Technical informations

CONTOIL®

fuel oil meters

- Flow measurement for mineral oils and heating or propellant fuels
- In burners, on board ships, land vehicles and fixed-position motors
- “Germanischer Lloyd” approval for use on board ships

CONTOIL® fuel oil meters – the right product for every application…

VZE 15 … 50 range (Standard) **with multi-function display and remote transmission**

Electronic display of
- total volume
- resettable volume
- flow rate in l/h in digitals and as bar diagram in %
  other operating data in the service level

Simple to operate

Normal commercial long-life battery, simple to change, data security

Option: Inductive INA pulser for control purposes

Housing with threaded or flanged connection

Main characteristic data:
- flow range 10 … 30,000 l/h
- temperature 70, 130 and 180° C
- nominal pressure PN 16 and PN 25 bar

Informations in chapter 1 ***Page 5***

VZO 4 … 50 range (Classic) **total volume display and remote transmission**

Total volume display on roller register

Option: Reed pulser RE or RV for remote totalisation

Option: Inductive IN pulser for control purposes

Housing with threaded or flanged connection

Main characteristic data:
- flow range 0.5 … 30,000 l/h
- temperature 60, 130 and 180° C
- nominal pressure PN 16, PN 25 and PN 40 bar

Informations in chapter 2 ***Page 8***

... CONTOIL® product groups and selection criteria

VZEA / VZOA 15 … 50 range

optimal solution for the differential measurement

VZEA
Electronic display of
- total volume
- resettable volume
- flow rate in l/h in digitals and as bar diagram in %
  other operating data in the service level

VZOA
- Volume display on roller register

Option: Inductive pulser, INA or IN, for control purposes

Option: RV Reed pulser for remote totalisation,
integrated into the roller register (VZOA)

Housing with threaded or flanged connection

Main characteristic data:
- flow range 10 … 30,000 l/h
- temperature 130 and 180° C
- nominal pressure PN 16 and PN 25 bar

with special pairing for minimum measurement variance.

Informations in chapter 3 ***Page 15***

CONTOIL®, the world's most frequently used oil consumption meter

Leading manufacturers of oil burners and operators of heating systems, ships or diesel engines rely on CONTOIL® fuel oil meters – and with good reasons.

The advantages of CONTOIL® fuel oil meters – your benefits

You can decide which of these many benefits are the most important for you:

- the optimal solution for every application
- simple burner setting with flow rate display (types VZE)
- simple consumption monitoring or manual dosing feature, with the resettable counter (types VZE)
- can be mounted on the pressure or suction side
- space-saving installation, because no straight inlet/outlet sections are needed
- the meter can be mounted flexibly in a horizontal, vertical or inclined position
- accurate measurement result, since the reading is independent of the temperature and viscosity of the fluid
- minimum failure costs due to simple function monitoring, rapid fault analysis and the possibility of simple repairs on site

Areas of use

- to measure heating fuel consumption by oil burners (for example, in heating boilers, industrial furnaces, tar processing plants)
- to measure propellant fuel consumption by motors and engines (such as diesel locomotives, construction machinery and ships, or in standby power groups, combined heating and power stations)
- consumption monitoring
- flow measurement for mineral oils, option with remote transmission
- manual dosing / filling
- flow measurement for machine and motor/engine oils
- engine testbenches

Medium

- heating fuel extra light / light, medium, heavy
- naphtha
- diesel
- petrol
- and other media which can be used for lubrication purposes

1. VZE 15 ... 50 (Standard)

Technical data [1]

- with electronic display of total volume, resettable volume and flow rate, units: litres or US gallons [2]
- fuel oil meter with threaded or flanged connection
- for mounting in a horizontal, vertical or inclined position

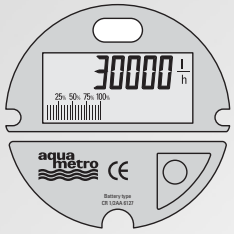
Option: with inductive INA pulser

Versions available on request:
- different flange drillings, such as ANSI, JIS

Type			VZE 15	VZE 20	VZE 25	VZE 40	VZE 50
Nominal diameter	**DN**	**mm**	**15**	**20**	**25**	**40**	**50**
		inch	1/2	3/4	1	1 1/2	2
Installation length		mm	165	165	190	300	350
Nominal pressure with threaded ends	PN	bar	16				
Nominal pressure with flanges	PN	bar	25				
Maximum temperature		° C	70, 130, 180				
Maximum flow rate	Q_{max} [3]	l/h	600	1500	3000	9000	30000
Nominal flow rate	**Q_n [3]**	**l/h**	**400**	**1000**	**2000**	**6000**	**20000**
Minimal flow rate	Q_{min}	l/h	10	30	75	225	750
Approx. starting flow rate		l/h	4	12	30	90	300
Measurement error limit			± 1% of actual value				
Repeatability			± 0,2%				
Smallest readable amount:							
Total volume		l	No decimals				
Resettable volume		l	3 decimal places with floating decimal point				
Digital flow rate display		l/h	1 decimal place				
Registration capacity		m^3	100000				
Registration at Q_n before return to zero		h	250000	100000	50000	16660	5000
Safety filter mesh width		mm	0,400	0,400	0,400	0,800	0,800
Dirt trap mesh width		**mm**	**0,250**	**0,400**	**0,400**	**0,600**	**0,600**
Volume of the measuring chamber		approx. cm^3	12	36	100	330	1200
Housing finish			enamelled red RAL 3013				
Weight with threaded ends [4]		approx. kg	2,2	2,5	4,2	17,3	–
Weight with flanges PN 25		approx. kg	3,8	4,5	7,5	20,3	41,0
Pulse values of pulsers:		approx.					
INA inductive according to DIN 19234 [5]		l/pulse	0.0006	0.00185	0.005	0.017	0.060
Pulse frequency INA	at Q_{max}	Hz	277,778	225,225	166,667	147,059	138,889
	at Q_{min}	Hz	4,630	4,505	4,167	3,676	3,472

1) Manufacturer's specification, valid for the following reference condition: EL heating fuel / diesel at 20° C.
2) 1 US gallon corresponds to 3.785 litres.
3) For burners and engines or motors, the meter must basically be selected for permanent flow. For higher viscosity, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be considered; see Chapters 5 and 8.
4) Weight without couplings.
5) The precise pulse value can be taken from the meter; it is only known after the calibration. The next device must have an adjustable input.

Electronic display



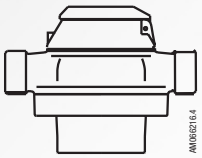
66017.4a

Display values:	• total volume, resettable volume, flow rate • In the service level, service hours and other information can be read out
Display:	• 8-character LCD with identification of the parameter, height of numbers: 8 mm, flow rate (meter load) using bar diagram
Temperature:	• ambient temperature –10 … +70° C, storage temperature –20° … +80° C
Safety:	• CE, vibration and shock test to DIN IEC 68
Supply:	• usual commercial lithium battery, type CR 1/2AA or CR2
Data reception:	• by non-volatile memory (EEPROM)
Change of battery:	• after 5 years, based on a battery lifetime of 6 years with a maximum of 10 hours' digital display of the flow rate
Protection:	• IP54 (IEC 144) against splash water and dust

Pressure drop curves

in chapter 5

Dimensions in mm

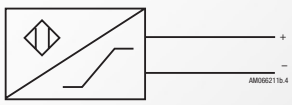


Meter	Length	Width	Height of meters VZE			
			VZE … 70° C		VZE … 130° C and 180° C	
				-INA		-INA
	L	W	H	H	H	H
VZE 15	165	105	106	147	185	185
VZE 20	165	105	115	156	194	194
VZE 25	190	130	142	183	221	221
VZE 40	300	210	194	235	273	273
VZE 50	350	280	250	291	329	329

Detailed dimensional drawings in chapter 5

INA pulsers

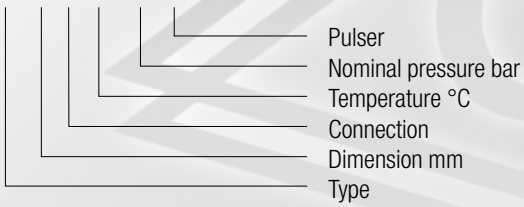
High-resolution pulsers for industrial applications.
Plug-in proximity switch with Ex approval.



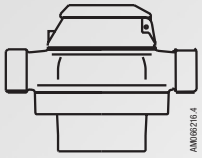
Switching element:	• inductive slot initiator according to DIN 19234
Switching voltage:	• 5 … 15 VDC
Residual ripple:	• max. 5 %
Switching current:	• > 3 mA at 8 VDC / 1 kOhm
Static current:	• < 1 mA at 8 VDC / 1 kOhm
ON-time:	• 50 % ± 10 %
Ambient temperature:	• –10 … +70° C
Type of protection:	• IP 65 (IEC 144) against water jets and dust
Connection:	• Cable, min. 2 × 0,35 mm² and 4 … 6 mm external diameter, on plug supplied with product.

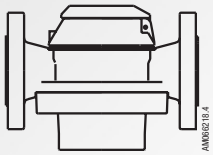
Type designation key

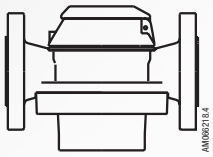
VZE 25 FL 130 / 25-INA



Ordering specifications

Threaded ends	Type	Order No.	Type	Order No.
	VZE 15 RC 70/16	92206	VZE 25 RC 70/16	92224
	VZE 15 RC 70/16-INA	92207	VZE 25 RC 70/16-INA	92225
	VZE 15 RC 130/16	92208	VZE 25 RC 130/16	92226
	VZE 15 RC 130/16-INA	92209	VZE 25 RC 130/16-INA	92227
	VZE 20 RC 70/16	92214	VZE 40 RC 70/16	92234
	VZE 20 RC 70/16-INA	92215	VZE 40 RC 70/16-INA	92235
	VZE 20 RC 130/16	92216	VZE 40 RC 130/16	92236
	VZE 20 RC 130/16-INA	92217	VZE 40 RC 130/16-INA	92237

Flanges 130° C / PN 25				
	VZE 15 FL 130/25	92212	VZE 40 FL 130/25	92240
	VZE 15 FL 130/25-INA	92213	VZE 40 FL 130/25-INA	92241
	VZE 20 FL 130/25	92220	VZE 50 FL 130/25	92246
	VZE 20 FL 130/25-INA	92221	VZE 50 FL 130/25-INA	92247
	VZE 25 FL 130/25	92230		
	VZE 25 FL 130/25-INA	92231		

Flanges 180° C / PN 25				
	VZE 20 FL 180/25	92222	VZE 40 FL 180/25	92242
	VZE 20 FL 180/25-INA	92223	VZE 40 FL 180/25-INA	92243
	VZE 25 FL 180/25	92232	VZE 50 FL 180/25	92248
	VZE 25 FL 180/25-INA	92233	VZE 50 FL 180/25-INA	92249

DN 15 meters are not suitable for heavy fuel oil; this is only possible if special precautions are taken.

2. VZO 4 ... 50 (Classic)

2.1

VZO 4 and 8

Technical data [1]

- oil meter with inside thread connections located on the bottom plate
- with mechanical roller counter, volume display in litres
- meters in US-Gallons [2]
- for mounting in horizontal, vertical an inclined positions

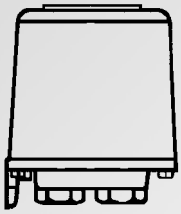
Option: Reed pulser 48 V

Type				VZO 4 Q_{min} 0,5	VZO 4	VZO 8
Nominal diameter			**mm**	**4**	**4**	**8**
			inch	1/8	1/8	1/4
Connection threads of meter			inch	1/8	1/8	1/4
Nominal pressure			bar	25		
Temperature			°C	60		
Maximum flow rate		Q_{max} [3]	l/h	40	80	200
Nominal flow rate		**Q_n [3]**	**l/h**	**25**	**50**	**135**
Minimal flow rate		Q_{min} [4]	l/h	0,5	1	4
Approx. starting flow rate			l/h	0,3	0,4	1,6
Measurement error limit				± 1% of actual value [4]		
Repeatability				± 0,2%		
Smallest readable amount			l	0,001	0,001	0,01
Registration capacity			m^3	100	100	1000
Registration at Q_n before return to zero			h	4000	2000	7400
Safety filter mesh width			mm	0,125	0,125	0,150
Dirt trap mesh width			**mm**	**0,080**	**0,080**	**0,100**
Volume of the measuring chamber			approx. cm^3	5	5	12,5
Weight without couplings			approx. kg	0,65	0,65	0,75
Reed pulsers	RE 1		l/pulse	–	–	1
	RE 0,1			–	0,1	0,1
	RE 0,01			–	0,01	–
	RE 0,00125			–	0,00125	–
	RE 0,00311			–	–	0,00311
Pulse frequency for	RE 0,00125	at Q_{max}	Hz	–	17,777	–
		at Q_{min}	Hz	–	0,222	–
Pulse frequency for	RE 0,00311	at Q_{max}	Hz	–	–	17,864
		at Q_{min}	Hz	–	–	0,357

1) Manufacturer's specification, valid for the following reference condition: EL heating fuel / diesel at 20° C.
2) 1 US gallon corresponds to 3.785 litres
3) For burners and engines or motors, the meter must basically be selected for permanent flow. For higher viscosity, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be considered; see Chapters 5 and 8.
4) Accuracy limits: VZO 4 Q_{min} 0,5: 0,5 l/h ... 2 l/h = + 1% /– 2%. VZO 4: 1 l/h ... 2 l/h = + 1% /– 2%.

Pressure drop curves
in chapter 5

Dimensions in mm

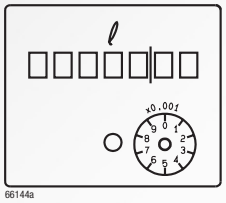


height = 79
width = 65
depth = 65

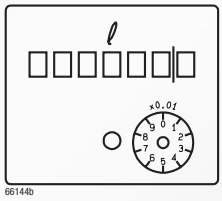
Detailed dimensional drawings in chapter 5

Dial

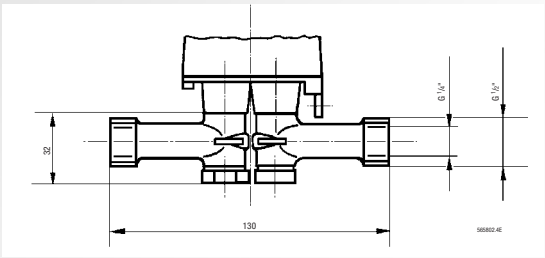
VZO 4



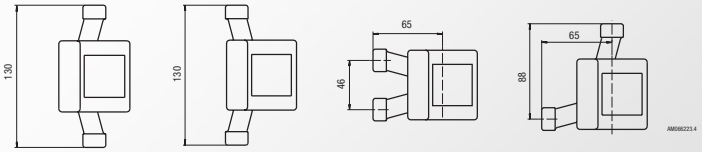
VZO 8



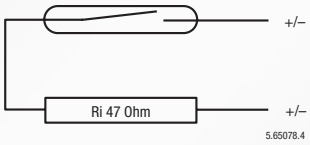
Mounting Kit for VZO 8



Order No. 81130: some possible mounting positions



RE Pulsers



Switching element:	• Reed switch with dry contact (inert gas)
Switching voltage:	• Max. 48 V AC/DC
Switching current:	• Max. 50 mA
Static current:	• Open Contact
Switching power:	• Max. 3 VA
ON-time:	• 30 … 70 % (pulse value 1/0, 1/0,01 l/pulse)
	• 40 … 55 % (pulse value 0,00125/0,00311 l/pulse0)
Temperature:	• Ambient –10 … +60° C
Protection:	• IP 65 (IEC 144) against water-jets and dust
Connection:	• On plug supplied with product for cable, 2 × 0,35 mm^2

Ordering specifications

Type	Order No.	Type	Order No.
VZO 4	92680	VZO 8	92630
VZO 4 RE 0,00125	89763	VZO 8 RE 0,00311	89733
VZO 4 RE 0,01	89760	VZO 8 RE 0,1	89730
VZO 4 RE 0,1	89761	VZO 8 RE 1	89731
VZO 4 Q_{min} 0,5	92678		

VZO 4 and 8 OEM

Technical data [1]

- fuel oil meters for OEM's (original equipment manufacturers), to be mounted under the burner cover
- meters with internal threaded connection, positioned laterally
- with 230V Reed pulser to display measurement values on remote totaliser or on burner control unit
- for mounting in horizontal, vertical or inclined positions

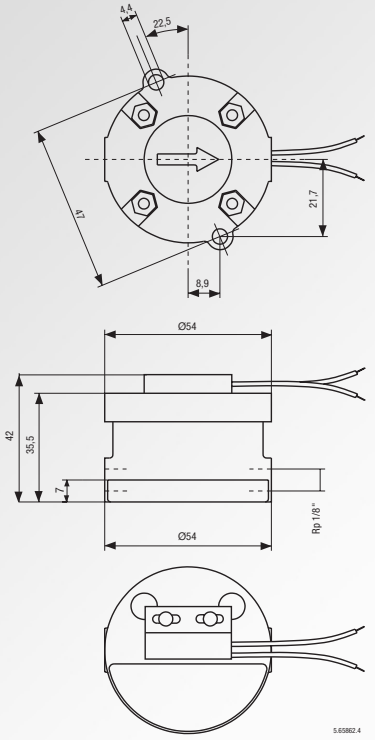
Type			VZO 4 OEM	VZO 8 OEM
Nominal diameter		**mm**	**4**	**8**
		inch	1/8	1/4
Connection threads of meter		inch	1/8	1/4
Nominal pressure		bar	32	25
Temperature		° C	60	60
Maximum flow rate	Q_{max} [2]	l/h	80	200
Nominal flow rate	**Q_n [2]**	**l/h**	**50**	**135**
Minimal flow rate	Q_{min} [3]	l/h	1	4
Approx. starting flow rate		l/h	0,4	1,6
Measurement error limit			± 1 % of actual value [3]	
Repeatability			± 0,2 %	
Safety filter mesh width		mm	0,125	0,150
Dirt trap mesh width		**mm**	**0,080**	**0,100**
Volume of the measuring chamber		approx. cm^3	5	12,5
Weight		approx. kg	0,65	0,75
Reed pulsers RE		l/pulse	0,005	0,0125
Pulse frequency	at Q_{max}	Hz	4,444	4,444
	at Q_{min}	Hz	0,056	0,089

1) Manufacturer's specification, valid for the following reference condition: EL heating fuel / diesel at 20° C.
2) For burners and engines or motors, the meter must basically be selected for permanent flow. For higher viscosity, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be considered; see Chapters 5 and 8.
3) Accuracy limits: VZO 4 OEM: 1 l/h … 2 l/h = + 1 % /– 2 %.

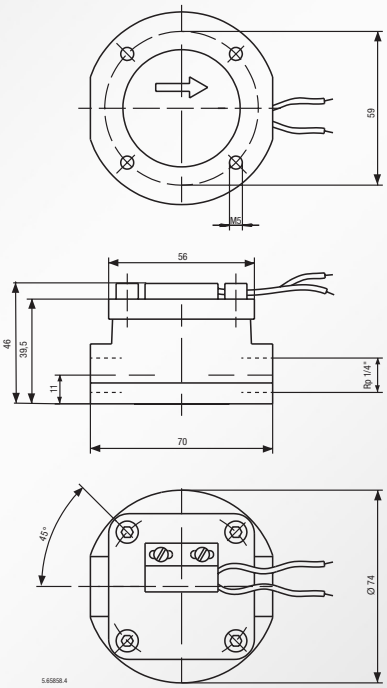
Pressure drop curves
in chapter 5

Dimensions in mm

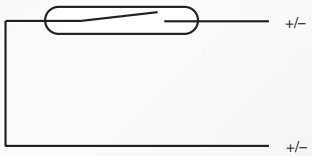
VZO 4 OEM



VZO 8 OEM



RE Pulsers

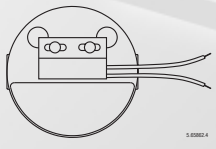


Switching element:	• Reed switch with dry contact (inert gas)
Switching voltage:	• max. 230 V AC/DC
Switching current:	• max. 50 mA
Static current:	• Open Contact
Switching power:	• max. 3 VA
ON-time:	• 40 … 55 %
Temperature:	• Ambient –10 … +60° C
Protection:	• IP 65 (IEC 144) against water-jets and dust
Connection:	• Cable cross section $2 \times 0{,}5$ mm^2, length 480 mm

Remote totaliser for VZO 4 OEM

Power supply:	• 230 V, 50/60 Hz
Pulse value (input):	• 0,005 l
Smallest readable amount:	• 0,005 l
Registration capacity:	• 10 000 l
Registration:	• at Q_n before return to zero 200 h
Panel cut-out:	• $27 \times 14{,}4$ – 0/+ 0,2 mm
Installation depth:	• 56 mm

Ordering specifications



Type	Description	Order No.
VZO 4 OEM-RE 0,005	Version for OEM's	89765
	Remote totaliser for VZO 4 OEM	93349
VZO 8 OEM-RE 0,0125	Version for OEM's	89771

VZO 15 … 50

Technical data [1]

- Volume display on roller register, in litres
- fuel oil meter with threaded or flanged ends
- for horizontal, vertical or inclined mounting

Option: Reed pulser or RV / IN pulser

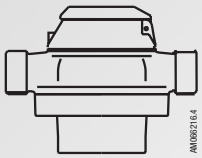
Versions available on request:
- different flange drillings, such as ANSI, JIS
- meters in US Gallons [2] (option)

Type			VZO 15	VZO 20	VZO 25	VZO 40	VZO 50
Nominal diameter	**DN**	**mm**	**15**	**20**	**25**	**40**	**50**
		inch	½	¾	1	1½	2
Installation length		mm	165	165	190	300	350
Nominal pressure with threaded ends	PN	bar	16				
Nominal pressure with flanges	PN	bar	25, 40				
Maximum temperature		°C	130, 180				
Maximum flow rate	Q_{max} [3]	l/h	600	1500	3000	9000	30000
Nominal flow rate	**Q_n [3]**	**l/h**	**400**	**1000**	**2000**	**6000**	**20000**
Minimal flow rate	Q_{min}	l/h	10	30	75	225	750
Approx. starting flow rate		l/h	4	12	30	90	300
Measurement error limit			± 1% of actual value				
Repeatability			± 0,2%				
Smallest readable amount		l	0,01	0,1	0,1	0,1	1
Registration capacity		m^3	1000	10000	10000	10000	100000
Registration at Q_n before return to zero		h	2500	10000	5000	1667	5000
Safety filter mesh width		mm	0,400	0,400	0,400	0,800	0,800
Dirt trap mesh width		**mm**	**0,250**	**0,400**	**0,400**	**0,600**	**0,600**
Volume of the measuring chamber		approx. cm^3	12	36	100	330	1200
Housing finish			enamelled red RAL 3013				
Weight with threaded ends [4]		approx. kg	2,2	2,5	4,2	17,3	–
Weight with flanges PN 25		approx. kg	3,8	4,5	7,5	20,3	41,0
Weight with flanges PN 40		approx. kg	4,4	5,5	7,8	20,5	42,0
Pulse values of pulsers:							
IN inductive according to DIN 19234		l/pulse	0,01	0,01	0,1	0,1	1
RV Reed		l/pulse	0,1	1	1	1	10
RV Reed		l/pulse	1	–	–	10	100
Pulse frequency IN	at Q_{max}	Hz	16,667	41,667	8,333	25,000	8,333
	at Q_{min}	Hz	0,278	0,833	0,208	0,625	0,208

1) Manufacturer's specification, valid for the following reference condition: EL heating fuel / diesel at 20° C.
2) 1 US gallon corresponds to 3.785 litres
3) For burners and engines or motors, the meter must basically be selected for permanent flow. For higher viscosity, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be considered; see Chapters 5 and 8.
4) Weight without couplings.

Pressure drop curves
in chapter 5

Dimensions in mm

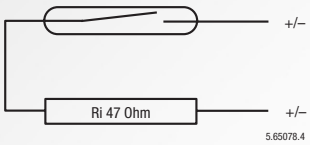


Meter	Length	Width	Height of meters VZO					
			VZO … 130° C			VZO … 180° C		
				-RV	-IN		-RV	-IN
	L	W	H	H	H	H	H	H
VZO 15	165	105	106	130	185	147	171	225
VZO 20	165	105	115	139	194	156	180	234
VZO 25	190	130	142	166	221	183	207	261
VZO 40	300	210	235	259	273	235	259	313
VZO 50	350	280	291	315	329	291	315	369

Detailed dimensional drawings in chapter 5

RV Pulsers

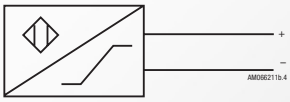
This pulser is integrated into the roller counter and is thus especially appropriate for remote totalisation. For other applications the use of the inductive pulser IN is preferable.



Switching element:	• Reed switch with dry contact (inert gas)
Switching voltage:	• max. 48 V AC/DC
Switching current:	• max. 50 mA (Ri = 47 Ohm/0,5 W)
Static current:	• Open Contact
Switching power:	• max. 2 W
ON-time:	• 50 % ± 10 %
Temperature:	• Ambient –10 … +70° C
Protection:	• IP 65 (IEC 144) against water-jets and dust
Connection:	• Cast-in cable, length 3 m
Cable cross section:	• 2 × 0,14 mm²

IN Pulsers

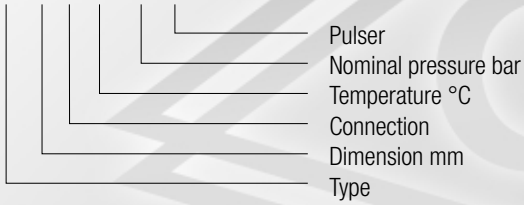
Pulser for industrial applications. Supplied with plug-in pulser sensor for use in hazardous area.



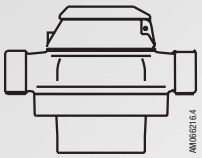
Switching element:	• Slot initiator according to DIN 19234
Switching voltage:	• 5 … 15 V DC
Residual ripple:	• max. 5 %
Switching current:	• > 3 mA bei 8 V DC / 1 kOhm
Static current:	• < 1 mA bei 8 V DC / 1 kOhm
ON-time:	• 50 % ± 10 %
Temperature:	• Ambient –10 … +70° C
Protection:	• IP 65 (IEC 144) against water-jets and dust
Connection:	• Cable min. 2 × 0,35 mm² and 4 … 6 mm external diameter, on plug supplied with product
Ex approval:	• EEx ia IIC T6

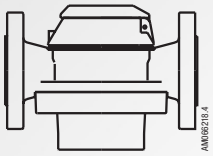
Type designation key

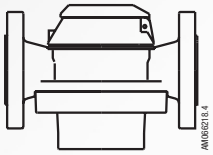
VZO 25 FL 130/25-IN …

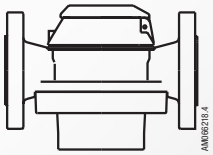


Ordering specifications

Threaded ends	Type	Order No.	Type	Order No.
	VZO 15 RC 130/16	92041	VZO 25 RC 130/16	92057
	VZO 15 RC 130/16-RV 0,1	92042	VZO 25 RC 130/16-RV 1	92058
	VZO 15 RC 130/16-RV 1	92043	VZO 25 RC 130/16-IN 0,1	91913
	VZO 15 RC 130/16-IN 0,01	91900		
	VZO 20 RC 130/16	92047	VZO 40 RC 130/16	92004
	VZO 20 RC 130/16-RV 1	92048	VZO 40 RC 130/16-RV 1	92018
	VZO 20 RC 130/16-IN 0,01	91902	VZO 40 RC 130/16-IN 0,1	91906

Flanges 130° C / PN 25				
	VZO 15 FL 130/25	92044	VZO 40 FL 130/25	92005
	VZO 15 FL 130/25-RV 0,1	92045	VZO 40 FL 130/25-RV 1	92020
	VZO 15 FL 130/25-RV 1	92046	VZO 40 FL 130/25-IN 0,1	91907
	VZO 15 FL 130/25-IN 0,01	91910		
	VZO 20 FL 130/25	92049	VZO 50 FL 130/25	92007
	VZO 20 FL 130/25-RV 1	92050	VZO 50 FL 130/25-RV 10	92024
	VZO 20 FL 130/25-IN 0,01	91903	VZO 50 FL 130/25-IN 1	91909
	VZO 25 FL 130/25	92059		
	VZO 25 FL 130/25-RV 1	92060		
	VZO 25 FL 130/25-IN 0,1	91914		

Flanges 180° C / PN 25				
	VZO 15 FL 180/25	92250	VZO 40 FL 180/25	92274
	VZO 15 FL 180/25-RV 0,1	92251	VZO 40 FL 180/25-RV 1	92275
	VZO 15 FL 180/25-RV 1	92252	VZO 40 FL 180/25-IN 0,1	92276
	VZO 15 FL 180/25-IN 0,01	92253		
	VZO 20 FL 180/25	92258	VZO 50 FL 180/25	92280
	VZO 20 FL 180/25-RV 1	92259	VZO 50 FL 180/25-RV 10	92281
	VZO 20 FL 180/25-IN 0,01	92260	VZO 50 FL 180/25-IN 1	92282
	VZO 25 FL 180/25	92264		
	VZO 25 FL 180/25-RV 1	92265		
	VZO 25 FL 180/25-IN 0,1	92266		

Flanges 180° C / PN 40				
	VZO 15 FL 180/40	92254	VZO 40 FL 180/40	92277
	VZO 15 FL 180/40-RV 0,1	92255	VZO 40 FL 180/40-RV 1	92278
	VZO 15 FL 180/40-RV 1	92256	VZO 40 FL 180/40-IN 0,1	92279
	VZO 15 FL 180/40-IN 0,01	92257		
	VZO 20 FL 180/40	92261	VZO 50 FL 180/40	92283
	VZO 20 FL 180/40-RV 1	92262	VZO 50 FL 180/40-RV 10	92284
	VZO 20 FL 180/40-IN 0,01	92263	VZO 50 FL 180/40-IN 1	92285
	VZO 25 FL 180/40	92267		
	VZO 25 FL 180/40-RV 1	92268		
	VZO 25 FL 180/40-IN 0,1	92269		

DN 15 meters are not suitable for heavy fuel oil; this is only possible if special precautions are taken.

3. VZEA/VZOA 15…50, special products for differential measurement

Important information in your interest, please note!
For a differential measurement, the flow is measured in the supply and return pipes. The difference between the two measurements is regarded as the consumption.

To obtain optimal measurement results, you should only use VZEA or VZOA CONTOIL® fuel oil meters calibrated in pairs, which are co-ordinated precisely to the plant/system operating conditions. The flow rate occurring in each meter, the permissible pressure drop and the viscosity of the fluid must all be considered during the design phase. The load on the meter is obtained as follows: flow in supply section less consumption = flow in return section.

When the order is placed, the following information is required:

• application	e.g. differential measurement for diesel engines in a standby power group
• fluid	e.g. diesel fuel
• temperature	e.g. 15 … 40° C
• operating pressure	e.g. 4 bar
• flow rate in supply section	e.g. fixed pumping rate 200 l/h
• flow rate in return section	e.g. 120 … 190 l/h (for a consumption of10 … 80 l/h)

The meters are marked “supply” and “return” during calibration and final testing in the factory. They must then be installed in the correct pipes.

For further information on the subject of differential measurement, please see Chapter 8, System Planning and Chapter 9, Application Examples.

Technical data [1]

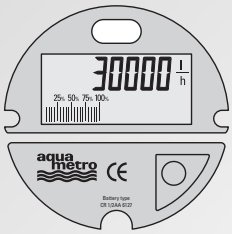
- fuel oil meters with special paired calibration for optimal results from differential measurements
- VZEA with electronic display of total volume, resettable volume, and flow rate, units: litres or US gallons [2]
- VZOA with display of total volume on roller register, units: litres. Optional versions with display in US gallons
- VZEA option: with inductive INA pulser
- VZOA option: with reed or inductive pulser, RV or IN
- with threaded or flanged connection
- for mounting in horizontal, vertical or inclined positions

Versions available on request:
- different flange drillings, such as ANSI, JIS

Type			VZEA/ VZOA 15	VZEA/ VZOA 20	VZEA/ VZOA 25	VZEA/ VZOA 40	VZEA/ VZOA 50
Nominal diameter	**DN**	**mm**	**15**	**20**	**25**	**40**	**50**
		inch	1/2	3/4	1	1 1/2	2
Installation length		mm	165	165	190	300	350
Nominal pressure with threaded ends	PN	bar	16				
Nominal pressure with flanges	PN	bar	25				
Maximum temperature		°C	130, 180				
Maximum flow rate	Q_{max} [3]	l/h	600	1500	3000	9000	30000
Nominal flow rate	**Q_n [3]**	**l/h**	**400**	**1000**	**2000**	**6000**	**20000**
Minimal flow rate	Q_{min}	l/h	10	30	75	225	750
Approx. starting flow rate		l/h	4	12	30	90	300
Measurement error limit			< 0.5% of actual value				
Repeatability			± 0,1%				
VZEA							
Smallest readable amount:							
Total volume		l	No decimals				
Resettable volume		l	3 decimal places with floating decimal point				
Digital flow rate display		l/h	1 decimal place				
Registration capacity		m^3	100000				
Registration at Q_n before return to zero		h	250000	100000	50000	16660	5000
VZOA							
Smallest readable amount		l	0,01	0,1	0,1	0,1	1
Registration capacity		m^3	1000	10000	10000	10000	100000
Registration at Q_n before return to zero		h	2500	10000	5000	1667	5000
Safety filter mesh width		mm	0,400	0,400	0,400	0,800	0,800
Dirt trap mesh width		**mm**	**0,100**	**0,100**	**0,250**	**0,250**	**0,250**
Volume of the measuring chamber		approx. cm^3	12	36	100	330	1200
Housing finish			enamelled red RAL 3013				
Weight with threaded ends [4]		approx. kg	2,2	2,5	4,2	17,3	–
Weight with flanges PN 25		approx. kg	3,8	4,5	7,5	20,3	41,0
Pulse values of pulsers on VZOA:							
IN inductive according to DIN 19234		l/pulse	0,01	0,01	0,1	0,1	1
RV Reed		l/pulse	0,1	1	1	1	10
RV Reed		l/pulse	1	–	–	10	100
Pulse values of pulsers on VZEA:							
INA inductive according to DIN 19234 [5]		approx. l/pulse	0,0006	0,00185	0,005	0,017	0,060
Pulse frequency IN	at Q_{max}	Hz	16,667	41,667	8,333	25,000	8,333
	at Q_{min}	Hz	0,278	0,833	0,208	0,625	0,208
Pulse frequency INA	at Q_{max}	Hz	277,778	225,225	166,667	147,059	138,889
	at Q_{min}	Hz	4,630	4,505	4,167	3,676	3,472

1) Manufacturer's specification, valid for the following reference condition: EL heating fuel / diesel at 20° C.
2) 1 US gallon corresponds to 3.785 litres.
3) For burners and engines or motors, the meter must basically be selected for permanent flow. For higher viscosity, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must also be considered; see Chapters 5 and 8.
4) Weight without couplings.
5) The precise pulse value can be taken from the meter; it is only known after the calibration. The next device must have an adjustable input.

Electronic display

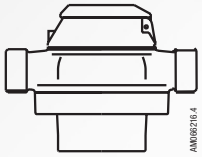


66017.4a

Display values:	• total volume, resettable volume, flow rate • In the service level, service hours and other information can be read out
Display:	• 8-character LCD with identification of the parameter, height of numbers: 8 mm, flow rate (meter load) using bar diagram
Temperature:	• ambient temperature –10 … +70° C, storage temperature –20 … +80° C
Safety:	• CE, vibration and shock test to DIN IEC 68
Supply:	• usual commercial lithium battery, type CR 1/2AA or CR2
Data reception:	• by non-volatile memory (EEPROM)
Change of battery:	• after 5 years, based on a battery lifetime of 6 years with a maximum of 10 hours' digital display of the flow rate
Protection:	• IP54 (IEC 144) against splash water and dust

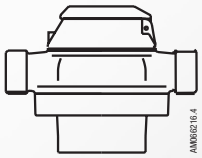
Pressure drop curves
in chapter 5

Dimensions VZEA in mm



Meter	Length	Width	Height of meters VZEA	
			VZEA … 130° C and 180° C	
				-INA
	L	W	H	H
VZEA 15	165	105	185	185
VZEA 20	165	105	194	194
VZEA 25	190	130	221	221
VZEA 40	300	210	273	273
VZEA 50	350	280	329	329

Dimensions VZOA in mm

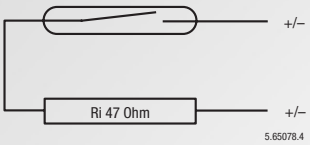


Meter	Length	Width	Height of meters VZOA					
			VZOA … 130° C			VZOA … 180° C		
				-RV	-IN		-RV	-IN
	L	W	H	H	H	H	H	H
VZOA 15	165	105	147	171	185	147	171	225
VZOA 20	165	105	156	180	194	156	180	234
VZOA 25	190	130	183	207	221	183	207	261
VZOA 40	300	210	235	259	273	235	259	313
VZOA 50	350	280	291	315	329	291	315	369

Detailed dimensional drawings in chapter 5

RV Pulsers

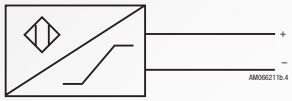
This pulser is integrated into the roller counter and is thus especially appropriate for remote totalisation. For other applications the use of the inductive pulser IN is preferable.



Switching element:	• Reed switch with dry contact (inert gas)
Switching voltage:	• max. 48 V AC/DC
Switching current:	• max. 50 mA (Ri = 47 Ohm/0,5 W)
Static current:	• Open Contact
Switching power:	• max. 2 W
ON-time:	• 50 % ± 10 %
Temperature:	• Ambient –10 … +70° C
Protection:	• IP 65 (IEC 144) against water-jets and dust
Connection:	• Cast-in cable, length 3 m
Cable cross section:	• 2 × 0,14 mm²

IN / INA Pulsers

Pulser for industrial applications. Supplied with plug-in pulser sensor for use in hazardous area.



Switching element:	• Slot initiator according to DIN 19234
Switching voltage:	• 5 … 15 V DC
Residual ripple:	• max. 5 %
Switching current:	• > 3 mA bei 8 V DC / 1 kOhm
Static current:	• < 1 mA bei 8 V DC / 1 kOhm
ON-time:	• 50 % ± 10 %
Temperature:	• Ambient –10 … +70° C
Protection:	• IP 65 (IEC 144) against water-jets and dust
Connection:	• Cable min. 2 × 0,35 mm² and 4 … 6 mm external diameter, on plug supplied with product
Ex approval:	• EEx ia IIC T6 (Ex installation only with VZOA)

Type designation key

VZOA 25 FL 130 / 25-IN

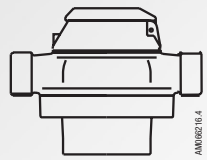
- Pulser
- Nominal pressure bar
- Temperature °C
- Connection
- Dimension mm
- Type

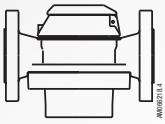
Information required to process orders
When the order is placed, information is required on the plant operating conditions (as stated in the note at the start of this Chapter).

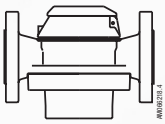
Exemple

Application:		differential measurement Diesel, supply 200 l/h, return 120. … 190 l/h
2 Pieces	Order No. 92290	CONTOIL® fuel oil meter, type VZOA 20 RC 130/16
2 Pieces	Order No. 96112	Modification for differential measurement

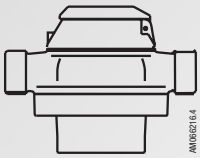
Ordering specifications VZEA (with electronic display)

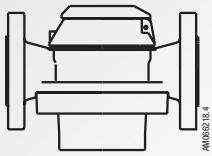
Threaded ends 	Type	Order No.	Type	Order No.
	VZEA 15 RC 130/16	92331	VZEA 25 RC 130/16	92335
	VZEA 15 RC 130/16-INA	92332	VZEA 25 RC 130/16-INA	92336
	VZEA 20 RC 130/16	92333	VZEA 40 RC 130/16	92337
	VZEA 20 RC 130/16-INA	92334	VZEA 40 RC 130/16-INA	92338

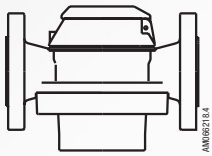
Flanges 130° C / PN 25 				
	VZEA 15 FL 130/25	92339	VZEA 40 FL 130/25	92353
	VZEA 15 FL 130/25-INA	92340	VZEA 40 FL 130/25-INA	92354
	VZEA 20 FL 130/25	92343	VZEA 50 FL 130/25	92361
	VZEA 20 FL 130/25-INA	92344	VZEA 50 FL 130/25-INA	92362
	VZEA 25 FL 130/25	92347		
	VZEA 25 FL 130/25-INA	92350		

Flanges 180° C / PN 25 				
	VZEA 15 FL 180/25	92341	VZEA 40 FL 180/25	92355
	VZEA 15 FL 180/25-INA	92342	VZEA 40 FL 180/25-INA	92360
	VZEA 20 FL 180/25	92345	VZEA 50 FL 180/25	92363
	VZEA 20 FL 180/25-INA	92346	VZEA 50 FL 180/25-INA	92365
	VZEA 25 FL 180/25	92351		
	VZEA 25 FL 180/25-INA	92352		

Ordering specifications VZOA (Volume display on roller register)

Threaded ends	Type	Order No.	Type	Order No.
	VZOA 15 RC 130/16	92286	VZOA 25 RC 130/16	92293
	VZOA 15 RC 130/16-RV 0,1	92287	VZOA 25 RC 130/16-RV 1	92294
	VZOA 15 RC 130/16-RV 1	92288	VZOA 25 RC 130/16-IN 0,1	92295
	VZOA 15 RC 130/16-IN 0,01	92289		
	VZOA 20 RC 130/16	92290	VZOA 40 RC 130/16	92296
	VZOA 20 RC 130/16-RV 1	92291	VZOA 40 RC 130/16-RV 1	92297
	VZOA 20 RC 130/16-IN 0,01	92292	VZOA 40 RC 130/16-IN 0,1	92298

Flanges 130° C / PN 25				
	VZOA 15 FL 130/25	92299	VZOA 40 FL 130/25	92309
	VZOA 15 FL 130/25-RV 0,1	92300	VZOA 40 FL 130/25-RV 1	92310
	VZOA 15 FL 130/25-RV 1	92301	VZOA 40 FL 130/25-IN 0,1	92311
	VZOA 15 FL 130/25-IN 0,01	92302		
	VZOA 20 FL 130/25	92303	VZOA 50 FL 130/25	92312
	VZOA 20 FL 130/25-RV 1	92304	VZOA 50 FL 130/25-RV 10	92313
	VZOA 20 FL 130/25-IN 0,01	92305	VZOA 50 FL 130/25-IN 1	92314
	VZOA 25 FL 130/25	92306		
	VZOA 25 FL 130/25-RV 1	92307		
	VZOA 25 FL 130/25-IN 0,1	92308		

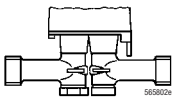
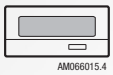
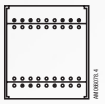
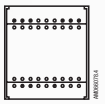
Flanges 180° C / PN 25				
	VZOA 15 FL 180/25	92315	VZOA 40 FL 180/25	92325
	VZOA 15 FL 180/25-RV 0,1	92316	VZOA 40 FL 180/25-RV 1	92326
	VZOA 15 FL 180/25-RV 1	92317	VZOA 40 FL 180/25-IN 0,1	92327
	VZOA 15 FL 180/25-IN 0,01	92318		
	VZOA 20 FL 180/25	92319	VZOA 50 FL 180/25	92328
	VZOA 20 FL 180/25-RV 1	92320	VZOA 50 FL 180/25-RV 10	92329
	VZOA 20 FL 180/25-IN 0,01	92321	VZOA 50 FL 180/25-IN 1	92330
	VZOA 25 FL 180/25	92322		
	VZOA 25 FL 180/25-RV 1	92323		
	VZOA 25 FL 180/25-IN 0,1	92324		

Modifications

	for differential measurement	96112	for VZEA or VZOA	
	for approval Germ. Lloyd	96295	only for VZOA	

4. Ancillaries

Ordering specifications

	Type	Description	Order No.
Threaded connections 	VSR 1/2" VSR 3/4" × 1/2" VSR 3/4" VSR 1" VSR 1 1/2"	for DN 15 for DN 20 for DN 20 for DN 25 for DN 40	81160 81163 81166 81169 81181
Threaded connections kit 	PS-Kit VZO 4	1/8" – 8	81583
Mounting kit 	PS-Kit VZO 8 VSR 3/8"	Mounting Kit Threaded connections to suit PS-Kit VZO 8	81130 81156
Remote totaliser 	SY3233	Count step with or without zeroing, adjustable	93374
Frequency current converter 	WEM-FSU WEM/Ex-FSU	freely programmable freely programmable, for Ex areas	93200 93240
Pulse converter 	KFA6-SR2-Ex 1.W KFA6-SOT2-Ex2	with relay output, max. 10 Hz with electronic output, max. 5 kHz	81705 80013

5. Meter data (annexe)

Function
CONTOIL® flow meters work on the volumetric principle of rotary piston meters (positive displacement meters).

The main features of this measuring principle are large measuring ranges, high accuracy, suitability for high viscosity's and independence from power supply; flow disturbances do not influence proper operation.

Construction
Rotary piston, guide roller and driver are the only moving parts in contact with the liquid. As the hydraulic part is completely separated from the roller counter, the movement of the rotary piston is transmitted by a magnetic coupling through the sealing plate.

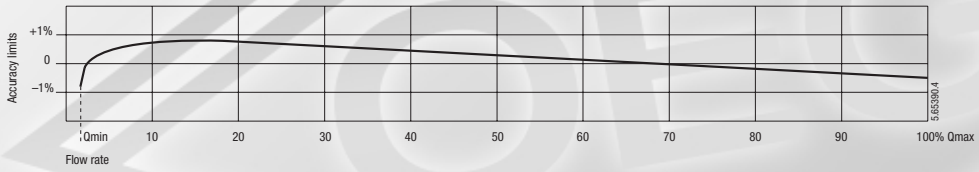
VZO 4 and VZO 8
Inlet and outlet connections are to be made perpendicular to the bottom plate of the meter.
OEM versions with connections located at the sides.

VZE/VZO/VZEA and VZOA 15 … 50
These meters are equipped with counters, which are rotatable through almost 360° for easy reading (exception: versions with Reed pulser RV).

Accuracy Limits: Reference Conditions
Accuracy limits according to technical data of meter in % of actual value for the whole measuring range.

Reference conditions
Liquid: extra light heating fuel
Temperature: 18 … 25° C

CONTOIL® Oil meters are never to be tested with water, otherwise they would get damaged.



Pressure drop curves
Viscosity information

Kinematic viscosity	Stokes, Centi-Stokes, mm^2/s	St, cSt, mm^2/s
Dynamic viscosity	Pascal seconds, millipascal seconds	Pas, mPa.s
	Poise, Centipoise (outmoded)	P, cP

Conversion

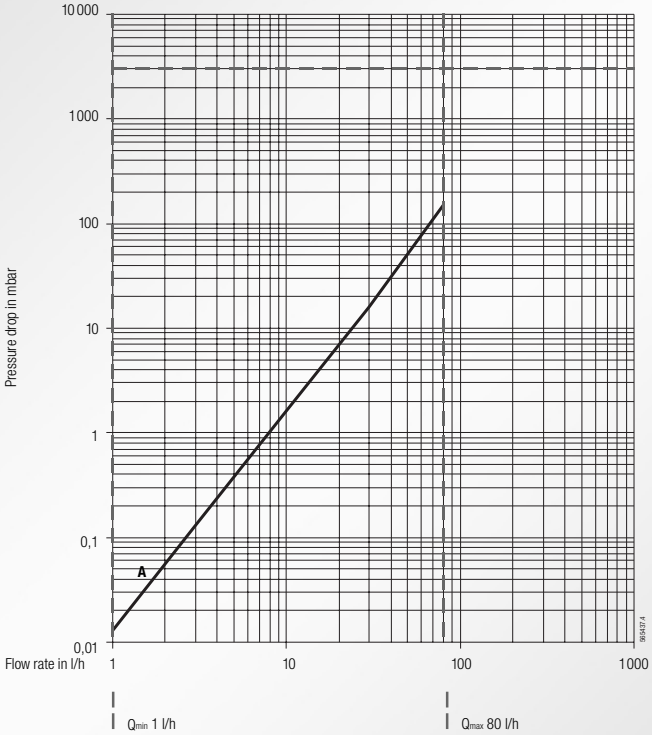
cSt × density = mPa.s
Engler degrees °E to mPa.s: only using comparative table
Saybold units to mPa.s: only using comparative table
Redwood units to mPa.s: only using comparative table

Rule of thumb

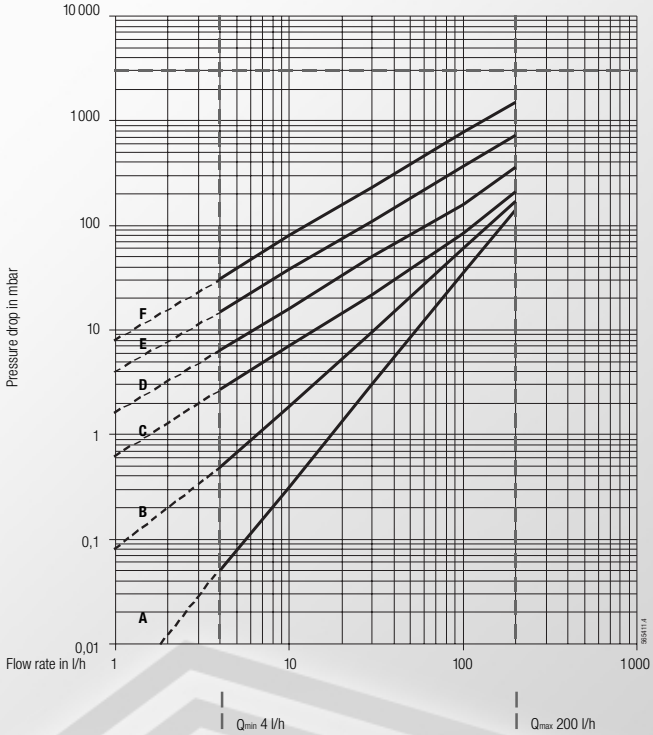
1 cSt → 1 mm^2/s → 1 mPa.s

VZO 4 and 8 / VZO 4 OEM and VZO 8 OEM

VZO 4



VZO 8



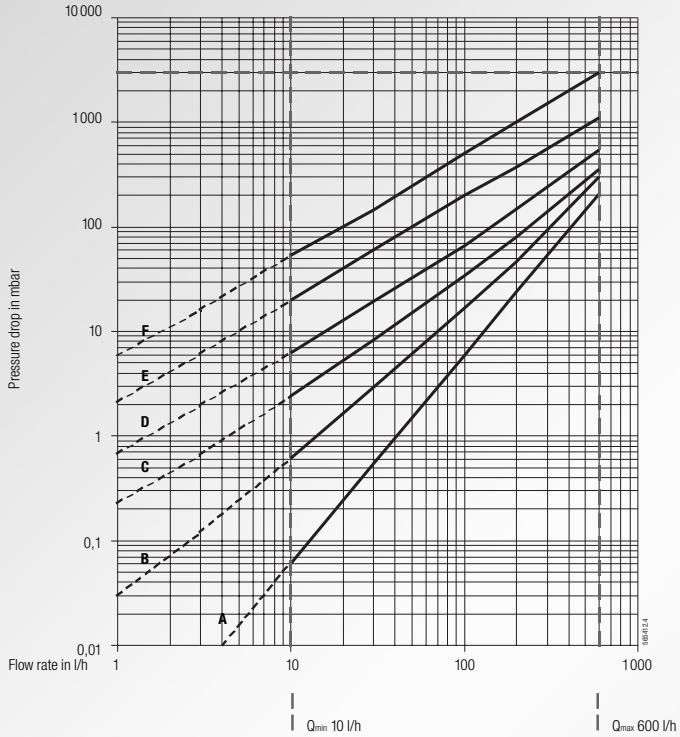
Viskosity curves:

A = 5 mPa.s	C = 100 mPa.s	E = 500 mPa.s
B = 50 mPa.s	D = 200 mPa.s	

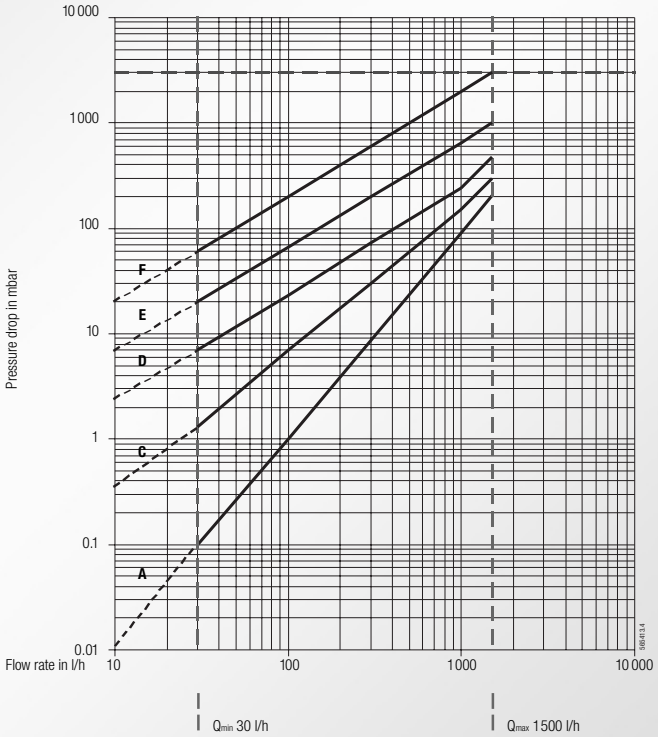
For a pressure drop of more than 1 bar, you are advised to use the next higher nominal meter width.
Maximum permissible pressure drop = 3 bar

VZE / VZO / VZEA / VZOA 15 … 50

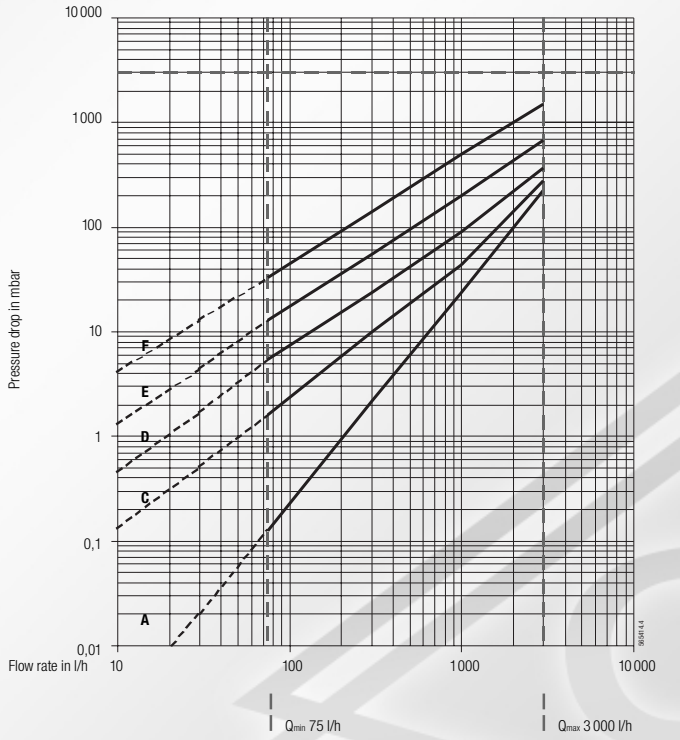
VZE / VZO / VZEA / VZOA 15



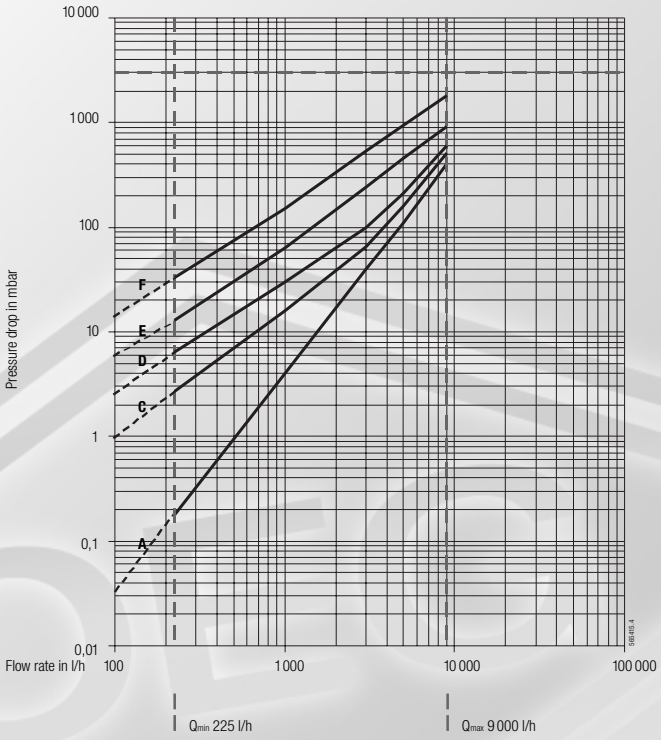
VZE / VZO / VZEA / VZOA 20



VZE / VZO / VZEA / VZOA 25



VZE / VZO / VZEA / VZOA 40

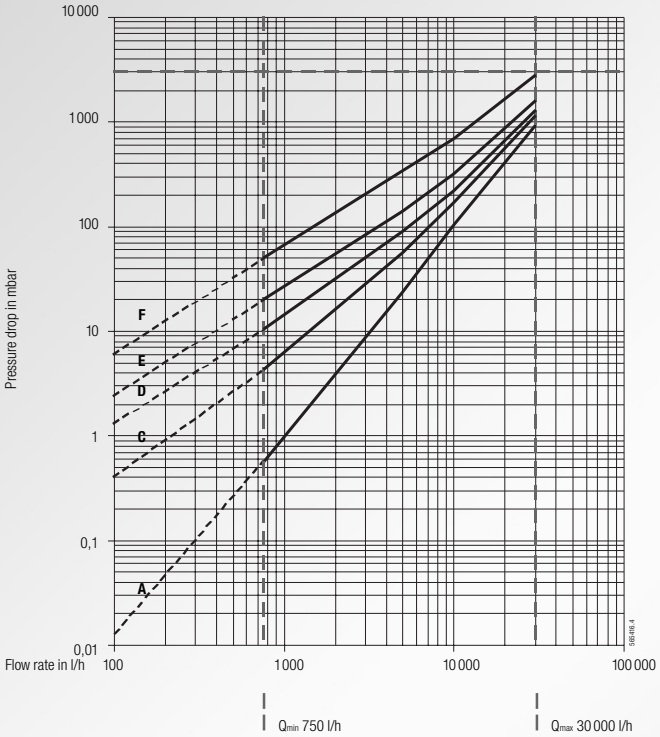


Viskosity curves:

A = 5 mPa.s	C = 50 mPa.s	E = 200 mPa.s
B = 25 mPa.s	D = 100 mPa.s	F = 500 mPa.s

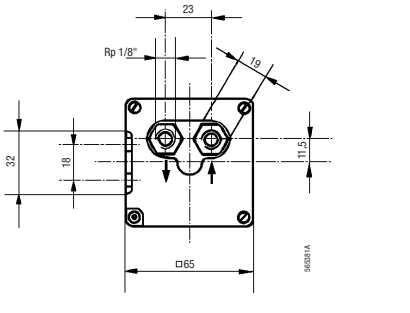
For a pressure drop of more than 1 bar, you are advised to use the next higher nominal meter width.
Maximum permissible pressure drop = 3 bar

VZE / VZO / VZEA / VZOA 50

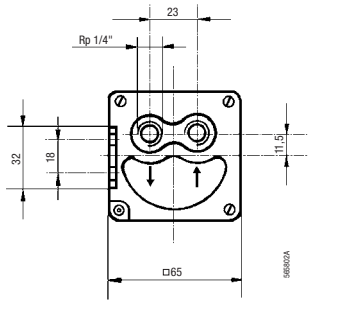


Dimensions in mm
VZO 4 and 8

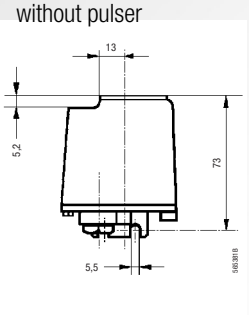
VZO 4

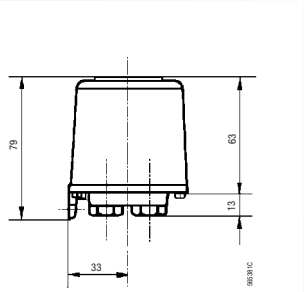


VZO 8

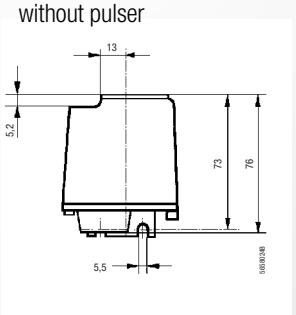


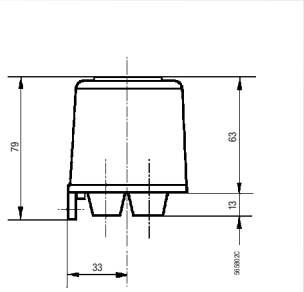
without pulser



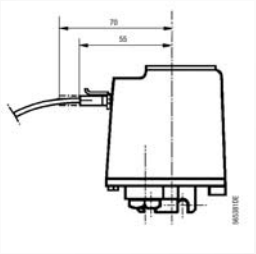


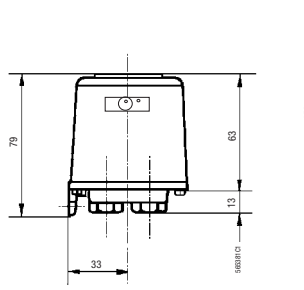
without pulser



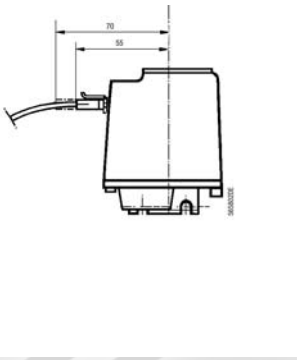


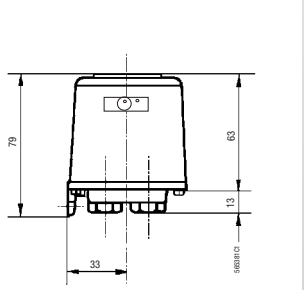
with pulser





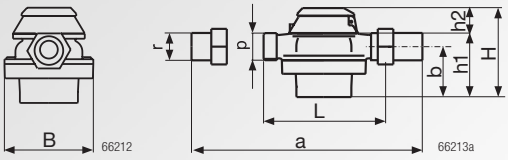
with pulser



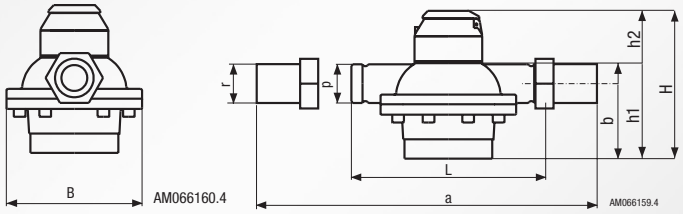


Dimensions in mm
VZE / VZO / VZEA / VZOA Measuring units

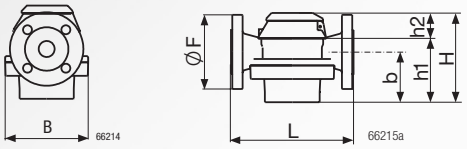
DN 15, 20, 25: with threaded ends



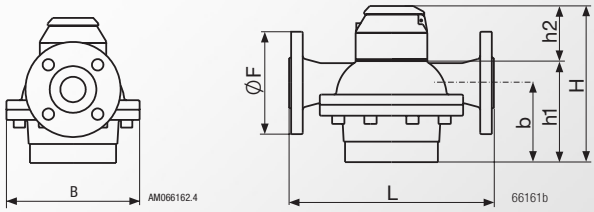
DN 40: with threaded ends



DN 15, 20, 25: with flanges (DIN 2501/SN 21843)



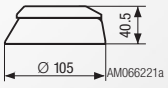
DN 40, 50: with flanges (DIN 2501/SN 21843)



Nominal width	L	B	a	Ø F	b	h1	p	r
DN 15	165	105	260	95	45	65	G 3/4"	G 1/2"
DN 20	165	105	260	105	54	74	G 1"	G 3/4"
DN 25	190	130	305	115	77	101	G 1 1/4"	G 1"
DN 40	300	210	440	150	116	153	G 2"	G 1 1/2"
DN 50	350	280	–	165	166	209	–	–

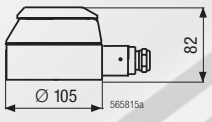
VZE / VZEA Ancillaries

Electronic display

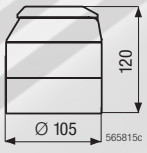


Tmax. 70° C

Electronic display and INA pulser

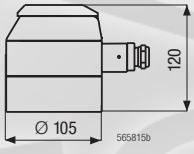


Electronic display



Tmax. 130° C resp. 180° C

Electronic display and INA pulser

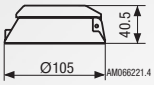


Dimensions in mm
VZO / VZOA Ancillaries

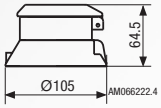
VZO 15, 20, 25

Tmax. 130° C

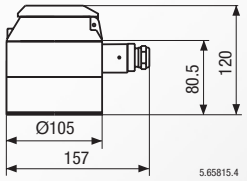
Roller register



Roller register with RV pulser



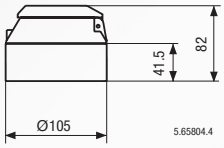
Roller register and IN pulser



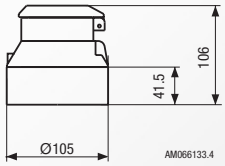
VZO 40, 50
VZOA 15 … 50

Tmax. 130° C

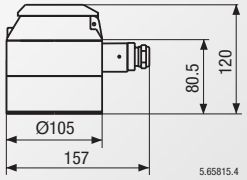
Roller register



Roller register with RV pulser



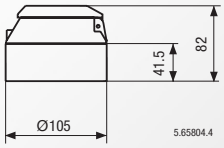
Roller register and IN pulser



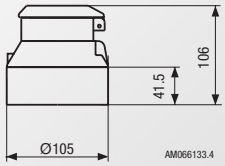
VZO 15 … 50
VZOA 15 … 50

Tmax. 180° C

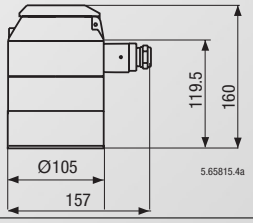
Roller register



Roller register with RV pulser

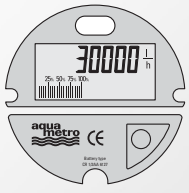


Roller register and IN pulser

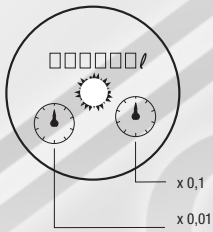


Electronic display / dial

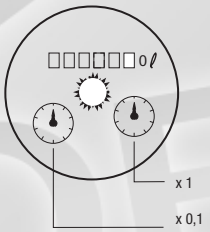
VZE / VZEA



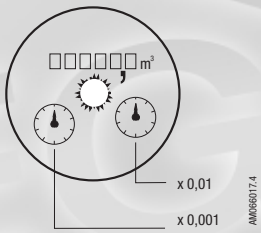
VZO / VZOA 15



VZO / VZOA 20, 25, 40



VZO / VZOA 50



6. Selection of the optimal meter

Type	VZO 4 – 8		VZE 15 – 50	VZO 15 – 50	VZEA / VZOA 15 – 50	
Application						
Direct consumption measurement	●		●	●	●	
Differential measurement	–		–	–	●	
Measurement for billing purposes	–		–	–	–	
Most frequent areas of use						
Domestic / industrial burners	●		●	●	●	
Diesel engines	●		●	●	●	
Petrol engines	●		○	○	○	
Medium						
Heating fuel light	●		●	●	●	
Heating fuel medium	●		●	●	●	
Heating fuel heavy [1)]	–		●	●	●	
Diesel	●		●	●	●	
Petrol	●		○	○	○	
Display of flow data						
Total volume	●		●	●	●	
Resettable volume	–		●	–	VZEA	
Acutal flow rate	–		●	–	VZEA	
Method of display						
Electronic display LCD	–		●	–	VZEA	
Total volume display on roller register	●		–	●	VZOA	
Accuracy limit						
± 1% of actual value	●		●	●	–	
< ±0,5% of actual value	–		–	–	●	
In accordance with cal. laws / appr. conditions	–		–	–	–	
Pulser (Option)						
Inductive, with high resolution	–		●	–	VZEA	
Inductive, with decadic pulse value	–		–	●	VZOA	
Reed pulse for remote totalisation	●		–	●	VZOA	
Informations in chapter	**2**		**1**	**2**	**3**	

● Applicable
○ Good chance, testing required
– Not applicable

Fluids and suitable meter sizes	DN 4	DN 8	DN 15	DN 20	DN 25	DN 40	DN 50
Heating fuel light	●	●	●	●	●	●	●
Heating fuel medium	●	●	●	●	●	●	●
Heating fuel heavy	–	–	1)	●	●	●	●
Diesel	●	●	●	●	●	●	●
Petrol	●	●	○	○	○	○	○

1) DN 15 meters are not suitable for heavy fuel oil; this is only possible if special precautions are taken.

Application note
For viscosity's higher than 5mPa.s or for installations on the suction side, consider pressure drop and possible limitation of flow range (see chapter 5 and 8).

7. Fluid fuel oil

Characteristics of different fuels

Fuel			extra light	light	medium	heavy	Bunker C
Density at 15° C	min.	kg/dm³	0,82	0,82	0,82	0,82	0,90
	max.	kg/dm³	0,86	0,95	0,96	0,99	1,01
Volume at average density		l/kg	1,19	1,12	1,12	1,11	1,08
Viscosity at 20° C		mPa.s	8	14	50	420	4200
Viscosity at 40° C		mPa.s	3	5	16	60	380
Viscosity at 100° C		mPa.s	–	–	3	10	35
Energy value		kWh/kg	11,8	10,6	11,4	11,2	11,0
		MJ/kg	3,28	2,94	3,17	3,11	3,06

Data for burner and engine power
Burner

Burner			Fuel oil meter	
Power	Flow rate heating fuel EL		Flow rate	Dimension
up to kW	kg/h	l/h	Qmin...Qn l/h	DN
500	42	50	1... 50	4
1 300	113	135	4 ... 135	8
4 000	336	400	10 ... 400	15
10 000	840	1 000	30 ... 1 000	20
20 000	1 680	2 000	75 ... 2 000	25
60 000	5 040	6 000	225 ... 6 000	40
200 000	16 800	20 000	750 ... 20 000	50

Formula for consumption in litres/hour:

$$\frac{\text{Burner power in kW}}{\text{Energy value of fuel in kWh/kg } \chi \text{ density in kg/dm}^3}$$

Example:

$$\frac{600 \text{ kW}}{11{,}8 \text{ kWh/kg } \chi \text{ } 0{,}82 \text{ kg/dm}^3} = 62 \text{ l/h}$$

Engines

Engine			Fuel oil meter [1]	
Power up to ...		Diesel fuel consumption	Flow rate	Dimension
approx. HP	approx. kW	l/h	Qmin...Qn l/h	DN
250	184	50	1... 50	4
680	500	135	4 ... 135	8
2 000	1 470	400	10 ... 400	15
5 000	3 680	1 000	30 ... 1 000	20
10 000	7 360	2 000	75 ... 2 000	25
30 000	22 000	6 000	225 ... 6 000	40
100 000	73 600	20 000	750 ... 20 000	50

1) For differential measurement the flow meter has to be selected according to the pump flow rate and the flow in the return pipe. Consider chapter 9!

Formula:

1 HP = 0,736 kW
1 kW = 1,36 HP

1 kg Diesel at 0,84 kg/dm3 = 1,19 l

Rule of thumb:

approx. 190 g/kWh correspond to 0,226 l/kWh
approx. 140 g/HP and hour correspond to 0,167 l/HP/h

8. How to obtain an optimal measurement

8.1

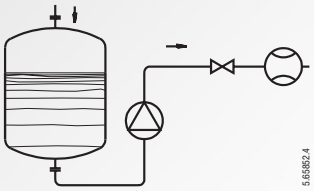
Planning

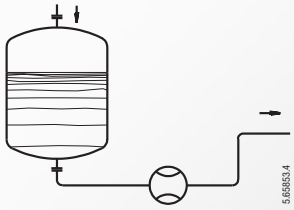
Flow meters are precision measuring instruments. They achieve optimal results if

- a few important rules are observed during plant design,
- mounting and commissioning are carried out with care,
- the meters are used for their defined purpose only.

Layout of Pipework

- The quantities consumed by all the users must be registered by the meter.
- Rotary piston meters can be mounted without straight stabilisation pipes (after bends, T-pieces or fittings) in horizontal, vertical or inclined position. Do not mount the meter with the head pointing downwards.
- The layout of piping must ensure that the meter is at all times filled with liquid and that no inclusion of air or gas may occur.
- Easy access for reading the meter and controlling the ancillary equipment is essential.





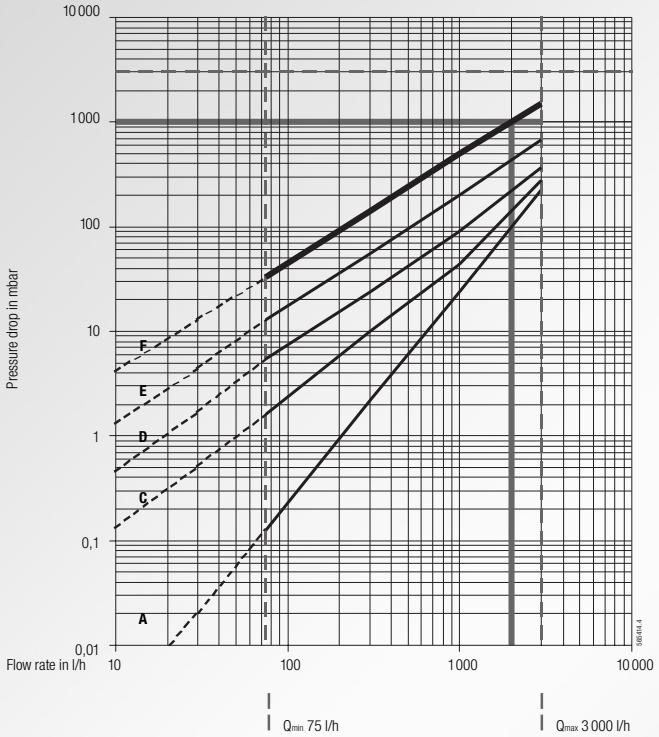
Selection of the Meter and Ancillaries

To be considered when selecting the meter:

- Operating temperature
- Viscosity of the medium
- Operating pressure
- Flow rate
- Resistance of the material against liquid to be metered and working conditions

The technical data are valid for the following reference condition: EL heating fuel / diesel at 20° C. For higher viscosity's or if the meter is mounted on the suction side, it is necessary to determine the pressure drop and the flow rate that can still be attained by using the pressure loss curves (Chapter 5). If the pressure drop is more than 1 bar, you are advised to use the next higher nominal meter width. Maximum permissible pressure drop = 3 bar.

Example 1:



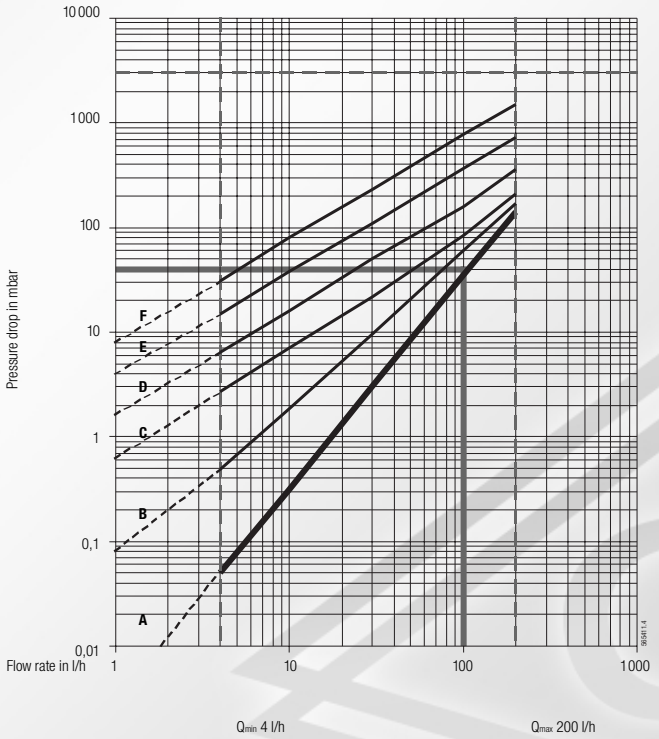
Medium Mineral oil, Viscosity 450 mPa.s
Mounting VZE 25 on pressure side

1. Viscosity line
E = 200 mPa.s
F = 500 mPa.s

2. Supposition for max. permissable pressure drop = 1 bar

3. From the intersection of line F and pressure drop 1 bar downwards, the possible flow rate of 2000 l/h is obtained.

Example 2:



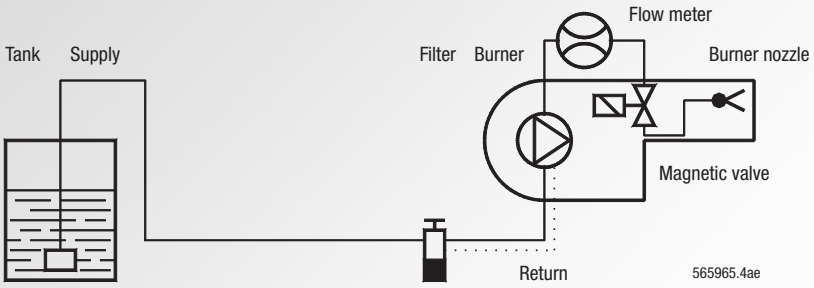
Medium Heating fuel extra light
Mounting VZO 8 on suction side

1. Viscosity line
A = 5 mPa.s
B = 25 mPa.s
C = 50 mPa.s

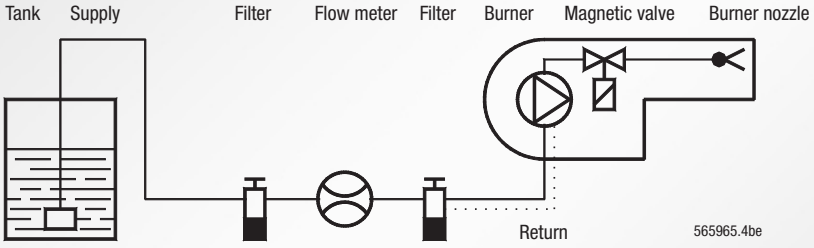
2. Supposition for max. permissable pressure drop = 40 mbar

3. From the intersection of line A and pressure drop 40 mbar downwards, the possible flow rate of 100 l/h is obtained.

Mounting on pressure side (burners)



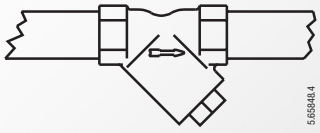
Mounting on Suction side (burners)



Impurities in plant or liquid

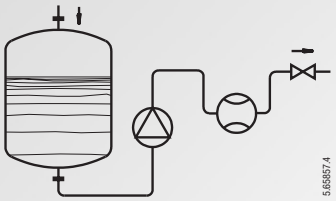
Should impurities occur in the plant or in the liquid, a strainer (dirt trap) has to be installed before the meter. The filter mounted in the meter inlet is only a safety filter and is too small to act as a strainer.

Maximum mesh width for strainers/dirt traps

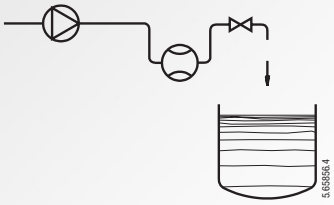


Meter size	Meter type		
	VZE	VZO	VZEA / VZOA
DN 4	–	0,080 mm	0,080 mm
DN 8	–	0,100 mm	0,100 mm
DN 15	0,250 mm	0,250 mm	0,100 mm
DN 20	0,400 mm	0,400 mm	0,100 mm
DN 25	0,400 mm	0,400 mm	0,250 mm
DN 40	0,600 mm	0,600 mm	0,250 mm
DN 50	0,600 mm	0,600 mm	0,250 mm

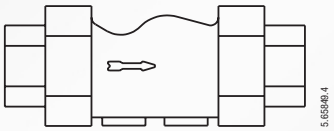
Shut-off Devices
In order to avoid backflows and drainings, shut-off devices have to be mounted after the meter. Backflows and drainings cause measuring errors and can damage the meter.



Filling/Dosing
For filling and dosing the valve has to be mounted between meter an discharge. The shorter the pipe section between meter and discharge, the higher the accuracy. Fast opening and shutting of the valve should be avoided (pressure hammer!).



Remote Processing/Ancillaries
Any backflow must be avoided on meters equipped with pulsers for remote processing. If this cannot be achieved by appropriate plant design, a non-return valve should be fitted.



Electrical lines and installations
Electrical lines and installations are subject to statutory regulations which must be taken into account when planning the system. For installations in zones subject to explosion hazards, please consult an expert.

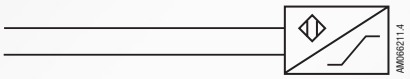
The following factors should be taken into account during plant design:
- ancillaries connected after the meter
- environmental disturbances
- maximum cable lengths with or without amplifier
- connection boxes, cable guides

Pulsers

Power supply

Our range of products includes passive pulsers for the remote processing of flow data. The pulser generates one pulse unit of volume and is to be supplied with power from the pulse processing device.

Power supply 5 … 48 V AC/DC



Power supply 5 … 15 V DC

Selection of the appropriate pulser

The selection of the most appropriate pulser and pulse value depends on the application. As a rule, remote totalisation demands rather large pulse values, whereas analogue signals, dosing control or indication of actual flow tend to need small values. Battery supplied devices can only be used together with Reed pulsers.

Selection of the processing device

The pulse length depends on the flow rate. Continuous contact may occur at zero flow. The device connected must therefore be able to accept continuous load; otherwise, protective measures have to be taken. For remote totalisation, you are recommended to use an electronic pulse counter with a low power consumption and bounce filter.

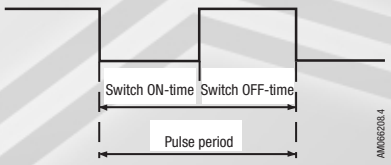
Correct pulse processing

Interrupted flow may cause hydraulic oscillation of the liquid in certain plants (hydraulic vibration with minimal flow backward/forward). The pulses which can occur in such cases may be interpreted as forward flow by the connected device. Such faulty pulses do not affect the indication of the actual value since they can only occur at almost zero flow. However, if the pulser controls a counting device, hydraulic vibration must be avoided by an appropriate modification or layout of the plant.

Pulse values

Pulse values depend on type and nominal diameter of the meter. They are listed in the technical information of the meter concerned.

Pulse period



Pulse period as well as on- and off-times can be calculated with the following formula:

$$\text{Pulse period in s} = \frac{\text{pulse value in litres} \times 3600}{\text{flow Q in l/h}}$$

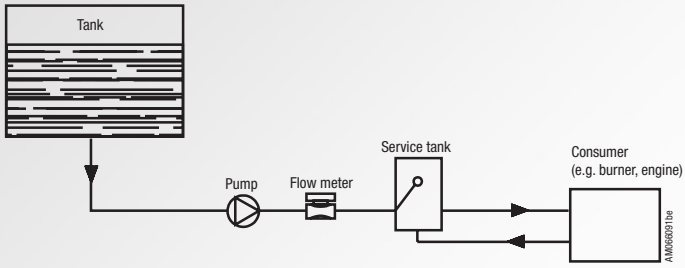
$$\text{On-time} = \frac{\text{pulse period in s x on-time in \% of pulse period}}{100}$$

$$\text{Off-time} = \text{pulse period in s minus on-time}$$

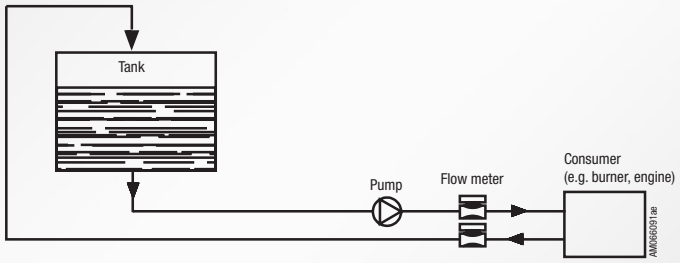
We recommend that this calculation is carried out for the min. and max. expected flow rates.

9. Application examples

Diesel engine
Direct consumption measurement
In place of the fuel feedback, an intermediate container with a heat exchanger is installed in the tank on the system side. The flow measurement is taken in the supply pipe to the intermediate tank. The load on the meter and the measuring result correspond precisely to the consumption.



Differential measurement
For a differential measurement, the pipe routing is kept unchanged, with circulation back into the tank. A flowmeter is installed in both the pipes. The consumption is determined as the difference between the amount in the supply section and the amount in the return section. The meter loads therefore correspond to the supply and return flow rates.



Reason to use meters with special pairing
Standard meters feature a large measuring range and a measuring error limit of ±1%. This makes them unsuitable for differential measurements, as the following example shows:

Full load

Supply	400 l/h	Error ±1%	= nominal ±4,0 l
Return	150 l/h	Error ±1%	= nominal ±1,5 l
Consumed	250 l/h	Measuring error	= nominal ±5,5 l

Maximum measuring error
Consumed = 5,5 × 100 : 250 = ±2,2 %

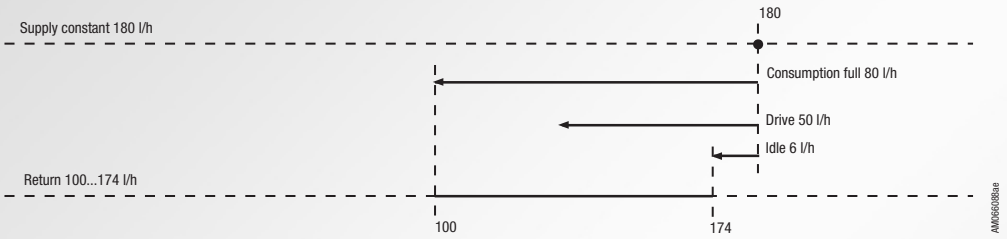
Min. load

Supply	400 l/h	Error ±1%	= nominal ±4,0 l
Return	360 l/h	Error ±1%	= nominal ±3,6 l
Consumed	40 l/h	Measuring error	= nominal ±7,6 l

Maximum measuring error
Consumed = 7,6 × 100 : 40 = ±19 %

For an optimal result, special meters are therefore used for differential measurements. These are precisely co-ordinated to the operating conditions and are calibrated in pairs. This means that the measurement variance can be significantly reduced (for example: supply, at constant flow, to ±0.1%; return, with slightly variable flow, to ±0.3%).

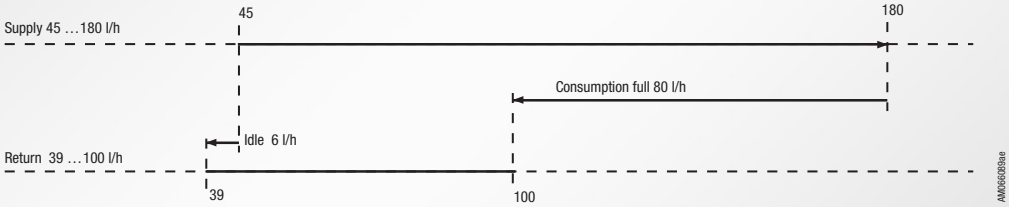
Loads on meters
Example: Engine power 500 hp, vehicle with electric pump



Effective loads on meters

Supply	constant 180 l/h
Return	100 … 174 l/h

Example: Engine power 500 hp, vehicle with RPM dependent pump 1:4

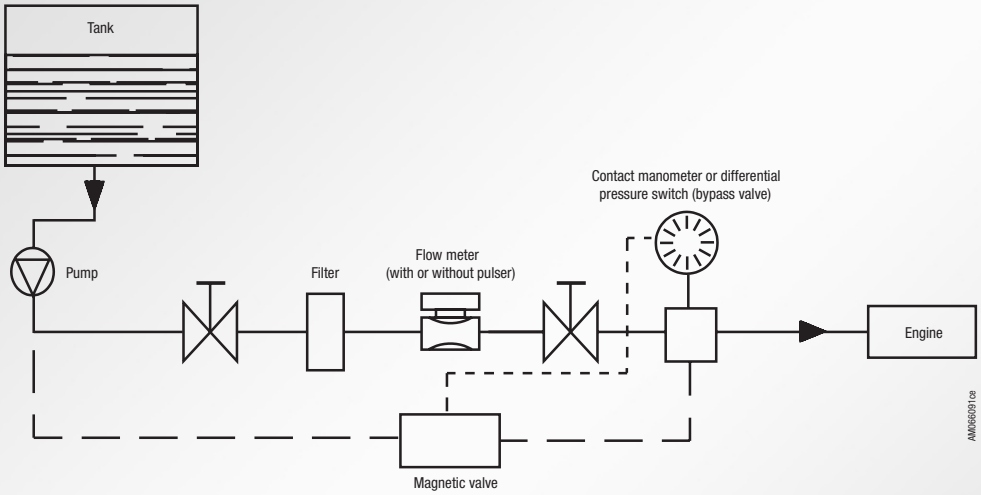


Effective loads on meters

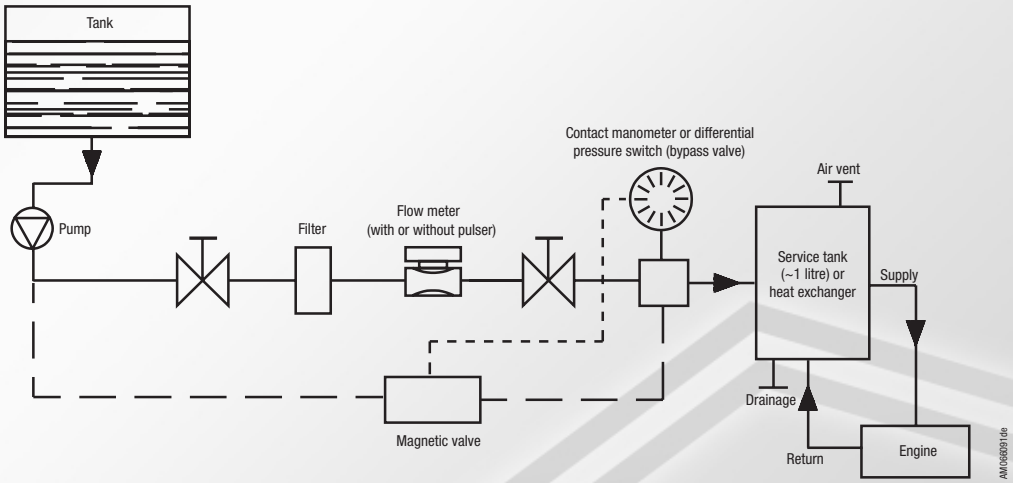
Supply	45 … 180 l/h
Return	39 … 100 l/h

Consumption measurement on board ships

On board ships, care is usually taken to ensure that the engine can still be operated at full power even if the filter is heavily contaminated or if the meter is damaged. When switching over to the bypass, attention may be drawn to the necessary maintenance via an alarm output, and the engine can be temporarily operated without measuring the consumption.



The magnetic valve opens as soon as the pressure drops below a defined level.



Float or valve control in service tank required. Formation of gas is to be avoided. The magnetic valve opens as soon as the pressure drops below a defined level. For measuring the consumption of more than one engine, each will require a separate installation similar to the one above.