Turbine Gas Meters Quantometers and Index Solutions

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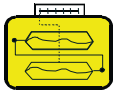
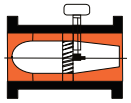
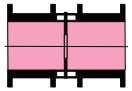
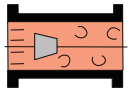
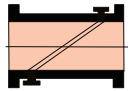
- Measurement Principles
- Turbine Gas Meters
- Quantometers
- Bearings and Lubrication
- Pertubation Tests
- Advanced ELSTER Index Solutions
- System Overview Pyramid

Comparison of Gas Meters

	Diaphragm Meter	Rotary Meter	Turbine Meter	Orifice Meter	Vortex Meter	Ultrasonic Meter	Coriolis Meter
							
Size	G 1.6 to G 100	G 10 to G 650	G 65 to G 16 000		G 40 to G 16 000		
Flow range (working condition)	0,016 m3/h to 160 m3/h	0,6 m³/h to 1000 m³/h	5 m³H to 25 000 m³/h	from 1000 m³/h	3 m³/h to 2500 m³/h	10 m³/h to 40 000 m³/h	1 kg/h to 27 000 kg/h
Measuring range	1: 160	1: 20 to 1:100	1:20 to 1:50 (HP)	1:5	1:20	1:100	
Pressure rate	up to 8 bar	up to PN 16	up to PN 100	>100 bar	up to PN 100	up to PN 100	5 bar to PN 250
Accuracy	± 2 %	± 1 %	± 1 % (± 0,5 %)	± 1 %	± 1 %	± 1 %	± 1 %
Inlet length	none	none	2 x DN	7 x DN to 62 x DN	20 x DN	10 x DN	none
Outlet length	none	none	none	7 x DN	5 x DN	3 x DN	none
Nominal width	DN 25 to DN 100	DN 25 to DN 150	DN 50 to DN 600	up to DN 600	DN 40 to DN 500	DN 80 to DN 700	DN 25 to DN 150
Pressure loss (atm. air)	2 -4 mbar	2 -4 mbar	2 - 8 mbar		5 - 20 mbar	< 2 mbar	
Validity of calibration	16 years	16 years	8 resp. 12 years	4 years		5 years	

Turbine Gas Meters Wheels

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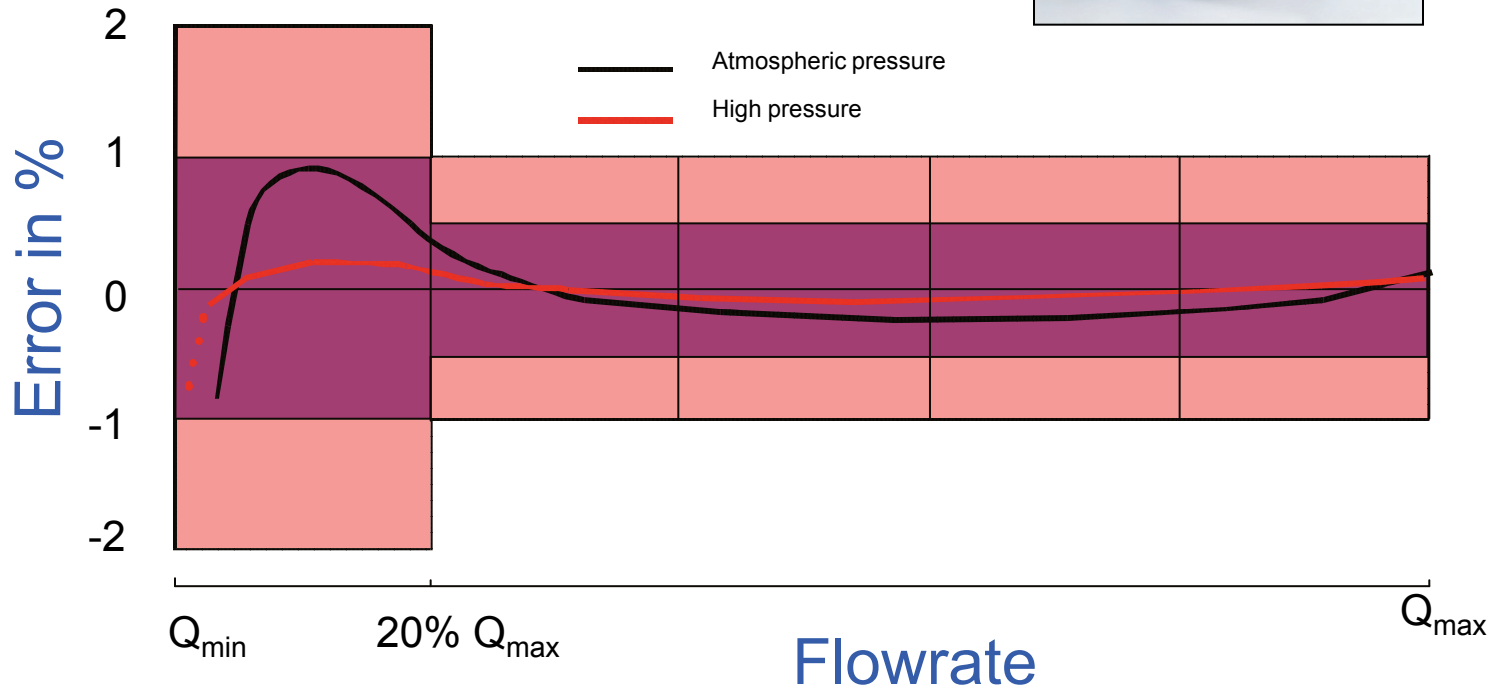
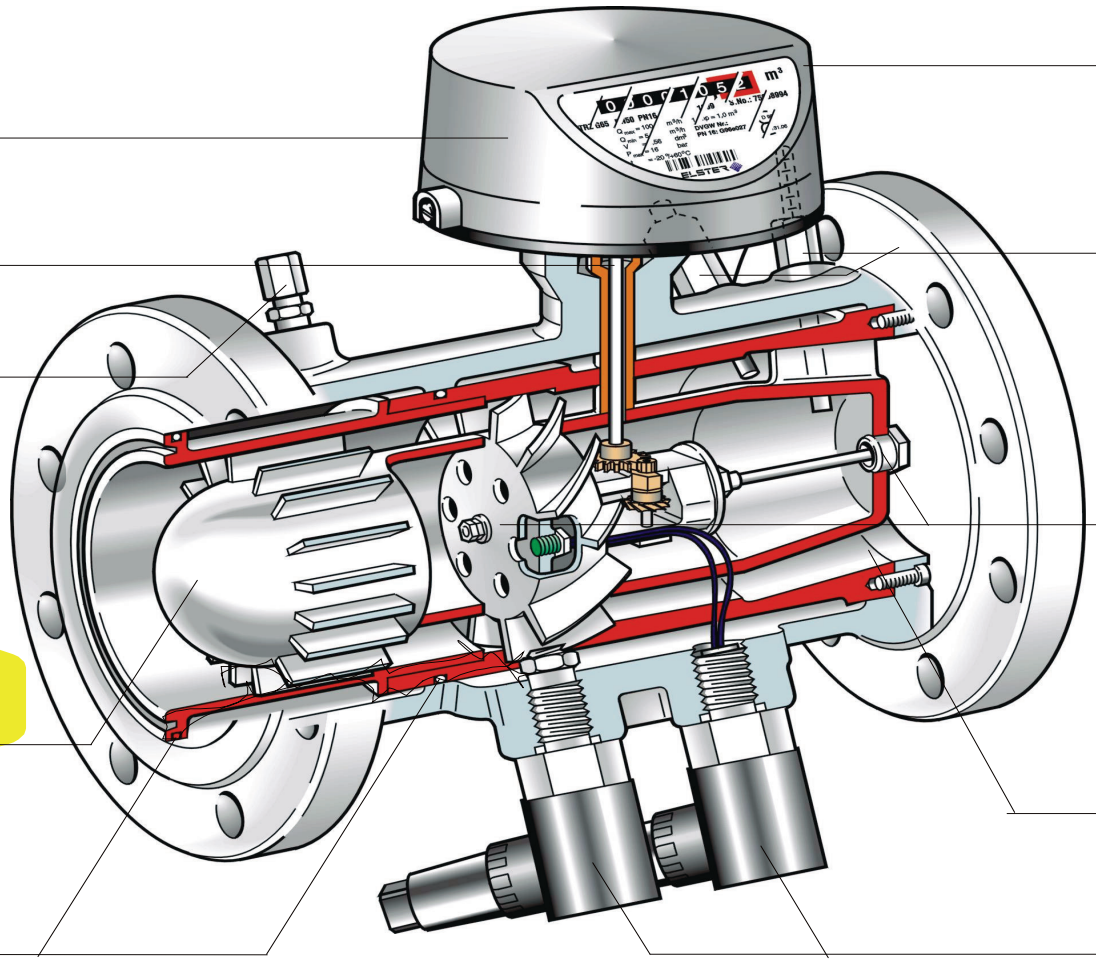
Accuracy Turbine Meters



Turbine Meter Cutaway Drawing



Totalizer for outdoor installation

Magnetic coupling

Pressure tap

Inlet flow straightener

Stress free sealing of the measuring cartridge

Low prequency pulsers + PCM

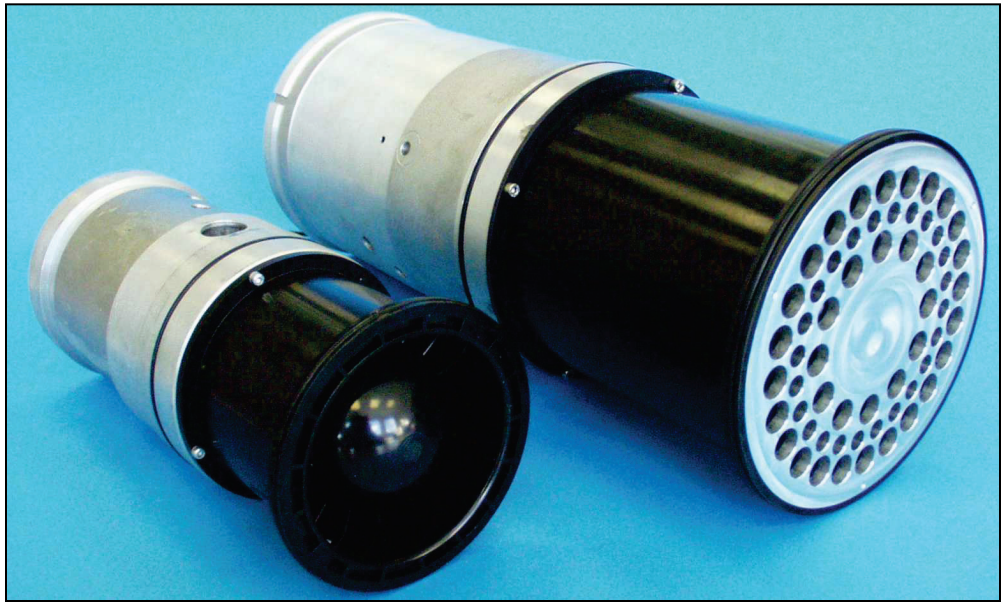
Integrated temperature measuring points for volume correction

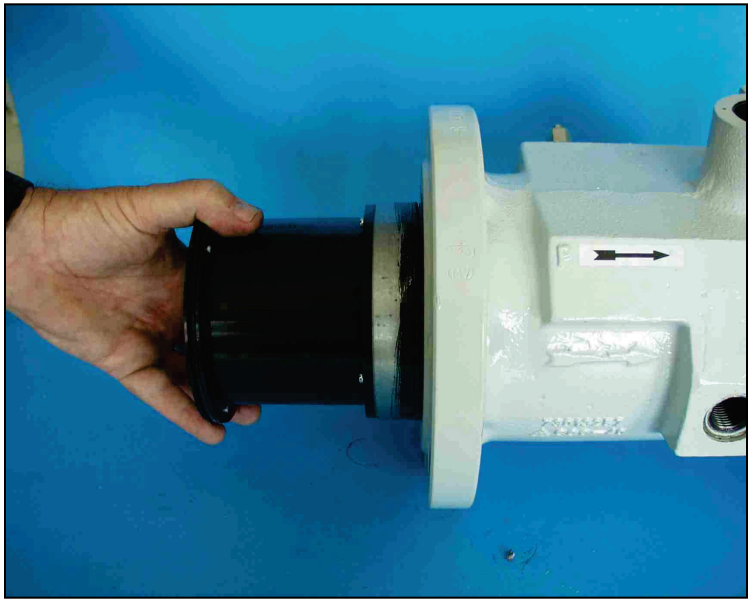
High precision ball bearings, maintenance free option: lubrication by an oil pump

Outlet channel with pressure recovery

High frequency pulsers

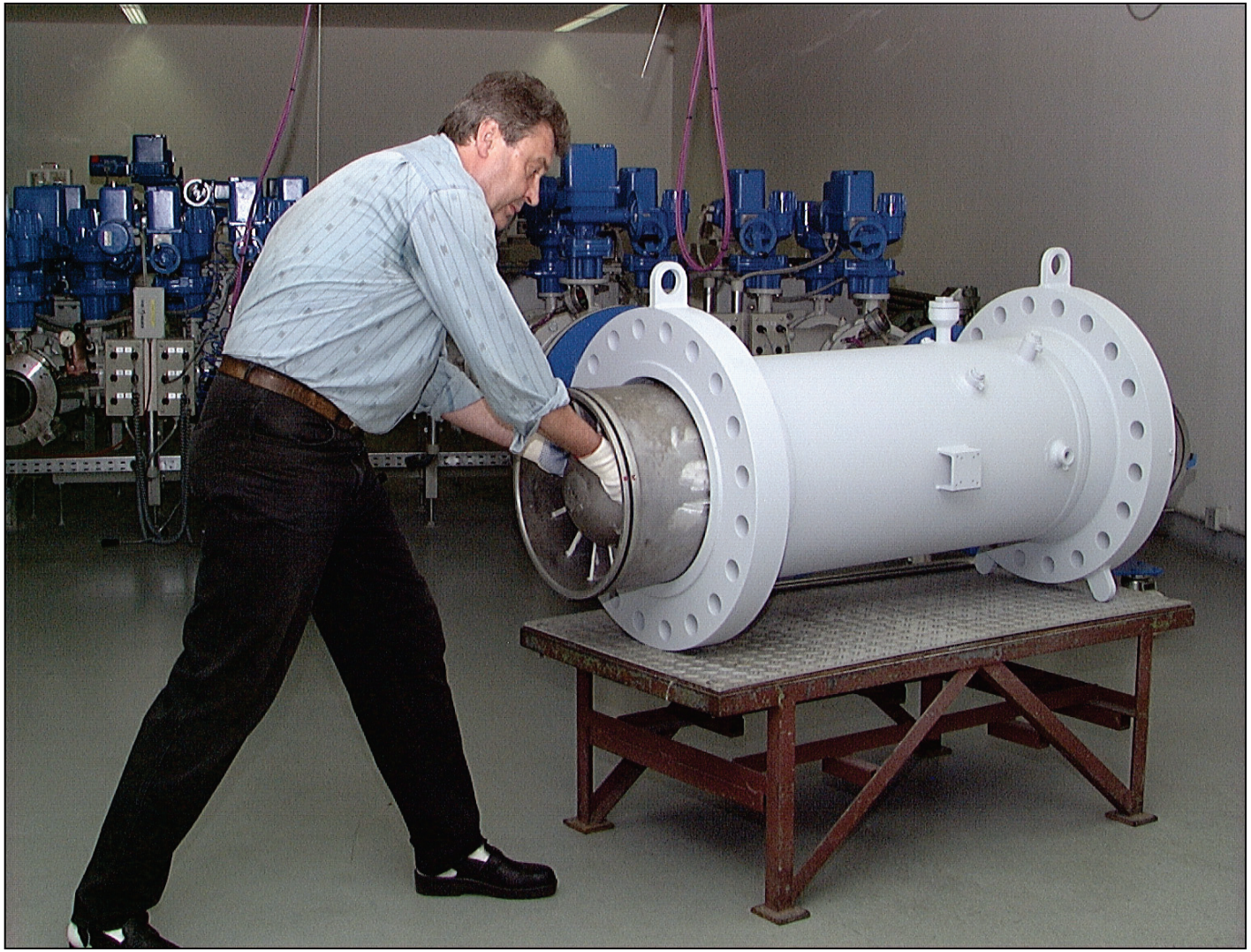
Measuring Cartridge
-Unique ELSTER Design-



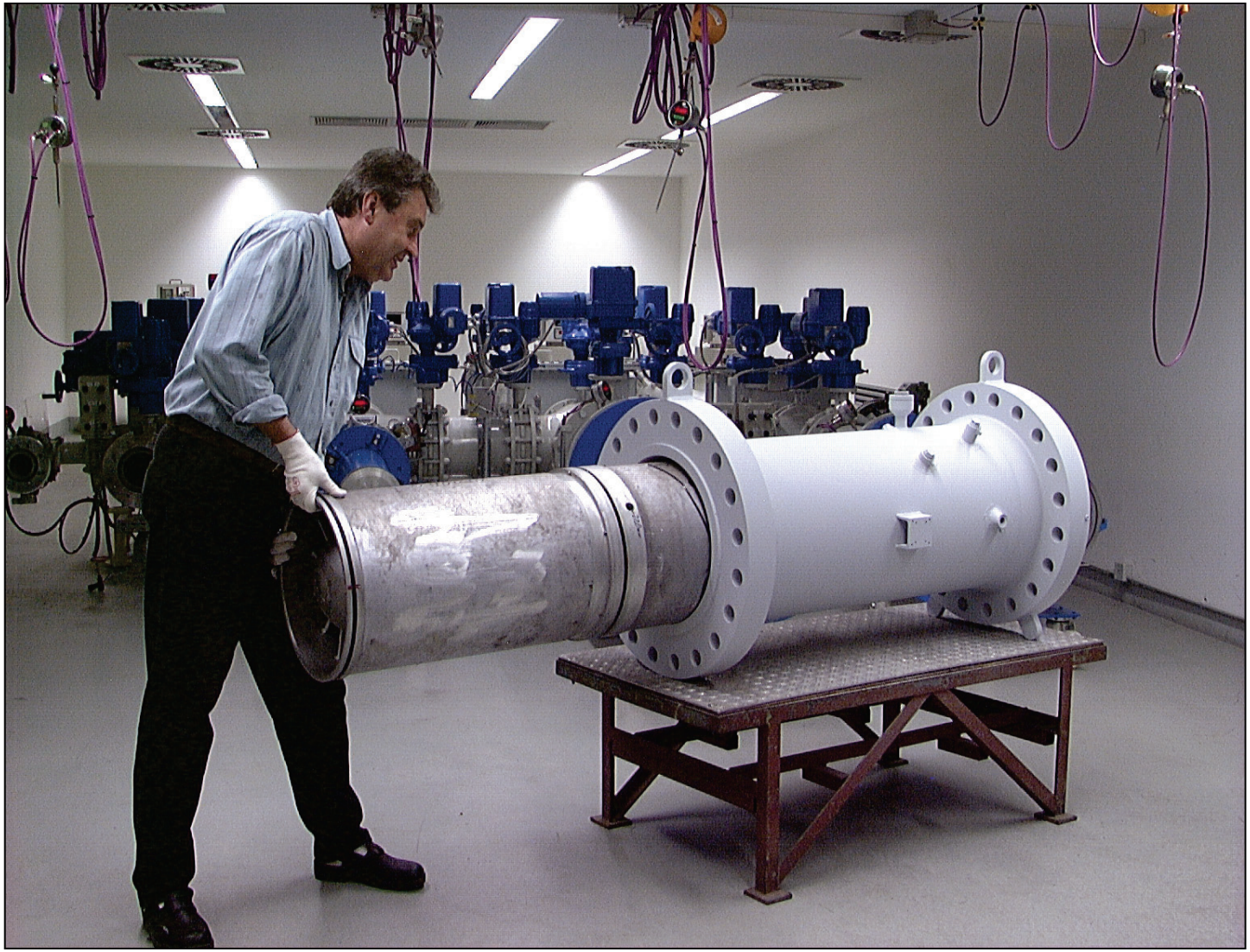


- Stress free measuring unit
- Quick replacement
- Isolated from housing - independent from ambient temperature changes
- ELSTER patent since 1975

TRZ DN 300 Pull Out of the Cartridge



TRZ DN 300 Cartridge Nearly Removed

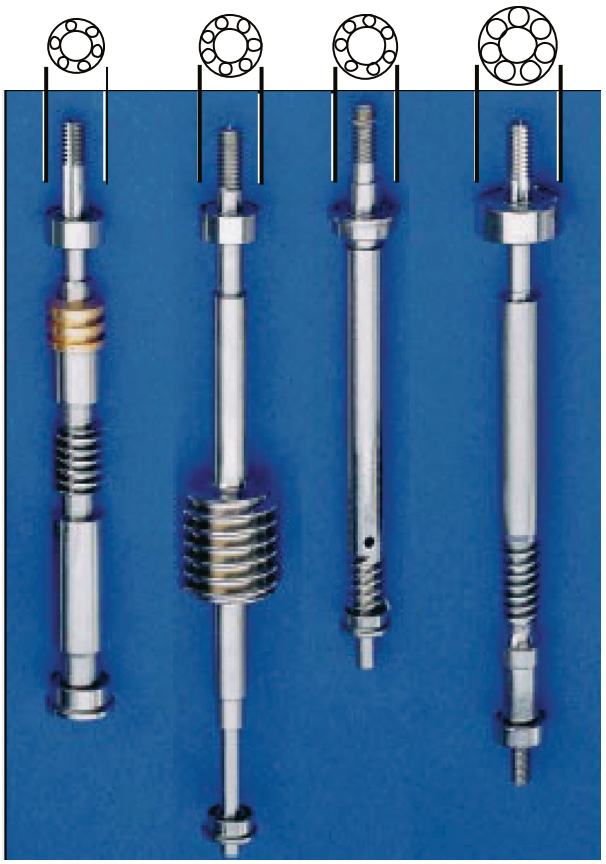


Turbine Meter TRZ2

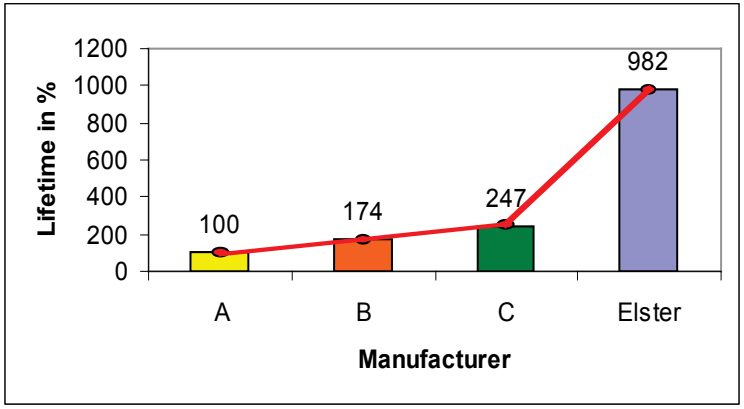
- Features
  - ELSTER measuring cartridge
  - Inlet length L ≥ 2 DN
  - Range G 100 DN80/3" - G 1000 DN 150/6"
  - PN 10 -16, ANSI 150
  - Totalizer S1 IP 67
  - LF pulser, pressure tap
  - Permanent lubricated bearings
  - Outdoor installation
  - Prepared for system with volume corrector
- Options
  - No special options
  - Oil pump
  - Integrated flow straightener
  - Pressure tap metrical or in inches
  - HF pulsers A1S and A1R
  - Thermowell in meter housing
- Applications
  - Gas distribution network
  - Low cost applications

Precision Ball Bearings

Manufacturer	A	B	C	Elster
bearing ∅ in mm inside/outside	3/8	4/9	4.75/9.5	4/13



- Swiss made quality
- Oversized design guarantees reliability
- Bigger than competitors equivalent parts
- Overload up to 160%



Even under tough conditions
- long lifetime
- low wear and tear
- insensible to overload

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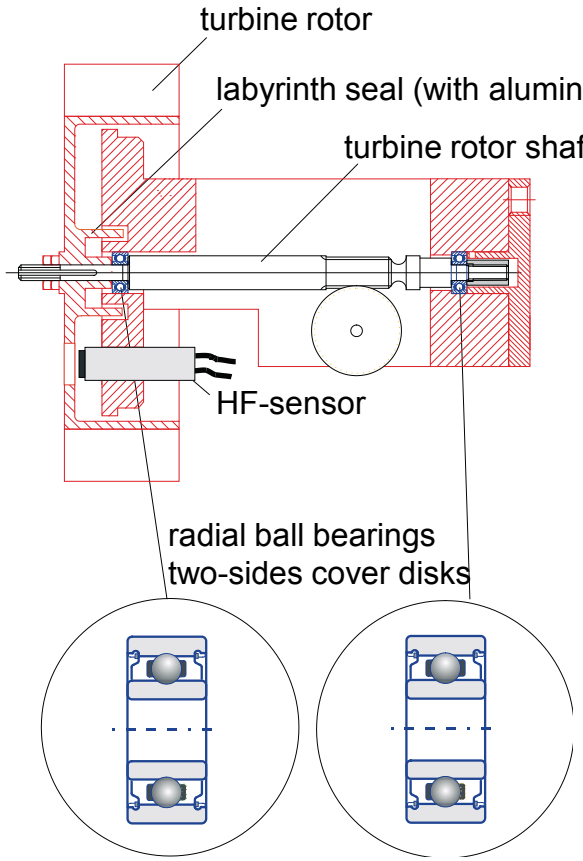
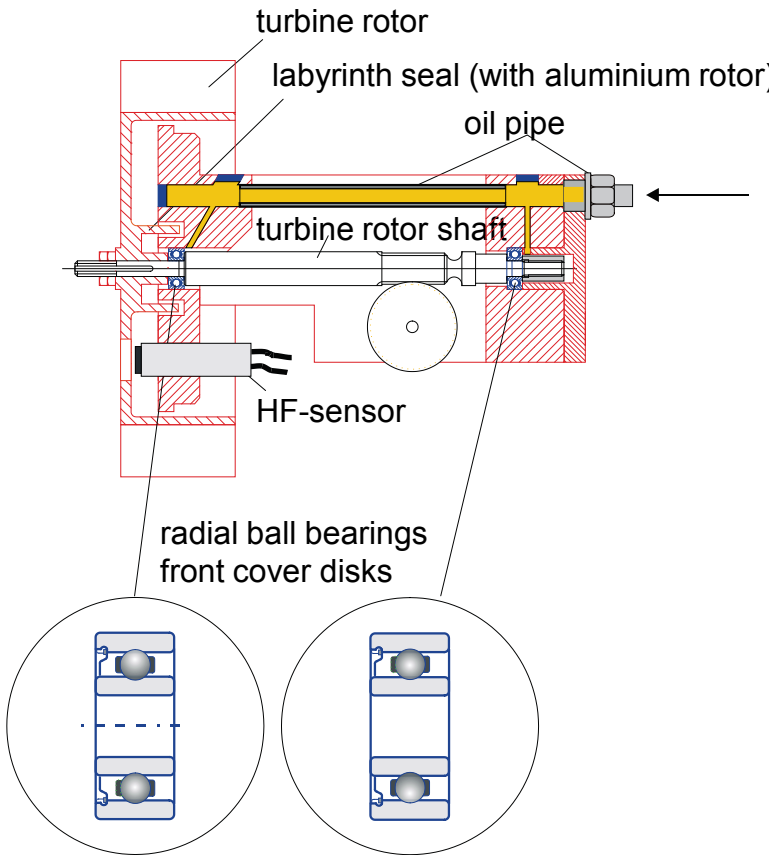
Gear -Permanent Lubrication-

DN 50 - DN 150, maintenance free

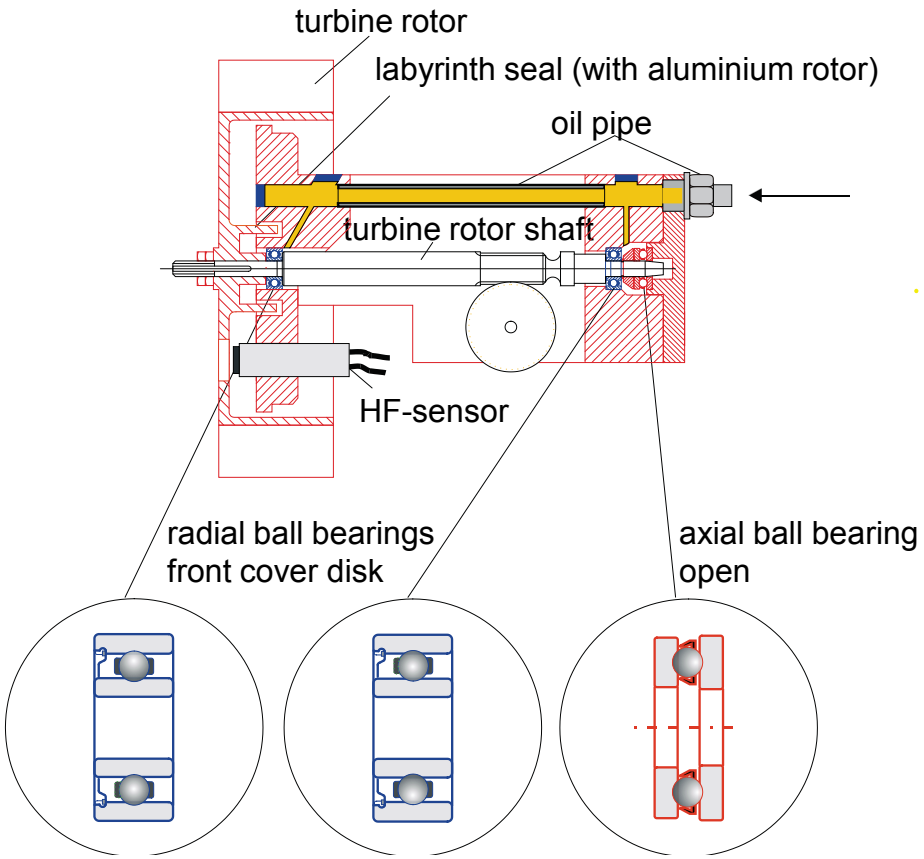


Gear -Oil Lubrication-

DN 80 - DN 150



DN 200 - DN 600



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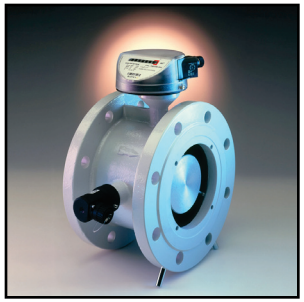
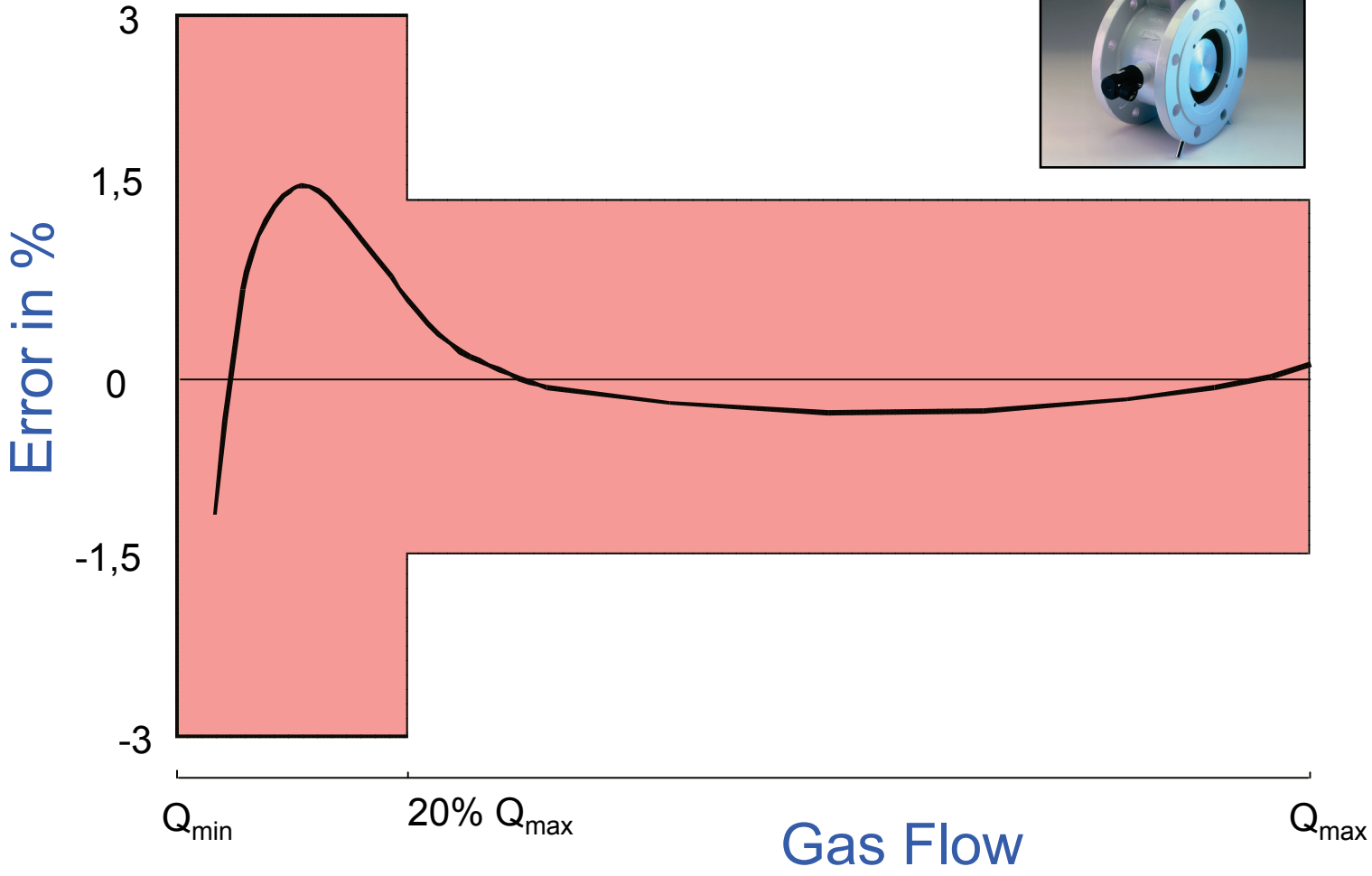
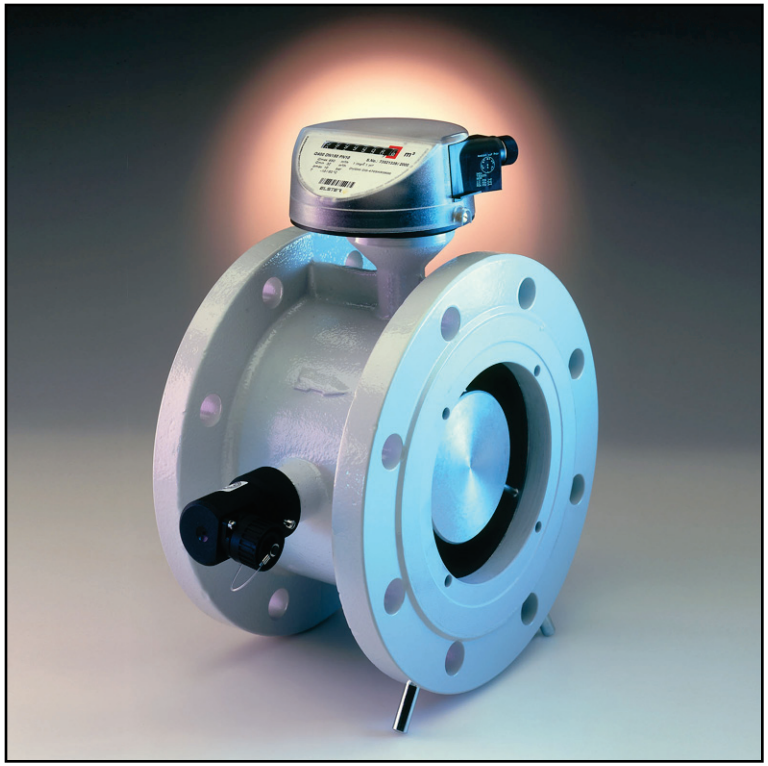
Accuracy Quantometers





Quantometer Q



- Features
  - Short pattern housing
  - Range G 65 - G 16.000
  - PN 10 - 100, ANSI 150 - 600
  - Totalizer S1 IP 67
  - 2 LF pulsers + PCM
  - Permanent lubricated bearings
- Options
  - HF pulsers A1S and A1R
- Applications
  - In-plant measurement
  - Custody transfer (UK, Asia)

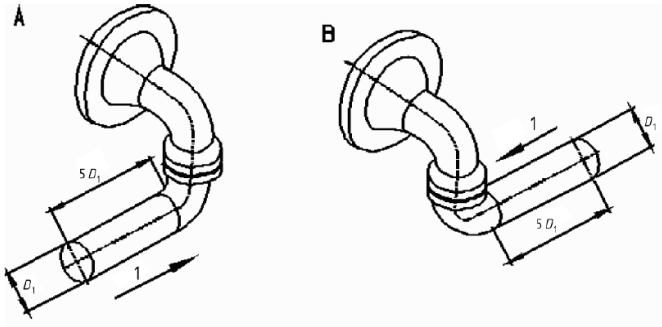
Quantometer QA/QAe

- Features
  - Short pattern aluminium housing
  - QA 10 DN 25 - QA 1000 DN 150
  - Sandwich design (no flanges)
  - 7 digits index
  - LF and MF pulser
- Options
  - QAe with electronic totalizer
    6 digits
    indicates volume in m³
    flow rate in m³/h
    Data transfer via M-Bus (special option)
  - DN 25 stainless steel housing up to 40 bar
- Applications
  - Industrial, in-plant measurement
    e. g. burner control
  - Chemical industry

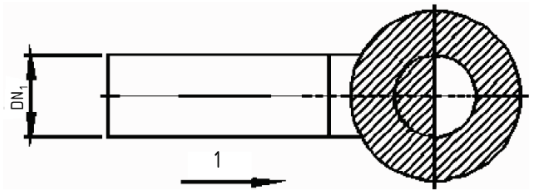
Meter Comparison

	Turbine Meter TRZ / TRZ-IFS / ETM	Quantometer Q / QA
Application	Custody Transfer Meas. Transport & Distribution	In-Plant Measuremen
Sizes	DN 50/2“ – 600/24“	DN 25/1“ – DN 500/2(
Pressure	ETM: max. 20 bar TRZ: max. 100 bar	QA: max. 20 bar Q: max. 100 bar
Flow Range	5 – 25.000 m³/h	1 – 16.000 m³/h
Housing	ductile cast iron (ETM, TRZ) cast steel (TRZ) welded steel (TRZ)	Aluminium (QA) Q see TRZ
Length	3 DN	1.5 DN
Accuracy	± 1%	± 1.5%
Range	1:20 (1:30 for 10 types) up to 1:200 (High Pressure)	1:20

European Standard EN12261
Annex B, Pertubation Testing



Piping configurations for perturbation tests



Location of half area opening for high level perturbation tests

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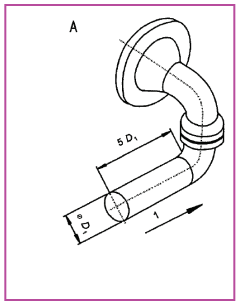
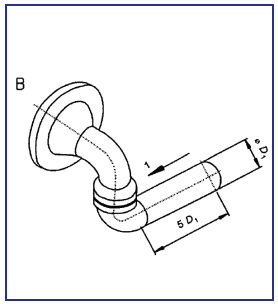
Flow Pertubation Test
According European Standard EN12261

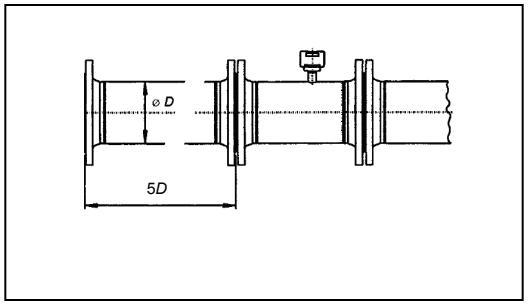
2nd Step



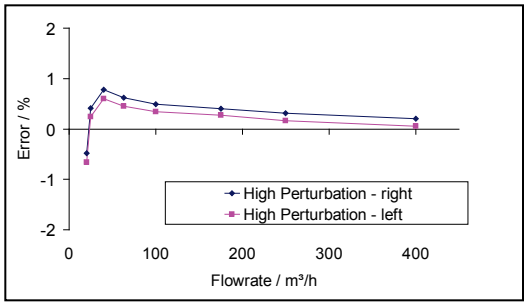
3rd Step



1st Step
Basis Measurement



The difference has to be lower than ±0,33%



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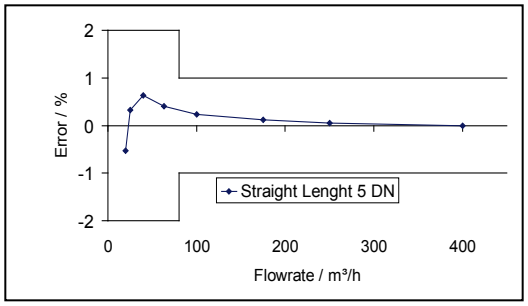

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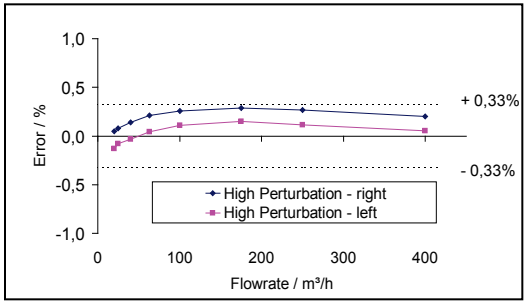

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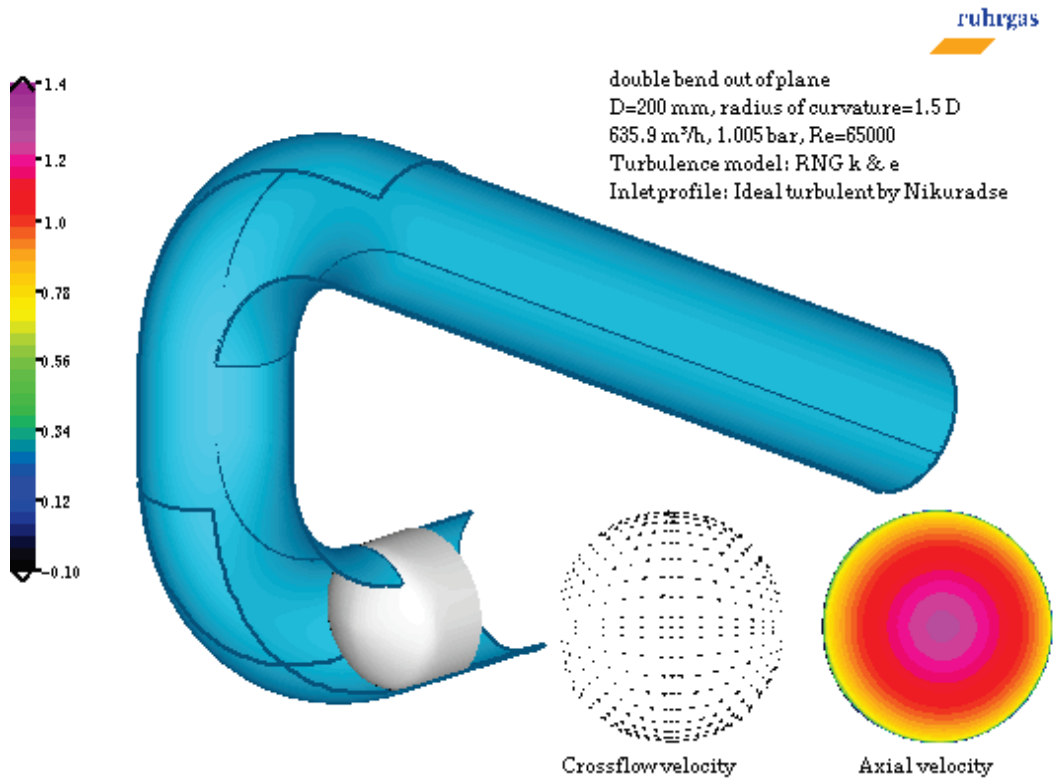
Simulation Screenshots
Double Elbow



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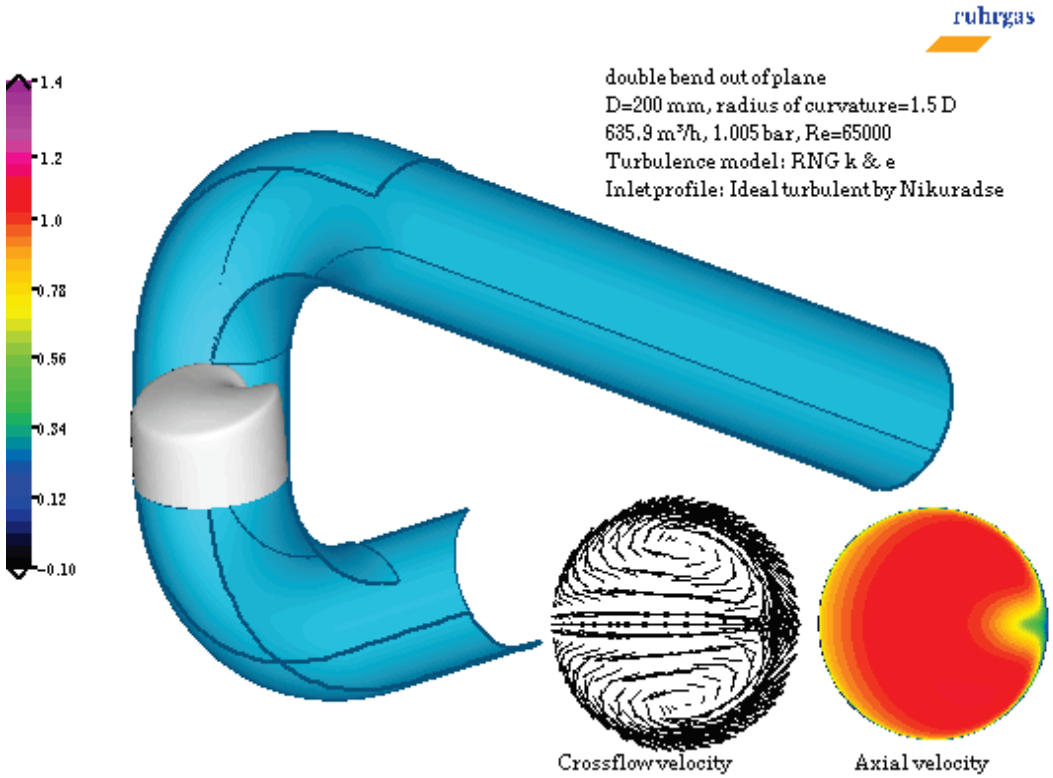
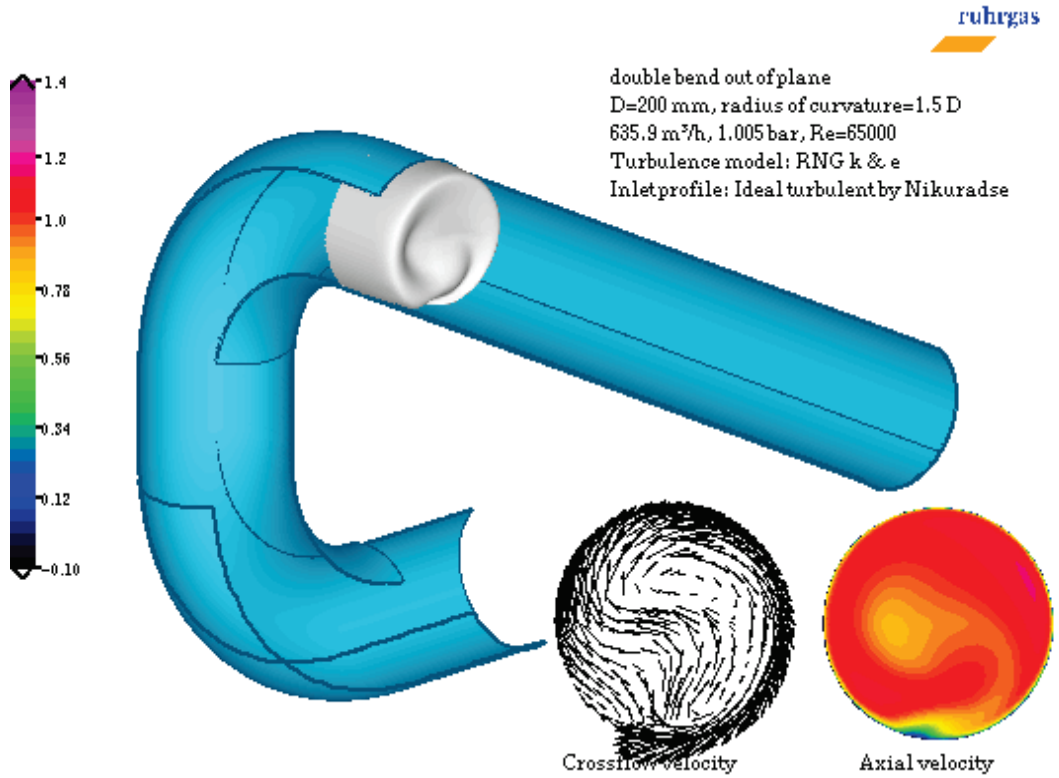


Simulation Screenshots
Double Elbow



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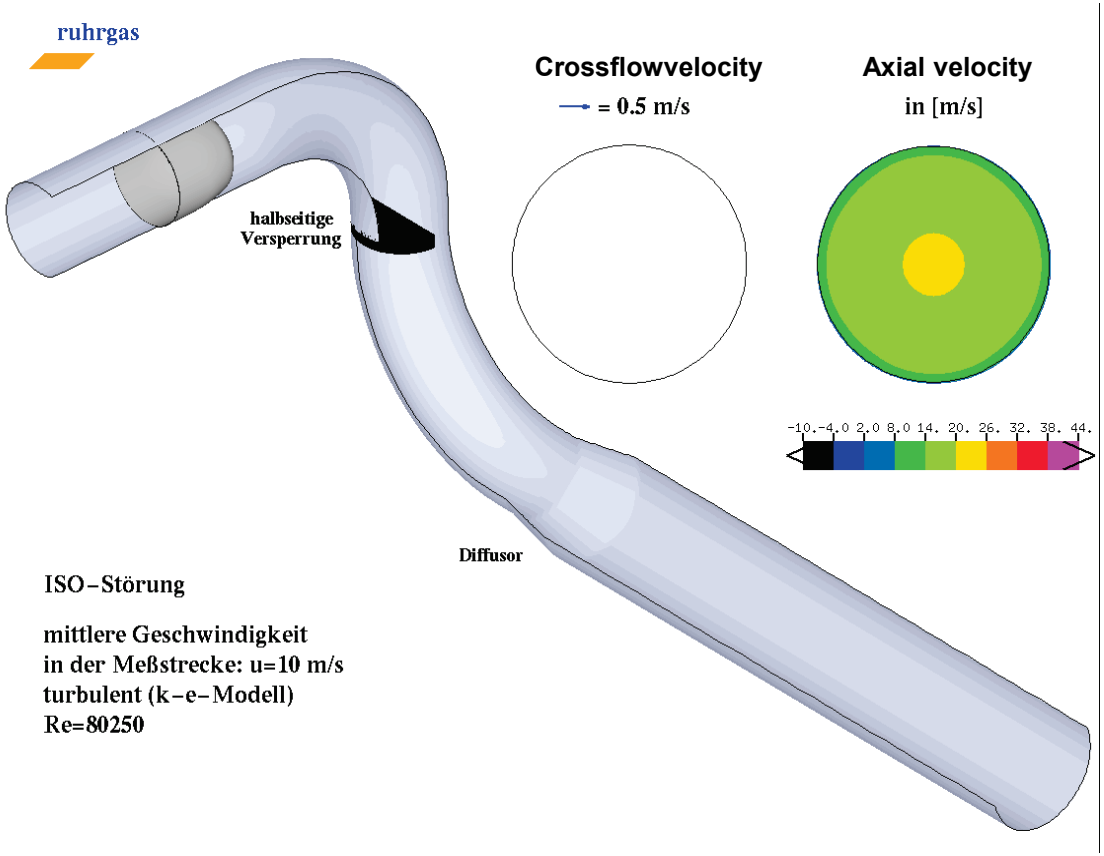
Simulation Screenshots
High Level Pertubation



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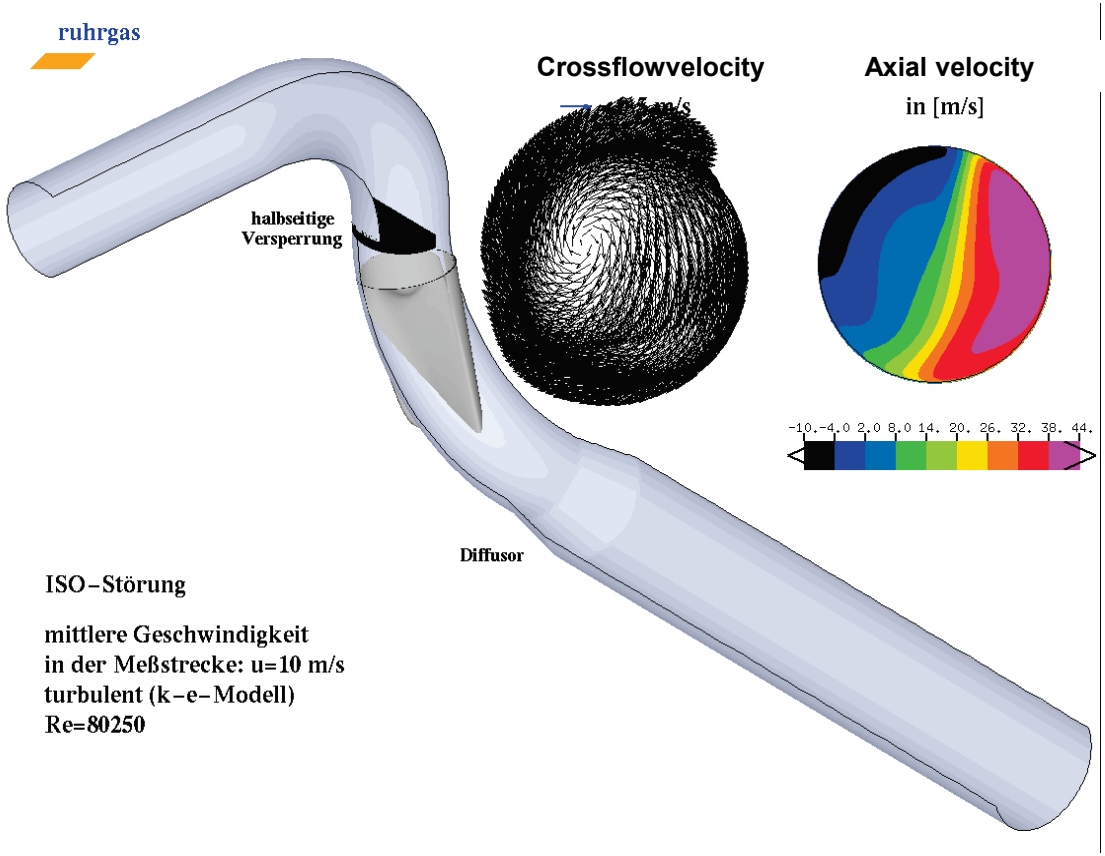
Simulation Screenshots
High Level Pertubation



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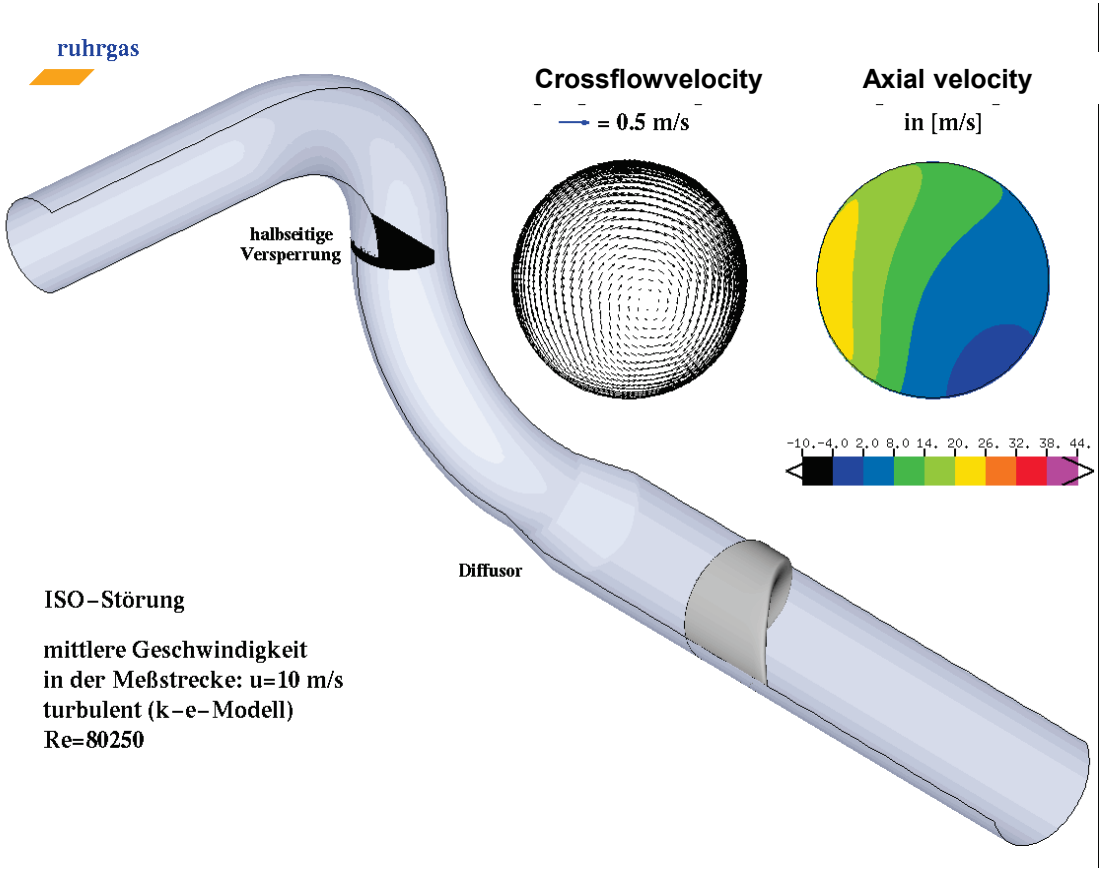
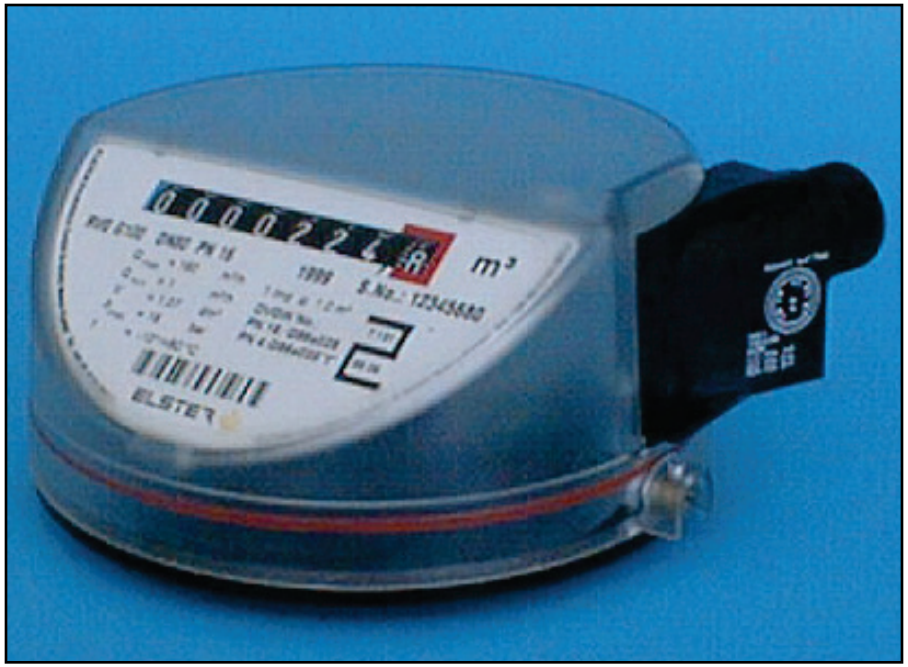
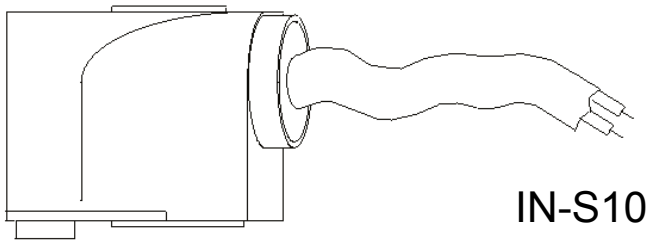
Simulation Screenshots
High Level Pertubation

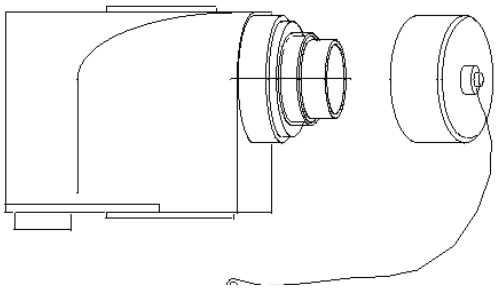


Index and Retrofit LF Options

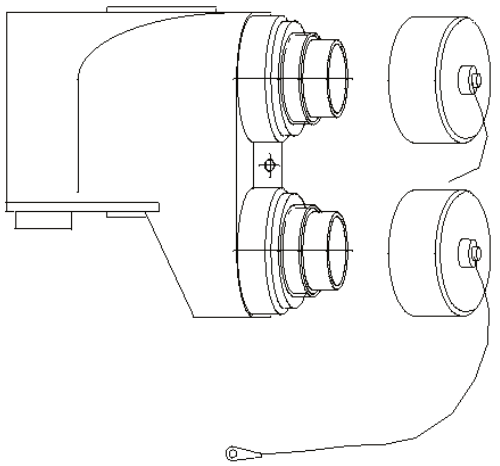




IN-S10



IN-S11

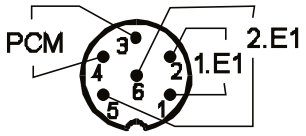


IN-S12

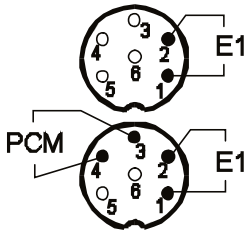
IN-S10

1. E1: white - brown
2. E1: green - yellow
PCM: gray - pink

IN-S11



IN-S12



View on soldering side of female plug

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Transfer of Meter Reading

- Operating volume measured by the gas meter is always the origin of the data chain
- Transmission to auxiliary devices by pulses
  - ⇨ Replica of the meter reading in the Volume Corrector or Data Logger
- Sometimes deviations between original meter reading and replica in auxiliary devices caused by:
  - Bouncing
  - Slight backward flow
  - Temporary disconnection
  - Double pulses
  - Setting wrong pulse value

The ELSTER advanced index solutions solves this problem!

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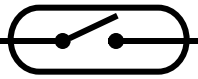
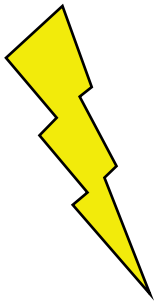
Transfer of Meter Reading

Reed switch



Potential Error Sources:

- Bouncing
- Slight backward flow
- Temporary disconnection
- Double pulses
- Setting wrong pulse value



The correct billing depends on a Reed switch!!

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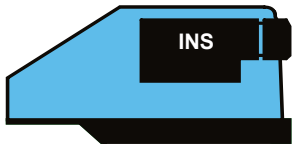
Transfer of Meter Reading

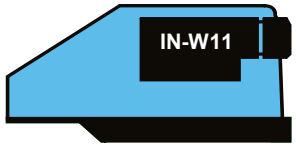
Reed Switch



$V = \Sigma$ 

Pulse counting

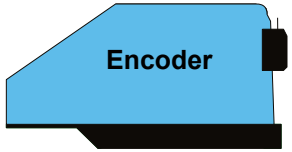
Wiegand Sensor



$V = \Sigma$ 

Pulse counting

Absolute Encoder Reading



$V =$ 7778254.1 $\triangleq$ 

Index reading

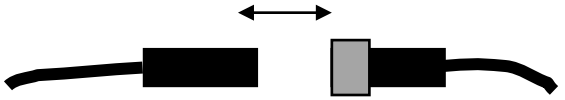
Potential Error Sources

- Bouncing
- Slight backward flow
- Temporary disconnection
- Double pulses
- Setting wrong pulse value

- ~~Bouncing~~
- ~~Slight backward flow~~
- Temporary disconnection
- ~~Double pulses~~
- Setting wrong pulse value

- ~~Bouncing~~
- ~~Slight backward flow~~
- ~~Temporary disconnection~~
- ~~Double pulses~~
- ~~Setting wrong pulse value~~

NO PROBLEM



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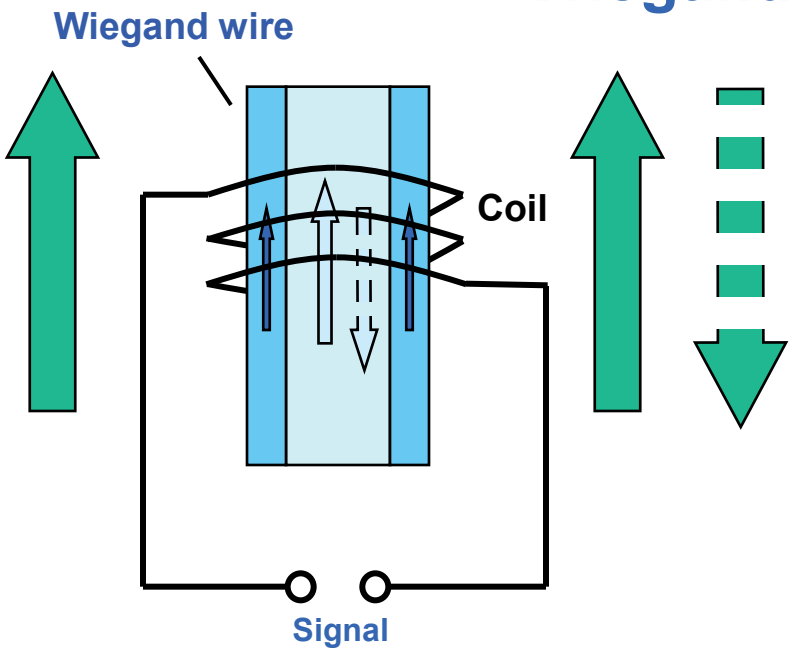
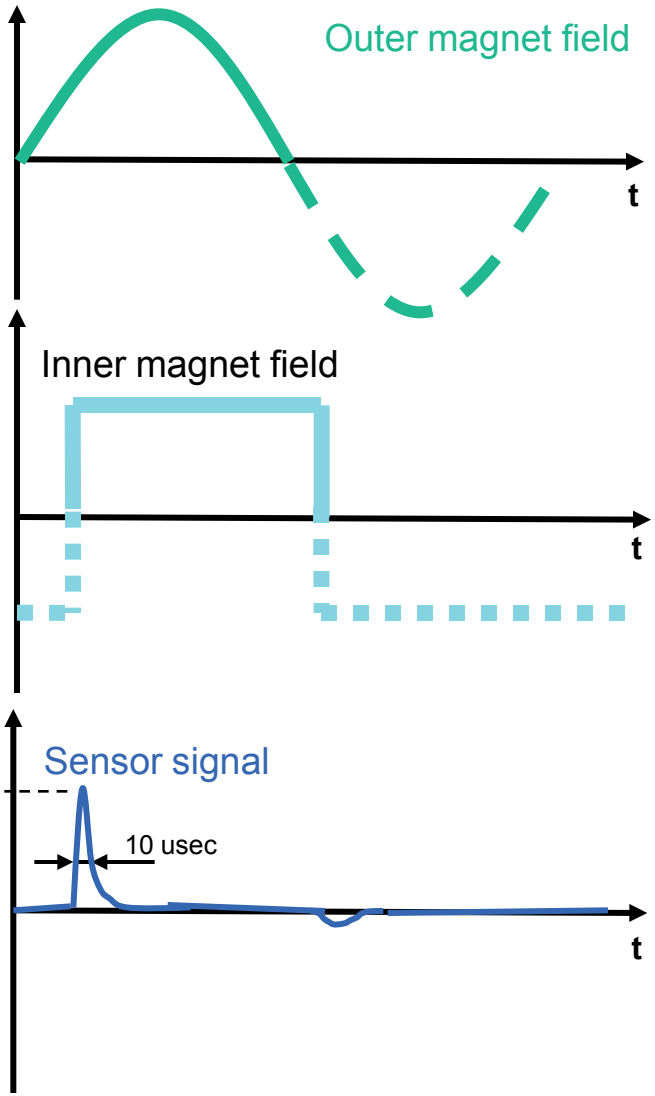
Wiegand Sensor Principle





Permanent magnetized

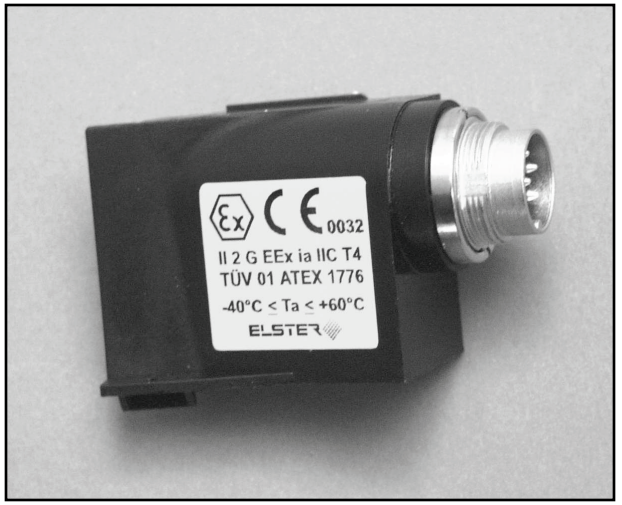
Weak magnetized

Outer magnet field

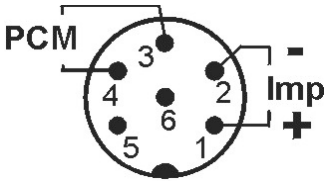
Wiegand Pulser IN-W11

Main features:

- No external power required
- Protection class IP 67
- Ex approval EEx ia IIC T4
- Operating temperature :
  - 40°C to + 60°C
- Two wire operation
- No mechanical wear and tear
- No spurious pulses by slight forward / backward motion
- Absolute no bouncing
- Pulse width > 100 msec
- Integrated tampering contact (PCM)
- Fits to all totalizer S1(TRZ/RVG/Q)



Connection:



Electrical characteristic:

Switch open:

0.1 V <= U <= 24 V; I = 0 mA

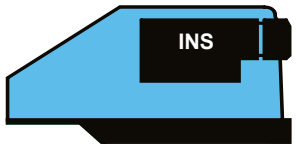
Switch closed:

0.1 V <= U <= 12 V ; R = 105 Ohm puls width > 100ms

U <= 24 V ; R = 105 Ohm puls width > 50ms

Transfer of Meter Reading

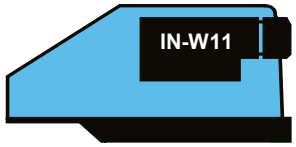
Reed Switch



$V = \Sigma$ 

Pulse counting

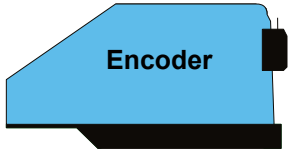
Wiegand Sensor



$V = \Sigma$ 

Pulse counting

Absolute Encoder Reading



$V =$ 7778254.1 $\triangleq$ 

Index reading

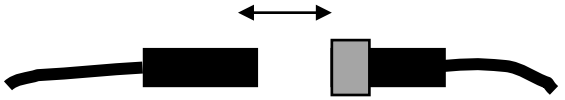
Potential Error Sources

- Bouncing
- Slight backward flow
- Temporary disconnection
- Double pulses
- Setting wrong pulse value

- ~~Bouncing~~
- ~~Slight backward flow~~
- Temporary disconnection
- ~~Double pulses~~
- Setting wrong pulse value

- ~~Bouncing~~
- ~~Slight backward flow~~
- ~~Temporary disconnection~~
- ~~Double pulses~~
- ~~Setting wrong pulse value~~

NO PROBLEM



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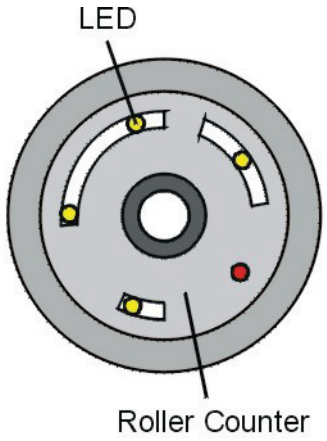
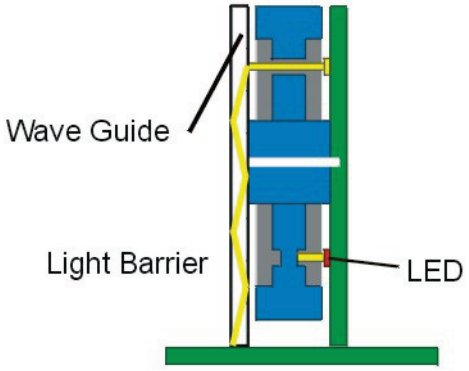
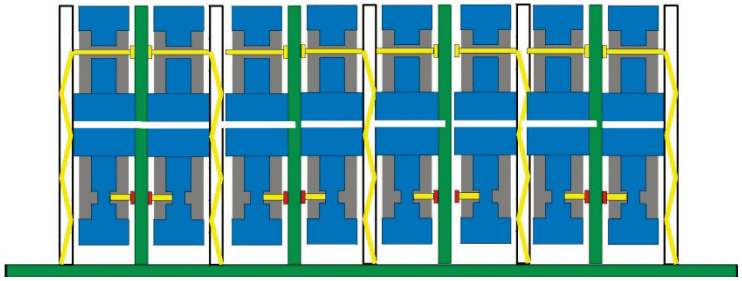
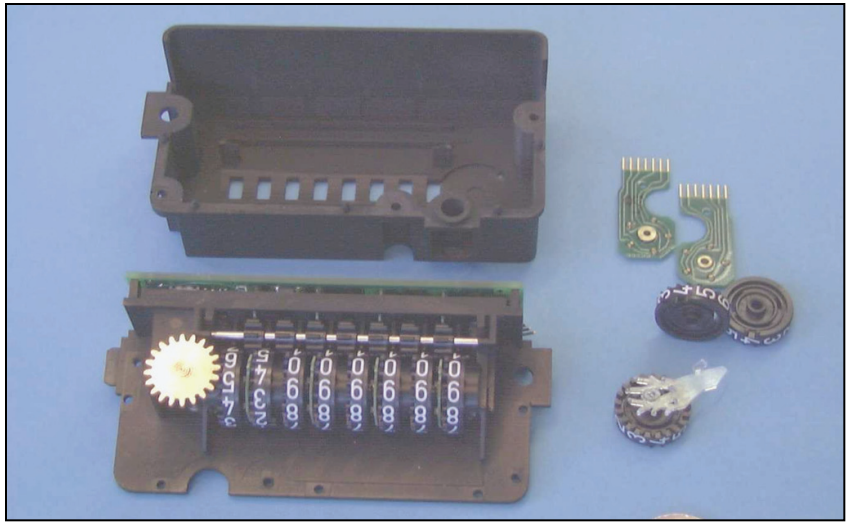
Encoder Index







8 index roller



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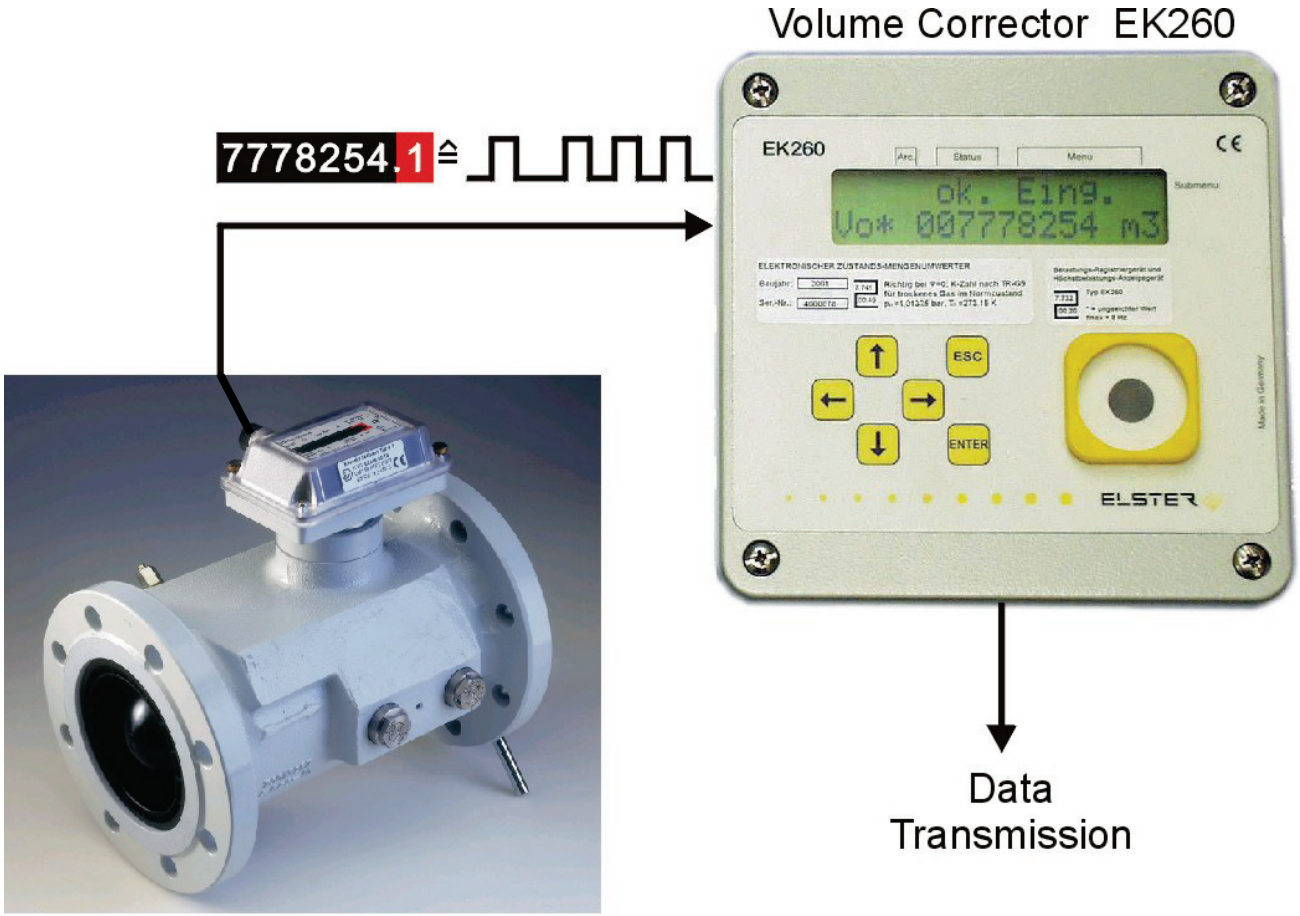
Encoder Index

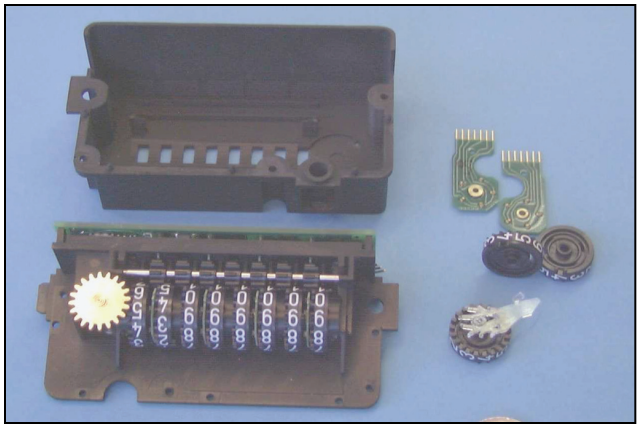
Ideal combination of the advantages of a mechanical and an electronic index!!



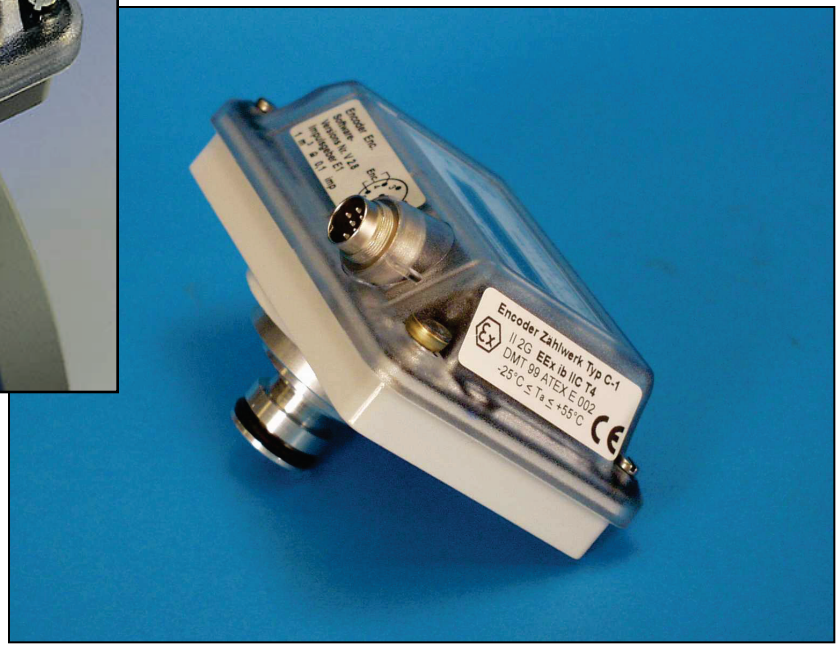
Turbine Meter with Encoder Index

Encoder Index

- Combination of the advantages of a mechanical and an electronic index
- Digital transmission of the original meter reading based on optical contactless sensing
- Comparison and adjustment of meter readings (because of wrong pulses) not necessary
- Power supply only during reading necessary **-no battery in index-**
- Application in Ex-zone 1
- Ideal for contract customers and stations



Turbine Gas Meter with Encoder-Index



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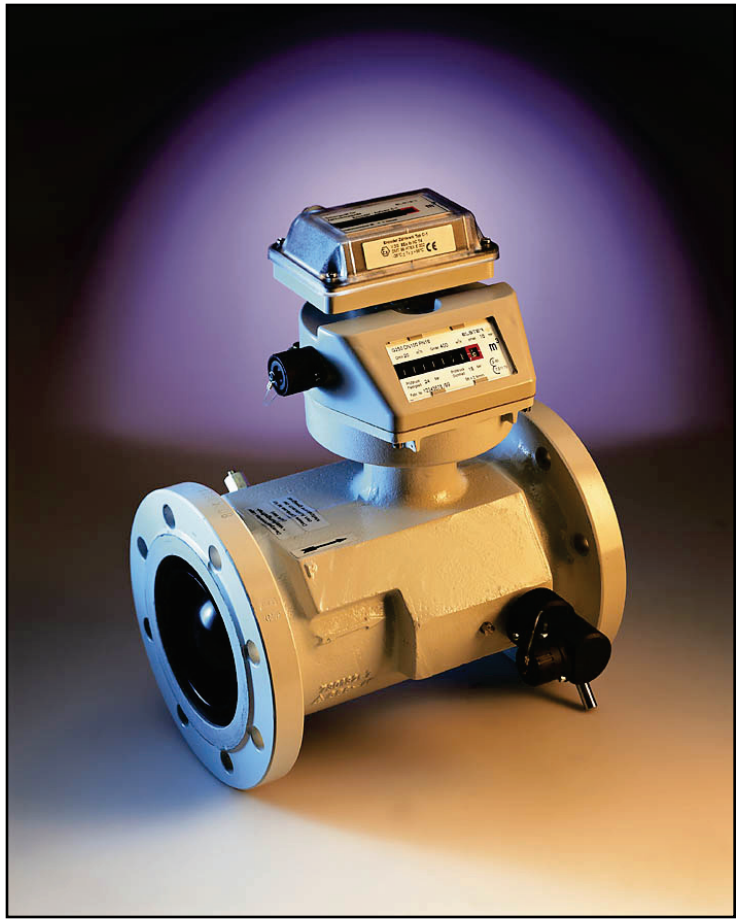
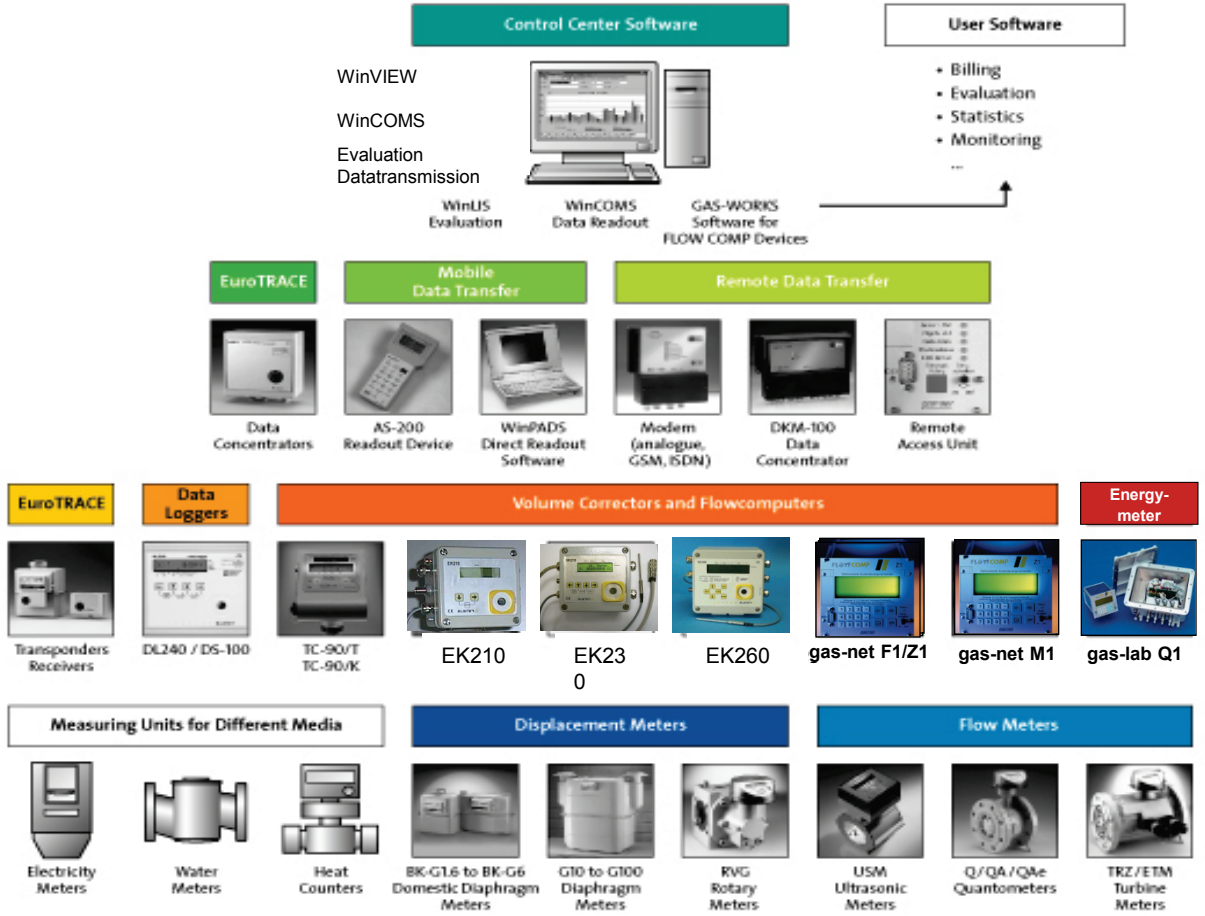
Turbine Gas Meter with Add On Encoder Index



For gas meters with mechanical instrument drive

Gas Metering Systems Overview

- Evaluation
- Data Transfer
- Data Regístration / Volume Correction
- Metering



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Example of high pressure calibration

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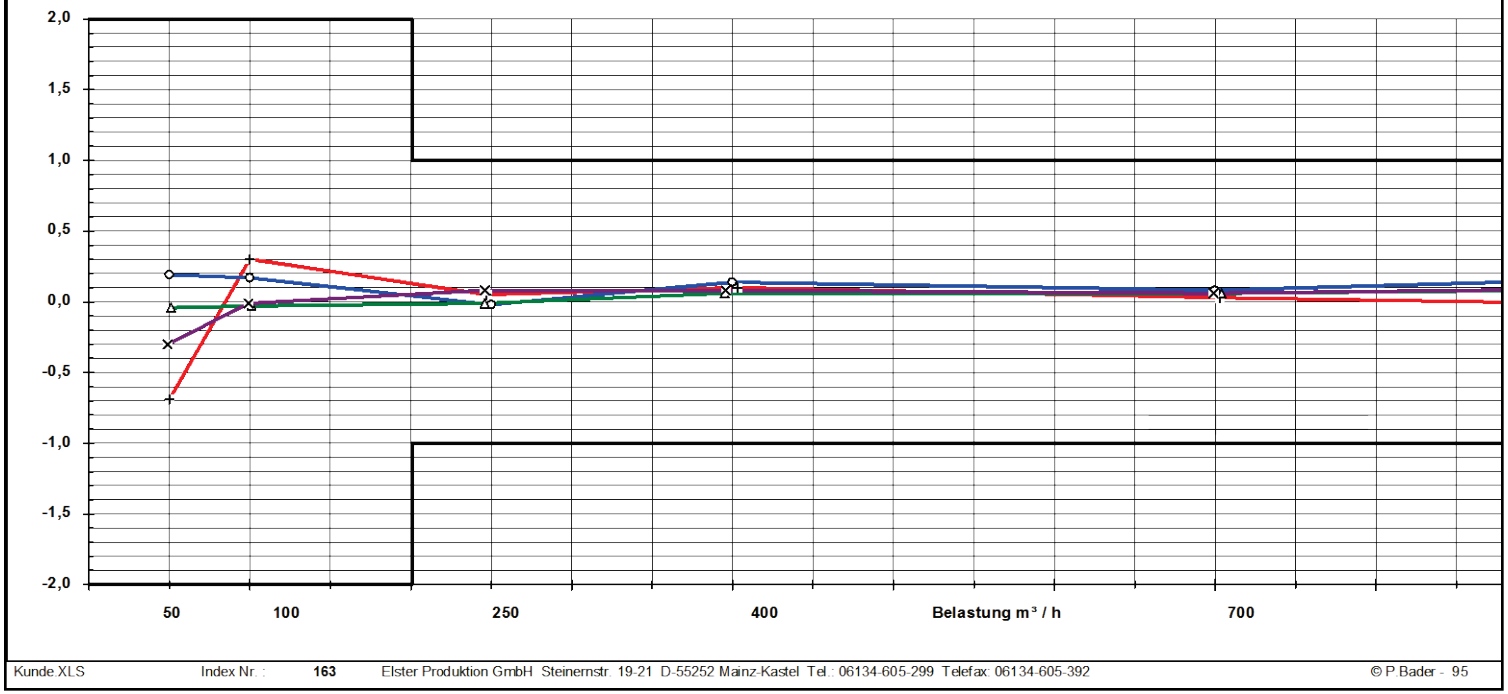
Großgasmessung

Größe G : 650	**Messpatr. Nr.** : 3815099	**Fabriknr.** : 83008369	**PN/ANSI** : 600	**Baujahr** :
Projekt / Kunde : ESB, München	**PA Nr.** : 3103	**Gehäuse DN** : 150	**Messpatr. DN** : 150	**Hersteller** :
Getriebewert IG : 187,0	**Markenzahl ZM** : 8	**Wechselrad ZA** : 35	**Justierrad J1** : 25	**Cp-A1R** :
1 Tr m³ : 1,0	**Schaufelzahl ZS** : 16	**Wechselrad ZB** : 55	**Justierrad J2** : 31	**Cp-A1S** :

	Prüfdruck bar[abs]	Prüftemp. °C	Prüfort
Fehlerkurve 1 ------ + --------	1,0	21	Elster MZ
Fehlerkurve 2 ------ 0 --------	11,9	10	Darmstadt
Fehlerkurve 3 ------Δ-------	21,4	15,7	Dorsten
Fehlerkurve 4 ------ X --------	46,5	16	Dorsten



Kunde.XLS Index Nr. : **163** Elster Produktion GmbH Steinernstr. 19-21 D-55252 Mainz-Kastel Tel.: 06134-605-299 Telefax: 06134-605-392 © P.Bader - 95

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Thank You for Your Attention!!