

Dualstream II *advanced* Subsea

Background

Wet gas measurement is now an integral part of most gas condensate field developments. Dualstream wet gas flow meters have been utilized in over 100 projects since the early 1990's and have been a key factor in enabling marginal field development providing wet gas allocation measurements and enhancing reservoir data.

Dualstream II *advanced* (Subsea)

Solartron ISA's Dualstream II *advanced* meter is the latest version of the original Dualstream II concept. This meter now incorporates our original 2nd DP device together with pressure loss ratio measurement to extend the overall measurement range. Wet gas flow rates from dry gas up to 20% liquid fraction, (i.e. 80% GVF) can now be measured. Dualstream II *advanced* produces individual flow rate data for gas, condensate and water flow rates in real time thus alleviating the requirement for well testing. For this reason Dualstream II *advanced* is particularly applicable to subsea flow rate measurement in reservoir management and allocation applications on unmanned wellhead platforms and as an economic method of water breakthrough detection.

Experience

Dualstream II meters are now operational in the Gulf of Mexico, North Sea, South America and China. During 2006 units will be commissioned in the Middle East and Russia. Subsea versions are installed in shallow water in the North Sea and deepwater (10,000 ft) in the GoM.

Key Benefits

- Intelligent on-line measurement
- Wide operational range
- Simple and robust flow spool
- Tried and tested instrumentation
- Simple Data Acquisition System
- Digital communications enabling reduced size and weight of subsea meters
- Large installed base including allocation systems

Our 2nd generation Dualstream II *advanced* wet gas meters now offer:

- improved performance on gas and liquid rate uncertainties
- water breakthrough detection
- Integral Equations of State

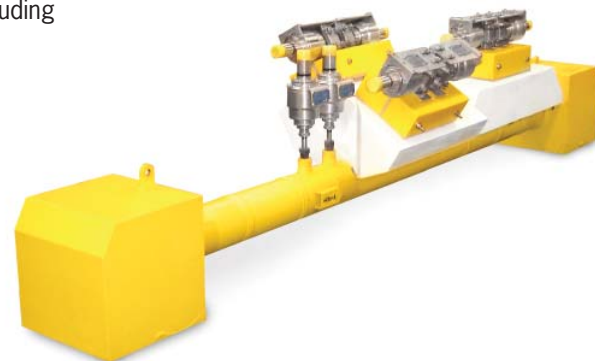
Applications

Reservoir management

- Optimise production
- Water breakthrough detection
- Remote well monitoring

Production allocation

- Royalty allocation
- Essential for economic development of marginal fields



Dualstream II advanced Subsea

Measurement Technique

- Dualstream Venturi, Pressure loss ratio measurement, Dual DP measurement, wet gas correction algorithm and PVT calculation

Mechanical Specification

- Standard Line Sizes 2" NB to 14" NB (larger sizes on request)
- Pressure Class API 5K/10K API (15K & ANSI ratings on request)
- Process Temperature Range -20 to 120°C (-4 to 248°F) (higher ranges on request)
- Meter Body Material Duplex UNS S31803 as standard
- Weight dependant on NB/Pressure rating
- Overall length 26D (typical)

Installation Requirements

- Upstream Straight lengths – None
- Downstream Straight lengths – None
- Horizontal Orientation

Performance

- Uncertainty
 - Gas Mass Flow Rate 2% (typical)
 - Liquid $\pm 10-20\%$
 - Condensate PVT calculation
 - Water $\pm 1 \text{ am}^3/\text{h}$ water or oil continuous flow
- Repeatability
 - Gas Mass Flow Rate $<0.15\%$
 - Liquid Mass Flow Rate $<1.5\%$
 - Water Sensitivity $\pm 0.2 \text{ am}^3/\text{h}$ (water or oil continuous flow)
- GVF Range 80 – 100%
- Turndown 3:1 or 8:1 (typical)
- Pressure Loss Specific to application ($<1\text{bar}$)
- Salinity effects negligible

Instrumentation

Redundancy

	Std	Dual	Triple
DP Transmitters	3 off	6 off	9 off
GP Transmitter	1 off	2 off	3 off
TT Transmitter	1 off	2 off	3 off

- Analogue Option 4-20 mA
- Digital Options
 - 1) MODBUS RS232C/RS485 Point to Point or Multidrop
 - 2) Foundation Fieldbus or Hart

Insulation

- Optional

Data Acquisition (Subsea)

- Available on special request

Data Acquisition (Topside – Safe Area)

- Option A – Solartron 7955 Flow Computer – Power Supply 20-30 VDC, 40W
- Option B – Industrial PC – Power Supply 90-260 VAC, 50-60 HZ or 24 VAC
- Input Protocol 4-20 mA, Hart or MODBUS
- Output Protocol 4-20 mA or MODBUS
- Electrical Interface RS232C/RS485
- PVT Package – Optional
- Typical Output Data –
 - Gas Mass Flow Rate
 - Liquid Mass Flow Rate
 - Condensate Mass Flow Rate
 - Water Mass Flow Rate
 - Gross & Nett Volume
 - Line Pressure

User Required Inputs

- Hydrocarbon composition



Solartron ISA

Hackworth Industrial Park, Shildon,
County Durham, UK, DL4 1LH
Tel: +44 (0) 1388 773065
Fax: +44 (0) 1388 774888
Email: sales.solartronisa@ametec.co.uk

Houston Sales & Service

3727 Greenbriar, Suite 106-B
Stafford, TX 77477 U.S.A.
Tel: (281) 240-9054
Fax: (281) 240-3583



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