AQUALIMPIA ENGINEERING

Precision Drum-Type Gas Meters (Wet-Test Gas Meters) Series: TG

TG 05 Model 5 (PVC transparent)

User Benefits

- Highest accuracy
- Use with extremely corrosive and inert gases
- Calibration traceable to National Primary Standard
- Lowest measurable flows
- Largest selection of measuring ranges
- Data acquisition option by PC with real-time data monitoring
- Most durable construction available
- No maintenance

Applications

RITTER™ drum-type (wet-test) gas meters are used universally to measure ***gas volume*** volumetrically in R&D laboratories, for example, in the petrochemical, chemical, coal mining, and steel production industries as well as in universities and environmental technology.

The ***gas flow rate*** can be calculated and monitored by the RITTER™ software *Rigamo* or *Electronic Display Unit EDU 32 FP* (options).

RITTER™ gas meters consistently provide the highest accuracy even at lowest gas flow rates with the most aggressive gases.

Measurement Principle

RITTER™ gas meters work on the principle of positive displacement. The gas flow causes a rotation of the measuring drum within a packing liquid, usually water or low viscous oil. The measuring drum compulsorily measures the gas volume by periodically filling and emptying the rigid measuring chambers. Coupled to the measuring drum, a needle-dial indicates the measured gas volume.

Measuring Range

The desired measurement range can be selected from among 8 meter sizes (types) extending as a whole from 1 Ltr/h to 18,000 Ltr/h.

Accuracy

Each RITTER™ wet-test gas meter provides a measuring accuracy of ± **0.2%** or better at standard flow and ± 0.5% across full measurement range.

Each instrument is manufactured according to the most rigorous German standards of quality control and is calibrated individually.

Gas **Pressure** & Temperature

RITTER™ wet-test gas meters have a maximum gas inlet pressure of 50 mbar (0.725 psi) with plastic casings and 500 mbar (7.25 psi) with stainless steel casings; custom meters up to 35 bars (500 psi) are available.

RITTER™ meters allow constant use temperatures ranging from -10°C to +80°C (14°F to +176°F), depending on the meter material.

Data Presentation

Standard models provide a direct needle-dial readout and an accumulating counter.

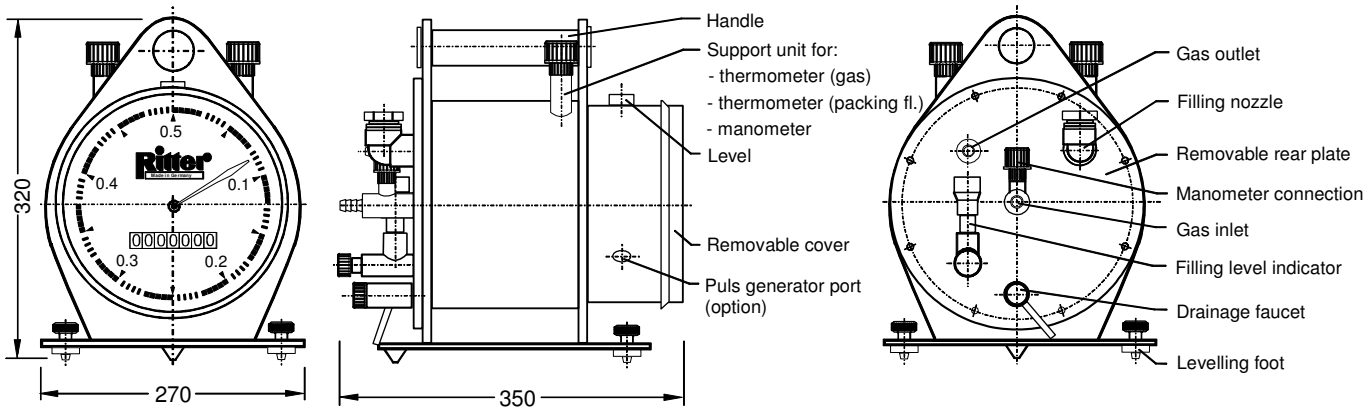
For data acquisition by PC the Windows software *Rigamo* is available. For remote operation the electronic display unit "EDU 32 FP" (including RS232) can be used.

Measurement Standard

RITTER™ wet-test meters measure the ***actual volume*** of gas flow **directly**. This is the major advantage and the superiority of the drum-type Gas Meter over other measurement principles, which determine gas volume using secondary measurands such as speed, heat capacity, hot-wire resistance or similar.

That means that the **condition** and the **composition** of the gas does not influence the measurement accuracy. **Correcting factors** which take into account gas composition, temperature, humidity etc. are **not necessary**. However, the dependence of gas volume from temperature remains valid.

Ritter Gas Meters ... where Perfection becomes Reality



TG 05 plastic models

Performance Specifications

Type	Flow Rate			Readout Indication		Packing Fluid Required[3]		Measuring Drum Volume	Max. Gas-Inlet Pressure	Min. Pressure Loss
	Min. [ltr/h]	Max. [ltr/h]	Std [1] [ltr/h]	Min. [2] [ltr]	Maximum [ltr]	Plastic [ltr]	SS [ltr]	[ltr]	[mbar]	[mbar]
TG 05	1	60	50	0.002	9,999,999.9	2.5	3.5	0.5	Plastic casing: 50 SS casing: 500	0.4
TG 1	2	120	100	0.01	99,999,999	3.0	3.5	1.0		0.2
TG 3	6	360	300	0.02	99,999,999	6.0	11	3.0		0.2
TG 5	10	600	500	0.02	99,999,999	8.5	11	5.0		0.2
TG 10	20	1,200	1,000	0.1	99,999,999	15.5	21	10.0		0.1
TG 20	40	4,000	3,200	0.2	999,999,990	28.5	30	20.0		0.1
TG 25	50	7,000	5,000	0.1	999,999,990	42	39	25.0		0.1
TG 50	100	18,000	10,000	0.5	999,999,990	91	88	50.0		0.1

[1] Accuracy determined @ standard flow and 20 ° C (68 ° F)
[2] Minimum dial division
[3] Approximately

Materials of Construction (Models)

RITTER™ gas meters are manufactured from 5 different excellent materials: Polyvinyl Chloride (PVC), Polypropylene (PP), Polyvinylide Fluoride (PVDF), PE-el (polyethylene electrically conductive) or refined stainless steel 1.4571 (316 Ti). Thus, the user is able to measure even highly aggressive gases with laboratory accuracy.

Casing	Measuring Drum	Model No.	Max. Constant Use Temperature	
			°C	°F
PVC-transparent	PVC-grey	5	40	104
PP	PP	6	80	176
PVDF	PVDF	7	80	176
PE-el	PE-el	8	60	140
SS (316 Ti)	PVC-grey	1	40	104
SS (316 Ti)	PE-el	2	60	140
SS (316 Ti)	PP	3	80	176
SS (316 Ti)	PVDF	4	80	176

PVC = Polyvinyl Chloride
PE-el = Polyethylene electrically conductive
PVDF = Polyvinylide Fluoride
PP = Polypropylene
SS = Stainless Steel
US: 316 Ti, GER: 1.4571

Packing Fluid

The measurement principle of drum-type gas meters requires the meter to be partly filled with a so called “packing liquid“. The high accuracy of RITTER™ drum-type gas meters is achieved by the precise setting of the packing liquid level.
Ordinary tap water is a suitable packing liquid for most gases. For those applications in which water is not suitable, RITTER™ recommends and supplies the following alternatives:

Ondina-909 is a paraffinic medical mineral „white” oil, which can be used for gases which are highly soluble in or reactive with water. Appearance: colourless, clear and odourless.

Autin-B is a paraffin „white“ oil with higher viscosity than Ondina-909 for use with lower and higher temperatures. Appearance: colourless and odourless.

CalRiX is ideal for use with the most aggressive gases under the most exacting measurement conditions. It is a synthetic fluid which is completely inert to almost all gases.

Maintenance

None

Standard Equipment

• Multi-chamber rotary measuring drum with counter mechanism • Large needle-dial readout • 8-digit accumulating counter • Liquid-level indicator for packing fluid • Supports for thermometer and manometer • Bubble level for levelling with adjustable feet.

Options /Accessories Available

• Windows software "Rigamo" for data acquisition by PC • High Precision Packing Liquid Level Indicator "HPLI" **(patented)** • Thermometer (gas) • Thermometer (packing fluid) • Manometer • LCD display, resettable • Pulse Generator • Electronic Display Unit "EDU 32 FP" • Custom meter design.

Dimensions: (approximate)

Type	Model	(mm) H	W	L		(inches) H	W	L
TG 05	1 – 4	310	265	380		12.2	10.4	15.0
	5 – 8	320	270	350		12.6	10.6	13.8
TG 1	1 – 4	310	265	380		12.2	10.4	15.0
	5 – 8	320	270	380		12.6	10.6	15.0
TG 3	1 – 4	410	363	445		16.1	14.3	17.5
	5 – 8	375	330	405		14.8	13.0	15.9
TG 5	1 – 4	410	363	445		16.1	14.3	17.5
	5 – 8	375	330	460		14.8	13.0	18.1
TG 10	1 – 4	470	420	590		18.5	16.5	23.2
	5 – 8	470	410	560		18.5	16.1	22.0
TG 20	1 – 4	560	484	610		22.0	19.1	24.0
	5 – 8	545	505	615		21.5	19.9	24.2
TG 25	1 – 4	560	517	645		22.0	20.4	25.4
	5 – 8	640	550	665		25.2	21.7	26.2
TG 50	1 – 4	725	675	740		28.5	26.6	29.1
	5 – 8	725	680	755		28.5	26.8	29.7

TG 1 Model 6 (PP) LCD Display

TG 5 Model 1 (SS/PVC)

Weight (approximate; without packing fluid)

Type	Model 1 kg	lb	Model 2&3 kg	lb	Model 4 kg	lb	Model 5 kg	lb	Model 6&8 kg	lb	Model 7 kg	lb
TG 05	8.3	18.3	8.2	18.1	8.5	18.7	4.0	8.8	3.0	6.6	5.0	11.0
TG 1	8.5	18.7	8.3	18.3	8.9	19.6	4.3	9.5	3.1	6.8	5.1	11.2
TG 3	15.8	34.8	15.7	34.6	16.2	35.7	6.3	13.9	4.5	9.9	8.1	17.9
TG 5	15.0	33.1	14.8	32.6	15.2	33.5	7.1	15.7	4.9	10.8	9.2	20.3
TG 10	25.6	56.4	25.2	55.6	25.8	56.9	10.6	23.4	7.8	17.2	13.6	30.0
TG 20	31.6	69.7	31.2	68.8	32.4	71.4	18.0	39.2	13.4	29.5	23.2	51.2
TG 25	40.0	88.2	39.6	87.3	40.8	90,0	26.7	58.9	19.4	42.7	34.5	76.1
TG 50	91.0	201	90.0	198	94.2	208	57.0	126	40.7	89.7	73.3	162

Configuration Work Sheet

Gases to be measured:

_____

_____

_____

_____

_____

Line pressure:

☐ Maximum _____

☐ Minimum _____

Max. Gas Temperature:

☐ 40 °C / 104 °F

☐ 60 °C / 140 °F

☐ 80 °C / 158 °F

Packing Fluid:

☐ Water

☐ *Ondina 909*

☐ *Autin-B* „White" Oil

☐ *CalRiX*

Flow Rate Required:

☐ 1-60 l/h ☐ 20-1,200 l/h

☐ 2-120 l/h ☐ 40-4,000 l/h

☐ 6-360 l/h ☐ 50-7,000 l/h

☐ 10-600 l/h ☐ 100-18,000 l/h

☐ Other: _____

Model (Number):

☐ PVC (5) ☐ SS/PVC (1)

☐ PP (6) ☐ SS/PE-el (2)

☐ PVDF (7) ☐ SS/PP (3)

☐ PE-el (8) ☐ SS/PVDF (4)

Accessories:

☐ Data acquisition software

☐ Digital Input Module "DIM"

☐ Thermometer (Gas)

☐ Thermometer (Pack. Fluid)

☐ Manometer

☐ Electr. Display Unit EDU 32

Options (built-in):

☐ Pulse Generator

☐ LCD display, resettable

☐ High Precision Level Indicator

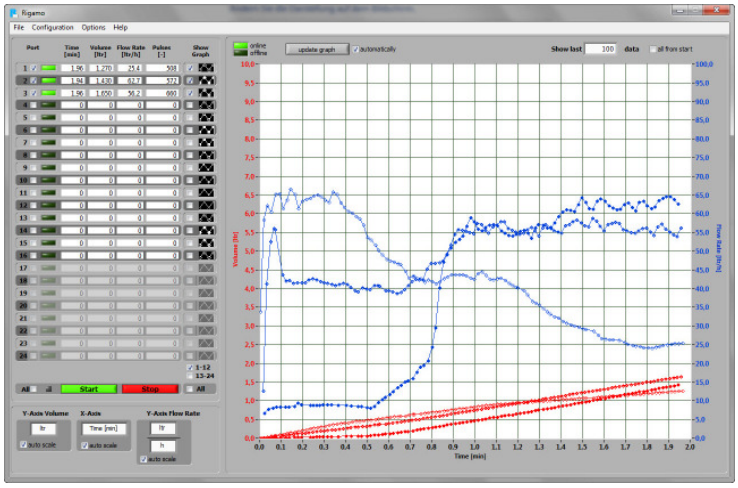
Data Acquisition Software “Rigamo” (Accessory)

Software Features

- Data acquisition of gas volume and flow rate from Ritter gas meters to a PC (USB port)
- Acquisition from max. 24 meters
- Support of multi-core processor
- Graphical and tabular display of data
- Storing of data
- Export of data to Microsoft Excel® spread-sheet

System Specification

- Gas meter with built-in pulse generator (option)
- Digital Input Module “DIM" (accessory)
- Operation system Windows XP / Vista / 7
- Recommended processor performance: >=1.5 GHz
- 2 free USB ports



Pulse Generators (Option)

Application

The Ritter™ Pulse Generators are rotary encoders with pulsed electronic output. The number of pulses is equivalent to the volume of measured gas and can be transferred to a data acquisition system.

Available versions

- V2.0: For ex-proof areas with inductive sensor, 50 pulses/rev.
- V3.2: 200 pulses per revolution
- V4.01: 2x200 pulses/rev. for forward / backward recognition
- V4.11: 500 pulses per revolution

Electronic Display Unit EDU 32 FP (Accessory)

Front view

Application

The EDU 32 FP accessory is a microcomputer-controlled counter and display unit. It is designed to be used in combination with all RITTER™ gas meters which are equipped with a Pulse Generator. The EDU 32 FP counts and displays the absolute volume and flow rate of gases flowing through the RITTER™ meter.

It consists of a unit in a separate desk top casing with a two-line text LCD display. The EDU 32 FP is programmable and provides the user with a number of adjustment options.

Features

- Large 2-line LCD display
- Programmable functions:
  Gas Meter type, display language (English/German), etc.
- Display of:
  - measured **gas volume**
  - actual **flow rate**
  - selected gas meter
- Interface **RS 232** for data transmission to PC
- Analogue **output:**
  4 - 20 mA or 0 - 1 Volt
- Mains and battery operation

Technical Data

Power supply:	110 V / 60 Hz or 230 V / 50 Hz
Input:	Pulses from Pulse Generator
Digital Output:	Interface RS 232 Signal: ± 15 Volts Transmission rate: 9,600 Baud Data = 8 Bit, Parity = N, Stopbit = 1
Analog Output:	0 - 1 Volt or 4 - 20 mA
Dimensions:	155 x 200 x 120 mm
Weight:	1.4 kg
Temperature Range:	0°C to + 50°C

Rear view

MilliGascounter®

Type MGC-1

MGC-1 (Mod. PMMA / PVDF)

Features:

- Minimum flow rate **1 ml/h**
- Maximum flow rate **1 ltr/h**
- Resolution (measurement cell volume): approx. **3 ml**
- Accuracy ±3% / ±1% [1]
- Use with inert and slightly corrosive gases (biogas) and aggressive gases
- Materials (casing/measurement cell): PMMA/PVDF, PVDF/PVDF, PVC/PVC
- Digital display with programmed calibration factor
- Battery operated; battery life-time 4-5 years
- Low maintenance

Applications

The MilliGascounter[2] (MGC) is designed for the volumetric measurement of small amounts of gas with ultra-low flow rates. It is suitable for measuring all inert, slightly corrosive gases such as **biogas** (PMMA model), and aggressive gases (PVDF model).

Measurement Principle

See description on rear side.

Measuring-Range

The minimum flow rate is theoretically zero ltr/h, as there are no mechanical limitations with the MGC which would restrict a minimum flow.

However, at such micro flow rates, there are external influences which become evident (temperature and pressure variation, tightness of the hose connection, permeability of the gas inlet hose). The **minimum flow rate** has therefore been defined as **1 ml/h**. The **maximum flow rate is 1.0 ltr/h**.

[1] Accuracy

Because of the physical measurement principle, the measurement error is dependent on the flow rate and rates ±3% across the full flow rate range.

Each MGC is individually calibrated at the standard flow rate of 0.5 ltr/h so that the measurement error is approx. 0% at this flow rate. At minimum flow rate the measurement error is approx. +3%, at maximum flow rate approx. -3%.

The Rigamo software which is available by option provides an algorithm, which automatically recalculates the actual measurement data to the real volume at the respective actual flow rate on the basis of the calibration curve. The **remaining error is smaller than ±1% across the full flow rate range**.

The volume is **measured** with a **resolution of approx. 3 ml which is the volume of the measurement cell.**

Display, Signal Output

The volume of the measured gas is displayed on an electronic digital display located on top of the MGC casing.

Additionally a floating reed contact can be used as a signal output.

Models

The MGC is available in the following materials concerning casing and measurement cell:

Casing	Meas.Cell	Photo
PMMA	PVDF	
PVDF	PVDF	
PVC red	PVC red	

[2] *Developed at the University of Applied Sciences Hamburg, Prof. Dr. Paul A. Scherer*

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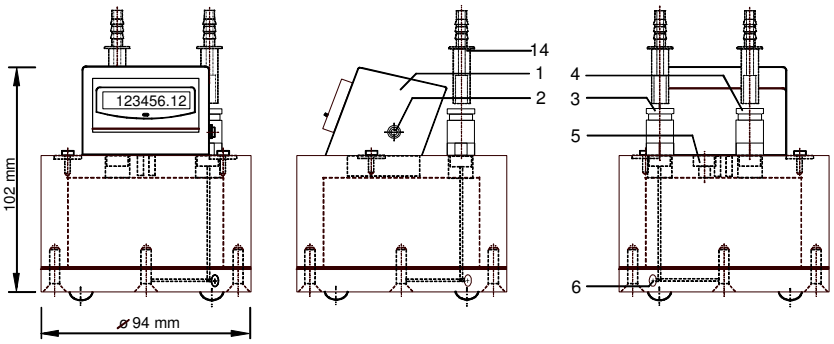
Gas Meters ... where Perfection becomes Reality



(1) Digital Display

(2) Signal Output (reed contact)

(3) Gas Inlet

(4) Gas Outlet

(5) Air-vent screw for filling

(6) Revision screw micro capillary

(14) Hose connection adapter for flexible hoses (PMMA-model only)

Performance Specifications

Minimum flow rate Q_{min}	1	ml/h	Measuring accuracy [3]	±3 / ±1	%
Maximum flow rate Q_{max}	1 (0.6)[1]	ltr/h	Gas inlet pressure at measurement start [4]	9	mbar
Minimum gas inlet pressure	5	mbar			
Maximum gas inlet pressure	**100**	**mbar**	Operating temperature	+10 ~ +40	℃
Display accuracy [2]	0.01	ml	Gas connection PMMA	Plug-in connector	
Meas. chamber volume, approx.	3 (2)[1]	ml	Gas connection PVC	Hose barb	
Packing liquid quantity, approx.	120	ml	Gas connection PVDF	Compression fitting	

[1] Value in bracket for PVC model

[2] For display of volume corrected by calibration factor with 2 decimals

[3] Without / with software “Rigamo” across the whole measurement range.

[4] Higher gas inlet pressure until gas inlet channel and micro capillary in base plate are clear of packing liquid

Standard Equipment

Electronic counter / display	Cleaning rod for micro capillary
Signal output (reed contact), floating output, 0.1 sec., max. load 100 V/DC / 0.33 A	Gas inlet / outlet nozzles: PMMA-casing: Plug-in connector $\varnothing_i$ 8 mm PVDF-casing: Compression fitting $\varnothing_i$ 8 mm PVC-casing: Hose barb $\varnothing_a$ 8 mm
Twin measuring chamber	
200 ml packing liquid	
1.5 m connection tubing (PVC)	

Accessories

Software “Rigamo” for data acquisition by PC	Gas connection tubing (PVC or PVDF)
Packing liquid 100 / 500 / 1,000 ml	

Measurement Principle with Schematic:

The gas to be measured flows through the gas inlet nozzle (1) and micro capillary tube (2) within the base plate into the casing of the MGC which is filled with a packing liquid (3).

The gas rises as small bubbles through the packing liquid and is collected in the measurement cell (4).

The measurement cell consists out of two measuring chambers (5), which are filled successively by the rising gas bubbles. When a measuring chamber is filled, the buoyancy of the filled chamber causes the measurement cell to tip over abruptly into such a position that the second measuring chamber begins to fill and the first one is emptied at the same time.

The tilting procedure of the measurement cell creates by means of the permanent magnet (6) on top of the cell and one of the two magnetic sensors (reed contacts) a pulse which is registered by the counter unit (8).

For external data logging (PC) the switching pulses of the second reed contact can be obtained via the signal output socket (9).

The measured gas escapes through the gas output nozzle (7).