

**bms**

Group of companies

**BOPP & REUTHER  
MESSTECHNIK**



FLOW, DENSITY AND CONCENTRATION MEASUREMENT TECHNOLOGIES

**LIQUID. STEAM. GAS.**

EXCELLENCE IN ACCURACY AND REPEATABILITY  
'MADE IN GERMANY SINCE 1872'

# PHILOSOPHY AND HISTORY



We offer competent solutions for a large number of measurement applications in many different industrial sectors. Our expert know-how covers a broad spectrum in the area of flow measurement, density measurement, including the commissioning, securing and conformity assessment of the measurement system, according to the Measuring Instruments Directive 2014/32/EU (old version 2004/22/EC) (MID, former national initial calibration).

Nowadays tasks are getting increasingly complex and their solution goes far beyond the function of individual components. The ongoing automation and increasing integration of application processes leads to a complexity, which is successfully solved by the Bopp & Reuther Messtechnik Group:

## OUR PHILOSOPHY

We want to offer our customers the best solution for their specific application.

We offer high quality products, made in Germany. These products help our customers to reduce their costs of production and to save energy. Their high reliability contributes to sustainability by reducing waste and securing investments for decades.

Our vision is based on long term perspectives. Our employees secure the success.

## OUR EXPERIENCE IS THE RESULT OF A LONG HISTORY OF MORE THAN 145 YEARS

We understand and propose the smart combination of traditional proven technologies and innovative technologies.

In **1872** Carl Reuther and Carl Bopp established a special factory for manufacture of pumps and heavy-duty valves. This was the beginning of our company.

In **1900** Bopp & Reuther supplies 60 % of the world's demand of water gate valves.

**1932** the oval wheel meter principle was developed by Bopp & Reuther and protected under patent in this year. The first Weights and Measure approval was issued by the PTR in Berlin in 1933.

**1972** Flow metering, batch and control technology – Bopp & Reuther directed its production range towards the increasing demand for automation.

**1995** Introduction of the new Series of Density Meter DIMF 2.0.

**2002** Bopp & Reuther Messtechnik GmbH moved to Speyer where it is based until today.

**2005** Acquisition of the company METRA Energie-Messtechnik GmbH (formerly Danfoss IWK Controls Limited) and expanding the product range.

**2012** Introduction of the Density Meter DIMF compact.

**2014** Introduction of the Flow Computer series UR06, URS06 and URS09.

**2016** Introduction of the Coriolis Dosing Mass Flow Meter FMD and Coriolis Mass Flow Meter FMO.

**2017** Introduction of the Oval Wheel Series Flowal Plus and OP.



# INDUSTRIES & OFFICES

## INDUSTRIES

Wherever liquid, steam and gaseous fluids need to be reliably measured and analyzed our company's products are used.

Whether the job involves problems of process engineering in the chemical or petrochemical industry, questions of mechanical engineering or equipment manufacture, or highly specific requirements in a food or beverage process – our comprehensive range of top-quality measuring instruments enables us to offer you the right solution for each and every application.

The tasks in industrial flow measuring technology are characterized by increasing complexity. At the same time, there is a growing trend to providing custom-tailored, comprehensive concepts.



This requires a measuring instrument manufacturer to have an exact knowledge of the application targets and operating conditions involved.

Our products and services are based on well-founded competence in application technology which we have acquired in cooperation with users from an extremely wide range of industries, such as

- 🔥 OIL AND GAS
- 🔥 CHEMISTRY AND PHARMACEUTICAL
- 🔥 MECHANICAL AND PLANT ENGINEERING
- 🔥 FOOD AND BEVERAGE
- 🔥 ENERGY AND POWER PLANTS
- 🔥 SHIPBUILDING

For these applications we provide a range of measuring instruments which includes not only volumetric meters and turbine meters, coriolis meter but also vortex meters, orifice meters, density / concentration meters, and metering systems for gas and liquids.

In conjunction with the available evaluation and metering electronics we are able to offer state-of-the-art measuring system technology for virtually any application. This particularly applies to the expansion and modernization of existing systems.



# CERTIFICATES

The quality is our top priority. Therefore our product spectrum and its adequation to the various industry targets is proven by a full set of certifications:



- ISO 9001:2008  
Quality management



- ATEX, IEC EX (TÜV)  
Certificate for the whole  
company



- Pressure Equipment  
Directive PED (TÜV)



- Measuring Instrument  
Directive (Europe):  
Module B & D acc.  
2014/32/EU (PTB, old  
version: MID 2004/22/EC)



- Organisation Internationale  
Métrologie Légale:  
OIML R117



- Evaluation Certificate:  
NMI, LNE

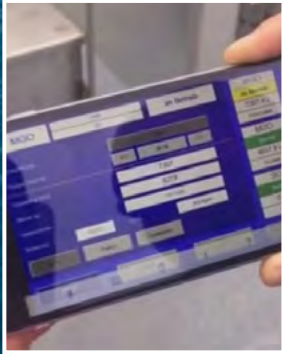


# EXAMPLES OF SOLUTIONS

## METERING ON A BUNKER SHIP

**Volumetric metering systems acc. MID requirements including volume measurement for**

- 1 x Diesel und 1 x Gas oil, 3000 l/min
- 1 x Lubrication oil, 300 l/min
- 2 x density meters DIMF 1.3
- 2 x Flow Computer UR06
- 1 x PLC to control pumps, valves and alarm signals
- 1 x touchscreen 10" for visualization and operation incl. data transfer to smart phone



Replication of visualization on Smart phone or Tablet



Flow Computer cabinet



Metering system for diesel measurement



# EXAMPLES OF SOLUTIONS

## DOSING METER OK-TRONIC

- Oval wheel meter with high accuracy
- also available with Massflow Meter
- Flow computer DC155
- 2 step shut down
- for high viscosity (up to 10000 mPa-s)
- measuring of non-conductive liquids
- no need of in- or outlet section
- Menu driven configuration
- also available for Ex-zone



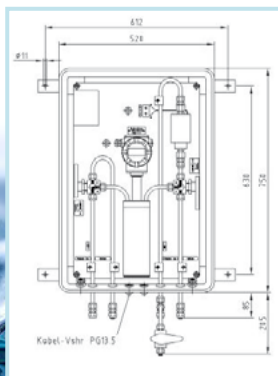
## MOBILE DOSING SYSTEM FOR LUBRICATING OIL

- high accuracy up to  $\pm 0.1$  %
- repeatability better than  $\pm 0.02$  %
- viscosity of 1.5 % up to 1000 mPa-s
- with Type Examination Certificate, acc. to MID
- intuitive operation
- Containers from 5 liter
- easy installation with reduced set-up times



## DENSITY CABINETS FOR THE QUALITY CONTROL OF LIGHT PETROLEUM PRODUCTS

- high accuracy up to  $\pm 0.1 \text{ kg/m}^3$
- design for custody transfer available incl. Evaluation Certificate acc. to MID
- Exi or Exd designs available
- easy installation
- options: heating, pump, colorimeter, sampling system ...



# AFTER SALES SERVICE

## SERVICE FEATURES

**We have been a competent partner in flow measurement technology for decades. With our comprehensive services we offer our customers for all current flowmeters (displacement meters, magnetic-inductive flow meters, mass flow meters, ultrasonic flow meter, turbine meter, etc.) an individual service package:**

- Pickup and return of measuring instruments/fittings
- Cleaning of the chemically contaminated equipment according to VCI Guidelines (Association of the Chemical Industry)
- Decision support between repair and use of new ones equipment
- Repair of all above-mentioned flowmeters
- Calibration on Test bench traceable to national and international standards for flow rates up to max. 20,000 l/min (5,283.4 gal/h)
- Certified test certificates according to ISO 9001: 2008 and MID Module D
- Onsite services f. e. supervision at commissioning and start-up
- Onsite repair services
- Periodical calibration according to ISO 9001
- Customer-specific "MID" consulting on site according to the European Measuring Instruments Directive 2014/32/EU (old version: 2004/22/EC)
- Long-term spare parts supply

The decontamination of measuring instruments and fittings in accordance with the VCI guidelines is carried out in our examination room. For this purpose our company is approved for the repair of contaminated measuring instruments by one of the largest chemical companies in the world.



# TESTING AND CALIBRATION RIGS

We perform tests and calibrations of flowmeters in a range of 3 l/min up to 1,200 m<sup>3</sup>/h (0,79 gal/min up to 317006,5 gal/h) on our certified test benches which are the follows:

## TEST BENCH "WATER TEST BENCH"

For calibration of oval wheel and turbine meters, vortex meter and vortex meter run, orifices, nozzles, venturi tubes, complete differential pressure meter runs up to DN150

- test medium: water
- provers: 100, 500 and 3,000 l (26.42 gal, 132.1 gal and 792.5 gal)
- flow rate max.: 450 m<sup>3</sup>/h (118877 gal/h)
- measurement uncertainty:  $\pm 0.03$  % of current value
- max. 5 bar

## TEST BENCH "MASTER METER"

For calibrations of oval wheel meters

- test medium: hydrocarbon, approx. 2.8 mPa-s
- nominal size: DN15 – DN250
- flow rate: 30 up to 1,200 l/min ("Master Meter 1") (7.93 gal/min up to 317 gal /min)
- flow rate: 3 l/min up to 100 l/min ("Master Meter 2") (0.79 gal/min up to 26.42 gal/min)
- measurement uncertainty:  $\pm 0.06\%$  of current value
- flow rate: 3 l/min up to 600 l/min ("Master Meter 3") (0.79 gal/min up to 158.5 gal/min)
- measurement uncertainty:  $\pm 0.03\%$  of current value

## TEST BENCH "BIDIRECTIONAL PROVER LOOP"

For calibration of oval wheel and turbine meters, vortex meters and vortex meter run, mass flow meters, orifices, nozzles, venturi tubes, complete differential pressure meter runs up to DN400

- test medium: hydrocarbon, ca. 2.8 mPa-s
- nominal size: DN80 – DN400
- flow rate: 12 m<sup>3</sup>/h up to 1,200 m<sup>3</sup>/h (3170.06 gal/h up to 317006.5 gal/h)
- measurement uncertainty:  $\pm 0.06\%$  of current value

## TEST BENCH "PISTON PROVER"

For calibration of oval wheel and turbine meter

- test medium: water
- nominal size: DN15 – DN50
- flow rate: max. 72 m<sup>3</sup>/h (19020.4 gal/h)
- measurement uncertainty:  $\pm 0.06$  % of current value

## NATIONAL ACCREDITED TEST BENCH KRP/2

Test bench for calibration and recalibration of heat meters, vortex meters, ultrasonic meters, orifices, venturi tubes and nozzles

- test medium: water
- test temperature: 55°C (131F)
- nominal size: DN15 – DN150 (up to overall length 500 mm)
- flow rate: max. 420 m<sup>3</sup>/h (110952 gal/h)



# PRODUCT LINES OVERVIEW

## PRODUCT SELECTION GUIDE

FLOW TECHNOLOGY	PRODUCT LINES	PAGE	
POSITIVE DISPLACEMENT, TYPE OVAL WHEEL METERS	OAP	20	
	OP	21	
	OI	22	
	FLOWAL®	23	
	OD	24	
CORIOLIS	FMO	36	
	FMD	37	
TURBINE	RQ	28	
VORTEX	VTX	30	
DIFFERENTIAL PRESSURE	ORIFLOW	32	
ELECTRO-MAGNETIC	MID MDS	38	
DENSITY/ CONCENTRATION TECHNOLOGIES			
TUNING FORK	DIMF 1.X	34	
VIBRATING TUBE	DIMF 2.X	34	
	DIMF COMPACT	34	

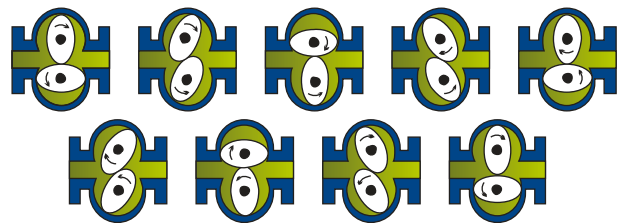


# OVAL WHEEL METER

The oval wheel meter was invented by Bopp & Reuther and protected as a patent in 1932. The first Weights and Measure approval was granted in 1933 by the PTR in Berlin.

## Measurement Principle

Oval wheel meters are direct volumetric meters for liquids. Their measuring element consists of two toothed precision oval wheels, rolling on each other driven by the fluid pressure. Such a defined amount of liquid is transported through the meter for each rotation of the oval wheels.



Therefore the number of revolutions is an accurate measure for the amount of liquid flowing through the meter.

## Application

Volume measurement of liquids and liquefied gases in loading applications for chemical and petrochemical industry, petroleum industry and of food and beverages:

- in the oil industry for the measurement of crude oil or refined products or for the measurement of LPG
- in dosing and loading applications for the measurement of defined amounts of various fuels and additives
- in the petrochemical industry for measuring of products such as ethylene or propylene liquid
- in the chemical industry for measuring of various acids or alkalis
- in mechanical engineering for measurement of process liquids or lubricants
- in shipbuilding for measuring of fuel consumption as well as lubricating oil

## Characteristics

- high measurement accuracy:

### Single case Oval Wheel Meter:

accuracy: Flowal® Plus up to  $\pm 0.25$  %

accuracy: OI up to  $\pm 0.1$  %

### Double case Oval Wheel Meter:

accuracy: OP up to  $\pm 0.15$  %

accuracy: OaP up to  $\pm 0.05$  %



### Special features

- mechanical or electronic counters available
- no straight inlet and outlet pipe sections required
- wide viscosity range
- easy installation and commissioning
- maintenance-free
- national and international approvals
- custody certification / OIML / MID 2014/32/EU (old version 2004/22/EC)
- Evaluation certificate (Welmec 8.8)
- SIL2 (series OaP)
- Llyods Register (OI, OaP)
- Approved for custody transfer
- ATEX
- PED
- NACE

### Technical datas in general

<b>Nominal size</b>	6 to 400 mm (1/4" to 16")
<b>Process connection</b>	Females threading Flanges according to DIN or ANSI
<b>Material</b>	Pressure relevant: cast steel, stainless steel, PVDF Other wetted parts: PEEK, aluminium, brass, ceramics, stainless steel, others
<b>Flow Range</b>	0.03 l/min to 24,000 l/min (0.008 gal/min 6,340 gal/min)
<b>Linearity</b>	±0.05 % to ±0.5 % o. R.
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.1 to 100,000 mPa·s
<b>Process temperature</b>	-40°C to 290°C (-40°F to 554°F)
<b>Process pressure</b>	max. 100 bar (1,450 psi)
<b>Ex-protection</b>	Flame proof or intrinsically safe



Oil and gas  
Chemistry and pharmaceutical  
Mechanical and plant engineering  
Food and beverage  
Energy and power plants  
Shipbuilding

# OVAL WHEEL METER



Oval Wheel Meter OaP

## TYPE OaP

### Application

Oval Wheel Meters Type OaP are used for measuring liquid raw-, intermediate- or finished- products such as liquefied gases, gasolines, heating oils, lubricating oils, transmission oils, solvents, bitumen, alkaline solutions, acids and other chemical liquids.

### Characteristics

- oval wheel meters for low-, mid- and high viscosity liquids
- high measurement accuracy
- low pressure loss
- high life time

### Special features

- double case meter design
- no straight inlet and outlet pipe sections required
- measuring principle independent of the viscosity
- compact design
- easy start-up
- maintenance-free
- the only SIL 2 oval wheel meter world wide
- broad range of custody transfer approvals

### Technical data

<b>Nominal size</b>	25 to 400 mm (1" to 16")
<b>Process connection</b>	Flanges according to DIN or ANSI
<b>Material</b>	Pressure relevant: cast steel, Other wetted parts: aluminium, brass, stainless steel, others
<b>Flow Range</b>	300 l/h to 24,000 l/min (79 gal/h to 6,340 gal/min)
<b>Linearity</b>	±0.05 % to ±0.5 % o. R.
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.1 to 100,000 mPa·s
<b>Process temperature</b>	-40°C to +290°C (-40°F to +554°F)
<b>Process pressure</b>	max. 100 bar (1,450 psi)
<b>Ex-protection</b>	Flame proof or intrinsically safe

- ◆ Oil and gas
- ◆ Chemistry and pharmaceutical
- ◆ Mechanical and plant engineering
- ◆ Food and beverage
- ◆ Energy and power plants
- ◆ Shipbuilding



# OVAL WHEEL METER

## TYPE OP

### Application

Oval Wheel Meters Type OP are used for measuring liquids such as gasolines, heating oils, lubricating oils, diesel oil, bio ethanol and some chemical liquids.

### Characteristics

- oval wheel meters for mid to high viscosity liquids
- low pressure loss
- high life time

### Special features

- double case meter design
- no straight inlet and outlet pipe sections required
- measuring principle independent of the viscosity
- easy start-up
- maintenance-free

### Technical data

<b>Nominal size</b>	15 to 150 mm (1/2" to 6")
<b>Process connection</b>	Flanges acc. to DIN or ANSI
<b>Material</b>	Pressure relevant: cast steel, stainless steel Wetted parts: aluminium or stainless steel
<b>Flow Range</b>	5 l/min to 5,000 l/min (1.32 gal/min to 1,320 gal/min)
<b>Linearity</b>	±0.2 % to ±0.5 % o. R. option special calibration: +/- 0.15 %
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.3 to 120 mPa·s
<b>Process temperature</b>	-10°C to +110°C (14°F to 230°F)
<b>Process pressure</b>	max. 40 bar (580 psi)
<b>Ex-protection</b>	Flame proof or intrinsically safe

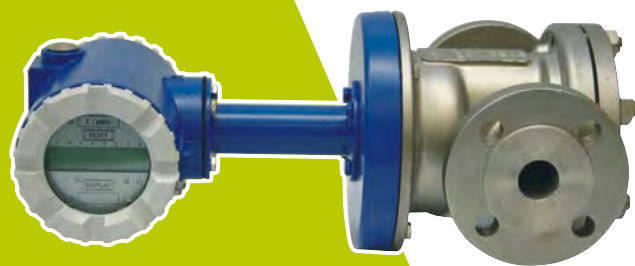


Oval Wheel Meter OP



Oil and gas  
Chemistry and pharmaceutical  
Mechanical and plant engineering  
Food and beverage  
Energy and power plants  
Shipbuilding

# OVAL WHEEL METER



Oval Wheel Meter OI

## TYPE OI

### Application

Oval Wheel Meters Type OI are used for the measurement of liquid products such as liquefied gases, acids, alkaline solutions, fats, alcohols, solvents, dispersions, polymers, poly-condensates, paints, colors and adhesives etc.

### Characteristics

- oval wheel meters for mid to high viscosity liquids
- high measurement accuracy
- low pressure loss
- high life time

### Special features

- single case meter design
- no straight inlet and outlet pipe sections required
- measuring principle independent of the viscosity
- compact design
- easy start-up
- maintenance-free

### Technical data

<b>Nominal size</b>	25 mm to 100 mm (1" to 4")
<b>Process connection</b>	Flanges acc. to DIN or ANSI
<b>Material</b>	Pressure relevant: cast steel, cast iron, stainless steel Wetted parts: aluminium, brass, cast Iron
<b>Flow Range</b>	8 l/min to 1,000 l/min (2 gal/h to 264 gal/min)
<b>Linearity</b>	±0.1 % to ±0.3 % o. R.
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.3 to 3,000 mPa·s (standard) 1.5 to 60,000 mPa·s (ball bearing) -60°C up to +180°C (-76°F up to +356°F)
<b>Process temperature</b>	High temperature design: Special clearances / extension 300 mm Low temperature design: Special clearances / extension 400 mm + 2 Magn. Coupling / pmax = 0,5 x PN
<b>Process pressure</b>	max. 40 bar (580 psi)
<b>Ex-protection</b>	Flame proof or intrinsically safe

- ◆ Oil and gas
- ◆ Chemistry and pharmaceutical
- ◆ Mechanical and plant engineering
- ◆ Food and beverage
- ◆ Energy and power plants
- ◆ Shipbuilding



# OVAL WHEEL METER

## TYPE FLOWAL® PLUS

### Application

Versatile flowmeter for measuring the volume of liquids in mechanical engineering, factory automation and process instrumentation, such as suited for industrial fluids, chemical fluids, mineral oils and fuels. The modular design combines reliable mechanical sensors with modern electronics. The plastic version is suitable for measuring the volume of corrosive liquids, acids, alkalis, solvents, dyes ...

### Characteristics

- oval wheel meters for low to mid viscosity liquids
- battery powered model available
- low pressure loss

### Special features

- single case meter design
- no straight inlet and outlet pipe sections required
- measuring principle independent of the viscosity
- easy start-up
- maintenance-free
- plastic version: no wetted metal parts and low weight
- built-in temperature sensor
- battery-supplied compact devices
- detection of flow direction

### Technical data

<b>Nominal size</b>	G1/4", G1/2", G3/4", G1", G2" Flanges DN15, DN25, DN50 Flanges ½", 1", 2"
<b>Process connection</b>	inside threads acc. to ISO 288, flanges acc. to DIN or ANSI
<b>Material</b>	Pressure relevant: stainless steel, Aluminium, PVDF, PP Other wetted parts: PEEK, stainless steel
<b>Flow Range</b>	0.03 l/min to 660 l/min (0,008 gal/min to 174 gal/min)
<b>Linearity</b>	±0.25 % to ±0.5 % o. R.
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.3 up to 3,000 mPa·s
<b>Process temperature</b>	-40°C up to +130°C (-40°F up to +266°F)
<b>Process pressure</b>	up to 68 bar (986 psi)
<b>Ex-protection</b>	Intrinsically safe (ATEX or IEC-Ex)



Flowal® Series OR Plastic



Flowal® Series OF

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# OVAL WHEEL METER

## TYPE OD

### Application

The focus is on the measurement of non-conductive liquids. This meter is designed for the measurement of e.g. oil or demineralized water. Due to the measuring principle, there is no need for an inlet or outlet section.

### Characteristics

- direct measurement of volume
- measurement of non-conductive and conductive liquids
- high accuracy / repeatability also for small quantities
- high long term stability

### Special features

- Fillings from 10 ml available
- Very short dosing times > 250 ms
- Automatic zero point adjustment
- High resolution (e.g. DN 10: 3,333 pulses/l)
- Wide range of filling quantities with various diameters
- Combinable with the batch controller MDS-PLC

### Technical data

<b>Nominal size</b>	DN10, DN15, DN25
<b>Process connection</b>	TriClamp to DIN 32676
<b>Material</b>	Body: stainless steel Oval wheels: stainless steel Seals: Viton, alternative FEP
<b>Flow Range</b>	0.2 l/min to 5 l/min (0.05 gal/min to 1.32 gal/min) 3,333 pulse/l 1 l/min to 30 l/min (0.26 gal/min to 7.93 gal/min) 1,000 pulse/l
<b>Linearity</b>	±0.25 % to ±0.5 % o. R.
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.3 to 1,500 mPa·s
<b>Process temperature</b>	Liquid temperature: -10°C to +130°C (-14°F to +266°F) Ambient temperature: -20°C to +70°C (-4°F to +158°F)
<b>Process pressure</b>	max. 16 bar (232 psi)
<b>Ex-protection</b>	not available



Oval Wheel Meter OD

- ◆ Oil and gas
- ◆ Chemistry and pharmaceutical
- ◆ Mechanical and plant engineering
- ◆ Food and beverage
- ◆ Energy and power plants
- ◆ Shipbuilding



# ELECTRONICAL AND MECHANICAL DISPLAYS AND COUNTERS

THE PROPER SOLUTION FOR EACH OF YOUR NEEDS AVAILABLE FOR OUR PD-METERS

## Flow Computer



**UR 06**  
wall mounted



**UR 06**  
19" rack mounted



**URS 06**  
Batch



**URS 09**  
Batch/Loading



## Local Indicators



**E-head**  
Single pointer



**D-head**  
Double Pointer  
resettable



**M5-head**  
Totalisator  
resettable



**M5V-head**  
Totalisator  
preset



**UST 4-20 mA**  
HART Transmitter



**FW Battery**  
Totalisator



**URS 09**  
Batch/Loading



## pick-up



**AG19**  
Single channel  
NAMUR Exi



**AG20**  
Dual channel  
NAMUR Exi



**AG01-08**  
Dual channel  
Open Coll. Exd



**AG4x**  
Single channel,  
Exi

## PD-Meter Type OaP or OP or OI



# COMMUNICATION UPGRADE KITS

ELECTRONIC SOLUTIONS TO FACELIFT YOUR PROVEN INSTALLATION BASE SUITABLE FOR OVAL WHEEL METER SERIES OI AND OAP

- 4-20 mA output/passive
- NAMUR or Open Collector pulse output/passive
- large local indicator flowrate/totalizer, battery powered
- approved and released by the original manufacturer
- secure your installed investments
- enable a better integration in modern systems (HART, Modbus options)

**Before**  
Upgrade Kit



**After**



Kit Type	LCD local indicator	Power supply	4-20 mA output	Pulse output	Data transfer
FW	17 mm	Battery or 24 VDC	yes	Open Collector	Modbus
MFE	5 mm	Battery or 24 VDC	yes	Open Collector	no
UST	8 mm	24 VDC	yes	NAMUR	HART (PACT-ware)



# TURBINE METER

**The turbine meter is used for flow and volume measurement of liquid.**

**Measuring principle:**

The turbine meter is an indirect volume meter. It essentially consists of a freely rotating axial turbine wheel in a liquid flow. The turbine wheel is rotated by the liquid and spins at a rotational speed, which corresponds to the average flow velocity of the liquid in the free cross section of the turbine flow meter. The rotational speed of the turbine wheel is thus proportional to the volumetric flow and the number of revolutions is proportional to the volume, which flows through.

The rotational movement is transmitted through the casing wall in a non-interacting manner to the outside by means of magnetic-inductive pulse pick up. A pick up mounted outside of the casing is used for this purpose. An electromagnetic field is generated with a coil located in the scanning head.

Ferromagnetic components move through this field and induce electrical voltage. The ferromagnetic components consist, depending on the series of the turbine meter, of the turbine wheel blades or pins, which are arranged around the cover band of the turbine wheel.

Per blade or pin an electrical voltage pulse is produced, which corresponds to a certain volume. This value is the meter factor K (pulse/volume unit). A preamplifier amplifies and transforms the voltage pulse into a square-wave signal corresponding to NAMUR, which allows secure transmission at up to 1000 meters.

**Applications:**

Measuring liquids and liquified gases in the chemical and petrochemical industry, in the mineral oil industry and loading systems, especially for high operating pressures and low viscosities.

The following liquid media can be measured with the turbine meter:

- crude oil
- mineral oil
- acids
- alkaline solutions
- solvents
- water
- liquified gases
- refined oil products (gasoline, Kerosene, Jet A1, JP8, Diesel)
- vinyl chlorid



RQ Series 1 with  
Universal Smart  
Transmitter (UST)

**Characteristics:**

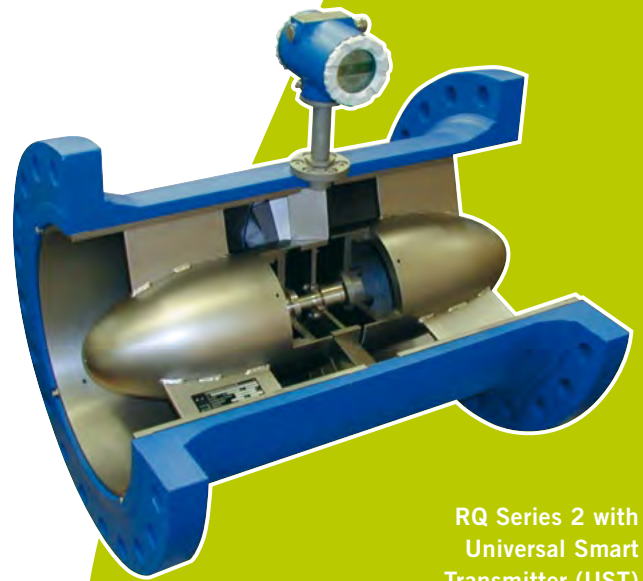
- high accuracy
- high repeatability
- proven and reliable measuring instruments

**Special features:**

- high flow capacity
- approved for fiscal metering

**Technical data:**

<b>Nominal size</b>	DN15 to DN300 (1/2" to 12")
<b>Process connection</b>	Flanges DIN or ANSI
<b>Material</b>	Carbon steel, stainless steel (option: Hastelloy, Duplex)
<b>Flow Range</b>	0.15 to 2,400 m <sup>3</sup> /h (40 gal/h to 643,013 gal/h)
<b>Linearity</b>	±0.15 % to ±0.5 % o. R.
<b>Repeatability</b>	±0.02 %
<b>Viscosity</b>	0.2 to 50 mPa·s
<b>Process temperature</b>	-60°C to +250°C (-76°F to +482°F)
<b>Process pressure</b>	up to 320 bar (4,641 psi)
<b>Output</b>	current and pulse output
<b>Ex-protection</b>	Flame proof or intrinsically safe



RQ Series 2 with  
Universal Smart  
Transmitter (UST)

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# VORTEX METER



VTX sandwich version

**The VTX vortex meter is used for flow and volumetric measurements of conductive and non-conductive fluids, gases and vapours in all industrial branches.**

## **Principle of measurement**

When a liquid or gaseous medium flows around an object, the medium will be capable of following the contour of the object only to a limited extent and to a certain point at the object's surface. Thereafter the flow will stall and behind the object vortices will form which are entrained in the downstream flow about the object's axis whereby the vortices rotate in opposing directions. Thus vortex street is produced. This effect has for a long time now been known as „Karman vortex street“. The frequency of the emerging vortices is proportional to the velocity of the flow.

In the vortex meter from the VTX series, a trapezoidal object is used to generate the vortices. This ensures in the instance of both fluid and gaseous media as well as vapours a precise and highly reliable generation of the vortices.

By suitably designing the bluff body with a well-defined edge at which the vortices form, excellent linearity can be ensured. The vortices forming at the bluff object and rotating downstream in opposing directions to each side of the axis give rise to local changes in velocity and pressure which may be detected by a piezoelectric sensor and which are then converted by the sensor electronics with autoadaptive microprocessor controlled filtering in to standardised signals.

## **Application**

Applications include volumetric measurements for balancing (compressed air systems, heat carriers, vapours, chemical products, for example), process control and high throughput applications, thermal oil.

## **Characteristics**

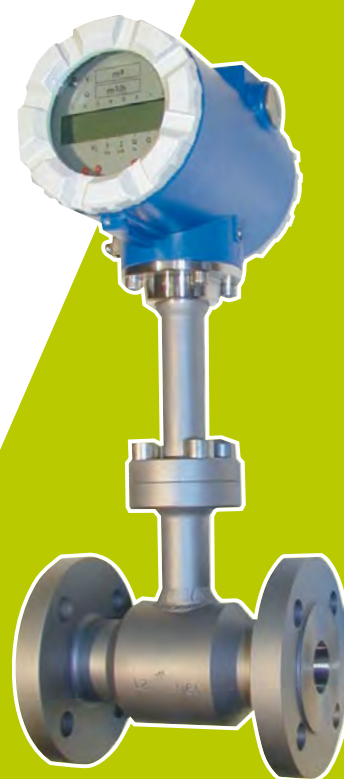
- extremely rugged and stable measuring instrument
- maintenance-free

### Special features:

- insensitive to pulsations, pressure bursts and temperature shocks
- with auto-adaptive digital signal processing
- with P- and T-correction
- three simultaneously and independently usable signals (current output, HART®, pulses)
- suited for high operating temperatures
- with an optional shut-off valve, the sensor and the electronics can be replaced under process conditions
- optional with complete measuring section and universal flow computer for pressure and temperature compensation

### Technical data

<b>Nominal size</b>	DN15 to DN300
<b>Process connection</b>	Wafer, flanges DIN or ANSI
<b>Material</b>	stainless steel
<b>Flow Range</b>	0.4 m <sup>3</sup> /h to 20,000 m <sup>3</sup> /h (106 gal/h to 5,283.4 gal/h)
<b>Linearity</b>	up to ±0.6 % o. R.
<b>Process temperature</b>	-40°C up to +260°C / 450°C (-40°F up to +500°F / 842°F)
<b>Process pressure</b>	up to PN100
<b>Output</b>	current output with HART®, or current pulses and scalable pulse output acc. to NAMUR
<b>Display</b>	eight digit display up front with operating keys, DTM and AMS drivers are available
<b>Ex-protection</b>	Flame proof or intrinsically safe



VTX flange version

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# COMPACT ORIFICE

The oriflow compact orifice is used for flow measurements of conductive and non conductive fluids, gases and vapours in all industrial branches.

## Principle of measurement

The principle of measuring the differential pressure is based on the fact that a differential pressure is created across that section of a pipe where its cross section is reduced. This is then taken as a measure for the flow. For the differential pressure produced (differential pressure  $\Delta p$  at the point where the pressure is read) and the flow  $q$ , the flowing equation applies:

$$q = k \cdot \sqrt{\Delta p}$$

This principle of measurement is so popular because related terms, definitions and equipment characteristics have been laid down by way of standards already at a very early stage. The agreement between theoretical calculations and measured values has been proven through comprehensive experiments. This has been the basis for wide-spread acceptance throughout the industry. Today, about 50% of all flow meters rely on the principle of measuring the differential pressure.

## Application

Applications include flow measurements (volume / mass) for balancing (compressed air systems, heat carries, vapours, chemical products, for example), process control and high throughput applications, redundant solutions for safety applications.

## Characteristics

- highest market acceptance already over 10,000 units in operation worldwide
- extremely rugged and stable measuring instrument
- suitable for extreme applications



Triple compact orifice

### Special features

- dry calibration
- high repeatability
- easy installation without pressure lines

### Technical data

<b>Nominal size</b>	DN15 up to DN1000
<b>Process connection</b>	Wafer, flanges DIN or ANSI
<b>Material</b>	stainless steel, Hastelloy, Tantalum, Titanium, PVDF, Monel
<b>Flow Range</b>	0.2 m <sup>3</sup> /h bis 150,000 m <sup>3</sup> /h (52.83 to 39,625808 gal/h)
<b>Linearity</b>	up to $\pm 0.6$ % o. R.
<b>Process temperature</b>	-40°C up to +400°C (-40°F up to +752°F)
<b>Process pressure</b>	up to PN40 (up to 320 bar/4,641 psi on request)
<b>Output</b>	current output / Foundation Fieldbus / Profibus A
<b>Ex-protection</b>	Flame proof or intrinsically safe



Compact Oriflow with Transmitter

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# DENSITY AND CONCENTRATION METER

**The density meter is used for continuous measurement of density and concentration of liquids.**

## **Principle of measurement:**

The DIMF series of oscillation type of density sensors provides the possibility for the continuous measurement of the density and concentration of liquids, liquid mixtures and multiphase fluids.

The central component of the DIMF series of density sensors is an oscillating element consisting of an oscillating fork, type DIMF 1.3, or an oscillation pipe, type DIMF 2.0 and DIMF 2.1. The liquid to be measured flows through the oscillating element, which is electromagnetically excited and oscillating at its characteristic frequency. Changes in density result in changes in the characteristic frequency.

These frequency changes are measured. The frequency is registered directly by the transmitter and transformed into a signal proportional to the density and concentration. At the same time, an integral temperature sensor measures the temperature of the material. This temperature is then used to make corrections. In doing so, the temperature influence of the oscillation element and the temperature behavior of the liquid density are also considered.

The corrections are made directly in the transmitter. The frequency and the temperature can be transmitted to a Bopp & Reuther density computer or to a density-massflow converter, series UR06, and processed further there.

## **Application**

Continuous monitoring of density, mass flow measurement, fiscal measurements, quality control, monitoring of waste water, product recognition, dosing, injection or blending of additives, control of chemical reactions, measurement of concentrations; monitoring and control of distillation, filtration, sedimentation, mixing or fermentation processes; process control, measurement of solid percentages in liquids, measurement of foams and suspensions etc.



DIMF 1.3 TVS



DIMF 2.0 TVS

### Characteristics

- high repeatability
- maintenance-free
- high long-term stability

### Special features

- special calibration within the required density range
- fiscal metering for DIMF 1.3 (Evaluation Certificate)
- also useable for highly aggressive liquids, pastes and foams
- output signals scalable for density and concentration
- materials: Stainless Steel, Hastelloy, Tantalum, Monel Inconel, etc.
- 400-points correction table for customer specific calibration

### Technical data

<b>Nominal size</b>	DN6 to DN50
<b>Process connection</b>	Flanges or Swagelok, sanitary threads, sterile fittings
<b>Material</b>	Stainless steel, Hastelloy, Tantalum, Monel, Inconel, 304 L
<b>Density Range</b>	0 to 5,000 kg/m <sup>3</sup> (0 to 312 lb/ft <sup>3</sup> )
<b>Linearity</b>	up to ±0.1 kg/m <sup>3</sup> depending on model
<b>Process temperature</b>	-40°C to +210°C (-40°F to +410°F)
<b>Process pressure</b>	up to 300 bar (4,351 psi)
<b>Output</b>	current output, frequency output, RS232
<b>Ex-protection</b>	Flame proof or intrinsically safe



DIMF – compact



- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# CORIOLIS MASS FLOW METER: SERIES FMO



Coriolis  
Mass Flow Meter  
FMO 08



Coriolis  
Mass Flow Meter  
FMO 15

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

Mass flow meters dedicated to the measurement of liquids and gases.

## Principle of measurement

The mass flow meter utilizes the Coriolis force for flow measurement. The omega loop has proven itself particularly suitable for this purpose.

The measuring tubes, which are bent to omega loops, are completed by two measuring bars and vertically secured torsion bars to create a harmonious oscillator. This carefully balanced and robust design has an extremely low power consumption. The frequency of the system essentially depends on the mass of the bars and the elasticity module of the torsion bars.

Two electromagnetic coils set the system in motion. As soon as liquid or gas flows through the oscillating omega tubes, the resultant Coriolis force causes displacement of the tubes. The resulting phaseshift is detected by sensor and is proportional to the mass flow.

## Application

- custody transfer for mineral oils, bitumen and other viscous media
- process measurement of mechanical and plant engineering

## Characteristics

- high accuracy
- easy installation
- independence on the flow profile
- low sensitivity to air bubbles

## Special features

- suitable for high pressure applications
- measurement of corrosive fluids
- various electronic converters available

## Technical data

<b>Nominal size</b>	DN15 up to DN300 (1/2" up to 12")
<b>Process connection</b>	female threading, Flange DIN or ANSI
<b>Material</b>	Stainless steel, Hastelloy, Tantalum, Duplex
<b>Flow Range</b>	0.004 up to 30,000 kg/min (0.009 lb/min up to 66,139 lb/min)
<b>Linearity</b>	±0.15 % o. R.
<b>Repeatability</b>	±0.05 %
<b>Process temperature</b>	-200°C up to +400°C (-328°F up to +752°F)
<b>Process pressure</b>	1,379 bar (20,000 psi)
<b>Ex-protection</b>	Flame proof or intrinsically safe

# CORIOLIS DOSING MASS FLOW METER: SERIES FMD

The dosing mass flow meter extends the range of dosing-sensors with special attention to the dosage of non-conductive media and direct mass dosage.

## Principle of measurement

Dosing flowmeters that use the Coriolis principle are classified as direct mass flowmeters. They consist of two U-shaped measuring tubes, an actuator and two sensors. In operation, the two measuring tubes are stimulated to an antiphase oscillation. Without flow, both sides of the measuring tubes vibrate equally and the sensors deliver in-phase signals.

When liquid flows through the measurement tubes, the inlet end of the tube decelerates and the outlet end of the tube accelerates by the occurring Coriolis effect. As a result a phase difference in the two sensor signals is generated, which is proportional to the mass flow.

## Application

The focus is on the measurement of non-conductive liquids with a low content of gas or solids. This equipment is also designed for the purposes of measurement of oil, distilled water or alkanes. Due to the measuring principle, direct measurement of the mass of dosage is possible.

## Characteristics

- compact design
- direct measurement of mass
- measurement of non-conductive and conductive liquids
- high accuracy / repeatability
- no moving parts
- easy to clean compared with piston filler
- product gentle filling

## Special features

- Outstanding fast fillings
- Fillings from 10 ml
- Very short dosing times > 250 ms
- High accuracy / repeatability also for small quantities
- High resolution (e.g. DN10: 63660 pulses/kg)
- Wide range of filling quantity with various diameters
- Wear-free measurement
- Fully welded, no gaskets
- Combinable with controller MDS-PLC

## Technical data:

<b>Nominal size</b>	DN10, DN15 (3/8", 1/2")
<b>Liquid temperature</b>	0°C to 90°C (32°F to 194°F)
<b>Connections</b>	Tri Clamp acc. DIN 32676 Sanitary thread acc. DIN 11851
<b>Cleanability</b>	CIP / SIP up to 140°C (284°F)



Coriolis Dosing  
Mass Flow Meter  
FMD

Oil and gas  
Chemistry and pharmaceutical  
Mechanical and plant engineering  
Food and beverage  
Energy and power plants  
Shipbuilding

# DOSING TECHNOLOGY

## MID-MDS DOSING MODULES

**Modular dosing system (MDS) for filling conductive liquids in filling machines fitted with electromagnetic flowmeters.**

### Principle of measurement

Electromagnetic flowmeters belong to the group of direct volumetric meters. They work according to the Faraday principle. They work according to the Faraday principle. In contrast to all other magnetic-inductive flow meters available in the market, they work in an alternating field instead of a synchronised DC field. This enables higher measuring dynamics and faster, precise measurements for dosing filling timing down to 100 ms.

### Application

Their function is based on conductive liquids ( $>1 \mu\text{S}/\text{cm}$ ) in filling machines. These machines are mainly used in the food and beverage industry as well as in the pharmaceutical and fine chemicals industry. Among others, milk and dairy products (also with pieces of fruit), ketchup, mayonnaise, mustard, sauces, dressings, cleaning and washing agents, medical products (e.g. stomach gels), sterile injection products and cosmetics are measured.

### Characteristics

- easy cleaning in comparison with piston fillers (CIP/SIP)
- easy adjustment of filling quantities
- no shear forces are applied to the product



MID-MDS



### Special features

- shortest dosing times less than 100 ms possible
- small dimensions of the sensor
- complete system for linear and rotative filling machines
- wide range of filling quantity with various diameters
- direct control of the dosing valve
- CIP / SIP cleaning
- change of flow transmitter without re-programming possible

### Batch controllers

- MID-MDS system to control the filling (measurement and valves)
  - up to 540 electromagnetic meters series MID and valves
  - with communication interface RS232 to communicate with the PLC
- MDS-Terminal to configure and visualize the MID-MDS system
- UV14 converter module to use custom PLCs
- MID-PLC to build up small filling application up to 4 meters and 4 valves

### Technical data

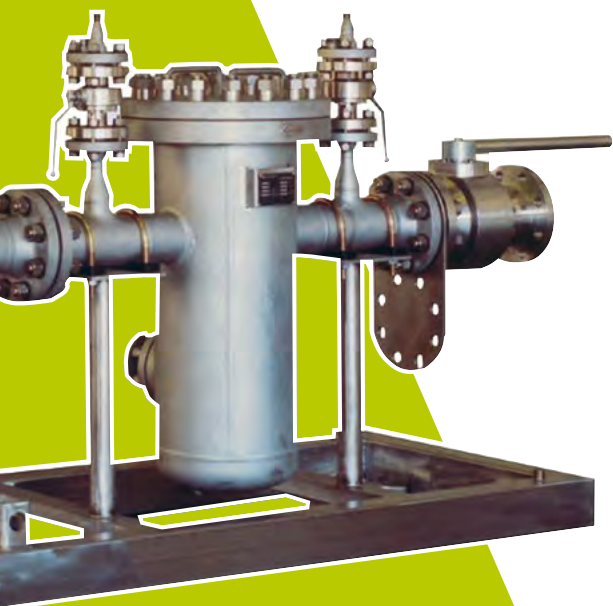
<b>Nominal size</b>	DN10 up to DN40
<b>Process connections</b>	Tri-Clamp, hygienic connection for milk, sterile connections, sterile mini flange
<b>Material</b>	stainless steel
<b>Conductivity</b>	>1 $\mu$ S/cm
<b>Flow ranges</b>	0.25 m/s to 10 m/s
<b>Repeatability</b>	$\pm$ 0.1 % (depends on the flow range)
<b>Process temperature</b>	up to 95°C – cleaning up to 140°C (up to 203°F – cleaning up to 284°F)
<b>Process pressure</b>	up to 16 bar
<b>Ex-Protection</b>	not available



UV 14

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# ACCESSORIES



Strainer NC welded design



Strainer

- ◆ Oil and gas
- ◆ Chemistry and pharmaceutical
- ◆ Mechanical and plant engineering
- ◆ Food and beverage
- ◆ Energy and power plants
- ◆ Shipbuilding

## STRAINER

### Application

To avoid measuring errors and damage caused by solid particles contained in the fluid.

### Characteristics

- the strainer can be completely drained using the drain valve at the lowest position of the strainer and the conical design of the device (only cast strainers)

### Special features

- low pressure loss because of large filtration area (up to 16 times larger than the pipeline cross section)
- according to Pressure Equipment Directive (2014/68/EU)
- customized design
- NACE

### Technical data

<b>Nominal size</b>	DN15 to DN400 (1/2" to 16")
<b>Process connection</b>	Flanges DIN or ANSI
<b>Material</b>	Carbon steel, cast steel, stainless steel (option: Hastelloy)
<b>Flow range</b>	up to 3,000 m <sup>3</sup> /h (792516 gal/h)
<b>Process temperature</b>	-200°C to +300°C (-328°F to +572°F)
<b>Process pressure</b>	up to 420 bar (6,092 psi)

## CENTRIFUGAL GAS SEPARATOR

### Application

To avoid measuring errors that result from air or gas contained in liquids measured with volumetric and massflow meters.

### Characteristics

- maintenance-free
- complete emptying via drainage valve

### Special features

- with automatic float-deaeration device or level probe and controlled magnetic valve or defined reflux to the process (orifice)
- if applicable, necessary for measuring systems in legal transactions and measuring systems for tax billing of liquids except water
- Bopp & Reuther Centrifugal Gas Separators have received European design approval
- OIML and EC-Certificates are available
- manufactured according to Pressure Equipment Directive (2014/68/EU) ASME, CODAP
- NACE

### Technical data

<b>Nominal size</b>	DN25 to DN400 (1" to 16")
<b>Material</b>	Flanges DIN or ANSI
<b>Process connection</b>	Carbon steel, stainless steel
<b>Flow range</b>	up to 25,000 l/min (6604 gal/min)
<b>Viscosity</b>	up to 20 mPa·s
<b>Process temperature</b>	-200°C to +300°C (-328°F to +572°F)
<b>Process pressure</b>	up to PN100 (1,450 psi)



Centrifugal Gas Separator  
Series ZGA

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding

# ACCESSORIES

## COMPACT BATCH CONTROLLER SERIES MDS-PLC

### Application

The area of application for the MDS-PLC is the control of meters and valves in small filling machines. The MDS-PLC configures the parameters and settings, visualizes the data and controls the valves.

By using this compact controller filling machine manufacturers can quickly integrate the dosing functions in their filling machines. There is no need for an extra PLC. The compact controller is operated via the external inputs or via the touch screen. All accuracy-related functions are integrated in the compact controller: even if a low-cost PLC will be used, for other purposes on the dispensing quantity.

### Characteristics

- max. for 4 meters like electromagnetic flowmeters, mass flowmeter, oval wheel meters or others with pulse output
- Color Touch Panel
- many features out of 30 years experiences in filling applications

### Special features

- 4 counting inputs 100 kHz
- 4 valve outputs 0,2A
- suitable for fast dosing applications
- with overflow correction and max. dosing time shutdown

### Technical data

<b>Inputs</b>	4 counting inputs 100 kHz
	4 Start inputs
	4 Stop inputs
	1 CIP input
<b>Outputs</b>	4 valve outputs 0.2 A
	4 tolerance outputs
	4 outputs for valve closing
<b>Power</b>	24 VDC (20 – 28 V)
<b>Temperature range</b>	0 to +50°C (32°F to +122°F)
<b>Display</b>	Color Touch Screen 320 x 240 Pixels
<b>Dimensions</b>	170 x 135 x 80 mm (6.7 x 5.9 x 3.1 inches)



MDS-PLC

- ◆ Oil and gas
- ◆ Chemistry and pharmaceutical
- ◆ Mechanical and plant engineering
- ◆ Food and beverage
- ◆ Energy and power plants
- ◆ Shipbuilding

## UNIVERSAL FLOW COMPUTER FOR LIQUIDS

### Application

The flow computers are used to register, display and output mass- and volumetric flow rates, including calculation of net values for standard conditions. The URS models with integrated PLC also allow the control of automated dispensing or filling operations. Plug-in modules enable the connection of different sensor systems for detection of mass flow, pressure, temperature or density. This flow computer is for metering and batching mineral oil and chemical liquid products.

### Characteristics

- 24-bit AD converter
- modular design
- short cycle times
- Error curve linearization

### Special features

- extensive data logging function
- OIML approval
- Evaluation Certificate
- MID 2014/32/EU (former 2004/22/EC)
- RS232, RS485, Ethernet
- MBus, Modbus, Profibus

### Technical data

- integrated PLC
- up to 4 current inputs
- 6 frequency Inputs
- 2 temperature Inputs
- 7 digital outputs
- 4 current outputs



Flow computer URS 09



Flow computer  
UR 06



Flow computer  
URS 06

- Oil and gas
- Chemistry and pharmaceutical
- Mechanical and plant engineering
- Food and beverage
- Energy and power plants
- Shipbuilding



bms- Bulk Meter Services Limited,

3 Faversham Road, Challock,  
Ashford, Kent, TN25 4BQ, U.K.

Phone : +44 ( 0 ) 1233 740134

Email : [sales@bms-ltd.com](mailto:sales@bms-ltd.com)

Web : [www.bms-ltd.com](http://www.bms-ltd.com)