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CPT-04 M

QUANTOMETER

OPERATING MANUAL

Łódź, June 2024

Technical specification and construction may change due to improvement. This publication serves as general information only, and all specifications are subject to confirmation by COMMON S.A.

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1 INTRODUCTION

CPT-04M Turbine Quantometers are instruments used for measurement of a gas volume that flows through the installation. The standard execution of the devices allows to install them in places where may occur the hazard of explosion (air and gas mixtures - class IIA and class IIB; with special execution – also class IIC). The CPT-04M quantometers may be used for measurement of gases indicated in Table 1. Maximum operating pressure for the CPT-04M quantometers is 2 MPa. The standard quantometers can be installed between flanges PN16 or PN20 (ANSI150). As an option they can be equipped with threaded connections or flanges. The quantometers can be mounted indoor (rooms with stable temperature) or outdoor. The CPT-04M quantometers are service-less devices due to assembled bearing with lubricating oil. The CPT-04M can be adapted optionally for the external lubrication — from DN 65 till DN 200.

The technical data

1. Conformity with the requirements of ATEX Directive 2014/34/EU

- certificate — KOMAG 21ATEX0213X
- CE marking — CE 1453
- application conditions
  - pulsers: LFK, LFW, LFI, HF- special execution — Ex II 2G Ex ia IIC T5 Gb
  - pulsers: LF-BC — Ex II 2G Ex ia IIC T4 Gb
  - or Ex II 2G Ex ia IIC T3 Gb
- index housing protection — IP66/67
- ambient temperature
  - standard — $-25°C \le T_a \le +70°C$
  - depending on the input power P_i — $-25°C \le T_a \le +55°C$

2. Conformity with the requirements of PED Directive 2014/68/UE:

- certificate — 95580/JN/001/03
- CE marking — CE 1433, UDT (Technical Control Institute)
- maximum operating pressure — $p_{max} = 2$ MPa,
- ambient temperature — $-25°C \le t \le +70°C$
- gas temperature — $-25°C \le t_g \le +70°C$
- storage temperature — $-30°C \le t_s \le +70°C$

3. Conformity with the requirements of Directive 2014/30/UE (EMC)

- the requirement is covered by the implementation of LF and HF pulse transmitters (NAMUR) that are in accordance with the EMC requirement and norm PN-EN 60947-5-6:2002.

4. Other usage conditions

- class of metrological accuracy — 1,5 (OIML R 137-1 Edition 2006 (E) Table 2)
- metrology parameters — Table 2
- operating position — horizontal (H) or vertical (V)

The intrinsically safe parameters and condition of usage

Attention!

The electrostatic charges may accumulate on the surface of the plastic cover of the index head under certain extreme environmental operating conditions. The discharge may be capable of initiating the ignition of an explosive mixture in such environment.

The device cannot be installed and used in potentially explosive atmospheres in places where conditions may occur the accumulation of electrostatic charges. In particular:

- avoid the impact of strong, high-velocity air streams (e.g. the direct outlets of pneumatic installations)
- avoid an accidental or predictable rubbing by foreign non-conductive objects (e.g. loose covers, roofs)
- do not rub the surface of the housing with dry fabrics, materials. Cleaning the surface is allowed only with cloths moistened with water!

There is a warning mark on the nameplate of the gas meter with a plastic counter cover:

Attention! Danger from electrostatic charges. See instruction.

To maintain the safety rules, regardless of the type of the index head cover (plastic or aluminium) there is recommended to discharge the charge from your own body by touching grounded metal elements before the entrance to the potentially explosive atmosphere.

Intrinsically safe parameters

name of the signal outputs of socket Gn1 and socket Gn2	**parameters on clamps**			**range of T_{amb}. ambient temperature**
	IIB	**IIC**	**temperature class T3 / T4 / T5**	
LFK1 LFK2 AFK		Ui = 20V Ii = 60mA Li ~ 0 Ci ~ 0	**T4** @ **Pi** = 200mW	-25…+70°C
			T5 @ **Pi** =130mW	-25…+55°C
			T5 @ **Pi** = 80mW	-25…+70°C
LFI1 LFI2 AFK		Ui = 20V Ii = 60mA Li ~ 0 Ci = 120nF	**T4** @ **Pi** = 200mW	-25…+70°C
			T5 @ **Pi** = 130mW	-25…+55°C
			T5 @ **Pi** = 80mW	-25…+70°C
HF1 HF2		Ui = 20V Ii = 60mA Li = 17µH Ci = 1nF	**T4** @ **Pi** = 200mW	-25…+70°C
			T5 @ **Pi** = 130mW	-25…+55°C
			T5 @ **Pi** = 80mW	-25…+70°C
LFW1 LFW2 AFK	Ui = 20V Ii = 60mA Li ~ 0 Ci = 1nF	Ui = 20V Ii = 40mA Li ~ 0 Ci = 1nF	**T4** @ **Pi** = 200mW	-25…+70°C
			T5 @ **Pi** = 130mW	-25…+55°C
			T5 @ **Pi** = 80mW	-25…+70°C
LF-BC (OC) -LF-BC -F-Dir -LF1 -LF2 -AFK relativ. GND	Lo = 2mH Co = 14uF	Ui = 20V Ii = 60mA Pi = 200mW Li = 1µH Ci = 1nF Uo = 5,73V Io = 4mA Po = 6mW Lo = 1mH	**T4** – battery Tadiran SL-760 **T3** – battery SAFT LS14500 **T3** – battery EVE ER14505 The marking of temperature class on the name plate is corelated with the type of battery that is physically installed	-25…+70°C

		Co = 2,9µF		
LF-BC (Namur) -LF-BC -F-Dir -LF1 -LF2 -AFK relativ. +8.2V	Lo = 2mH Co = 14uF	Ui = 20V Ii = 60mA Pi = 200mW Li = 1µH Ci = 1nF Uo = 5,73V Io = 4mA Po = 6mW Lo = 1mH Co = 2,9µF	**T4** – battery Tadiran SL-760 **T3** – battery SAFT LS14500 **T3** – battery EVE ER14505 The marking of temperature class on the name plate is corelated with the type of battery that is physically installed	-25…+70°C

Attention! Safety classification to group IIB and class T4 depends on the intrinsically safe parameters of externally connected circuits and on the temperature.

Attention!
The sum of the voltages of separate intrinsically safe circuits connected to one socket: socket Gn1 or socket Gn2, cannot exceed 30V.

Attention!
The intrinsically safe parameters are determined in the analysis process of the intrinsically safe device. Their values are specified, based on the assumption of worst-case operating conditions, or device damage situations. The values of these parameters are limited to safe levels for a given explosive mixture. These parameters should not be understood as standard rating technical parameters of the device.

compatibility conditions for intrinsic safety parameters				
co-operating device		**condition**	**gas meter**	
voltage output	**Uo**	≤	**Ui**	voltage input
current output	**Io**	≤	**Ii**	current input
power output	**Po**	≤	**Pi**	power input
capacity external max.	**Co**	Co ≥ Ci + Ck	**Ci**	capacity internal
inductance external max.	**Lo**	Lo ≥ Li + Lk	**Li**	Inductance internal

The dispersed parameters of cables (C_k), (L_k) should be assessed as:

- the worst parameters declared by the manufacturer
- the parameters measured according to the PN-EN 60079-14 standard, or 200 pF/m and 1 µH/m or 30 µH/Ω where connection includes 2 or 3 wires (shielded or without shield).

The basic metrological parameters of the CPT-04M

The basic metrological parameters of the CPT-04M quantometers are presented in the Table 2 (page 4). This information should not be considered as an trade offer. The appropriate information may be obtained from authorised dealers or direct from the manufacturer.

Table 1. Physical properties of most popular gases that may be measured with the CPT-04M Quantometers - density at 101,325 kPa (1013,25 mbar), and at temperature 200 C.

gas or gas mixture	chemical symbol (formula)	density ρ [kg/m^3]	density related to air
argon	Ar	1,66	1,38
nitrogen	N_2	1,16	0,97
butane	C_4H_{10}	2,53	2,1
carbon dioxide	CO_2	1,84	1,53
ethane	C_2H_6	1,27	1,06
ethylene	C_2H_4	1,17	0,98
natural gas	$\approx CH_4$	$\approx$ 0,75	$\approx$ 0,63
helium	He	0,17	0,14
methane	CH_4	0,67	0,55
propane	C_3H_8	1,87	1,56
carbon monoxide	CO	1,16	0,97
acetylene	C_2H_2	1,09	0,91
hydrogen	H_2	0,084	0,07
air	—	1,20	1,0

Pressure drop

The quantometer cause a pressure drop in the installation. Maximum value of the Δp_{max} pressure drop for each CPT-04M quantometer is presented in Table 2.

The Δp_{max} pressure drop has been determined with air with density ρ_o =1,2 [kg/m^3] for a Q_{max} gas stream.

The Δp_{rz} pressure drop [mbar] at real operating conditions may be calculated by using formula:

$$\Delta p_{rz} = \frac{\rho}{\rho_o} \cdot \frac{p_a + p}{p_a} \cdot \left(\frac{Q_{rz}}{Q_{\max}} \right)^2 \cdot \Delta p_{\max} \quad [mbar]$$

where:

ρ — gas density, according to the Table 1 [kg/m^3],

ρ_o = 1,2 [kg/m^3] air density,

p_a — atmospheric pressure ($p_a \cong 1013$ [mbar]),

p — gauge pressure upstream the quantometer [mbar],

Δp_{max} — maximum pressure drop (Table 2) [mbar],

Q_{max} — maximum flow for the quantometer (Table 2) [m^3/h],

Q_{rz} — actual flow [m^3/h]

The pressure drop measured for individual gas meters may vary from the value given in Table 2 within ± 5%. For the fully equipped gas meter (HF transmitter installed in the main body over impeller blade and thermowell), the pressure drop Δp_{max} may be higher up to about 10%.

Table 2. Basic metrology parameters of CPT-04M quantometers

nominal diameter	size	maximum flow Q_{max}	minimum flow Q_{min} at rangeability			pulse values (approximate values: HF1 HF2 HF3)			pressure loss at Q_{max}
			1:10	1:20	1:30	LF	HF1, HF2	HF3	Δp_{max}
—	—	[m^3/h]	[m^3/h]	[m^3/h]	[m^3/h]	[imp/m^3]	[imp/m^3]	[imp/m^3]	
DN 25	G 16	25	2,5	—	—	10	3460	125630	5,0
(1”)	G 25	40	4	—	—	10	2900	105360	4,0
DN 32	G 16	25	2,5	—	—	10	3460	125630	5,0
(1¼”)	G 25	40	4			10	2900	105360	3,4
DN 40	G 40	65	6	—	—	10	2610	94830	3,6
(1/2“)	G 65	100	10	5	—	10	2610	94830	6,8
DN 50	G 40	65	6	—	—	10	2610	94830	3,0
(2”)	G 65	100	10	5	—	10	2610	94830	5,6
DN 65	G 65	100	8	—	—	1	1081	42560	1,6
	G 100	160	16	8	—	1	1081	42560	3,8
DN 80	G 100	160	8	8	—	1	1081	26974	3,7
	G 160	250	13	13	8	1	844	26974	6,4
	G 250	400	40	40	13	1	470	15070	15,0
DN 100	G 160	250	—	13	8	1	692	16782	2,1
	G 250	400	—	20	13	1	692	16782	5,0
	G 400	650	—	32	20	1	401	9719	11,4
DN 150	G 400	650	—	32	20	1	227	6873	2,4
	G 650	1000	—	50	32	1	227	6873	6,4
	G 1000	1600	—	80	50	0,1	129	3910	16,0
DN 200	G 650	1000	—	50	32	1	114	3113	2,0
	G 1000	1600	—	80	50	0,1	116	3167	6,0
	G 1600	2500	—	130	80	0,1	67	2025	15,0

2 CONSTRUCTION

The operation of the turbine quantometer is based on a proportionality of rotational speed of the turbine wheel to the linear velocity thus the flowing gas volume. Gas entering to the gas meter (see Fig.1) is directed through the inlet flow straightener into the measurement assembly module and causes the rotation of the turbine wheel. The wheel rotations are transmitted by means of gears and magnetic coupling into the index assembly. The index sums up the volume that has flown through the gas meter, and it is presented on the 9-digit counter. The proper performance of each CPT-04M quantometer is maintained and confirmed only in the range of Q_{min} and Q_{max}, as determined in Table 2.

Main body assembly.

The main body assembly consists of the main body, inlet straightener, and plugs for the connection inlets.
The main body is made of an aluminum profile, extruded on chamber dies or cast aluminum in die molds. Die-cast main body can be made with threaded connections. The main body of the DN200 is made of steel tube.
The inlet flow straightener, located in front of the turbine, symmetrizes the gas flow and directs it to the turbine wheel. There is a connection inlet in each main body for pressure measurement. Optionally (on request), the body can be equipped with the socket to install an inductive HF transmitter, the socket for thermowell and the socket for an external lubrication valve. These optional sockets can only be made during the manufacture stage only.
The inlet straightener, placed upstream the turbine wheel, distributes evenly the gas flow and directs it onto the turbine wheel vanes. As an option main body could be equipped with threaded connections or flanges.

Measurement assembly.

It consists of the turbine wheel, the turbine wheel housing, the measurement assembly housing, shafts, and gears. The turbine wheel is placed in the axis of the quantometer body and operates on two high-precision bearings. There are used self-lubricated bearings as a standard version. As an option, the measuring units (from DN 65 to DN 200) may be adjusted for external lubrication.

Drive transmission assembly.

It is installed in the main body of quantometer. It consists of the basis with the hermetic, gas tight divider and the magnetic clutch. The driving part of magnetic clutch is placed inside the quantometer and is connected with the turbine assembly by means of an articulated shaft. The driven part of the magnetic clutch is placed outside the divider and connected with the index assembly.

Counter assembly.

Counter assembly unit is the next reduction stage of rotational speed (by worm gear and helical gear) in order to drive the mechanical counter and elements that activate electrical signal pulses. The counter assembly unit includes the LF and optionally HF transmitters, for which the sockets of electrical signal output are located on the counter cover. There are the name plates on the counter cover. The cover can be plastic (UV resistance) or aluminum.

The manufacturing standard of quantometers from DN25 till DN200 is self-lubricated bearings. The external lubrication is available as the option. External lubrication version includes individual lubricating valve. The sticker placed on the cover of valve informing about oil type, which should be use.

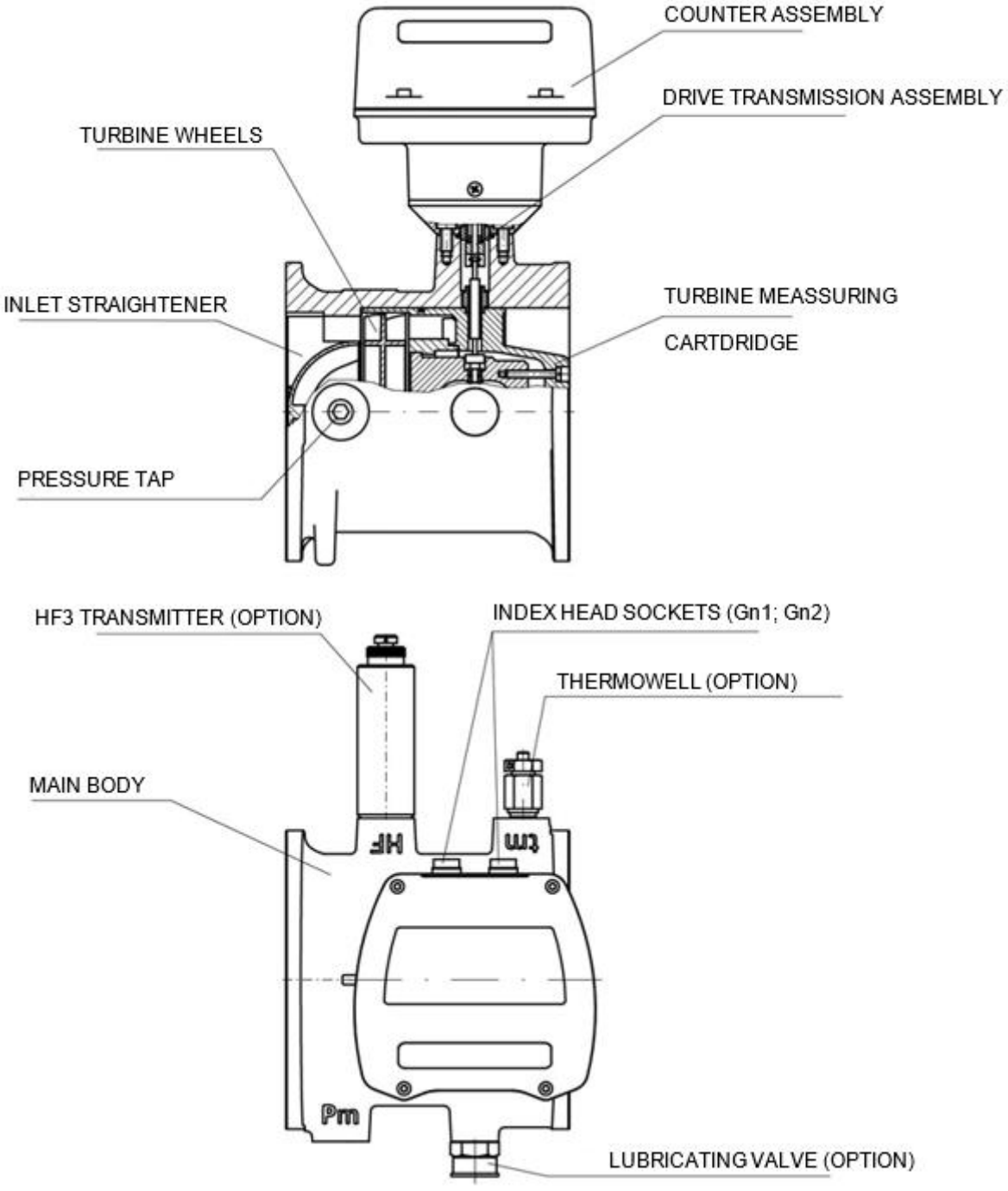


Figure 1. Construction of turbine quantometer

3 READING UNIT AND MEASUREMENT OUTPUTS

The reading unit of CPT-04M quantometer consist of a mechanical counter with the outputs of electric signal, as well as a pressure output and a socket for installing the external HF transmitter (main body over the turbine wheel). These outputs enable the control of the instrument operation and connections of external devices. Location of measurement outputs on the quantometer is shown in the Fig. 2

Mechanical counter

The mechanical index is located inside the index unit and is visible through the polycarbonate sight glass. It enables direct reading of the gas volume flowing through the meter at operating conditions, i.e. at actual pressure and temperature. The index unit may be rotated by 350° against its axis, what enables reading of the index from any direction

Outputs of electrical signals

There are two types of electrical signal outputs: LF - low frequency and HF - high frequency.

The mechanical counter may be equipped maximum in two sockets (type male or female), and in the transmitters of electric signals in vary configuration:

- 2 LFK (reed contact / low frequency; standard version)
- 1 or 2 LFW (Wiegand coil / low frequency),
- 1 or 2 LFI (NAMUR standard / proximity inductive type / low frequency),
- 1 or 2 HF (NAMUR standard / proximity inductive type / high frequency)
- 1 LF-BC (gas flow direction control option / low frequency),
- 1 AFK (control circuit with “normally closed” reed contact)

Transmitters: LFK, LFW, LF-BC, LF1,LF2 with the output type “contact” are designed to operate with volume corrector or data logger located close to the quantometer.
Transmitters type: LFI (inductive / low frequency) and HF (inductive / high frequency), may send electric signals (NAMUR standard) for longer distances (depends on conditions up to 200 m). These transmitters have high current consumption and may operate only with the devices supported into external power source.
The gas volume (in m^3) that corresponds to “one LF pulse value” is presented in the Table 2.
The gas volume (in m^3) that corresponds with the HF pulse value is determined individually for each quantometer and is indicated on the nameplate. The values presented in the table 2 are approximation only.

The main feature and advantage of the LF-BC transmitter is the compensation (blocking) function of the transmitted pulses at the LF-BC output, preventing loss of counter synchronization between the gas meter and connected external reading device in the situation of reverse gas flow.
During unexpected reverse gas flow (backflow) and its re-working time, the pulses at the LF-BC output are not issuing. Moreover, this transmitter has additional outputs:

- state output signaling the gas flow direction F-Dir
- two standard outputs LF1 and LF2 pulses shifted synchronously in phase
- control circuit with a reed switch or normally closed OC marked as AFK.

Every transmitter installed in the index head is connected to industrial standards M16 (male or female) round-shape, six-pins sockets. The used sockets are IP66/67 protection level.

Example of socket type "female" – separated transmitters

location of the sockets Gn1 and Gn2 / front view

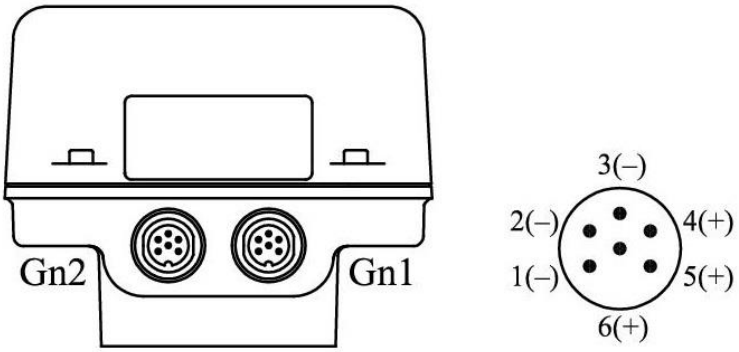


Figure 2a. Location of the socket type female and numbering of pins

Table 3a possible configuration of separated transmitters of each socket (type: female)

	pin:	LFK 1	LFK 2	LFW 1	LFW 2	AFK	LFI 1	LFI 2	HF 1	HF 2
socket: Gn1	1	S		O (–)			O			
	4	S		O (+)			O			
	2		O			P	P	O		O (–)
	5		O			P	P	O		O (+)
	3					O			S (–)	
	6					O			S (+)	
socket: Gn2	1		P		O (–)		O			
	4		P		O (+)		O			
	2		O		O (–)	O	O	P		O (–)
	5		O		O (+)	O	O	P		O (+)
	3								O (–)	P (–)
	6								O (+)	P (+)

S — connections for the standard execution

P — recommended connection for full version

O — alternative connections

(+),(-) — polarity is significant / no symbols: polarity isn't significant

Example of socket type "male" – separated transmitters

location of the sockets Gn1 and Gn2 / front view

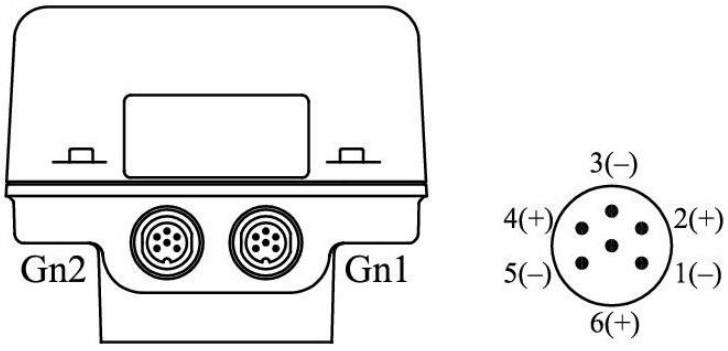


Figure 2b. Location of the socket type male and numbering of pins

Table 3b possible configuration of separated transmitters of each socket (type: male)

	pin:	LFK 1	LFK 2	LFW 1	LFW 2	AFK	LFI 1	LFI 2	HF 1	HF 2
socket: Gn1	1	S		O (–)			O			
	2	S		O (+)			O			
	3		O			P	P	O		O (–)
	4		O			P	P	O		O (+)
	5					O			S (–)	
	6					O			S (+)	
socket: Gn2	1		P		O (–)		O			
	2		P		O (+)		O			
	3		O		O (–)	O	O	P		O (–)
	4		O		O (+)	O	O	P		O (+)
	5								O (–)	P (–)
	6								O (+)	P (+)

S — connections for the standard execution

P — recommended connection for full version

O — alternative connections

(+),(-) — polarity is significant / no symbols: polarity isn't significant

Example of socket type "male" – not separated transmitters

location of the sockets Gn1 and Gn2 / front view

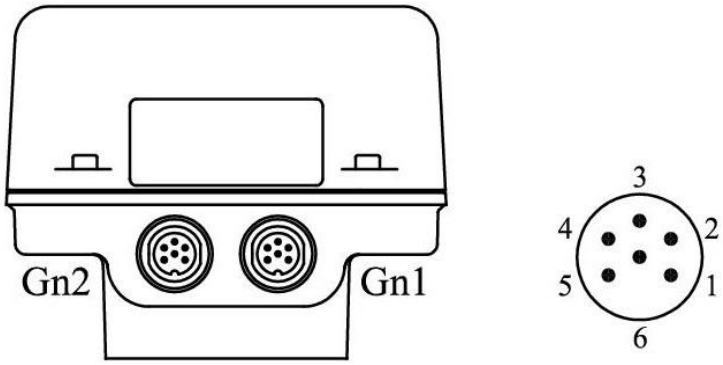


Figure 2c. Location of the socket type male and numbering of pins

Table 3c possible configuration of not separated transmitters of each socket (type: male)

LF-BC transmitter / output Open-Collector

socket Gn1	LF-BC	LF1	1 (+)
		LF2	2 (+)
		AFK	3 (+)
		F-Dir	4 (+)
		LF-BC	5 (+)
		GND	6 (–)

LF-BC transmitter / output NAMUR

socket Gn1	LF-BC NAMUR	LF1	1 (–)
		LF2	2 (–)
		AFK	3 (–)
		F-Dir	4 (–)
		LF-BC	5 (–)
		+8,2V	6 (+)

LFK transmitter / common "GND" (ground)

socket: Gn1 or Gn2	LFK	LFK1	1
		LFK2	2
		AFK	3
		GND	6
	LFI1, LFI2, HF1, HF2, LFW1 or LFW2		4 (+)
			5 (–)

LFW transmitter / common "GND" (ground)

socket: Gn1 or Gn2	LFW	LFK1	1 (+)
		LFK2	2 (+)
		AFK	3 (+)
		GND	6 (–)
	LFI1, LFI2, HF1 or HF2		4 (+)
			5 (–)

NAMUR transmitter – common "+8,2V"

version 1

socket: Gn1 or Gn2	LFI1 + HF1	LFI1	3 (–)
		LFI1, HF1 (+8,2V)	4 (+)
		HF1	5 (–)
	LFI12 + HF2	LFI2	2 (–)
		LFI2, HF2 (+8,2V)	6 (+)
		HF2	1 (–)

version 1

socket: Gn1 or Gn2	LFI1 + LFI2	LFI1	3 (–)
		LFI1, LFI2 (+8,2V)	4 (+)
		LFI2	5 (–)
	HF1 + HF2	HF1	2 (–)
		HF1, HF2 (+8,2V)	6 (+)
		HF2	1 (–)

LFK, AFK transmitter – common "GND" and NAMUR transmitter – common "+8,2V"

socket: Gn1 or Gn2	LFI1 + HF1	LFK1	3
		LFK1, AFK	4
		AFK	5
	LFI1 + HF1	LFI1	2 (–)
		LFI1, HF1 (+8,2V)	6 (+)
		HF1	1 (–)

The electrical output of the CHFI-03 transmitter installed in the main body

The high frequency transmitter CHFI-03 may be installed in the main body of quantometer, over the turbine wheel. In such case the impeller blades of turbine wheel are modulating elements of the HF transmitter magnetic field. The HF transmitter is installed in the socket presented in the figure 1. The socket inlet is threaded - M16 x 1,5 (figure 3)

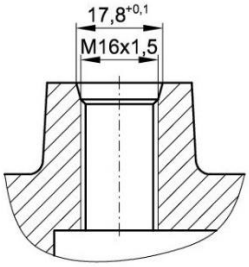


Fig.3. The dimensions of the assembly tap for HF transmitter.

The installation of the HF transmitter in the main body of gas meter requires a high accuracy and usage of electronic control device. Therefore the installation may be performed only by the manufacturer or authorised representative.

Intrinsically safe parameters are presented in the name plate of CHFI-03 transmitter (Fig.9)

The transmitter is equipped with M16 socket, 4-pin, male, industrial standard, IP66/67. The connection diagram of the transmitter with the control circuit is shown in Fig.4.

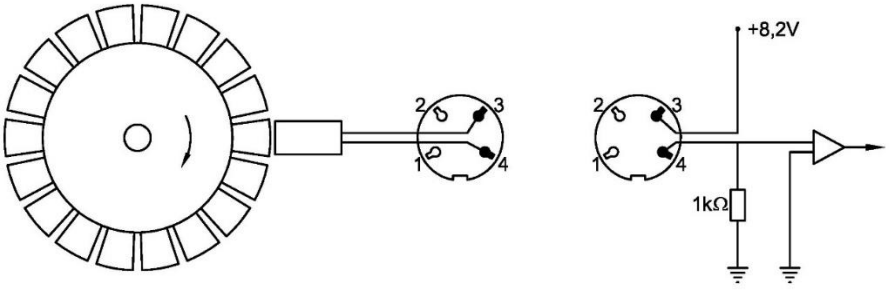


Fig.4. Connection diagram of the HF pulse transmitter

The HF pulse value corresponding to 1m^3 of gas is determined individually for each CPT-04M Quantometer and is presented on the nameplate of electrical outputs (Fig.7). The nameplate is located on top of the index head**.** The approximated HF pulse values are presented in table 2.

The HF inductive transmitter that is installed over the turbine wheel in main body of quantometer may be used as a control element.

The rated parameters of used transmitters:

The transmitters with the output reed switch type or “open collector”: **LFK / AFK / LFW / LF-BC**

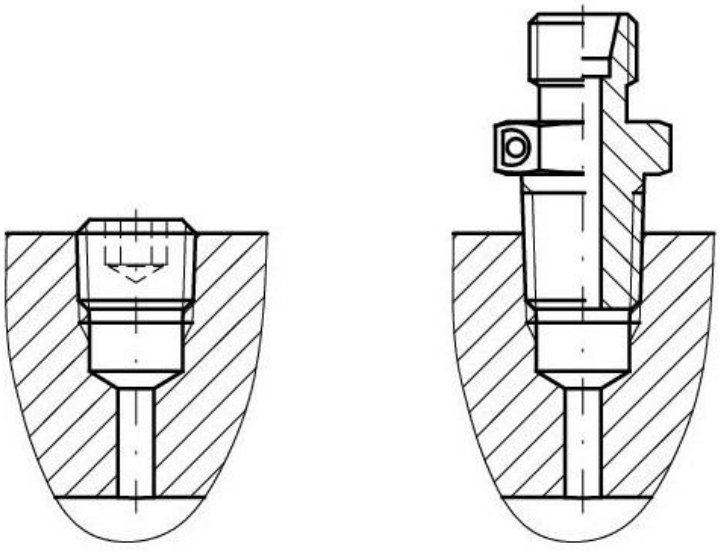
resistance of closed contact	R_Z = 0Ω ÷ 100Ω
resistance open contact	R_O > 100 MΩ
maximal switching frequency	f_p = 2 Hz

The transmitters NAMUR standard:	**LFI**	**HF1, HF2**
maximal switching frequency	f_p = 2 Hz	f_p = 0,5 kHz
rated power supply	U_n = 8,2 V	
rated current of the not active transmitter	I >= 2,1 mA	
rated current of the active transmitter	I >= 1,2 mA	

Other rating parameters of used transmitters are according to the requirements of standard PN-EN 60947-5-6:2002
The polarity of cables has to be maintained by connection the transmitters to inputs of pulse receiving devices.
The transmitters: LFK, AFK, LFI do not require maintain the polarity.

The output of pressure measurement.

The output of pressure measurement is in the main body (Fig.1). This inlet is 1/4 NPT thread (Fig.5). The pressure transmitters can be connected directly to the inlet, or indirectly by means of three-way valve. The unused outputs are covered with installation seals.



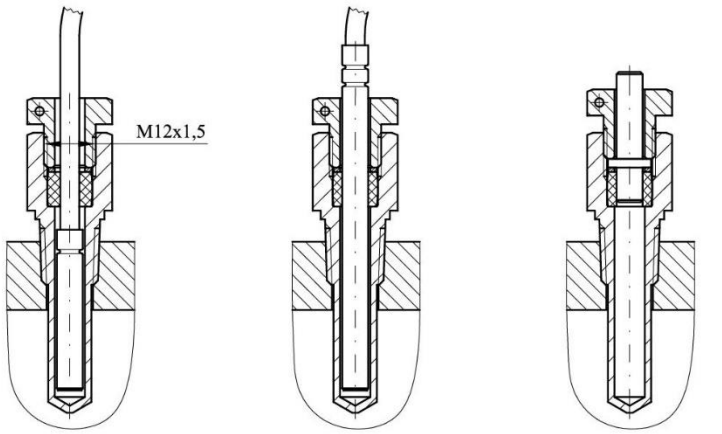
(a) (b)

Fig.5. 1/4 NPT pressure measurement inlet

The output of temperature measurement

The inlet of temperature measurement is an option on request. The quantometers are not delivering with the thermowells.

The thermowell should be installed in the inlet of the main body (Fig.6). The thermowell has a M12x1,5 thread. The ends of the electric thermo-probes or temperature transducers are placed in the thermowell that is filled with silicone oil. The unused outputs are covered by the 1/4 NPT tap (Fig.5)



(a) Type 1 cable sealed

(b) Type 2 sealed on the body

(c) unused covered by the tap

Fig.6. The thermowells

4 MARKING AND CALIBRATION

Information about the basic technical parameters of quantometer as well as the serial number and year of production are indicated on rated name plate (Fig. 7 and 8.). Other markings and information plates are placed on the surface of main body and on the equipment elements (Fig.9)

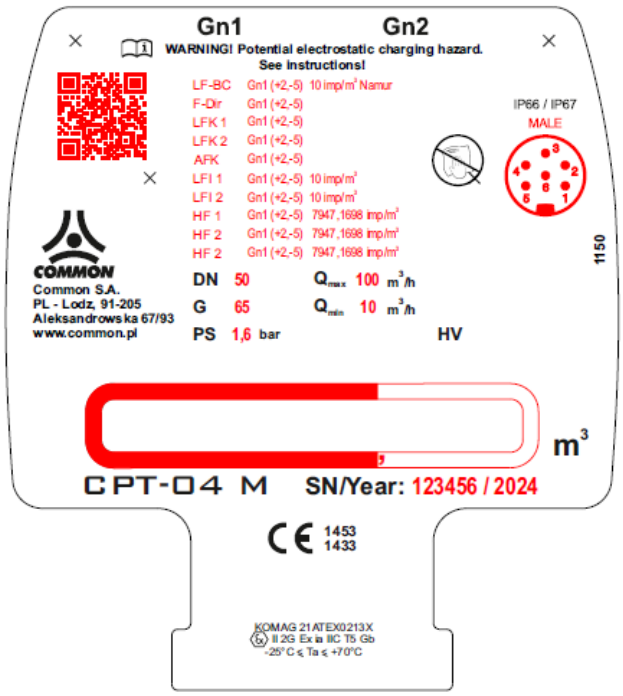


Fig.7. CPT-04M name plate (index head with the transparent cover) - sample

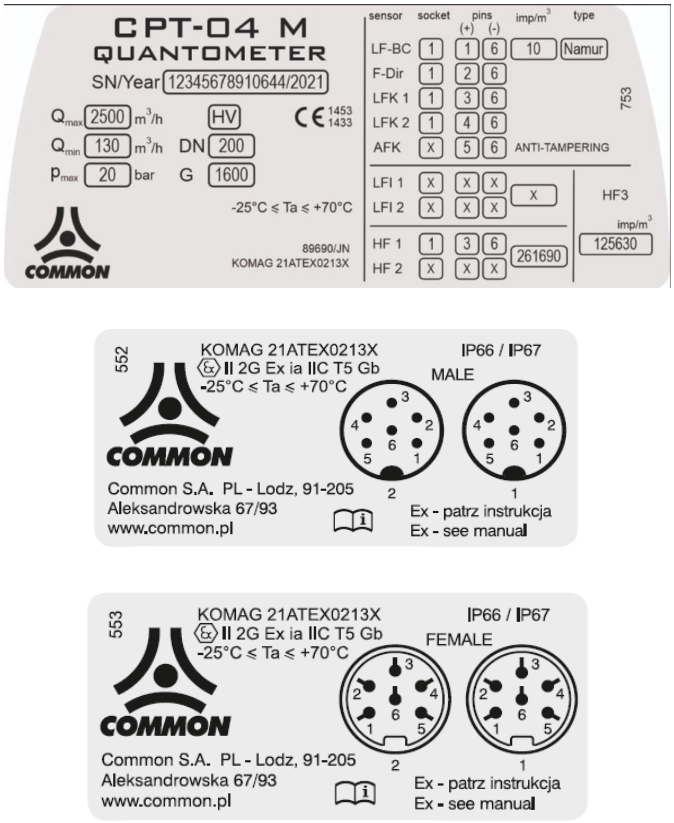


Fig.8. CPT-04M name plate (index head with the aluminium cover) - sample

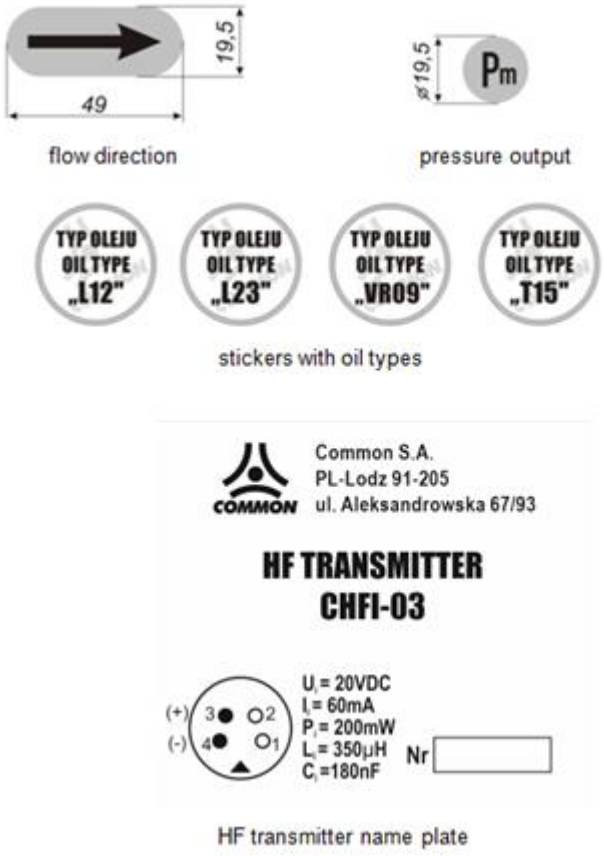
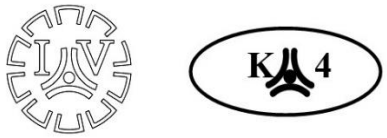


Fig.9. CPT-04M markings and information plates

Each quantometer is tested in calibration laboratory (manufacturers or other authorized). The calibration certificate may be delivered with the quantometer on request. The CPT-04M is sealed after calibration procedure.
The parts of the quantometer that are not dismantled during the installation process are protective seals (Fig.10) or marked by manufacturer or authorized laboratory (positions: P1, P2, P3, P4, P5 / Fig.11a and Fig.11b).
There are manufacturer marking pressed on installation seals (positions: P6 , P7, P8 , P9). Protective seals are also on the tap of pressure inlet, unused electric outputs and optionally on the three-way valve if installed. There are two types of seals: stickers or pressed seals.



pressed seals

stickers

Fig.10. Protective seals (samples)

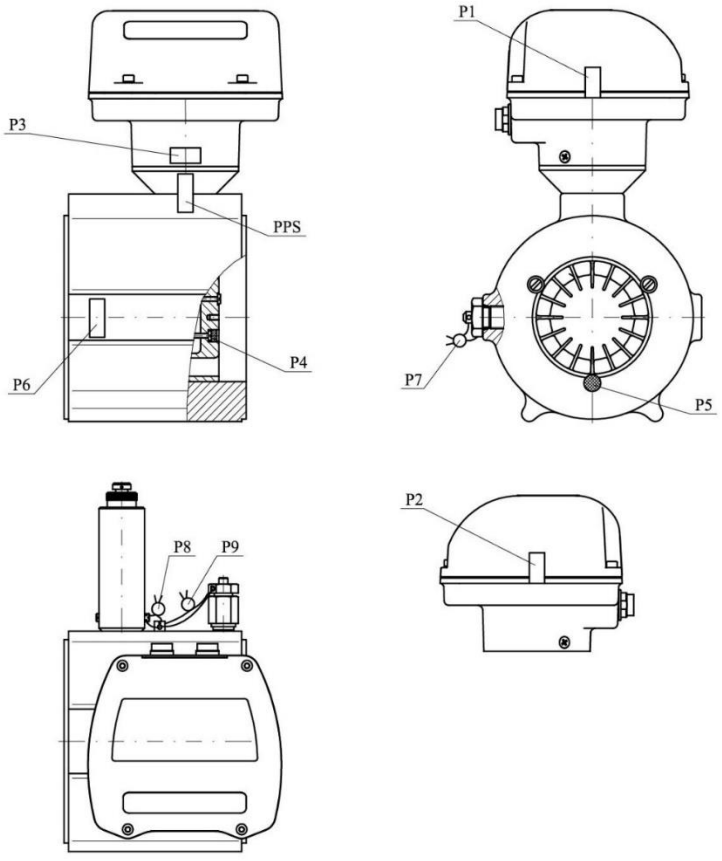


Fig.11a. location of the protective seals

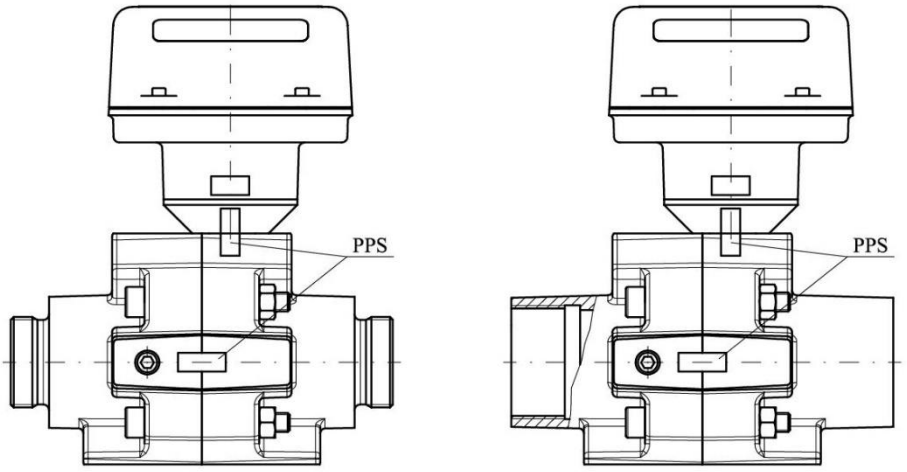


Fig.11b. Location of the protective seals – quantometers with thread connection

Damaged of seal/s may become the guarantee invalid.

5 PACKAGING, TRANSPORTATION AND STORAGE

The CPT-04M quantometer is delivered in a factory package that secures the gas meter during transportation and storage. The package consists of strong cardboard box with shaped-foam inserts. The DN 200 quantometers are transported on the pallets. Appropriate information on the package informing about the content of the package, and limitation of loading / unloading during the transport. There are carry holders on the side walls of package.
The quantometers returned for repairs or recalibration, should be delivered to the factory in their original package or other that provide at least the same level of security during transportation as the original ones.

THE TURBINE QUANTOMETER IS A PRECISE MEASURING INSTRUMENT.
THE PROPER CARE IS REQIURED.

The following recommendations should be kept during transportation and storage:

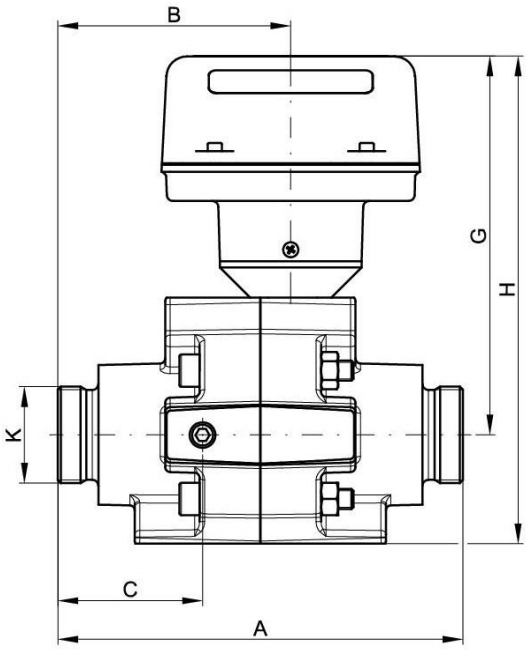
1. The quantometers should be protected against falls, impacts, or strong vibrations.
2. There is not allowed to lift the gas meter by index head.
3. The protective covers of inlets should be removed just before installation.
4. The storage place should be protected against direct atmospheric influence, and humidity.
5. There is important to care for protective and secure seals installed on the quantometer

6 INSTALLATION AND START-UP

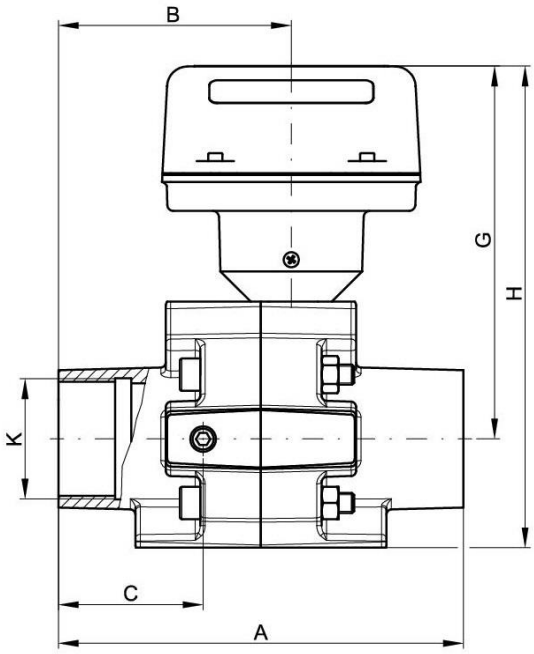
Before the installation of the quantometer check if it has been properly selected, in accordance with the require operating parameters - attention should be paid to the information contained in the nameplate:

- maximum operating pressure [MPa], marked p_{max}
- maximum real flow [m^3/h], marked Q_{max}

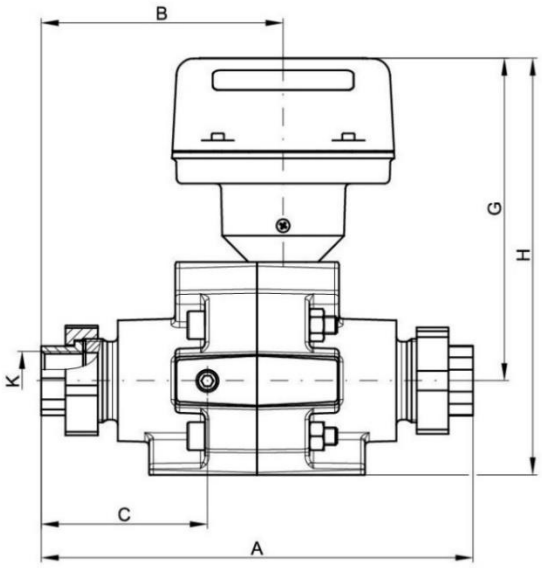
It is permitted to operate the quantometer with flow bigger by 25% than the designed maximum flow within maximum 30 minutes.



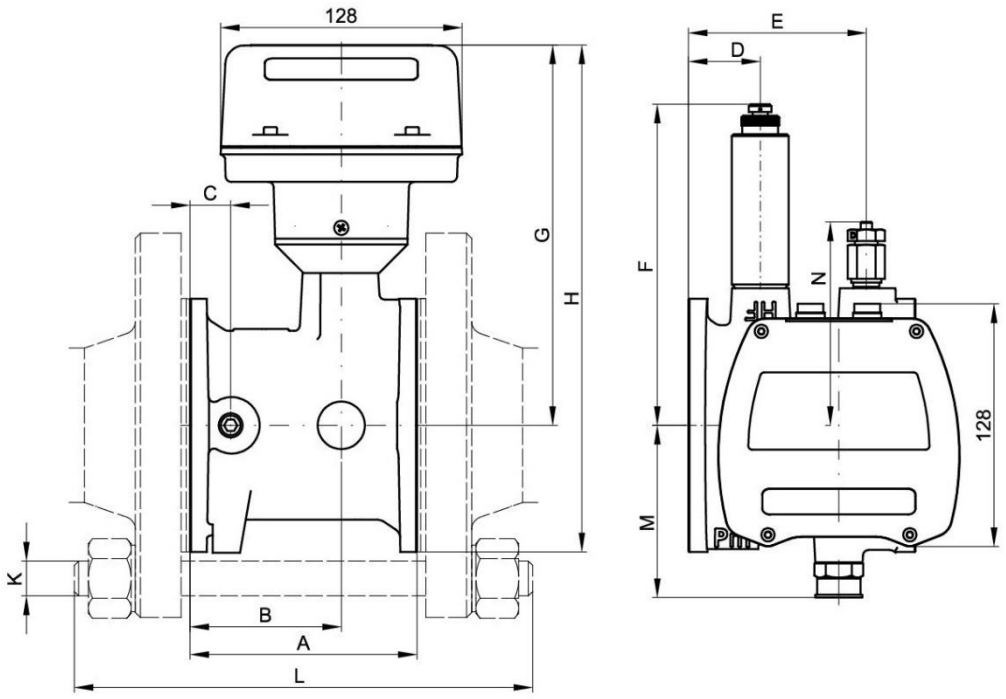
[Z] main body with the external thread



[W] main body with the internal thread



[P] main body with the internal thread and coupling



[S] standard version (face flange)

Fig.12. CPT-04M dimensions in different variants of main body

The quantometers can be installed in closed rooms with stabilized temperature and outdoors (open locations). The quantometers should not be installed in the lowest position of the installation as it is possible that condensate and other impurities may collect there. The appropriate nominal diameter of the piping need to be maintained. Proper alignment of the meter and pipe flanges need to be secured. It is recommended to install straight appropriate upstream and downstream pipe sections (minimum length: 2 x DN).

The standard version [S] of CPT-04M has face flange for installation between flanges PN16 and PN20 (ANSI 150). The special version of CPT-04M may be equipped with thread connection:

- [S] standard version (face flange)
- [Z] main body with the external thread
- [W] main body with the internal thread
- [P] main body with the internal thread and coupling

Permissible values of bending moment for CPT-04M with thread connection as follows:

- for DN 25 Mg = 220 Nm
- for DN 32 Mg = 280 Nm
- for DN 40 Mg = 350 Nm
- for DN 50 Mg = 440 Nm

The quantometer is to be installed between flanges by means of stud bolts according to : PN-EN ISO 898-1:2009, PN-EN ISO 3506-1:2009, PN-ISO 888:1996.

The flange connection should be sealed with asbestos-free, suitable gaskets with compliant with the requirement of ZN-G-4008 and WUDT-UC-WO-O/19.

The flat gasket may be used to standard flanges for p_{max} = 2 MPa according to PN-EN 1514-1:2001 or PN-EN 12560-1:2002.

Dimensions of the CPT-04M are presented in tables: 4a and 4b and Fig.13.

Table 4a. CPT-04M standard version [S] - basic dimensions and weight

DN	A	B	C	D	E	F	G	H	M	N	K	L	mass
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	kg
50	100	-	18	32	86	157	190	243	-	86	4xM16	200	3,6 (1)
65	120	80	22	38	94	170	202	269	90	107	4xM16(6)	220	3,3 (2)
80	120	80	22	38	94	170	202	269	90	107	8xM16(4)	220	3,5 (2)
100	150	100	29	53	125	183	216	296	105	120	8xM16	250	5,5 (2)
150	180	127	50	76	153	208	234	342	130	145	8xM20	300	10,7 (2)
200	200	146	56	83	162	223	263	398	145	160	12xM20(5)	320	48 (3)

Table 4b. CPT-04M threaded version - basic dimensions and weight

DN	K	version	A	B	C	D	E	F	G	H	N	Mass
mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
25	G1½"	Z	200	115	65	82	134	157	190	243	86	4,0 (2)
32	G2"	Z	200	115	65	82	134	157	190	243	86	4,0 (2)
25	G1"	P	258	144	94	111	163	157	190	243	86	4,4 (2)
32	G1¼"	P	262	146	96	113	165	157	190	243	86	4,4 (2)
40	G1½"	W	200	115	65	82	134	157	190	243	86	4,1 (2)
50	G2"	W	200	115	65	82	134	157	190	243	86	4,1 (2)

- (1) aluminium main body (plastically reworked)
- (2) die-cast aluminium body
- (3) steel main body
- (4) 8xM16 (PN16) lub 4xM16 (PN20)
- (5) 12xM20 (PN16) lub 8xM20 (PN20)
- (6) 4xM16 lub 8xM16 (PN16) lub 4xM16 (PN20)

Impurities contained in gas and in the piping may cause damages of measuring assembly and decrease the accuracy of measurement. Therefore it is recommended to install at least the 10μm filter (or better) on upstream (especially in case of heavy contaminated gases). In addition, before the installation, it is recommended to clean the upstream piping, and to install cone sieve at the inlet of the inlet section. The cone sieve should be removed after 1–2 months of operation. If the cone sieve is not removed, it is recommended to check regularly a level of its contamination and maintain regular services to control the pressure drop. In case of clogging, the sieve may get damaged by gas pressure, and its scraps may seriously damage the quantometer.

MANUFACTURER IS NOT LIABLE FOR ANY DAMAGES OF THE QUANTOMETER DUE TO IMPROPER FILTRATION OF THE FLOWING GAS

The user should pay attention to some risks related to gas flow changes. If the flow in the piping was relatively low for a long time period, after commissioning, the impurities (e.g. weld spatters) could remain upstream of the gas meter. Only when the flow rate is significantly increased, can the gas entrain these contaminants and damage the gas meter as a result. For this reason, the cone sieve can be useful when the system is reaching maximum efficiency.

Before the final installation of the quantometer, it is necessary to check that it is properly directed, i.e. that the turn of the arrow on the main body is in line with the direction of the gas flow.

The START-UP

In order to start up the quantometer properly (typical installation with a by-pass, Fig.17) the following recommendations should be maintained:

1. The quantometer is installed with the valves: 1, 2, 5 closed, and the open by-pass valve: 4.
   The blow-off valve: 3 remains open after the installation was degassed.
2. Having tightened the installation bolts remove the air from the installation accordingly to the local regulations by opening the valve: 5. The valve: 3 remains open.
3. After removing the air from the installation (venting procedure) close valve: 3 and equalize the gas pressure in the piping. Observe/maintain the pressure increasing no greater than 30 ± 10 kPa/s.
4. When the quantometer index does not indicate any flow (what indicates that pressure is equal in the installation), close the valve: 5.
5. open in order:

   step_1: open valve: 1

   step_2: open valve:2
6. Having fully opened valve: 2, the by-pass valve: 4 can be closed.

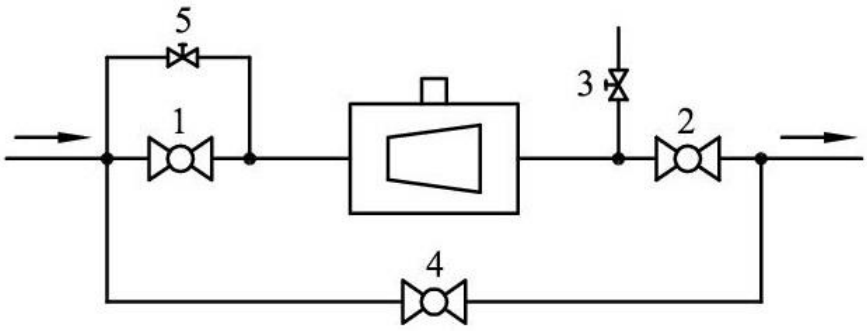


Fig.13. Diagram of a measuring system with bypass ("bypass")

When deinstalling the quantometer from the piping / installation, proceed opposite, i.e.:

1. first, open the by-pass valve: 4
2. in sequence, close the valve: 2, and next the valve: 1
3. release the pressure from the installation by means of the blow-off valve: 3; decrease of gas pressure should not be more than 30 ± 10 kPa/s.

In other installation cases, the same principle must be followed, i.e. the valves regulating the gas flow should be open and close very slowly. Sudden changes in gas flow occurring by improper operation of the valves, can cause damage of the measuring turbine due to large pressure differences upstream and downstream of the gas meter.

If during the usage of the quantometer overloading occurred (i.e. Q_{max} may be overcome by more than 25 %), then it is recommended to install the limiting orifices. The orifice should be installed downstream the gas meter at the distance 5÷10 nominal pipe diameters (DN). The orifice size is determined individually, depending on the nominal pipe diameter, flow, pressure and temperature of the gas. On request Common S.A. can design and deliver proper orifice.

After installation of the quantometer it is important to check that indication of the counter reading is correct. The wheel of the index should rotate freely, and after one full turn, it should cause the forward move of the next left wheel by 1/10 of its turn.

Unused electric output sockets must be closed by means of factory caps with installation seals.

7 MAINTENANCE, FAULTS, REPAIRS

The standard version of CPT-04M quantometers is maintenance-free. The bearings used in the construction are self-lubricating with the reserve of lubricant. Optionally CPT-04M quantometers (from DN 65 to DN 200) may be adapted to external lubrication (see section VIII Auxiliary Equipment). Maintenance of externally lubricated quantometers should be performed as described further.

Quantometers operating with gases indicated in Table 1 require periodical lubrication after each volume of gas that has flown V_g [m^3]. The values of V_g are indicated in Table 5, but at least once pro month. Refinery gases, biogas, sewerage gas – the period of lubrication should be at least once a week.

Table 5. Recommended lubrication conditions

G	Vg [m^3]	Vo [cm^3]	G	Vg [m^3]	Vo [cm^3]
G65	65.000	1	G400	400.000	3
G100	100.000	2	G650	650.000	4
G160	160.000	2	G1000	1.000.000	4
G250	250.000	3	G1600	1.600.000	6

Recommended oils for lubrication are: Lubrina or VR09, (both distributed by COMMON S.A.).

- DN65 and DN80 should be lubricated with VR09 or Lubrina L12, viscosity 12 mm^2/s (cSt) at 20^0 C.
- Larger diameters require lubrication with Lubrina L23 (viscosity approx. 23 mm^2/s).
- for the gases indicated in Table 1 the oil Shell Tellus T15 is also allowed

Quantometers operating with other types of gases than indicated in Table 1 require other lubricants. Please contact the authorised representative or the manufacturer.

Dust or other impurities may be removed from the quantometer surface by means of a cloth moistened in soup-water. It is not permitted to use solvents or other chemical agents.

If during operation of the quantometer any abnormality occurs (e.g. uneven run, stoppage of index, higher noise level, rattling etc.) the quantometer should be reinstall from the installation and sent for inspection / repair.

REPAIRS OF THE QUANTOMETERS MAY BE PERFORMED BY THE MANUFACTURER OR BY AUTHORISED PERSONNEL ONLY. IS NOT ALLOWED TO PERFORM REPAIRS BY THE USER!

After repairs that could not be proceeded without removing/damaged the calibration seals it is necessary to recalibrate the quantometer.

CPT-04M quantometers are covered by manufacturer guarantee. Procedure regarding warranty is regulated by general rules of commercial law.

8 AUXILIARY EQUIPMENT

Lubrication kit for quantometers

In a special version, the quantometer may be adapted to external lubrication. These gas meters are equipped with an internal oil-supply system ending with a pressure back-valve in the main body – see Fig.18. The oil system delivers the oil to the bearings. The lubrication procedure is performed using a dedicated tool kit.

- basic tool kit contains: oil container, a syringe.
  to be used for pressure not greater than 0,5 MPa
- special tool kit contains: oil container and a pump
  (to be used for pressure greater than 0,5 MPa up to 2 MPa)

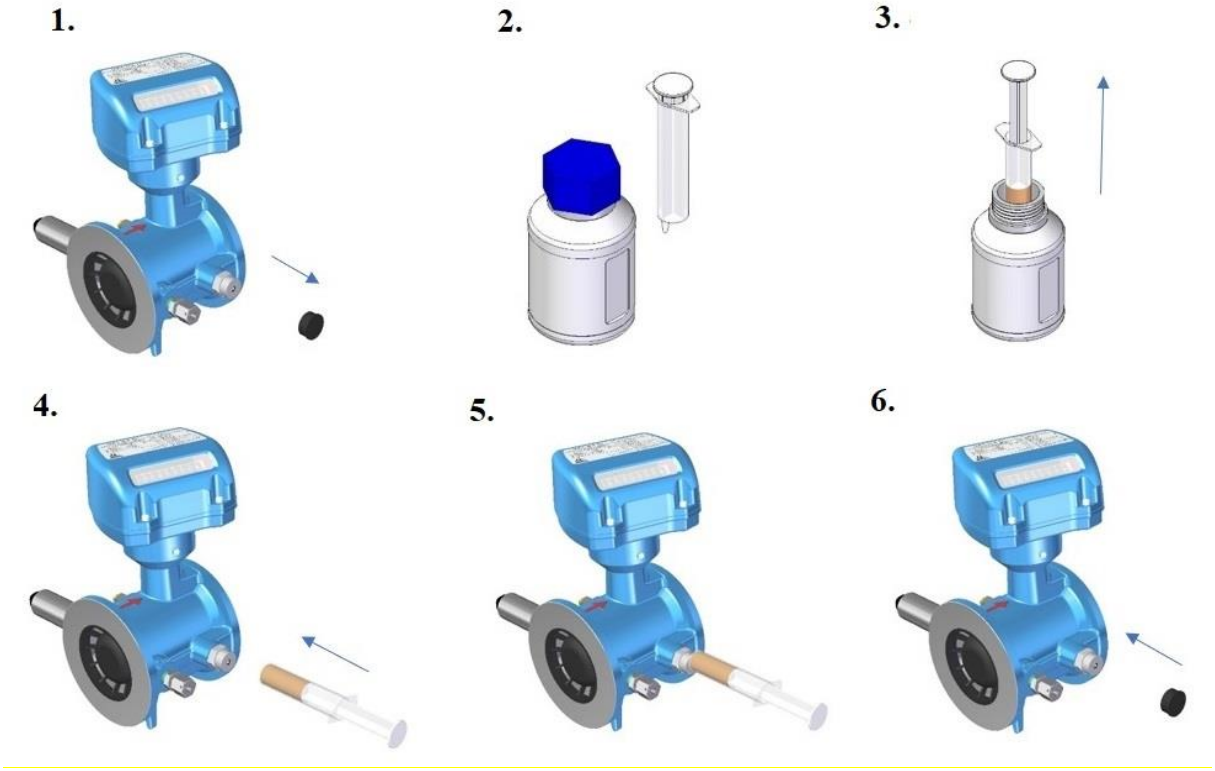


Fig.18. CPT-04M lubrication

Sequence of steps to lubricate the quantometer (Fig.18):

1. remove the cap protecting the lubricator against contaminations,
2. prepare the oil injection kit,
3. retract appropriate amount of oil (see Table 5) into the syringe (pump),
4. press the tip of the syringe into the inlet of the pressure valve,
5. slowly inject the measured amount of oil,
6. remove the syringe (pump) of the valve and replace the protective cap.

Quantometers may be lubricated directly by means of a syringe only in installations with a maximum operating pressure not greater than 0,5 MPa.
If the operating pressure is greater than 0,5 MPa it is require a special pump.

Connection of the CPT-04M quantometer with a EVC (Electronic Volume Corrector)

It is often necessary (or recommended) to use an electronic device such as data logger or electronic volume converter or other data transmission device to operate with the quantometer.

Common S.A. is a manufacturer of such types of devices: CMK-03 volume converter; CRP-03 recorder of gas parameters; CRS-04 pulse recorder and others. Common S.A. can deliver electronics and design the completed installations between them. An example of installation is presented in Figure 19.

Electronic volume converters require three input signals: gas flow signal (from a low- or high-frequency pulse transmitter), pressure signal, and a temperature signal.

The pressure signal is acquired from the pressure tapping. It is recommended to use three-way valve type CKMT (Fig. 20) in this configuration. The three-way valve allows to cut off the gas flow of the pressure sensor, and as a result, to disassemble and inspect the sensor. There is no need to stop the gas flow through the quantometer. The lever of the three-way valve may be secured with the seal in order to protect against unauthorized position-changing.

The temperature signal is acquired from a transmitter installed in the temperature pocket located in the upstream inlet pipe, see Figure 19

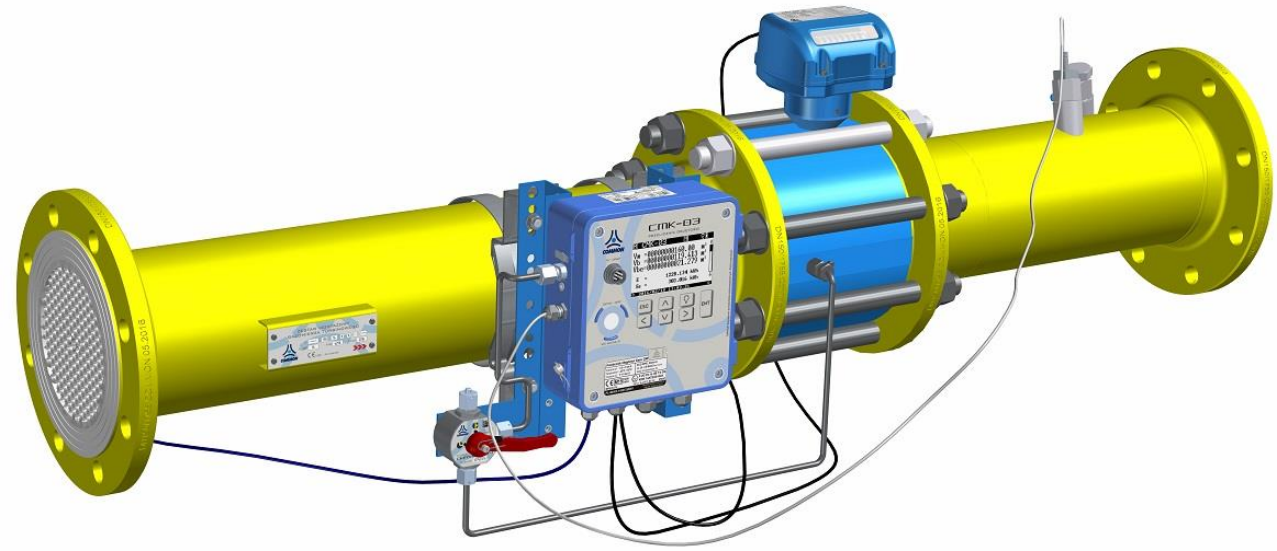


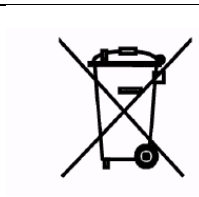
Fig.19. Installation kit: CPT-04M quantometer and CMK-03

Fig.20. CKMT three-way valve

9 LIST OF STANDARDS AND TECHNICAL SPECIFICATIONS

- PN-EN 12392 Aluminium and aluminium alloys – Forged and cast products
  Special requirements for products intended for the manufacture of pressure equipment.
- PN-EN 13445-3 Non-flame heated pressure vessels – part 3: Design
- PN-EN 13463-1 Non-electrical equipment in potentially explosive atmospheres – Part 1: Basic assumptions and requirements
- PN-EN 60079-0 Explosive atmospheres – Part 0: Equipment – Basic requirements
- PN-EN 60079-11 Explosive atmospheres – Part 1: Intrinsic safety protection of equipment "i"
- PN-EN 60947-5-2 Low-voltage switchgear and controlgear – Part 5-2: Switchgear and switchgear – Proximity switches
- PN-EN 60947-5-6 Low-voltage switchgear and control gear – Part 5-6: Control devices and switches – Interfaces d.c. of proximity sensors and switching amplifiers (NAMUR)
- PN-EN ISO 3506-1 Mechanical properties of corrosion-resistant fasteners made of stainless steel – Part 1: Stud bolts and bolts
- PN-EN 12261:1005 Gas meters. Turbine gas meters.
- WUDT/UC/2003
  Conditions of the Office of Technical Inspection – Pressure equipment

NOTE: For undated documents, the most recent edition of the publication (including changes) is used. A list of current standards and technical specifications is given in the "EC Declaration of Conformity" supplied with the product.

	**The quantometers, after their "life cyckle" under no circumstances must not be disposed in the municipal waste container. The Waste Act of 14 December 2012 requires selective collection of metal waste. It is recommended to return the gas meter to the manufacturer where it will be disposed in a proper way. If it is not possible the user is obliged to return the meter to an appropriate waste disposal for recycling.**
	The quantometer package shall not be disposed as utility refuse. The package is properly marked and shall be recycled in accordance with appropriate regulations.

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