

## RHM

### 015L/02L/03L/04L

#### Compact Low Flow Coriolis Flow Sensors

### Features

- Pressure ratings up to **20000 psi / 1379 bar**
- Temperature ratings from **-196 to 350°C (-320 to 662°F)**
- Mass flow **uncertainty less than 0.10%**
- Repeatability better than **0.05%**
- Response time **30ms and better**
- Ranges between **1 g/min to 30 kg/min**
- Dual path (parallel) and **single path** (serial) internal pipe configurations available
- **Omega Coriolis Design**: unique torsion driven oscillation system
- Rheonik's **Connectivity Promise** – nearly any connection customization available
- **Extremely compact design** with minimal footprint
- Approved for use in hazardous areas
- Entire **enclosure** / external parts in **stainless steel 316Ti** available
- Removable connection manifold version available for easy maintenance
- Remote and compact mount transmitter versions available

### Applications

- General Flow Control
- High Pressure Gas Dispensing
- Additive Dosing
- Mixing and Batching
- Chemical Injection
- Package and Container Filling
- Polyurethane, Paint, Adhesives

### Rheonik Sensor Benefits

- Torsion oscillator design assures a stable and drift free measurement with excellent signal to noise ratios
- Resilient to external noise and vibration
- Insensitive to pipe pressure changes
- Robust tube wall thickness provides increased operational safety
- Long sensor life guaranteed due to low mechanical stresses of torsional movement
- No moving parts to wear or fail
- Selected sensors for enhanced performance (Goldline)

## General Specification Overview

	RHM015L	RHM02L	RHM03L	RHM04L
<b>Nominal Flow (<math>Q_{nom}</math>)*</b>	0.8 kg/min (1.76 lb/min)	2 kg/min (4.4 lb/min)	6 kg/min (13.2 lb/min)	15 kg/min (33 lb/min)
<b>Maximum Flow (<math>Q_{max}</math>)*</b>	1.8 kg/min (3.97 lb/min)	4 kg/min (8.8 lb/min)	12 kg/min (26.4 lb/min)	30 kg/min (66 lb/min)
<b>Minimum Flow (<math>Q_{min}</math>)*</b>	0.008 kg/min (0.018 lb/min)	0.050 kg/min (0.11 lb/min)	0.1 kg/min (0.22 lb/min)	0.2 kg/min (0.44 lb/min)
<b>Serial Tube/ Single Path Versions</b>	Flow rates $Q_{nom}$ , $Q_{max}$ , $Q_{min}$ will be 50% of the above listed parallel/dual tube version of the same size			
<b>Operating Temperature</b>	Temperature range options cover applications from -196°C to 350°C (-320°F to 662°F)			
<b>Pressure Ratings</b>	Up to 1379 bar / 20000 psi - dependent upon material			
<b>Electrical Connection</b>	Cable entry M25 x 1.5 (standard), M20 x 1.5, ½" NPT, ¾" NPT (optional) Max. cable length to remote RHE transmitter 100m / 330ft (300m application dependent)			
<b>Sensor Enclosure Materials</b>	Stainless steel (standard), 316 stainless steel (optional) Epoxy coated aluminum terminal box (standard), 316 stainless steel terminal box (optional)			
<b>Enclosure Type</b>	Protection class IP 66 / NEMA 4 (standard), NEMA 4X, IP68/69K (optional)			
<b>Wetted Materials</b>	1.4435(316L) / 1.4539 (904L) / 1.4571 (316Ti) / 2.4602 (Alloy C22) Sandvik HP160 (ideal for very high pressure hydrogen), 1.4410 (SuperDuplex) Standard seal types (manifold construction): FKM, FFKM, FVQM Additional/customer specific materials available upon request			
<b>Process Connections</b>	Nearly any - <b>the RHEONIK Connectivity Promise</b> . Consult factory for types not listed			
<b>Pressure Rating Compliance</b>	Europe - PED according to Sound Engineering Practice (SEP)			
<b>Certifications and Approvals</b>	ATEX / IECEx Approvals for zone 0 and 1 (suitably rated RHE required) North American Approvals for Class I, Div. 1, Groups ABCD (suitably rated RHE required) American Bureau of Shipping (ABS) Product Type Approval for use on marine vessels			
<b>Documentation, Testing and Inspection</b>	All sensors are hydro tested, calibrated and supplied with a traceable calibration certificate. Customized calibration and testing services available			
<b>Project Documentation and QA Services</b>	Rheonik offers of full set of services for large and complex engineering projects. Typical services offered are, but not limited to: <ul style="list-style-type: none"> <li>▪ Certificates of origin and conformity, mill certificates</li> <li>▪ Data books including WPAR, WQS, NDT, test &amp; quality plans, functional testing, calibration procedures, customized packing, factory acceptance etc.</li> <li>▪ Start up and commissioning services on/offshore</li> </ul>			
<b>Options</b>	Enclosure heating for high temperature applications Mounting brackets: wall and floor mounting versions available Cleaning for oxygen service Full service painting to project specifications – consult factory			

\* At  $Q_{nom}$ , pressure drop across a parallel tube sensor will be approximately 3 bar (40 psi) for H<sub>2</sub>O. Sensors can be operated up to  $Q_{max}$  where pressure drop across the sensor can reach up to 20 bar (290psi) and flow velocity within sensor up to 20 m/s. Beyond  $Q_{max}$ , cavitation may occur.  $Q_{min}$  is the recommended lowest flow rate. Sensors will measure flow rates lower than  $Q_{min}$ , but uncertainty will increase beyond 0.5% of rate.

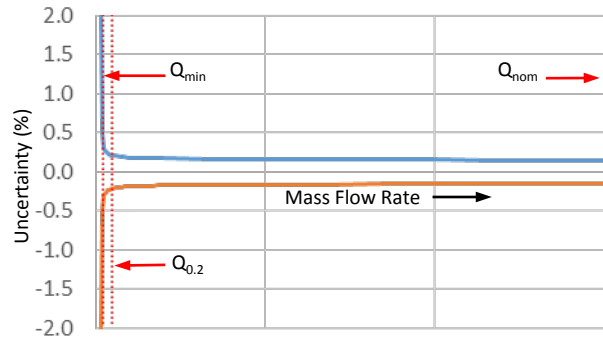
\* The flow specifications above relate to standard pressure parallel tube sensor versions. Models with higher pressure ratings have increased wall thickness and will have higher pressure drops and lower  $Q_{nom}$  values.

## Measurement Performance

### Standard Calibration A or B

A	<b>0.5% Uncertainty</b> ±0.5% uncertainty between $Q_{nom}$ and $Q_{min}$
B	<b>0.2% Uncertainty</b> ±0.2% uncertainty between $Q_{nom}$ and $Q_{0.2}$

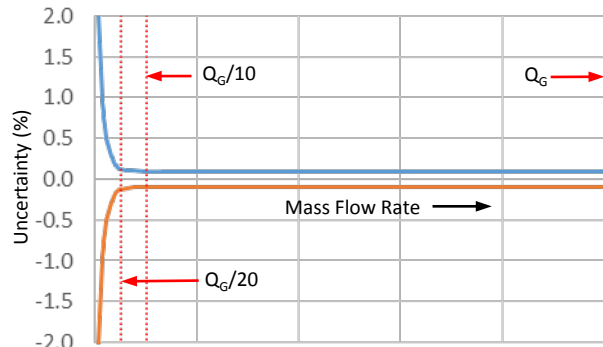
Higher pressure units may have lower  $Q_{nom}$  values due to reduced tube ID



### Goldline (Selected Sensor) Calibration G or P

G	<b>0.12% Uncertainty</b> ±0.12% uncertainty between $Q_G$ and $(Q_G/20)$
P	<b>0.1% Uncertainty</b> ±0.1% uncertainty between $Q_G$ and $(Q_G/10)$

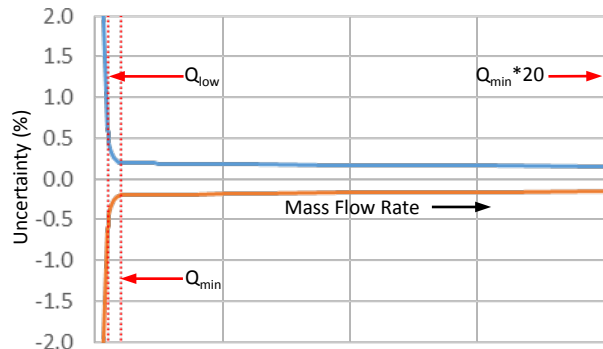
Only for sensors with standard temperature and pressure range  
Customized calibration services are available – consult factory



### Low Flow (Selected Sensor) Calibration C or 1

C	<b>1:20 Turn Up Calibration</b> ±0.2% uncertainty between $Q_{min}$ and $(Q_{min} * 20)$
1	<b>Low Flow Optimized Calibration*</b> ±0.2% uncertainty between $Q_{min}$ and $(Q_{min} * 20)$ and ±0.6% uncertainty between $Q_{min}$ and $Q_{low}$

Only for sensors with standard temperature and pressure range  
\* Low flow calibration is not available with RHM02L



	RHM015L	RHM02L	RHM03L	RHM04L
$Q_{max}$	1.8 kg/min (3.97 lb/min)	4 kg/min (8.8 lb/min)	12 kg/min (26.4 lb/min)	30 kg/min (66 lb/min)
$Q_{nom}$	0.8 kg/min (1.76 lb/min)	2 kg/min (4.4 lb/min)	6 kg/min (13.2 lb/min)	15 kg/min (33 lb/min)
$Q_{min}$	0.008 kg/min (0.018 lb/min)	0.05 kg/min (0.11 lb/min)	0.10 kg/min (0.22 lb/min)	0.2 kg/min (0.44 lb/min)
$Q_G$	0.6 kg/min (1.32 lb/min)	2 kg/min (4.4 lb/min)	5 kg/min (11.0 lb/min)	10 kg/min (22 lb/min)
$Q_{0.2}$	0.03 kg/min (0.066 lb/min)	0.10 kg/min (0.22 lb/min)	0.25 kg/min (0.55 lb/min)	0.5 kg/min (1.10 lb/min)
$Q_{low}$	0.003 kg/min (0.007 lb/min)	N/A	0.075 kg/min (0.17 lb/min)	0.1 kg/min (0.22 lb/min)

### Calibration Reference Conditions

Performance statements relate to the following conditions:

- Water
- Temperature: 20 to 23°C (68 to 74°F)
- Pressure at 1 to 3 barg (15 to 45 psig)

### Temperature Performance

Better than ±1°C

### Flow Measurement Repeatability

Standard ± 0.1% of rate  
Goldline ± 0.05% of rate

## Measurement Tube Pressure Ratings

The maximum pressure ( $P_{max}$ ) of a sensor is determined by its lowest rated part. The lowest rated part can be either the measurement tube ( $P_{max}$  indicated below), the construction type ( $P_{max}$  indicated in the Part Number Code section, last page) or the process connection (for  $P_{max}$  see published standards or manufacturer information).

	RHM 015L		RHM 02L		RHM 03L		RHM 04L	
<b>P1</b>	316 L		904 L		316 Ti		316 L	
	bar	psi	bar	psi	bar	psi	bar	psi
50°C / 122°F	362	5250	345	5000	275	3985	170	2465
120°C / 248°F	300	4350	300	4350	250	3625	150	2175
210°C / 410°F	250	3625	292	4235	231	3350	130	1885
350°C / 662°F	200	2900	240	3480	200	2900	110	1595
<b>P2 - SS 904L</b>					bar	psi	bar	psi
50°C / 122°F					372	5395	332	4815
120°C / 248°F					300	4351	319	4625
210°C / 410°F					250	3626	281	4075
350°C / 662°F					200	2901	231	3350
<b>P2 - Alloy C22</b>	bar	psi	bar	psi				
50°C / 122°F	612	8875	622	9020				
120°C / 248°F	540	7830	540	7830				
210°C / 410°F	463	6715	470	6815				
350°C / 662°F	384	5570	390	5655				
<b>P2 - Sandvik HP160</b>					bar	psi	bar	psi
50°C / 122°F					630	9135	630	9135
120°C / 248°F					540	7830	540	7830
210°C / 410°F					410	5945	410	5945
<b>PH - Sandvik HP160</b>					bar	psi	bar	psi
50°C / 122°F					1070	15520	1070	15520
120°C / 248°F					900	13050	900	13050
210°C / 410°F					723	10485	723	10485
<b>P3 - Super Duplex</b>	bar	psi	bar	psi				
50°C / 122°F	1070	15520	1070	15520				
120°C / 248°F	900	13055	900	13055				
210°C / 410°F	720	10445	720	10445				
<b>P4 - Super Duplex</b>	bar	psi	bar	psi	bar	psi	bar	psi
50°C / 122°F	1379	20000	1379	20000	1379	20000	1379	20000
120°C / 248°F	1220	17695	1220	17695	1220	17695	1220	17695
210°C / 410°F	1150	16675	1150	16675	1150	16675	1150	16675

## Other Materials

Other wetted materials (e.g. Inconel, Monel, 304 stainless steel, others) may be possible for chemical compatibility, lower pressure drop, abrasion allowance, other application specific requirements.

Contact factory with specification for assessment and availability.

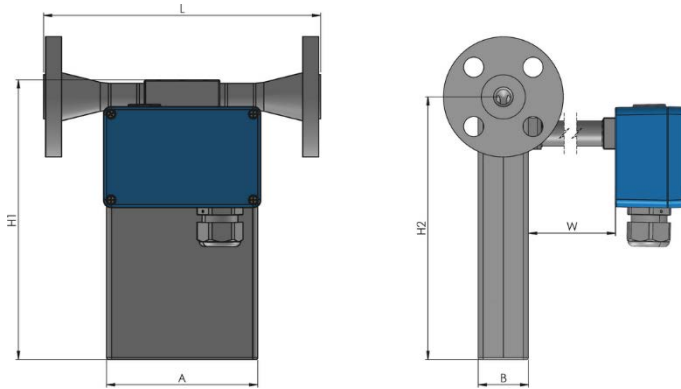
## Mechanical Construction

Sensors are manufactured with two internal measurement tubes arranged side by side. In parallel or dual path sensors (order code Pxx), these tubes are connected in parallel and the flowing fluid is split equally between them. In serial or single path sensors (order code Sxx), the tubes are connected end to end, creating a single path through which all fluid flows. Manifold designs have a removable inlet/outlet manifold block and utilize seals between the manifold and sensor body. In seal-less designs, the measurement tubes are continuous between the process connections and do not have seals. Manifold designs offer shorter delivery lead times and may have a lower pressure drop than seal-less designs for the same flow rate.

### - TYPE 1. Manifold design with seals and flange connections

PM0: parallel/dual path

SMO: serial/single path



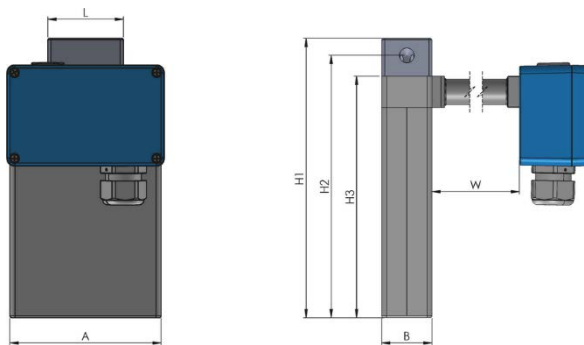
Dimensions on next page

Process Connection	Face to Face (L)		Order Code
	mm	in	
ANSI ½" 150#RF	220	8.66	A1
ANSI ½" 300#RF	220	8.66	A2
ANSI ½" 600#RF	220	8.66	A3
ANSI ½" 1500#RF	300	11.81	A6
ANSI ½" 1500#RTJ	300	11.81	R1
DIN DN15/PN40	220	8.66	D1
DIN DN15/PN100	220	8.66	D2
DIN DN15/PN160	220	8.66	D3
JIS RF10K 15A (½")	220	8.66	J1
JIS RF20K 15A (½")	220	8.66	J2

### - TYPE 2. Manifold design with seals and threaded connections

PM0/PH0/PV0: parallel/dual path

SMO/SH0/SV0\*: serial/single path



\*SV0 version only available with RHM015L  
Dimensions on next page

Process Connection	Face to Face (L)		Order Code
	mm	in	
Female Thread G ¼"	60	2.36	G1
Female Thread ¼" NPT	60	2.36	N1
Autoclave ⅜" MP (⅜"-18 UNF female thread) only with _H0, _V0	70	2.76	P2

### Material of Manifold Seals (Wetted Part)

Depending upon sensor temperature range, sensors are supplied with the following seal types as standard:

Temperature Range	PM0	SMO	PH0	SH0	PV0	SV0
N1	FKM	FKM	FKM	FKM	FKM	FKM
NA	FVMQ	FVMQ	FVMQ	FVMQ	FVMQ	FVMQ
E2*	FFKM	FFKM				

For non-standard sealing (e.g. FVMQ seals for N1) and seals for higher temperature ranges, please see Options / contact factory  
\*PH0, PV0, SH0, SV0 manifolds are not recommended with E2 temperature range

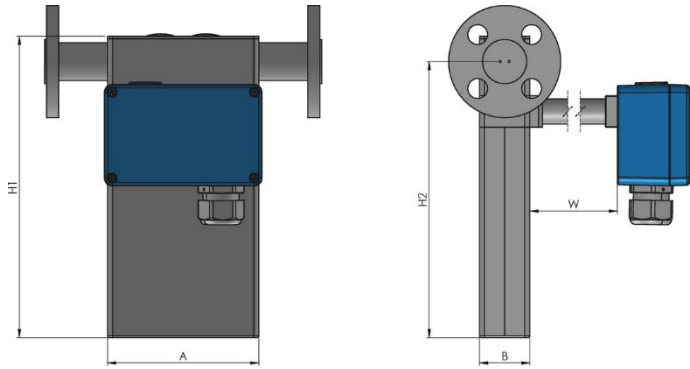
All dimensions are for standard products. For customization of face to face length and/or process connection types other than the ones listed on this page, please consult factory. Note that larger diameter flange process connections are always possible.

## Mechanical Construction (continued)

### - TYPE 3. Seal-less design with flange connections

PFO: parallel/dual path

SFO: serial/single path



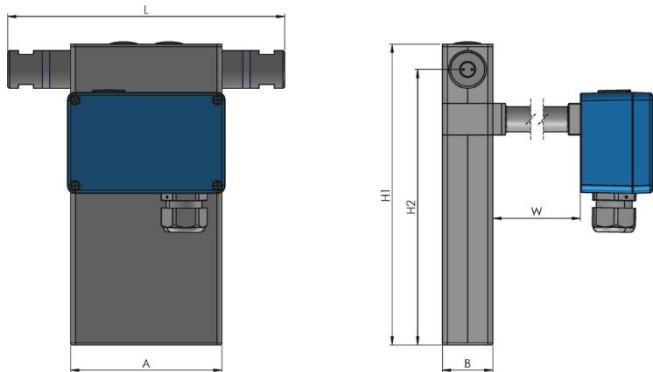
Meter will be supplied with a wetted material facing disc and 1.4571 (316Ti) stainless steel backing flange for some material selections (e.g. Tantalum)

Process Connection	Face to Face (L)		Order Code
	mm	in	
ANSI ½" 150#RF	220	8.66	A1
ANSI ½" 300#RF	220	8.66	A2
ANSI ½" 600#RF	220	8.66	A3
ANSI ½" 1500#RF	300	11.81	A6
ANSI ½" 1500#RTJ	300	11.81	R1
ANSI ½" 2500#RF	300	11.81	A8
DIN DN15/PN40	220	8.66	D1
DIN DN15/PN100	220	8.66	D2
DIN DN15/PN160	220	8.66	D3
JIS RF10K 15A (½")	220	8.66	J1
JIS RF20K 15A (½")	220	8.66	J2
Sanitary ½" Triclamp DIN 32676 - only with SFO	220	8.66	S1

### - TYPE 4. Seal-less design with threaded connections

PFT: parallel/dual path

SFT: serial/single path



Process Connection	Face to Face (L)		Order Code
	mm	in	
Female Thread G ¼"	220	8.66	G1
Female Thread ¼" NPT	220	8.66	N1
Swagelok® ¼" Tube Fitting (SS-400-14W)	220	8.66	W1
Autoclave ⅜" MP (⅝"-18 UNF female thread)	220	8.66	P2

Dimensions	mm	in
A	120	4.72
B	40	1.57
H1 (PM0, PH0, PV0)	222	8.74
H1 (SM0, SH0, SV0)	267	10.51
H1 (PFO, SFO, PFT, SFT)	239	9.41
H2	208	8.19
H3	192	7.56

Standard blue terminal box in Aluminum, size = 125 x 80 x 57 mm (4.92 x 3.15 x 2.24 in)

Optional SS 316 box, size = 100 x 100 x 61 mm (3.94 x 3.94 x 2.40 in)

W = 2 mm (0.08 in) for Aluminum box and Temperature Range N1 and NA

W = 30 mm (1.2 in) for SS 316 box and Temperature Range N1 and NA

W = 100 mm (3.94 in) for all other Temperature Ranges

Terminal box size for compact mount RHE16 transmitter = 140 x 140 x 91 mm (5.51 x 5.51 x 3.58 in):

W = 2 mm (0.08 in) for Temperature Range N1 and NA, fluid max. +85°C, ambient max. +50°C

W = 50 mm (2 in) for Temperature Range N1 and NA, fluid max. +120°C, ambient max. +50°C

NOTE: Junction boxes are supplied with M25 x 1.5 cable entries as standard. M20 x 1.5, ½" NPT, ¾" NPT cable entries are optionally available and must be ordered separately.

All dimensions are for standard products. For customization of face to face length and/or process connection types other than the ones listed on this page, please consult factory. Note that larger diameter flange process connections are always possible.

## RHM015L / 02L / 03L / 04L Part Number Code

015L / 02L / 03L / 04L

**Temperature Range**

- N1 -20 to +120°C (-4 to +248°F) (std.)
- NA -50 to +120°C (-58 to +248°F)
- E2 -50 to +210°C (-58 to +410°F)
- E3 -196 to +50°C (-320 to +122°F)
- H4 -20 to +350°C (-4 to +662°F)

**Pmax of Measuring Tubes** (see pressure rating page)

See measurement tube pressure rating page for pressures by material and meter model

**Construction Type (pmax @ 120°C /248°F) - Manifold material is always 316 Ti**

- PMO Parallel manifold, pmax = 540 bar (7830 psi)
- PHO Parallel manifold, pmax = 900 bar (13055 psi)
- PVO Parallel manifold, pmax = 1220 bar (17695 psi, 20000 psi @ 50°C)
- SMO Serial manif, pmax = 540 bar (7830 psi), wetted 1.4410 SuperDuplex crossover link
- SHO Serial manif., pmax = 900 bar (13055 psi), wetted 1.4410 SuperDuplex crossover link
- SVO Serial manif., pmax = 1220 bar (20000 psi @ 50°C), wetted 1.4410 SuperDuplex crossover link
- PFO Parallel path, seal-less for flange and hub connections
- PFT Parallel path, seal-less for thread connections
- SFO Serial path, seal-less for flange, hub and clamp connections
- SFT Serial path, seal-less for thread connections

**Material of Wetted Part (Measuring Tube)**

- M0 Measuring tubes: 1.4539 (904 L) - Standard for RHM02L
- M1 Measuring tubes: 1.4571 (316 Ti) - Standard for RHM03L
- 35 Measuring tubes: 1.4435 (316 L) - Standard for RHM015L, 04L
- M3 Measuring tubes: 2.4602 (Alloy C22) - PFO, SFO only
- 10 Measuring tubes: 1.4410 (SuperDuplex)
- HP Measuring tubes: HP160 - RHM03L, 04L only

**Process Connection**

See mechanical construction pages for available connections and codes

**Transmitter Interconnect Type (for other transmitter models, please consult factory)**

- JM Coated Alu terminal box, for remote RHE2x, only with Haz. Area NN, A1, C1
- SM SS316 terminal box, for remote RHE2x, only with Haz. Area NN, A1, A0, C1
- TM 2m fixed / integral PTFE cable, for remote RHE16/2x, only with Haz. Area NN, A1, C1
- C6 Coated Alu TB, for RHE16 compact mount, only with N1, NA temperature, Haz. Area NN

**Options Codes**

See options listing for specific codes

**Hazardous Area Certifications**

- NN Without Ex Approval
- A0 ATEX/IEC Approvals Zone 0: Ex II 1G Ex ia IIC T1...T6 Ga
- A1 ATEX/IEC Approvals Zone 1: Ex II 2G Ex ib IIC T1...T6 Gb
- C0 CSA Approvals USA-Canada Class I, Div. 1, Groups A, B, C, D

**Pressure Design Compliance**

- NN No specific design compliance required
- SE PED (SEP) [Europe]

**Performance Certification**

- N No Performance Certification
- O Custody Transfer according to OIML

**Mass Flow Calibration Selection**

See performance page for code options



## Options and Accessories

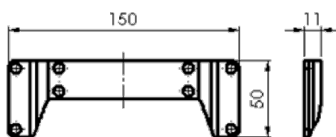
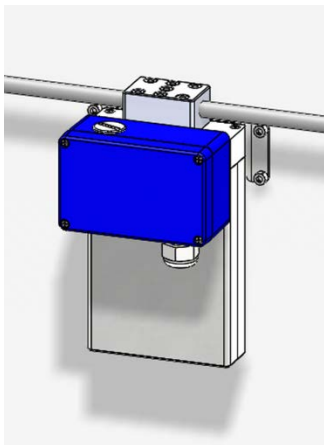
Options Codes	
HE	Electrical Heating Jacket (IP40, ordinary area only)
H1	Steam/Oil Heating Jacket
SH	Entire Enclosure in 316 SS
P2	Housing Purge ½" NPT (2 pcs)
PD	Housing Purge ½" NPT, with Integrated Rupture Disk
RD	Rupture Disk on Housing
FK	FFKM Manifold O-Ring Seals instead of Standard
FO	FVMQ Manifold O-Ring Seals instead of Standard

Options (order separately)	
ORHM-E1	½" NPT Terminal Box Cable Entry
ORHM-E2	M20 x 1.5 Terminal Box Cable Entry
ORHM-E3	¾" NPT Terminal Box Cable Entry

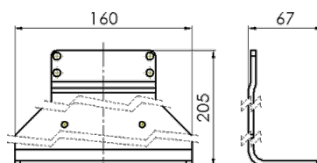
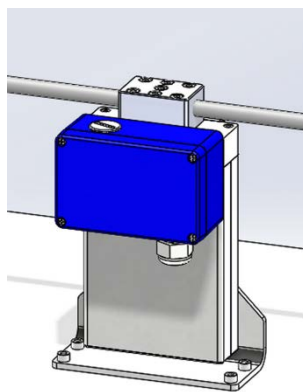
Accessories	
ORHMS-M	Wall mounting bracket (highly recommended for low flow installations)
ORHMS-MF	Floor mounting bracket standard
ORHMS-MG	Floor mounting bracket upside down installation (not for serial manifold versions)

NOTE: when specifying a sensor with multiple part code options (i.e. SH and RD), separate each code with a comma in the part string (...SH,RD...)

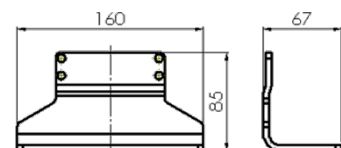
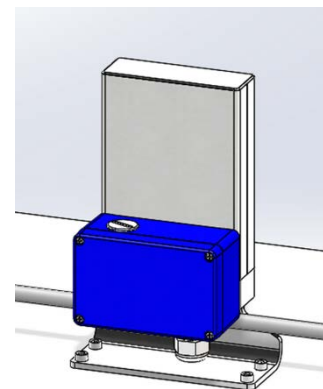
## Mounting Bracket Accessory Details



Type M  
Wall Mount



Type MF  
Floor Mount



Type MG  
Floor Mount



## Transmitter Range



Any Rheonik Mass Flow Transmitter model can be combined with a Rheonik Mass Flow Sensor to provide an overall mass flow measurement system to suit any requirement. Rheonik Coriolis transmitters are available in versions specifically designed for process, industrial and OEM applications. Together they offer a tremendous range of options for system designers and end users alike.

## About Rheonik

Rheonik has a single purpose: to design and manufacture the very best Coriolis meters available. Our research and engineering resources are dedicated to finding new and better ways to provide cost effective accurate mass flow solutions. Our manufacturing group care for each and every meter we produce from raw materials all the way to shipping and our service and support group are available to help you specify, integrate, start-up and maintain each and every Rheonik meter you have in service. Whether you own just one meter or have hundreds, you will never be just another customer to us, you are a valued business partner. Need a special configuration for your plant - don't compromise with a "standard" product from elsewhere. If we can't configure it from our extensive product range, we can build you what you need as a custom meter.

Rheonik only make Coriolis meters - we are **The Coriolis Experts** - contact us for all of your Coriolis meter requirements.