SERIES MFM (Ludino)

MUD FLOW METER
(PATENTED)

LUDINO FLOW IN

LUDINO FLOW OUT

DYNAMIC DENSITY COLUMN

DESCRIPTION

Accurate measures of drilling fluid flow through the well is essential for drillers to monitor and control the wellbore. Advanced control to ensure safe drilling condition requires the measurement of the drilling fluid flow rates entering and coming out the well. Evaluation of the balance of flow in / flow out is a key parameter to ensure the proper drilling behavior. To have comparable measurement of fluid flow is fundamental to have measuring devices based on the same measurement principle, with a consequent better value of differential flow and highest comparison capability.

Valcom® and 3FASE srl developed the Ludino flow meter MFM to provide reliable and accurate measurements at the inlet as well as at the outlet of the wellbore.

The measurement of the flow is obtained by the measurement of pressure drop through a Venturi tube and the measurement of absolute pressure and temperature of the flowing medium as well as of the flowing fluid density. Different configurations of the system layout are possible to satisfy existing piping schemes.

The measurement system allows to manage under increased safety the mud flow at wellheads in order to reveal flow rates of mud, mixture of liquids, solids and gas. The system can operate in real-time measurement with flow of drilling fluid at different density (1.00-2.00 SG), different content of gas (up to 30%) and solids (up to 5%). It is not affected even when high density mud (2.00 SG) is left inside the bypass without circulation for more than 24 hrs; at the resume of circulation the readings are stable and accurate immediately.

The measurement system requires an initial calibration to provide reliable and accurate reading.

THE HEART OF MEASUREMENT SYSTEM

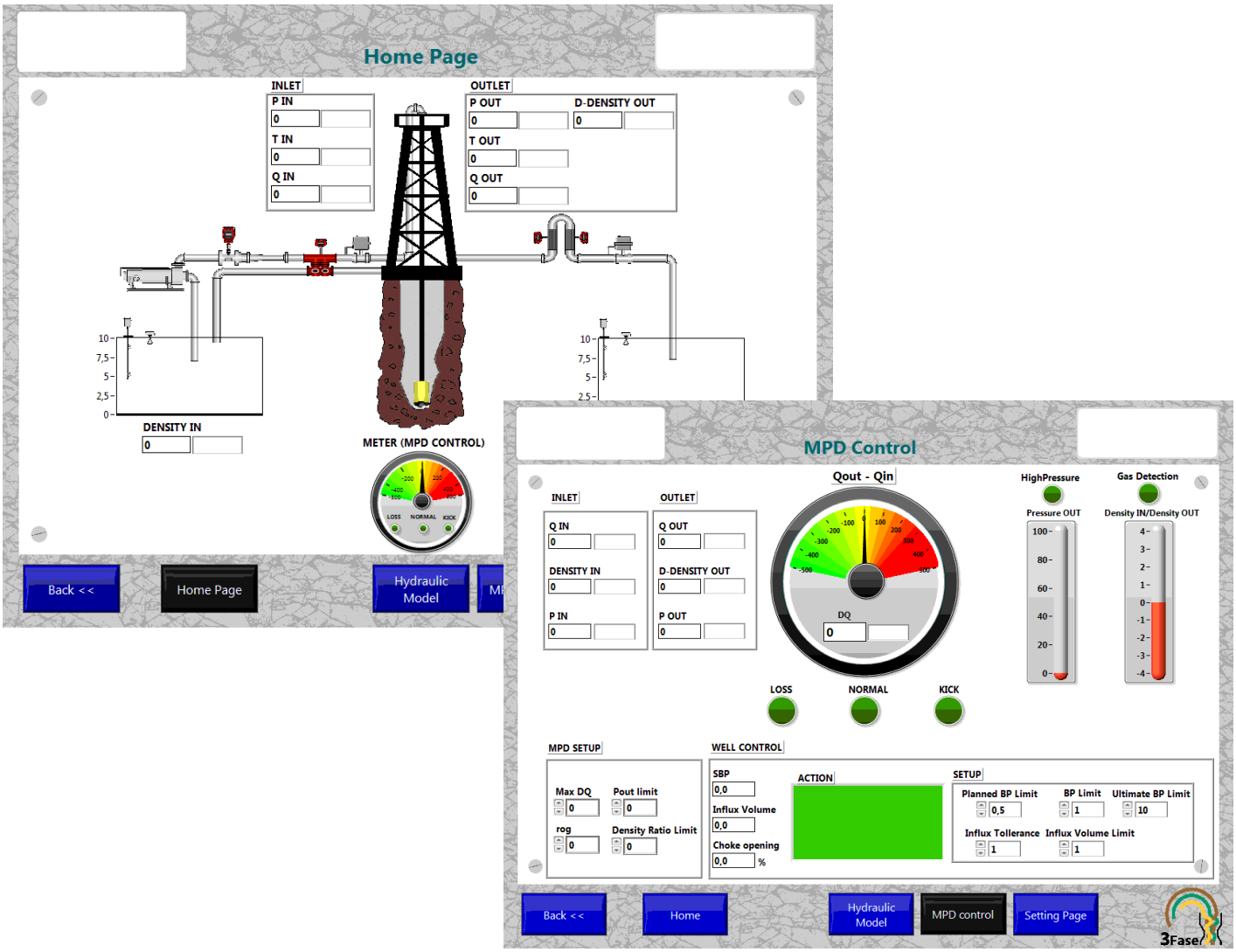
The MFM Ludino has an extended rangeability up to 6-7 times in order to cover a wide range of flowrates. The 5" unit gives a reliable measurement from 300 to 3500 l/min.

The unit is extra compact: up to ten sensors within a length of 650 mm. The sensors have been specially developed and patented for this application and sensor-to-fluid connections protect sensor diaphragms (against abrasions or possible built up) and increase reliability and long term accuracy. The special sensor design, utilizing traditional well proven technology, allows easy and reduced maintenance need and fast sensor installation.

For inlet flow meter, the unit is rated for high pressure and can be installed on the stand pipe pressure line, extending the monitoring of Flow in even with Oil Base Mud (OBM), overcoming a limitation of Coriolis and magnetic flowmeter application respectively.

The meters have reduced pressure losses (less than 0.3 bar) compared to the equivalent diameter of Coriolis sensor; the mechanical construction reduce drastically possible mud spill upstream.

SCREEN SHOT OF CONTROL PANEL



INSTALLATION OF LUDINO MFM

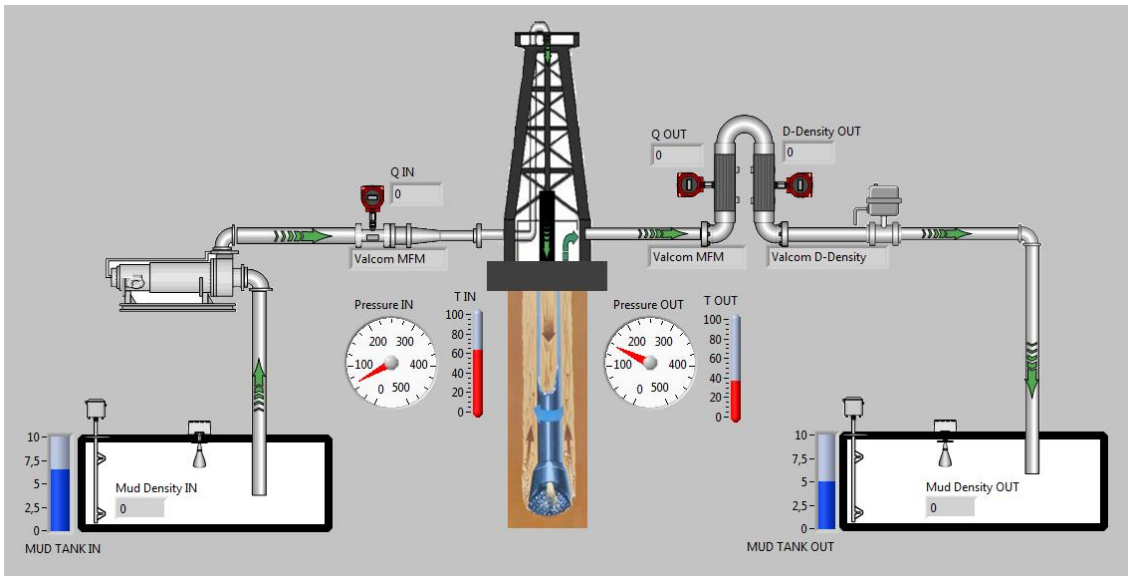
The system installation is different following the inlet and outlet section of the circulation plant.
For Flow IN application the *Ludino* can be installed on the stand pipe or at its base either in horizontal or vertical position or if required in an inclined position. The system requires the measure of the density at the mud tank fitted with a T7S.
Considering Flow OUT applications different configurations are possible. In all cases the system is fitted with the DDM (Dynamic Density Meter) to ensure a simultaneous measurement of flowrate and density. U shaped configurations are possible and reduce the required space. It is possible to install it with a less intrusive, compact and lighter tailored bypass, compared conventional Coriolis meter; in addition, the bypass will not require flushing / dumping lines and pumps associated, as usually installed in a Coriolis bypass.

Sizing based on Vmin = 0,5 m/s and Vmax = 5 m/s

SIZE	DIAMETER (mm)	THROAT DIAMETER (mm)	Qmin (l/min)	Qmax (l/min)
4" XS	97,2	58,3	200	2000
4" XXS	80,1	48,0	150	1500
5" XS	122,3	73,4	350	3500
5" XXS	103,2	61,9	250	2500
6" XS	146,3	87,8	500	5000
6" XXS	124,4	74,6	360	3600
8" XS	193,7	116,2	900	9000
8" XXS	174,6	104,8	700	7000
10" XS	247,7	148,6	1400	15000
12" XS	298,5	179,1	2000	21000

The maximum velocity is due to limit the effects of erosion on piping and Venturi meter. Instead, the minimum velocity is required to ensure the flush of the piping and avoid any problem due to settling and clogging of pipes. The expected accuracy in these ranges of velocity is within +/- 2%.

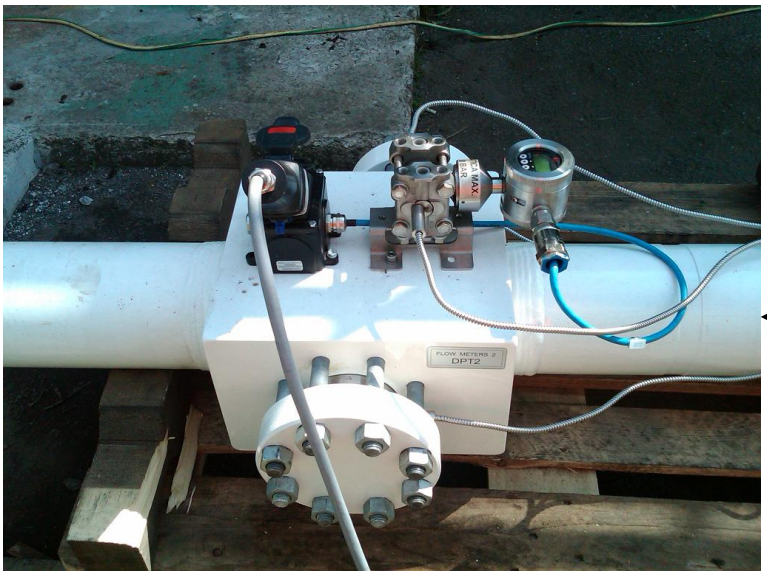
SCREEN SHOT OF INSTALLATION



LUDINO INSTALLED IN FLOW-IN

Any direction from horizontal to vertical position.

Installation in Vertical position



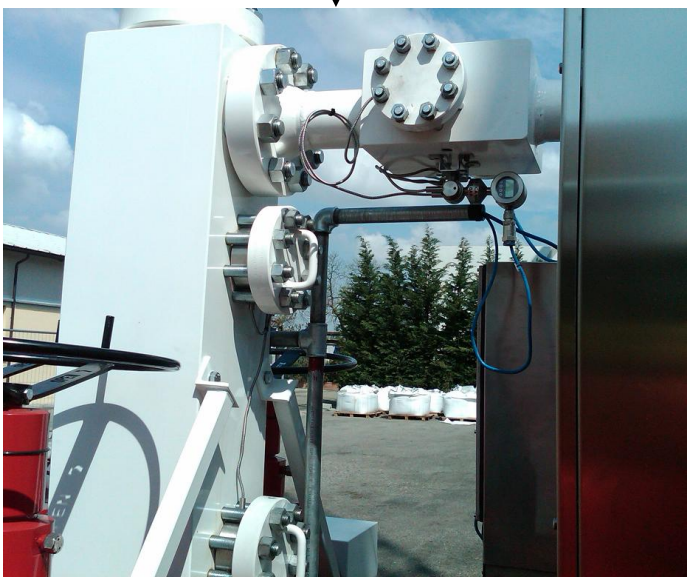
Installation in Horizontal position

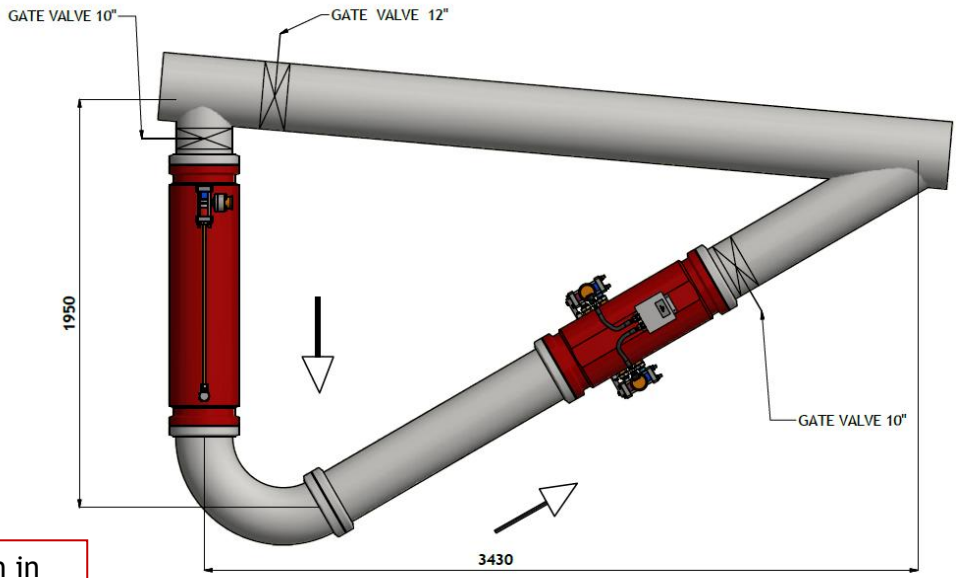
LUDINO INSTALLED IN FLOW-OUT

The MFM flow meter is fitted with the DDM (Dynamic Density Meter) and can be installed on flow line in different configurations.

Installation in Vertical position

Installation in Horizontal position





Installation in inclined position

AMBIENT CONDITIONS

- ✓ Temperature:
  Process fluid (Std): -40 ÷ +80°C (Std), up to 283°C (On request)
  Transmitters: -40 ÷ +80°C
  Handling and storage: -40 ÷ +90°C
- ✓ Relative Humidity: from 0 to 100% R.H.

MFM PERFORMANCES

- ✓ Flow rate: < ±2%
- ✓ Density: < ±5%

TRANSMITTERS PHYSICAL SPECIFICATIONS

- ✓ Housing: SS AISI316 IP67, Dust and sand tight, protected against sea wave effects as defined by IEC IP67. Suitable for tropical climate operation as defined by DIN 50015.
- ✓ Covers O-ring: EPDM.
- ✓ Filling fluid: silicon oil.
- ✓ Nameplate: stainless steel, fixed on housing.

WETTED PARTS (TRANSMITTERS)

- ✓ AISI 316L Nace MR0175 compliance.
- ✓ Inconel.
- ✓ Tantalum and others on request.

OPTIONS

- ✓ Wetted parts: AISI 4130, Duplex, Hard insert, etc..

TRANSMITTERS PHYSICAL CHARACTERISTICS

- ✓ Power supply: 12.5 – 30 Vdc
- ✓ Output signal: Analog 4-20mA, 2 wires / Digital HART® / MODBUS RS485
- ✓ Electrical connections: intrinsically safe plug connectors

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EUROPEAN LEGISLATION APPROVALS

T7S$_{IN/OUT}$	Smart specific gravity transmitter		Ex	PED	SIL
KRG$_{IN/OUT}$	Smart radar level transmitter		Ex		
MFM$_{IN}$	Venturi Inlet Mud Flow Meter		Ex	PED	SIL
MFM$_{OUT}$	Venturi Outlet Mud Flow Meter				
DDM	Dynamic Density Meter				
FLOW COMPUTER	-		Ex		

Compliant with **Directive 2004/108/EC (EMC)**.

ORDERING CODE

MFM Mud Flow Meter

01 Configuration Type	
A	MFM_{IN} + Flow Computer
B	MFM_{OUT} + DDM + Flow Computer

02 Pipe Nominal diameter	
1	4”
2	5”
3	6”
9	Others

03 Pipe Rating	
A	ANSI 300
B	ANSI 600
C	ANSI 900
D	API 3000
E	API 5000
F	API 10000
Z	Special

04 Body Material	
A	AISI 4130
B	Duplex
Z	Other

05 Housing material (sensors)	
1	SS AISI 316

06 Explosion protection (sensors)	
0	Ex ia Intrinsic Safety
1	Ex d Explosion Proof