Suitable for: RITTER Drum-type Gas Meters

Measuring Ranges:

0 °C	to + 60°C,	scale graduation 0.5°C
0 °C	to + 50°C,	scale graduation 0.1°C
0 °C	to + 125°C,	scale graduation 1°C
15 °C	to + 30°C,	scale graduation 0.1°C

Application:

The Thermometer (Gas) can be used for measurement of the gas temperature while measuring the gas flow. Among other reasons, this is necessary if the measured and indicated **actual volume** of gas must be recalculated into the **norm volume**. The **actual** volume is the volume at the **actual** temperature and the **actual** pressure. The **norm volume** of a gas is the volume at **norm conditions** which are (in Germany):

Norm temperature	=	273.15	Kelvin (= 0 °C)
Norm pressure	=	1,013.25	mbar

The formula for converting the **actual volume** into **norm volume** is:

$$V_N = V_i \times \frac{P_a}{P_N} \times \frac{T_N}{T_i}$$

where

V_N	=	Norm Volume in	[ltr]
V_i	=	indicated Volume in	[ltr]
p_N	=	Norm Pressure in	[mbar-absolute]
p_a	=	actual Pressure in	[mbar-absolute]
T_N	=	Norm Temperature in	[Kelvin]
T_i	=	indicated Temperature in	[Kelvin]

Installation:

Unpack the Thermometer. Unscrew the closing cap of the Thermometer (Gas) support on the Gas Meter. Mount the Thermometer by inserting carefully through the Thermometer (Gas) support (see middle picture above). Seal the Gas Meter's casing by tightly screwing the union nut which is attached to the Thermometer. Thus, the Thermometer is ready for use. The removed closing cap of the support can be stored easily by screwing it onto the respective thread support at the rear side of the Thermometer (Gas) support. (See arrow in the right-hand picture above.)

Suitable for: RITTER Drum-type Gas Meters

Measuring Ranges:

0 °C	to + 60°C,	scale graduation 0.5°C
0 °C	to + 50°C,	scale graduation 0.1°C
0 °C	to + 125°C,	scale graduation 1°C
15 °C	to + 30°C,	scale graduation 0.1°C

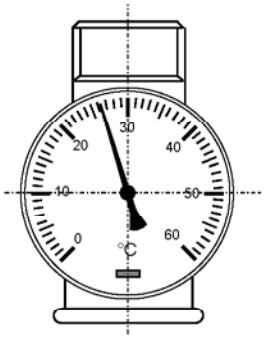
Application:

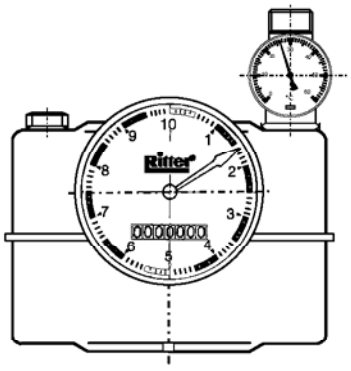
The Thermometer (Packing Liquid) can be used for measurement of the Packing Liquid temperature while measuring the gas flow.

According to the rules for calibration and measurement with Drum-type Gas Meters, the temperature of the Packing Liquid may vary from the gas temperature by up to 0.5 °C at most. A greater temperature deviation would cause too great a change to the gas temperature when the gas comes unavoidably into contact with the Packing Liquid during measurement. This temperature change would cause an unknown change in the volume of the measured gas which might lead to a measurement/indication error.

Installation:

Unpack the Thermometer. Unscrew the closing cap of the Thermometer (Packing Liquid) support on the Gas Meter. Mount the Thermometer by inserting carefully through the Thermometer (Packing Liquid) support (see middle picture above). Seal the Gas Meter's casing by tightly screwing the union nut which is attached to the Thermometer. Thus, the Thermometer is ready for use. The removed closing cap of the support can be stored easily by screwing it onto the respective thread support at the rear side of the Thermometer (Packing Liquid) support (see arrow in the right-hand picture above)





Suitable for:	RITTER Bellows-type Gas Meters
Measuring Range:	0° to +60°C
Resolution:	1°C

Application:

The Thermometer can be used for measurement of the gas temperature while measuring the gas flow. Among other reasons, this is necessary if the measured and indicated **actual volume** of gas must be recalculated into the **norm volume**. The **actual** volume is the volume at the **actual** temperature and the **actual** pressure. The **norm volume** of a gas is the volume at **norm conditions** which are (in Germany):

Norm temperature	=	273.15	Kelvin (= 0 °C)
Norm pressure	=	1,013.25	mbar

The formula for converting the **actual volume** into **norm volume** is:

$$V_N = V_i \, x \, \frac{P_a}{P_N} \, x \, \frac{T_N}{T_i}$$

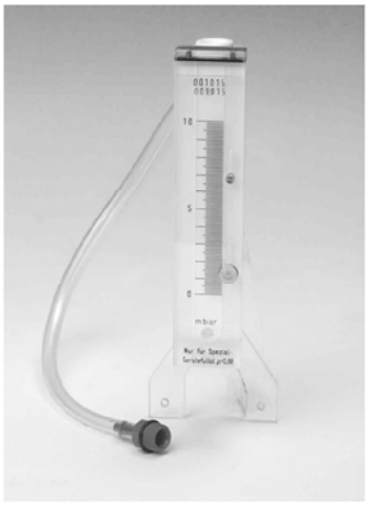
where

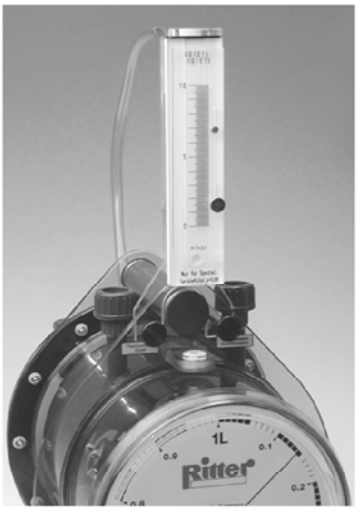
V_N	=	Norm Volume in	[ltr]
V_i	=	indicated Volume in	[ltr]
p_N	=	Norm Pressure in	[mbar]
p_a	=	actual Pressure in	[mbar]
T_N	=	Norm Temperature in	[Kelvin]
T_i	=	indicated Temperature in	[Kelvin]

Installation:

Unpack the Thermometer which is mounted into a T-piece. According to the rules for calibration and measurement with gas meters, the thermometer must be positioned at the gas outlet of the meter (see right picture above). The gas outlet nozzle is labelled accordingly.

Mount the Thermometer onto the gas outlet nozzle by tightly screwing the union nut which is attached to the Thermometer. Thus, the Thermometer is ready for use.





Suitable for:	RITTER Drum-type Gas Meters
Measuring Range:	0 to 10 mbar (over- / underpressure); also available: 0 to 20 mbar
Resolution:	0.1 mbar

Application:

The Manometer can be used for measurement of the gas pressure while measuring the gas flow. Among other reasons, this is necessary if the measured and indicated **actual volume** of gas must be recalculated into the **norm volume**. The **actual** volume is the volume at the **actual** temperature and the **actual** pressure. The **norm volume** of a gas is the volume at **norm conditions** which are (in Germany):

Norm temperature	=	273.15	Kelvin (= 0 °C)
Norm pressure	=	1,013.25	mbar

The formula for converting the **actual volume** into **norm volume** is:

$$V_N = V_i \, x \, \frac{P_a}{P_N} \, x \, \frac{T_N}{T_i}$$

where

V_N	=	Norm Volume in	[ltr]
V_i	=	indicated Volume in	[ltr]
p_N	=	Norm Pressure in	[mbar-absolute]
p_a	=	actual Pressure in	[mbar-absolute]
T_N	=	Norm Temperature in	[Kelvin]
T_i	=	indicated Temperature in	[Kelvin]

Note: The indicated gas pressure at the manometer is the differential pressure between the gas pressure at the gas inlet and the actual atmospheric air pressure. Thus, the actual gas pressure (p_a) of the above formula equals the **indicated gas pressure** at the Manometer **plus** the **actual atmospheric air pressure** in [mbar].

Installation:

Unpack the Manometer. Mount the Manometer into the Manometer support (see middle picture above). Unscrew the closing cap of the "Manometer Connection" port located at the "Gas Inlet" nozzle at the centre of the rear plate. The removed closing cap of the port can be stored easily by screwing it onto the respective thread support at the rear side of the Manometer. (See arrow in the

right-hand picture above.) Screw the closing cap, which is attached to the flexible Manometer pipe, tight to the "Manometer Connection" port.

Filling:

The Manometer must be filled unpressurised. It is to be filled with the blue Special-Equipment Filling Oil ("Spezial-Gerätefüllöl") provided with the Manometer. First remove the white thumb screw from the Filling Hole. Pour in the oil until the oil column reaches the "0"-mark at the adjustable scaled front plate (or until it comes close to the "0"-mark). If necessary, adjust the moveable plate to the exact liquid level by loosening the screw(s) and moving the plate.

Replace the white thumb screw. **Please note: Only the specially provided blue oil should be used with this Manometer** (Density 0.88)**!!** If the manometer is filled with an oil with a different density, the Manometer indication will inevitably be wrong.

Then, unscrew the closing cap of the "Manometer Connection" port located at the Gas Inlet nozzle (on the rear side of the Gas Meter casing). The removed closing cap of the port can be stored easily by screwing it onto the thread support on the rear of the Manometer (see arrow in the right-hand picture). Lastly, tightly screw the closing cap attached to the flexible Manometer tube, onto the " Manometer Connection" port.

The Manometer is then ready for use.

Prior to future measurements the correct position of the adjustable scaled front plate must be checked. For doing this, the manometer must be unpressurised. If the liquid level of the manometer column is not exactly at the "0"-mark of the adjustable scaled front plate, the plate must be adjusted accordingly.

Reading:

The oil column of the Manometer indicates the differential pressure in [mbar] of the gas between the Gas Inlet of the Gas Meter and the atmospheric pressure.

Caution: If the Manometer is connected to the gas inlet of the Gas Meter but **not** filled with oil, gas will leak through the Manometer. This will inevitably cause a **measurement error** of the Gas Meter.

Suitable for:	RITTER Drum-type Gas Meters
Measuring Range:	0 - 4 mbar with oil filling (γ = 0.88) 0 - 60 mbar with mercury filling (γ = 13.85) (both over- and underpressure)
Resolution:	0.1 mbar with oil filling (γ = 0.88) 1 mbar with mercury filling (γ = 13.85)

Application:

The Manometer can be used for measurement of the gas pressure while measuring the gas flow. Among other reasons, this is necessary if the measured and indicated **actual volume** of gas must be recalculated into the **norm volume**. The **actual** volume is the volume at the **actual** temperature and the **actual** pressure. The **norm volume** of a gas is the volume at **norm conditions** which are (in Germany):

Norm temperature	=	273.15	Kelvin (= 0 °C)
Norm pressure	=	1,013.25	mbar

The formula for converting the **actual volume** into **norm volume** is:

$$V_N = V_i \times \frac{P_a}{P_N} \times \frac{T_N}{T_i}$$

where

V_N	=	Norm Volume in	[ltr]
V_i	=	indicated Volume in	[ltr]
p_N	=	Norm Pressure in	[mbar-absolute]
p_a	=	actual Pressure in	[mbar-absolute]
T_N	=	Norm Temperature in	[Kelvin]
T_i	=	indicated Temperature in	[Kelvin]

Note: The indicated gas pressure at the manometer is the differential pressure between the gas pressure at the gas inlet and the actual atmospheric air pressure. Thus, the actual gas pressure (p_a) of the above formula equals the **indicated gas pressure** at the Manometer **plus** the **actual atmospheric air pressure** in [mbar].

General:

The inclined tube manometer consists of a acryl glass block 30 mm thick. The size of the board corresponds to the individual measuring range. The liquid container and the measuring column are built into this block. The measuring scale is adjustable, which allows for a quick an easy setting to zero point.

Installation:

Unpack the Manometer. Mount the Manometer to the Manometer support by screwing the two provided knurled screws to the support unit (see right-hand picture above). Unscrew the sealing plug of the "Manometer Connection" port located at the "Gas Inlet" nozzle at the centre of the rear plate. The removed sealing plug of the port can be stored easily by screwing it into the respective thread support at the rear side of the meter handle. Screw the hose tap nozzle, which is attached to the flexible pressure supply pipe, tight to the "Manometer Connection" port.

Adjusting of the manometer:

For exact horizontally adjusting each inclined tube manometer is provided with a bubble level. For easy adjusting there are two suspension eye hooks one of which is slot shaped. After releasing both the fixing screw on top of the manometer as well as the screw inside the slot, the manometer can be adjusted. After adjusting both screws must be fixed again.

Filling:

Filling is easily performed via the vertical left-hand connection port. If the manometer was not premounted: Unscrew the yellow screw cap. Fill in the respective filling liquid (blue Special-Equipment Filling Oil [γ = 0.88] or mercury[1]). For easier handling the hose barb nozzle can be removed.

Please note that only the liquid must be filled which the manometer is designed for!

Fill in the liquid until the liquid column inside the inclined tube is in the near of the zero mark. The liquid column must not be set perfectly to the zero mark, because the manometer scale is moveable. The "fine tuning" (= setting the zero mark perfectly to the end of the liquid column) can then be done by moving the scale up or down. The scale can be moved after releasing the white fixing knob (fixing screw) of the scale.

After the scale is moved into the correct position. the fixing know **must** be fixed again.

Connection of the pressure supply pipe to the manometer:

Unscrew both yellow screw plugs on top of the manometer. The pressure supply pipe is to be provided with a hose tap nozzle. Screw this tap nozzle

- into the left-hand connection port if overpressure is to be measured,
- into the right-hand connection port if underpressure is to be measured.

The Manometer is then ready for use.

Reading:
The oil column of the Manometer indicates the differential pressure in [mbar] of the gas between the Gas Inlet of the Gas Meter and the atmospheric pressure.**Caution:** If the Manometer is connected to the gas inlet of the Gas Meter but **not** filled with oil, gas will leak through the Manometer. This will inevitably cause a **measurement error** of the Gas Meter.**Operating:**

[1] The mercury version is labelled by the engraving „For Mercury Only“ at the front side.

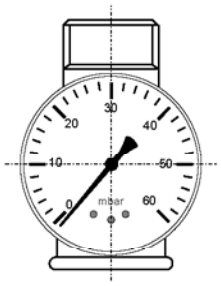
Operate the manometer only within its pressure limits.
When operating the manometer, care should be taken that it is protected against radiant heat.

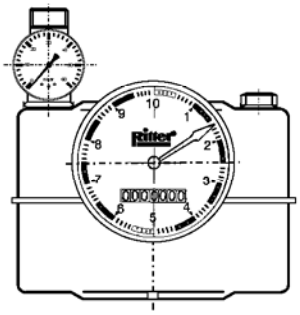
Maintenance:

In general a special maintenance service is not necessary. But it is recommended to check the zero-point of the scale from time to time. If necessary, the scale must be re-adjusted or measuring liquid may have to be refilled.

Cleaning:

According to the degree of contamination cleaning agent M 3 is used. After the filling liquid was removed, M 3 is filled into the unit via the left-hand hose nozzle. Leave the cleaning agent there for some time to dissolve the contamination. If special filling oil γ = 0,88 has been used and the contamination is considerable, the cleaning process has to be repeated several times. Subsequently rinse well with pure warm water until the liquid container and the measuring column are clear again.





Suitable for:	**RITTER** Bellows-type Gas Meters
Measuring Range:	0 to 60 mbar
Resolution:	2 mbar
Type of manometer:	Capsule pressure gauge

Application:

The Manometer can be used for measurement of the gas pressure while measuring the gas flow. Among other reasons, this is necessary if the measured and indicated **actual volume** of gas must be recalculated into the **norm volume**. The **actual** volume is the volume at the **actual** temperature and the **actual** pressure. The **norm volume** of a gas is the volume at **norm conditions** which are (in Germany):

Norm temperature	=	273.15	Kelvin (= 0 °C)
Norm pressure	=	1,013.25	mbar

The formula for converting the **actual volume** into **norm volume** is:

$$V_N = V_i \, x \, \frac{P_a}{P_N} \, x \, \frac{T_N}{T_i}$$

where

V_N	=	Norm Volume in	[ltr]
V_i	=	indicated Volume in	[ltr]
p_N	=	Norm Pressure in	[mbar]
p_a	=	actual Pressure in	[mbar]
T_N	=	Norm Temperature in	[Kelvin]
T_i	=	indicated Temperature in	[Kelvin]

Note: The indicated gas pressure at the manometer is the differential pressure between the gas pressure at the gas inlet and the actual atmospheric air pressure. Thus, the actual gas pressure (p_a) of the above formula equals the **indicated gas pressure** at the Manometer **plus** the **actual atmospheric air pressure** in [mbar].

Installation:

Unpack the Manometer which is mounted into a T-piece. According to the rules for calibration and measurement with gas meters, the Manometer must be positioned at the gas inlet of the meter (see right picture above). The gas inlet nozzle is labelled accordingly.

Mount the Manometer onto the gas inlet nozzle by tightly screwing the union nut which is attached to the Thermometer. Thus, the Manometer is ready for use.

Suitable for	RITTER Gas Meters			
Measuring Range	0 … 600 mbar	0 … 1 bar	0 … 6 bar	0 … 10 bar
Resolution	20 mbar	50 mbar	0.2 bar	0.5 bar
Type	Bourdon tube pressure gauge			
Material	Stainless steel (Cr-Ni)			

Application:

The Manometer can be used for measurement of the gas pressure while measuring the gas flow. Among other reasons, this is necessary if the measured and indicated **actual volume** of gas must be recalculated into the **norm volume**. The **actual** volume is the volume at the **actual** temperature and the **actual** pressure. The **norm volume** of a gas is the volume at **norm conditions** which are (in Germany):

Norm temperature = 273.15 Kelvin (= 0 °C)
Norm pressure = 1,013.25 mbar

The formula for converting the **actual volume** into **norm volume** is:

$$V_N = V_i \times \frac{P_a}{P_N} \times \frac{T_N}{T_i}$$

where
V_N = Norm Volume in [ltr]
V_i = indicated Volume in [ltr]
p_N = Norm Pressure in [mbar]
p_a = actual Pressure in [mbar]
T_N = Norm Temperature in [Kelvin]
T_i = indicated Temperature in [Kelvin]

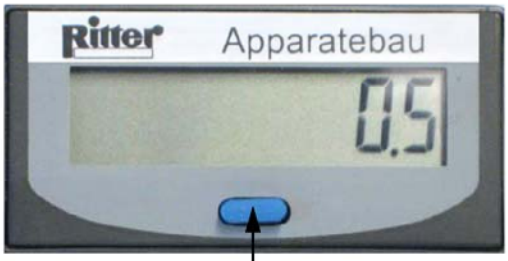
Note: The indicated gas pressure at the manometer is the differential pressure between the gas pressure at the gas inlet and the actual atmospheric air pressure. Thus, the actual gas pressure (p_a) of the above formula equals the **indicated gas pressure** at the Manometer **plus** the **actual atmospheric air pressure** in [mbar].

Installation:

The Manometer is pre-mounted to the gas meter (positioned at the gas inlet nozzle). The gas inlet nozzle is labelled accordingly. Therefore, the manometer is ready for use and no further installation is to be performed by the user.

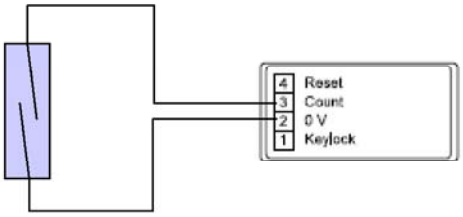
Please note: The manometer screw connection to the gas meter is sealed by Teflon® tape. When disassembling the manometer from the gas meter, the Teflon® tape cannot be used again and must be replaced by a new Teflon® tape.

Counter
(Display with TG05)



Reset

Reed Contact



Terminal Assignment
of Counter

Suitable for:	RITTER drum-type and bellows-type gas meters (not for TG01)
Indication:	TG05: 0 to 9,999,999.5 ltr all other meters: 0 to 99,999,999 ltr
Resolution:	= volume of measuring drum

Application:

The resettable LCD counter displays the volume measured by the gas meter. As an option it is available for Ritter drum-type and bellows-type gas meters and must be ordered along with the gas meter.

Use in ex-proof areas:

The LCD counter is not intrinsically safe. **Therefore, it cannot be used in ex-proof areas in general!** For exceptions please check with your authorized ex-proof safety representative .

Functional principle:

A permanent magnet as well as a reed contact are mounted within the counter casing of the gas meter. The permanent magnet closes the reed contact once per revolution of the measuring drum of the gas meter. Each pulse of the reed contact adds a volume increment to the displayed volume. The volume increment equals the measuring drum volume of the respective gas meter. Fractions of a drum revolution are indicted by the dial face indicator (needle).

The LCD display is battery operated.

Please note:

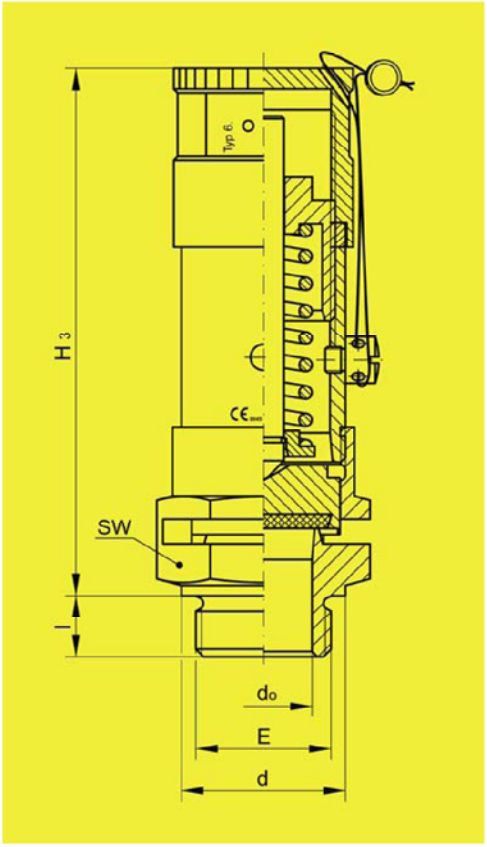
- If the direction of drum rotation is reversed (by under-pressure at the gas inlet or over-pressure at the gas outlet), the pulses of the reed contact are detected by the counter. Subsequently, the respective “negative“ gas volume is wrongly added because a detection of the rotational direction of the drum is not possible with the red contact.

- Prior to resetting the counter to „zero“, the indication needle must be turned to „zero“ as well. Because the indication needle is coupled to the drum via the shaft and magnetic coupling, the gas meter must be depressurised (gas inlet/outlet open). Thus, the drum can rotate without resistance and the indicator needle can be reset to “zero” easily.

Technical data:

Battery life time approx.	approx. 5 years
Reset	manual reset via pushbutton, (can be locked)
Reset lock	via bridge between terminals “Keylock” and “0 V”
Operating temperature	-10 .. +50°C
Display	8-digit LCD, 7 mm
Supply voltage	internal lithium battery
Protection class (IEC 144)	front side IP 65, terminals IP 20
Electrical connection	screw terminals
Input resistance	< 50 kΩ (static)

Suitable for:	RITTER drum-type and bellows-type gas meters
Gases:	**non-toxic**
Set pressure:	**50 mbar**
Maximum flow rate:	Air (0°C) 38.4 Nm³/h
	CO_2 (0°C) 31.2 Nm³/h
	N (0°C) 39.1 Nm³/h
Material:	1.4571 / 1.4301
Function:	Spring loaded
Operating temperature: [1]	-60°C … +130°C
Installation position:	vertical



Caution:

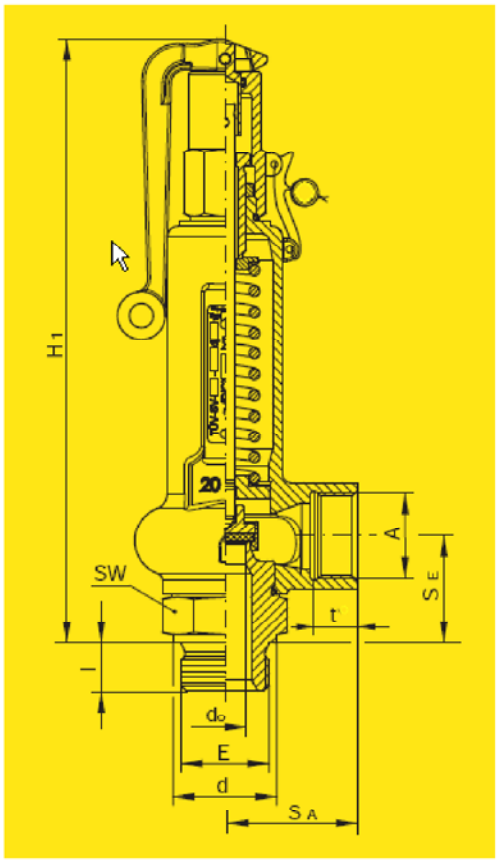
If the pressure will exceed 50 mbar, the safety valve will open. However, if the flow rate from the gas source exceeds the above-mentioned max. flow rate, the valve would not be able to vent the meter quickly enough.

This would built-up a pressure inside of the meter and may destroy the gas meter despite of the opened valve!

Eintritt * Inlet *			Austritt Outlet	Baumaße Dimensions				Ansprechdruck Set pressure		Gewicht Weight
E	d	l	A	H3	H5	SW	do	p min	p max	
G	[mm]	[mm]		[mm]	[mm]	[mm]	[mm]	[bar(g)]	[bar(g)]	[kg]
1/2	26						13	0,05	10	0,4
3/4	32	12	frei / free	103	120	36	19	0,05	6	0,5
1 1)	36						22	0,05	10	0,5

[1] Please mind the temperature range of the gas meter!

Suitable for:	**RITTER** drum-type and bellows-type gas meters
Gases:	**toxic**
Set pressure:	**50 mbar**
Maximum flow rate:	Air (0°C) 11 Nm³/h
Material:	1.4571 / 1.4581
Function:	Spring loaded
Connection:	Pipe connection
Operating temperature: [1]	-60°C to +280°C
Installation position:	Vertical
Sealing	Viton



Caution:

If the pressure will exceed 50 mbar, the safety valve will open. However, if the flow rate from the gas source exceeds the above-mentioned max. flow rate, the valve would not be able to vent the meter quickly enough.

This would built-up a pressure inside of the meter and may destroy the gas meter despite of the opened valve!

Inlet				Outlet			Dimensions					Set pressure	Weight
E	S_E	d	l	A	S_A	t	H_1	H_2	H_3	SW	d_0	p	
	mm	mm	mm	G	mm	mm	mm	mm	mm	mm	mm	bar	kg
G 3/4	34	32	16	1/2	40	14	200	205	185	32	16	0.05	1

[1] Please mind the temperature range of the gas meter!

Pulse Generator	Properties	Page
Version V2.0ex	• 50 pulses per revolution of measuring drum • For use with TG05 to TG50, BG4 to BG100 • Uni-directional • Applicable for ex-proof areas [2]	03.21
Version V3.2	• 200 pulses per revolution of measuring drum • For use with TG05 to TG50, BG4 to BG100 • Uni-directional • Not applicable for ex-proof areas	03.16
Version V4.01	• 2 x 200 pulses per revolution of measuring drum • For use with TG05 to TG50, BG4 to BG100 • Bi-directional • Not applicable for ex-proof areas	03.26
Version V4.11	• 500 pulses per revolution of measuring drum • For use with TG05 to TG50, BG4 to BG100 • Uni-directional • Not applicable for ex-proof areas	03.33
Version V5.0	• 50 pulses per revolution of measuring drum • For use with TG01 version V4.x • Uni-directional • With standard output socket: Not applicable for ex-proof areas With optional explosion-proof output socket: Applicable for ex-proof areas [1]	03.38

[2] Please note: According to European laws (EC directive 94/9/EC), a Declaration of Conformity ("ATEX" Declaration of Conformity) must be available for the gas meter, in which the Pulse Generator is built into, if and when the meter shall be used in ex-proof areas. This Declaration of Conformity is in preparation for the meter models made out of PE-el (model no. 8).

Quick reference:

- 200 pulses per revolution of measuring drum
- For use with TG05 to TG50, BG4 to BG100
- Uni-directional
- Not applicable for ex-proof areas

Application: The Pulse Generator for **RITTER** gas meters is a rotary encoder for pulse output. It can be used to transfer the measured gas volume for remote display and/or data processing (calculation of flow rate, data transfer via RS232) to the accessory EDU 32 or to an external measuring system / PC. In the latter case, the external system must provide the power supply for the photo sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume and flow rate. For connection to an external system, please refer to the electrical data on page 03.18 and the wiring diagrams on page 03.19.

Components: The Pulse Generator is located within the housing of the counter mechanism of the Gas Meter (behind the dial plate) and it consists of the following components:

- Optical encoding film disc
- mini board with integrated infra-red photo sensor and LED operating indicator
- round, 5-pin output socket (180°, DIN 41524)

Description: The measuring drum of drum-type meters and the measuring unit of bellow-type meters are coupled 1:1 to the slit disc via a magnetic coupling. The slits/flags of the slit disc rotate through the U-shaped photo sensor, thereby interrupting the light beam of the photo diode intermittently. Thus, the photo interrupter converts the revolution of the measuring drum into a sequence of pulses. The number of pulses represents the **volume of gas** which has passed through the Gas Meter, depending on the respective resolution (see table on Page 03.17). The frequency of the sequence of pulses is a measure of the rotational speed of the measuring drum and thereby a measure of the **flow rate** of the gas.

For operation of the photo sensor, an external electric power supply in the range of 5-24 Volts DC is required. More electrical data are stated on the data sheet 03.18. **The output signal is a TTL signal**, whereby the pulse level (= min./max. voltage of the signal) depends on the power supply:

- Power Supply 5 V ⇒ Output Signal Level 0.7 / 3.7 Volt
- Power Supply 24 V ⇒ Output Signal Level 2 / 21 Volt

For power supply values between 5 and 24 Volts, the output signal level can be linearly interpolated for the first approximation.

Output Socket: The pin connection of the 5-pin output socket is shown on data sheet 03.18.

Sample circuit: The connection of a measurement instrument to the Pulse Generator is shown schematically on data sheet 03.19.

Use with Drum-type Gas Meters:

Drum-type gas meters are volumetric gas meters. That means, that they are measuring gas volume precisely. When the Pulse Generator is used with drum-type gas meters for recording the gas flow, it is possible for the respective Voltage Output curve (line) to be wavy, even when gas flow is constant. This is (unpreventably) caused by the type of construction of the measuring

drum: the drum consists of four separate chambers, which are closed and opened in sequence. The previous chamber **has to be** closed **before** the next chamber will open.

This compulsory measurement is the reason for the high measurement accuracy. However, each closing also causes a little build-up of pressure at the inside of a chamber. The surface tension creates an additional pressure increase during emerging of a chamber (water highest surface tension, oil: lower, CalRix lowest). The resulting pressure increase causes a small reduction in the rotational speed of the measuring drum. This is barely visible to the eye but is documented precisely by a computer/transcriber. Thus, the wavy output line at constant input flow documents the **true** flow through the gas meter.

Performance Data:

Gas Meter [Type]	Pulses per Revolution* [P/R]	Gas Flow per Revolution* [ltr/R]	Resolution [ltr/Pulse]	Pulses per Liter [Pulse/ltr]	Maximum Pulse Frequency [Pulse/min]
TG 01	not applicable				
TG 05	200	0.5	0.0025	400	400
TG 1	200	1.0	0.005	200	400
TG 3	200	3.0	0.015	66.7	400
TG 5	200	5.0	0.025	40	400
TG 10	200	10	0.05	20	400
TG 20	200	20	0.1	10	467
TG 25	200	25	0.125	8	933
TG 50	200	50	0.25	4	1,200
BG 4	200	10	0.05	20	2,000
BG 6	200	20	0.1	10	1,667
BG 10	200	50	0.25	4	1,067
BG 16	200	100	0.5	2	833
BG 40	200	100	0.5	2	2,167
BG 100	200	100	0.5	2	2,167

* TG types: Revolution of measuring drum
(= revolution of large needle of dial plate)
BG types: Revolution of large needle of dial plate

Temperature range:

- 0 to +55°C

At higher temperatures the Pulse Generator must be cooled by flushing the counter mechanism casing with room air.
Necessary equipment: Optional connection nozzle at counter mechanism casing.

Humidity range:

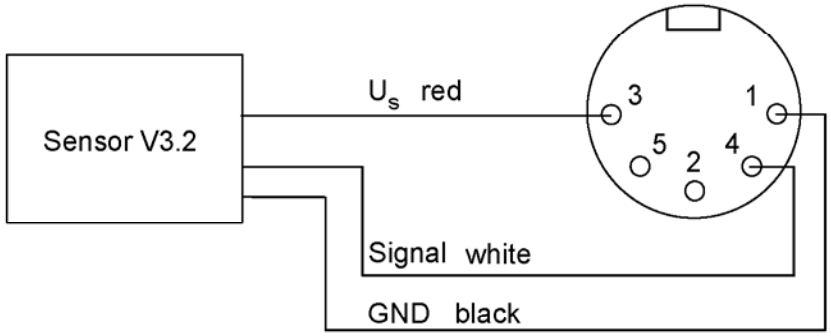
- 0 to 65% relative humidity, **non-condensing**

With a higher humidity, the circuit board of the Pulse Generator can be covered with a protective lacquer. Please indicate prior to order.

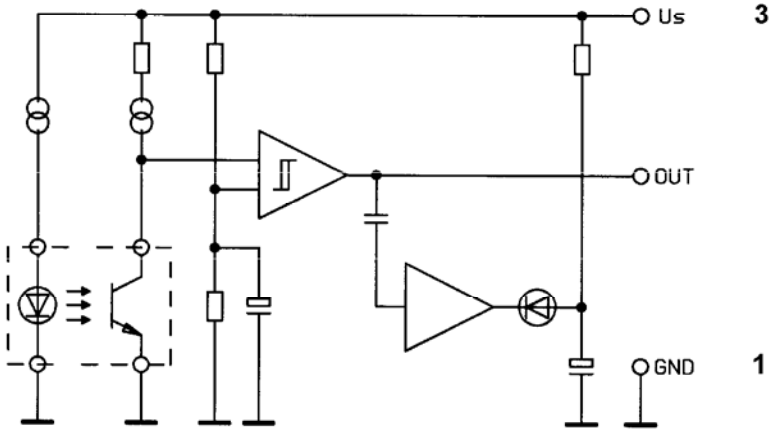
Electrical Data:

Supply Voltage U_S		5 – 24	V DC
Supply Current		< 3	mA
Voltage output Us = 5 V:	high level	min. 3.7	V
	low level	max. 0.7	V
Voltage output Us = 24 V:	high level	min. 21	V
	low level	max. 2	V
Current Output	Source	min. +7	mA
	Sink	min. -6	mA
Operating Frequency photo diode		0 – 250	Hz

Pin configuration of the Output Socket:
(View to **plug-side** of the socket)

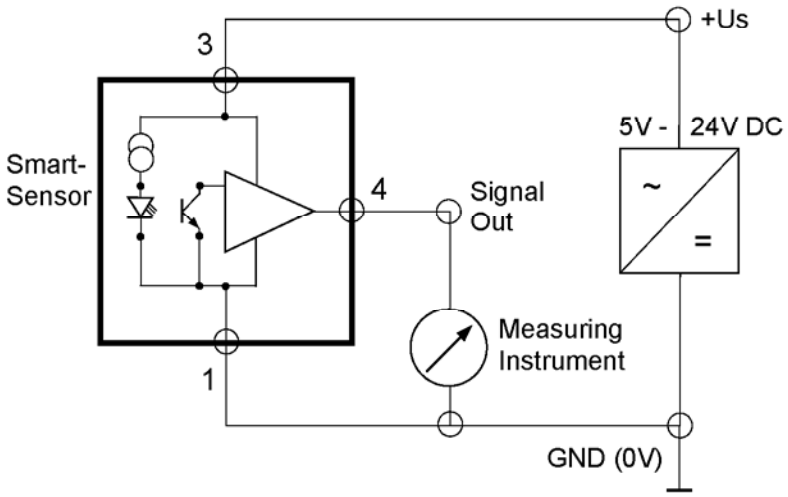


Circuit diagram:



Caution: The Pulse Generator is not protected against incorrect connection of wires. Inverting of wires will damage the Pulse Generator!

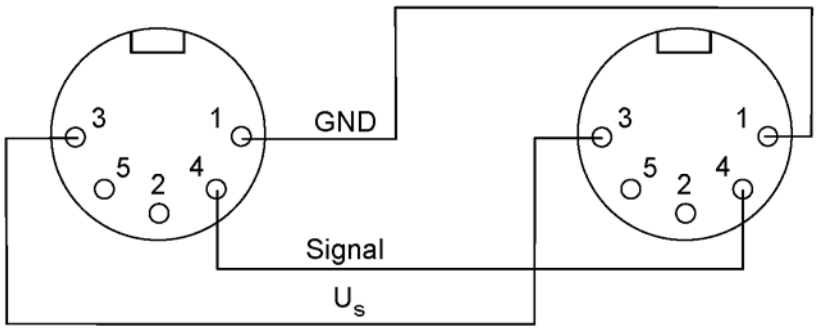
Wiring diagram / sample circuit (schematic):



Connection of the Pulse Generator
to the "Electronic Display Unit" EDU 32 FP (optional accessory)**:**

The Pulse Generator can be connected to the optional accessory "Electronic Display Unit" by means of the 3-pin connection cord, which is supplied in conjunction with the Electronic Display Unit. The Electronic Display Unit contains the power supply for the inductive sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume [ltr] and flow rate [ltr/h].

Wiring of the Pulse Generator to the EDU socket
(view to **plug-side** of the sockets):



Pulse Generator Output Socket EDU Input Socket

The measurement results displayed by the Electronic Display Unit can be transmitted to a computer via the standard-type interface RS 232 (refer to chapter 4 "Electronic Display Unit" as well). Additionally, the value of the flow rate can be transmitted to an analog measurement device via the standard-type analog output (0-1 Volt or 4-20 mA).

Set-up of EDU:

- Programming of sensor type: Select sensor type "PG V3.X"
  (please refer to the EDU Operation Instructions par. 6.2.4 as well)
- Programming of slit disc / encoding disc: Select "200 Pulses/Rev"
  (please refer to the EDU Operation Instructions par. 6.2.5 as well)

Dimensions of slit disc:

	TG05 to TG50 BG [mm]
Diameter:	144
Slit width:	1.2
Flag width:	1.0

Exchanging the spare parts kit „Complete Photo diode "

The kit consists of the following components which are already mounted on a transparent plastic cover plate:

- Photo diode on a mini board,
- Fixture,
- Wiring,
- 5-pin socket.

Removal of the built-in kit:

- Remove the plug of the signal transmission cable from the socket of the pulse generator,
- Unscrew the 4 screws of the transparent cover plate,
- Remove the cover plate together with the built-in-kit.

Replacement with the new kit:

- Carefully mount the fork-shaped photo diode over the circumference of the folio disc without bending the disc,
- Fasten the cover plate to the counter mechanism casing with the 4 screws. By way of the free play in the washer holes the photo diode can be positioned such that the folio disc can freely rotate through the middle of the fork-shaped photo diode. After that tighten the screws to fix the built-in-kit.

Quick reference:

- 50 pulses per revolution of measuring drum
- For use with TG05 to TG50, BG4 to BG100
- Uni-directional
- Applicable for ex-proof areas [3]

Application: The Pulse Generator for **RITTER** gas meters is a rotary encoder for pulse output. It can be used to transfer the measured gas volume for remote display and/or data processing (calculation of flow rate, data transfer via RS232) to the accessory EDU 32 or to an external measuring instrument (PC, transcriber). In the latter case, the external system must provide the power supply for the sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume and flow rate. For connection to an external system, please refer to the pin configuration on page 03.22 and the electrical data on page 03.24.

This explosion proof Pulse Generator is equipped with an inductive sensor for use in hazardous environments[3] according categories[4] ATEX 1G and ATEX 2G. Approval No.: PTB 99 ATEX 2219 X, marking: ⟨Ex⟩ II 1 G EEx ia IIC T6

For use in **ex-proof areas** an external intrinsic safety barrier has to be installed between Pulse Generator (gas meter) and the power supply (for example by the EDU) for galvanic decoupling.

For selection of the gas meter model to be used in ex-proof areas: See footnote.

Equipment: The Pulse Generator is located within the casing of the counter mechanism of the Gas Meter (behind the dial plate) and it consists of the following components:

- Slit disc
- Sensor: inductive proximity switch with PTB/ATEX certificate
- 3-pin ex-proof output socket

Description: The measuring drum of drum-type meters and the measuring unit of bellow-type meters are coupled 1:1 to the slit disc via a magnetic coupling. The slits/flags of the slit disc rotate through the U-shaped inductive sensor. Thus, the inductive sensor converts the revolution of the measuring drum into a sequence of pulses. The number of pulses represents the **volume of gas** which has passed through the Gas Meter, depending on the respective resolution (see table on page 03.22). The frequency of the sequence of pulses is a measure of the rotational speed of the measuring drum and thereby a measure of the **flow rate** of the gas.

For operation of the inductive sensor, an external electric power supply with 5 Volts DC is required. More electrical data are stated on the data sheet 03.24. The

[3] Please note: According to European laws (EC directive 94/9/EC), a Declaration of Conformity ("ATEX" Declaration of Conformity) must be available for the gas meter, in which the Pulse Generator is built into, if and when the meter shall be used in ex-proof areas. This Declaration of Conformity is in preparation for the meter models made out of PE-el (model no. 8).

[4] Equivalence of categories and zones: category 1 = zone 0, category 2 = zone 1, category 3 = zone 2
"G" stands for "gas" ("D" for "dust")

output signal is a rectangular pulse, whereby the pulse level (= min./max. voltage of the signal) depends on the user-side circuit, i.e. the value of the used resistors.

Output Socket: The pin connection of the 3-pin output socket is shown on page 03.22.

Use with Drum-type Gas Meters:

Drum-type gas meters are volumetric gas meters. That means, that they are measuring gas volume precisely. When the Pulse Generator is used with drum-type gas meters for recording the gas flow, it is possible for the respective Voltage Output curve (line) to be wavy, even when gas flow is constant. This is (unpreventably) caused by the type of construction of the measuring drum: the drum consists of four separate chambers, which are closed and opened in sequence. The previous chamber **has to be** closed **before** the next chamber will open.

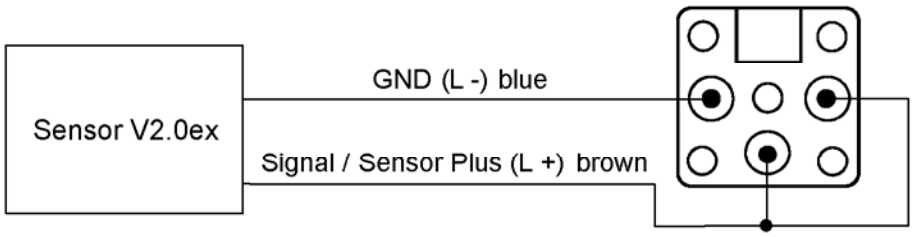
This compulsory measurement is the reason for the high measurement accuracy. However, each closing also causes a little build-up of pressure at the inside of a chamber. The surface tension creates an additional pressure increase during emerging of a chamber (water highest surface tension, oil: lower, CalRix lowest). The resulting pressure increase causes a small reduction in the rotational speed of the measuring drum. This is barely visible to the eye but is documented precisely by a computer/transcriber. Thus, the wavy output line at constant input flow documents the **true** flow through the gas meter.

Performance Data:

Gas Meter [Type]	Pulses per Revolution* [P/R]	Gas Flow per Revolution* [ltr/R]	Resolution [ltr/Pulse]	Pulses per Liter [Pulse/ltr]	Maximum Pulse Frequency [Pulse/min]
TG 01	not applicable				
TG 05	50	0.5	0.01	100	100
TG 1	50	1.0	0.02	50	100
TG 3	50	3.0	0.06	17	100
TG 5	50	5.0	0.1	10	100
TG 10	50	10	0.2	5	100
TG 20	50	20	0.4	3	117
TG 25	50	25	0.5	2	233
TG 50	50	50	1.0	1	300
BG 4	50	10	0.2	5	500
BG 6	50	20	0.3	3	417
BG 10	50	50	1	1	267
BG 16	50	100	2	1	208
BG 40	50	100	2	1	542
BG 100	50	100	2	1	1,333

* TG types: Revolution of measuring drum
(= revolution of large needle of dial plate)
BG types: Revolution of large needle of dial plate

Pin configuration of the Output Socket:
(View to the (female) socket)



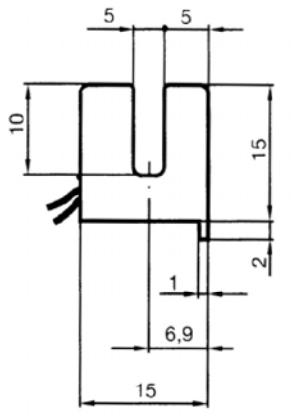
Temperature range:

- -25°C to +70°C
- At higher temperatures the Pulse Generator can be cooled by flushing the counter mechanism casing with room air. Necessary equipment: Optional connection nozzle at counter mechanism casing.

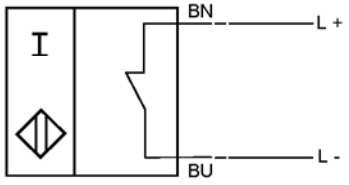
Dimensions of slit disc:

	TG05 to TG50 BG [mm]
Diameter:	144
Slit width:	4.2
Flag width:	4.4

Dimensions of Sensor:



Standard symbol, connection:



Technical Data:

Slot width	5	mm
Entry depth	5 … 7	mm
Nominal voltage	8	V
Current consumption:		
Sensing face covered	≤ 1	mA
Sensing face free	≥ 3	mA
Switching frequency	0 … 2000	Hz
Hysteresys	0.05 … 0.65	mm
EMC to	EN 60947-5-2	
In compliance with	DIN EN 60947-5-6 (NAMUR)	
Protection to IEC 60529	IP67	
Operating temperature	-25 … +100	°C
Connection	0.5 m, leads LIY	
Conductor cross section	0,14 mm^2	
Casing material	PBT	
Ex category	1G, 2G	

Connection of the Pulse Generator
to the "Electronic Display Unit" EDU 32 FP (optional accessory)**:**

The EDU is not suitable for use in ex-proof areas and must therefore be positioned outside of the ex-proof area.

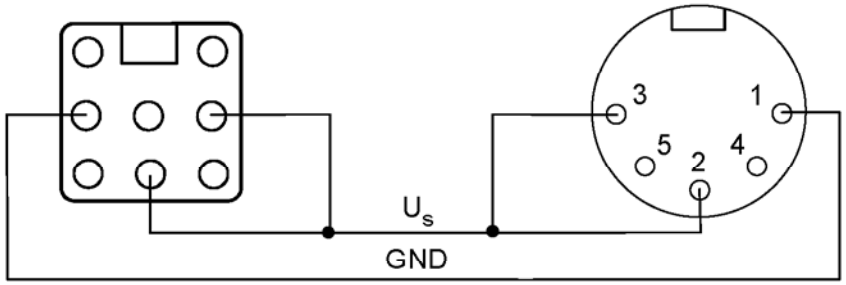
In this case the pulse generator must be connected to the EDU via an external intrinsic safety barrier for galvanic decoupling of the power supply (by the EDU).

For programming of the EDU for this application please refer to the instructions in "Set-up of the EDU" below.

In case the gas meter is not positioned in an ex-proof area and/or shall be connected to the EDU for testing purposes only, the Pulse Generator can be connected to the EDU by means of the 3-pin connection cord, which is supplied in conjunction with the EDU.

The Electronic Display Unit contains the power supply for the inductive sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume [ltr] and flow rate [ltr/h].

Wiring of the Pulse Generator to the EDU socket
(view to **plug-side** of the sockets):



Pulse Generator Output Socket EDU Input Socket

The measurement results displayed by the Electronic Display Unit can be transmitted to a computer via the standard-type interface RS 232 (refer to chapter 4 "Electronic Display Unit" as well). Additionally, the value of the flow rate can be transmitted to an analog measurement device via the standard-type analog output (0-1 Volt or 4-20 mA).

Set-up of EDU:

1. Gas meter is positioned inside of ex-proof area and connected to the EDU via an external switch amplifier for galvanic decoupling of the power supply (by the EDU):
   - Programming of sensor type: Select sensor type "PG **V3.X**" (please refer to the EDU Operation Instructions par. 6.2.4 as well)
   - Programming of slit disc / encoding disc: Select "50 Pulses/Rev" (please refer to the EDU Operation Instructions par. 6.2.5 as well)
2. Gas meter is positioned outside of ex-proof area and connected to the EDU via the 3-pin connection cord, which is supplied in conjunction with the EDU:
   - Programming of sensor type: Select sensor type "PG **V2.0Ex**" (please refer to the EDU Operation Instructions par. 6.2.4 as well)
   - Programming of slit disc / encoding disc: Select "50 Pulses/Rev" (please refer to the EDU Operation Instructions par. 6.2.5 as well)

Quick reference:

- 2 x 200 pulses per revolution of measuring drum
- For use with TG05 to TG50, **not** for BG types (because of pawl with BG types)
- Bi-directional[1]
- Not applicable for ex-proof areas

Application: The Pulse Generator for **RITTER** gas meters is a rotary encoder for pulse output. It can be used to transfer the measured gas volume for remote display and/or data processing (calculation of flow rate, data transfer via RS232) to the accessory EDU 32 or to an external measuring system / PC. In the latter case, the external system must provide the power supply for the photo sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume and flow rate. For connection to an external system, please refer to the electrical data on page 03.29 and the wiring diagram on page 03.29.

The version V4.01 is a twin channel encoder with bi-directional recognition of the rotation of the measuring drum. **(Please refer to footnote!)** This feature provides the possibility to recognize a backward rotation of the measuring drum caused by a change of gas flow direction or by vibration of the drum (e.g. due to a pulsating gas flow with negative pressure peaks). (A mono-channel encoder would wrongly cumulate the pulses (= volume) in these conditions.)

Please note however: The ability to measure a backward rotation does not mean that the gas meter can measure a continuing reversed gas flow correctly. The measuring drum is measuring correctly only at standard gas flow direction from the gas inlet towards the gas outlet. This gas flow direction can either be generated by a positive (over)pressure at the gas inlet or by a negative (under)pressure at the gas outlet. The feature of bi-directional recognition of the rotation of the measuring drum is only for compensation of limited reverse flow or vibrations of the measuring drum.

Components: The Pulse Generator is located within the housing of the counter mechanism of the Gas Meter (behind the dial plate) and it consists of the following components:

- Optical encoding film disc
- Sensor unit with integrated twin infra-red photo sensors and LED operating indicators
- Round, 5-pin output socket (180°, DIN 41524)

Description: The measuring drum of drum-type meters and the measuring unit of bellow-type meters are coupled 1:1 to the slit disc via a magnetic coupling. The optical encoding bars of the film disc rotate through the U-shaped photo sensor, thereby interrupting the light beam of the photo diode intermittently. Thus, the photo interrupter converts the revolution of the measuring drum into a sequence of pulses. The number of pulses represents the **volume of gas** which has passed through the Gas Meter, depending on the respective resolution (see table on page 03.28).

[1] The recognition of the rotating direction is done by evaluating the signals of the two channels. The logic for this feature is incorporated in the Electronic Display Unit EDU 32, i. e. the EDU 32 indicates the resulting volume (= volume forward rotation minus volume backward rotation). If connected to an external data acquisition system the evaluation of the two channels has to be done by the data acquisition system.

The frequency of the sequence of pulses is a measure of the rotational speed of the measuring drum and thereby a measure of the **flow rate** of the gas.

For operation of the photo sensor, an external electric power supply in the range of 5-28 Volts DC is required. More electrical data are stated on the data sheet 03.29. **The output signal is a TTL signal**, whereby the pulse level (= min./max. voltage of the signal) depends on the power supply voltage and current load (please refer to the table on data sheet 03.29).

For power supply values between 5 and 28 Volts, the output signal level can be linearly interpolated for the first approximation.

Output Socket: The pin configuration of the 5-pin output socket is shown on data sheet 03.29. These pin numbers are equivalent to the numbers shown in the diagram of the photo sensor on data sheet 03.29.

Use with Drum-type Gas Meters:

Drum-type gas meters are volumetric gas meters. That means, that they are measuring gas volume precisely. When the Pulse Generator is used with drum-type gas meters for recording the gas flow, it is possible for the respective Voltage Output curve (line) to be wavy, even when gas flow is constant. This is (unpreventably) caused by the type of construction of the measuring drum: the drum consists of four separate chambers, which are closed and opened in sequence. The previous chamber **has to be** closed **before** the next chamber will open.

This compulsory measurement is the reason for the high measurement accuracy. However, each closing also causes a little build-up of pressure at the inside of a chamber. The surface tension creates an additional pressure increase during emerging of a chamber (water highest surface tension, oil: lower, CalRix lowest). The resulting pressure increase causes a small reduction in the rotational speed of the measuring drum. This is barely visible to the eye but is documented precisely by a computer/transcriber. Thus, the wavy output line at constant input flow documents the **true** flow through the gas meter.

Performance Data:

Gas Meter [Type]	Pulses per Revolution* [P/R]	Gas Flow per Revolution* [ltr/R]	Resolution [ltr/Pulse]	Pulses per Liter [Pulse/ltr]	Maximum Pulse Frequency [Pulse/min]
TG 01	not applicable				
TG 05	200	0.5	0.0025	400	400
TG 1	200	1.0	0.005	200	400
TG 3	200	3.0	0.015	66.7	400
TG 5	200	5.0	0.025	40	400
TG 10	200	10	0.05	20	400
TG 20	200	20	0.1	10	467
TG 25	200	25	0.125	8	933
TG 50	200	50	0.25	4	1,200
BG 4	200	10	0.05	20	2,000
BG 6	200	20	0.1	10	1,667
BG 10	200	50	0.25	4	1,067
BG 16	200	100	0.5	2	833
BG 40	200	100	0.5	2	2,167
BG 100	200	100	0.5	2	2,167

* TG types: Revolution of measuring drum
(= revolution of large needle of dial plate)
BG types: Revolution of large needle of dial plate

Temperature range:

- 0 to +55°C
- At higher temperatures the Pulse Generator can be cooled by flushing the counter mechanism casing with room air. Necessary equipment: Optional connection nozzle at counter mechanism casing.

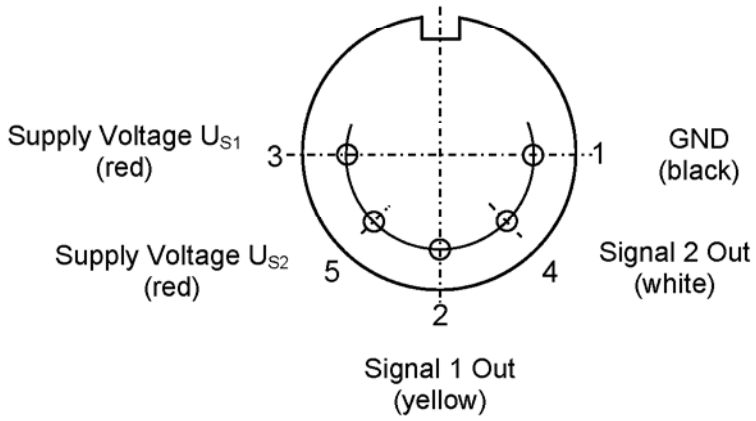
Dimensions of encoding disc:

	TG05 to TG50 BG [mm]
Diameter:	144
Slit width:	1.2
Bar width:	1.0

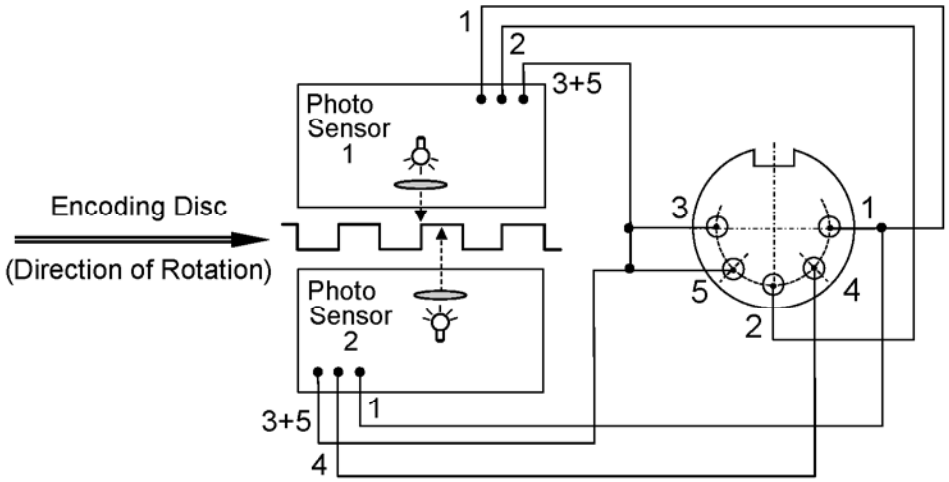
Electrical Data:

Supply Voltage U_S		5 – 28	V DC
Supply Current Us = 5 V:		< 2	mA
Us = 28 V:		< 4	mA
Voltage Output Us = 5 V, no load:	high level	4.95	V
Us = 5 V, load I_{Source} 4.7 mA:	high level	3.56	V
Us = 5 V, no load:	low level	0.01	V
Us = 5 V, load I_{Sink} 7 mA:	low level	1.05	V
Voltage Output Us = 28 V, no load:	high level	26.8	V
Us = 28 V, load I_{Source} 7 mA:	high level	26.5	V
Us = 28 V, no load:	low level	0.01	V
Us = 28 V, load I_{Sink} 7 mA:	low level	1.2	V
Current Output Us = 5 V:	source	4.7	mA
Us = 28 V:	source	7	mA
Us = 5-28 V:	sink	7	mA
Operating frequency photo diode		0 – 500	Hz

Pin configuration of the Output Socket:
(View to **plug-side** of the socket)



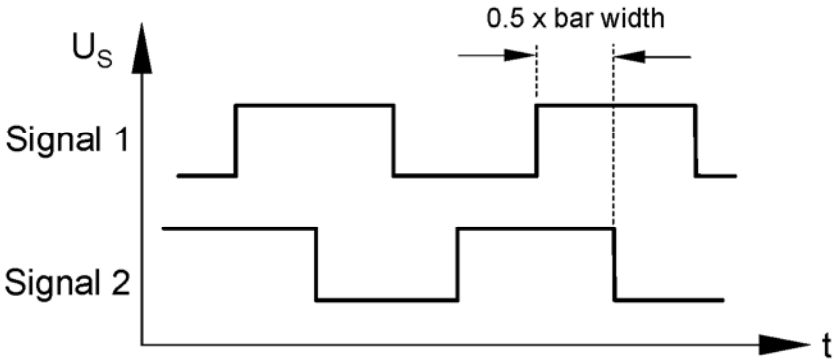
Internal wiring:



	Pin No.	Function	Lead Colour
Photo Sensor 1	3+5	Supply Voltage U_{S1} + U_{S2}	red
	2	Signal 1 Out	yellow
	1	Ground	black
Photo Sensor 2	3+5	Supply Voltage U_{S1} + U_{S2}	red
	4	Signal 2 Out	white
	1	Ground	black

Attention: The mini plugs of the cables which connect the leads from the sensor to the output socket **must not** be exchanged. (The yellow lead of signal 1 must be on the sensor side showing to the meter drum, the white lead of signal 2 must show to dial face.) Furthermore, the plugs **must** be put onto the pins of the sensor in the shown position. Especially the red leads must be connected to the pin close to the corner of the sensor casing. **Otherwise the sensor will be destroyed!**

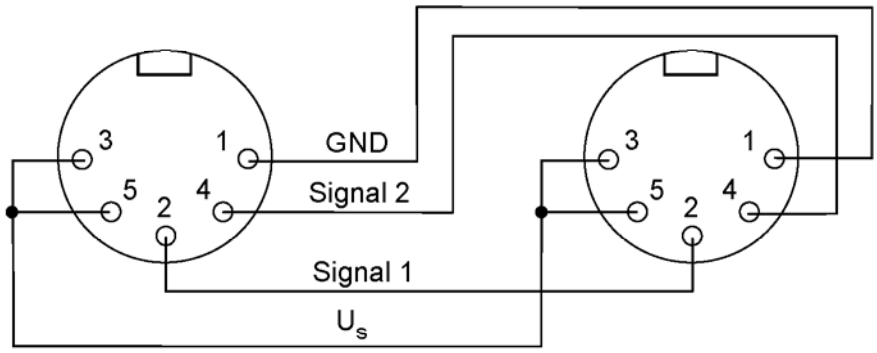
Signal Output:



Connection of the Pulse Generator to the "Electronic Display Unit" EDU 32 FP (optional accessory)**:**

The Pulse Generator can be connected to the optional accessory "Electronic Display Unit" (V 5.0 or higher) by means of the 5-pin connection cord, which is supplied in conjunction with the Electronic Display Unit. The **maximum possible length** of the connection cable is **10 m** (unshielded cable) or **100 m** (shielded cable). The Electronic Display Unit contains the power supply for the photo sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume [ltr] and flow rate [ltr/h].

Wiring of the Pulse Generator to the EDU socket
(view to **plug-side** of the sockets):



Pulse Generator Output Socket EDU Input Socket

The measurement results displayed by the Electronic Display Unit can be transmitted to a computer via the standard-type interface RS 232 (refer to chapter 4 "Electronic Display Unit", par. 7.3, as well). Additionally, the value of the flow rate can be transmitted to an analog measurement device via the standard-type analog output (0-1 Volt or 4-20 mA).

Set-up of EDU:

- Programming of sensor type: Select sensor type “PG V4.0”
  (please refer to the EDU Operation Instructions par. 6.2.4 as well)
- Programming of slit disc / encoding disc: Select “2 x 200 Pulses/Rev”
  (please refer to the EDU Operation Instructions par. 6.2.5 as well)

Quick reference:

- 500 pulses per revolution of measuring drum
- For use with TG05 to TG50, BG4 to BG100
- Uni-directional
- Not applicable for ex-proof areas

Application: The Pulse Generator for **RITTER** gas meters is a rotary encoder for pulse output. It can be used to transfer the measured gas volume for remote display and/or data processing (calculation of flow rate, data transfer via RS232) to the accessory EDU 32 or to an external measuring system / PC. In the latter case, the external system must provide the power supply for the photo sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume and flow rate. For connection to an external system, please refer to the electrical data on page 03.35 and the wiring diagram on page 03.35.

Components: The Pulse Generator is located within the housing of the counter mechanism of the Gas Meter (behind the dial plate) and it consists of the following components:
- Optical encoding film disc
- Sensor unit with integrated infra-red photo sensor and LED operating indicator
- Round, 5-pin output socket (180°, DIN 41524)

Description: The measuring drum of drum-type meters and the measuring unit of bellow-type meters are coupled 1:1 to the slit disc via a magnetic coupling. The optical encoding bars of the film disc rotate through the U-shaped photo sensor, thereby interrupting the light beam of the photo diode intermittently. Thus, the photo interrupter converts the revolution of the measuring drum into a sequence of pulses. The number of pulses represents the **volume of gas** which has passed through the Gas Meter, depending on the respective resolution (see table on page 03.34). The frequency of the sequence of pulses is a measure of the rotational speed of the measuring drum and thereby a measure of the **flow rate** of the gas.

For operation of the photo sensor, an external electric power supply in the range of 5-28 Volts DC is required. More electrical data are stated on the data sheet 03.35. **The output signal is a TTL signal**, whereby the pulse level (= min./max. voltage of the signal) depends on the power supply voltage and current load (please refer to the table on data sheet 03.35).

For power supply values between 5 and 28 Volts, the output signal level can be linearly interpolated for the first approximation.

Output Socket: The pin configuration of the 5-pin output socket is shown on data sheet 03.35.

Use with Drum-type Gas Meters:

Drum-type gas meters are volumetric gas meters. That means, that they are measuring gas volume precisely. When the Pulse Generator is used with drum-type gas meters for recording the gas flow, it is possible for the respective Voltage Output curve (line) to be wavy, even when gas flow is constant. This is (unpreventably) caused by the type of construction of the measuring drum: the drum consists of four separate chambers, which are closed and opened in sequence. The previous chamber **has to be** closed **before** the next chamber will open.

This compulsory measurement is the reason for the high measurement accuracy. However, each closing also causes a little build-up of pressure at the inside of a chamber. The surface tension creates an additional pressure increase during emerging of a chamber (water highest surface tension, oil: lower, CalRix lowest). The resulting pressure increase causes a small reduction in the rotational speed of the measuring drum. This is barely visible to the eye but is documented precisely by a computer/transcriber. Thus, the wavy output line at constant input flow documents the **true** flow through the gas meter.

Performance Data:

Gas Meter	Pulses per Revolution*	Gas Flow per Revolution*	Resolution	Pulses per Liter	Maximum Pulse Frequency
[Type]	[P/R]	[ltr/R]	[ltr/Pulse]	[Pulse/ltr]	[Pulse/min]
TG 01	not applicable				
TG 05	500	0.5	0.001	1,000.0	1,000
TG 1	500	1.0	0.002	500.0	1,000
TG 3	500	3.0	0.006	166.7	1,000
TG 5	500	5.0	0.010	100.0	1,000
TG 10	500	10	0.020	50.0	1,000
TG 20	500	20	0.040	25.0	1,167
TG 25	500	25	0.050	20.0	2,333
TG 50	500	50	0.100	10.0	3,000
BG 4	500	10	0.020	50.0	5,000
BG 6	500	20	0.040	25.0	4,167
BG 10	500	50	0.100	10.0	2,667
BG 16	500	100	0.200	5.0	2,083
BG 40	500	100	0.200	5.0	5,417
BG 100	500	100	0.200	5.0	13,333

* TG types: Revolution of measuring drum
(= revolution of large Needle of dial plate)
BG types: Revolution of large Needle of dial plate

Temperature range:

- 0 to +55°C
- At higher temperatures the Pulse Generator can be cooled by flushing the counter mechanism casing with room air. Necessary equipment: Optional connection nozzle at counter mechanism casing.

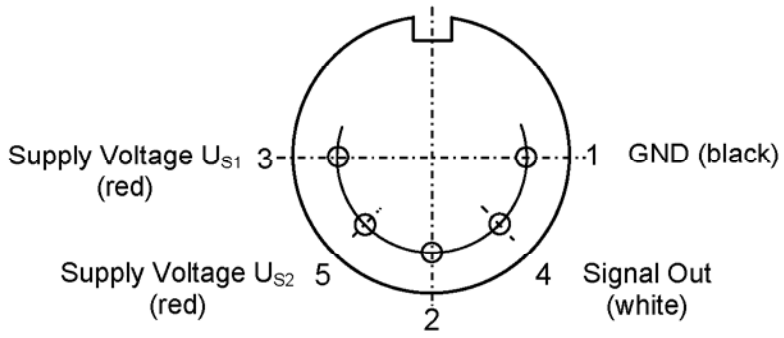
Dimensions of encoding disc:

	TG05 to TG50 BG [mm]
Diameter:	144
Slit width:	0.492
Bar width:	0.356

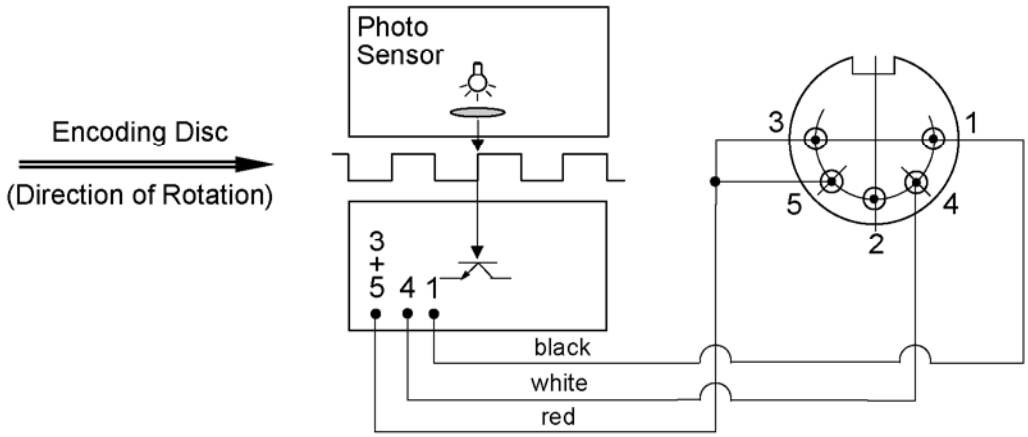
Electrical Data:

Supply Voltage U_S		5 – 28	V DC
Supply Current Us = 5 V:		< 2	mA
Us = 28 V:		< 4	mA
Voltage Output Us = 5 V, no load:	high level	4.95	V
Us = 5 V, load I_{Source} 4.7 mA:	high level	3.56	V
Us = 5 V, no load:	low level	0.01	V
Us = 5 V, load I_{Sink} 7 mA:	low level	1.05	V
Voltage Output Us = 28 V, no load:	high level	26.8	V
Us = 28 V, load I_{Source} 7 mA:	high level	26.5	V
Us = 28 V, no load:	low level	0.01	V
Us = 28 V, load I_{Sink} 7 mA:	low level	1.2	V
Current Output Us = 5 V:	source	4.7	mA
Us = 28 V:	source	7	mA
Us = 5-28 V:	sink	7	mA
Operating frequency photo diode		0 – 500	Hz

Pin configuration of the Output Socket:
(View to **plug-side** of the socket)



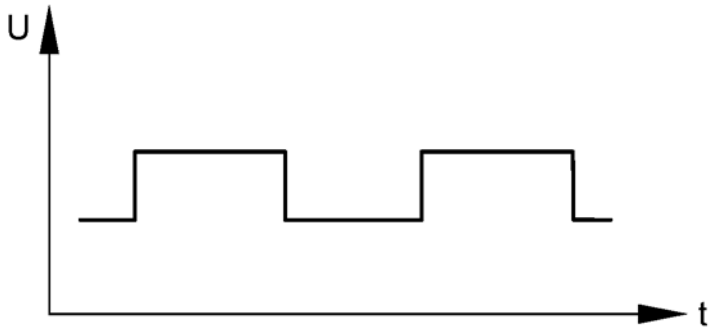
Internal wiring:



	Pin No.	Function	Lead Colour
Photo Sensor	3+5	Supply Voltage U_{S1} + U_{S2}	red
	4	Signal Out	white
	1	Ground	black

Attention: The mini plug of the cable which connect the sensor and the output socket **must** be mounted to the sensor in the shown position. Especially the red leads must be connected to the pin close to the corner of the sensor casing. **Otherwise the sensor will be destroyed!**

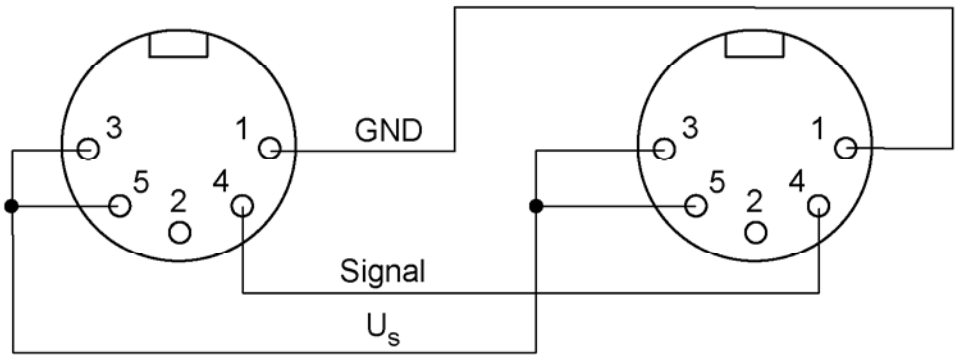
Signal Output:



Connection of "Electronic Display Unit" EDU 32 FP (optional accessory**) to the Pulse Generator:**

The Pulse Generator can be connected to the optional accessory "Electronic Display Unit" (V 5.0 or higher) by means of the 5-pin connection cord, which is supplied in conjunction with the Electronic Display Unit. The **maximum possible length** of the connection cable is **10 m** (unshielded cable) or **100 m** (shielded cable). The Electronic Display Unit contains the power supply for the photo sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume [ltr] and flow rate [ltr/h].

Wiring of the Pulse Generator to the EDU socket
(view to **plug-side** of the sockets):



The measurement results displayed by the Electronic Display Unit can be transmitted to a computer via the standard-type interface RS 232 (refer to chapter 4 "Electronic Display Unit" as well). Additionally, the value of the flow rate can be transmitted to an analog measurement device via the standard-type analog output (0-1 Volt or 4-20 mA).

Set-up of EDU:

- Programming of sensor type: Select sensor type “PG V4.1”
  (please refer to the EDU Operation Instructions par. 6.2.4 as well)
- Programming of slit disc / encoding disc: Select “500 Pulses/Rev”
  (please refer to the EDU Operation Instructions par. 6.2.5 as well)

Quick reference:

- 50 pulses per revolution of measuring drum
- For use with TG01 version V4.x
- Uni-directional
- Applicable for ex-proof areas with explosion-proof output socket only (option) [5]

Application: The Pulse Generator for **RITTER** gas meters is a rotary encoder for pulse output. It can be used to transfer the recorded data (quantity of measured gas volume [ltr]) to the accessory EDU 32 or to an external measuring instrument (PC, transcriber). In the latter case, the external system must provide the power supply for the photo sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume and flow rate. For connection to an external system, please refer to the pin configuration and electrical data on page 03.40.

Please note: The Pulse Generator provides a currency signal, not a voltage signal. In order to read the signal by an external data acquisition system, it is therefore necessary in general to use a terminal amplifier with a power supply of 10-30 VDC.

Use in ex-proof areas[5]: The gas meter must be equipped with a 3-pin explosion-proof output socket instead of the standard DIN 5-pin output socket (please specify when ordering).

For use in **ex-proof areas** an external switch amplifier for galvanic decoupling of the power supply (by the EDU) has to be installed between Pulse Generator (gas meter) and the EDU.

For selection of the gas meter model to be used in ex-proof areas: See footnote.

Equipment: The Pulse Generator is located within the meter casing and it consists of the following components:

- Sensor: Inductive proximity switch

Device category 2G:	For use in hazardous areas with gas, vapour, and mist
Directive conformity:	94/9/EG
Ignition protection:	"Intrinsic safety"
EC Type Examination Certificate:	PTB 00 ATEX 2048 X,
Ex identification:	II 2G Eex ia IIC T6.

- Socket:

Standard equipment:	DIN 5-pin output socket
EX- equipment:	3-pin EX-proof output socket

Description: The inductive sensor converts the revolution of the measuring drum into a sequence of pulses. The number of pulses represents the **volume of gas** which has passed through the Gas Meter, depending on the resolution (see "Performance Data" on page 03.39). The frequency of the sequence of pulses is a measure of the rotational speed of the measuring drum and thereby a measure of the **flow rate** of the gas.

[5] Please note: According to European laws (EC directive 94/9/EC), the gas meter, in which the Pulse Generator is built into, must be certified ("ATEX" Declaration of Conformity) if and when used in ex-proof areas. This Declaration of Conformity is available for all meter models made out of PE-el (model no. 8).

For operation of the inductive sensor, an external electric power supply with 5 Volts DC is required. More electrical data are stated on the data sheet 03.40. The output signal is a rectangular current signal with min. / max. level of 1 mA / 3 mA.

Output Socket: The pin configuration of the output sockets is shown on page 03.40.

Use with Drum-type Gas Meters (general):

Drum-type gas meters are volumetric gas meters. That means, that they are measuring gas volume precisely. When the Pulse Generator is used with drum-type gas meters for recording the gas flow, it is possible for the respective Voltage Output curve (line) to be wavy, even when gas flow is constant. This is (unpreventably) caused by the type of construction of the measuring drum: the drum consists of four separate chambers, which are closed and opened in sequence. The previous chamber **has to be** closed **before** the next chamber will open.

This compulsory measurement is the reason for the high measurement accuracy. However, each closing also causes a little build-up of pressure at the inside of a chamber. The surface tension creates an additional pressure increase during emerging of a chamber (water highest surface tension, oil: lower, CalRix lowest). The resulting pressure increase causes a small reduction in the rotational speed of the measuring drum. This is barely visible to the eye but is documented precisely by a computer/transcriber. Thus, the wavy output line at constant input flow documents the **true** flow through the gas meter.

Performance Data:

Pulses per Revolution*	50	Pulse/Rev
Gas Volume per Revolution	0.1	[ltr/Rev]
Resolution	0.002	[ltr/Pulse]
Pulses per Liter	500	[Pulse/ltr]
Maximum Pulse Frequency	250	[Pulse/min]
Output signal	Current signal	

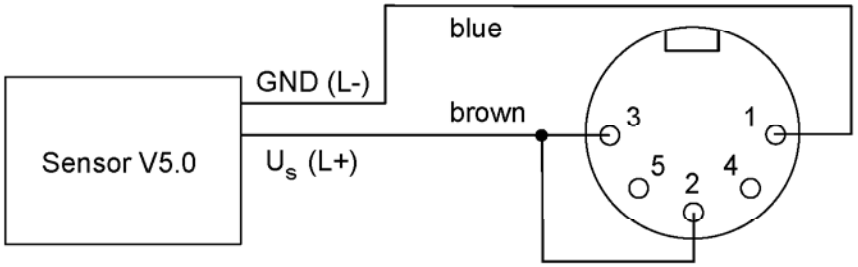
* Revolution of measuring drum

Temperature range:

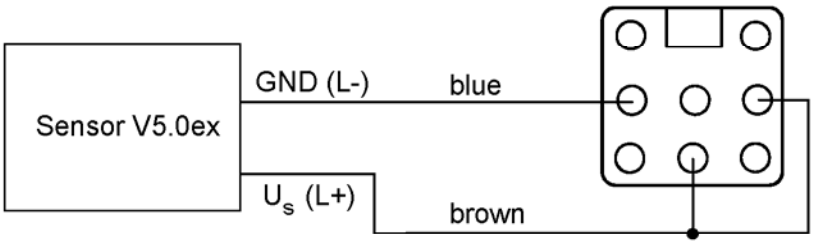
- -25°C to +100°C
- **But:** Mind the minimal/maximal working temperature of gas meter casing and drum

Pin configuration of the Output Socket
(View to **plug-side** of the (female) socket) **:**

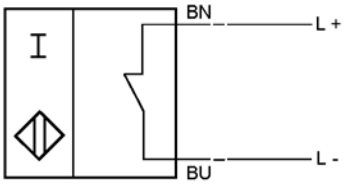
Standard version:



EX-proof version:



Standard symbol, connection:



Technical Data of sensor:

Switching element function	NAMUR NC	
Installation	embaddable	
Nominal voltage U_0	8	V
Current consumption:		
Measuring plate not detected	1	mA
Measuring plate detected	3	mA
Max. switching frequency f	5000	Hz
Self inductance L_i	50	µH
Self capacitance C_i	71	nF
EMC to	EN 60947-5-2	
In compliance with	EN 50227	
Protection to IEC 60529	IP67	
Operating temperature	-25 – +70	°C

Connection	0.2 m, PVC cable	
Conductor cross section	0,14 mm^2	
Housing material	Stainless steel	
Sensing face	PBT	
Device category	2G	

Connection of "Electronic Display Unit" EDU 32 FP (optional accessory) **to the Pulse Generator:**

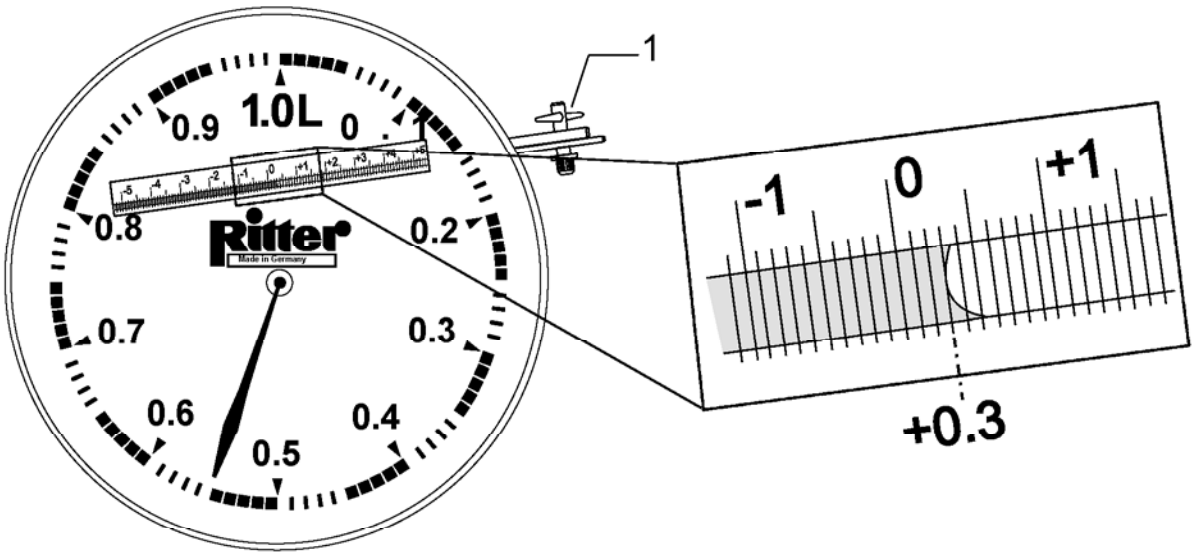
The Pulse Generator can be connected to the optional accessory "Electronic Display Unit" (V 4.0 or higher) by means of the 3-pin connection cord, which is supplied in conjunction with the Electronic Display Unit. The Electronic Display Unit contains the power supply for the inductive sensor as well as the evaluation circuit/logic which enables the direct readout of the measured volume [ltr] and flow rate [ltr/h].

The measurement results displayed by the Electronic Display Unit can be transmitted to a computer via the standard-type interface RS 232 (refer to chapter 4 "Electronic Display Unit" as well). Additionally, the value of the flow rate can be transmitted to an analog measurement device via the standard-type analog output (0-1 Volt or 4-20 mA).

For use in **ex-proof areas** an external switch amplifier for galvanic decoupling of the power supply (by the EDU) has to be installed between Pulse Generator (gas meter) and the EDU.

Set-up of EDU:

- Programming of sensor type (please refer to the EDU Operation Instructions par. 6.2.4 as well):
  With EDU versions V4.x : Select sensor type “PG V2.0Ex”
  With EDU versions V5.x and higher: Select sensor type “PG V5.0”
- Programming of slit disc / encoding disc: Select “50 Pulses/Rev”



(1) Screw cap
(Not with high pressure meters; with high pressure meters the upper end of the HPLI tube is connected to the inside of meter casing above the liquid level.)

Location of indicator shown for models TG 01 to TG 10
Location with models TG 20 to TG 50: Beside of the counter mechanism casing.

1. Application:

The High-Precision Packing Liquid Level Indicator allows highly precise reading and setting of the packing liquid level in RITTER drum-type Gas Meters. Precise adherence to the factory-set level is very important for the Meter's measurement accuracy, as the measurement deviation given in the Calibration Certificate is only valid when the packing liquid level is correct. Packing liquid levels other than that set in the factory cause the volume in the chambers of the measuring drum to be different to the volume at time of calibration, which inevitably results in a measurement error.

2. Operational principle:

The High Precision Packing Liquid Level Indicator consists of the following parts:

- sloping glass tube
- scale (behind the sloping tube)
- screwed cap (not present on High Pressure Meters)

Following the principle of communicating pipes, the sloping tube is connected with the packing liquid in the Gas Meter casing. Because of this, the liquid level in the sloping tube exactly reflects the level in the Gas Meter casing.

Because the tube is sloping i.e. set at a small angle to horizontal, a small change in the liquid level in the Gas Meter casing results in a large change in the liquid level inside the sloping tube. Thus, the sloping tube acts like a „magnifier" of the liquid level inside the casing and can therefore be set extremely precisely. Furthermore, parallax error when reading the level, as can occur with the Standard Level Indicator, is nearly impossible.

3. Setting the correct level:

The gas meter must be aligned horizontally and unpressurised (not connected to gas tubes). Before filling the Gas Meter casing with the Packing Liquid (through the filling nozzle on the rear plate of the casing), the screwed cap (1) on the outer end of the glass tube must be removed by unscrewing it (not applicable to High Pressure Meters). During filling, the liquid level rises inside the sloping glass tube in proportion to the level in the casing. (It becomes visible only when the liquid level in the casing approaches the correct level.)

The value on the scale in the sloping tube which represents the correct liquid level is stated in the Calibration Certificate of the respective Meter. The Gas Meter casing must be filled so that the liquid level in the sloping tube exactly reaches that scale value (see below).

Remark: When the inside of the glass tube is dry (which is the case with the first filling or when the Meter has not been used for some time), the liquid „column" inside the tube might not flow smoothly. This effect can be eradicated by „forcing" the liquid column to rise **above** the relevant correct scale value for that Meter, thus wetting the inside of the glass tube. This can either be done by slightly tilting the Meter forwards and then putting it back on its feet, or by quickly but gently tapping several times with a finger tip on the open end of the glass tube (where the opened tap is). After forcing the liquid column up the tube in one of these ways, it will swing backwards and forwards in a pendulum effect, gradually coming to rest at the **exact** scale value which represents the current level of the liquid in the Gas Meter casing.

Adjustment of the packing liquid level in the Gas Meter casing using the scale value given in the Calibration Certificate is done as follows:

The surface of the liquid column inside the tube has a concave meniscus due to surface tension. **The base of the meniscus arc defines the correct liquid level** (and not the points where the meniscus touches the glass tube). This is demonstrated in the right-hand drawing on the previous page. In this example, the base of the meniscus arc is positioned exactly at the scale value of + 0.3. If this were also the scale value given in the Meter's Calibration Certificate, the packing liquid level of this Meter would be correct.

In the above example, if the scale value given in the Meter's Calibration Certificate were +0.8, packing liquid would have to be added through the filling nozzle on the rear-plate of the casing until the base of the meniscus arc was positioned exactly on the sloping tube's scale value of +0.8. Similarly, if the scale value given in the Meter's Calibration Certificate were –1.2, packing liquid would have to be drained out of the Meter casing via the drainage faucet on the casing's rear-plate, until the base of the meniscus arc was positioned exactly on –1.2.

Once the packing liquid level has been correctly set in this way, the screwed cap on the outer end of the sloping tube must be replaced (not applicable to High Pressure Meters). Hereby the level will slightly be moved downwards. However, this does not affect the measurement accuracy. The screwed cap must always be closed before gas measurements are made, otherwise the gas pressure will force packing liquid out of the tube!!

4. Cleaning of the glass tube (inside):

If the liquid column inside of the glass tube doesn't run smoothly during setting of the liquid level, this may be caused by soiling of the tube's inside surface. (The soiling may occur through the use of oil or grease polluted gas.)

In this case, the glass tube can be cleaned by using the attached cleaning rods (similar to pipe cleaners). The cleaning rods should be soaked with an appropriate cleaning liquid (alcohol, detergent, etc.).

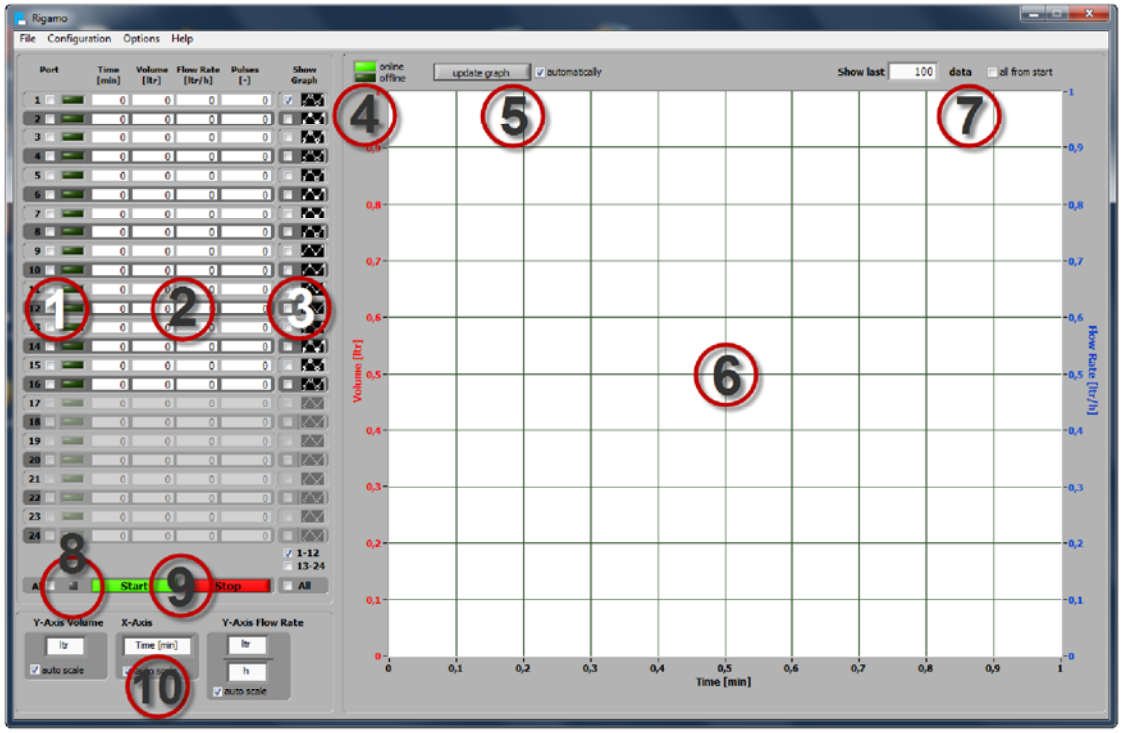
a) With Standard Meters: Remove the screwed cap.

b) With High Pressure Meters: **The Gas Meter must be pressure-free.** Take out the hexagon socket screw by turning it anti-clockwise. The hexagon socket screw is located at the 2-o'clock-position of the counter mechanism casing.

Lower the liquid level within the glass tube by either tilting the Meter backwards or by partly emptying out the packing liquid. Clean the inside of the glass tube by using a cleaning rod. Finally, the glass tube must be closed again.

Software Features (overview):

- Windows software for **data acquisition** of gas volume and flow rate from up to 24 Ritter gas meters to a PC USB port.
- Support of **multi-core processors**
- **Graphical and tabular display** of measurement data
- **Storing** of data
- **Print out** (separately or in any combination) of
  - Diagram
  - Test parameters
  - Measured values in tabular form
- **Export** of stored data to Microsoft Excel® spread-sheet (Excel 2003 or higher)
- **Automatic correction** of the dynamic (flow rate dependent) measurement error (MGC only)
- **Please note:** Rigamo can only started once at a time at one PC.
  No support of bi-directional recognition of the measuring drum rotation with Pulse Generator V4.01

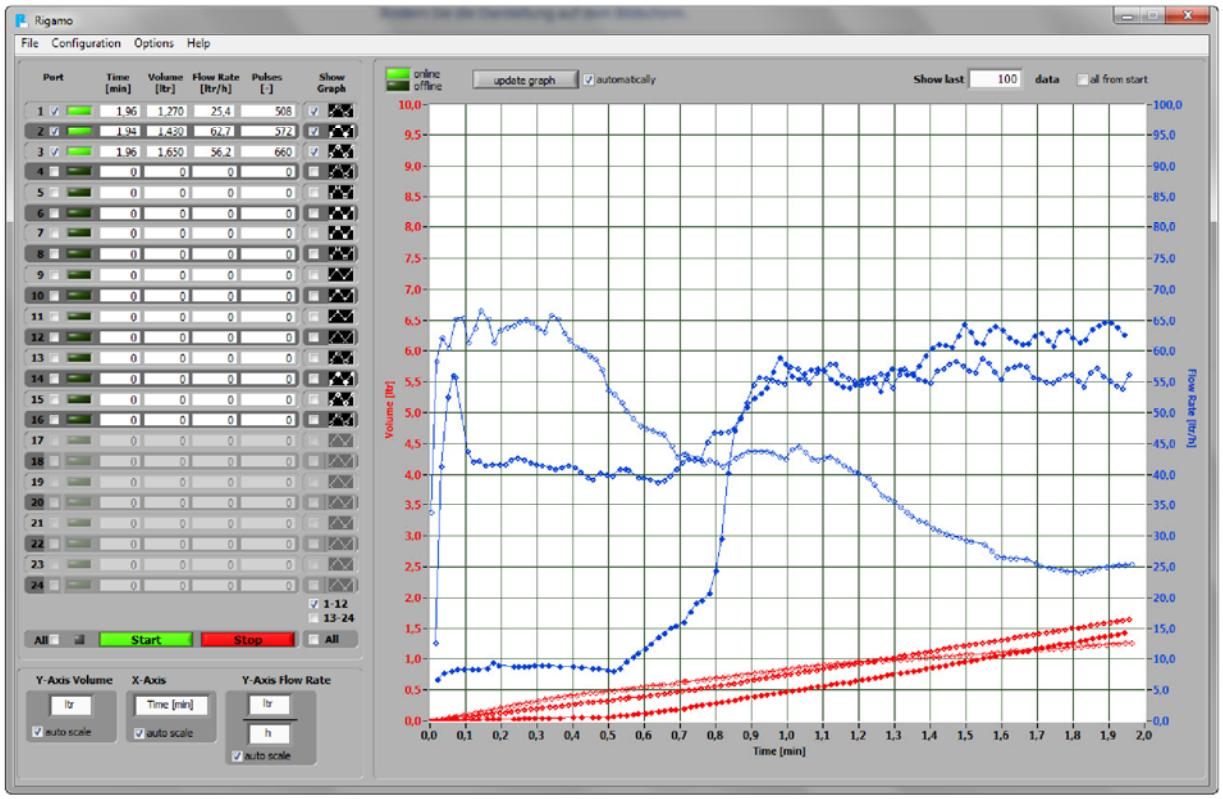


- Area 1: Display of port status
- Area 2: Tabular display of data for respective ports in real time
- Area 3: Tick boxes for display "show" / "no show" of graphs
- Area 4: Indicator for online / offline display of graphs
- Area 5: Selection of graph updating mode (automatically/manually)
- Area 6: Diagrams for gas volume and flow rate
- Area 7: Number of last measurement data to show in diagram
- Area 8: Indicator of processor load status
- Area 9: Buttons „Start/Stop" of data acquisition
- Area 10: Dimensions of diagram axes**System Requirements:**

- Gas meter with built-in pulse generator (option)
- Digital Input Module "DIM" (accessory)
- Operating system Windows XP®, Windows Vista®, Windows 7®
- Licence (dongle) for requested number of ports (= gas meters to be connected)
- Microsoft Excel® 2003 or higher for data export to Excel®
- Recommended processor performance: ≥1.5 GHz
- Random access memory (RAM): ≥500 MB
- 2 free USB ports (1 port for data acquisition, 1 port for licence dongle)
- Monitor 17"
- Monitor setting: Optimised for monitor resolution of 1280x 1024 pixel or higher
- Mouse / mouse pointer

Please note: A standard converter "USB to RS232" for connection to COM port cannot be used.

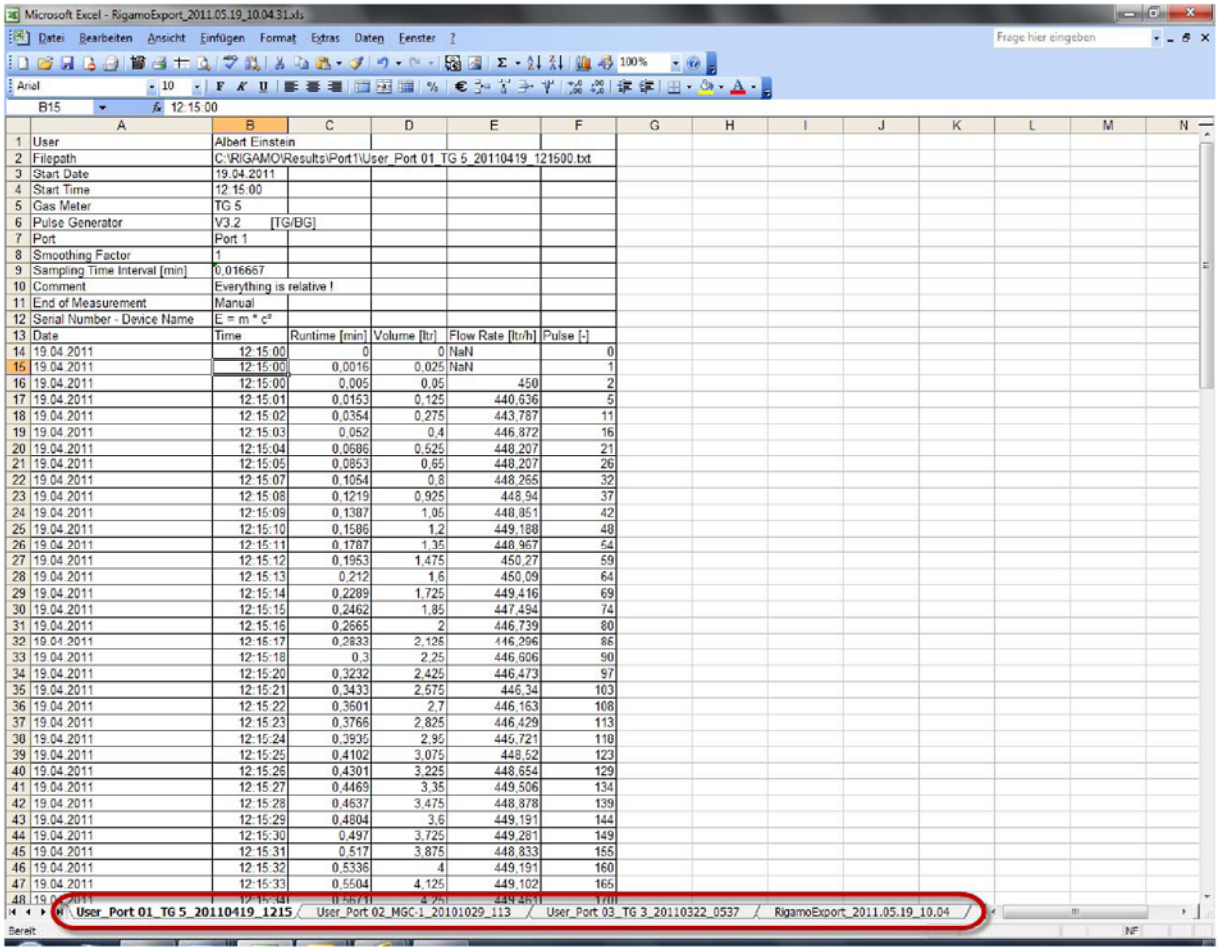
Monitor Display of Data Acquisition (Example):
(Data acquisition from 3 gas meters; red graphs: volume; blue graphs: flow rates)



Data export to Microsoft Excel®:

System requirement: Microsoft Excel® 2003 or a later version

Export example of three data files:



	A	B	C	D	E	F
1	User	Albert Einstein				
2	Filepath	C:\RIGAMO\Results\Port1\User_Port 01_TG 5_20110419_121500.txt				
3	Start Date	19.04.2011				
4	Start Time	12:15:00				
5	Gas Meter	TG 5				
6	Pulse Generator	V3.2	[TG/BG]			
7	Port	Port 1				
8	Smoothing Factor	1				
9	Sampling Time Interval [min]	0,016667				
10	Comment	Everything is relative !				
11	End of Measurement	Manual				
12	Serial Number - Device Name	E = m * c²				
13	Date	Time	Runtime [min]	Volume [ltr]	Flow Rate [ltr/h]	Pulse [-]
14	19.04.2011	12:15:00	0	0	NaN	0
15	19.04.2011	12:15:00	0,0016	0,025	NaN	1
16	19.04.2011	12:15:00	0,005	0,05	450	2
17	19.04.2011	12:15:01	0,0153	0,125	440,636	5
18	19.04.2011	12:15:02	0,0354	0,275	443,787	11
19	19.04.2011	12:15:03	0,052	0,4	446,872	16
20	19.04.2011	12:15:04	0,0686	0,525	448,207	21
21	19.04.2011	12:15:05	0,0853	0,65	448,207	26
22	19.04.2011	12:15:07	0,1054	0,8	448,265	32
23	19.04.2011	12:15:08	0,1219	0,925	448,94	37
24	19.04.2011	12:15:09	0,1387	1,05	448,851	42
25	19.04.2011	12:15:10	0,1586	1,2	449,188	48
26	19.04.2011	12:15:11	0,1787	1,35	448,967	54
27	19.04.2011	12:15:12	0,1953	1,475	450,27	59
28	19.04.2011	12:15:13	0,212	1,6	450,09	64
29	19.04.2011	12:15:14	0,2289	1,725	449,416	69
30	19.04.2011	12:15:15	0,2462	1,85	447,494	74
31	19.04.2011	12:15:16	0,2665	2	446,739	80
32	19.04.2011	12:15:17	0,2833	2,125	446,296	85
33	19.04.2011	12:15:18	0,3	2,25	446,606	90
34	19.04.2011	12:15:20	0,3232	2,425	446,473	97
35	19.04.2011	12:15:21	0,3433	2,575	446,34	103
36	19.04.2011	12:15:22	0,3601	2,7	446,163	108
37	19.04.2011	12:15:23	0,3766	2,825	446,429	113
38	19.04.2011	12:15:24	0,3935	2,95	445,721	118
39	19.04.2011	12:15:25	0,4102	3,075	448,52	123
40	19.04.2011	12:15:26	0,4301	3,225	448,654	129
41	19.04.2011	12:15:27	0,4469	3,35	449,506	134
42	19.04.2011	12:15:28	0,4637	3,475	448,878	139
43	19.04.2011	12:15:29	0,4804	3,6	449,191	144
44	19.04.2011	12:15:30	0,497	3,725	449,281	149
45	19.04.2011	12:15:31	0,517	3,875	448,833	155
46	19.04.2011	12:15:32	0,5336	4	449,191	160
47	19.04.2011	12:15:33	0,5504	4,125	449,102	165

The data of each data file (parameters plus measurement data) are exported into a separate table. Additionally, a blank table is created with the name of the export file (see red mark in the window above).