

# Rotary Meters Series FMR

**Cartridge Design**  
**Robust Construction**  
**Low Sensitivity to Installation Stress**  
**Multi Position**  
**Square Impeller Technique**  
**Compact Installation**  
**Easy Local Repair**  
**On-Site Cleaning**

**Integrated Thermo wells**  
**Tamper Proof Index**  
**Class 1 or Class 1.5**  
**> 1:160 Range**  
**500mT Magnetic Field Resistant**  
**Optional: Multiple Wiegand**  
**Optional: Ansi300 / Ansi600**  
**Optional: integrated bypass**  
**Optional: double HF**

## General Description.

The FMG rotary gas meter is a displacement type gas meter. The actual measurement is performed by two 8-shaped impellers in combination with a measurement chamber. During a full revolution of the impellers a fixed volume is displaced from the inlet to the outlet of the meter. The number of revolutions represents the amount of volume passed. The volume is displayed on a direct read counter type index. Several low and high frequency pulsers can be used for flow computing or control purposes.

The FMG series of rotary gas meters are designed to meet the highest demands of reliable and accurate measurement of gas flow. The meters fully comply with the EN12480 and OIML R137 directives. The compact exchangeable aluminum cartridge allows local repair and on-site cleaning. The robust design of the casing and the cartridge makes the meter less sensitive to installation stresses caused by the connecting piping. A significant amount of misalignment of the connecting piping/flanges can be tolerated by the meter without affecting the meter performance or locking the impellers.

The aluminum casing of the FMR (body and cover) is designed for working pressures up to 20 bar with a safety factor of 5. The square impellers and the improved position of the main bearings and shafts, makes the meter less sensitive to overload and pressure shocks.

The aluminum index and the protection of the LF pulsers with the associated magnets, makes the meter less sensitive for manipulation by externally applied magnets or other external forces. Tampering of meters with strong neodymium magnets is one of the major concerns of utility companies, as this kind of manipulation is very difficult to detect/prove. In order to be prepared for the "smart grid", the index can be equipped with an intelligent encoder.

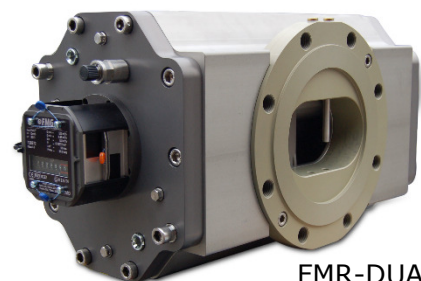
The unique proprietary oiling system, where the oil is distributed directly to the timing gears by means of a disc, eliminates oil loss at high impeller speed and will lubricate the timing gears at very low loads. All plugs and oil sight glasses are in the front of the meter, allowing the meter to be installed in very compact installations.



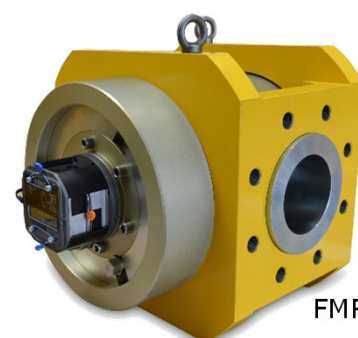
Universal Index



Basic Index



FMR-DUAL



FMR-HP



## Cartridge Design

All FMR meters consist of an aluminum cartridge inserted in a meter body. The cartridge can be removed and inserted with the body remaining installed. This allows local repairs such as replacement of the main bearings and on-site cleaning to be carried out without removing the meter body. Particular owners of older networks, suffering from dirt and/or condensate, will benefit from the ability to remove the cartridge. FMG has a cartridge exchange program to replace older cartridge by new calibrated ones.



## Robust Construction

In the new cartridge FMR design, the impellers, timing gears and bearings are fixed and positioned by a synchroplate. Since this synchroplate is machined in one operation, the tolerances can be controlled and maintained at a very high level. As a consequence, the clearance between the impellers and the meter body is equally divided and as such maximized, making the meters less sensitive to dirt and debris.

The short impeller and high strength shaft connecting the timing gear to the impeller overcomes flexing or bending of the impellers, hence the meters are less sensitive to flow and pressure shocks. Severe intermittent on/off applications are typically handled without damage. Temporarily overloading the meter up to 50% of the maximum capacity will not cause any degradation of the metrological quality.

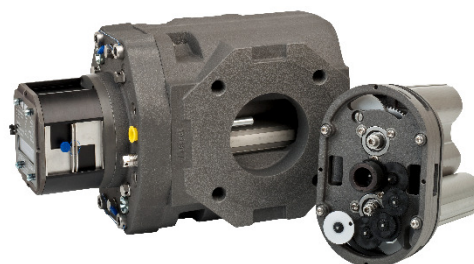
## Square Impeller Technique

The use of square impellers not only makes the meter very robust and short, but also improves the accuracy and rangeability. The unregistered leakage causing an error at minimum capacity, thus limiting the rangeability, is significantly smaller for square impellers (shorter outline) compared to the traditional long impellers.



## Low maintenance / Easy repair

The use of a cartridge (pre-calibrated) and the accessibility of the front and rear bearings (without the need for removing the timing gears), makes the FMG series of rotary meter unique in terms of repair. Every repair shop can repair or re-condition the meters without special skills and tools. When regulation permits, a new, calibrated cartridge can be installed.



## Tamper Proof

All plugs, sensors and oil sight glasses can be sealed (wire) and as such the meter is not sensitive to tampering. If, for example, the oil compartment is accessible, the metrological performance can be changed (increasing or decreasing mechanical friction) by changing oil properties.

In addition to the mechanical precautions, the index can be equipped with an intelligent encoder, recording time stamping of all attempts of unauthorized access or manipulation, such as magnetic interference, reverse flows, etc.



## Basic Index

The basic index consists of a UV-resistant polycarbonate cover glued to an aluminum frame. The aluminum frame will give strength to the index and as such sufficient protection against mechanical interference (Tampering). The index is 100% sealed (IP67) by multiple layers of glue.

The index can be rotated over 350° for flow directions right-left, left-right and top-down.

The index can be equipped with multiple LF switches and Normally Closed tamper contacts. The LF pulsers and its driving magnet can be shielded to overcome tampering with an externally applied magnetic field. Magnetic fields up to **500 mT** will not have an effect on the pulse counting.



## Multifunctional Aluminum Index

The extremely strong double walled, aluminum, index is designed to withstand any external interference. To protect against large forces applied to the index window, an additional glass window is mounted beneath the polycarbonate window. This glass window will break in case excessive force is applied to the index.

Four slots in the outer extrusion can be used for various add-ons such as multiple connectors, additional outgoing shafts, marking plates with bar codes, etc. The use of slots makes the index multifunctional and as such "prepared for the future".



## Instrument Drive / Side Reading

The instrument drive can be used to mount auxiliary equipment like chart recorders or mechanically driven volume correctors. The rotation of the outgoing shaft is equal to one m³ or CF or (sub) multiple thereof. A single or double counter can be added to the instrument drive. The instrument drive can be rotated over 90°, hence allowing both horizontal and vertical installation.

The instrument drive can be equipped with low frequency pulsers, an encoder as well as a reverse flow lock, preventing meters from registering backwards in case of tampering. On request the index can be supplied as side reading (without instrument drive) allowing the meter to be installed in an extremely high or low position. The rotating direction of the output shaft can be changed on site.



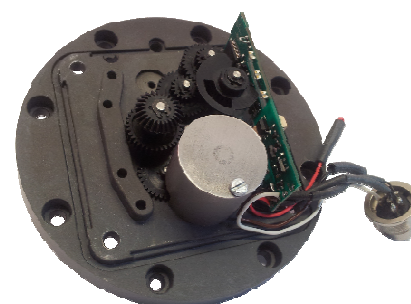
## Options for Indexes and Instrument drive

The index or instrument drive can be equipped with several options making the meter prepared for the future:

**Magnetic Field Protection (up to 500 mTesla);** The LF pulsers and its driving magnet can be shielded to overcome tampering with an externally applied magnetic field. Magnetic fields up to **500 mT** will not have an effect on the pulse counting.

**Reverse Flow Lock;** In order to avoid tampering by reverse flow, the index or instrument drive can be equipped with a Reverse Flow Lock.

**Wiegand Pulsers:** the Index can be equipped with multiple Wiegand pulsers. The Wiegand pulsers do have significant advantages over the traditionally used Reed contacts. Wiegand sensors do not face "bouncing" problems and the actual live time is not limited as much as the traditional Reed contacts





**Intelligent Index/Encoder:** The index can be equipped with an intelligent encoder. The encoder sends out the total volume with an interval of 400 msec. The encoder uses a standard NAMUR serial data format, and can be modified to special applications on request. The encoder is powered by one **AA** cell battery guaranteed for 12 years of operation. On request two **AA** cells can be installed for a guaranteed life time of 20 years. The encoder is equipped with a special Hall sensor to detect and register interferences from external magnets. Several programmable inputs/outputs are available for advanced – anti fraud – functions.

**IP67:** On request the index can be sealed up to IP67.

## Integrated Bypass (Security of Supply)

Rotary meters are used in a wide variety of industrial applications due to their reliability and accuracy over an extremely large range. Unlike other meter types such as turbine meters and ultrasonic meters, a rotary meter is always accurate unless it is locked up. In actuality, the rotary meter is a digital device, it runs and is accurate or it stops. The only drawback of a rotary meter is, when it stops (locks up), the gas flow is interrupted. As such, there is no security of supply unless precautions are taken. The most convenient and reliable precaution is to have an automatic bypass valve integrated in the meter. This provides security of supply as the bypass opens automatically when the differential pressure over the meter reaches a certain pre-set level.

The FMG series of rotary meters can be equipped with an MID approved automatic bypass. The mechanism in the bypass works on a high force level (large diaphragm and strong springs) and as such, the bypass becomes very reliable over its expected life time. With two reed switches (one normally closed, one normally open) the status of the valve can be monitored (by an EVCD). It occasionally happens that an operator will open the inlet or outlet valves to fast and accidentally activates the bypass. In which case, the bypass can be re-set onsite. A removable plug provides access to the reset mechanism.

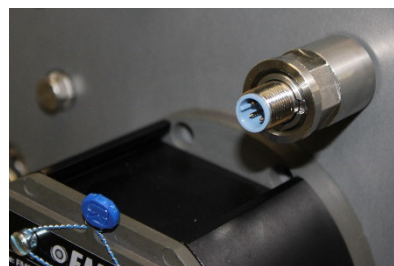
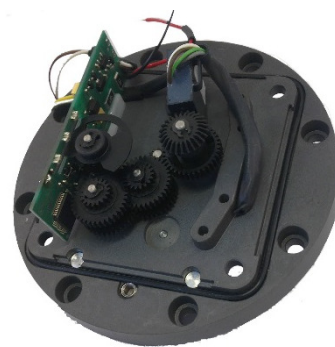
## High Frequency Pulsers

FMG rotary meters can be equipped with a high frequency sensor. Unique is the fact that the high frequency sensor generates two independent phase shifted signals and as such the flow direction can be monitored.

## Integrated Double Thermowells

FMG rotary meters can be equipped (optional) with two integrated thermo wells. Having two thermowells, the verification of Electronic Volume Conversion Devices (when built on to the meter) can be done on site and on line without interruption of the operation. By comparing the reading of EVCD temperature sensor with a calibrated temperature sensor or one of known accuracy placed in the second thermowell, the EVCD can be verified.

Since the thermowells are isolated with O-rings and are hardly in contact with the meter body, the temperature measurement in the well is almost identical to the actual conditions of the gas flow stream. As a result, the uncertainty element of the corrected volume is very small.



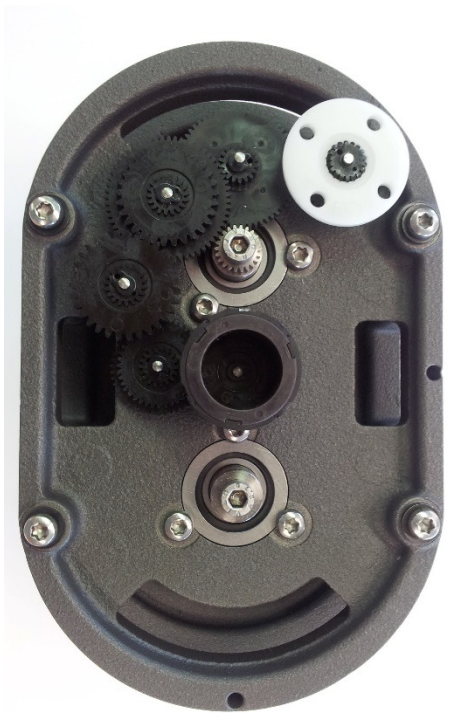
## Designed For Logistical Optimization

FMG rotary meters have exchangeable cartridges and as such can be maintained and repaired locally. In order to calibrate the cartridge or meter locally in accordance with the applicable metrological laws and directives, the meters are prepared for testing with a high frequency optical sensor. By using the HF signal, the test time becomes significantly shorter and the uncertainty of the calibration is less. Due to this high frequency feature, a test at the lowest flow rate can be performed within the maximum allowable testing time (EN 12480). Since the reference disc acting on the sensor is directly connected to the main shaft of the impeller, the repeatability of the resulting high frequency pulses is extremely good, hence the high frequency signal becomes very suitable for time measurement (the most accurate and fastest way to calibrate meters).

FMG rotary meters do not have sight glasses, connections or plugs in the rear and as such have a short installation depth. Actually, with the exception of the G160 (171mm) and G400 (241mm), the installation depth is comparable with the depth of the adjacent flanges and as such the meter will always fit in the installation. Due to the extremely rigid construction additional flexible connections to compensate for installation stress are not needed.

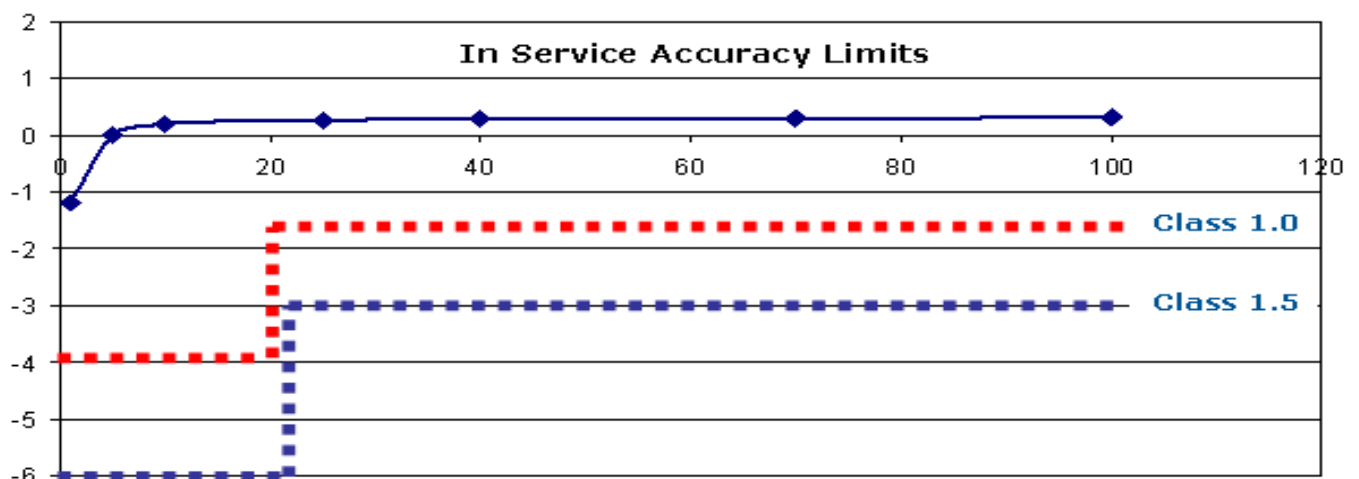
FMG rotary meters do have multiple sight glasses and oil plugs on the front and as such the meter becomes suitable for all installation positions. Whether the direction is left-right, right-left or top-down, the meter is suitable and accurate.

The very large rangeabilities, larger than 1:160, can also be used to limit the number of different meter types. It is possible to consider having only one type per flange size on stock. For instance a 2" G65 (range 1:160) can easily be used as an G40 (range 1:100). The same applies for the 3" G160 and G100.



## Superior Metrological Performance

Starting with the G40, all meters are approved according to both EN12480 and OIML R137/1 for rangeabilities up to 1:160 and as such can, on request, be designated as Class 1.5 meters. In situations where the installation- or gas conditions are severe, the risk of rejection is elevated when recalibration is done against in-service tolerances. The designation of class 1.5 (instead of 1.0), while still maintaining the class 1.0 accuracy limits, could be of interest since the in-service tolerances of a class 1.5 meter are significantly larger than the class 1.0 tolerances.





## Installation

Installation of FMG rotary meters can be horizontal or vertical. Since the meter is designed for multi position, consideration need only be given to the arrow on the front cover showing the flow direction. After the meter is installed, the index can be rotated to the correct position. The index can be rotated over 350°. FMG rotary meters can be metrological sealed by various systems from total flexibility to highly tamper proof.

## Maintenance

FMG rotary gas meters have a rotating disc for distributing the oil directly to the timing gears. The mechanism is designed to prevent oil loss at high loads or from pressure variations and maintains sufficient oiling at low flows. Since the oil system operates between 40% and 120% of the maximum flow, sizing of the installation is no longer critical. The oil supplied with the meter is suitable for 10 years of operation under normal conditions.

## Cleaning / Repairing

After removing the front cover of the meter, the entire cartridge can be removed for cleaning. During this cleaning process, the meter body can remain in line. For cleaning purposes the seals of the front cover have to be removed. The construction of the FMG rotary gas meters allows local repair or replacement of all the main bearings without special tools. In case the main bearings are replaced, the critical timing of the impellers is secured. It is recommended that replacement of the main bearings (mounted in the synchroplate) is performed by a skilled technician in a clean environment. The rear bearings can be replaced with the meter body in situ. In case a meter is locked by dirt, the cartridge can be removed for cleaning.

## Applications

- Gas distribution in low / medium / high pressure networks
- Industrial applications
- Master meters for test benches

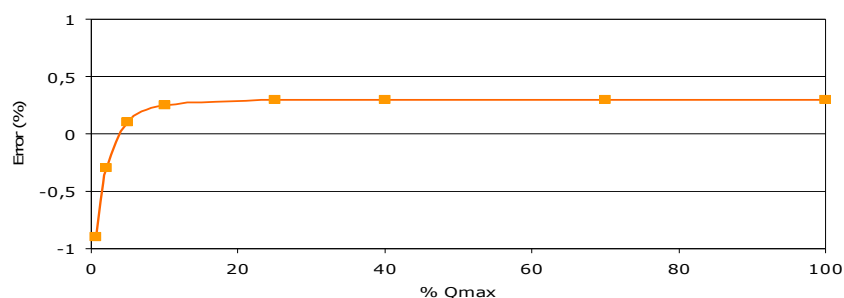
## Metrology

The accuracy is in accordance with MID (EN12480, OIML R137-1/2):

Atmospheric Air:	0,2 Q <sub>max</sub> – 1,0 Q <sub>max</sub>	: +/- 1%
	Q <sub>min</sub> – 0,2 Q <sub>max</sub>	: +/- 2%
Repeatability:	0,2 Q <sub>max</sub> – Q <sub>max</sub>	: +/- 0,10%
Range:	Up to 1 : 160 (larger ranges on request)	
Accuracy Class:	1 or 1,5	
The pressure loss:	in accordance with the EN12480 and OIML R137-1	

All metrological approvals are performed by the Dutch NMI.

## Typical error curve



## Approvals

The FMG rotary meters are approved /accredited according:

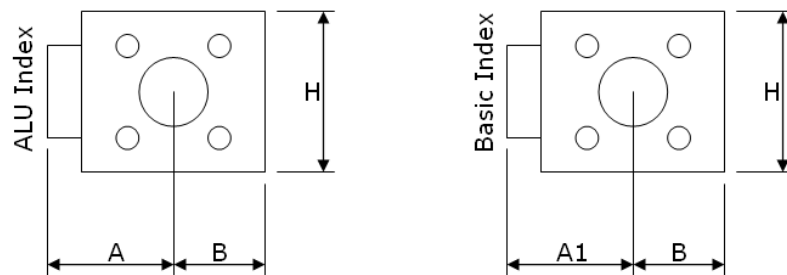
- 2004/22/EC (MID)
- 97/23/EC (PED)
- 94/9/EG (ATEX)
- 2004/108/EG (EMC)

## Technical Data FMR

Environment Class	M2 / E2	
Protection Class Index	Universal ALU Index: IP54 or IP67 Basic Index: IP67	
Accuracy Class	1,0 or 1,5	
Magnetic Field Resistance	500 mT for Index (optional)	
Gas Temperature	-25 to +55 C -40 to +70 C (EN12480)	
Ambient Temperature	-25 to +55 C -40 to +70 C (EN12480)	
Max. Operating Pressure	FMR: 20 barg	
Media	Natural gas, Town gas, Inert gases	
Safety Approvals	PED	
Metrological Approvals	MID by NMi	
Applicable Standards	EN12480, OIML R137-1/2	
ATEX Approvals	e II 2 G / Ex ia IIC T4...T6	
Pressure Tapping Pm (Pr)	1/4" NPT	
Pressure Tapping P	1/4" NPT	
Temperature Tapping Tm	1/4" NPT / 6 mm	
Accuracy Class 1,0	+/-1% for Qt-Qmax	
	+/-2% for Qmin - Qt	
	Rangeability up to 1:160 Larger Rangeabilities on request	
	Reproducibility < 0,1%	
Accuracy Class 1,5	+/-1,5% for Qt-Qmax	
	+/-3% for Qmin - Qt	
	Rangeability 1:160	
	Reproducibility < 0,15%	
Electrical Outputs	Double Reed Switch or Wiegand	
	Normally Closed Tamper Switch	
Connectors	Binder male or female	
	Multiple connectors on request	
Materials	Meter body	Aluminum, hard coated
	Impellers	Aluminum, hard coated
	Synchro plate	Aluminum, hard coated
	Shafts / timing gears	Steel / Stainless steel
	Bearings	Stainless steel
	Gears	POM
	Index glass	Poly Carbonate, UV stabilized / Glass
	Plugs	Steel (optional Stainless)



# Ranges / Dimensions / Weight FMR (larger ranges on request)

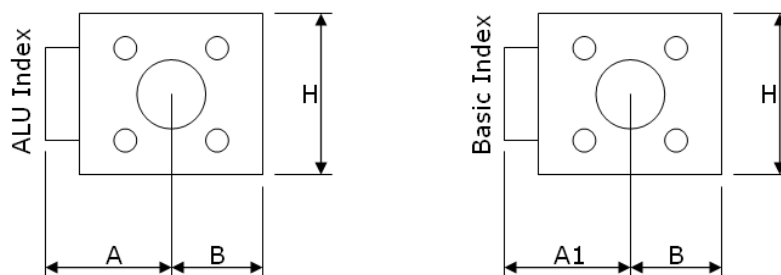


Type	Size (mm)	Qmax (m³/h)	Measuring Range	Dimensions (mm)					Weight (kg)
				L	H	A	A1	B	
G10	NPT Thread	16	50	150	150		150	35	5,5
G16	40	25	100	171	205	200	180	75	12
G16	50	25	100	150/171	205	200	180	75	12
G16	NPT Thread	25	50	150	150		150	35	5,5
G25	40	40	100	171	205	200	180	75	12
G25	50	40	100	150/171	205	200	180	75	12
G25	NPT Thread	40	80	150	150		150	35	5,5
G25	40	40	65	171	150		175	70	8
G25	50	40	65	171	150		175	70	8
G40	40	65	100	171	205	200	180	75	12
G40	50	65	100	150/171	205	200	180	75	12
G40	40	65	100	171	150		175	70	8
G40	50	65	100	150/171	150		175	70	8
G40	40	65	65	171	150		175	70	9
G40	50	65	65	150/171	150		175	70	9
G65	50	100	160	150/171	205	200	180	75	12
G65	50	100	100	150/171	150		175	70	9
G65	80	100	100	171	205	230	210	95	14
G100	50	160	160	171	205	230	210	95	14
G100	80	160	160	171	205	230	210	95	14
G100	80	160	160	241	205	250	230	115	21
G100	100	160	160	241	205	250	230	115	21
G160	80	250	160	171	205	250	230	115	17,5
G160	80	250	160	171	205	270	250	135	18,5
G160	80	250	160	241	205	250	230	115	21
G160	100	250	160	241	205	250	230	115	21
G160	80	250	160	241	290	210	190	125	32
G160	100	250	160	241	290	210	190	125	32
G250	80	400	160	241	290	245	225	160	38
G250	100	400	160	241	290	245	225	160	38
G400	100	650	160	241	290	300	280	220	50
G400	150	650	160	260	290	300	280	220	52





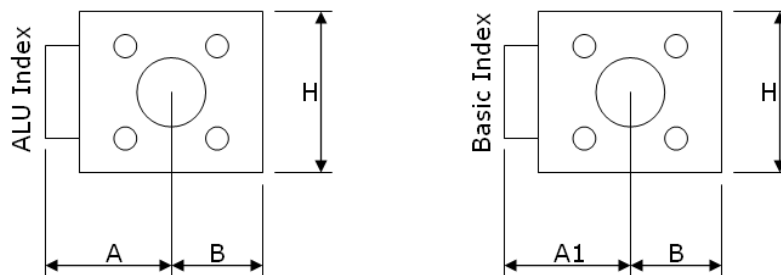
## Ranges / Dimensions / Weight FMR-DUAL (larger ranges on request)



Type	Size (mm)	Qmax (m³/h)	Measuring Range	Dimensions (mm)					Weight (kg)
				L	H	A	A1	B	
G160	80	250	100	241	290	270	250	195	51
G160	100	250	100	241	290	270	250	195	51
G250	80	400	160	241	290	270	250	195	51
G250	100	400	160	241	290	270	250	195	51
G250	150	400	160	241	290	270	250	195	51
G400	100	650	160	241	290	305	285	230	59
G400	150	650	160	260	290	305	285	230	59
G650	100	1000	160	241	290	375	355	300	75
G650	150	1000	160	260	290	375	355	300	75

For special G-ratings / dimensions please contact your agent.

## Ranges / Dimensions / Weight FMR-HP (larger ranges on request)



Type	Size (mm)	Qmax (m³/h)	Measuring Range	Dimensions (mm)					Weight (kg)
				L	H	A	A1	B	
G40	50	65	50	273	280	220	175	195	50
G65	50	100	80	273	280	220	175	195	50
G65	50	100	65	273	280	260	240	215	75
G100	80	160	100	273	280	260	240	215	75
G100	80	160	65	375	365	240	220	190	125
G160	80	250	100	375	365	240	220	190	125
G160	100	250	65	375	365	275	255	230	140
G250	100	400	100	375	365	275	255	230	140
G400	150	650	100	450	375	300	325	275	245

For special G-ratings / dimensions please contact your agent.

## Your Contact



[www.flowmetergroup.com](http://www.flowmetergroup.com)