

AERZEN

ROTARY PISTON GAS METERS

for reliable measuring of gaseous medium



AERZENER MASCHINENFABRIK
GMBH

Z1-001 | 15 | EN

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8.2010

Aerzen Rotary Piston Gas Meters

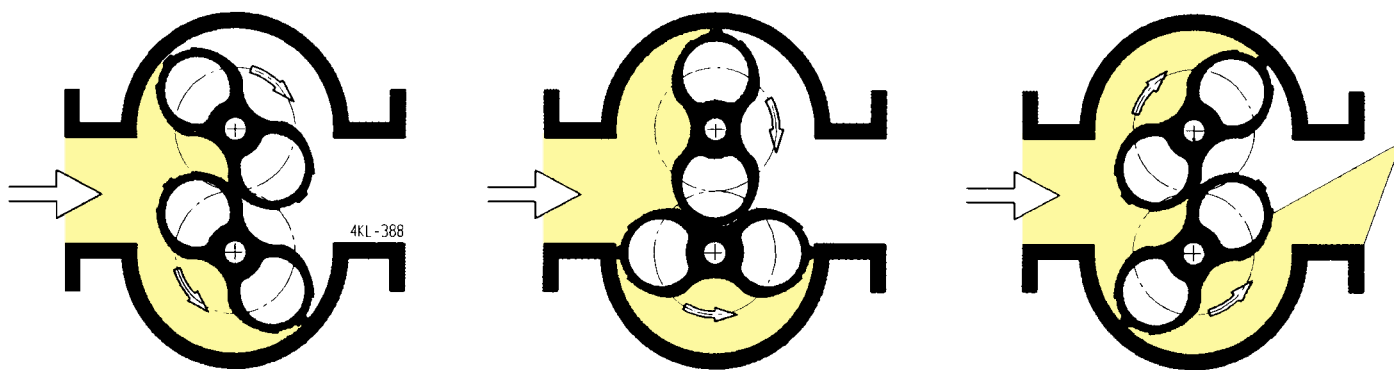
Over 70 years of successful experience

Rotary piston gas meters have been manufactured since 1930 by Aerzener Maschinenfabrik, one of the largest and oldest manufacturers worldwide. The basis for the design of the gas meter series is from many years of experience and continual dialogue with the end users, as well as using the harmonized EU-standards which will apply to all installations within the European Market. They are manufactured in accordance with the Aerzen tradition for quality corresponding to the quality assurance system, certified to DIN ISO 9001 and as per pressure device guideline DGRL 97/23/EG.

Advantages:

- Largest series of all competitors up to G 4000 (6.500 m³/h)
- In series HTB design 5 bar operating pressure (G 40 - G 400)
- Extended measuring range up to 1:160
- Guaranteed measuring resistance within the calibration validity
- Re-calibration every 16 years, unlimited for sizes up to G 1600 and larger
- Reduced assembly dimensions (3 x DN possible)
- Minimum maintenance, oil change intervals are 16 years on gas streams with utmost purity
- Double roller type counter in series makes change of the flow direction at site possible without supervision of a calibration inspector
- No measured orifices required compared to turbine wheel counters
- Pressure and temperature connections are available in the housing on both sides (please refer to page 9)
- Flexible customer-orientated solutions by additional equipment (please refer to page 8)





Mode of operation

The Rotary piston gas meter is used for volumetric measurement of gas in closed piping systems.

A pressure difference between the inlet and outlet of the gas meter produces a rotation torque on the rotary pistons. Once the rotation torque exceeds the moment of inertia of the rotors, they begin to rotate in the direction of the arrows. During rotation, the cavities formed between the rotors and the cylinder housing fill and discharge with a volume of gas. Therefore, the rotation of the pistons is proportional to the gas flow. The rotation is transmitted via an adjusting gear to the counter, it records the gas volume that has passed across the gas meter in actual cubic meters.

The rotors turn very freely, because no metal contact takes place within the measuring chamber. Measuring starts at $\Delta p < 0.1 \text{ mbar}$ and $Q \sim 1/1000 Q_{\max}$.

Fields of application

Aerzen rotary piston gas meters are designed for metering gas volumes. They are primarily used

- in the public gas supply network - in gas transfer and metering stations - for the measurement of gas consumption and distribution in municipal and gas provider facilities, as well as the gas consumed by end users. e.g. steelworks, tile and glass making plants, as well as schools, hospitals, apartment complexes etc.
- in the chemical industry for metering gas consumption, gas distribution, also for process gas flow control.
- in the car industry, for measuring the inlet air flow of combustion engines on test and research benches.
- in the industry for measuring the consumption of compressed air
- in the compressor technology for determination of the air volume generated on test benches

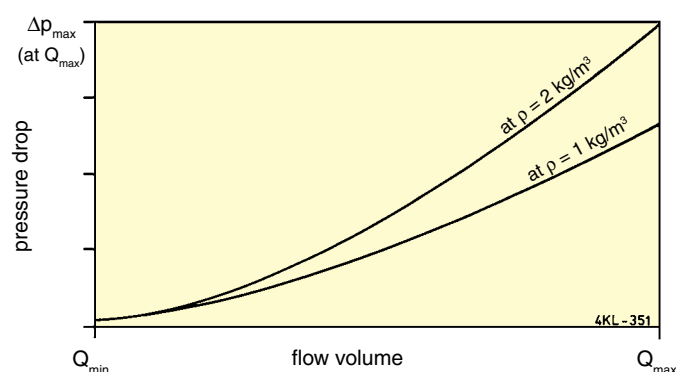
Measuring accuracy, flow resistance

With increasing gas prices, high accuracy and reliability of measurements are paramount. Rotary piston gas meters offer these advantages over other gas meter types. The accuracy of repetitive measuring is excellent and under normal conditions remains constant for decades. After approximately 50 years of operation, re-calibration of Aerzen gas meters has shown virtually no deviation from the accuracy curve at new condition. A special manufacturing process guarantees exacting tolerances and the highest precision of this „Roots type“ measuring system.

A measuring range of up to 1:160 and even higher can therefore be achieved as a standard. The optimal design of bearings and gears results in very smooth operation and low pressure drop Δp .

The pressure drop is nearly proportional to the specific weight of the gas and to the square of the gas flow.

The Δp values for the various gas meter sizes at Q_{\max} are given in the table on page 6.



Typical pressure drop diagram for gas specific weights $\rho = 1 \text{ kg/m}^3$ and $\rho = 2 \text{ kg/m}^3$.

Design and layout

Rotary piston gas meters are manufactured for pressure stages p_{\max} 10 bar, 16 bar. The pressurized parts within the gas meter are made of nodular cast iron, up to size G 1000 the rotors are made of anodized light alloy, above G 1000 they are made of grey cast iron. The anodizing layer achieves a considerably higher resistance to wear of the piston surface.

Oversize bearings and ground timing gears ensure quiet vibration-free operation. A frictionless and pressure tight magnetic coupling transmits the rotation from the pressure chamber to the drive shaft of the counter mechanism. This shaft carries the magnet core and drives the counter mechanism in its isolated housing. The counter mechanism features a closely stepped adjusting gear and 8 counting wheels.

The gas meters up to size G 400 are flange mounted. Larger gas meters feature bolted-on mounting feet.

All Aerzen gas meters meet the requirements of DVGW-sheet G 492/II and DIN 30690 T 1, DIN 3230 T 5 and pressure device guideline DGRL 97/23/EG.

They are subject to the pressure and leakage tests prescribed by these standards.

The housing materials correspond to the requirements of DIN EN 13445-2 with PED-QM certification with acceptance test certificate EN 10204/3.1.B.

Aerzen rotary piston gas meters already now meet the essential requirements of the future European Rotary piston gas meter standard EN 12480. Until this standard becomes binding the previous legal regulations (calibration law, calibration order) apply, according to which the Aerzener Maschinenfabrik manufactures, tests and approves its products. Works certificates for tests acc. to EN 12480 can be issued on request.

Gases

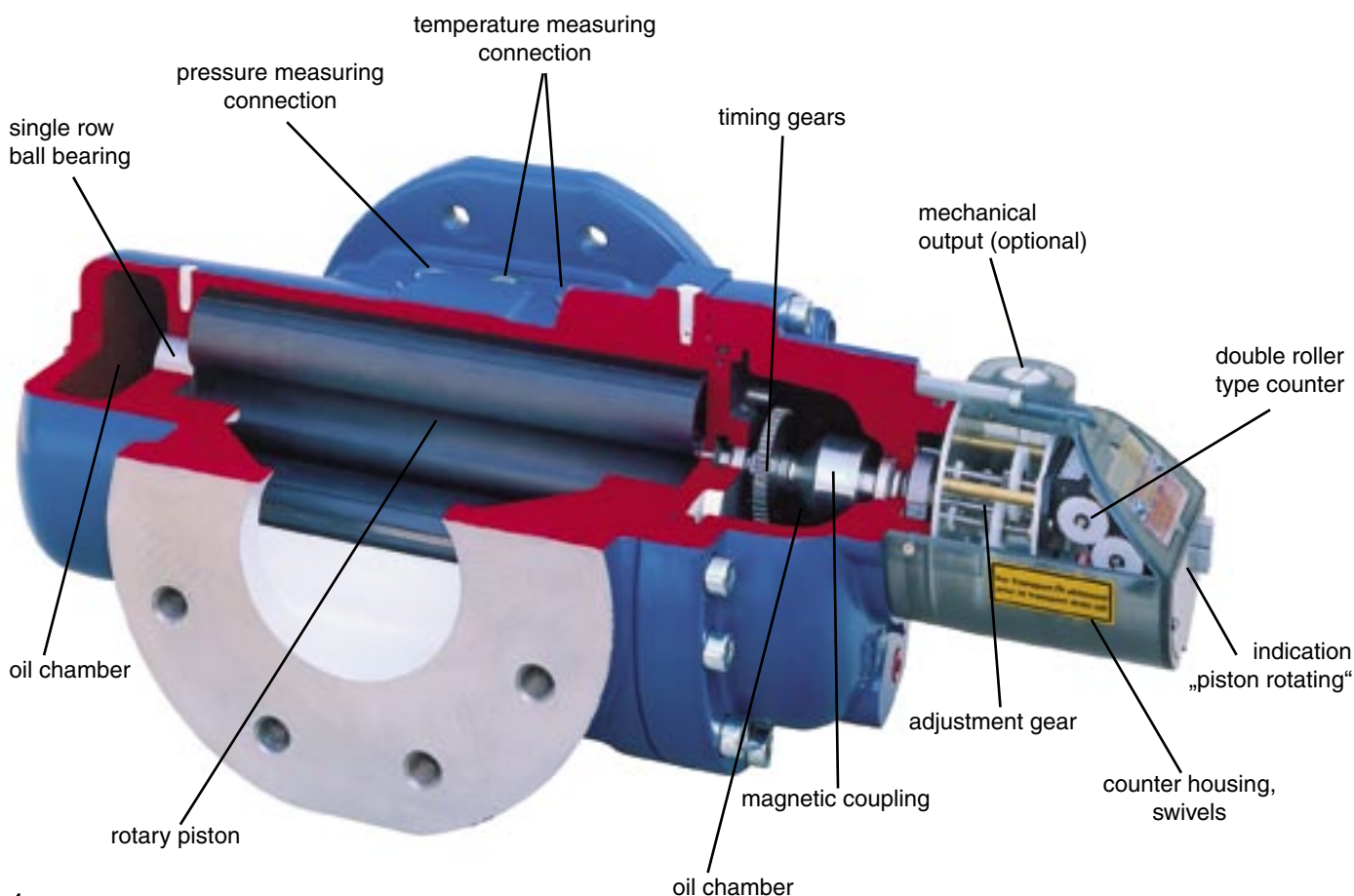
Aerzen gas meters can be used with any noncorrosive gas according to DVGW-worksheet G 260, including natural gas, town gas, coke oven gas, refinery gas, propane, butane, liquid gas/air mixtures, methane, ethylene, hydrogen and other gases.

Operating temperature

The normal operating temperature range is between -10°C and $+40^{\circ}\text{C}$. Please contact our sales department for higher or lower temperatures. The gas meters can be stored at temperatures between -20°C and $+60^{\circ}\text{C}$.

High Temperature Resistance (HTB - 5 bar)

In the case of a fire, the gas meter must not be an additional hazard. Therefore, the Aerzen gas meter sizes G 40 to G 400 are designed to fulfill the HTB-requirements of DIN 3374.



Mounting positions

The meters are designed to operate in horizontal and vertical flow directions, the counter can be rotated **(without supervision of a calibration inspector.)**

Sizes G 40 to G 400

The oil level control screws are **positioned** for horizontal and vertical flow. The gas meters can therefore be rotated through 90 degrees, the counter housing must be rotated to fit the actual orientation **without supervision of a calibration inspector.**

Sizes G 650 to G 4000

The oil level indicators and the mounting feet can be **relocated** for horizontal and vertical flow. The gas meters can therefore be rotated through 90 degrees, and the counter housing can be rotated **without supervision of a calibration inspector.**

More flexibility by new counter design

The Aerzen rotary piston gas meters are equipped with a new double roller type counter, which enables upon commissioning an adjustment to the flow direction **without adjustment of the counter and without supervision by a calibration inspector.** Consequently, less stock is necessary and costs of short-term modifications regarding planned projects can be avoided. The adjustment at site to the requested flow direction can be effected easily and without the use of tools. The counter provides two displays working in opposite direction which are covered by a shield when delivered. After determination of the flow direction, the cover is removed and the corresponding display becomes visible. If necessary - the counter head can be turned by 90° by loosening 2 hexagon socket screws.

Further features:

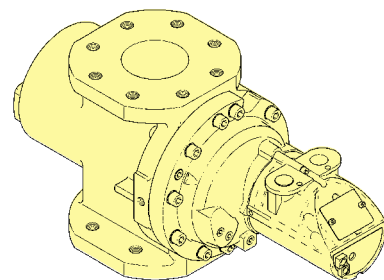
- 1 unit low frequency impulse generator installed as standard
- further impulse generators (high- or low frequency) can be added
- retrofit of mechanical output drive possible acc. to DIN 33800

Installation and maintenance

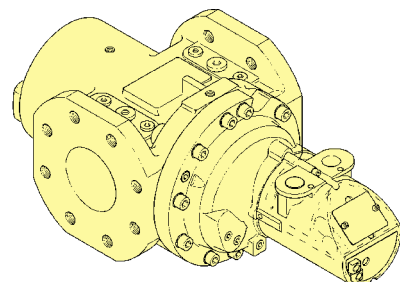
Rotary piston gas meters require no inlet orifice's. Both the gas and the pipe line must be clean; it is advisable to temporarily install a starting strainer. The meters are splash lubricated. The oil level can be checked by oil level indicators. In case of normal operation, an oil change is only necessary every 5 years (when measuring gas streams with utmost purity every 16 years only). The counter does not require any particular maintenance for several years. For further details please refer to the corresponding operating manual.



Aerzen
Rotary Piston Gas Meters
G 160, PN 16



Aerzen Rotary Piston Gas Meters - universal
flow directions (counter rotation **without
supervision of a calibration inspector.**



Measuring ranges, sizes, pressure losses, volume per revolution U_p

Connecting flange side	Gas meter size	model number	Measuring range which can be calibrated							Differential pressure Δp at Q_{\max} and $\rho = 1 \text{ kg/m}^3$	smallest indicator wheel U_p
			EG-certification EWG 1.33-3271.3-AEM-E01			German national calibration 1.33-3271.3-AEM-N01					
			Q_{\max}	1 : 10 Q_{\min}	1 : 20 Q_{\min}	1 : 30 Q_{\min}	1 : 50 Q_{\min}	1 : 100 Q_{\min}	1 : 160 Q_{\min}		
DN	-	-	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[m³/h]	[mbar]	[m³/U]
50	G 40	Zc 038.05	65	6	3	2	1.3	0,65	-	3	0.1
50	G 65	Zc 038.06	100	10	5	3	2	1	0,6	3	0.1
80	G 100	Ze 039.0	160	16	8	5	3	1.6	1	4	1.0
80	G 160	Ze 039.1	250	25	13	8	5	2.5	1,6	4	1.0
100	G 160	Ze 039.1	250	25	13	8	5	2.5	1,6	4	1.0
100	G 250	Zc 11.3	400	40	20	13	8	4	2,5	5	1.0
150	G 400	Zc 11.4	650	65	32	20	13	6.5	4	5	1.0
150	G 650	Za 13.f7	1000	100	50	32	20	10	-	5	1.0
200	G 1000	Za 13.8	1600	160	80	50	32	16	-	6	10.0
250	G 1600	Za 15.11	2500	250	130	-	-	-	-	5	10.0
300	G 2500	Za 16.f13	4000	400	200	-	-	-	-	5	10.0
300	G 4000	Za 16.13	6500	650	320	-	-	-	-	11	10.0

All the meter sizes can be operated with a mechanical output drive without limitation of the measuring ranges

Q_{\max} = maximum allowable volumetric gas flow at actual gas conditions

Q_{\min} = minimum allowable volumetric gas flow at actual gas conditions

Δp = pressure loss across the gas meter, measured between inlet- and outlet socket

U_p = value per revolution of the first indicator wheel (on the right)

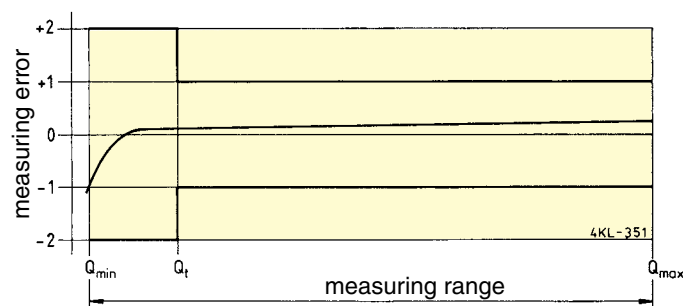
Measuring error

Aerzen Rotary Piston Gas meters are measuring units appropriate for calibration. On customers' request they are calibrated at our factory in accordance with German national standards or to the latest rules established by the European Union - the calibration is carried out under supervision of an official inspector or by our own inspector using calibrated and registered instruments - and afterwards delivered accordingly.

Our measuring system offers the following advantages:

- wide measuring ranges while maintaining highest accuracy
- high repeatability (approximately 0.1 %)
- negligible hysteresis
- high reliability of the measurements, even under fluctuating flow volumes, such as heating systems
- no run on, as e. g. with turbine wheel meters
- long term measuring accuracy over many decades
- excellent operation at high pressure due to the absence of typical high pressure offset

The regulations governing the calibration prescribe the measuring error limits (of the actual value). These limits are shown on a measuring error curve such as in the following figure.



The allowable measuring error not used:

In the range from Q_{\min} to $Q_t \pm 2\%$ and from Q_t to $Q_{\max} \pm 1\%$

Q_t varies with the measuring range as follows:

1:10 $Q_t = 0,20 Q_{\max}$ (EU-calibration)

1:20 $Q_t = 0,20 Q_{\max}$ " "

1:30 $Q_t = 0,15 Q_{\max}$ (German national calibration)

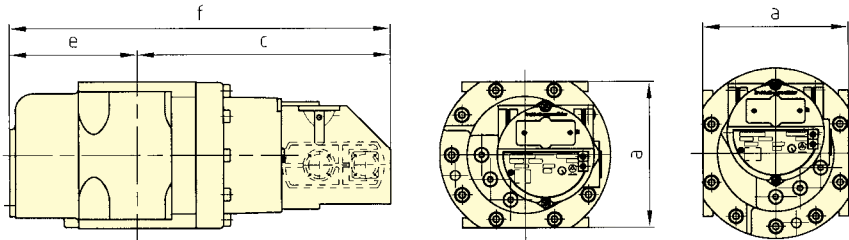
1:50 $Q_t = 0,10 Q_{\max}$ " " "

1:100 $Q_t = 0,08 Q_{\max}$ " " "

1:160 $Q_t = 0,06 Q_{\max}$ " " "

Dimension chart:

Gas meter sizes G 40 and G 65, PN 16, housing GGG-40. Double roller type counter can be rotated

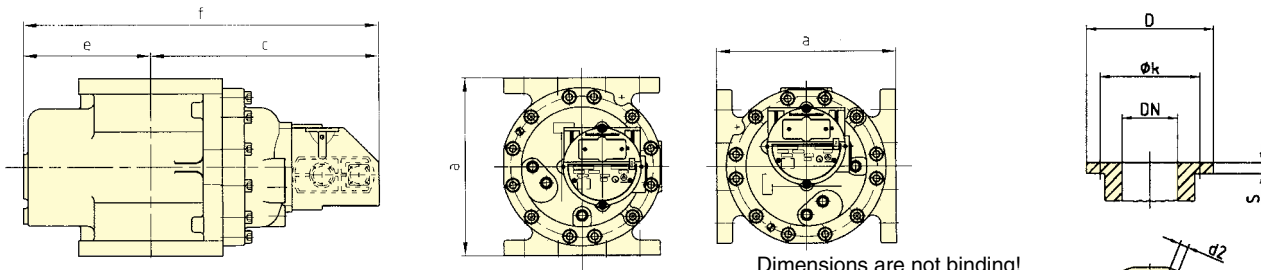


Dimensions are not binding!

nozzle size DN	Gas meter size	model number	pressure rating PN	* a mm	c mm	e mm	f mm	h ³ mm	For connecting flanges to EN 1092-2				s	weight approx. kgs
									ø k	D	*** d ₂	Quantity d ₂		
50	G 40	Zc 038.05	16	150	261	131,5	392	80	125	-	M 16	4	20	22
50	G 65	Zc 038.06	16	150	291	161,5	452	80	125	-	M 16	4	20	26

- * construction length acc. to „Euro“-standard
- ** recommended free space for maintenance work
- *** fully threaded / stud hole (depth = s)

Dimension chart: Gas meter sizes G 100 to G 400, PN 16, housing GGG-40. Double roller type counter can be rotated

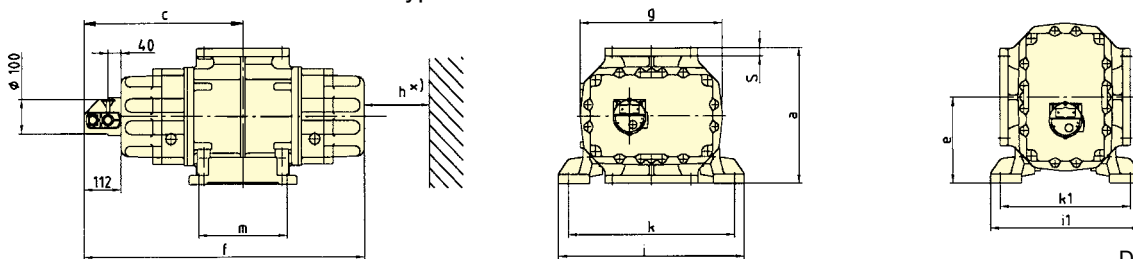


Dimensions are not binding!

nozzle size DN	Gas meter size	model number	pressure rating PN	* a mm	c mm	e mm	f mm	h ³ mm	For connecting flanges to EN 1092-2				s	weight approx. kgs
									ø k	D	*** d ₂	Quantity d ₂		
80	G 100	Ze 039.0	16	230	294	164	458	80	160	210	M 16	8	20	38
80	G 160	Ze 039.1	16	230	349	164	513	80	160	210	M 16	8	20	45
100	G 160	Ze 039.1	16	230	349	164	513	80	180	229	M 16	8	20	45
100	G 250	Zc 11.3	16	340	333	189	522	85	180	229	M 16	8	20	90
150	G 400	Zc 11.4	16	340	383	239	622	85	240	285	M 20	8	24	110

- * construction length acc. to „Euro“-standard
- ** recommended free space for maintenance work
- *** fully threaded / stud hole (depth = s)

Dimension chart: Gas meter sizes G 650 to G 4000, PN 10, PN 16, series 324 foot mounted, housing GGG-40. Double roller type counter can be rotated



Dimensions are not binding!

nozzle size DN	Gas meter size	model number	pressure rating PN	* a mm	c mm	e mm	f mm	g mm	h ³ mm	Dimensions of the machine mount					For connecting flanges to EN 1092-2				s	weight approx. kgs
										m mm	i mm	k mm	i ₁ mm	k ₁ mm	ø k	D	*** d ₂	Quantity d ₂		
150	G 650	Za 13.f7	10	400	452	268	862	440	100	270	570	510	440	380	240	285	23	8	26	265
			16	630	502	315	902	460	150	440	640	550	640	550	240	318	23	8	37	415
200	G 1000	Za 13.8	10	400	522	268	1002	440	100	410	570	510	440	380	295	340	23	8	26	310
			16	630	572	315	1042	460	150	580	640	550	640	550	295	381	23	12	41	580
250	G 1600	Za 15.11	10	630	592	420	1092	660	150	410	800	720	580	510	350	395	23	12	28	650
			16	900	642	465	1202	750	200	620	870	770	870	770	355	445	27	12	48	1360
300	G 2500	Za 16.f13	10	710	752	490	1372	810	200	525	910	830	640	560	400	445	23	12	24	1020
			16	900	792	465	1452	920	250	860	870	770	870	770	410	460	27	12	51	1600
300	G 4000	Za 16.13	10	710	812	490	1502	810	200	655	910	830	640	560	400	445	23	12	24	1060
			16	900	852	465	1582	920	250	990	870	770	870	770	410	460	27	12	51	1800

*construction length acc. to „Euro“-standard / **recommended free space for maintenance work / *** bored through)

Possibilities for connection and ancillary equipment

Impulse generators, installed in counter housing

This new Aerzen gas meter series is equipped with a low frequency impulse generator model IZ 9 as standard (optional double impulse generator model IZ 9-2). In addition the following impulse generators can be installed:

- high frequency impulse generator type IZ 6
- low frequency impulse generator type IZ 4
- low frequency impulse generator type IZ 8

Gas meter size	Model	Installed impulse generators				Mechanical output (Option)		Optional impulse generators (Option) installed to output drive				
		Induction switch		Reed contact		Displacement per unit U _a	Maximum allowable M _{max}	Induction switch		Reed contact		Diode no exapproval Typ IZ 111
		Option Typ IZ 4	Option Typ IZ 6	Standard Typ IZ 9	Option Typ IZ 8			Typ IZ 10	Typ IZ 11	Typ IZ 50	Typ IZ 51	
		[m³/lmp]	f bei Q _{max}	[m³/lmp]	[m³/lmp]	[m³/U]	[N _{mm}]	[m³/lmp]	[m³/lmp]	[m³/lmp]	[m³/lmp]	[m³/lmp]
G 40	Zc 038.05	0.01	360 Hz	0.1	0.01	0.01	2	0.001 oder 0.010	0,01 x U _a up to 100 x U _a	0.010	0,1 x U _a up to 100 x U _a	0,0005 x U _a up to 1 x U _a
G 65	Zc 038.06	0.01	400 Hz	0.1	0.01	0.01						
G 100	Ze 039.0	0.1	400 Hz	1.0	0.1	0.1						
G 160	Ze 039.1	0.1	460 Hz	1.0	0.1	0.1	5	0.010 or 0.10				
G 250	Zc 11.3	0.1	400 Hz	1.0	0.1	0.1						
G 400	Zc 11.4	0.1	440 Hz	1.0	0.1	0.1						
G 650	Za 13.f7	0.1	250 Hz	1.0	0.1	0.1	20	0.10 or 1.0				
G 1000	Za 13.8	1.0	280 Hz	10.0	1.0	1.0						
G 1600	Za 15.11	1.0	170 Hz	10.0	1.0	1.0						
G 2500	Za 16.f13	1.0	120 Hz	10.0	1.0	1.0						
G 4000	Za 16.13	1.0	170 Hz	10.0	1.0	1.0						
Technical data sheets		4 SZ-372				4 SZ-376		4 SZ-377				4 SZ-291

Impulse generator, installed at mechanical output drive

In addition to the impulse generators installed another impulse generator can be installed - in accordance with the chart by means of the mechanical output drive.

Mechanical output drive

All meter sizes can be operated with a mechanical output drive without limitation to the measuring ranges!

For connection of additional equipment a mechanical output drive is available ex factory or can be retrofitted at site under supervision of a calibration inspector. The connection sizes for the accessories correspond to DIN 33800, which has been the Aerzen standard since 1951.

The values of rotation and admissible connection torques are shown in the above chart. The mechanical output drive can be used e.g. for installation of the following equipment, observing M_{max}:

- impulse generators (see chart)
- mechanically driven volume converters
- electronic compact converters (other makes)
- encoder counter

Optional accessories

- for temperature measurement thermowells in different threads are available (G¹/₄ / G¹/₂) – please also refer to drawing 4 SZ-464.
- for protection against impurities optionally starting strainers in different designs (conical strainers – drawing 3 SZ-242 and filter screen – drawing 4 TZ-802) are available.
- encoder counter on request

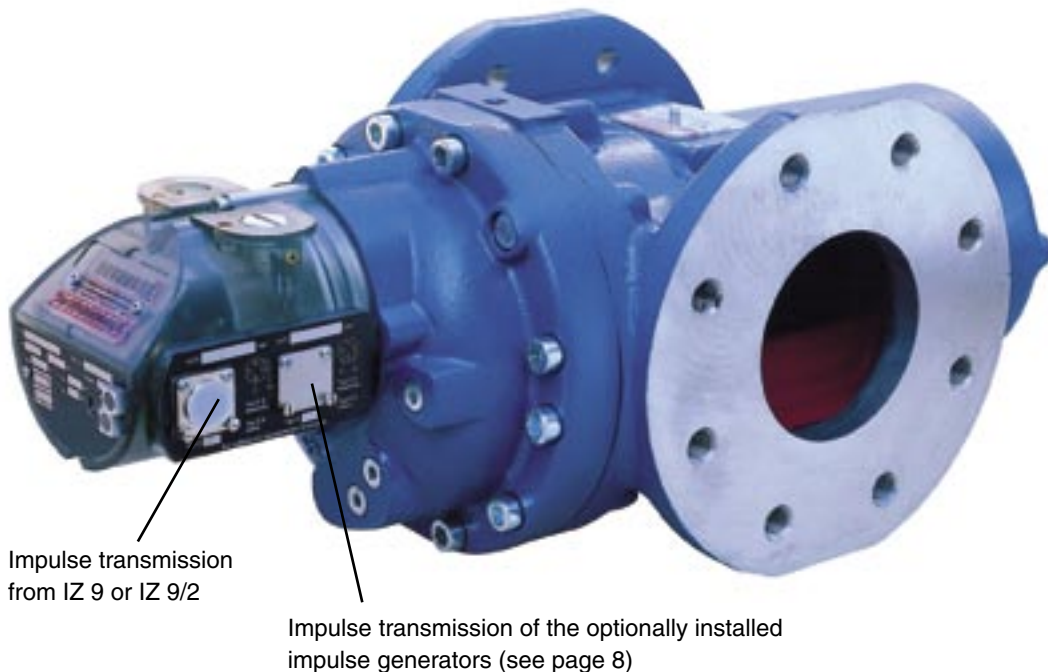
output drive location



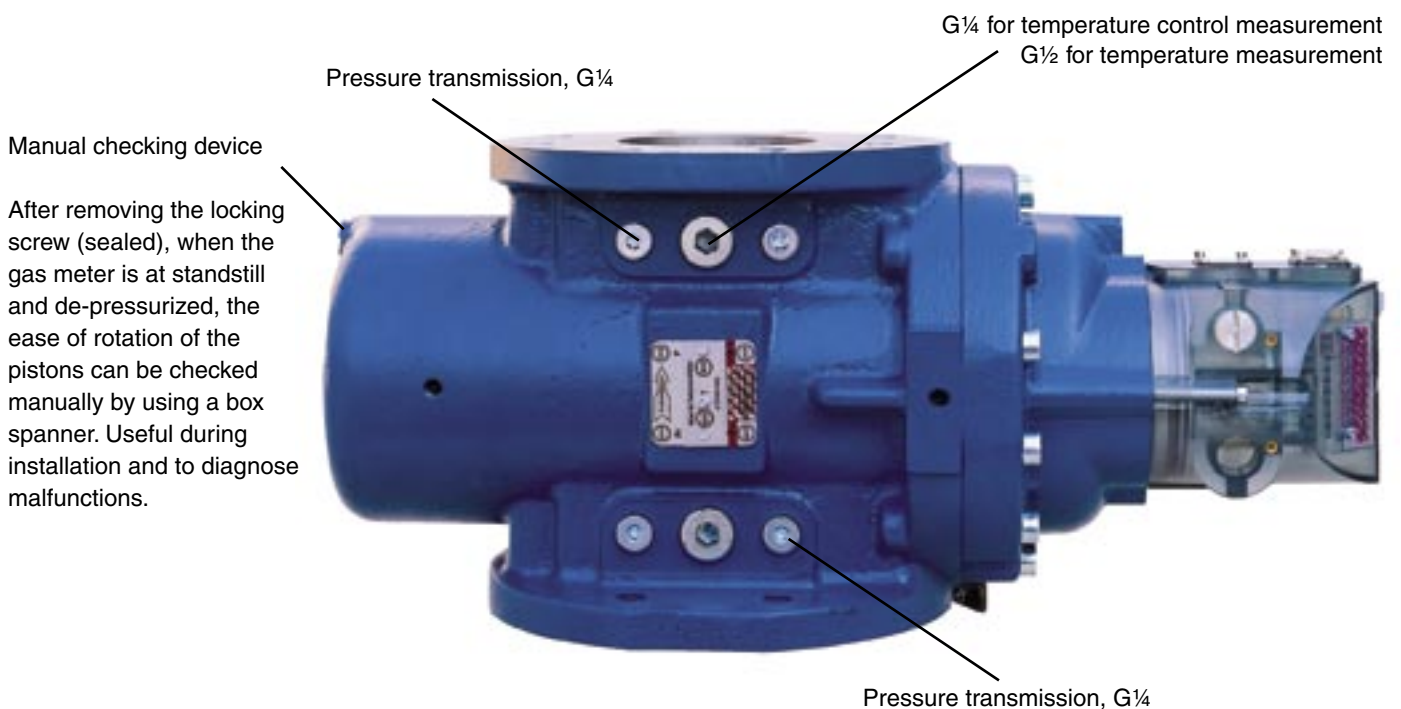
Mechanical output drive
Connection dimensions per
DIN 33800 (shown for U_a = 0,1 m³)

Suggestions for connecting accessories

All the usual measuring tasks encountered in the public gas distribution industry can be accomplished by using the impulse generators to be installed in the counter or via the mechanical output drive - please refer to page 8 -. In addition the high frequency impulse generators allow for accurate indication of the instantaneous value (e.g. m³/h), as it is used for vehicle diagnostics. Here some examples:



Shown for gas meter sizes G 40 to G 400
(For gas meter sizes G 650 to G 4000 -
temperature connections provided in the pipe)



Electronic compact volume converter UNIGAS PTZ Compact

The volume converter UNIGAS PTZ Compact designed especially for the requirements in gas measuring is optionally available for Aerzen Rotary Piston Gas meters or can even be retrofitted.

Task:

The state volume converter UNIGAS PTZ converts the measured gas volume V_b of one gas meter at operation condition into m^3 dry gas from standard condition $p_n = 1,01325$ bar and $T_n = 273,15$ K. The compressibility is considered as fixed value or acc. to charts stored in the computing device pressure- and temperature dependent. The conversion is effected acc. to the following formula:

$$V_n = V_b \cdot \frac{p_{abs} \cdot T_n}{p_n \cdot T} \cdot \frac{1}{K}$$

V_n = volume at standard condition (DIN 1343) in m^3

p_n = standard value of pressure = 1,01325 bar

T_n = standard value of temperature = 273,15 K

V_b = volume at operation condition in m^3

p_{abs} = operation value of gas pressure in bar

T = operation value of gas temperature in Kelvin

K = compressibility factor

Operating principle:

In operation the volume gas meter transmits impulses proportional to the measured flow to the processor of the UNIGAS PTZ by means of a low frequency impulse converter mounted in or at the gas meter. The processor receives the values of the operation pressure and -temperature from the sensors, which are either installed directly at the gas meter or in the piping.

Retrievable data:

During operation the UNIGAS PTZ indicates the actual volume at standard condition via the LCD-display. By depression of a key, the following values can be retrieved in addition:

- operation cubic meter V_b
- gas temperature in $^{\circ}C$
- operation pressure p_{abs} in bar
- condition indicator Z
- fault codes
- battery consumption in mAh
- operating hours
- fault register for V_n
- fault register for V_b
- compressibility factor K
- remote data transfer on request



Scope of supply:

UNIGAS PTZ consists of the microprocessor controlled computing device, the pressure- and the temperature sensors and an optimised 3-way test cock. The computing device can be mounted directly to the gas meter or separately and is certified for use in hazardous areas according to (EEx ia IIc T4).

Pressure ranges

$P_{abs} = 0,8$ bar to 2,8 bar

$P_{abs} = 0,9$ bar to 6,0 bar

$P_{abs} = 2,0$ bar to 10,0 bar

Temperature ranges

Gas temperatures -10 $^{\circ}C$ to 40 $^{\circ}C$

Ambient temperatures -25 $^{\circ}C$ to 55 $^{\circ}C$

Gas types

Natural gas acc. to DVGW-worksheet G 260, technical gases

Accuracy

Total errors of measurement (reproducibility, hysteresis, room temperature) within $\pm 0,3$ % from measured value.

Impulse output

A standard m^3 impulse output with pulse times of 10 ms, 30 ms, 40 ms or 100 ms is programmable.

Furthermore, an actual m^3 impulse output **or** a fault indication output is also programmable.

Data interface RS 232, as well as remote data transfer (protocol IEC 1107 Mode C, VDEW 2.0, Görlitz) are also available.

Impulse input

Potential-free low frequency impulses
to 1,5 c/s frequency

Pressure sensor

Ceramic measuring cell, diffusion-tight,
stainless steel AISI 304, for -10 °C to 40 °C

Temperature sensor

PT 500 DIN 73760 (IEC) for -10 °C to 40 °C,
stainless steel

Dimensions, weight, type of protection

Calculator: approx. height 120 mm,
width 175 mm, depth 62 mm, type of
protection IP 65, weight approx. 1,2 kg
Pressure sensor: approx. Ø 90 mm,
height approx. 60 mm, type of
protection IP 55, weight approx. 0,5 kg
Temperature sensor: Ø 6 mm, length 50 mm



After-Sales-Service on Aerzen Rotary Piston Gas meters

Performances of the Aerzen After-Sales-Service

Since 1990, Aerzener Maschinenfabrik counts itself among the manufacturers whose quality assurance has been certified acc. to ISO 9001, worldwide.

Recalibrations in 5 working days!

- Recalibrated Gas meters meet the requirements of brand-new Gas meters
- Most thorough examination guarantees long service life
- Exchange of mounting parts
- You will receive a quotation for acceptance of costs

Repair quotation leads to cost clarification!

- Disassembly of the Gas meter for exact determination of the damage
- Preparation of an individual repair quotation
- Repair and re-calibration will be commenced as soon as possible after receipt of your order number to proceed

Take an Aerzen exchange Gas meter!

- Company exchange pool
- Re-calibrated before dispatch
- Return of your Gas meter after exchange at site
- Invoicing of the real incurred costs
- If required, please pre-book

Rent an Aerzen Gas meter!

- Re-calibrated before dispatch
- Charge at fixed costs per commenced month
- If required, please pre-book
- All the mounting parts available at short notice!
- Dispatch by courier services

**Connect volume converter at site? -
With our technicians no problem!**

- Exchange counters (under supervision of a calibration inspector)
- Assembly, operation tests and re-calibrations of volume converters (under supervision of a calibration inspector)
- Technicians sent by our parent company or by our Sales offices

Internal budgeting ? -**Achieve more planning safety with us!**

You can take from our price lists:

- Prices for re-calibrations
- Prices for standard repairs
- Prices for rental gas meters
- and much more besides

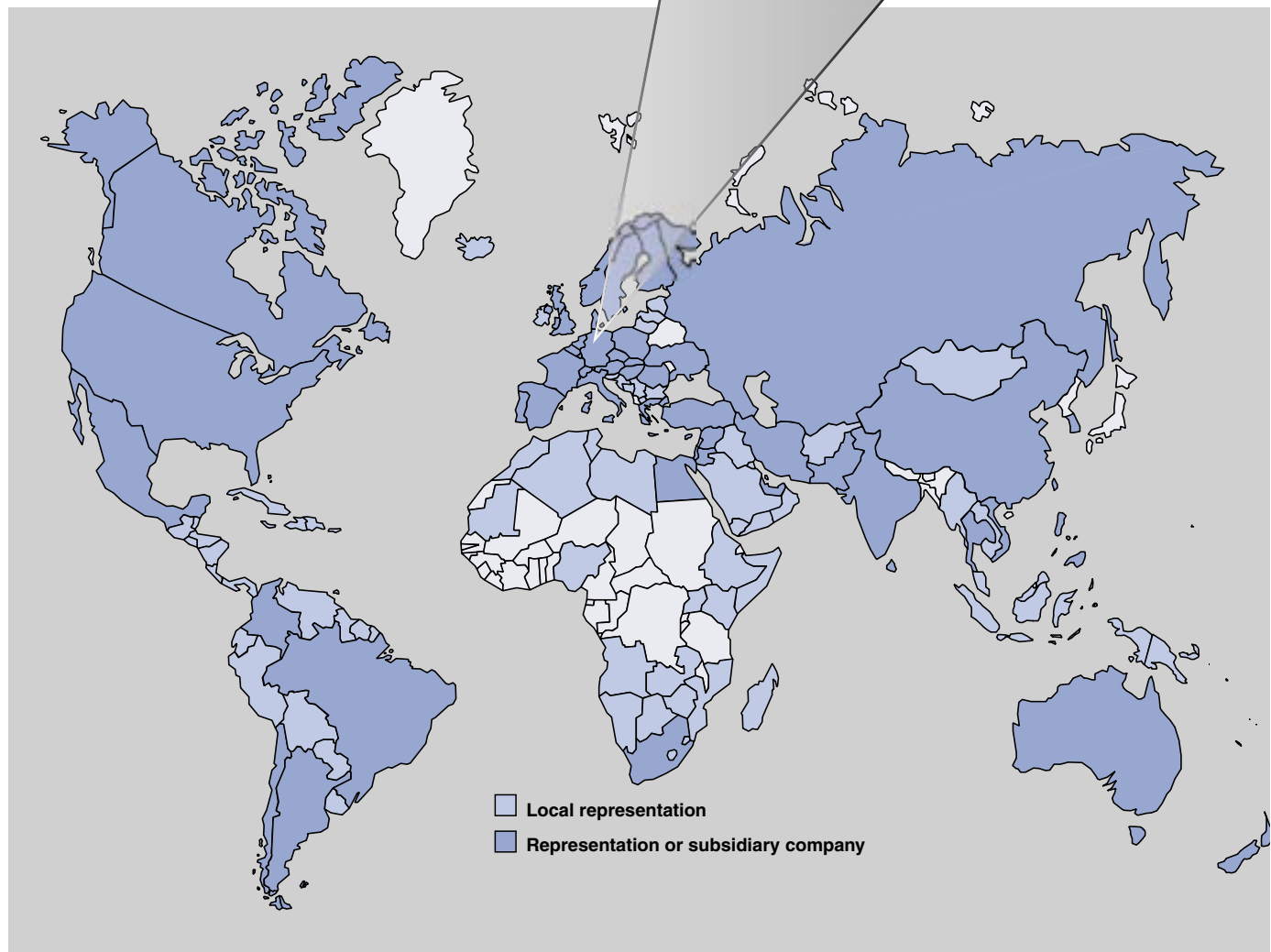
A good address - everywhere

A central point of the Aerzen company policy is the local presence at the customers.

- 7 sales offices in Germany
- 1700 employees worldwide
- more than 30 international subsidiary companies
- representations for more than 100 countries
- more than 100 service technicians on all continents

are the guarantee for competent contact partners nearby and with the corresponding national language.

Addresses and communication data under
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