Installation and Operation Guide (UK)
Rotary Gas Meter

Used signs in this manual

WARNING 	Indicates a procedure that has to be followed strictly as contravention could result in escaping gas, and cause property damage, serious injury or death.
CAUTION 	Highlights a procedure which, if not strictly followed, can result in damage to the meter.
NOTE 	Is an important element of the procedure and should be observed.

Contents:

1. Introduction

The Flow Meter Group Rotary Piston Gas Meter is a positive displacement type of meter which, by means of minimal two counter-rotating impellers and a counting mechanism, measures a known volume of gas with each rotation. As a result of years of experience in development, Flow Meter Group has been able to provide a meter of incomparable accuracy and turn down ratio. Its construction and the materials used will give years of reliable service even under very demanding conditions. The meter is designed for future flexible functionality.

The purpose of this manual is to provide a general guide to the installation, operation and care of a standard Flow Meter Group rotary gas meter. Every effort has been made to ensure that the information contained in this manual is as accurate as possible; however, the continuous enhancement which Flow Meter Group makes to its products may result in small inconsistencies. Custom manufactured meters or "specials" may also result in small differences.

NOTE

It is therefore wise to consult the specific technical data sheets and other documents which accompany the meter. If in any doubt, Flow Meter Group should be consulted!

2. General description

WARNING

The meter must be considered a part of the pressure containing system.

Operating Principal

The FRM Rotary Meter is a positive displacement type of meter, passing pre-determined volumes of gas by means of two counter-rotating impellers. Four times per each revolution a fixed unit of volume is displaced through the measurement chambers. The flowing gas volume is proportional with the number of revolutions of the output. The output of this model Rotary Gas Meter is a special designed magnetic coupling where one part is fitted inside the meter body and the associated part is in the read-out unit. The read-out unit can either be a mechanical index, Instrument drive or an electronic index.

The typical square design of the impellers allows considerable increased turn down ratios. Since the shape of the impeller tip is at least two times larger compared to conventional impeller tips, the unregistered leakage through the meter is significantly reduced resulting in an enlarged turn down ratio whereby the meter is still less sensitive to installation stress or dirty gas.

The robust design of the FMR series is quite visible:

- the shape of the meter body
- the shape of the impellers
- the design of the main shafts and its bearings
- the material selected for the meter body
- the overall dimensions of the meter
- No bending, no twisting, no torque, no vibrations.

The bearings are placed on the outside of the timing gears, which allows the connection between the impellers and the timing gears to be much stronger then conventional type of rotor meters. Consequently, these rotor meters are far less sensitive for improper start up.

The FMG series rotary meters are designed to provide maximum comfort for the user. All functions, like index, sight glass and oil filling plugs are accessible from the front side. This also makes it possible to install the meter with the back against the wall, and as such saving space in, for instance basements installations.

The index can be equipped with several options as an encoder, Wiegand and Reed low frequency pick-ups, Protection against externally applied magnets (up to 450 mT)

The FRM series of rotary meters are suitable for handling most types of clean, dry, common gases at either constant or varying flow rates. The meter is not suitable for handling liquids. Measurement accuracy and life expectancy can be impeded by excessive deposits of dirt of other types of foreign material present in the gas stream.

Meters of standard construction are not directly suitable for handling oxygen, acetylene, biogas or sewage gas. Specially constructed meters made of materials directly compatible with these and other gases are available. Please contact Flow Meter Group for details.

The FRM Series have a maximum Allowable Operating Pressure (MAOP) rating of (2000kPa). Every meter is leak tested at the factory at 1.1 times its MAOP (2200 kPa) and the static pressure is tested at the factory at 1.5 times its MAOP (3000 kPa). All in accordance with International Standards and Codes. Important: The maximum working pressure of a rotary meter is limited by casing design. Meters should not be installed where line pressure can exceed the Maximum Allowable Operating Pressure. Refer to the basic meter body name plate for the MAOP.

The standard meter operating temperature range is -40°C to 70°C according EN12480 or -25°C to 55°C according to OIML R137

Displaced volume measurement is completely independent of the gas specific gravity, temperature and pressure. Displaced volume can be easily converted to volume at Standard conditions for elevated pressure and varying temperature by application of the Basic or Ideal Gas Laws.

Meter Indexes

NOTE

In some countries it is not allowed to change the index without supervision by the local metrological authorities. Removing the seal could invalidate the metrological status of the meter.

Using a special coupling, the index of the meter can be changed on-site with the meter in-line. This enables to change the functionality in the future by just "one click". The Index is already prepared for the most commonly used functions. For information regarding availability contact Flow Meter Group or it's representative**.**

Accessories

Various accessories such as volume correctors, pressure and temperature transmitters, etc. can be fitted to the FRM. When connecting these accessories, reference should be made to the instructions and other documents accompanying these products.

The FRM series are equipped with two thermo wells for mounting a temperature sensor or a temperature transmitter (max. 6 mm). The position of the two thermo wells allows calibration of volume correctors in the field.

3. Receiving, handling and storage

FRM Rotary Meters are precision measurement instruments. Although of very rugged construction, reasonable care should be given during handling and storage.

At time of delivery:

1. check the packing list to account for all items received.
2. inspect each item for damage.
3. record any visible damage or shortages on the delivery record.
    - file a claim with the carrier
    - notify Flow Meter Group or representative immediately
    - Do not accept any shipment with evidence of mishandling in transit without making an immediate inspection for damage and checking each meter for free rotation of the impellers. All new meters should be checked

for free rotation after arrival since damage to internal working parts can exist without obvious external evidence.

- Should any serious problems be encountered during installation or initial operation of the meter, notify Flow Meter Group or representative immediately.
- Do not attempt repairs or adjustments, as doing so is a basis for voiding all claims for warranty.
- If the meter is not tested or installed soon after receipt, store in a dry location. Leave the protective caps or tape installed at the meter flanges. The caps or tape will provide reasonable protection against atmospheric moisture.
- Only add oil to the meter after the meter has been installed in a permanent installation and is ready for service.
- When reporting a suspected problem, please provide the following information:
    i. Your sales order number and/or Flow Meter Group's order number.
    ii. Meter model, serial number.
    iii. Description of the problem.
    iv. Application information such as gas type, pressure, temperature and flow characteristics.

Authorization for return is required for all Flow Meter Group Products shipped to the Factory for repair, calibration, warranty, exchange or credit. To obtain authorization for return of Flow Meter Group products purchased from an Flow Meter Group Distributor of Representative, please contact the Distributor or Representative from whom the product was purchased.

4. Installation

WARNING

Installation only by authorized skilled people.
International, national, local and company safety rules are to be strictly followed as contravention may result in serious injury or death.

Piping Configurations

CAUTION

The gas should be clean and free of liquids, dust or foreign material, which could damage or block the meter impellers.

The FRM series of rotary meters may be installed in either a Top Inlet (vertical) or a Side Inlet (horizontal) configuration. The preferred or recommended installation is top inlet in a vertical pipe line with gas flow downward. Although the design of the impellers tends to make the

meter inherently self-cleaning, the top inlet mounting allows gravity to pass dirt, pipe scale, or other debris trough the meter.

An additional recommendation is to install the meter in a side loop with a bypass adjacent to the main line. Piping should be solid and properly aligned. Eliminate piping strains on the meter body.

Optional the meters can be equipped with an integrated bypass, opening when the meter is locked.

Do not install the meter lower than the discharge pipe run to avoid accumulation of condensate and foreign materials in the metering chamber. Use a Gasket Strainer or other Y-type strainer upstream of the meter to remove liquids and foreign matter (pipe sealant, tape, weld slag, etc.) from the gas stream. A 100 micron mesh screen is recommended.

Do not install a lubricated gas valve directly before a meter, as excess valve lubricant or other foreign material can stop impeller rotation.

If over-speed conditions occur, a restricting flow orifice plate should be installed 2 to 4 pipe diameters downstream of the meter outlet. Contact Flow Meter Group for sizing, pricing and availability. Warranty does not cover over-speed conditions.

Placing the meter in the Line

CAUTION

Remove the plastic protective caps or tape from both meter flanges prior to meter installation.

1. Before installing a meter:

   Make sure the upstream piping is clean by partially opening the valve to let a sufficient amount of gas blow to atmosphere.

   Insure the impellers turn freely and no objects or contaminants are in the measuring chamber. Depending upon meter condition(for instance used meters), it may be necessary to flush the meter with an approved solvent. After flushing, drain all solvent from the front cover. Make sure the measuring chamber is clean and dry and the impellers turn freely.

2. Meter Orientation:

   Connect meter inlet to the gas supply side of the line, insuring the gas flow will be in the same direction as the arrow on the meter body nameplate (i.e., arrow pointing downward for top Inlet). See also fig.1 in the appendix. Turn the index in the required position.

3. Install the meter without piping strain to prevent a binding of the impellers. Use pipe supports, as required. Level the FRM series rotary gas meters to within 5mm/m, side-to-side and front-to-back.

4. Tighten flange bolts evenly in a cross-pattern. The flange bolts which should intrude at least 16 mm into the meter should have a maximum torque of:

Inlet Size	1½"	DN040	2"	DN050	3"	DN080
Flange conn.	ANSI	DIN	ANSI	DIN	ANSI	DIN
nominal Torque	40 Nm	40 Nm	50 Nm	50 Nm	40 Nm	40 Nm
max. Torque	50 Nm	50 Nm	60 Nm	60 Nm	50 Nm	50 Nm

Inlet Size	4"	DN100	6"	DN150		
Flange conn.	ANSI	DIN	ANSI	DIN		
nominal Torque	55 Nm	55 Nm	70 Nm	70 Nm		
max. Torque	65 Nm	65 Nm	80 Nm	80 Nm		

5. Connect connectors to the index according to the diaphragms accompanying the meter.

WARNING

If the meter is installed in a zone classified as hazardous area, then ensure all connections are to intrinsic safe circuits.

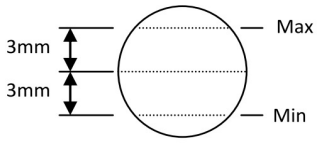
6. There is only one oil reservoir in the FRM Series. Oil is shipped with each new meter in a quantity sufficient to fill the reservoir in either a Top Inlet or a Side Inlet configuration.

WARNING

Be sure that the meter is depressurized before removing the oil filling plugs.

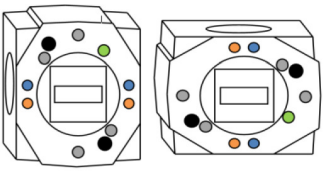
7. Remove the filling plug in the front end cover. Slowly add oil to the end cover reservoir until the oil level is to the centre of the oil gauge (sight glass). See also the figures in the appendix. Oil capacities:

Length	Horizontal position	Vertical position
171	37 cc	99 cc
241/260	119 cc	266 cc



Level – Oil Sight Glass

= pressure tapping
= Temperature tapping
= fill-/drain plug = oil sight glass
= Optical HF (non-standard feature)



Meter Start-Up

Slowly pressurize the meter in accordance with the following recommendations.

WARNING

Do not exceed 5 psig/second (35 kPa/second) maximum when pressurizing. Rapid pressurization can cause an over-speed condition which may damage the meter. Resulting damage is not covered by warranty.

a) Open the bypass and outlet (downstream of meter) gas valves.
b) Partially open the meter inlet gas valve until the meter starts operating at low speed. Throttling of the bypass valve may be necessary to initiate gas flow trough the meter. Verify gas is flowing trough the meter by watching for movement of index drum. If movement is present, go to step c). If the index drum is not turning, verify gas is being delivered to the meter. If gas is flowing to the meter inlet and meter is not moving, go to step e).
c) Let the meter operate at low speed for several minutes. Listen closely for unusual scraping or knocking sounds.
d) If operation is satisfactory, go directly to step f).
e) If unusual sounds are present or the meter is not turning, stop the installation procedure. Slowly depressurize and vent all pressure from the meter set before checking for piping misalignment, piping strain, torsion, or other related problems. Once the problem has been resolved, repeat the start-up procedure beginning with step a).
f) Gradually open the inlet valve until full line flow is passing through the meter and the inlet valve is fully open.
g) Slowly close the bypass valve.
h) Follow your company authorized procedure or common practice to leak test the meter and all connections. Soapy water and gas analysers are commonly used for this procedure.

NOTE

An indication of the meter condition can be obtained by analysing the pressure drop over the meter. It is recommended that the pressure drop over the new meter be measured and recorded in the meter records. Future measurements can then be compared to this value.

5. Maintenance

WARNING

It is not allowed to carry out any repair or maintenance when the meter is pressurized or in operation.

WARNING 	**A rotary gas meter can be used for measurements of gases with extremely high and low temperatures. Avoid direct contacts with the meter in operation since touching the meter can cause serious injuries.**

Periodic Inspections

WARNING 	**It is not allowed to carry out any inspections when the meter and the adjacent piping is pressurized.**
CAUTION 	**Like all precision instruments a rotary meter is vulnerable to abuse and operating conditions beyond its specifications and limits.**
CAUTION 	**It is prudent therefore to periodically check the security and running conditions of the meter. Especially, when a significant over pressure or shock load has occurred, or the installation is subjected to abnormal vibrations or if the gas is excessively contaminated.**
NOTE 	**Removing metrological seals may invalidate the calibration.**

Meters installed and maintained in accordance with the Flow Meter Group recommendations can be expected to operate dependably for many years. Proper oil level and cleanliness have the greatest effect on meter life expectancy. The oil reservoir in the front cover should be visually inspected for proper mid-gauge oil levels once per five years when running under normal conditions. Add oil as necessary.

Use only **Shell Morlina10** Oil or equivalent instrument grade oils approved for service by Flow Meter Group.

Oil change frequency will depend upon the cleanliness of the gas being measured. Change oil when the level increases significantly, indicating an accumulation of moisture. The FRM series of rotary meters require an oil change once every 5 to 10 years under favourable operating conditions.

Cleaning and flushing

CAUTION 	**Before performing the cleaning procedure, drain all oil from the meter. After the meter has been replaced in the installation again, add oil.**

If there is any evidence of dirt or dust in the meter a suggested method for removal is to windmill the impellers (at a speed less than the maximum capacity) by injecting controlled compressed air from a nozzle into the meter inlet. During wind milling the meter the preferred position is vertical with flow downward. Flush approximately 150 ml non-toxic, on – flammable solvent through the meter. Use compressed air to completely dry the meter.

6. Trouble shooting

WARNING

It is not allowed to carry out any repair or maintenance when the meter is pressurized or in operation.

During operation, irregular rotation or stoppage of the counter may indicate mechanical damage. Damage to the bearings, impeller or gears usually results in excessive noise and/or vibration.

If it is suspected that the problem is confined to the index, the index can be replaced while the line remains pressurized. Contact Flow Meter Group or the Flow Meter Group representative for the exchange procedures.

NOTE

In some countries it is not allowed to change the index without supervision by the local metrological authorities. Removing the seal could invalidate the metrological status of the meter.

NOTE

If an electronic output does not appear to work or does not agree with the mechanical readings contact Flow Meter Group or the Flow Meter Group representative for the exchange procedures.

NOTE

Before contacting Flow Meter Group or the Flow Meter Group representative please check the table below for trouble shooting.

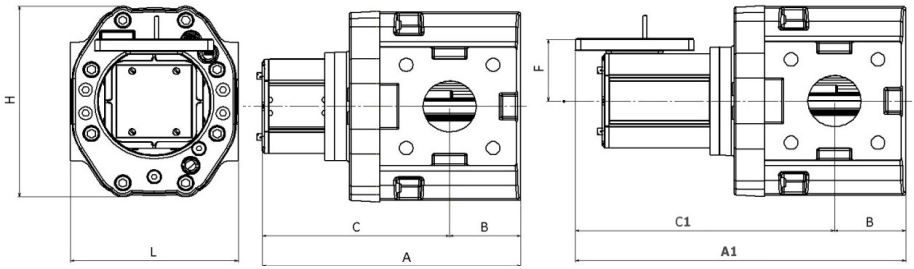
Trouble shooting table

Trouble	Item	Possible Cause	
No Flow registered	1	Obstruction in piping or meter	Check piping and valves to assure an open flow path
Low volume Registration	2 3 4	Meter oversized for load Leak at meter bypass Meter internal friction	Change meter size Check bypass and valves See item 5
High differential	5 6	Build-up of deposits in measuring chamber Worn bearings or gears	Flush meter, repair meter. Repair meter, replace oil.

	7	Heavy oil / Impellers rubbing cylinder or side plate / timing gears out of time	Check for binding or rubbing, remove obstructions, check the meter level.
Vibration Noise	9 10 11	Piping misalignment or strain Impellers rubbing casing Contaminations in measuring chamber	Remove piping strain, level meter See items 6 and 7 See item 5

7. Technical data

Dimensions



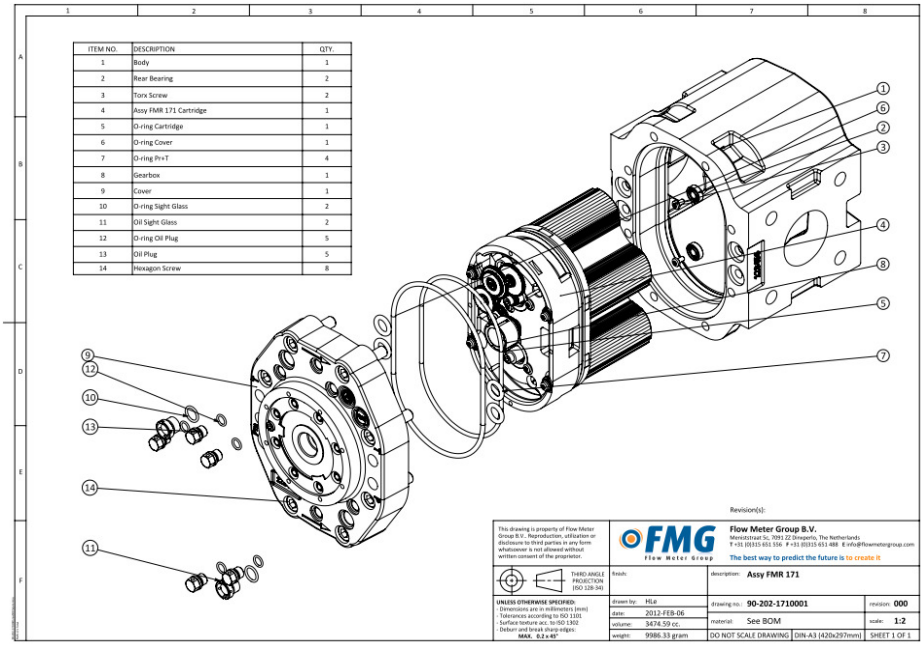
G Value	Qmax (m3/h)	Qmin (m3/h)	Size (DN) (mm)	**Cyclic V (dm3)**	Weight (kg)	Length (mm)	H (mm)	B (mm)	C (mm)		
									Basic	Universal	ID
G16	25	0,5	Threaded	**0,26**	5,5	150	150	35	150	-	-
G25	40	0,5	Threaded	**0,26**	5,5	150	150	35	150	-	-
G25	40	0,65	40/50	**0,4**	8	171	150	70	175	-	-
G40	65	0,65	40/50	**0,4**	8	171	150	70	175	-	-
G40	65	1	40/50	**0,62**	9	150 / 171	150	70	175	-	-
G65	100	1	40/50	**0,62**	9	150 / 171	150	70	175	-	-
G40	65	0,65	40/50	**0,72**	12	171	205	75	-	200	277
G65	100	0,65	40/50	**0,72**	12	171	205	75	-	200	277
G65	100	1	80	**1,16**	14	171	205	95	-	230	307
G100	160	1	80	**1,16**	14	171	205	95	-	230	307
G100	160	1,6	80	**1,4**	18	171	205	120	-	235	310
G160	250	1,6	80	**1,4**	18	171	205	120	-	235	310
G100	160	1,6	80/100	**1,4**	21	241	205	120	-	235	310
G160	250	1,6	80/100	**1,4**	21	241	205	120	-	235	310
G100	160	1,6	80	**1,8**	19	171	205	130	-	265	345
G160	250	1,6	80	**1,8**	19	171	205	130	-	265	345
G100	160	1,6	80 / 100	**1,98**	32	241	290	125	-	208	285
G160	250	1,6	80 / 100	**1,98**	32	241	290	125	-	208	285
G160	400	2,5	100	**3,17**	38	241	290	160	-	245	325
G250	400	2,5	100	**3,17**	38	241	290	160	-	245	325
G160	400	2,5	100	**5,15**	50	241	290	220	-	300	380
G250	400	2,5	100	**5,15**	50	241	290	220	-	300	380
G250	650	4	150	**5,15**	52	260	290	220	-	300	380
G400	650	4	150	**5,15**	52	260	290	220	-	300	380

**) the mentioned dimension may vary due to tolerances and options*

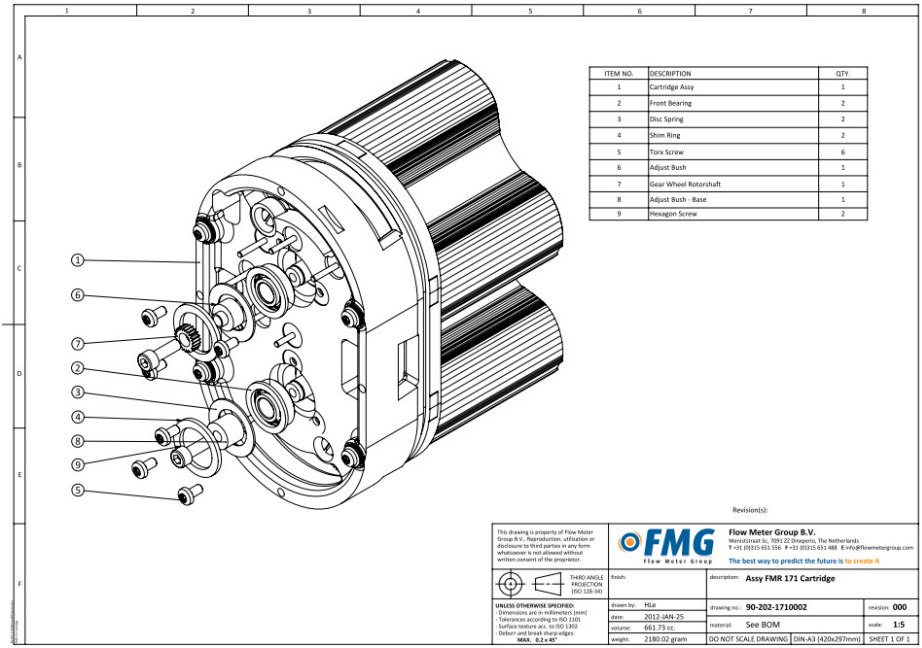
Materials

Part	*Material*
Meter body and covers	Aluminium hard anodized
Impellers	Aluminium hard anodized
Synchro plate	Aluminium hard anodized
Timing Gears	Steel
Main shafts	Stainless Steel
Gears	POM
Bearings front / rear	Steel / Stainless Steel
Index	Aluminium anodized / Poly Carbonate

Exploded View Main Components Meter



Exploded View Main Components Cartridge



Reference to International Standards

The rotary meters are designed in accordance with the following international standards:

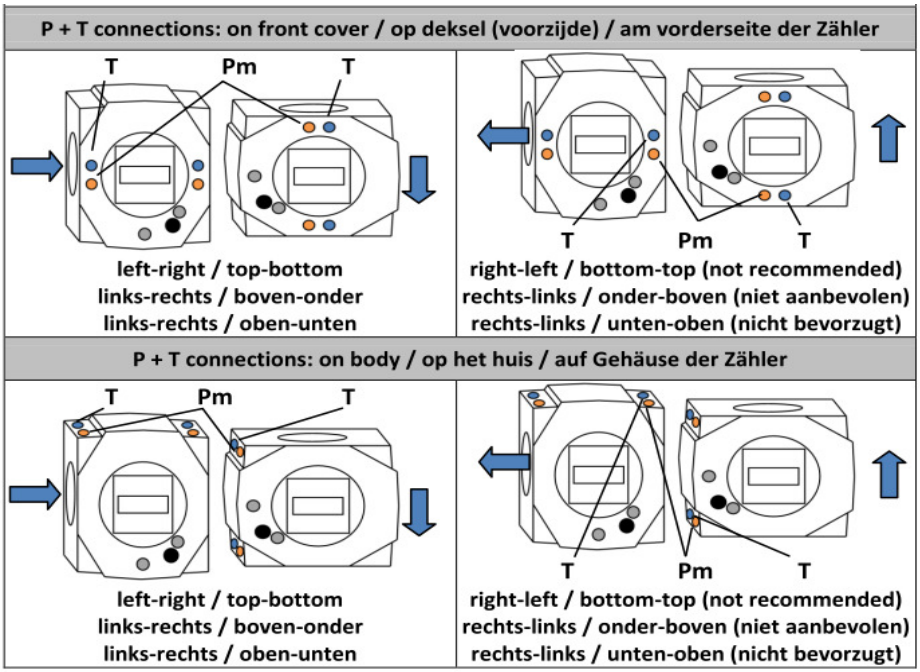
OIML R6	: General specifications for Gas Volume Meters
OIML R137	: Rotary Piston Meters and Turbine gas Meters
EN 12480	: Rotary Displacement Meters
ANSI B109.3	: Rotary Displacement Gas meters

WARNING

Should remain any doubts or questions after reading this manual carefully, contact Flow Meter Group or the local Flow Meter Group representative before any actions taken.

Figures

Position of pressure and temperature connections



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- *Is the information clearly presented?*
- *Do you need more information? If so, on what level or detail?*
- *Are the examples correct? Do you need more examples?*
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