

(Inside illumination as option available.)



PRESENTING
THE ALL-NEW
UNIQUE RITTER
DIP PIPE DESIGN
FOR CO₂ ABSORPTION
BETTER THAN 99%
NOW!

Biogas Batch Fermentation System

with Automatic Data Logging in Real Time

Maximum precise measurement results with individually calibrated RITTER MilliGascounters

RITTER Engineering has been successfully working in the field of plastic engineering for 65 years. Among other products RITTER manufactures Gas Flow Meters made of various superior plastics and high grade stainless steel. RITTER meters are used world-wide in research & development laboratories as well as in industry.

The MilliGascounter was developed for the volumetric measurement of the smallest amounts of gas with ultra-low flow rates. These small devices are suitable for measurement of inert, and slightly corrosive biogas, as well as most aggressive gases.

Each MilliGascounter is individually calibrated and supplied with an individual calibration certificate.

As a result, maximum measurement accuracy is guaranteed which provides the necessary basis for any research.

In the field of the biogas research the RITTER MilliGascounter became a central component of a system allowing investigation of fermentation processes with up to 18 PMMA fermentation bottles in a heating oven at the same time.

This RITTER Biogas Batch Fermentation System enables automatic measurement with data acquisition in real time.



National PTB certificates for all Ritter master meters

±1%

Measurement accuracy over the whole measuring range with »RIGAMO« software and with calibration certificate for each MilliGascounter.

By PTB calibration of RITTER master meters the traceability to the national primary standard for each MilliGascounter is given.

»Wouldn't it be great to receive multiple results at one time – especially when measuring very small gas volumes in biogas research and development?«



The RITTER Biogas Batch Fermentation System with automatic data logging in real time

The primary advantage of the RITTER Biogas Batch Fermentation System is the uniform tempering of the entire fermentation bottle inside the heating oven. In contrast to tempering the fermentation bottles in a water bath there will be no uncontrolled cooling of the upper part of the bottles by air and air currents. All temperature deviations can be minimized by e.g. an optional inner glass door of the heating oven for visual inspections.

Features:

- > Batches of up to ...
 - > 18 RITTER PMMA Fermentation Bottles (1 ltr) and 18 RITTER MilliGascounters in heating oven type FD 115 (116 ltr)
 - > 9 RITTER PMMA Fermentation Bottles (1 ltr) and 9 RITTER MilliGascounters in heating oven type FD 56 (60 ltr)
- > **Individual volumetric calibration of each MilliGascounter, traceable to the German National Primary Standard (PTB)**
- > Automated data acquisition of gas volume and flow rate from biogas batch fermentation systems through real time data logging with Windows® software »RIGAMO«. (suitable for up to 24 RITTER MilliGascounters)
- > Graphical and tabular display, printing and storing of measurement data.
- > Export of stored data to Microsoft Excel®.
- > Advantage: In contrast to tempering the fermentation bottles in a water bath the entire bottle is heated inside the heating oven. An (uncontrolled) cooling of the upper part of the bottles by air and air currents is eliminated.

It is recommended - especially for anaerobic fermentation tests - to equip the system with the option »Inner glass door« . As a result all temperature deviation by opening the outer door is greatly reduced.

The RITTER Biogas Batch Fermentation System is available in packages with 8 or 16 PMMA fermentation bottles.

8x

- > **1x Heating oven FD56** with lead-through in heating oven top panel for gas tubing
- > **1x Tube distribution frame** for MilliGascounters on top panel of heating oven
- > **8x MilliGascounters** MGC-1 PMMA
- > **8x Tubing connection** from fermentation bottle to MilliGascounter
- > **8x PMMA Fermentation Glass Bottle**, 1 ltr
- > **8x Stirring device** for fermentation bottles
- > **1x Control unit** for stirring devices incl. power supply unit
- > **1x Licence** for »RIGAMO«-Software 8-Channel
- > **1x Digital Interface Module (»DIM«)** 8-Channel

16x

- > **1x Heating oven FD115** with lead-through in heating oven top panel for gas tubing
- > **1x Tube distribution frame** for MilliGascounters on top panel of heating oven
- > **16x MilliGascounters** MGC-1 PMMA
- > **16x Tubing connection** from fermentation bottle to MilliGascounter
- > **16x PMMA Fermentation Glass Bottle**, 1 ltr
- > **16x Stirring device** for fermentation bottles
- > **1x Control unit** for stirring devices incl. power supply unit
- > **1x Licence** for »RIGAMO«-Software 16-Channel
- > **1x Digital Interface Module (»DIM«)** 16-Channel

8x


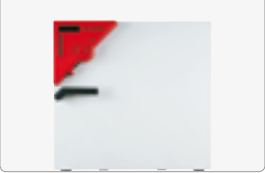

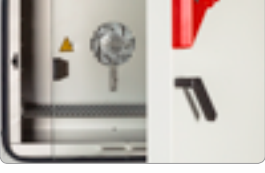


16x



„Worldwide - with the precision of the original!“

Overview of system components

Basic elements

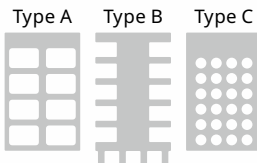
 <p>1A 1</p>	<p>Heating Oven Type 1A Fa. Binder / Model: FD 115 / Volume 116 ltr</p> <ul style="list-style-type: none"> Suitable for max. 18 x 0.5 ltr / 18 x 1 ltr / 12 x 2 ltr PMMA fermentation bottles Air circulation by forced convection (fan) Temperature range from 5°C above room temperature to 300°C (with option "Inner Glass Door" limited to 100°C) Control panel with LCD display Digital temperature setting, increment 0.1°C Adjustable ventilation via front control panel and rear exhaust Ø 50 mm USB interface for recording of heating oven data <table border="1"> <tr> <td>Outside</td> <td>Dimensions W 710 mm x D 676 mm x H 735 mm</td> <td rowspan="2">Weight 50 Kg</td> </tr> <tr> <td>Inside</td> <td>Dimensions W 530 mm x D 385 mm x H 550 mm</td> </tr> </table>	Outside	Dimensions W 710 mm x D 676 mm x H 735 mm	Weight 50 Kg	Inside	Dimensions W 530 mm x D 385 mm x H 550 mm	
Outside	Dimensions W 710 mm x D 676 mm x H 735 mm	Weight 50 Kg					
Inside	Dimensions W 530 mm x D 385 mm x H 550 mm						
 <p>1B 1</p>	<p>(Alternatively) Type 1B Fa. Binder / Model: FD 56 / Volume 60 ltr</p> <ul style="list-style-type: none"> Suitable for 9 x 0.5 ltr / 9 x 1 ltr / 9 x 2 ltr PMMA fermentation bottles <table border="1"> <tr> <td>Outside</td> <td>Dimensions W 560 mm x D 636 mm x H 625 mm</td> <td rowspan="2">Weight 39 Kg</td> </tr> <tr> <td>Inside</td> <td>Dimensions W 420 mm x D 345 mm x H 440 mm</td> </tr> </table>	Outside	Dimensions W 560 mm x D 636 mm x H 625 mm	Weight 39 Kg	Inside	Dimensions W 420 mm x D 345 mm x H 440 mm	
Outside	Dimensions W 560 mm x D 636 mm x H 625 mm	Weight 39 Kg					
Inside	Dimensions W 420 mm x D 345 mm x H 440 mm						
 <p>2 1 1</p>	<p>Lead-through in heating oven top panel for gas tubing</p> <ul style="list-style-type: none"> Diameter 50 mm Delivered with silicon plug 						
 <p>3</p>	<p>Inner Glass Door for Heating Oven FD115 1A and FD 56 1B (Option)</p> <ul style="list-style-type: none"> Visual control of oven content without major temperature loss when opening front door. Factory-adjusted limitation of temperature control up to 100°C. <p>This option is recommended especially for anaerobic fermentation tests because a temperature loss of the fermentation bottles is greatly reduced when opening the outer door.</p>						
 <p>4 1 1</p>	<p>Tube distribution frame for MilliGascounters on top panel of heating oven</p> <ul style="list-style-type: none"> Material: Plexiglass PMMA, for max. 16 MGC's with FD115 / 8 MGC's with FD56 Easy positioning of MilliGascounters 10 Kink-free tube routing between fermentation bottles and MilliGascounters 10 (and optional CO₂ absorption bottles) <table border="1"> <tr> <td>Top panel for 1A</td> <td>Dimensions W 710 mm x D 528 mm x H 90 mm</td> <td>Weight 4.8 Kg</td> </tr> <tr> <td>Top panel for 1B</td> <td>Dimensions W 560 mm x D 488 mm x H 90 mm</td> <td>Weight 3.5 Kg</td> </tr> </table>	Top panel for 1A	Dimensions W 710 mm x D 528 mm x H 90 mm	Weight 4.8 Kg	Top panel for 1B	Dimensions W 560 mm x D 488 mm x H 90 mm	Weight 3.5 Kg
Top panel for 1A	Dimensions W 710 mm x D 528 mm x H 90 mm	Weight 4.8 Kg					
Top panel for 1B	Dimensions W 560 mm x D 488 mm x H 90 mm	Weight 3.5 Kg					
 <p>10 8 16</p> <p>±3% GUARANTEED</p> <p>±1% with »RIGAMO« software</p>	<p>MilliGascounter MGC-1 PMMA Type: MGC-1 PMMA / Material: Casing PMMA, measurement cell PVDF</p> <ul style="list-style-type: none"> Measuring range: 1 ml/h to 1 ltr/h Measuring accuracy: ±3% across the whole flow rate range (better ±1% with »RIGAMO« software 11 by dynamic correction of measurement errors) Including individual calibration certificate Volume measurement cell: 3 ml Equipment: Digital display, 200 ml packing liquid, 1.5 m connection tube, cleaning tool, syringe and bubble level (1 piece each for up to max. 5 pc.) Resolution (= min. measurement increment): 3ml Max. operating temperature 60°C Max. overpressure: 100 mbar <table border="1"> <tr> <td>PMMA / PVDF</td> <td>Dimensions ø 96 mm x H 112 mm</td> <td>Weight 468 g</td> </tr> </table>	PMMA / PVDF	Dimensions ø 96 mm x H 112 mm	Weight 468 g			
PMMA / PVDF	Dimensions ø 96 mm x H 112 mm	Weight 468 g					

Components for Fermentation Process

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8
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RITTER PMMA Fermentation Bottle with stirring device

Feature highlights

- > **Absolute gas-tight by magnetic coupling between stirring motor and stirring blade**
- > 1 x Connection for gas outlet port, PVDF screw-type tube connection \varnothing_i 4 mm, \varnothing_o 6 mm
- > 1 x Connection for flushing of headspace or sample extraction, PVDF screw-type tube connection \varnothing_i 4 mm, \varnothing_o 6 mm
- > Various bottle sizes: 0.5 / 1 / 2 ltr – custom sizes on request
- > High breaking strength by PMMA material (no fragile glass gas outlet nozzle)
- > Incl. stirring blade ...
 - > Type A (standard): Suitable for media with medium viscosity and small to medium size solid materials
 - > Type B (optional): Suitable for media with high viscosity and fibrous solid materials
 - > Type C (optional): Suitable for media with low viscosity and low amounts of solid material
- > Custom stirring blades available
- > Incl. PVC tubing (Rauclair) \varnothing_i 4mm, \varnothing_o 6 mm, 1,5 m

0,5 ltr	Dimensions with stiring device	H 110 mm x \varnothing 105 mm	Weight	0.95 kg
1,0 ltr	Dimensions with stiring device	H 190 mm x \varnothing 105 mm	Weight	1.1 kg
2,0 ltr	Dimensions with stiring device	H 350 mm x \varnothing 105 mm	Weight	1.4 kg

Technical Data

- > Stirring speed adjustable from 1 to 30 r/min
- > Clocked stirring 1 min / 1 min
- > Suitable for media with low and high viscosity ($\leq 450 \text{ mm}^2/\text{sec}$)
- > Temperature range: 10 – 55°C
- > Step motor 2 Ampere
- > Material fermentation bottle: PMMA crystal clear

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8
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Filter 0.45 micron with 2 tube nozzles

- > 1 filter per MilliGascounter
- > Incl. tube nozzles for tube \varnothing_i 4 mm / \varnothing_o 6 mm
- > Materials: Housing Acrylic, filter element PTFE, hose nozzles Polypropylene
- > Function: Filtering of particles in gas flow to avoid blockade of micro capillary of MilliGascounter
- > Easy mounting in tubing in front of check valve ²³

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8
16

Check valve with 2 tube nozzles

- > 1 check valve per MilliGascounter
- > Incl. tube nozzles for tube \varnothing_i 4 mm / \varnothing_o 6 mm
- > Materials: Housing PC, valve body Silicone, hose nozzles Polypropylene
- > Function: Prevents reverse flow* of ...
 - > ... packing liquid into fermentation bottle when used with MilliGascounter
 - > ... absorption liquid into fermentation bottle when used with CO₂ absorption bottle
- > Easy mounting in tubing behind filter ²³ and in front of MilliGascounter ¹⁰

* Reverse flow may be caused due to an underpressure in the fermentation bottle for example by a decrease of temperature in the bottle

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RITTER PMMA Fermentation Bottle without stirring device (optional)

- > 1 x Connection for gas outlet port, PVDF screw-type tube connection \varnothing_i 4 mm, \varnothing_o 6 mm
- > 1 x Connection for flushing of headspace or sample extraction, PVDF screw-type tube connection \varnothing_i 4 mm, \varnothing_o 6 mm
- > Various bottle sizes: 0.5 / 1 / 2 ltr – custom sizes on request
- > High breaking strength by PMMA material (no fragile glass gas outlet nozzle)

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*
*

Control unit for step motors of stirring devices

- > Voltage distributor for connection of stirring devices
- > Available for connection from 1 up to 16 stirring devices
- > Incorporated power-supply unit

Introducing the unique RITTER dip pipe



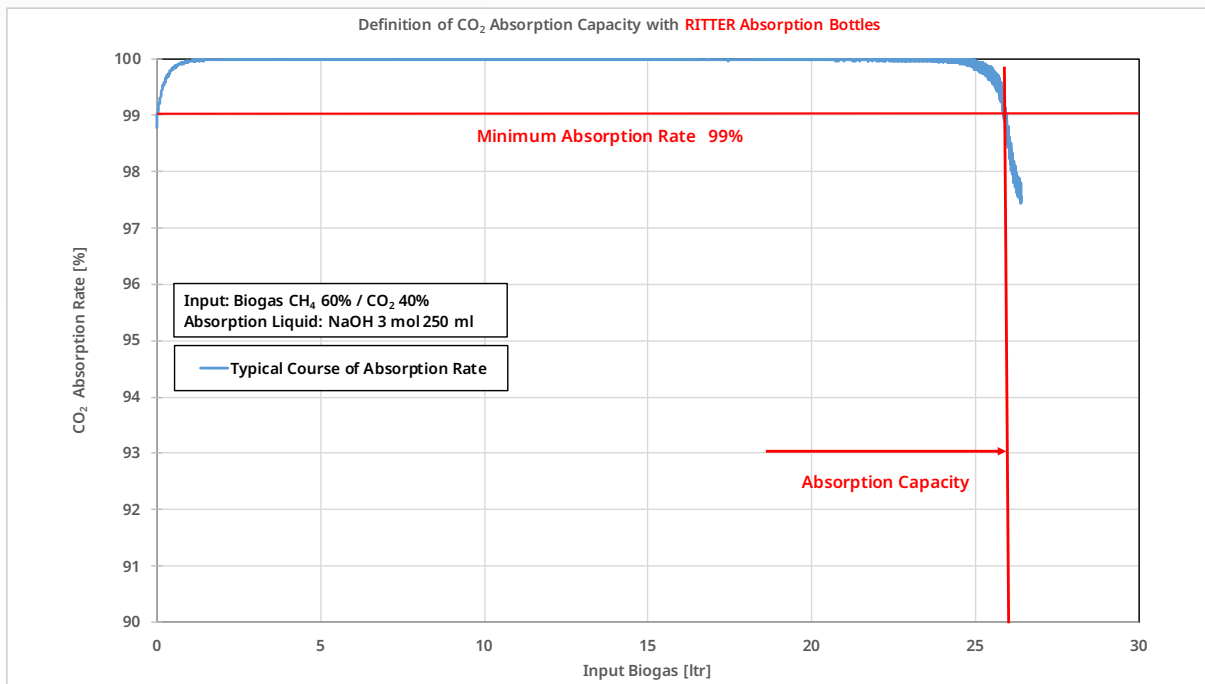
Ordinary systems for CO₂ absorption lead the biogas into the inside upper part of the absorption bottle, the gas thus wetting the absorption liquid surface. The real CO₂ absorption ranges between roughly 75% and 95%. Advanced systems are working with a dip pipe leading the gas into the absorption liquid. By bubbling the gas through the liquid, higher absorption rates can be obtained by the larger surface of the gas bubbles in contact with the liquid.

The ultimate advancement of the dip pipe system results in the unique RITTER dip pipe system: The lower end of the dip pipe is designed like a bell, holding the gas within the liquid. Both the large surface of the gas bubble inside of the bell as well as the long duration the gas bubble is kept in the bell result in the extraordinary absorption rate of better than 99%.

Another outstanding effect is the fact that the RITTER absorption system can operate without any absorption liquid indicator showing the limit of the absorption capacity. It is a general problem of such indicators that the colour doesn't change abruptly but continuously. Therefore, it is difficult for the user to recognize the true limit of the absorption capacity. In contrast to indicator systems the RITTER system guarantees a specific amount of CO₂ being absorbed at an absorption rate better than 99%.

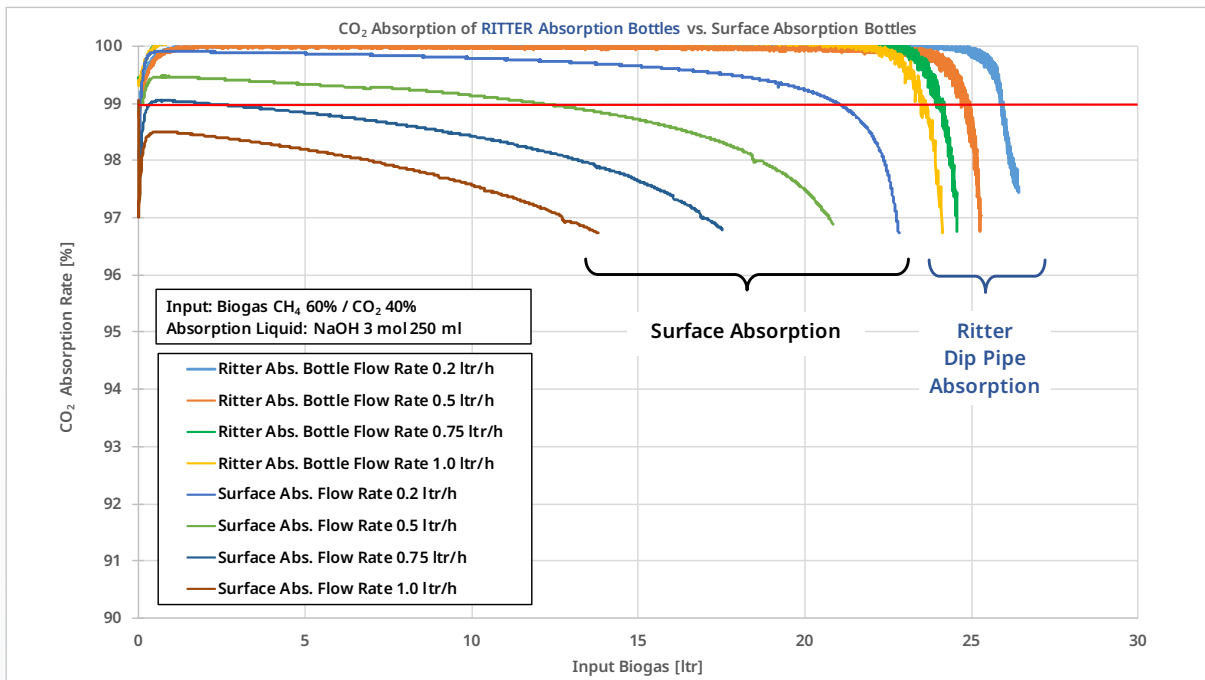
For example: The absorption capacity is approx. 10 ltr of CO₂ per 250 ml absorption bottle for biogas CH₄ 60% / CO₂ 40% and a volume flow of 0.2 ltr / h; corresponding to the input of approx. 25 ltr of biogas. See also table on page 8.

A new dimension of CO₂ absorption



Definition of CO₂ Absorption Capacity with RITTER Absorption Bottles:

The above diagram shows the definition of the CO₂ absorption capacity with the RITTER Absorption Bottle. The capacity limit is reached when the CO₂ absorption rate is reduced from 100% at start to 99%. That means: The CO₂ fraction of the biogas at the exit of the absorption bottle ranges between 0% and max. 1%. The remaining CH₄ fraction is measured and indicated by the MilliGascounter. The table of the measured and indicated CH₄ volume when reaching the absorption capacity is shown for various flow rates on page 8. Below of those stated volume values the user can be sure that the indicated CH₄ volume contains a maximum of 1% of CO₂.



CO₂ Absorption of RITTER Absorption Bottles vs. Surface Absorption Bottles:

The above diagram shows the CO₂ absorption rates of RITTER Absorption Bottles at various flow rates in comparison to those ones of common surface absorption bottles.

More than 99% CO₂-Absorption guaranteed with RITTER unique dip pipe design

Features

- › Absorption solution: 3-molar sodium hydroxide solution (NaOH 3Mol in aqua dest.)
- › Absorption bottle («bubbler»): Gas inlet via a dip pipe with a unique design, allowing an absorption of more than 99%
- › Volume of bubbler: 250 ml
- › Filling quantity of absorption solution: 250 ml per bubbler
- › CO₂ absorption capacities per bubbler: Please see the table on the bottom of this page
- › Absorption limit indicator: With the RITTER absorption system an absorption limit indicator is obsolete
- › Easy-connect PVDF screw-type tube nozzles allow quick connection to RITTER PMMA fermentation bottles (on the gas production side) and to RITTER MilliGascounters (on the measurement side)
- › Hanger (optional) made of PVC for 4 or 8 units of 250 ml bubblers

Application

The CO₂ Absorption System was developed by RITTER to absorb CO₂ from biogas reliably and with **guaranteed(!) more than 99%**.

Without indicator liquid for absorption limit! (Please see diagrams on page 7.) This absorption system combined with the »RITTER Biogas Batch Fermentation System«, provides the ideal solution for professional biogas research.

Operating Principle

The biogas generated in the fermentation bottles flows through a dip pipe into the bubbler containing the absorption solution. More than 99% CO₂ absorption will be achieved as a result of the large wetting surface of the biogas within the absorption liquid. This is made possible by the unique RITTER dip pipe design.

Standard Equipment

- › Absorption bottle («bubbler») 250 ml with PP dip pipe, 2 PVDF screw-type tube nozzles for gas inlet and outlet
- › Check valve ⁽¹⁾ with tube connection adapters for tubing $\varnothing_1 = 4$ mm
- › Connection tubes made of special PVC

Accessories / Options

- › 3-molar sodium hydroxide solution, 1-ltr
- › Hanger made of PVC (recommended, requires »Tube distribution frame for MilliGascounters«, suitable for RITTER drying / heating ovens...
 - › FD115 (116 ltr) for each 8 bubblers 250 ml
 - › FD56 (60 ltr) for each 4 bubblers 250 ml
- › Tube distribution frame for MilliGascounters on top panel of drying / heating oven for kink-free tube routing between fermentation bottles, bubblers, and MilliGascounters (recommended)

⁽¹⁾ Please note: After gas production has stopped, some biogas including CO₂ will remain in the headspace of the fermentation bottles. Even without gas flow, this CO₂ fraction will continue to be absorbed by the bubblers. This can lead to under-pressure within the fermentation bottles, which may cause the absorption solution to flow back into the fermentation bottles. To prevent this, a check valve is delivered as standard with the system. It should be located in the tube between the fermentation and absorption bottles.

Technical Specifications

Absorption bottle ("bubbler")	Volume 250 ml Material: Borosilicate glass, Screw cap, wide mouth GL80, \varnothing 95 mm x H 106 mm				
Absorption solution	3-molar sodium hydroxide solution (NaOH 3Mol in aqua dest.) Filling quantity per bubbler: 250 ml, delivered in 1-liter bottles				
CO ₂ absorption capacities	Volume Input Biogas CH ₄ 60% / CO ₂ 40% [ltr]	Flow Rate [ltr/h]			
	Indication of CH ₄ volume at MGC when reaching absorption rate of 99% [ltr]	0.20	0.50	0.75	1.00
Bubbler hanger	Material: light grey PVC, max. of 2 hangers per heating oven Dimensions W 505 x H 680 x \varnothing 125 mm, weight 4,6 kg				
Gas connections	PVDF screw-type tube nozzles for \varnothing_1 4 mm / \varnothing_0 6 mm tubes				
Connection tubes	Low diffusion special PVC, \varnothing_1 4 mm / \varnothing_0 6 mm				
Pressure loss per bubbler	approx. 4 mbar				

CO₂ Absorption System (Option)

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Complete CO₂ Absorption System with following components:

- > 8 / 16 Absorption bottles
- > 2 Hanger for 4 or 8 absorption bottles each

Components for CO₂ Absorption (Option)

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Absorption Bottle

- > CO₂ absorption rate better than 99%
- > CO₂ absorption capacities: See table at the bottom on page 8
- > With unique dip pipe design and PVDF screw-type tube coupling
- > Including tubing to fermentation bottle and to MilliGascounter \varnothing_1 4 mm / \varnothing_0 6 mm
- > Volume 250 ml, overall dimensions \varnothing 70 mm x H 200 mm, weight 290 g

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Hanger for Absorption Bottles

- > Suitable for ...
 - a) 8 Absorption bottles 250 ml, suitable for heating oven FD115 (116 ltr) ^{1A}
... for FD115 Dimensions W 528 mm x H 668 mm x D 125 mm Weight 4.9 kg
 - b) 4 Absorption bottles 250 ml, suitable for heating oven FD56 (60 ltr) ^{1B}
... for FD56 Dimensions W 488 mm x H 380 mm x D 125 mm Weight 2.6 kg
- > Material: PVC grey
- > Maximum of 2 hangers per heating oven
- > Requires »MilliGascounter Tube Distribution Frame« ⁴

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Absorption solution

- > Caustic soda solution (NaOH 3Mol in aqua dest.)
- > Filling quantity per absorption bottle: 250 ml
- > Delivery in bottles of 1 ltr

Please note: Due to transportation restrictions, the absorption solution might have to be purchased locally. Please contact RITTER!

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Indicator for indication of saturation limit

An indication liquid is obsolete for the RITTER CO₂ absorption system as RITTER guarantees a CO₂ absorption rate of more than 99%. Please see table of CO₂ absorption capacities on page 8.

⁸ Component of package for 8 fermentation bottles / ¹⁶ Component of package for 16 fermentation bottles / Figure inside box: Quantity of article in package
Subject to alterations. Please check our website for latest product updates at: www.ritter.de/en/products/fermentation-system/
Most components can be customized to match individual requirements. Do not hesitate to contact us directly!

Components for Condensate Separation (Option)



Condensate Separator for fermentation bottles

- › Flask with inside cooling spiral for water or air cooling
- › Gas connection: 2 x hose nozzle D 4 mm for tube \varnothing_1 4 mm / \varnothing_0 6 mm
- › Water connection: 2 x hose nozzle D 4 mm for tube \varnothing_1 4 mm / \varnothing_0 6 mm

Functional principle: For cooling by water the Condensation Separator is to be connected to a water circulation. If the difference between room and gas temperature is sufficient for condensate formation, the condensation can be done without water cooling.



Fixture for Condensate Separator

- › SS rod with clamp fixture holding the condensate separator
- › Easy mounting: The SS rod with clamp fixture is inserted into the »MilliGascounter Tube Distribution Frame«

Components for Data Acquisition in Real Time

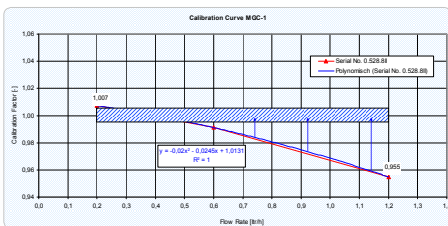


»RIGAMO« Software for data acquisition

Type: RIGAMO-V3.1

- › Improves the measurement accuracy of MilliGascounter ¹⁰ from $\pm 3\%$ to better than $\pm 1\%$ across the whole flow rate range by algorithm using individual calibration data
- › Software features
 - › Windows software (XP / Vista / 7 / 8 / 10) for data acquisition of gas volume and flow rate from up to 24 Ritter gas meters to a PC USB port. Attention: RIGAMO can only be started once at a time on a single PC
 - › Graphical and tabular real-time display of acquired data
 - › Storing of data
 - › Export of stored data to Microsoft Excel
 - › Automatic correction of the dynamic measurement error (flow rate dependent) only with MGC ¹⁰.
 - › No support of bi-directional recognition of measuring drum rotation with Pulse Generator V4.01
 - › »RIGAMO« is designed to run on one PC with only one Digital Input Module ⁹².

Please note the system specifications listed below ***



1-channel-type

Licence for »RIGAMO« Software

Types: 1-/4-/8-/16-/24-Channel licences / Model: USB-Dongle

- › Enables data acquisition for a defined amount of gas meters according to the number of licences



16-channel-type

Digital Input/Interface Module (»DIM«)

Types: 1-/4-/8-/16-/24-Channel / Model: Plastic casing

- › Pulse acquisition from MilliGascounter ¹⁰ and forwarding to PC
- › Input: phone jack socket for connection of MilliGascounter ¹⁰
- › Output: USB socket for PC connection
- › Data transmission cables to MilliGascounter ¹⁰ L=5m und zum PC L=1m



1-channel	Dimensions W 114 mm x H 96 mm x D 78 mm	Weight 183 g
4-channel		Weight 914 g
8-channel		Weight 947 g
16-channel	Dimensions W 185 mm x H 182 mm x D 90 mm	Weight 1,013 g
24-channel		Weight 1,080 g

No false readings with RITTER MilliGascounters due to CO₂ absorption

In contrast to other suppliers, RITTER provides the possibility of measuring the **total** biogas volume from fermentation test consisting of methane **and** carbon dioxide. However, the high solubility of CO₂ (0.8 ltr CO₂ / 1 ltr water) is a problem with all measurements of CO₂. In order to minimize the measurement error with the volumetric measurement by the MilliGascounter, RITTER uses acidulated distilled water (HCl 1.8%) as packing liquid.

The diagram on the right side shows the calibration curve of the MilliGascounter with synthetic biogas (CH₄ 40% / CO₂ 60%) vs. a reference curve with room air containing no significant amount of CO₂.

Discussion of those calibration curves:

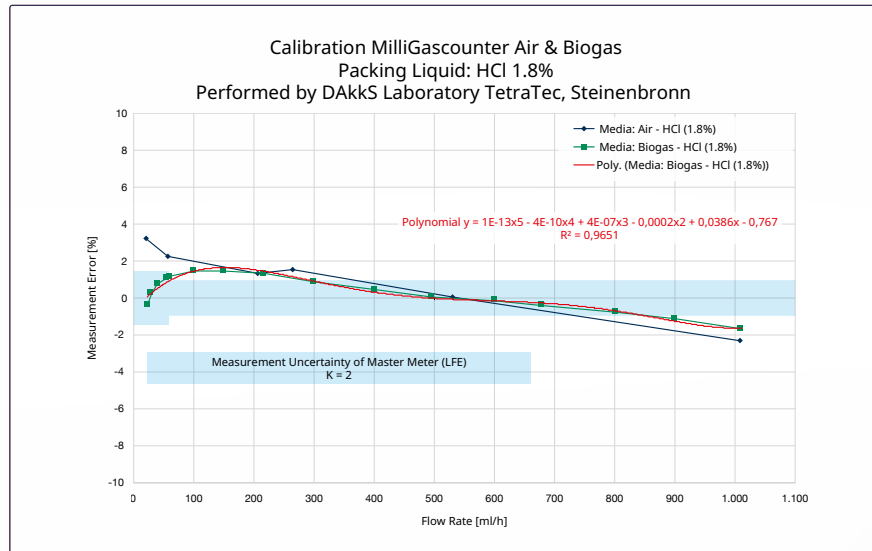
Above a flow rate of approx. 100 ml/h the curves of room air and biogas can be seen as more or less equal taking the measurement uncertainty into account.

Below that flow rate (which is a flow rate range many fermentation tests are operating in, at least during the last 2/3 of the tests) the biogas curve shows smaller values than that one of room air. In this area the remaining CO₂ absorption results in this deviation. However, the measured and indicated values tend to zero values thus reducing the measurement error. Furthermore, values unequal to zero are corrected by the optional "Rigamo" software. Rigamo uses a polynomial regression algorithm(*) basing on the very calibration data of the respective MilliGascounter. This algorithm corrects the measurement results dynamically, that means as a function of the flow rate. The remaining error is smaller than ±1% across the full flow rate range.

By the way:

When comparing our MilliGascounters with other systems, please ask for the calibration data or calibration curve.

(*) The actual software version uses a third order polynomial, a future version will use a fifth order polynomial.



*** System specifications for the »RIGAMO« Software for data acquisition

- > Gas meter with built-in pulse generator (MilliGascounter standard)
- > Digital Input Module »DIM« 92 (option)
- > Licence for requested number of connected gas meters (license dongle 91)
- > Operation system Windows XP / Vista / 7 / 8 / 10
- > Microsoft Excel® 2003 or higher for data export to Microsoft Excel
- > Recommended processor performance: ≥ 1.5 GHz
- > Random access memory (RAM): ≥ 500 MB
- > 2 free USB ports (1 for data acquisition, 1 for license dongle 91)
- > Monitor 17" (optimised for resolution of 1280x1024 pixel)



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