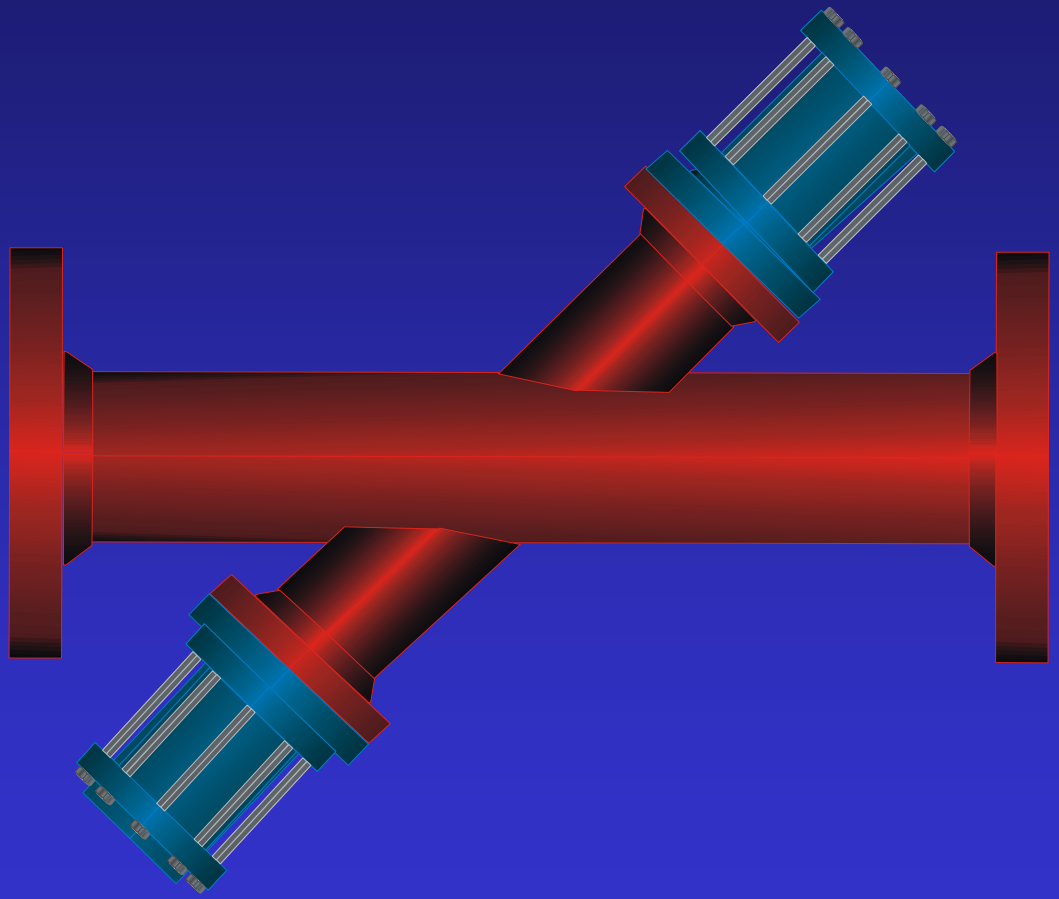
Ultrasonic High-Pressure Full-Bore Return Flow Meter



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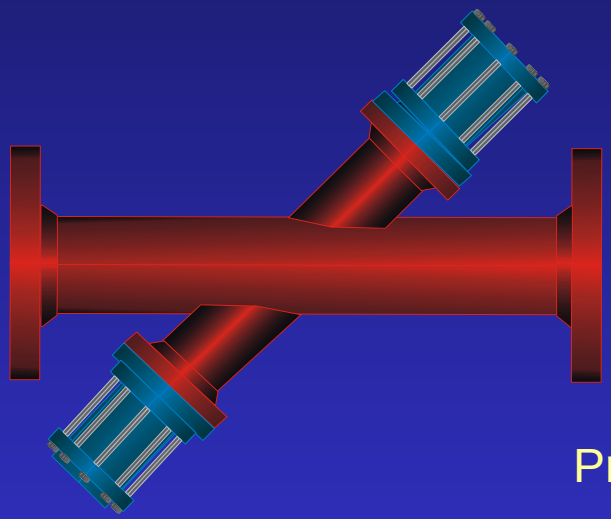
Mud Flow Meter-Principle & Properties

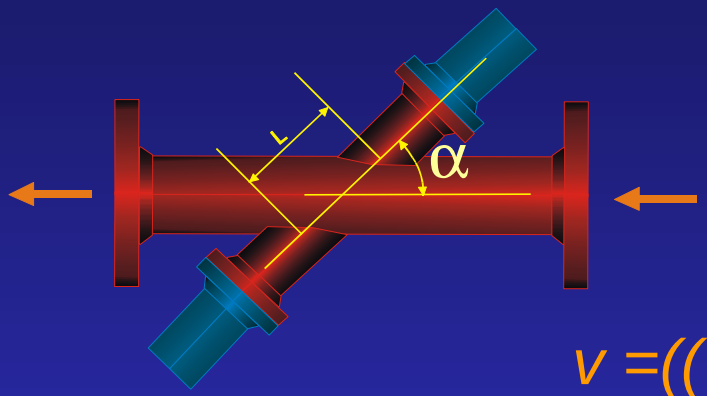


Principle: In IBJ Technology mud flowmeters the two ultrasonic transducers are placed at an angle in relation to the pipe axis. The transducers function as transmitters and receivers of the ultrasonic signals. Measurement is performed by determining the time the ultrasonic signal takes to travel with and against the flow.

Properties:
- For all drilling muds suited
- No limitation by cuttings and weight
- For all flange sizes and standards
- High Pressure class 2500 possible

Enhancements:
- Acoustic Attenuation Spectroscope
- Solids & Cutting Separator control

Mud Flow Meter-Measurement Basics



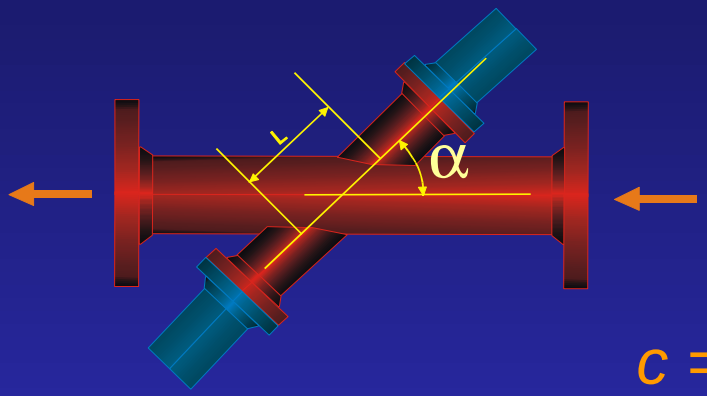
Velocity of drilling mud (Flow rate)

$$v = ((T2 - T1) / T1 * T2)) * (L / 2\cos\alpha)$$

Verily in this are:

- *V* – mean flow velocity of drilling mud
- *T1* – runtime of the ultrasonic signals with the flow direction
- *T2* – runtime of the ultrasonic signals against the direction of flow
- *L* – length of the ultrasound path
- *α* – angle of the ultrasonic signal to the direction of the flow

Mud Flow Meter-Measurement Basics



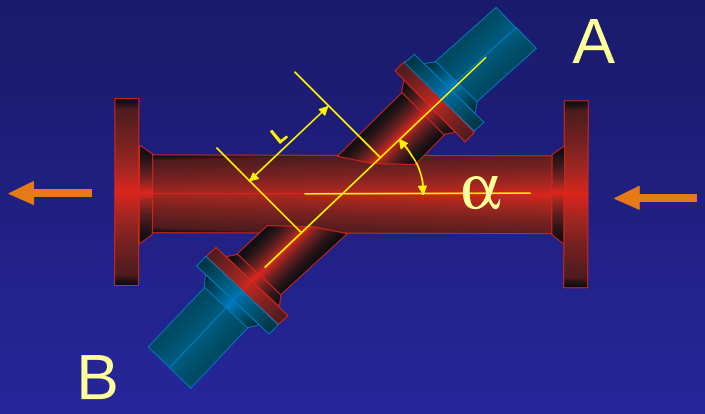
Enhancement
Sonic speed mud

$$c = L / \sin(2\alpha) * (T2 - T1) / T1 * T2$$

Verily in this are:

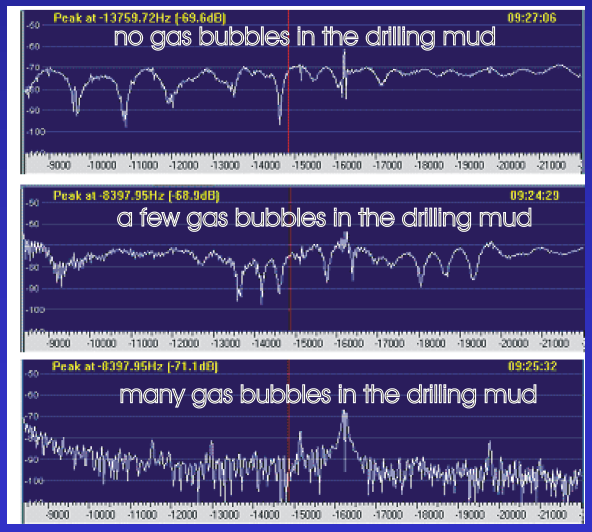
- *c* – mean speed of the ultra sound of drilling mud
- *T1* – runtime of the ultrasonic signals with the flow direction
- *T2* – runtime of the ultrasonic signals against the direction of flow
- *L* – length of the ultrasound path
- α – angle of the ultrasonic signal to the direction of the

Mud Flow Meter-Measurement Basics



Enhancement
time-and frequency-dependent
attenuation between A-B

Measurement: Content Gas bubbles
Cuttings



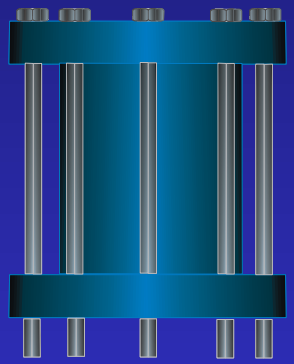
The signal is picked up on the receiver (sensor) and one with a sensitive amplifier for the Fourier Analysis (FFT spectral analysis software) processed. Figure shows exemplary three States a drilling mud.

Ultrasonic Mud Flow Meter Sizes

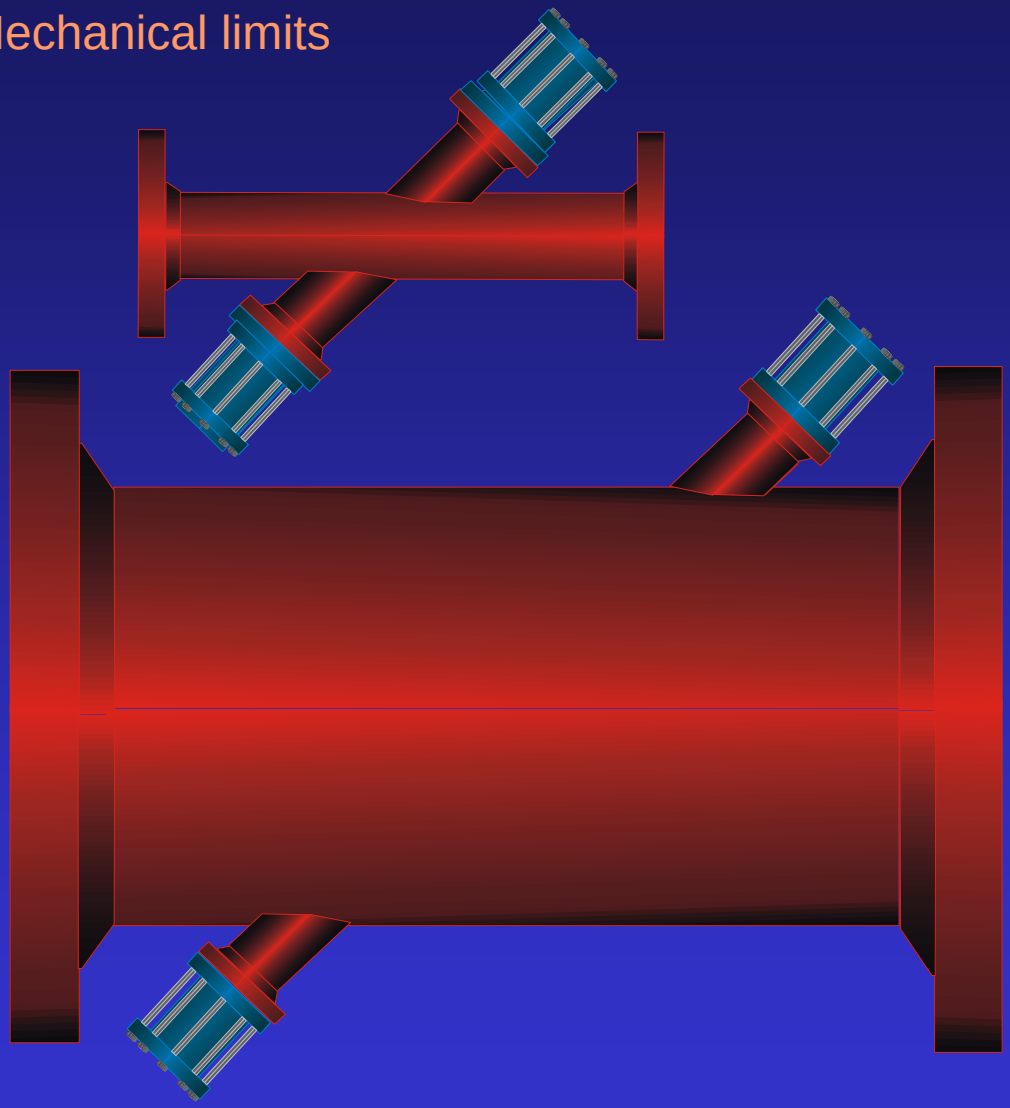
Mechanical limits

minimal flange sizes: 3 zoll

Standard : 4 1/16 zoll



Sensor basic modul for all
measurement pipes
flange sizes : 2 9/16 zoll



Maximum distance between sensor basic modules: 40 zoll

Ultrasonic Mud Flow Meter

Specifications I

Applicability: Any mud liquids mix including entrained gas and solids (cuttings)

Operating Temperature:	Sensor	- 40°C	+150°C
	Unit	- 40°C	+85°C

Operating Density: 0 – 25.5 PPG

Spool Sizes & Material: Avaliable in varios spool sizes and materials as required (stainless steel)

minimal 3 zoll flange sizes, maximal distance between basic sensor modules 40 zoll
unit housing aluminium

Ultrasonic Mud Flow Meter

Specifications II

Measurement & Ranges

	Units	Range
Sonic speed	m/s	300 – 10000
Resolution	m/s	0.02
Standard deviation	ps	>50

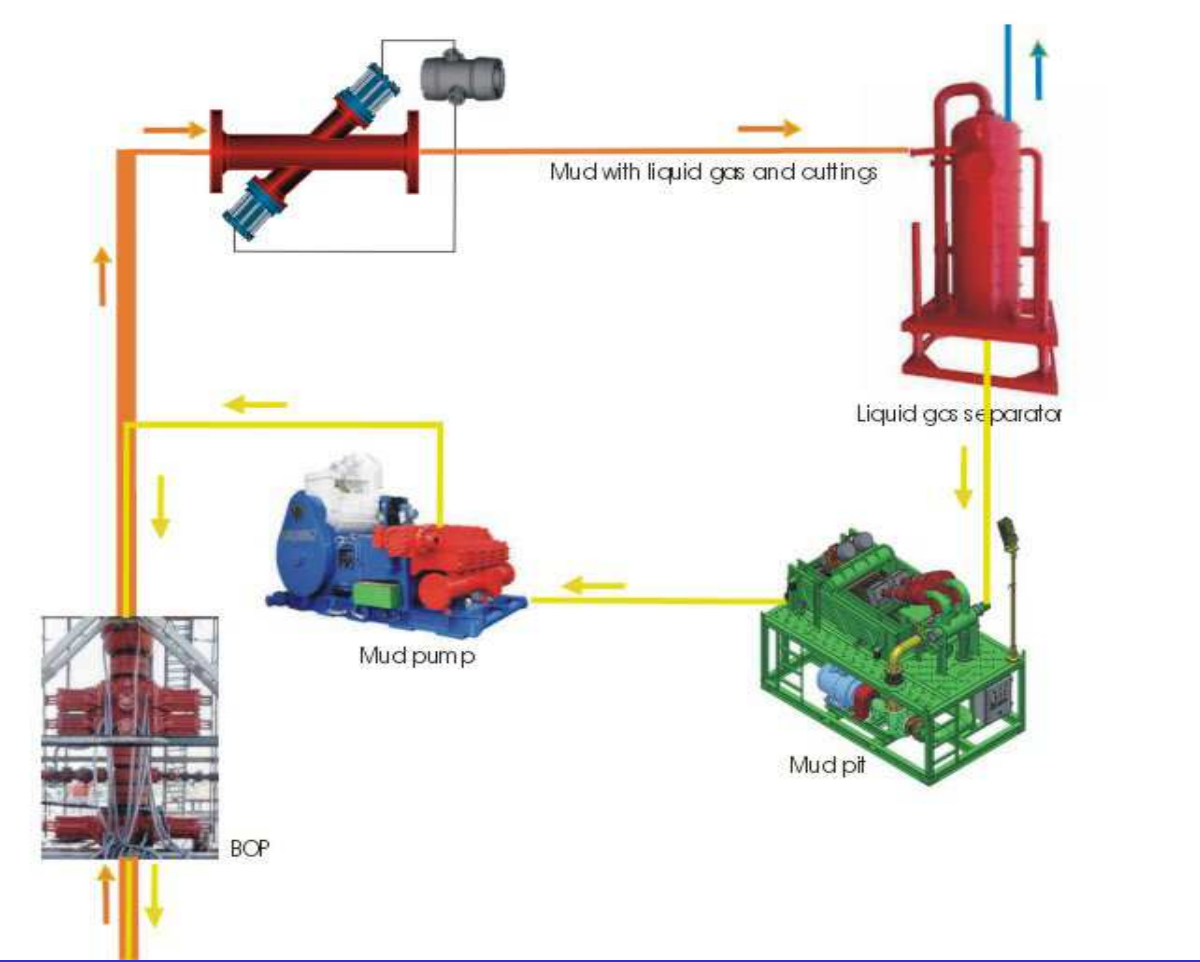
Mud Types	Oil based mud Water based mud Syntetic mud
Response Time	real time measurements (data updatet every 0.1 seonds)
Output Signals	RS485 Modbus Current & voltage loops Specific signals for AAS application

Ultrasonic Mud Flow Meter

Specifications III

Ingress Protection (IP) rating		
Transmitter	IP-67	
Sensor	IP-68	
Power requirements	18 to 35 V DC, 0.2 A	
Methods of protection	Flameproof (d) and encapsulation (m)	
Gas groups	IIB and IIA; US/Can Groups C	
Flammable substance	G, D	
Hazrdous area classification	ATEX: Zone 0, Zone 1	II2G Ex d IIC Gb
		II2D Ex t IIIC Db
	IECEx:	Ex d IIC Gb
		Ex t IIIC Db
	US: Class I, Division 1, Groups A, B, C	
	Class II, Division 1, Groups E, F, G	

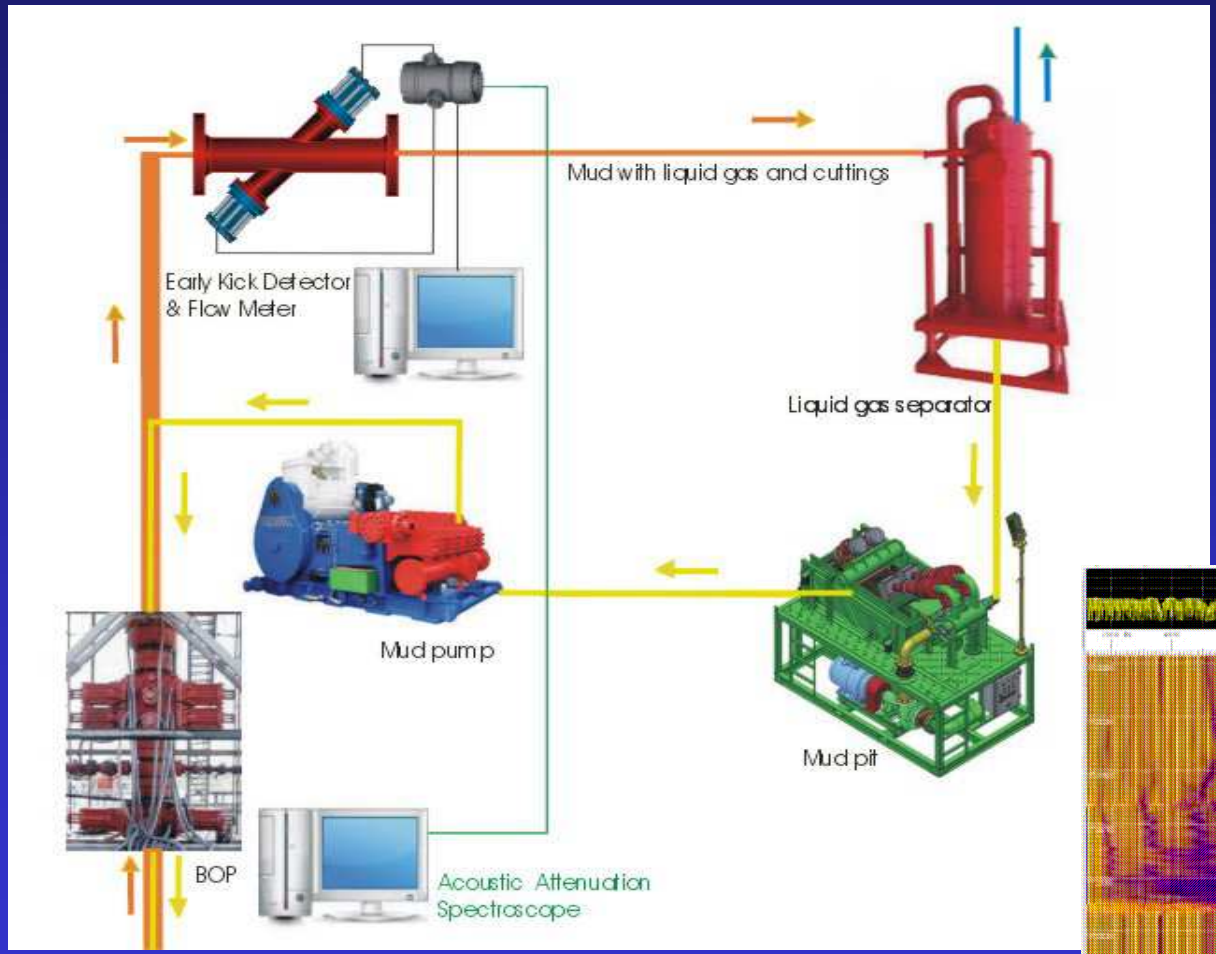
Mud Flow Meter – basic configuration



Basic configuration in the mud return line.

Mud Flow Meter in return line – basic & AAS

An option of the Flow Meter is the application of Acoustic Attenuation Spectroscopy (AAS).

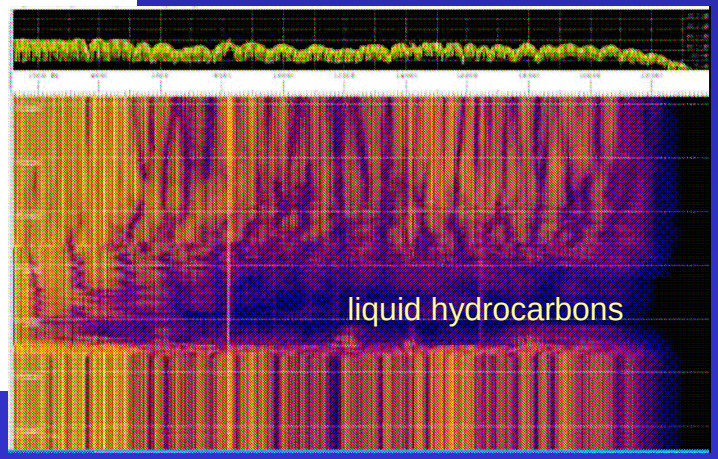


By disperse system of Mud can multiphase proportions of dissolved and gaseous hydrocarbons are immediately detected at very low concentrations. The resolution is unsurpassed.

Benefits:

-minimal Cost for Hardware Option

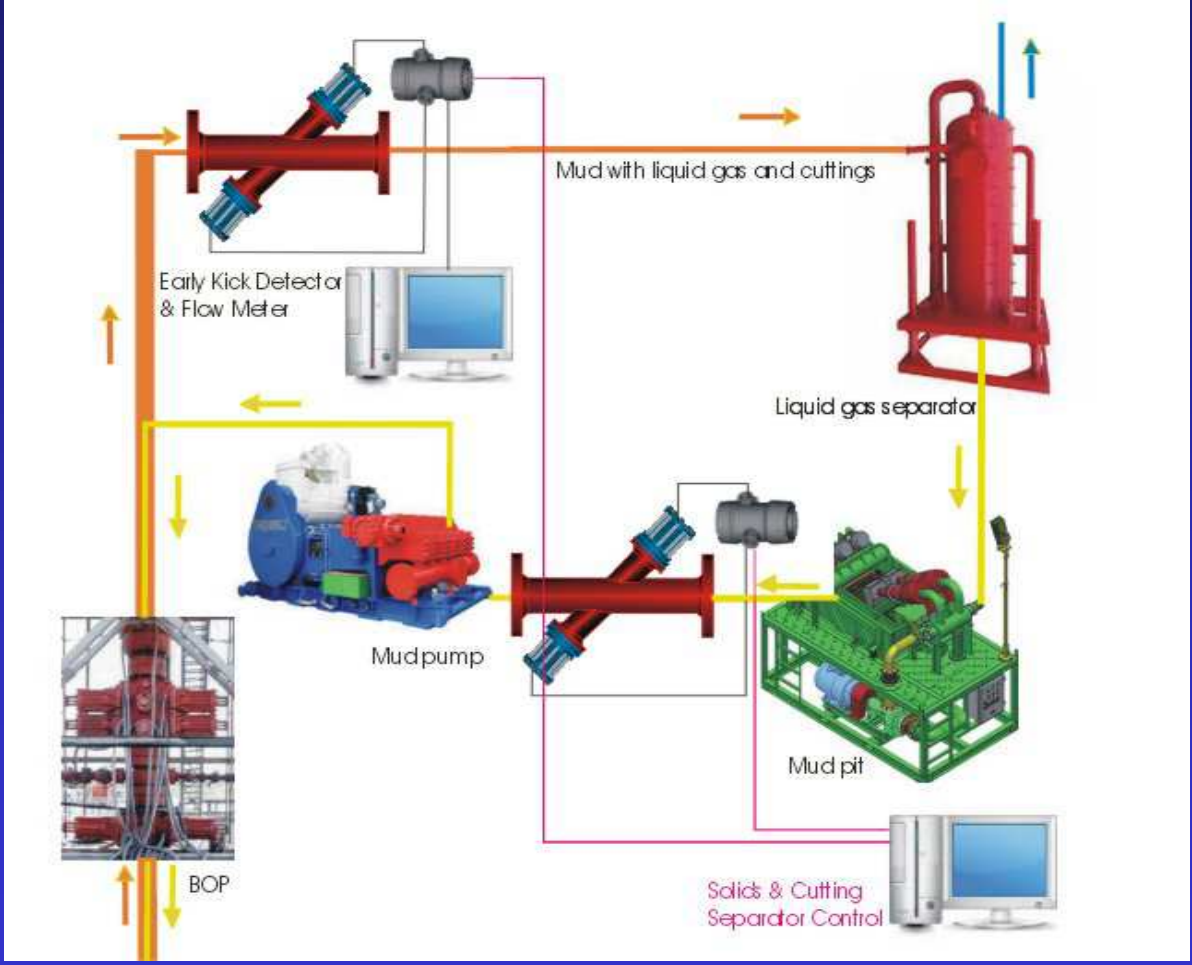
-GUI for PC and SCADA Systems



AAS real-time drilling mud sonic log

Mud Flow Meter – enhancement I

Solid and Cutting Separator Control Unit



Drilling fluid maintenance cost, clean up & dispositial cost as well as the over all cost of boring, can be reduced dramatucally when proper solids control techniques are utilized.

Several ultrasonic parameters are compared time range in a given in realtime. In case of differences that a defined predetermined range are larger can intervene in the process.

In large plants are several Detectors to be installed between the treatment stages.

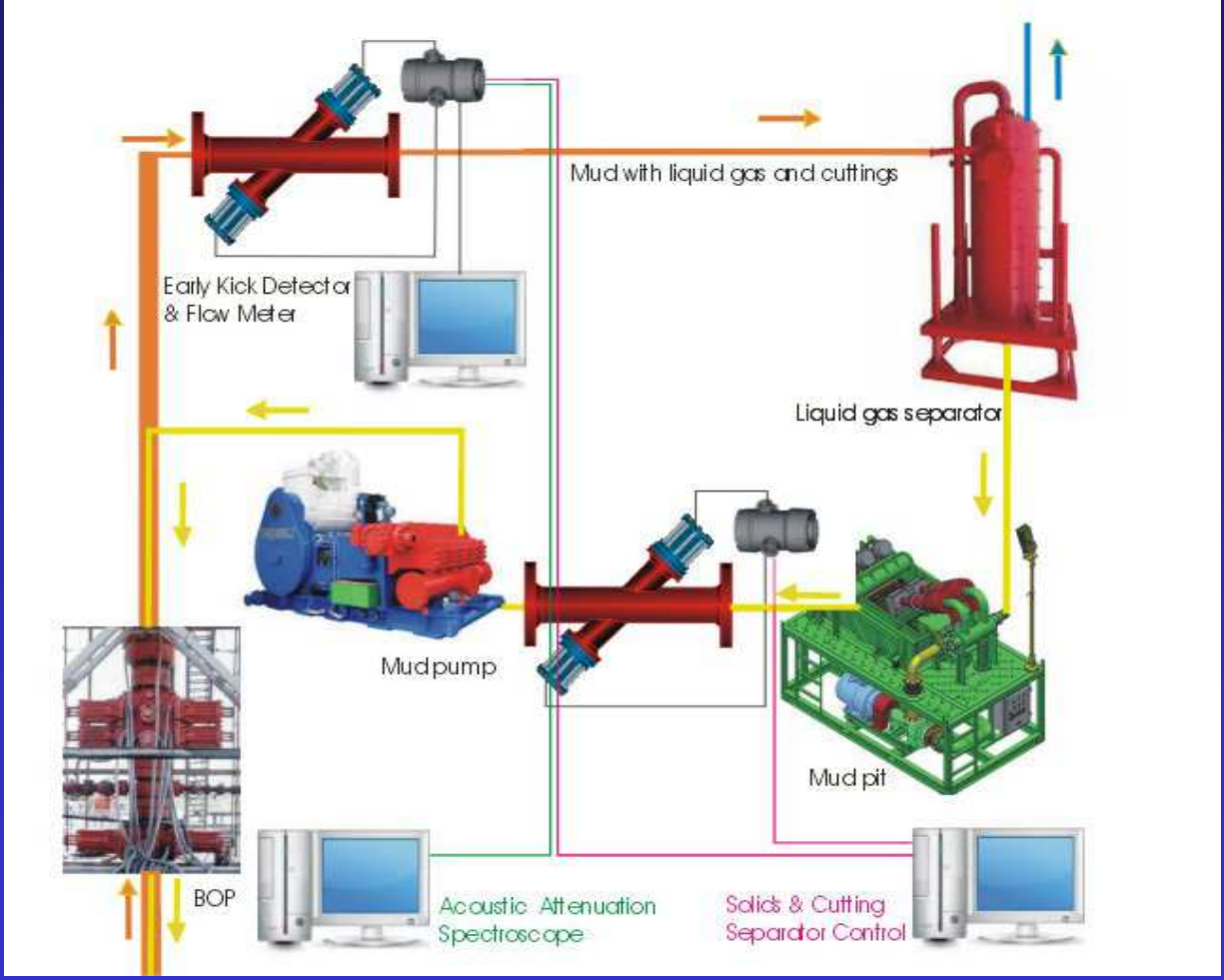
Benefit:

-low cost version for lower pressure levels

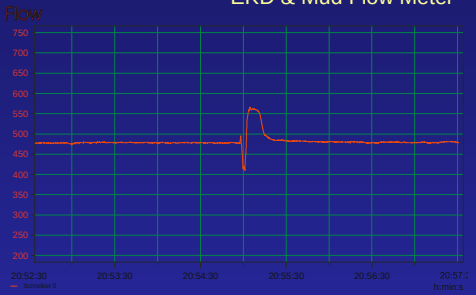
-same Detectors

Mud Flow Meter–enhancement I & AAS

Mud Flow Meter & Solid and Cutting Separator Control Unit & Acoustic Attenuation Spectroscope

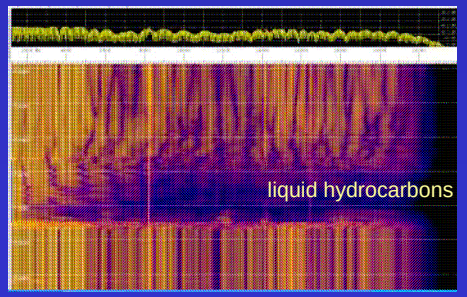


EKD & Mud Flow Meter



Solids &Cutting Separator Control Measurement

Acoustic Attenuation Spectroscope



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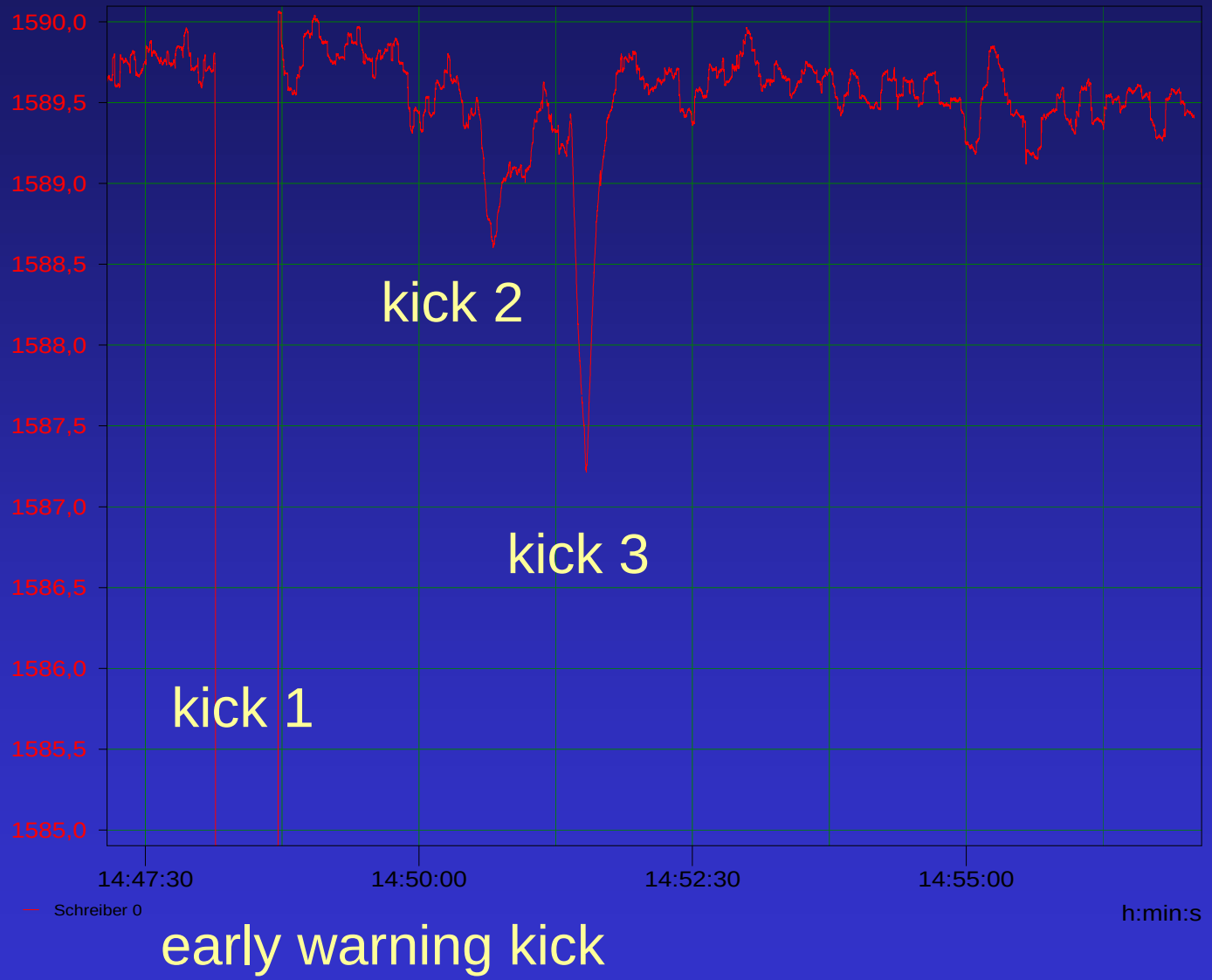
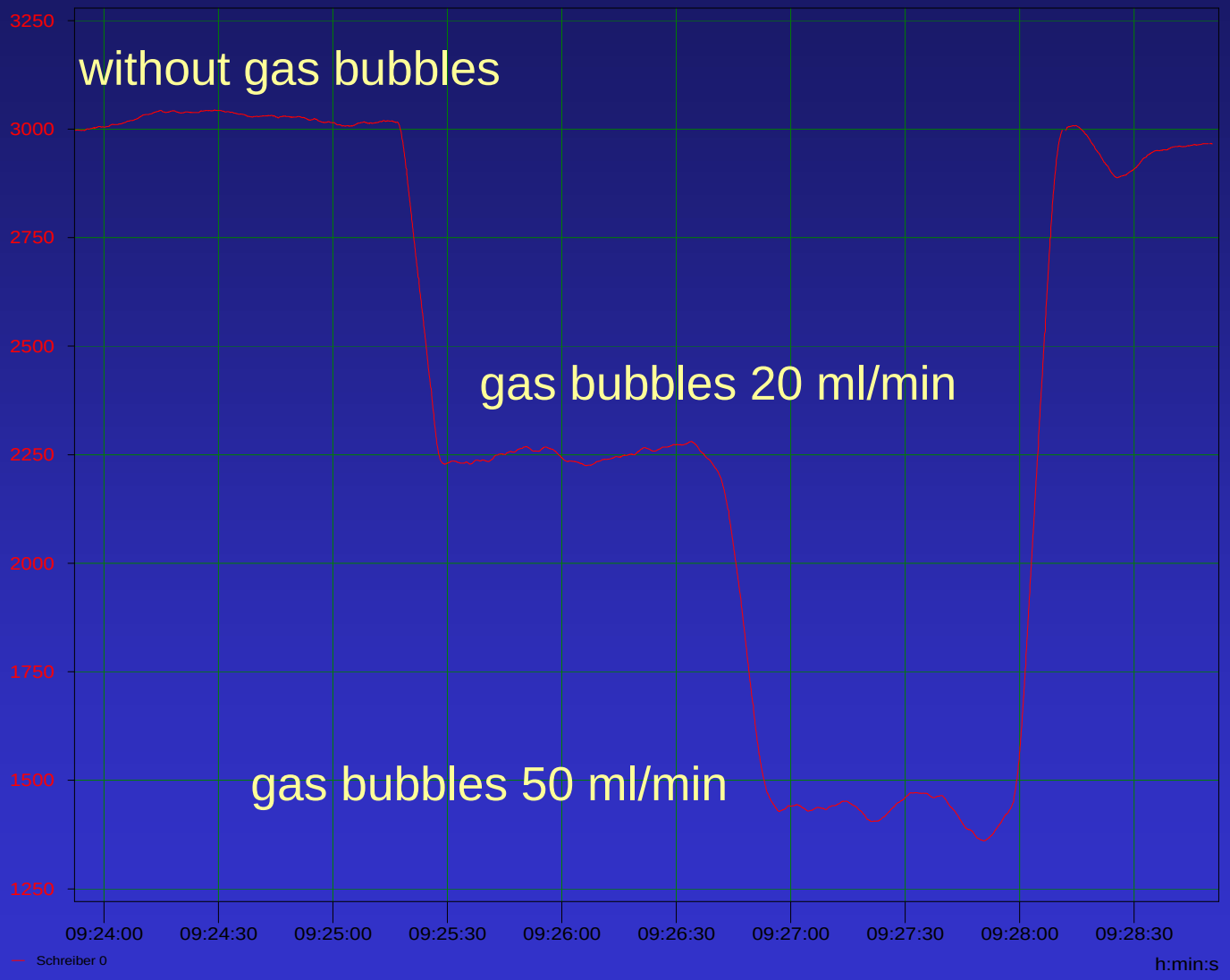
Ultrasonic Mud Flow Meter

Ultrasonic Mud Flow Meter – exemple measurement of sonic speed



early warning kick

Ultrasonic Mud Flow Meter – exemple measurement of attenuation



Ultrasonic Mud Flow Meter
for slurry with high solid content and high pressure

We manufacture slurry flow meter systems according to your applications.

Your inquiries about specific products for the measurement of EKD, Mud Solid Control, Flow or Solids Content in crude oil they should be directed to:

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