



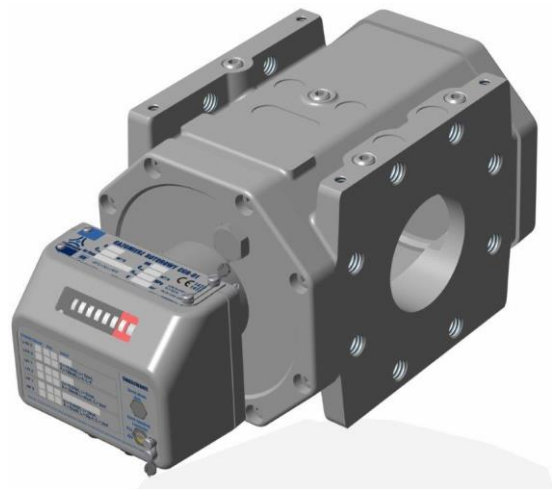
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# ROTARY GAS METERS

## CGR-FX

series

## OPERATION MANUAL



**CGR-FX / OM 20-04**

**April 2020**

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**PLEASE READ THE OPERATION MANUAL BEFORE INSTALLING  
AND OPERATING THE GAS METER**

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## I. INTENDED USE AND CONDITIONS OF USE

### Intended use

CGR-FX series rotary gas meters are electromechanical pressure devices designed to measurement of volume of gas transported by pipeline. Gas meters in the standard version can be installed in locations with potential presence of explosive atmospheres formed as mixtures of gases classified as explosion groups IIA and IIB with air. Special gas meters versions are designed for IIC gas explosion group. Table 1 lists the physical properties of the most common gases and gas mixtures that can be measured with CGR-FX rotary gas meters.

CGR-FX series rotary gas meters enable volume measurement of gas flowing in any from among four directions: horizontally from left to right or from right to left side and vertically from top to bottom or from bottom to top.

CGR-FX gas meters are manufactured in series of types in aluminium alloy bodies and cast iron bodies. Gas meters in cast iron bodies can be manufactured in high temperature resistant version (HTR), according to EN 12480:2002 Annex C.



CGR-FX gas meters can be optionally equipped with a mechanical output. Mechanical output may be used to drive peripheral devices. Rotational speed of an output shaft is equal to the speed of the fastest digit wheel of the mechanical counter. The maximum permissible load torque on the mechanical output shaft is 0,25 Nmm.

As an option, CGR-FX meters can be equipped with an internal bypass that opens automatically in case of rotors failure (seizure of rotors). This feature enables gas bypassing the meter measuring unit, thus providing continued gas supply in emergency conditions.




CGR-FX rotary gas meters can be used both indoors in stabilized temperature conditions and outdoors (open locations).

### Conditions for use

#### 1. Compliance with Directive 2014/32/UE ( MID ) :

- certificate T10569 ( NMI )
- CE marking   1450 ( INiG - Oil and Gas Institute )
- high temperature resistant version (option) HTR  $p_{max} = 0.4 \text{ MPa}$
- ambient temperature range  $-25^{\circ} \text{ C} \leq T_a \leq +70^{\circ} \text{ C}$
- gas temperature range from  $-25^{\circ} \text{ C}$  to  $+70^{\circ} \text{ C}$
- storage temperature range from  $-30^{\circ} \text{ C}$  to  $+70^{\circ} \text{ C}$
- maximum working pressure  $p_{max} = 1,6 \text{ MPa}$
- mechanical environment class M2
- electromagnetic environment class E2
- metrological parameters Tables 2a, 2b
- metrological accuracy class 1.0
- operational position HV

#### 2. Compliance with Directive 2014/34/UE ( ATEX ) :

- certificate KDB 04ATEX034 ed.1
- CE marking  1453 ( Central Mining Institute, Experimental Mine "Barbara" )
- operating conditions standard  II 2G Ex ia IIB T5 Gb  
special  II 2G Ex ia IIC T5 Gb
- meter case index of protection IP66/IP67,
- ambient temperature  $-25^{\circ} \text{ C} \leq t \leq +70^{\circ} \text{ C}$

3. Compliance with Directive 2014/68/UE ( PED ) :
- certificate 75119/JN/001/03 rev. 1
  - CE marking **CE** 1433 ( Office of Technical Inspection )
  - compliance with technical specification WUDT/UC/2003
  - maximum calculated pressure for gas meter bodies:
    - connection PN16 PS = 16 bar
    - connection PN20 (ANSI150) PS = 20 bar
    - connection PN25 (cast iron bodies only) PS = 25 bar
  - ambient temperature  $-25^{\circ}\text{C} \leq t \leq +70^{\circ}\text{C}$
4. Compliance with Directive 2014/30/UE (EMC) :
- requirements met by the use of LF and HF pulse transmitters (NAMUR) compliant with the following harmonized standards: EN 60947-5-2:2011, EN 60947-5-6:2000

Table 1. Physical properties of the most common gases and gas mixtures that can be measured with CGR-FX meters. Densities under pressure of 101,325 kPa at 20°C

Gas or gas mixture	Chemical symbol (formula)	Density $\rho$ [kg/m <sup>3</sup> ]	Relative density $\rho_w$	Gas meter version
argon	Ar	1,66	1,38	standard IIB
nitrogen	N <sub>2</sub>	1,16	0,97	standard IIB
butane	C <sub>4</sub> H <sub>10</sub>	2,53	2,1	standard IIB
carbon dioxide	CO <sub>2</sub>	1,84	1,53	standard IIB
ethane	C <sub>2</sub> H <sub>6</sub>	1,27	1,06	standard IIB
ethylene	C <sub>2</sub> H <sub>4</sub>	1,17	0,98	standard IIB
natural gas	≈CH <sub>4</sub>	ca. 0,75	ca. 0,63	standard IIB
helium	He	0,17	0,14	standard IIB
methane	CH <sub>4</sub>	0,67	0,55	standard IIB
propane	C <sub>3</sub> H <sub>8</sub>	1,87	1,56	standard IIB
carbon monoxide	CO	1,16	0,97	standard IIB
acetylene	C <sub>2</sub> H <sub>2</sub>	1,09	0,91	<b>special IIC</b>
hydrogen	H <sub>2</sub>	0,084	0,07	<b>special IIC</b>
air	–	1,20	1	standard IIB

The gas meter causes a gas pressure drop in the pipeline. Gas pressure drop values determined at  $Q_{\max}$  (for atmospheric conditions and density  $\rho_0 = 1,2 \text{ kg/m}^3$ ) for all CGR-FX rotary gas meter versions are given in Table 2.

In operating conditions, pressure loss  $\Delta p_r$  [Pa] is calculated according to the formula:

$$\Delta p_{rz} = \rho_w \frac{p_a + p}{p_a} \cdot W_{pd} \cdot \Delta p$$

where:  $\rho_w = \rho / \rho_0$  – relative gas density (compared to air density) as in Table 1  
 $p_a$  – atmospheric pressure ( $p_a \cong 101 \text{ [kPa]}$ )  
 $p$  – gauge gas pressure upstream the gas meter [kPa]  
 $W_{pd}$  – pressure drop ratio determined from Fig. 1  
 $\Delta p$  – pressure drop at  $Q_{\max}$  determined from Table 2 [Pa]

NOTE: Pressure drop in a meter with stuck rotors (bypass open) at operating conditions, can be calculated with the above formula, replacing  $\Delta p$  with  $B\Delta p$  (Table 2a or 2b).

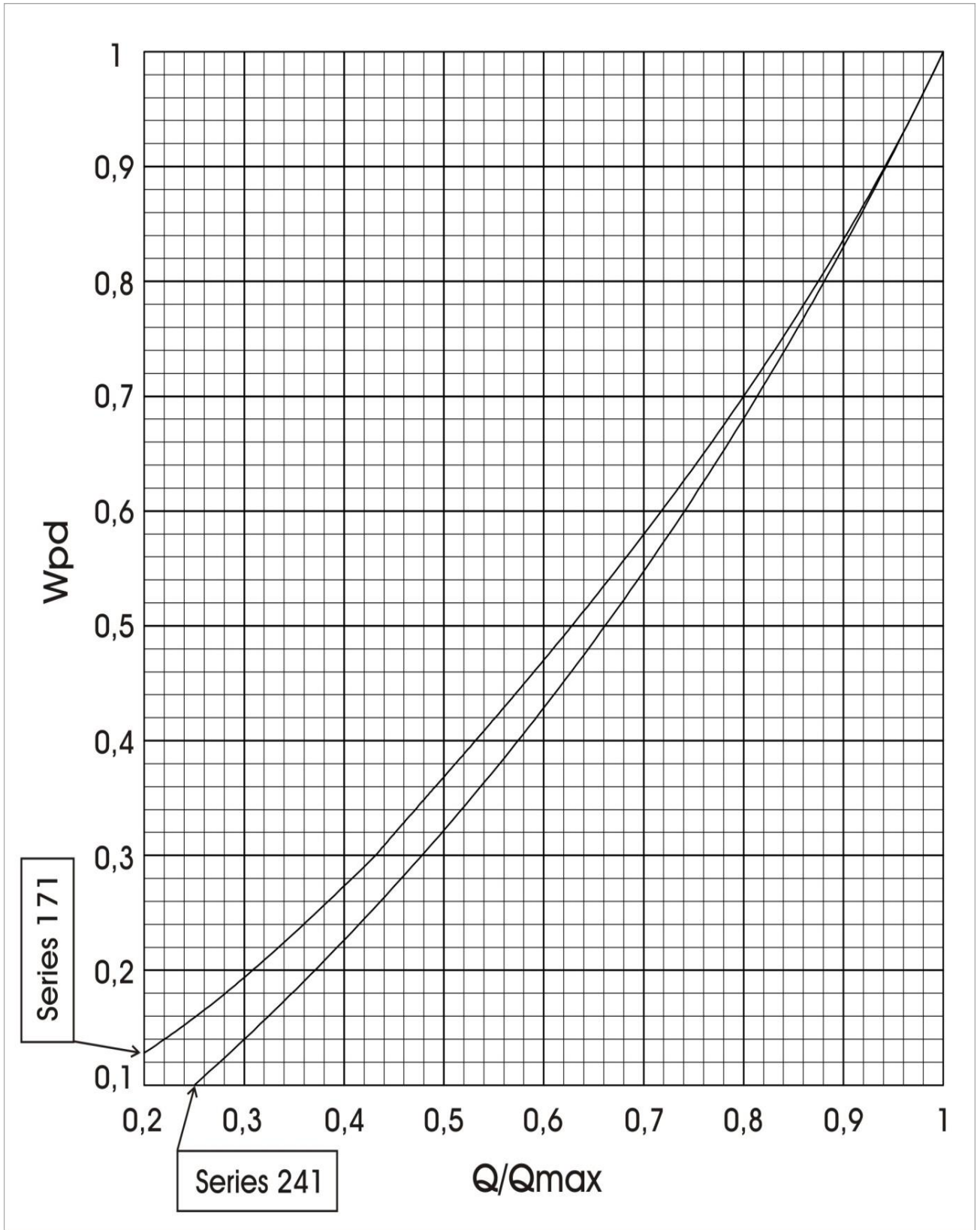


Fig. 1. Pressure drop ratio as a function of relative flow  $Q/Q_{max}$

**Table 2a. Basic metrological parameters of CGR-FX gas meters in aluminium alloy bodies**

DN nominal diameter	G meter size	Q <sub>max</sub> maxi- mum flow	Q <sub>min</sub> minimum flow	Q <sub>max</sub> / Q <sub>min</sub> flow range	LF pulse value	HF pulse factor (approx.)	V cyclic volume	Δp pressure drop at Q <sub>max</sub>	BΔp <sup>(3)</sup> at Q <sub>max</sub>	series
[mm]	[-]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[-]	[imp./m <sup>3</sup> ]	[imp./m <sup>3</sup> ]	[dm <sup>3</sup> ]	[Pa]	[kPa]	[-]
1	2	3	4	5	6	7	8	9	10	11
40/50	G10	16	0,8 ÷ 0,16	20 ÷ 100	10/100 <sup>(2)</sup>	15390	0.23	75 / 65	0,15	„171”
40/50	G16	25	1,3 ÷ 0,16	20 ÷ 160	10/100 <sup>(2)</sup>	15390	0.23	160 / 140	0,40	
40/50	G16	25	1,3 ÷ 0,16	20 ÷ 160	100 <sup>(2)</sup>	17400	0.31	105/80	0,36	
40/50	G16	25	1,3 ÷ 0,16	20 ÷ 160	10	11200	0.31	105/80	0,36	
40/50	G25	40	2,0 ÷ 0,16	20 ÷ 250	10/100 <sup>(2)</sup>	15390	0.23	375/280	0,90	
40/50	G25	40	2,0 ÷ 0,16	20 ÷ 250	100 <sup>(2)</sup>	17400	0.31	240/180	0,85	
40/50	G25	40	2,0 ÷ 0,16	20 ÷ 250	10	11200	0.31	240/180	0,85	
40/50	G25	40	2,0 ÷ 0,25	20 ÷ 160	100 <sup>(2)</sup>	11050	0,50	110/80	0,80	
40/50	G25	40	2,0 ÷ 0,25	20 ÷ 160	10	7170	0,50	110/80	0,80	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,25	20 ÷ 250	100 <sup>(2)</sup>	17400	0.31	340 / 320 / 240	2,10	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,25	20 ÷ 250	10	11200	0.31	340 / 320 / 240	2,10	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,25	20 ÷ 250	100 <sup>(2)</sup>	11050	0,50	280 / 210 / 150	2,05	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,25	20 ÷ 250	10	7170	0,50	280 / 210 / 150	2,05	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,40	20 ÷ 160	10	4340	0,81	195 / 150 / 110	2,00	
50/65 <sup>(1)</sup> /80	G65	100	5,0 ÷ 0,40	20 ÷ 250	10	7170	0,50	330 / 310 / 320	4,55	
50/65 <sup>(1)</sup> /80	G65	100	5,0 ÷ 0,40	20 ÷ 250	10	4340	0,81	325 / 270 / 200	4,50	
50/65 <sup>(1)</sup> /80	G65	100	5,0 ÷ 0,65	20 ÷ 160	10	2800	1,24	275 / 225 / 200	4,40	
50/65 <sup>(1)</sup> /80	G100	160	8,0 ÷ 0,65	20 ÷ 250	1/10 <sup>(2)</sup>	4340	0,81	650 / 540 / 430	10,5	
50/65 <sup>(1)</sup> /80	G100	160	8,0 ÷ 0,65	20 ÷ 250	1/10 <sup>(2)</sup>	2820	1,24	550 / 450 / 395	4,0 <sup>(4)</sup>	
80	G160	250	13,0 ÷ 1,0	20 ÷ 250	1/10 <sup>(2)</sup>	2820	1,24	1000	8,5 <sup>(4)</sup>	
80/100 <sup>(1)</sup>	G65	100	5,0 ÷ 0,65	20 ÷ 160	10	1630	1,29	115 / 85	1,20	
80/100	G100	160	8,0 ÷ 0,65	20 ÷ 250	1/10 <sup>(2)</sup>	1630	1,29	220 / 190	2,70	
80/100	G100	160	8,0 ÷ 1,0	20 ÷ 160	10 <sup>(2)</sup>	1560	2,00	180 / 135	2,60	
80/100	G100	160	8,0 ÷ 1,0	20 ÷ 160	1	1080	2,00	180 / 135	2,60	
80/100	G160	250	13,0 ÷ 1,0	20 ÷ 250	1/10 <sup>(2)</sup>	1630	1,29	510 / 470	6,30	
80/100	G160	250	13,0 ÷ 1,0	20 ÷ 250	10 <sup>(2)</sup>	1560	2,00	370 / 280	6,20	
80/100	G160	250	13,0 ÷ 1,0	20 ÷ 250	1	1080	2,00	370 / 280	6,20	
80/100	G160	250	13,0 ÷ 1,6	20 ÷ 160	10 <sup>(2)</sup>	1740	3,34	270 / 210	6,00	
80/100	G160	250	13,0 ÷ 1,6	20 ÷ 160	1	645	3,34	270 / 210	6,00	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	10 <sup>(2)</sup>	1560	2,00	875 / 660	4,2 <sup>(4)</sup>	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	1	1080	2,00	875 / 660	4,2 <sup>(4)</sup>	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	10 <sup>(2)</sup>	1740	3,34	580 / 460	4,0 <sup>(4)</sup>	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	1	645	3,34	580 / 460	4,0 <sup>(4)</sup>	
100 <sup>(1)</sup>	G400	650	32,0 ÷ 2,5	20 ÷ 250	10 <sup>(2)</sup>	1740	3,34	1200	9,2 <sup>(4)</sup>	
100 <sup>(1)</sup>	G400	650	32,0 ÷ 2,5	20 ÷ 250	1	645	3,34	1200	9,2 <sup>(4)</sup>	

(1) – meter versions not included in EN 12480, Table 7, acceptable by OIML Recommendations R137 1&2

(2) – meter version available with 9-digit counter only

(3) – pressure drop on damaged meter with stuck rotors and open bypass

(4) – pressure drop on damaged meter with stuck rotors and open double bypass

**Table 2b. Basic metrological parameters of CGR-FX gas meters in cast iron bodies**

DN nominal diameter	G meter size.	Q <sub>max</sub> maxi- mum flow	Q <sub>min</sub> minimum flow	Q <sub>max</sub> / Q <sub>min</sub> flow range	LF pulse value	HF pulse factor (approx.)	V cyclic volume	Δp pressure drop at Q <sub>max</sub>	BΔp <sup>(3)</sup> at Q <sub>max</sub>	series
[mm]	[-]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[-]	[imp./m <sup>3</sup> ]	[imp./m <sup>3</sup> ]	[dm <sup>3</sup> ]	[Pa]	[kPa]	[-]
1	2	3	4	5	6	7	8	9	10	11
40/50	G10	16	0,8 ÷ 0,25	20 ÷ 65	100 <sup>(2)</sup>	11050	0.50	33 / 17	0,10	„171”
40/50	G10	16	0,8 ÷ 0,25	20 ÷ 65	10	7170	0.50	33 / 17	0,10	
40/50	G16	25	1,3 ÷ 0,25	20 ÷ 100	100 <sup>(2)</sup>	11050	0.50	45 / 35	0,30	
40/50	G16	25	1,3 ÷ 0,25	20 ÷ 100	10	7170	0.50	45 / 35	0,30	
40/50	G25	40	2,0 ÷ 0,25	20 ÷ 160	100 <sup>(2)</sup>	11050	0.50	110/80	0,80	
40/50	G25	40	2,0 ÷ 0,25	20 ÷ 160	10	7170	0.50	110/80	0,80	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,25	20 ÷ 250	100 <sup>(2)</sup>	11050	0.50	280 / 210 / 150	2,05	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,25	20 ÷ 250	10	7170	0.50	280 / 210 / 150	2,05	
40/50/65 <sup>(1)</sup>	G40	65	3,2 ÷ 0,40	20 ÷ 160	10	4340	0.81	195 / 150 / 110	2,00	
50/65 <sup>(1)</sup> /80	G65	100	5,0 ÷ 0,40	20 ÷ 250	10	7170	0.50	330 / 310 / 320	4,55	
50/65 <sup>(1)</sup> /80	G65	100	5,0 ÷ 0,40	20 ÷ 250	10	4340	0.81	325 / 270 / 200	4,50	
50/65 <sup>(1)</sup> /80	G65	100	5,0 ÷ 0,65	20 ÷ 160	10	2800	1.24	275 / 225 / 200	4,40	
50/65 <sup>(1)</sup> /80	G100	160	8,0 ÷ 0,65	20 ÷ 250	1/10 <sup>(2)</sup>	4340	0.81	650 / 540 / 430	10,5	
50/65 <sup>(1)</sup> /80	G100	160	8,0 ÷ 0,65	20 ÷ 250	1/10 <sup>(2)</sup>	2820	1.24	550 / 450 / 395	4,0 <sup>(4)</sup>	
80	G160	250	13,0 ÷ 1,0	20 ÷ 250	1/10 <sup>(2)</sup>	2820	1.24	1000	8,5 <sup>(4)</sup>	
80/100	G100	160	8,0 ÷ 1,0	20 ÷ 160	10 <sup>(2)</sup>	1560	2.00	180 / 135	2,60	„241”
80/100	G100	160	8,0 ÷ 1,0	20 ÷ 160	1	1080	2.00	180 / 135	2,60	
80/100	G160	250	13,0 ÷ 1,0	20 ÷ 250	10 <sup>(2)</sup>	1560	2.00	370 / 280	6,20	
80/100	G160	250	13,0 ÷ 1,0	20 ÷ 250	1	1080	2.00	370 / 280	6,20	
80/100	G160	250	13,0 ÷ 1,6	20 ÷ 160	10 <sup>(2)</sup>	1740	3.34	270 / 210	6,00	
80/100	G160	250	13,0 ÷ 1,6	20 ÷ 160	1	645	3.34	270 / 210	6,00	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	10 <sup>(2)</sup>	1560	2.00	875 / 660	4,2 <sup>(4)</sup>	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	1	1080	2.00	875 / 660	4,2 <sup>(4)</sup>	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	10 <sup>(2)</sup>	1740	3.34	580 / 460	4,0 <sup>(4)</sup>	
80 <sup>(1)</sup> /100	G250	400	20,0 ÷ 1,6	20 ÷ 250	1	645	3.34	580 / 460	4,0 <sup>(4)</sup>	
100 <sup>(1)</sup>	G400	650	32,0 ÷ 2,5	20 ÷ 250	10 <sup>(2)</sup>	1740	3.34	1200	9,2 <sup>(4)</sup>	
100 <sup>(1)</sup>	G400	650	32,0 ÷ 2,5	20 ÷ 250	1	645	3.34	1200	9,2 <sup>(4)</sup>	

(5) – meter versions not included in EN 12480, Table 7, acceptable by OIML Recommendations R137 1&2

(6) – meter version available with 9-digit counter only

(7) – pressure drop on damaged meter with stuck rotors and open bypass

(8) – pressure drop on damaged meter with stuck rotors and open double bypass

NOTE: Available Q<sub>min</sub> values for each meter size can be selected of the range as per Tables 2a and 2b, column 4.

Exact Q<sub>min</sub> values are numbers and submultiples of the number sequence: 10, 13, 16, 20, 25, 32, 40, 50, 65, 80.

## II. DESIGN AND FUNCTION

The rotary gas meter is a volumetric rotary machine based on the principle of proportionality of rotational speed of rotors to the actual volume of gas flowing through the gas meter at particular pressure and temperature conditions. The gas flowing into the gas meter (Fig. 2)

fills the measurement chamber and the inlet overpressure causes rotation of rotors and transport of a portion of gas to the gas meter output. The rotational motion of rotors is transmitted to the counter by means of gears and magnetic coupling. The counter mechanism totalises the volume of gas flowing through the device and indicates the total gas volume.

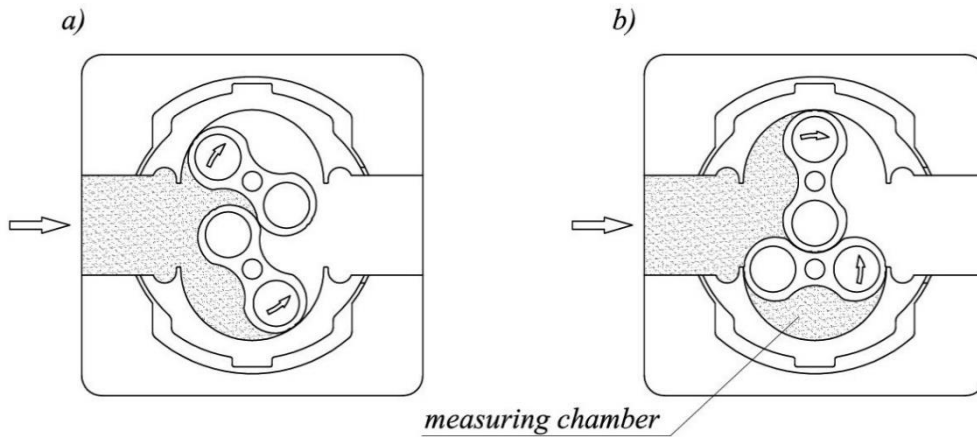


Fig. 2. Operation of the rotary gas meter

CGR-FX rotary gas meter (Fig. 3) is built of the following units:

**Main body.** Main body unit consists of main body and front and back covers. The parts are tightened with bolts and seals. The main body is furnished with sockets for measurement of gas pressure and temperature (option) and two flat face type facings with threaded holes to install the gas meter on the pipeline. The front cover unit contains a gas-tight partition to separate the gas chamber from the environment as well as oil filler plug and oil sight glass.

**Measurement unit.** Measurement unit is closed between the main body covers by the use of elastic sealing inserts. The unit consists of measurement chamber with (rotating) rotors and two side chambers separated by internal covers. The rotors are installed in these covers on ball bearings. Both side chambers contain proper oil supply for lubrication of bearings and timing gears. Lubrication is achieved by means of oil spray generated by vanes installed on rotors shafts.

Measurement unit may be equipped with an automatic bypass system activated if a failure of the meter occurs (blockage of rotors). In such case gas bypasses stuck rotors. The meter failure (bypass open) is signalled by a control circuit that sends an appropriate signal to an external device. This is an optional solution.

**Drive transmission unit.** Drive transmission unit, installed in the front meter cover, transmits and initially reduces the rotary motion of the rotors from the measurement unit to mechanical counter through a spur gear and magnetic coupling. The driven part of the coupling may be equipped with an inducer for the high frequency pulser.

**Index unit.** Mechanical index unit contains a set of worm and spur gears for the final and accurate rotations reduction and a mechanical counter along with accessories inducing low frequency electrical signal pulse transmitters. The unit is equipped with one or two sockets for cable transmission of low and high frequency electrical signals. Optionally it may be fitted out with mechanical output. The mechanical output is dedicated to CWSL Encoder external device. The available versions of the Encoder interface are CWSL-N, CWSL-A, CWSL-M. Data sent from the CWSL-N Encoder is consistent with the indications of the mechanical counter.



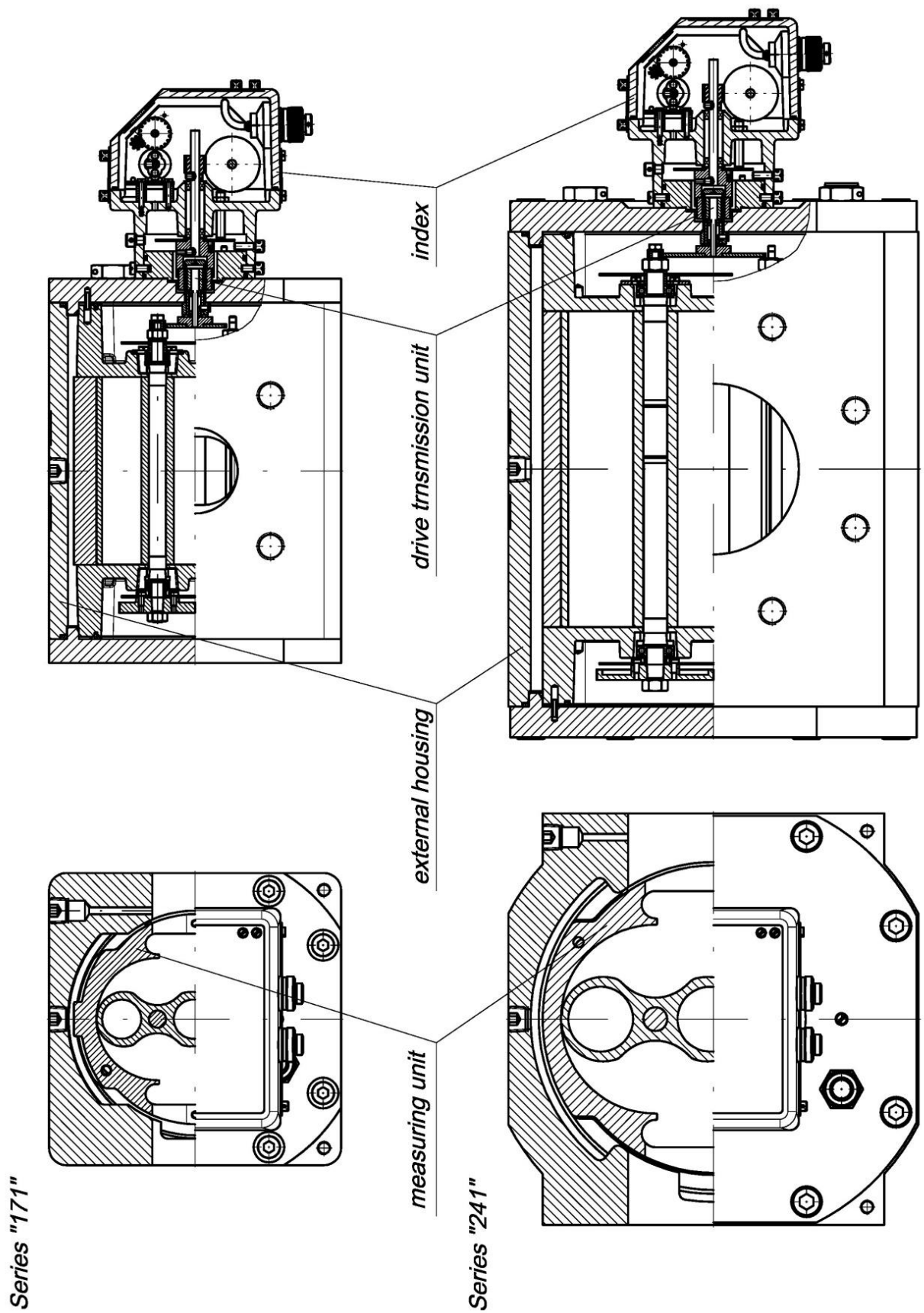


Fig. 3. Construction of CGR-FX rotary gas meters

### III. READOUT DEVICE AND MEASUREMENT OUTPUTS

CGR-FX gas meters are equipped with an indicating device in the form of a mechanical counter and electrical signal outputs. The mechanical counter can be manufactured in two versions: 8-digit or 9-digit version.

The index head may be equipped with:

- mechanical output (drive shaft),
- replaceable HF pulse sensor installed in the index head support,
- replaceable LF pulse transmitters installed on the cover of the index head, instead of mechanical output.

The meter housing is provided with pressure and temperature (option) measurement taps. The outputs allow to monitor of the gas meter operation and to connect external equipment. Figure 4 shows the location of measurement outputs of CGR-FX gas meter.

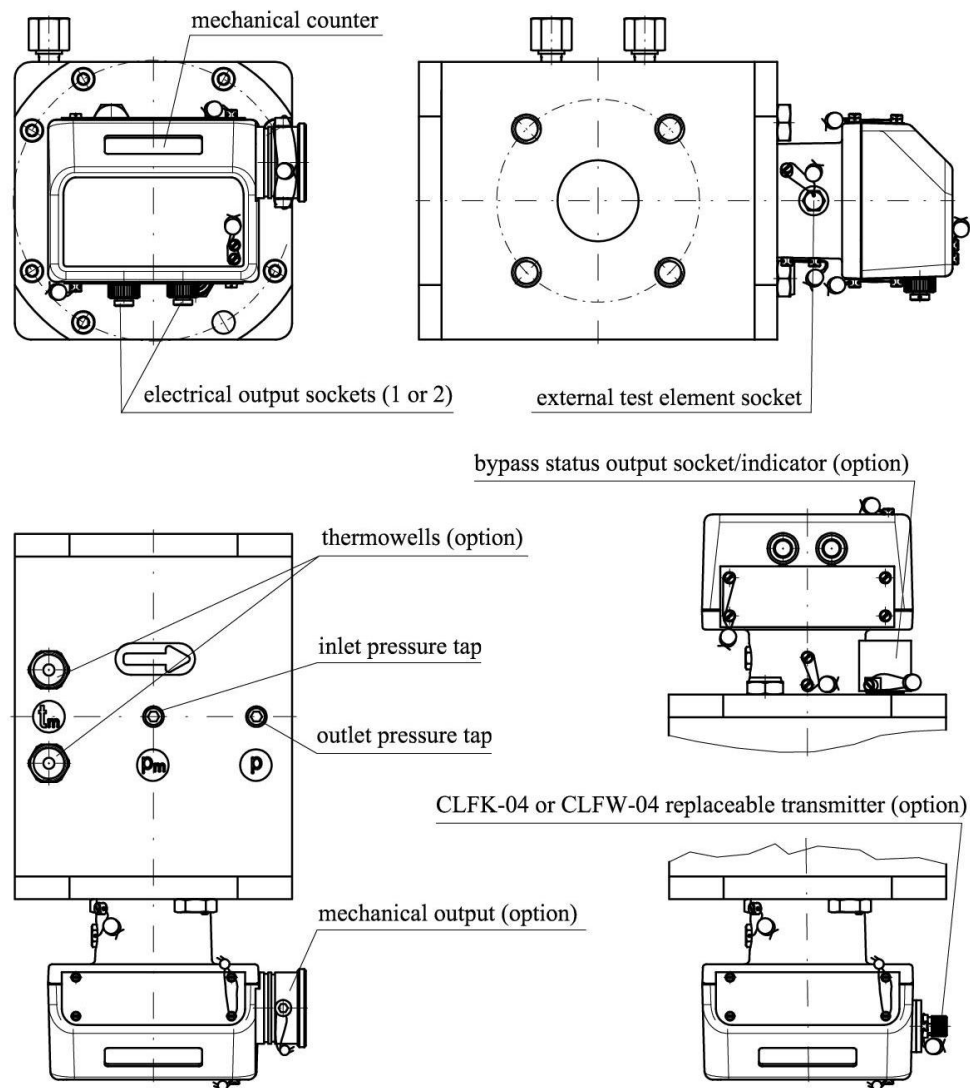


Fig. 4. Location of measurement outputs of CGR-FX gas meter

**Mechanical counter** is installed inside the index unit and visible through a polycarbonate inspection window. The counter allows direct readout of the total volume of gas that has flown through the gas meter under operating pressure and temperature conditions. Index head may be rotated around the horizontal axis of the gas meter in a range of ca. 350°, allowing convenient readout of the counter from virtually all directions.

**Electrical signal outputs.** There are two types of electrical signal outputs: low frequency (LF) and high frequency (HF) outputs. Index head can be equipped with maximum two sockets and six pulse transmitters. The available pulse transmitters are:

- one or two inductive high frequency pulse transmitters (HF),
- one or two inductive low frequency pulse transmitters (LFI),
- one or two low frequency reed contact pulse transmitters (LFK),
- one low frequency pulse transmitter equipped with Wiegand sensor (LFW),
- one control circuit utilising normally closed reed relay switch (AFK).

LFK reed relay and Wiegand LFW pulsers are designed to work with a battery-powered or grid/battery-powered data logger and volume converter located in the vicinity of the gas meter (up to ca. 2 m). HF and LFI inductive pulse transmitters may emit electrical current signals over significantly longer distances (up to ca. 200 m, depending on the conditions). Due to high power consumption, these pulse transmitters are designed to work only with grid-powered volume converters. Gas volumes corresponding to a single pulse of CGR-FX gas meters LF pulsers are given in Table 2. The number of HF pulses per one square meter of gas is determined individually for each gas meter and listed on its type plate. The approximate values of HF transmitters pulse factors are given in Table 2. The HF output is particularly useful for the meter gas fluctuations monitoring.


All pulse transmitters installed inside index unit are connected to 6 contact Amphenol-Tuchel C091 31N006 1002 or Lumberg 0304 06 sockets (1 or 2) on the rear side of the unit. Index connecting cables should be equipped with Amphenol-Tuchel C091 31H006 1002 or Lumberg 0332 06 plugs. All the connectors in CGR-FX gas meters are IP67 protected. Table 3 presents all alternative connections of pulsers to electrical signal output sockets.



**Table 3. Alternative connections of pulse transmitters to electrical output sockets**

	Pin	Polarity	LFK 1 or LFW 1	LFK 2 or LFW 2	AFK	(*) LFI 1	(*) LFI 2	HF 1	HF 2
Socket 1	1	-	S			O			
	4	+		S		O			
	2	-			O	P	P	O	O
	5	+			O	P	P	O	O
	3	-				O		P	
	6	+				O		P	
Socket 2	1	-		P		O			
	4	+		P		O			
	2	-		O	O	O	P		O
	5	+		O	O	O	P		O
	3	-						O	P
	6	+						O	P
<p>S – standard connections, P – preferred connections, O – optional connections            (*) – not available in index units with replaceable LF pulse transmitters            Index sockets wiring diagrams are shown on type plates Fig. 8b, 8c and 8d.</p>									
<p><b>Standard versions of CGR-FX gas meters features only one            LFK 1 low frequency reed contact pulse transmitter</b></p>									

One of the inductive pulsers installed in the index head may act as a gas meter test element. If the index is not equipped with HF pulse transmitters, an external test element can be connected (see section VII). Common S.A. offers CHFI-04 inductive pulsers specially

designed as external test elements. The pulse factor of the external test element is equal to HF1 and HF2 pulse factor and is given on the gas meter type plate. If an external test element is not connected, its socket must be tightly plugged and sealed (Fig. 10a and 10b).

In line with the conditions for use, CGR-FX gas meters should be equipped with pulse transmitters allowing for at least  II 2G Ex ib IIC T5 Gb protection. This condition is met by the following pulse transmitter types installed in the index unit:

- HF Bi1-EG05-Y1<sup>(1)</sup> type by Hans Turck GmbH  II 1G Ex ia IIC T6
- LFI Si5-K09-Y1<sup>(1)</sup> type by Hans Turck GmbH  II 1G Ex ia IIC T6
- LFK CLFK-03 type by Common S.A.
- LFW CLFW-01 type by Common S.A.
- LFW CLFW-02 type by Common S.A.

(1) – linear characteristics of pulse transmitter power circuit required

### Acceptable intrinsic safety parameters


Bi1-EG05-Y1	Si5-K09-Y1	CLFK-03	CLFW-01 CLFW-02
<b>U<sub>i</sub> = 20 V DC</b>	<b>U<sub>i</sub> = 20 V DC</b>	<b>U<sub>i</sub> = 15,5 V DC</b>	<b>U<sub>i</sub> = 30 V DC</b>
<b>I<sub>i</sub> = 60 mA</b>	<b>I<sub>i</sub> = 60 mA</b>	<b>I<sub>i</sub> = 52 mA</b>	<b>I<sub>i</sub> = 52 mA</b>
<b>P<sub>i</sub> = 200 mW</b>	<b>P<sub>i</sub> = 130 mW</b>	<b>P<sub>i</sub> = 169 mW</b>	<b>P<sub>i</sub> = 0,6 W</b>
<b>L<sub>i</sub> = 150 μH</b>	<b>L<sub>i</sub> = 350 μH</b>	<b>L<sub>i</sub> ≈ 0</b>	<b>L<sub>i</sub> ≈ 0</b>
<b>C<sub>i</sub> = 150 nF</b>	<b>C<sub>i</sub> = 250 nF</b>	<b>C<sub>i</sub> ≈ 0</b>	<b>C<sub>i</sub> ≈ 0</b>

#### ATTENTION!

The total voltage of separate galvanic intrinsically safe circuits connected to one connector must comply with:  $U_{i1} + U_{i2} \leq 30 \text{ V}$

Intrinsic safety parameters of the pulse transmitters installed in the gas meter are listed on the type plate.

The intrinsic safety requirements are met by the following pulse transmitters:

- HF CHFI-04<sup>(1)</sup> type by Common S.A.  II 2G Ex ia IIC T6.
- LFK CLFK-04 type by Common S.A.
- LFW CLFW-04 type by Common S.A.

(1) - linear characteristics of pulse transmitter power circuit required

### Acceptable intrinsic safety parameters

CHF1-04	CLFK-04	CLFW-04
<b>U<sub>i</sub> = 20 V DC</b>	<b>U<sub>i</sub> = 15,5 V DC</b>	<b>U<sub>i</sub> = 30 V DC</b>
<b>I<sub>i</sub> = 60 mA</b>	<b>I<sub>i</sub> = 52 mA</b>	<b>I<sub>i</sub> = 52 mA</b>
<b>P<sub>i</sub> = 200 mW</b>	<b>P<sub>i</sub> = 169 mW</b>	<b>P<sub>i</sub> = 0,6 W</b>
<b>L<sub>i</sub> = 150 μH</b>	<b>L<sub>i</sub> ≈ 0</b>	<b>L<sub>i</sub> ≈ 0</b>
<b>C<sub>i</sub> = 150 nF</b>	<b>C<sub>i</sub> ≈ 0</b>	<b>C<sub>i</sub> ≈ 0</b>

#### NOTICE!

Intrinsic safety parameters are electrical parameters determined during analysis of the device construction. Their values are determined for the most unfavourable operating conditions or a failure of the device. Values of these parameters are limited to safe levels of specific gas mixture. They are not to be regarded as rated working parameters of the device operation.

Compatibility of intrinsic safety parameters of external devices connected to CGR-FX meters are presented in the below table.

Compatibility conditions for intrinsic safety parameters				
External device			Condition	
Output voltage	<b>U<sub>o</sub></b>	≤	<b>U<sub>i</sub></b>	Input voltage
Output current	<b>I<sub>o</sub></b>	≤	<b>I<sub>i</sub></b>	Input current
Output power	<b>P<sub>o</sub></b>	≤	<b>P<sub>i</sub></b>	Input power
Maximum external capacitance	<b>C<sub>o</sub></b>	$C_o \geq C_i + C_k$	<b>C<sub>i</sub></b>	Internal capacitance
Maximum external inductivity	<b>L<sub>o</sub></b>	$L_o \geq L_i + L_k$	<b>L<sub>i</sub></b>	Internal inductivity

As regards (C<sub>k</sub>) and (L<sub>k</sub>) connecting cable parameters, the following parameters shall be assumed:

- The most unfavourable parameters declared by the cable manufacturer.
- Parameters measured in accordance with **EN 60079-14** or: 200pF/m and 1μH/m, or 30μH/Ω, where the connection contains two or three cable conductors (with or without screen).

### Nominal operating parameters of pulse transmitters:

LFK (reed contact) and LFW (Wiegand) [open collector transmitters]

#### CLFK-03 / CLFK-04 / CLFW-01 / CLFW-02 / CLFW-04

closed switch resistance  $R_z = 100\Omega \div 2 \text{ k}\Omega$

open switch resistance  $R_o > 100 \text{ M}\Omega$

max. switching frequency  $f_p = 2 \text{ Hz}$

Inductive proximity pulse transmitters – NAMUR standard

#### Si5-K09-Y1

#### Bi1-EG05-Y1 / CHFI-04

max. switching frequency  $f_p = 2 \text{ Hz}$

$f_p = 0,5 \text{ kHz}$

rated operating voltage  $U_n = 8,2 \text{ V}$

rated current of non-activated switch  $I \geq 2,1 \text{ mA}$

rated current of activated switch  $I \leq 1,2 \text{ mA}$

All the other nominal operating parameters of pulse transmitters offered for CGR-FX gas meters are in line with the requirements of the PN-EN 60947-5-6:2002 standard.

Please observe the correct polarity when connecting CGR-FX meters to external devices. It is not required in case of LFK and AFK pulsers only.

### Temperature measurement output

CGR-FX rotary gas meters offer temperature measurement only when delivered as a special order version (temperature measurement is not available in standard version). Temperature probes are not parts of the special version meter equipped with the temperature tap and it is necessary to order them separately.

Optional temperature measurement outputs are located at the inlet on both sides of the meter body (up to 4 outputs). Specified outputs are equipped with thermowells (Fig. 5) with length of 110 mm in case of “171” series meters and 120 mm for “241” series meters. The thermowells feature G ½” or M12x1,5 internal thread sockets. Temperature sensors must

be installed in thermowells filled with silicone oil to improve measurement accuracy. Thermowells not in use should be plugged (Fig. 5a), as well as temperature outputs without thermowells (¼ NPT plug, as presented in Fig. 6a).

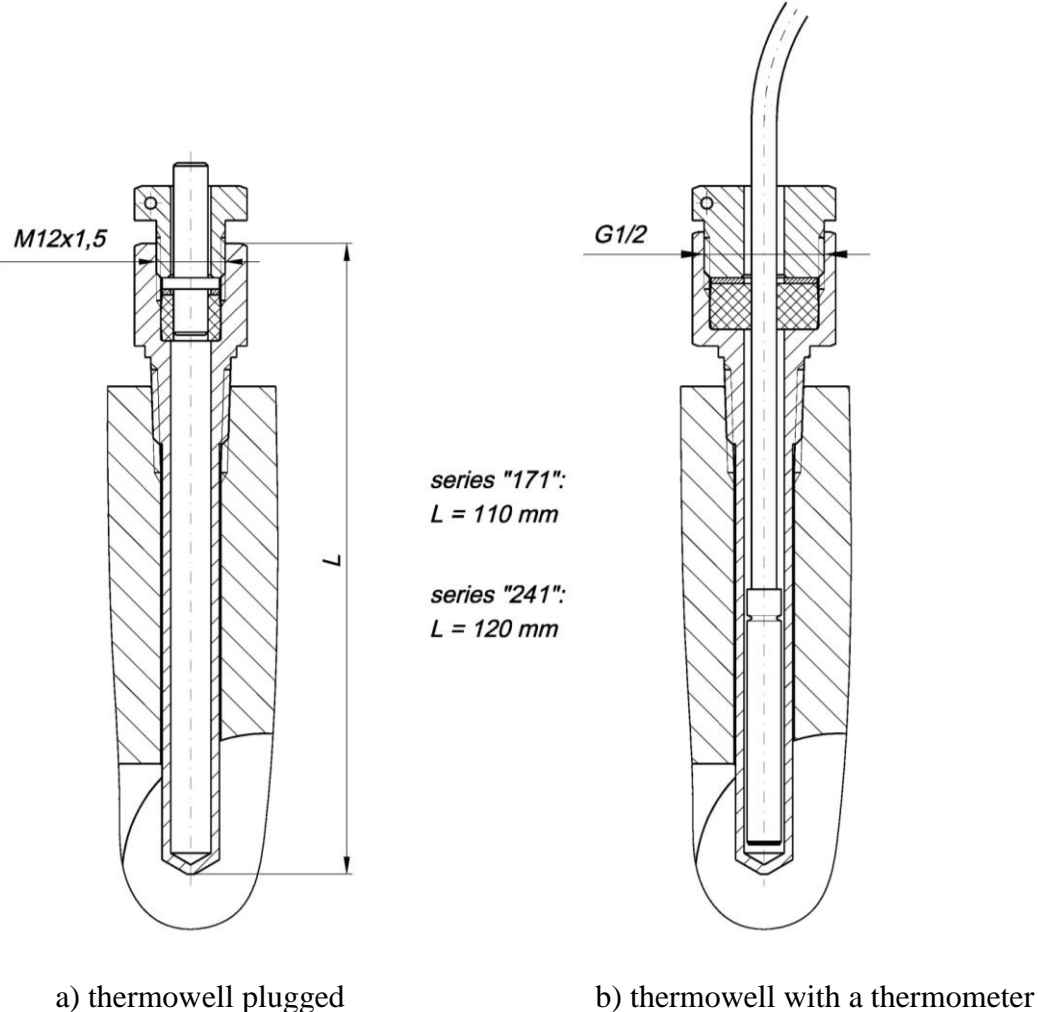


Fig. 5. Thermowells

**Pressure measurement output**

Pressure taps for pressure measurement at the inlet of the gas meter are located centrally on both sides of the meter main body. Two additional outputs for measuring the pressure downstream the meter measuring chamber are placed at the outlet of the meter body. All taps are ¼ NPT internal thread sockets (Fig. 6).

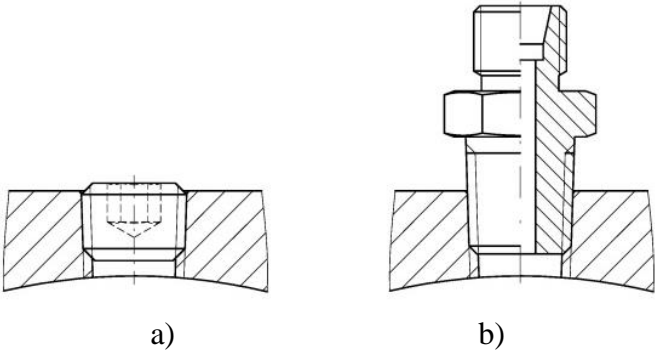


Fig. 6. ¼ NPT pressure measurement output

Pressure outputs are used for connecting pressure transducers, either directly to the socket or via three-way valves. The outputs must be blinded if not in use (Fig. 6a) or equipped with pressure measurement connectors (Fig. 6b), also blinded when not used. Both plugs and connectors should be protected by installation seals.

**Mechanical counter output (option)**

The gas meter may be optionally equipped with a mechanical output. The mechanical output may be used to drive external, removable accessories connected to the gas meter counter. A flat end of the counter shaft is located on the right side of the index head and covered by a protective cap. The rotational speed of the shaft is equal to the speed of the fastest digit wheel of the counter. The shaft rotates in counter-clockwise direction. This direction is marked on the plate (Fig. 7b) fixed at the mechanical output cover. The value of the maximum allowable load torque on the mechanical output shaft  $M_{max} = \dots\dots$  [Nmm] and the constant corresponding to a single revolution of the drive shaft  $1 \text{ tr} = \dots\dots$  [m<sup>3</sup>] are also given on the plate.

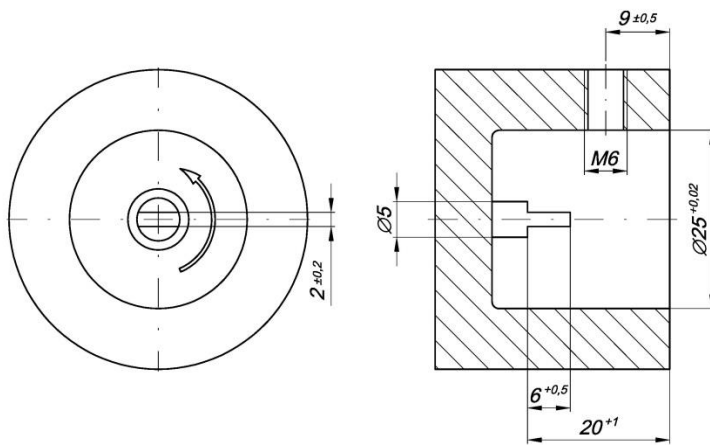


Fig. 7a. Mechanical output drive shaft

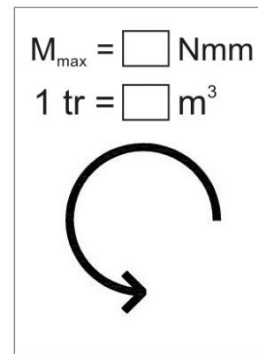


Fig. 7b. Mechanical output type plate

**IV. LABELLING AND PROTECTION**

Information on the basic technical parameters of the gas meter along with the serial number and manufacture year is listed on rating plates (Fig. 8a, 8b, 8c and 8d) fixed to the index head unit.

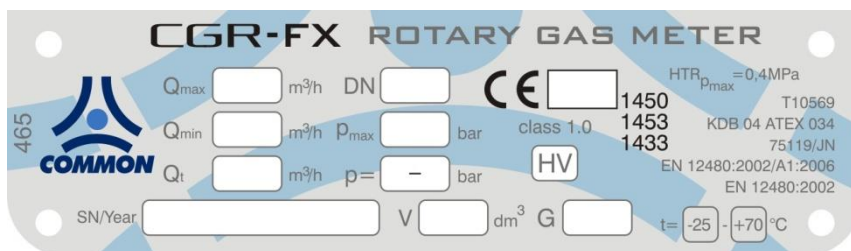


Fig. 8a. Type plates – HTR special version

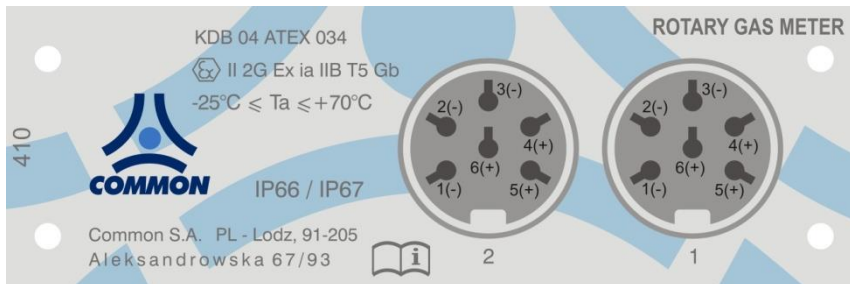
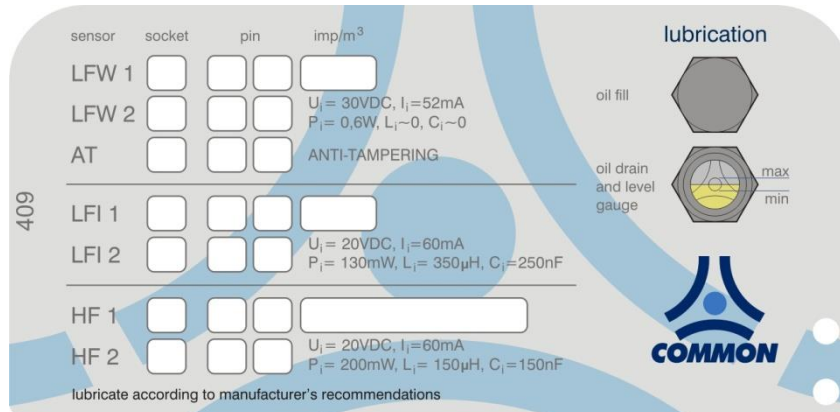
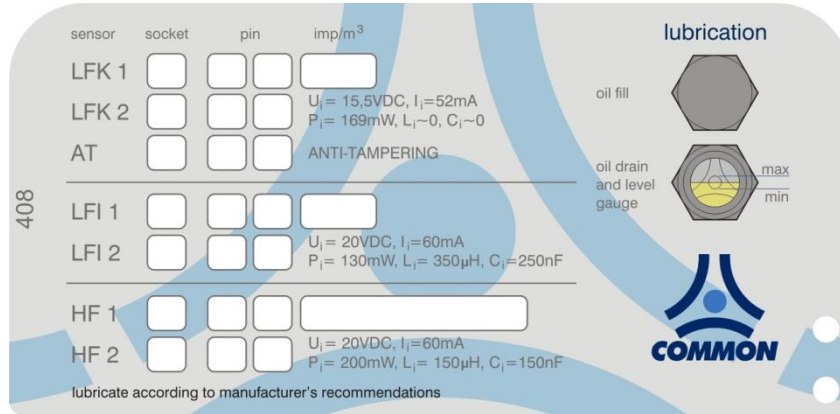
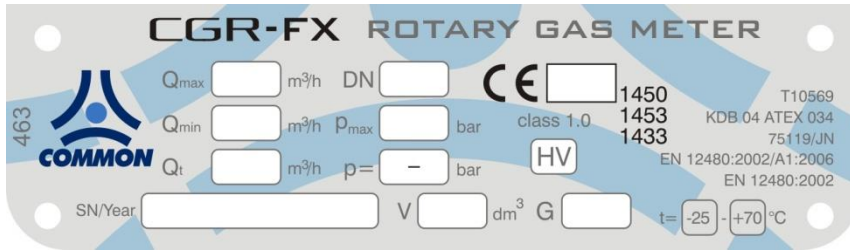


Fig. 8b. Type plates – standard version for IIA and IIB explosion groups

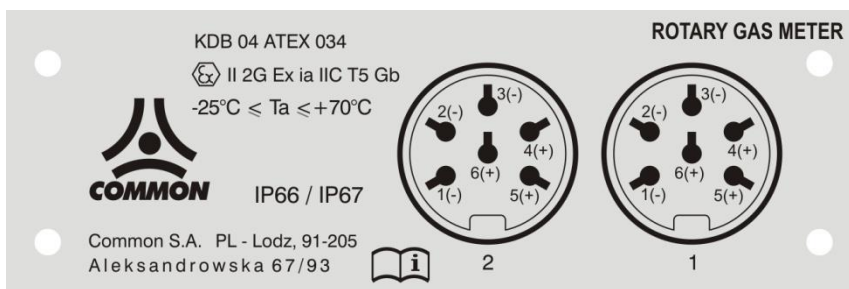


Fig. 8c. Type plates – special version for IIC explosion group



**468**

**COMMON**

**CGR-FX ROTARY GAS METER**


Q<sub>max</sub>  m<sup>3</sup>/h DN  CE  1450  
 T10569  
 KDB 04 ATEX 034  
 75119/JN  
 EN 12480:2002/A1:2006  
 EN 12480:2002

Q<sub>min</sub>  m<sup>3</sup>/h P<sub>max</sub>  bar class 1.0 HV

Q<sub>t</sub>  m<sup>3</sup>/h p =  bar

t = -25 - +70 °C

SN/Year  V  dm<sup>3</sup> G





**431**

sensor	socket	pin	imp/m <sup>3</sup>
LFK 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
LFK 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
AT	<input type="text"/>	<input type="text"/>	<input type="text"/>
U <sub>i</sub> = 15,5VDC, I <sub>i</sub> = 52mA P <sub>i</sub> = 169mW, L <sub>i</sub> = 0, C <sub>i</sub> = 0			
ANTI-TAMPERING			
LF1 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
LF1 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
U <sub>i</sub> = 20VDC, I <sub>i</sub> = 60mA P <sub>i</sub> = 130mW, L <sub>i</sub> = 350μH, C <sub>i</sub> = 250nF			
HF 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
HF 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
U <sub>i</sub> = 20VDC, I <sub>i</sub> = 60mA P <sub>i</sub> = 200mW, L <sub>i</sub> = 150μH, C <sub>i</sub> = 150nF			


lubricate according to manufacturer's recommendations

**lubrication**

oil fill 

oil drain and level gauge 

**COMMON**





**432**

sensor	socket	pin	imp/m <sup>3</sup>
LFW 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
LFW 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
AT	<input type="text"/>	<input type="text"/>	<input type="text"/>
U <sub>i</sub> = 30VDC, I <sub>i</sub> = 52mA P <sub>i</sub> = 0,6W, L <sub>i</sub> = 0, C <sub>i</sub> = 0			
ANTI-TAMPERING			
LF1 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
LF1 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
U <sub>i</sub> = 20VDC, I <sub>i</sub> = 60mA P <sub>i</sub> = 130mW, L <sub>i</sub> = 350μH, C <sub>i</sub> = 250nF			
HF 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
HF 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
U <sub>i</sub> = 20VDC, I <sub>i</sub> = 60mA P <sub>i</sub> = 200mW, L <sub>i</sub> = 150μH, C <sub>i</sub> = 150nF			


lubricate according to manufacturer's recommendations

**lubrication**

oil fill 

oil drain and level gauge 

**COMMON**



**433**

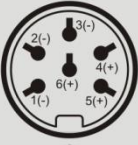
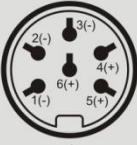
**COMMON**

KDB 04 ATEX 034  
 II 2G Ex ia IIB T5 Gb  
 -25°C ≤ Ta ≤ +70°C


IP66 / IP67

Common S.A. PL - Lodz, 91-205  
 Aleksandrowska 67/93

**ROTARY GAS METER**

2 1



**434**

**COMMON**

KDB 04 ATEX 034  
 II 2G Ex ia IIB T5 Gb  
 -25°C ≤ Ta ≤ +70°C

IP66 / IP67

Common S.A. PL - Lodz, 91-205  
 Aleksandrowska 67/93

**ROTARY GAS METER**



1



Fig. 8d. Examples of nameplates of CGR-FX gas meters (adhesive label version)

The upper and bottom face of the gas meter body is marked in respect to meter gas flow direction and pressure and temperature measurement outputs (Fig. 4).

Following verification performed by the authorized manufacturer laboratory, each gas meter is protected with seals located as shown in Fig. 10a and 10b. Seal P1 is an initial verification seal (Fig. 9a and 9b) or repeated legalization seal and seals P2÷ P13 are protective seals.



Fig. 9a. Initial verification stamp

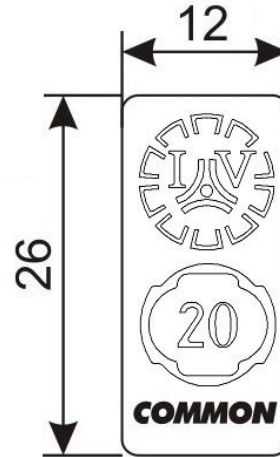


Fig. 9b. Initial verification security label

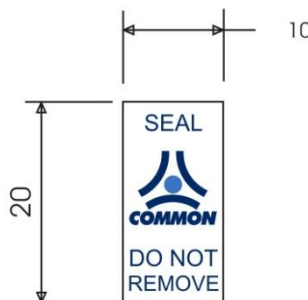
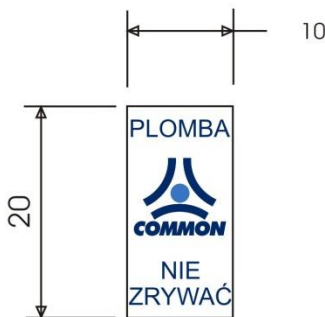


Fig. 9c. Protective seals (examples)

Each gas meter can be delivered along with a calibration certificate as a document confirming its metrological performance (error of indication).

The initial verification period depends on metrological regulations in the country of the meter installation. Before the end of the verification period, the gas meter should be submitted for secondary verification at an authorized laboratory (one should also provide for the lead time preceding the final legal approval date).

Common S.A. offers secondary verification at the manufacturer's laboratory, allowing for adjustments or repairs of the gas meters, if required.

**Presence of an intact verification seal is required to regard the gas meter as a legal measurement device.**

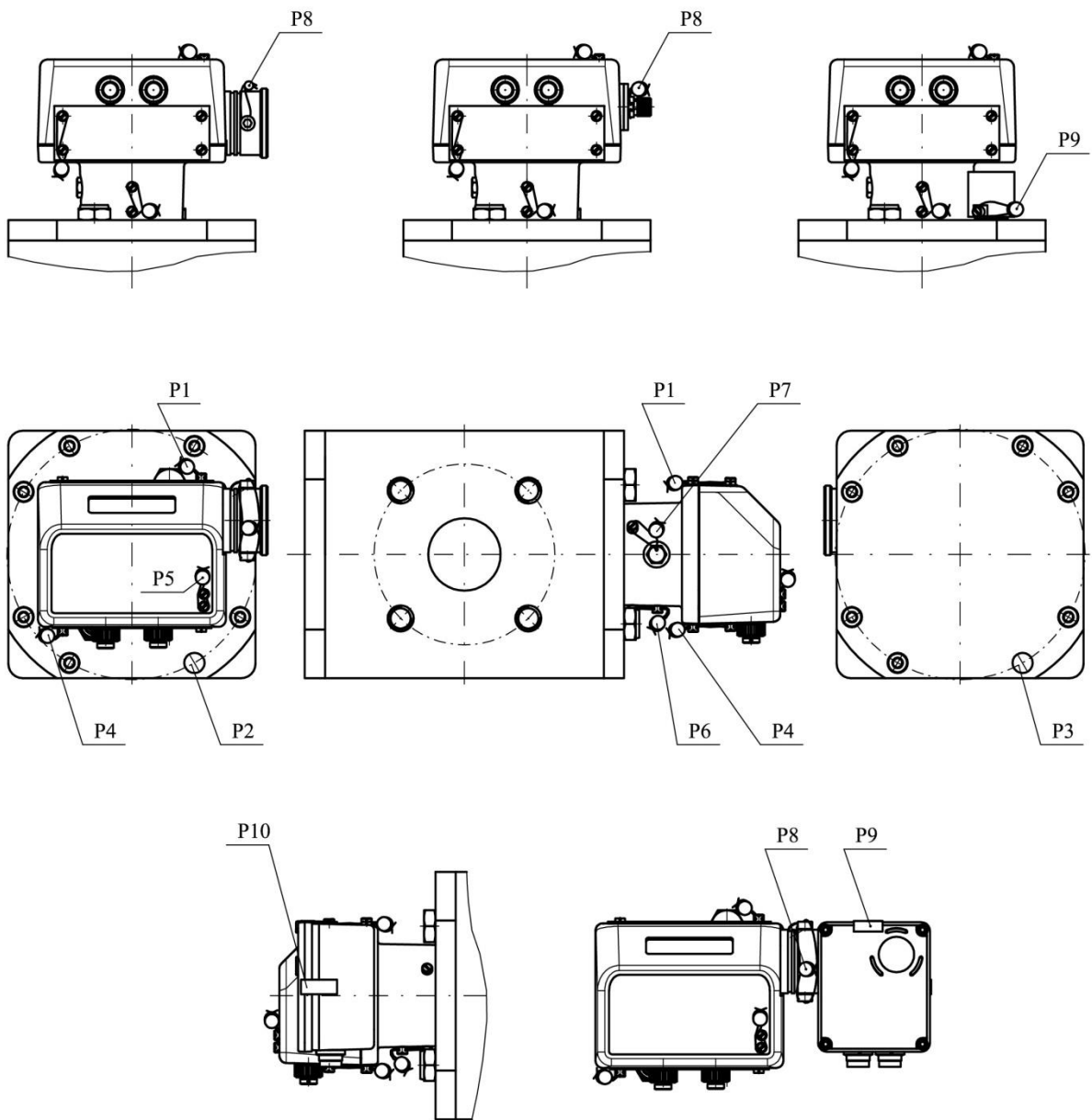


Fig. 10a. CGR-FX rotary gas meter seals locations (version 1)

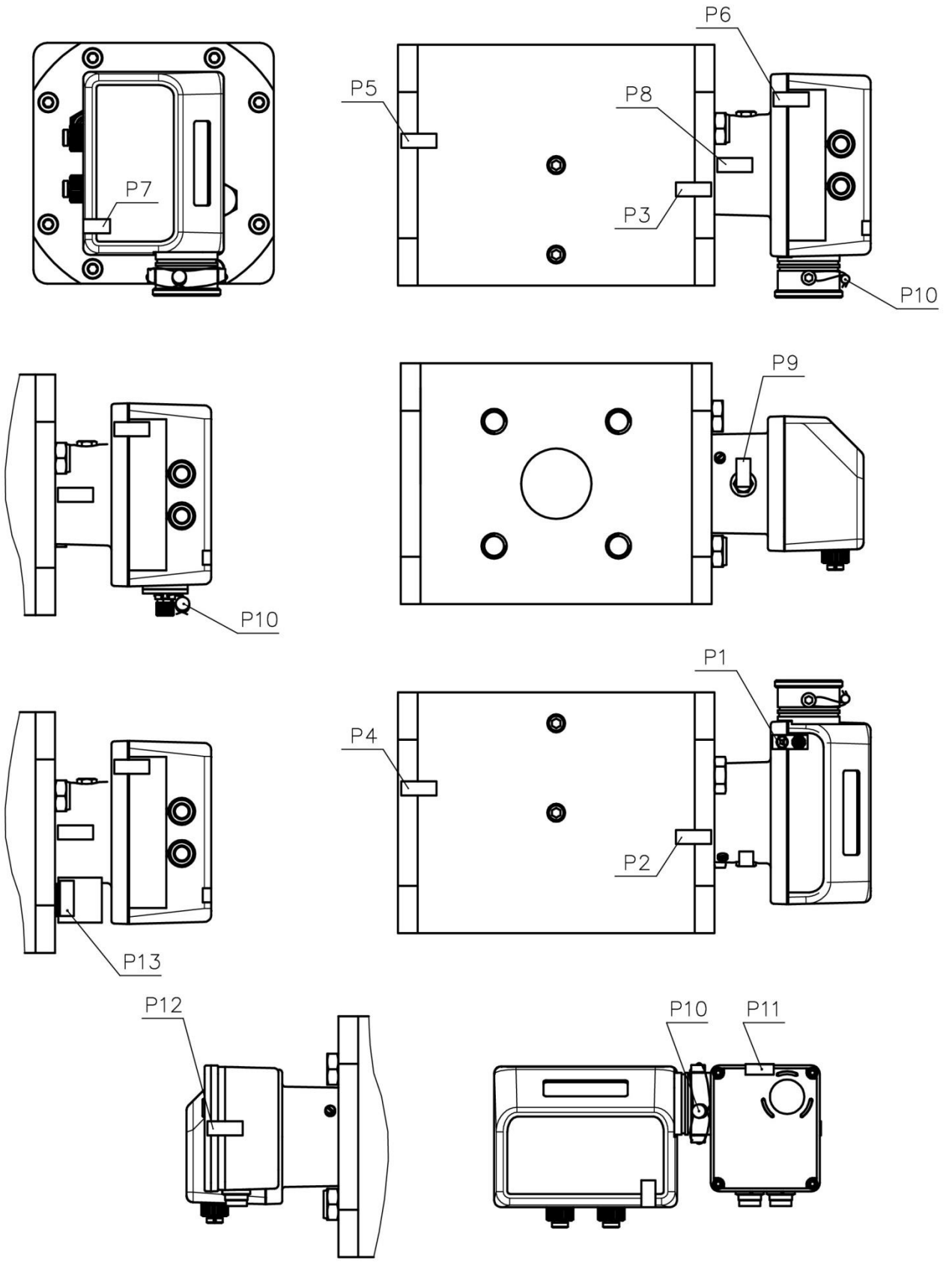


Fig. 10b. CGR-FX rotary gas meter seals locations (version 2)

## ***V. PACKAGING, TRANSPORT AND STORAGE***

The gas meter is supplied in factory-made packaging which provides appropriate protection during transport and storage (Fig. 11a and 11b). The packaging consists of reinforced cardboard box and profiled cardboard inserts. Appropriate information regarding the contents and restrictions on gas meter loading/unloading and transport is printed on the packaging. Side walls of the box feature handle holes for manual handling. Gas meters submitted for repair or renewed legal approval should be sent in factory-made packaging or other packaging providing at least equal protection during transport.

CGR-FX rotary gas meters produced by Common S.A. are supplied with the following accessories:

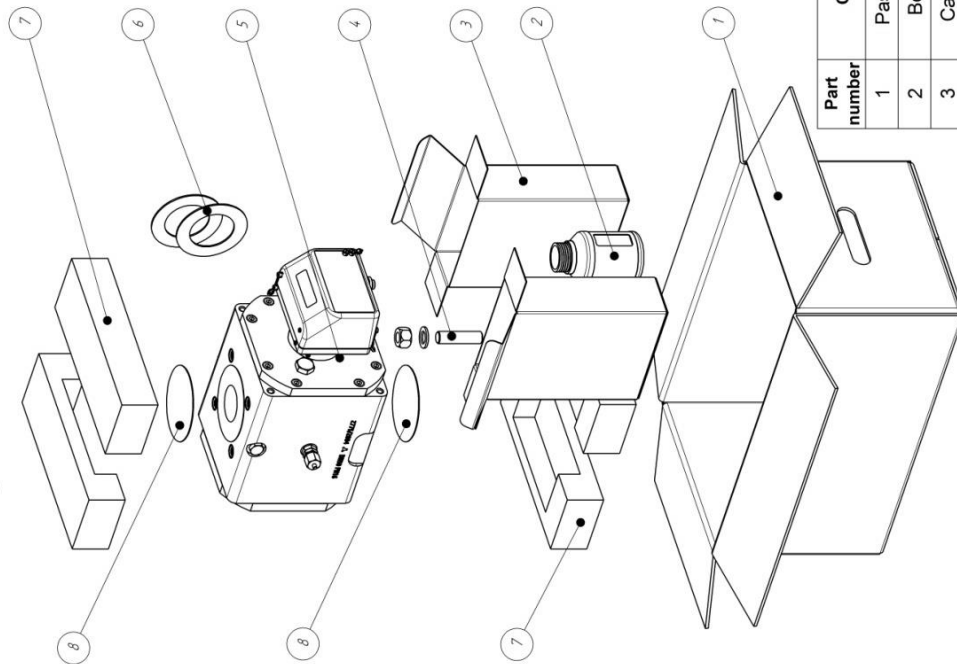
- 6 contact Amphenol-Tuchel C091 31H006 1002 or Lumberg 0332 06 plug for connecting a converter or data logger to the low frequency electrical signal output (1 or 2 plugs, depending on the number of outputs; plugs not supplied if the gas meter is delivered with a converter or data logger and complete connecting cables);
- bottle of oil for gas meter lubrication;
- fasteners for installation of the gas meter on pipelines: M16x70 hexagonal flat end or hexagonal socket set screws compliant with the PN-EN ISO 4026:2004 standard, washers and nuts;
- the operation manual (alternatively: one manual for a batch of meters, upon agreement with the customer).

**CGR-FX rotary gas meter is a high precision measurement device  
and should be handled with appropriate caution.**

The following principles should be observed during transport and storage of CGR-FX rotary gas meters:

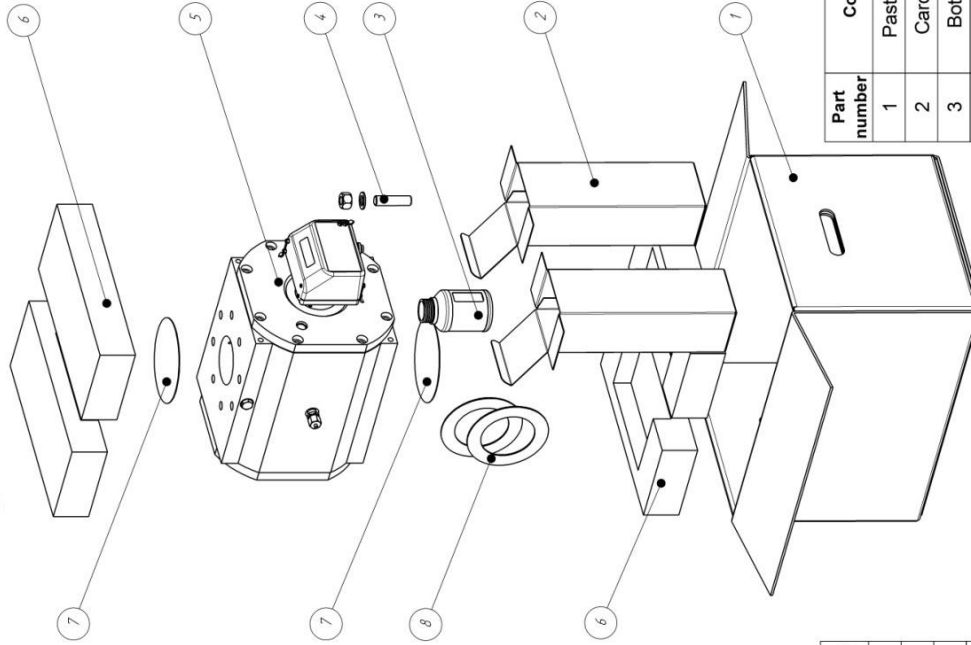
1. Gas meters should not be thrown, turned over or subjected to strong impacts (including transport on (unsprung) hand trolleys).
2. One must not lift or carry the gas meter by holding by the index unit.
3. Factory-placed covers or other shields of gas meter inlet and outlet should not be removed until directly before installation.
4. The storage site should protect the gas meter from atmospheric precipitation and moisture.
5. Care should be taken of the seals placed on the gas meter. **Damage of seals may lead to warranty voidance and legal consequences as regards financial settlements between the gas supplier and the customer.**
6. It is not required for gas meter to be filled with lubricating oil during warehouse storage.

### Packing of CGR series "171"



Part number	Component	Number
1	Pasteboard box	1
2	Bottle with oil	1
3	Cardboard box	2
4	Bolts, nuts, washers	
5	Rotary gas meter	1
6	Seals	2
7	Cardboard inserts	4
8	Protective sticker	2

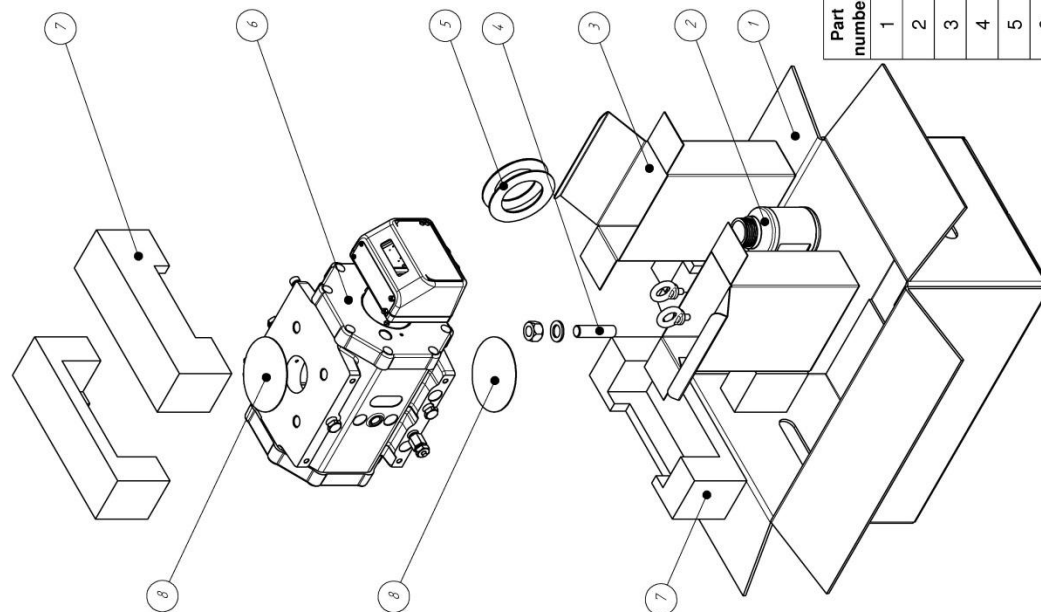
### Packing of CGR series "241"



Part number	Component	Number
1	Pasteboard box	1
2	Cardboard box	2
3	Bottle with oil	1
4	Bolts, nuts, washers	
5	Rotary gas meter	1
6	Cardboard inserts	4
7	Protective sticker	2
8	Seals	2

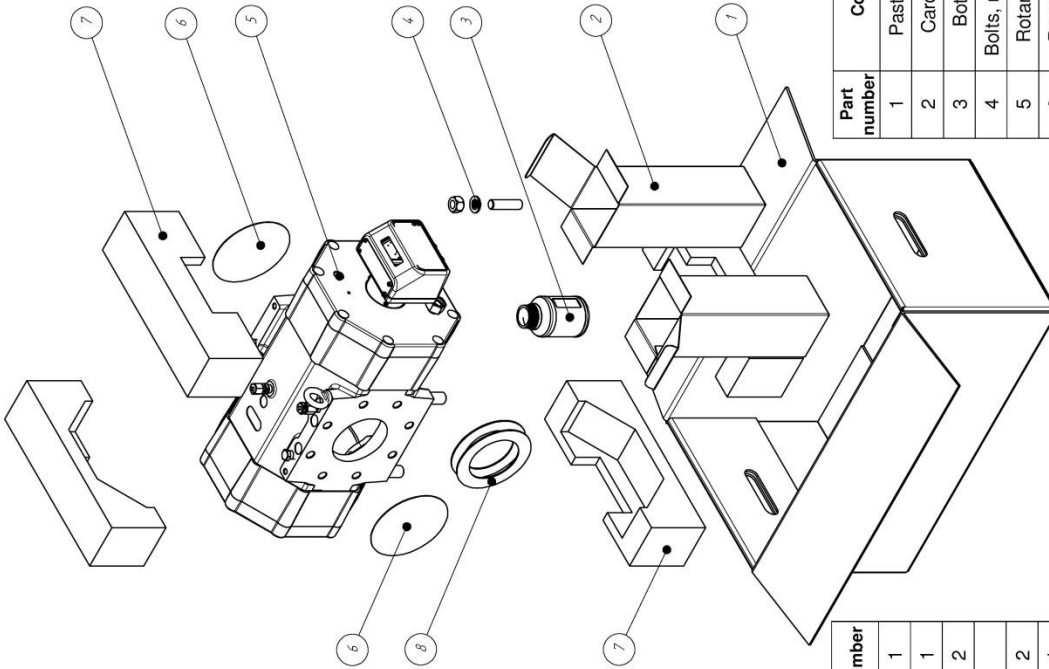
Fig. 11a. Packaging of CGR-FX gas meters (in aluminium alloy bodies)

### Packing of CGR HTB series "171"



Part number	Component	Number
1	Pasteboard box	1
2	Bottle with oil	1
3	Cardboard box	2
4	Bolts, nuts, washers	2
5	Seals	2
6	Rotary gas meter	1
7	Cardboard inserts	4
8	Protective sticker	2

### Packing of CGR HTB series "241"



Part number	Component	Number
1	Pasteboard box	1
2	Cardboard box	2
3	Bottle with oil	1
4	Bolts, nuts, washers	1
5	Rotary gas meter	2
6	Protective sticker	4
7	Cardboard inserts	2
8	Seals	2

Fig. 11b. Packaging of CGR-FX gas meters (in cast iron bodies)

## VI. INSTALLATION AND OPERATION

Before installing the gas meter ensure that it is suitable for the system operational parameters. In particular, the following type plate information should be taken into consideration:

- **Maximum gauge pressure [MPa], labelled  $p_{max}$ ,**
- **Maximum flow rate [ $m^3/h$ ], labelled  $Q_{max}$ .**

**Maximum overload of the gas meter is  $1,25Q_{max}$  and cannot last longer than 30 minutes.**

CGR-FX rotary gas meters may be installed in the following four operating positions (Figure 12 a, b, c, d):

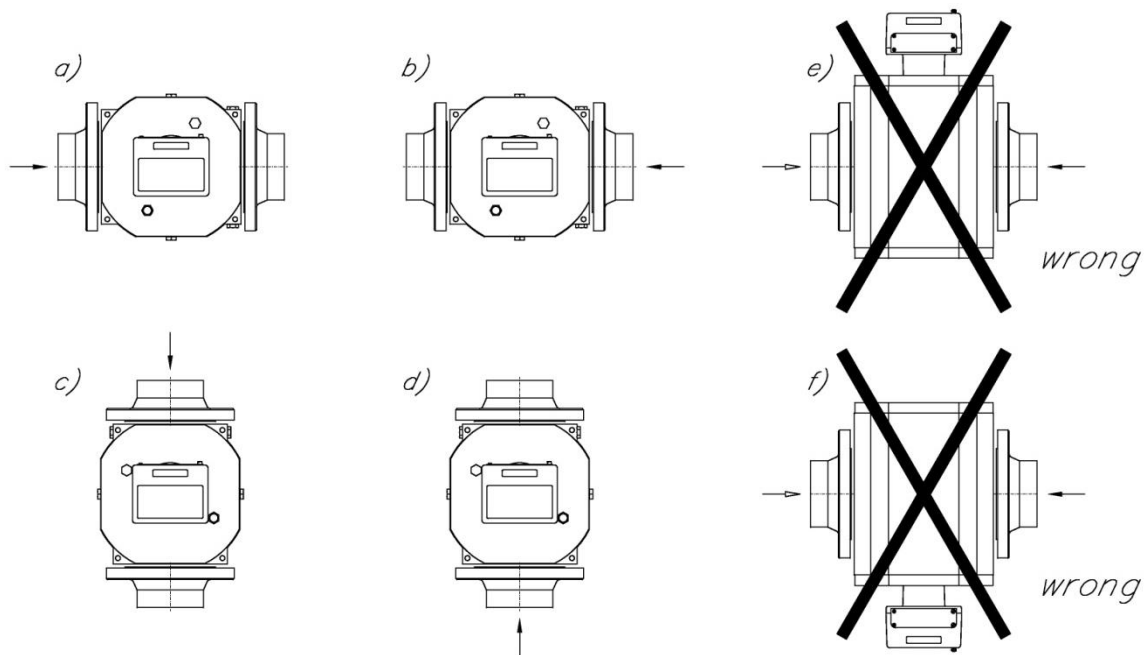


Fig. 12. Operating positions CGR-FX rotary gas meters

**The gas meter may not be installed vertically!  
See Figure 12e and 12f**

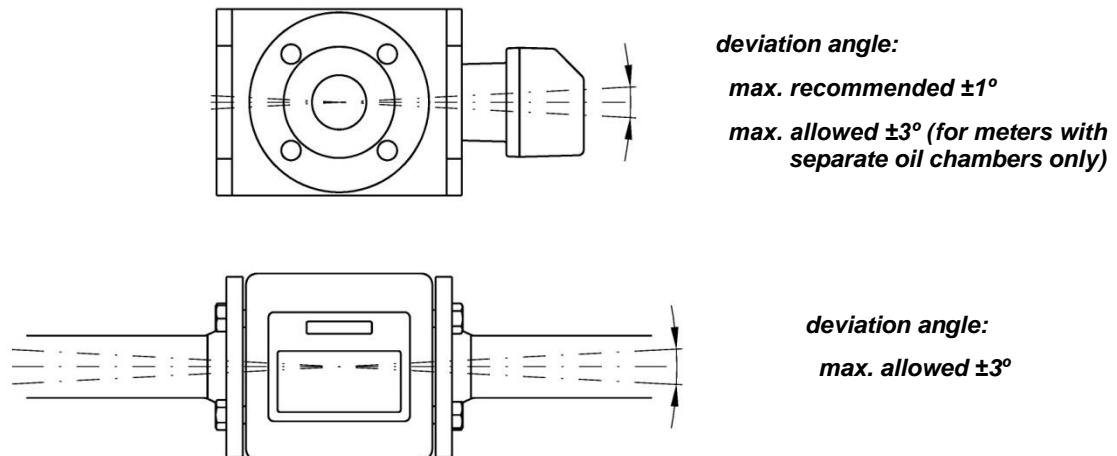


Fig. 13. CGR-FX meters installation acceptable horizontal deviation angles



Gas meters should not be installed at lowest points of the pipework, as condensate and impurities may accumulate in that area and cause the meter damage.

The rotary gas meters can be used both indoors in stabilized temperature conditions and outdoors (open locations). In the latter case, it is recommended that the gas meter is shielded from direct exposure to atmospheric factors (by use of metal containers, casings, roofs, shields etc.).

The gas meter must be installed in between pipeline sections of an appropriate nominal diameter, with axial alignment according to gas industry regulations. The static load of the pipework on the gas meter should not exceed the values given in the EN 12480:2002 standard.

Dimensions listed in Tables 4a, 4b, 4c, 4d and illustrated in Figure 14 may be helpful for the correct positioning a gas meter in the installation.

*Table 4a. Basic dimensions and weights of CGR-FX gas meters in aluminium alloy bodies*

Q <sub>max</sub> m <sup>3</sup> /h	DN					A mm	B mm	L mm	Weight at V <sub>cycl</sub>		Series
	40	50	65	80	100				kg	dm <sup>3</sup>	
16w	+	+				165	171	277	11	0,23	"171"
25p	+	+				165	171	277	11	0,23	
25w	+	+				184	171	296	12	0,31	
40s	+	+				165	171	277	11	0,23	
40p	+	+				184	171	296	12	0,31	
40w	+	+				225	171	337	14	0,50	
65s	+	+	+			184	171	296	12	0,31	
65p	+	+	+			225	171	337	14	0,50	
65w	+	+	+			295	171	407	19	0,81	
100s		+	+	+		225	171	337	14	0,50	
100p		+	+	+		295	171	407	19	0,81	
100w		+	+	+		391	171	503	24	1,24	
160s		+		+		295	171	407	19	0,81	
160p		+		+		391	171	503	24	1,24	
250s				+		391	171	503	24	1,24	
160p				+	+	249	241	356	25	1,29	"241"
160w				+	+	314	241	421	31	2,00	
250s				+	+	249	241	356	25	1,29	
250p				+	+	314	241	421	31	2,00	
250w				+	+	439	241	546	42	3,34	
400s				+	+	314	241	421	31	2,00	
400p				+	+	439	241	546	42	3,34	
650s					+	439	241	546	42	3,34	

p – basic version

w – low-speed version (larger overall dimensions, reduced pressure loss and noise level)

s – high-speed version (smaller overall dimensions, increased pressure loss and noise level)

Table 4b. Basic dimensions and weights of CGR-FX gas meters in cast iron bodies

Qmax	DN					A	B	L	Weight at V <sub>cycl</sub>		Series
	m <sup>3</sup> /h	40	50	65	80				100	mm	
16w	+	+				246	181	358	33	0,50	"171"
25w	+	+				246	181	358	33	0,50	
40w	+	+				246	181	358	33	0,50	
65p	+	+	+			246	181	358	33	0,50	
65w	+	+	+			316	181	428	38	0,81	
100s		+	+	+		246	181	358	33	0,50	
100p		+	+	+		316	181	428	38	0,81	
100w		+	+	+		412	181	524	45	1,24	
160s		+		+		316	181	428	38	0,81	
160p		+		+		412	181	524	45	1,24	
250s				+		412	181	524	45	1,24	
160w				+	+	327	253	439	64	2,00	"241"
250p				+	+	327	253	449	64	2,00	
250w				+	+	452	253	564	78	3,34	
400s				+	+	327	253	439	64	2,00	
400p				+	+	452	253	564	78	3,34	
650s					+	452	253	564	78	3,34	

p – basic version

w – low-speed version (larger overall dimensions, reduced pressure loss and noise level)

s – high-speed version (smaller overall dimensions, increased pressure loss and noise level)

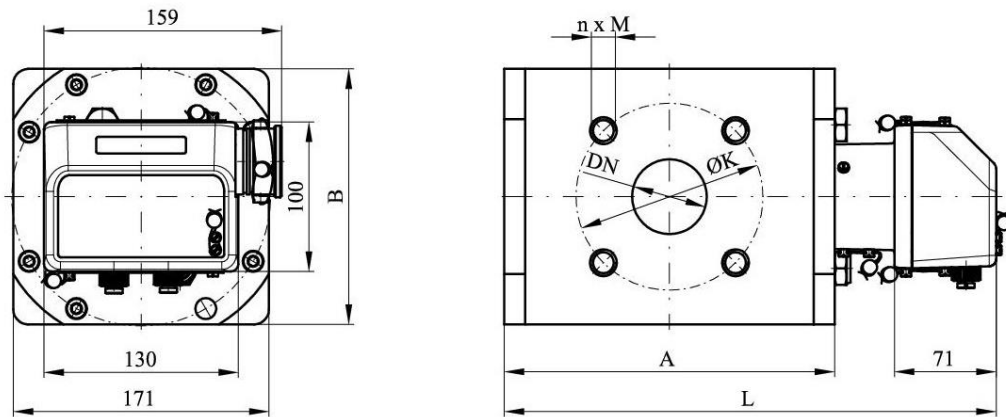
Table 4c. Dimension "K" (diameter of stud circle)

	DN40	DN50	DN65	DN80	DN100
PN 16	110	125	145	160	180
PN 20 (ANSI 150)	98,5	120,7	139,5	152,4	190,5
PN 25	110	125	145	160	190

Table 4d. Quantity of installation studs (n x M)

	DN40	DN50	DN65	DN80	DN100
PN 16	4 x M16	4 x M16	4 x M16 or 8 x M16	8 x M16	8 x M16
PN 20 (ANSI 150)	4 x M14	4 x M16	4 x M16	4 x M16	8 x M16
PN 25	4 x M16	4 x M16	8 x M16	8 x M16	8 x M20

Series "171"



Series "241"

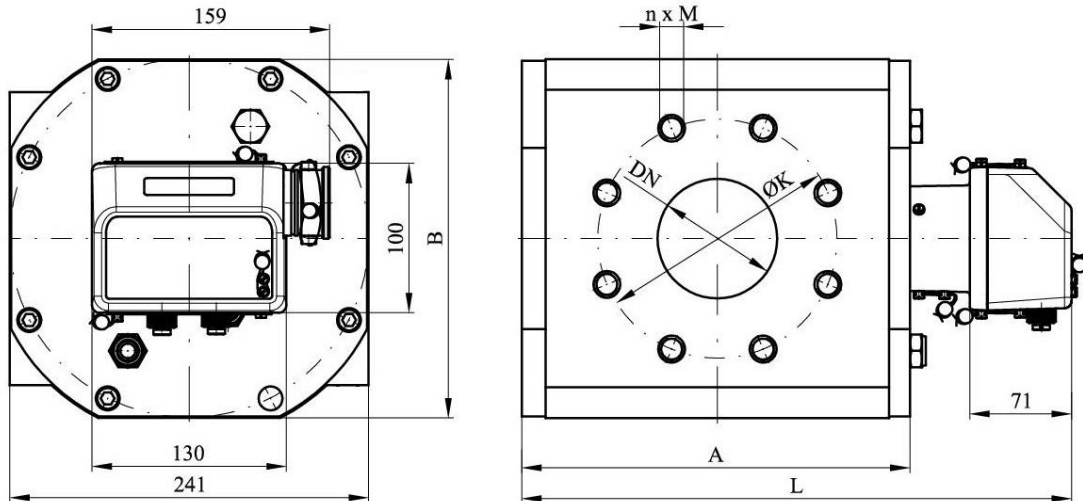


Fig. 14. Basic dimensions of CGR-FX rotary gas meters

The gas meter should be connected to the pipeline flanges by use of the factory-supplied M16x70 set screws or M16 bolts of appropriate length (mechanical property class 5.8). Proper gaskets should be selected for specific flange types and nominal pressures. The required tightening torques of screws/bolts for flange connections are listed in Table 5a and 5b.

Table 5a. Tightening torques for threaded, smooth, lubricated flange connections [Nm]

	DN40	DN50	DN65	DN80	DN100
PN 16	44	44	44 (4xM16) 27 (8xM16)	33	40
PN 20 (ANSI 150)	38	38	38	60	41
PN 25	44	44	44	33	53

Table 5b. Tightening torques for threaded, normal, non-lubricated flange connections [Nm]

	DN40	DN50	DN65	DN80	DN100
PN 16	82	82	82 (4xM16) 50 (8xM16)	61	74
PN 20 (ANSI 150)	71	71	71	112	76
PN 25	82	82	82	62	99

**Before the final installation of the gas meter ensure it is properly directed, that is the arrow on the meter body points in the direction of the gas flow.**

**Do not exceed the torque of 160 Nm when tightening installation screws/bolts!**

Any impurities in the pipework and those contained in gas may cause mechanical damage to the meter rotors or reduce the measurement accuracy. Therefore gas filtration rating not worse than 10 µm upstream the gas meter should be provided (especially if the gas contains large amounts of impurities). It is recommended that the upstream section of the pipework should be carefully cleaned and blown through before installation of the gas meter and a temporary mesh conical strainer installed at the inlet of the upstream pipe section. The filter should be removed after 1÷2 months of operation. If the filter is not removed, monitoring of the filter impurity level should be provided by means of pressure drop measurement or regular inspection. If clogged, the filter could be destructed by the gas pressure and filter debris would damage the gas meter.

**The manufacturer is not responsible for any damages or stoppage of the gas meter resulting from insufficient filtration of the gas flowing through the meter.**

The user should be aware of certain risks associated with significant changes of the gas flow. If the gas flow rate is relatively low for a long time after system launching, some installation works contaminants (e.g. welding debris) can still remain upstream the gas meter. Only after the flow is significantly increased, the contaminants may be swept by the gas and cause the meter damage. For this reason a filter (conical strainer) installed upstream the gas meter may come out to be beneficial until the maximum (target) system capacity is reached. In all cases, protection of the gas meter from mechanical damage is in the user's best interest.

The gas meter should be filled with lubricating oil after installation and before the start-up. Oil supplied and recommended by the gas meter manufacturer should be used. The following oil brands may be used with gases listed in Table 1:

- Lubrina L12 rotary gas meter oil (distributed by Common S.A.),
- VR09 rotary gas meter oil (distributed by Common S.A.),
- Shell Morlina S2 BL 5,
- Castrol Hyspin Oil E 5.

**Different types of oil should be used for lubrication of meters operated for measurement of gases not listed in Table 1. In all such cases consult the lubricating oil type with the manufacturer of the gas meter!**

The level of oil in the gas meter should be controlled during initial filling and subsequent refills through the sight glass. The oil surface must be visible between MIN and MAX levels on the sight glass (Fig. 15c). After filling some quantity of oil into the meter one should wait some time to let the oil get to the rear chamber and check the oil level only then. The sight glass is also used as a drain plug and should be placed in the bottom threaded oil hole of the front cover. If the sight glass is located in the upper oil hole of the cover, it should be replaced with the oil filler plug (Fig. 15a).

Approximate amounts of priming oil, depending on the gas meter position and size (Fig. 12):

position	series "171"	series "241"
"a" or "b"	30 mL	50 mL
"c" or "d"	50 mL	85 mL

Oil volumes required to refill from MIN to MAX level, depending on the gas meter position and size (Fig. 12):

position	series "171"	series "241"
"a" or "b"	10 mL	20 mL
"c" or "d"	15 mL	30 mL

CGR-FX rotary gas meter may be equipped with:

- oil filler plug (Fig. 15a) – standard version,
- pressure oil refill valve (Fig. 15b) – special version.

Each standard CGR-FX gas meter may be transformed into special version by installation of a pressure valve and equipment with an oil refill set.

If the gas meter is equipped with oil filler plug (Fig. 15a), lubricating oil should be poured into the gas meter through the upper oil hole in the front cover after removal of the plug.

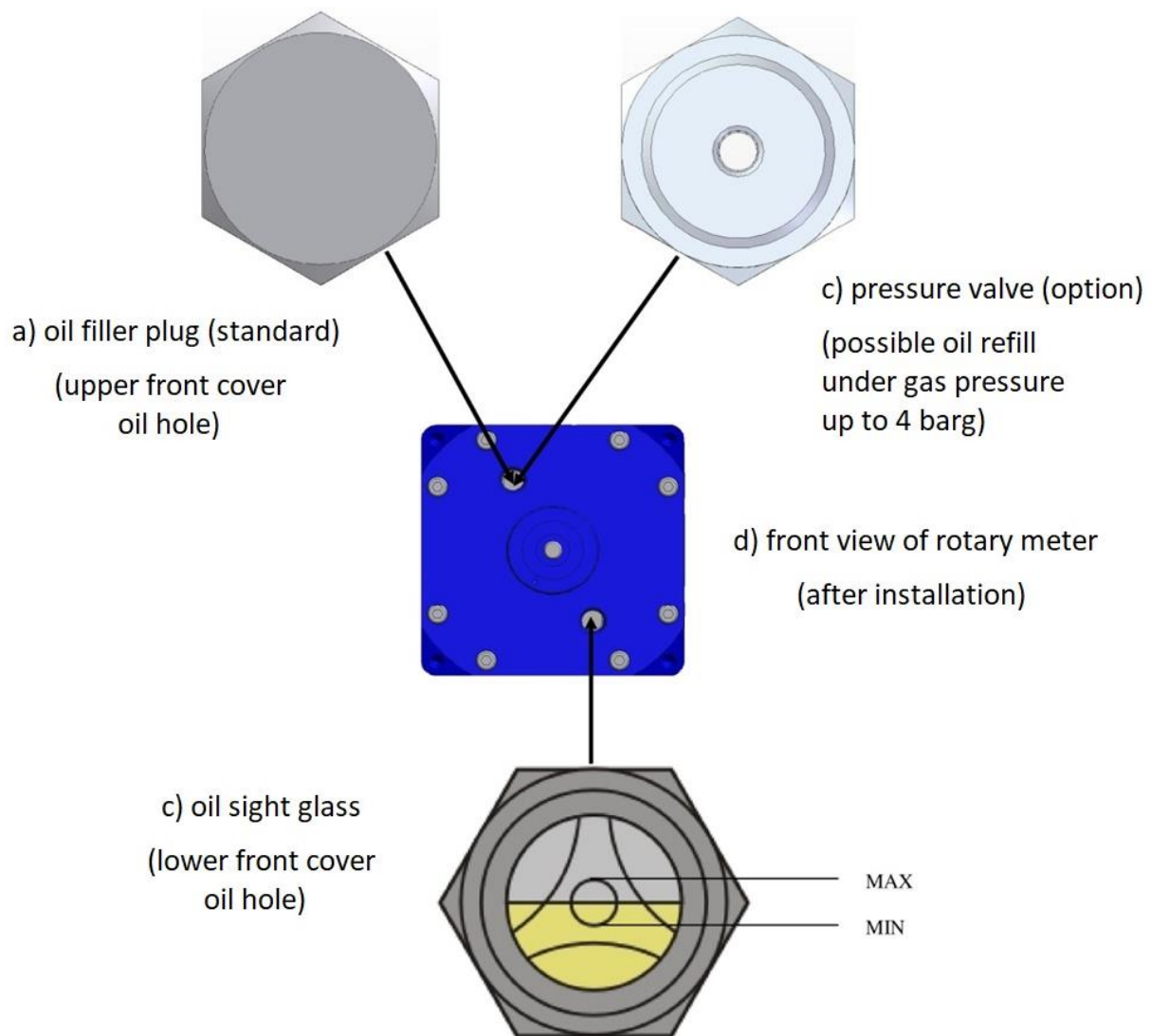


Fig. 15. Lubricating oil holes equipment

**Caution!**

**Gas pressure inside the gas meter should be reduced to atmospheric level before removal of the oil filler plug.**

If the gas meter is equipped with a pressure valve (Fig. 15b), oil may be refilled without reducing the system pressure to atmospheric level. Detailed information is presented in Section VIII. Additional equipment.

**Caution!**

**The pressure valve must not be removed when the gas meter is installed in the system under working pressure**

Optionally, the gas meter can be manufactured with two separate oil chambers, front and rear chamber. In such version, both covers (front and rear) are equipped with separate filler plugs and drain plugs with sight glass.

In a typical gas measurement installation, i.e. in a bypass system (Fig. 16), the gas meter start-up procedure should proceed as follows:

1. The gas meter is being installed while valves 1, 2 and 5 are closed and the bypass valve 4 open. The blow-off valve 3 remains open since gas has been evacuated from the pipework section prior to gas meter installation.
2. After levelling the gas meter and tightening bolts connecting the gas meter to the pipeline, the gas meter should be primed with oil according to the instruction.
3. Then the air must be removed from the pipework by opening valve 5, according to appropriate regulations. Valve 3 remains open.
4. After the air removal, valve 3 must be closed and system gas pressure stabilised with pressure increase rate not larger than  $30 \pm 10$  kPa/s.
5. Valve 5 should be closed after the gas meter counter stops indicating the gas flow (what is associated with pressure alignment in the pipework).
6. Thereafter, valve 1 should be opened, followed by valve 2.
7. Bypass valve 4 should be closed after valve 2 has been fully opened.

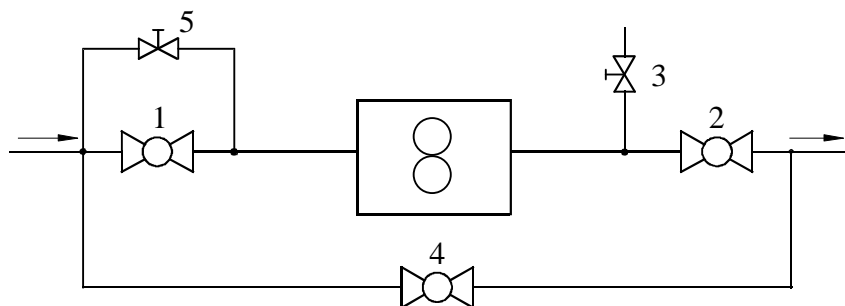


Fig. 16. Diagram of a bypass measurement installation

During a gas meter uninstallation, the above steps should be followed in reverse order, i.e.:

1. Bypass valve 4 is closed as first.
2. Valve 2 is closed, followed by valve 1.
3. Gas from the gas meter section of the measurement system is slowly evacuated by means of the blow-off valve 3, with pressure drop not larger than  $30 \pm 10$  kPa/s.

**Caution!**  
**Drain the oil before uninstalling the gas meter!**

The same principle should be followed in all gas metering installation arrangements, i.e. the gas flowing through the gas meter should be increased or decreased very slowly. Rapid change of the gas flow rate caused by sudden valve opening or closing may lead to the gas meter rotors bearings damage due to rapid and excessive rise of a pressure difference upstream and downstream the meter.

In case of risk of gas meter unacceptable overload (i.e. exceeding maximum gas flow  $Q_{\max}$  by more than 25%) during its operation, the use of a restrictor orifice is recommended. The orifice should be installed at a distance of 5÷10 nominal diameters (DN) downstream the gas meter. The orifice dimensions are calculated individually based on the pipeline nominal diameter, gas flow rate, pressure and temperature. Common S.A. offers design and delivery of the dedicated restriction orifice at the customer's request.

The accuracy of each gas meter counter indication should be checked after the meter installation and start-up. Each digit wheel of the counter should rotate smoothly and after its full revolution the neighbouring left wheel should perform 1/10 of a full revolution.

## VII. OPERATION MONITORING, MAINTENANCE, FAILURES, REPAIRS

In any doubt regarding the correctness of gas meter indications, the gas meter should be removed from the system and submitted to an appropriate laboratory for verification of its metrological performance. The test may be performed using test element, without breaking the legal approval seal. One of the inductive pulse transmitters installed in the index head may act as the test element. If the meter index is not equipped with HF pulser, an external HF pulser (CHFI-04 type by COMMON S.A.) should be connected to act as the test element (Fig. 17). For more information on CHFI-04 type HF pulse transmitter read Chapter VIII. Additional equipment.

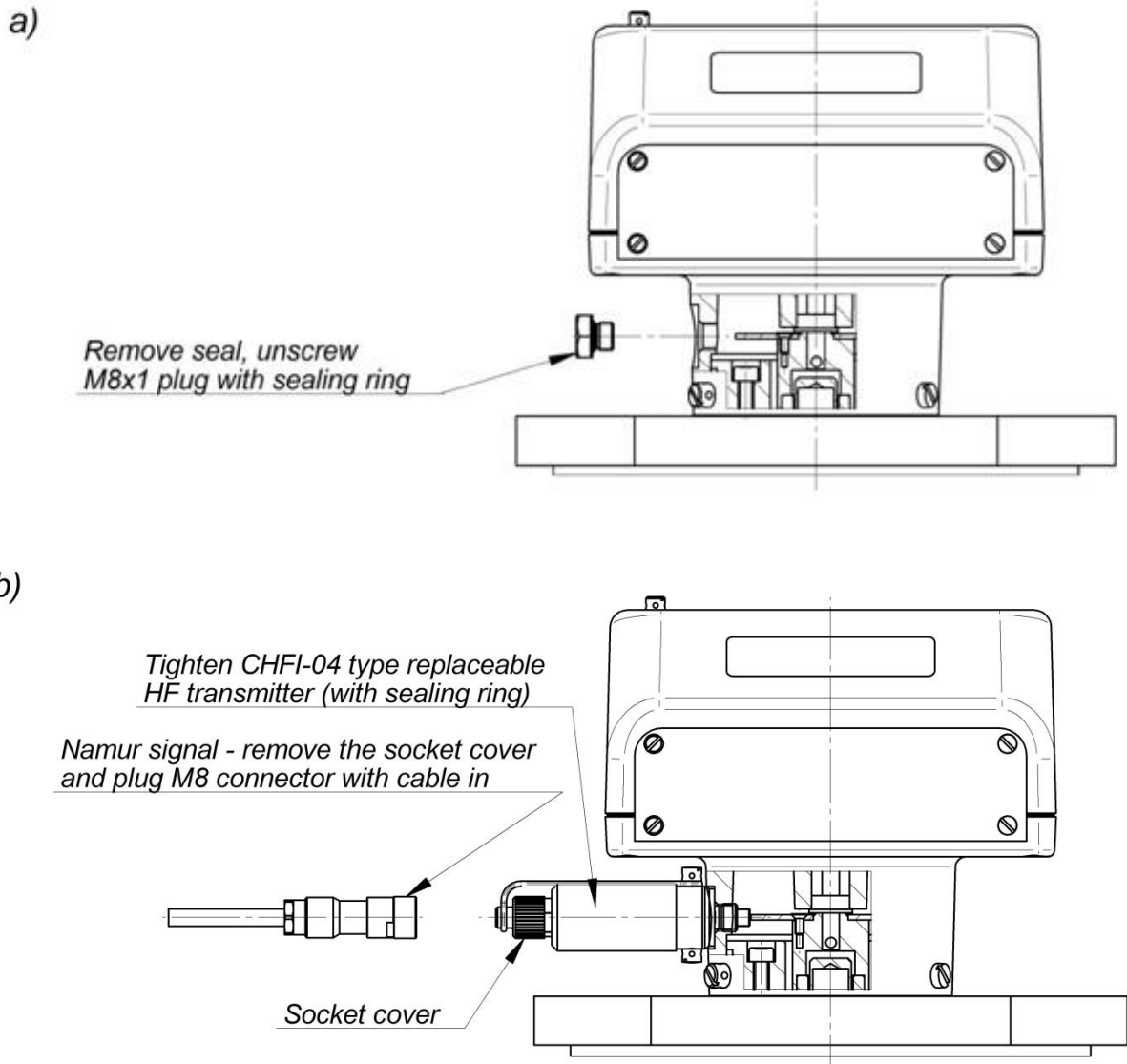


Fig. 17. Connection of the test element

The external test element should be installed in a dedicated M8x1 threaded hole in the cylindrical part of the index head, after removing the protection seal P7 (Fig. 10a) or P9 (Fig. 10b) and M8x1 plug (Fig. 17a.). CHFI-04 transmitter as a test element must be screwed in and tightened firmly in order to receive correct Namur compliant signal (Fig. 17b). After the test and removal of the test element, the hole should be tightly closed with the original M8x1 plug with sealing ring and sealed up with a protection seal.



CGR-FX gas meters are equipped with a lubrication system for rotors bearings and timing gears. All the other meter's mechanisms are based on lifetime lubricated bearings. Therefore the only activity required for the maintenance of CGR-FX gas meters is periodic inspection of oil level and its refill in case of necessity. Only oil supplied and recommended by the gas meter manufacturer should be used for oil refills.

**Oil refills may be performed only when the gas flow is closed.**

If the gas meter is equipped with an oil filler plug (Fig. 15a), gas pressure should be reduced to atmospheric level before the oil refill procedure. The oil should be refilled through the upper oil hole in the front cover of the gas meter after removal of the plug.

If the gas meter is equipped with a pressure valve (Fig. 15b), oil may be refilled without reducing the system pressure to atmospheric level. Detailed information is presented in Section VIII. Additional equipment.

Dust and other impurities can be removed from the gas meter surfaces by use of a cloth soaked in soap and water. Do not clean gas meters with solvents or other chemicals.

In case of any incorrectness in gas meter operation (e.g. irregular counter work or counter stoppage, elevated noise, crackling, oil leaks), the gas meter should be immediately submitted for repair.

**Gas meter repairs may be performed only by the manufacturer  
or a company authorized by the manufacturer.  
Users must not attempt to repair the gas meters on their own!**

Repairs associated with removal or breaking apart of the verification seals require repeated legal approval of the gas meter.

The CGR-FX gas meters are subject to manufacturer's warranty. The warranty proceedings are in line with the general trade law regulations.

## VIII. ADDITIONAL EQUIPMENT

### Oil refills in pressurized conditions

It is possible to refill oil without the need of gas pressure reduction to the atmospheric level when using a special version of CGR-FX rotary gas meter equipped with a pressure valve (Fig. 15b). A typical disposable syringe supplied with the oil container is used for pumping the oil through the pressure valve into the meter oil chamber.

**Caution!**  
**Pertains to systems with the maximum absolute gas pressure of 0,5 MPa.**  
**Before starting the oil refill procedure, stop the gas flow in the measurement system and wait several minutes until the oil level is stabilized in the gas meter.**

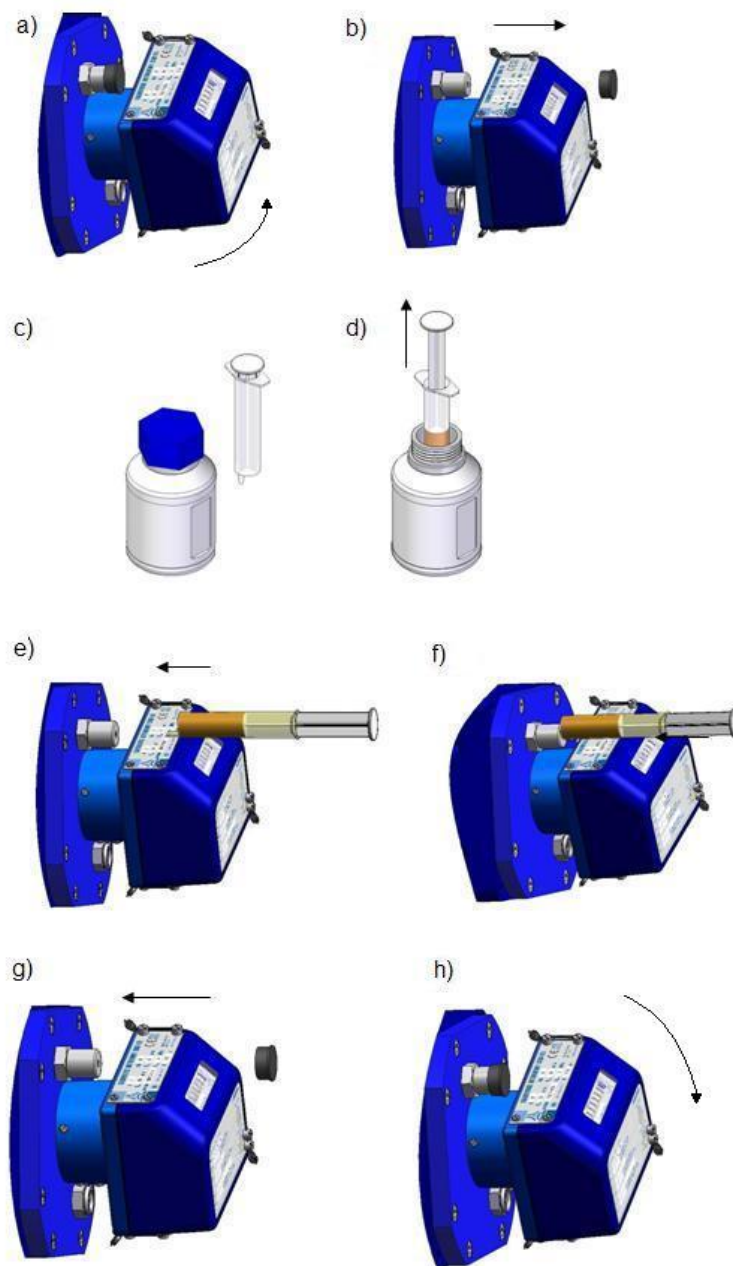


Fig. 18. Oil refill procedure in pressurized conditions

The procedure of oil refill under gas pressure (Fig. 18):

- a. Turn the index head so that the pressure valve is easily accessible.
- b. Remove the cap protecting the valve from contamination.
- c. Prepare the oil pumping kit.
- d. Draw appropriate amount of oil into the syringe.
- e. Insert the syringe tip into the pressure valve hole.
- f. Pump an appropriate amount of oil through the valve while monitoring the oil level in the sight glass.
- g. Remove the syringe tip from the valve, replace the protective cap, return excess oil from the syringe into the container.
- h. Return the index head to its previous, readout-convenient position.

### LF replaceable transmitters (CLFK-04 and CLFW-04)

Special versions of CGR-FX gas meters can be equipped with index head covers adjusted for replaceable LF transmitters. In case of failure, CLFK-04 (reed switch) or CLFW-04 (Wiegand) transmitters (Fig. 19a) can be replaced without disassembling the index head cover and without removal of seals of initial verification or repeated legalisation. The permissible power supply parameters of the transmitters are presented on the plates (Fig. 19b). The installation procedure of LF transmitters is presented in Fig. 20.

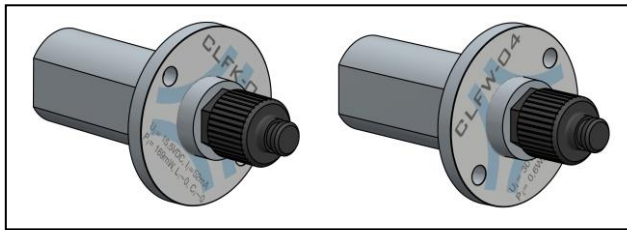


Fig. 19a. LF replaceable transmitters



Fig. 19b. Replaceable transmitters nameplates

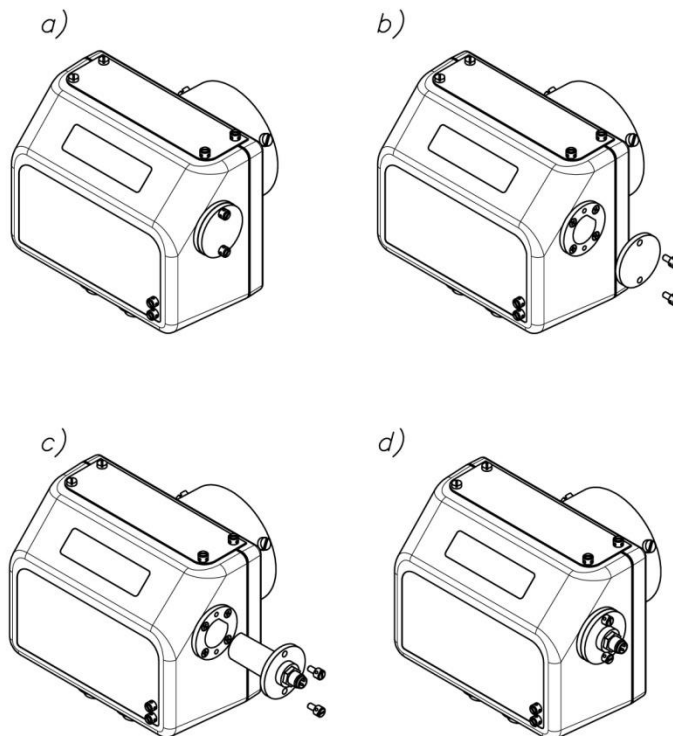


Fig. 20. Installation procedure of LF replaceable transmitters

**ATTENTION!**  
**CLFK-04 and CLFW-04 transmitters cannot be used interchangeably.**  
**The index head is adapted for one type of transmitter only.**

**Replaceable HF transmitter (CHF1-04)**

Ancillary external replaceable high frequency CHF1-04 transmitter (Fig. 21) can be installed in a dedicated M8x1 socket on the cylindrical neck of gas meter index head. It can function as a test element if the index head is not equipped with internal HF transmitter.

The installation procedure of CHF1-04 transmitters is shown in Figure 17.

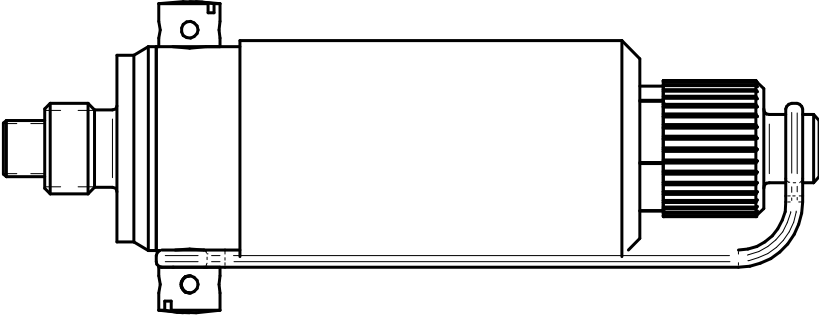


Fig. 21. CHF1-04 type replaceable HF transmitter

**CWSL Encoder**

CWSL Encoder can be installed on the mechanical output of gas meter index head. The available versions of the Encoder interface are CWSL-N, CWSL-A, CWSL-M (Fig. 22). Data sent from the CWSL-N Encoder is consistent with the indication of the mechanical counter of the index head.



Fig. 22. CWSL Encoder adapted to installation on CGR-FX gas meter index head

## Integrated bypass

Special version of CGR-FX gas meter can be equipped with an integrated internal bypass. The function of the bypass in rotary gas meter is ensuring continuous gas supply in case of gas meter failure resulting in stoppage of gas flow through the measuring chamber. During regular operation, the gas flows through the measuring chamber and the flow through the bypass is blocked by a hermetic membrane. In case of the gas meter failure when rotors are stuck, the membrane breaks and opens the alternative flow bypassing the measuring chamber. The rupture of the bypass membrane causes bypass control circuit status change and emergency is signalled (by means of an additional equipment). The impulse triggering bypass membrane breaking apart is pressure difference ( $\Delta p_{Kr}$ ) acting on the membrane. Membranes installed in CGR-FX internal bypass are designed to burst at  $\Delta p_{Kr} = 100$  kPa.

CGR-FX internal bypass is equipped with a control circuit (two-state) that should be connected to an external monitoring device, e.g. CMK-03 electronic volume corrector. In order to connect the bypass control circuit to CMK-03, socket cover (1) should be removed and connecting cable with M8x1 connector (2) plugged (Fig. 23). In case of gas meter failure (rupture of the hermetic membrane) an alarm is signalled by the change of control circuit status. Intrinsic safety parameters of bypass control circuit are the same as those of CLFK-03 sensors and are presented on the bypass nameplate (Fig. 23b).

CGR-FX gas meter with internal bypass can be optionally equipped with CSSB-01 control panel with bypass status indicator. In case of gas meter failure (breaking of the hermetic membrane) an alarm is signalled by the change of control circuit status and blinking of LED diode (2) on the bypass control panel (Fig. 24a). Button 1 enables inspection of the bypass control circuit in any time. After pressing the button, the LED (2) diode should blink (bypass closed). Bypass control circuit can be connected to an external monitoring device like CMK-03 through socket (3) on CSSB-01 control panel. Intrinsic safety parameters of bypass control circuit equipped with CSSB-01 control panel are presented on the control panel nameplate (Fig. 24b).



Fig. 23a. Integrated bypass – cable connection

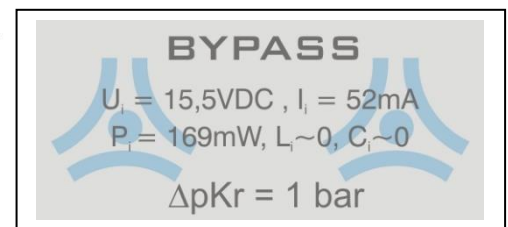


Fig. 23b. Bypass nameplate

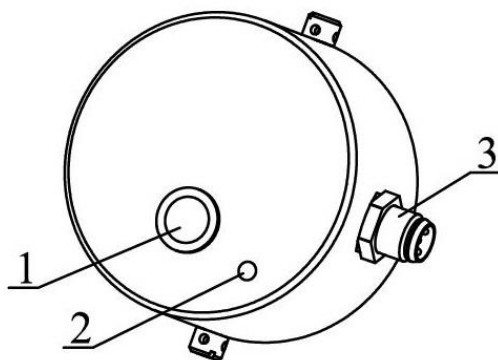


Fig. 24a. CSSB-01 bypass control panel  
(1) button; (2) signalling diode; (3) socket

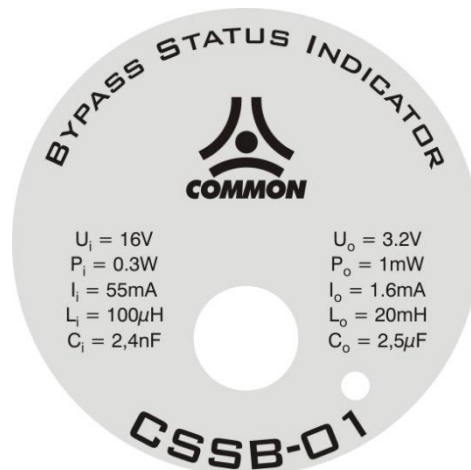


Fig. 24b. CSSB-01 nameplate

### ATTENTION!

#### CONDITIONS FOR THE PROPER OPERATION OF THE BYPASS!

1. **CGR-FX gas meters with internal bypass** installed in gas reduction and measurement station must be always placed at the **inlet side of the station** (the side of higher gas pressure).
2. **CGR-FX gas meters with internal bypass** can be installed on medium gas pressure pipelines of the inlet pressure range  $0,2 \text{ MPa} < p \leq 0,5 \text{ MPa}$  and on increased average gas pressure pipelines of inlet pressure  $0,5 \text{ MPa} < p \leq 2 \text{ MPa}$ .
3. **Pressure regulator and shutdown valve installed on a gas measurement station with CGR-FX rotary gas meter with internal bypass should be properly selected and adjusted according to  $\Delta p_{Kr}$  parameter of the bypass membrane. The above devices cannot be set to activate before CGR-FX bypass activates (membrane burst) at the critical pressure drop  $\Delta p_{Kr} = 1 \text{ bar}$ .**

#### Connecting a volume converter to a gas meter

Due to tariff requirements, it is often required (or recommended) for the gas meters to be operated together with electronic devices such as data loggers or volume converters and data transmission devices. Common S.A. manufactures such devices, e.g. CMK-03 battery/grid-powered volume converter and CRS-03 data logger. Common S.A. offers these devices as well as any installation services. Figure 25 presents an example installation of CGR-FX gas meter with CMK-03 volume converter.


Volume converter receives three types of input signals: flow rate signals (from low- or high-frequency pulse transmitter), pressure signals and temperature signals.

Pressure signal comes from a pressure measurement output of a gas meter. Installation of CKMT three-way valve (Fig. 26) along the pressure measurement tubing is recommended. Thus, any inspection, removal and replacement of pressure sensor or volume converter are easy and fast.



**IX. LIST OF STANDARDS AND TECHNICAL SPECIFICATIONS**

- EN 12480:2002 and EN 12480:2002/A1:2006  
Gas meters – Rotary displacement gas meters
- EN 60079-0:2012 +A11:2013  
Explosive atmospheres – Part 0: Equipment – General Requirements
- EN 60079-11:2012  
Explosive atmospheres – Part 11: Equipment Protection by Intrinsic Safety 'I'
- EN ISO 80079-36:2016  
Non electrical equipment for explosive atmospheres – Basic method and requirements
- EN 60947-5-2:2011  
Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and switching elements – proximity switches.
- EN 60947-5-6:2000  
Low-voltage switchgear and controlgear – Part 5-6: Control circuit devices and switching elements – DC interface for proximity sensors and switching amplifiers (NAMUR)
- EN 13445-3:2014  
Unfired pressure vessels – Part 3: Design
- EN 13445-6:2014  
Unfired pressure vessels – Part 6: Requirements for design and fabrication of pressure vessel and pressure parts constructed from spheroidal graphite cast iron
- WUDT/UC/2003  
Requirements of Office of Technical Inspection – Pressure Equipment

	<p><b>After ending the usage period, the gas meter should under no circumstances be discarded into municipal waste containers. The Waste Act of 14 December 2012 imposes an obligation for selective collection of metallic waste. Gas meters should be best returned to the manufacturer who would recycle them in an appropriate fashion. If unable to do so, the user is obliged to deliver the gas meter to an appropriate recycling point.</b></p>
	<p><b>Gas meter packaging should never be discarded into municipal waste containers. The packaging has been appropriately labelled; pursuant to the Act of 13 June 2013 on packaging and packaging waste, the user is obliged to submit the packaging for an appropriate recycling process.</b></p>

Note: Common S.A. reserves the right to modify the design of the gas meters while retaining the compliance with relevant standards and requirements regarding accuracy and safety of operation.