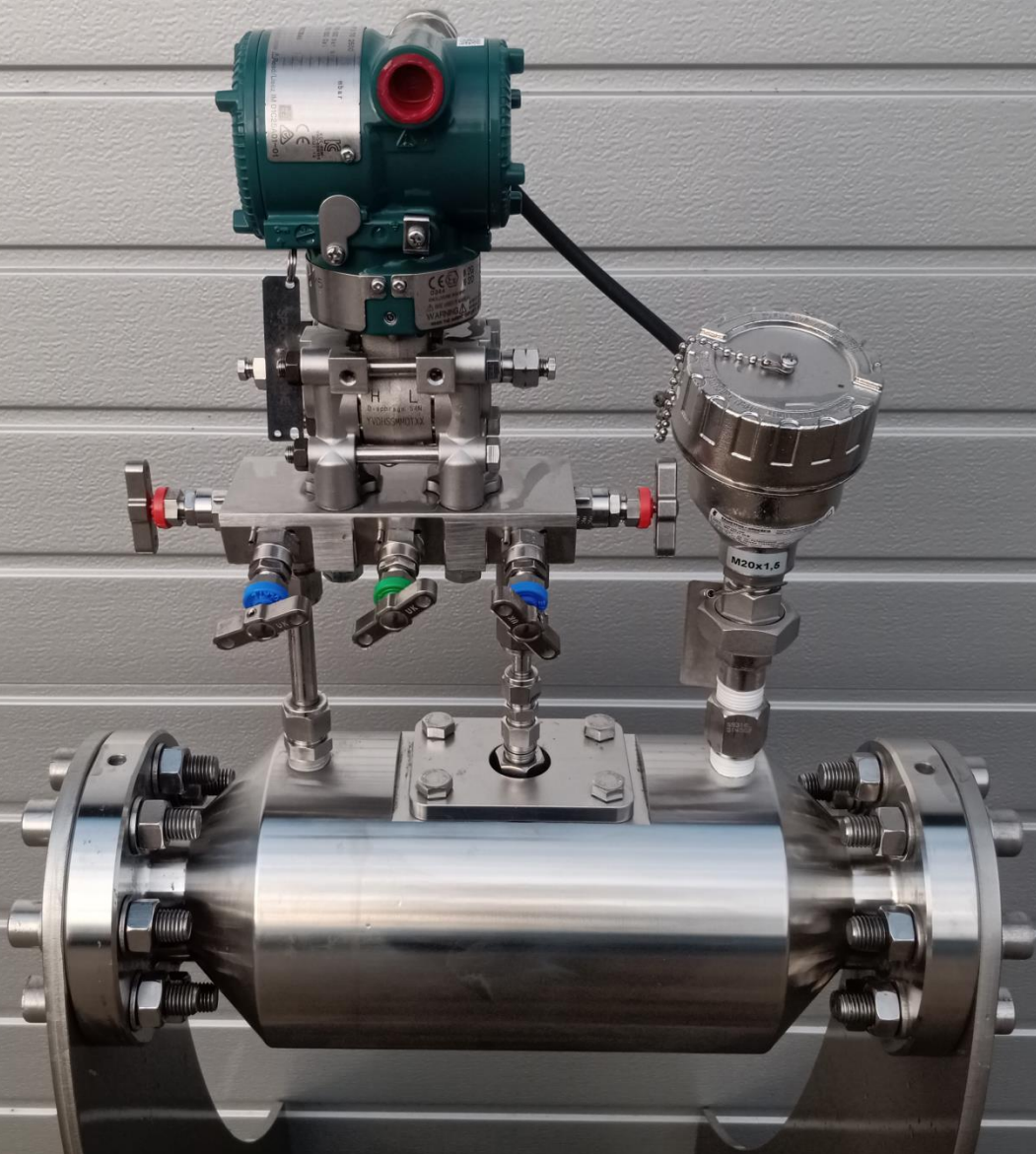


Multiphase Flow Meters for the Oil & Gas Industry

**Petroleum Software Ltd**



*esmerDual MPFM™*

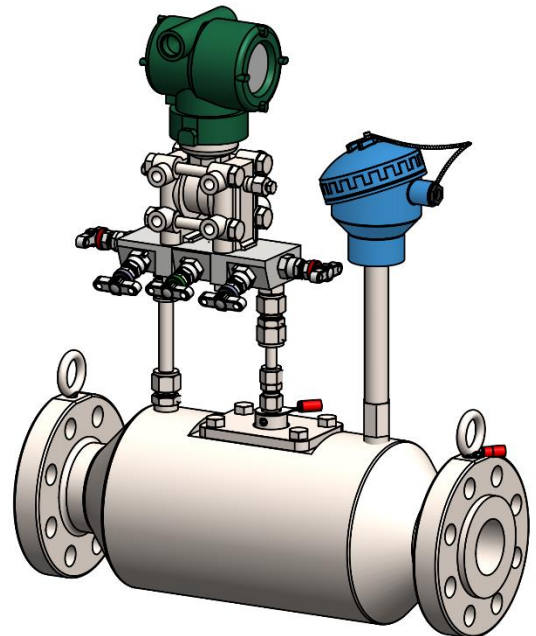


## Technology Overview

esmerDual™ is an innovative low cost multiphase flow meter for measuring the flow rates of all phases in oil and wet gas production lines across the full GVF and water cut range without the need for separation or complex sensor technologies.

esmerDual™ uses a cone as its flow and impedance probe element. Industry standard multivariable transmitters are used for flow rate measurement. Our proprietary esmerMux™ impedance transmitter is used for water cut measurement.

esmerDual™ is controlled from the esmerDigital™ application software which runs on industry standard Windows PCs. esmerDigital™ interfaces to esmerDual™ via RS485 and MODBUS protocol. The software is founded on a combination of fluid dynamic and thermodynamic models and signal processing technologies.



The low cost and digital implementation of the system renders an MPFM per well connected to the company network in the realm of reality.

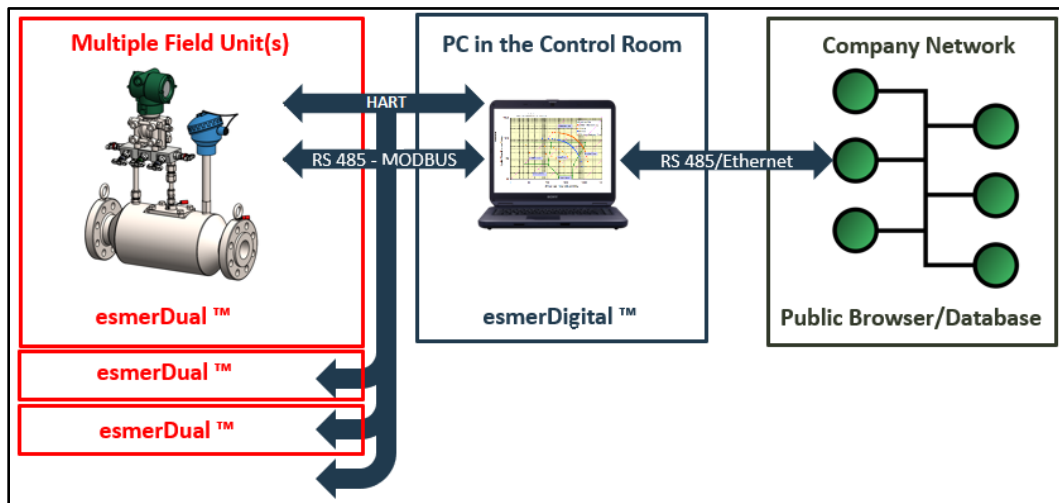
## Electro-Mechanical System

esmerDual™'s primary element is the cone fitted with a multivariable transmitter (Yokogawa MVT). The cone is easily retrievable for maintenance and replacement (eg for changing the beta ratio). esmerDual can be dropped into the process line horizontally or vertically (no skidding is required). For wiring, a 24V cable and an RS485 digital cable is required between the field unit(s) and the PC in the control room. I/O tasks, including network connection for output, are implemented on the RS485-Ethernet- Modbus platform.

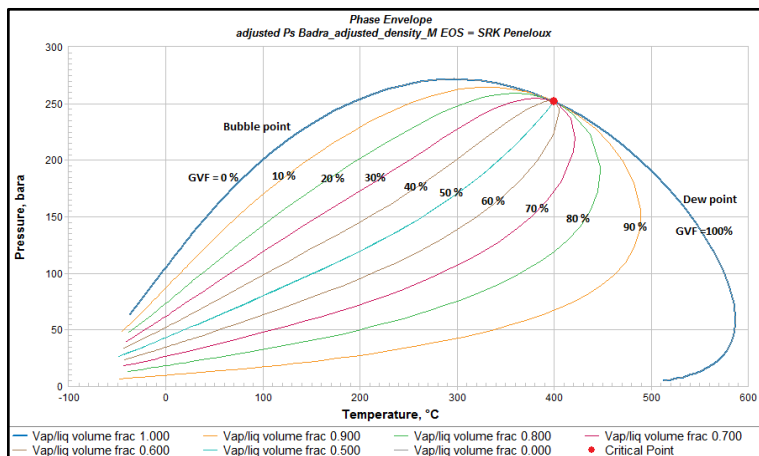
Typical dimensions and weights (ANSI 600)				
Size	L (cm)	H (cm)	W (cm)	WEIGHT (kg)
2"	55	110	70	90
4"	70	110	75	100
6"	85	110	80	120

2 Year spare parts: Multivariable (P, DP, T) transmitter, esmerMux™ impedance transmitter, RTD, power supply and fuses provided as standard.

## esmerDigital™ Connectivity



## esmerDigital™ – How Does It Work?

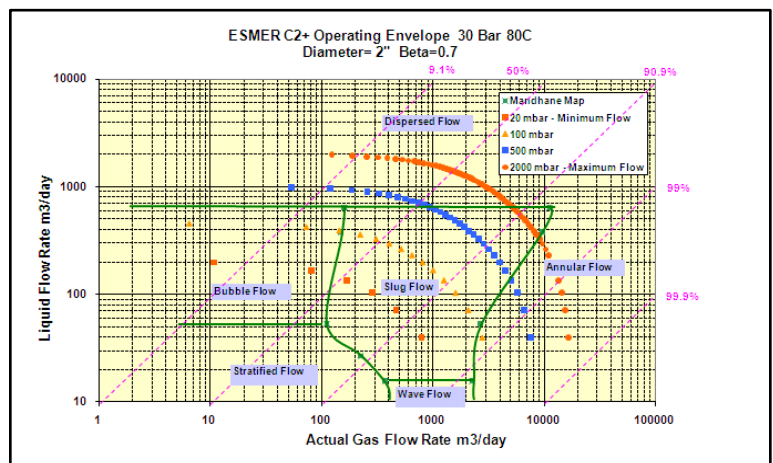


Processing and I/O tasks are carried out on the Windows PC by esmerDigital™ application software. Fluid dynamic and thermodynamic (equation of state – EOS) mathematical models are executed in real time to measure and transmit the flow rates of phases.

Initial model for the coefficient of discharge ( $C_d$ ) of the cone is based on multiphase flow loop tests. Initial model for EOS is based on PVT data provided by the user.  $C_d$  and EOS models are “tuned up” in-field to match the process

conditions by means of the esmerConfigurator™ application software. We make use of separator and/or esmerDual by-pass sample for tuning up the factory calibration.

The procedure and the tools provided for field calibration are in compliance with API 2566 guidelines. Petroleum Software Ltd. has a long track record of testing and applying the tune up methods in the field.



## Range & Uncertainty

### **esmerDual™ Operating Envelope**

Flow Range: Sized to suit given process conditions.

Water Cut: 0 – 100%

GVF: 0 – 100%

Pressure: up to 150 bar

Temperature: up to 140°C

Materials and rating: To suit given requirements.

### **esmerDual™ Measurement Accuracy**

esmerDual™ calibration will be tuned up to field conditions. Accuracy will depend on PVT data quality and process conditions. A specific accuracy target will be provided for each application.