

The difficult process conditions of slugging due to heavy fluctuating aeration, and slurry or solid particle entrainment are not ideal for most flow meters. Furthermore, the inherent coating in this process rules out any insertion type flow meters for this application.

### ABLE SlugMaster®

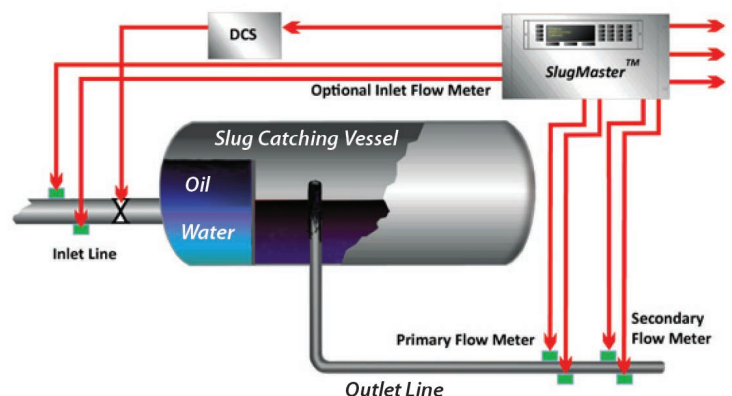
The **ABLE SlugMaster®** flow meter system is a dual technology ultrasonic flow metering system specifically developed to consistently measure liquid flow without interruptions caused by the changes in process parameters.

The **ABLE SlugMaster®** system deals effectively with the problematic process conditions by the use of dual ultrasonic technologies, available in dedicated or portable versions.

Time of flight, ultrasonic flow metering is used during low aeration periods with intelligent switching to Reflexor metering during heavy aeration and slugging, slurry or solid particle entrainment.

ABLE's time of flight ultrasonic flow meters have exceptional measurement accuracy, even with small levels of aeration. In the **ABLE SlugMaster®** system, this accuracy is used to calibrate a tandem Reflexor meter during the window when both meters are able to operate due to low aeration in the fluid. By calibrating the Reflexor to the time of flight at the point where time of flight is just failing to measure, the Reflexor becomes vastly more accurate than a standard Reflexor out of the box.

Ordinarily, the change over point between these two technologies would be difficult to achieve, yet with the **ABLE SlugMaster®**, an accurate and seamless changeover between the two metering technologies is achieved with unique mathematical software that enables accuracies that exceed the raw change over of both meters.



*Simplified Slug Detector Overview*

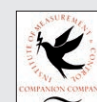
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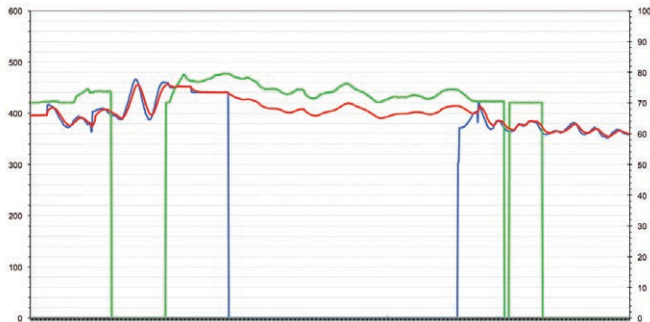
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# SlugMaster®

## Dual Technology Ultrasonic Flow Metering System



In the graph above, the blue line represents the time of flight flow meter as it experiences heavy aeration and begins to become unstable until the flow measurement is eventually lost. At this point the Reflexor flow, represented by the green line, begins pick up as it measures in heavy aeration. The **ABLE SlugMaster®** software cross calibrates the Reflexor to the time flight so that a calibrated Reflexor flow is developed and an accurate transition is achieved between both metering devices.

Finally, mathematical calculations are used to enable a smooth transition as shown in the red line which represents derived output from the **ABLE SlugMaster®**. The calibrated accuracy that is achieved with the Reflexor meter similar to that of the Time of Flight metering even during heavy aeration and particle entrainment so that considerable accuracy is achieved in the most difficult metering conditions.

This accuracy may not be instantly apparent due to the swelling the pipe during heavier aeration, as fluid transfer becomes erratic and staggered. When the **ABLE SlugMaster®** was tested against a Coriolis Mass flow meter at a point in the pipe where there is no aeration, the ultrasonic meter would see large variations in the flow during slugging as the liquid is pushed and pulled by the slugs and cavitations of gas.

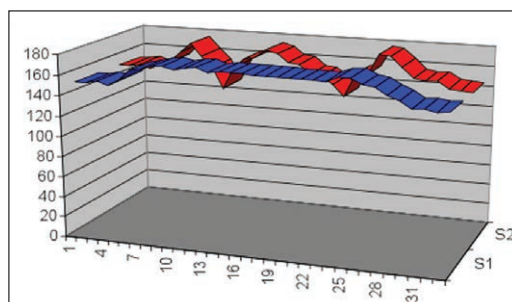


Figure 1

Figure 1 demonstrates this principle and explains this effect on ABLÉ's flow test rig in Aberdeen, where the actual fluid flow was measured against a Coriolis mass flow meter at the pump outlet after degassing with an overall totalization experiment conducted.

The blue line represents the flow as it was ramped up and back down again smoothly under the control of a pump. The red line shows the erratic fluid flow past the ultrasonic flow meter due to heavy gas entrainment and slugging. Upon restoring a steady flow with no aeration however, if accurate metering of the liquid has been achieved then the overall totalization from both systems will agree within a very small percentage.

During factory testing and customer demonstrations, accuracies of well within 3% were achieved under all test conditions and most tests were within 1% accuracy against the Coriolis Mass Flow metering device. With such accuracies this makes the **ABLE SlugMaster®** an extremely accurate solution to challenging metering applications where only clamp-on metering transducers are suitable and achieves exceptional accuracy compared to other metering technologies.

### ABLE SlugMaster® Technical Information

Typical performance based on 6" (DN150) schedule 40 steel pipe

Power Supply:	24Vdc, 100-120Vac, 200-250Vac versions
Enclosure Classification:	ATEX EExd IIA & IIB, IP66, Zones 1, 2, 21, 22
Transducer Cable Length:	up to 300 metres
Electronic Temperature Range:	-18°C to +60°C
Transducer Temperature Range:	Universal up to +121°C High precision T1 -40°C to +66°C High precision T2 +15°C to +121°C 991 universal up to +232°C
TOF Calibrated Accuracy:	Universal 1% to 2% High Precision 0.5% to 1% Ultra High Precision 0.2% to 0.5%
TOF Resolution:	-0.01 ft/sec (0.003 m/s)
TOF Repeatability:	High Precision 0.15% Universal 0.25%
Data Logging:	4Gb (approx 24 mths continuous standard)
Display:	40 Character Alpha Numeric
Main Output:	Volumetric Flow, any units / any time scale
Data Outputs:	Ethernet DHCP, RS232, 4-20mA, Alarm vfc Relays
Inputs:	Density, Pressure, Temperature

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