

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 down to 0.10%
- Density uncertainty down to 0.005 kg/liter
- Repeatability better than 0.05%
- Ranges between 2 g/min to 10 kg/min
- Dual path (parallel) and single path (serial) internal pipe configurations available
- **Omega Coriolis Design:** unique torsion driven oscillation system
- Rheonik **AnyPipeFit Commitment** brings you the possibility to get any custom process connection type and size for savings on installation costs. Compact design with minimal footprint
- 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 integral 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
Nominal Flow (Q_{nom})*	0.6 kg/min (1.76 lb/min)	2 kg/min (4.4 lb/min)	5 kg/min (13.2 lb/min)	10 kg/min (33 lb/min)
Minimum Flow (Q_{min})*	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)
Serial Tube/ Single Path Versions	Flow rates Q_{nom} , Q_{min} will be 50% of the above listed parallel/dual tube version of the same size			
Operating Temperature	Fluid from -196°C to 350°C (-320°F to 662°F), see options in Part Number Code Ambient from -50°C to 80°C (-58°F to 176°F), optional up to 210°C (410°F)			
Pressure Ratings	Up to 1379 bar / 20000 psi - dependent upon material			
Electrical Connection	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			
Sensor Enclosure Materials	Stainless steel (standard), 316 stainless steel (optional) Coated aluminum terminal box (standard), 316 stainless steel terminal box (optional)			
Enclosure Type	Protection class IP 66 / NEMA 4 (standard), NEMA 4X, IP68/69K (optional)			
Wetted Materials	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, FVMQ Additional/customer specific materials available upon request			
Process Connections	Nearly any - the RHEONIK AnyPipeFit Commitment . Consult factory for types/sizes not listed in this data sheet			
Pressure Rating Compliance	Europe - PED according to Sound Engineering Practice (SEP)			
Certifications and Approvals	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			
Documentation, Testing and Inspection	All sensors are hydro tested, calibrated and supplied with a traceable calibration certificate. Customized calibration and testing services available			
Project Documentation and QA Services	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"> ▪ Certificates of origin and conformity, mill certificates ▪ Data books including WPAR, WQS, NDT, test & quality plans, functional testing, calibration procedures, customized packing, factory acceptance etc. ▪ Start up and commissioning services on/offshore 			
Options	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			

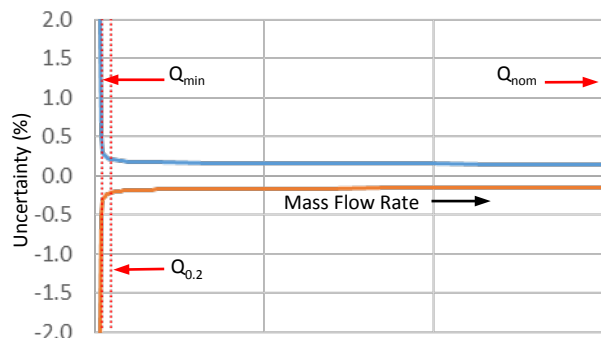
* At Q_{nom} , pressure drop across a parallel tube sensor will be approximately 1-3 bar (15-44 psi) for H₂O. Sensors can be operated at higher flow rates but pressure drop will be higher. Q_{min} is the recommended lowest flow rate. Sensors will measure flow rates lower than Q_{min} , but uncertainty will increase beyond 0.5% of rate.

The flow specifications above relate to standard pressure, parallel tube, manifold sensor versions. Models with higher pressure ratings have increased wall thickness and will have higher pressure drops.

Measurement Performance

Standard Calibration A or B

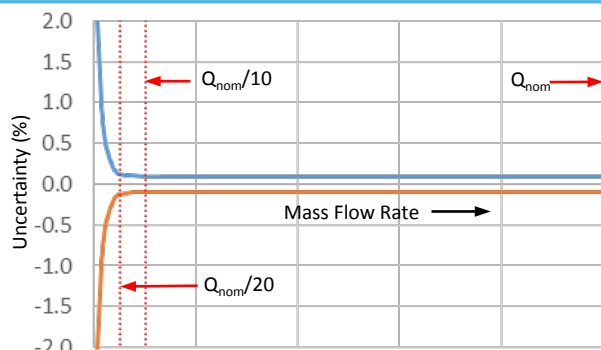
A	0.5% Uncertainty ±0.5% uncertainty between Q_{nom} and Q_{min}
B	0.2% Uncertainty ±0.2% uncertainty between Q_{nom} and $Q_{0.2}$



Goldline (Selected Sensor) Calibration G or P

G	0.12% Uncertainty ±0.12% uncertainty between Q_{nom} and $(Q_{nom}/20)$
P	0.1% Uncertainty ±0.1% uncertainty between Q_{nom} and $(Q_{nom}/10)$

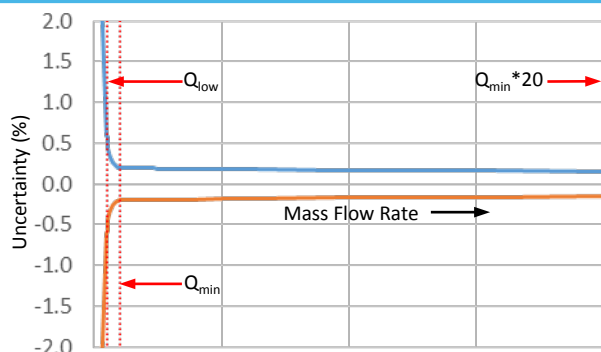
Only for sensors with standard temperature and pressure range
Customized calibration services are available – consult factory



Low Flow (Selected Sensor) Calibration C or 1

C	1:20 Turn Up Calibration ±0.2% uncertainty between Q_{min} and $(Q_{min} * 20)$
1	Low Flow Optimized Calibration* ±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	RHM02S	RHM03L	RHM04L
Q_{nom}	0.6 kg/min (1.76 lb/min)	2 kg/min (4.4 lb/min)	5 kg/min (13.2 lb/min)	10 kg/min (33 lb/min)
Q_{min}	0.008 kg/min (0.018 lb/min)	0.04 kg/min (0.11 lb/min)	0.10 kg/min (0.22 lb/min)	0.2 kg/min (0.44 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 (for mass flow accuracy)
- Temperature: 18 to 24°C (66 to 76°F)
- Pressure at 1 to 3 barg (15 to 45 psig)
- RHM with standard temperature, material and pressure range

Flow Measurement Repeatability

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

Temperature Performance

Better than ±1°C

Density Calibration (RHM02L, 03L, 04L)

N	No Live Density Calibration
S	Standard +/- 0.01 kg/liter uncertainty between 500 and 1400 kg/m ³
D	Enhanced +/- 0.005 kg/liter uncertainty between 500 and 1400 kg/m ³

For live volumetric flow with S or D, the sensor must be operated by an RHE with live density capability. Even with No Calibration, volumetric flow can still be calculated with an inferred density value based upon a manually entered norm density value and its temperature gradient.

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	
P1	316 L		904 L		316 L		316 L	
	bar	psi	bar	psi	bar	psi	bar	psi
50°C / 122°F	362	5250	300	4350	270	3916	170	2465
120°C / 248°F	300	4350	250	3625	240	3481	150	2175
210°C / 410°F	250	3625	230	3335	200	2900	130	1885
350°C / 662°F	200	2900	195	2828	170	2466	110	1595
P2	Super Duplex		Super Duplex		904 L			
	bar	psi	bar	psi	bar	psi		
50°C / 122°F	630	9135	630	9135	372	5395		
120°C / 248°F	540	7830	540	7830	300	4351		
210°C / 410°F	410	5945	410	5945	250	3626		
350°C / 662°F					200	2901		
P2 - Sandvik HP160					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
PH - Sandvik HP160					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
P3 - Super Duplex	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				
P4 - Super Duplex	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. Alloy C22, 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.

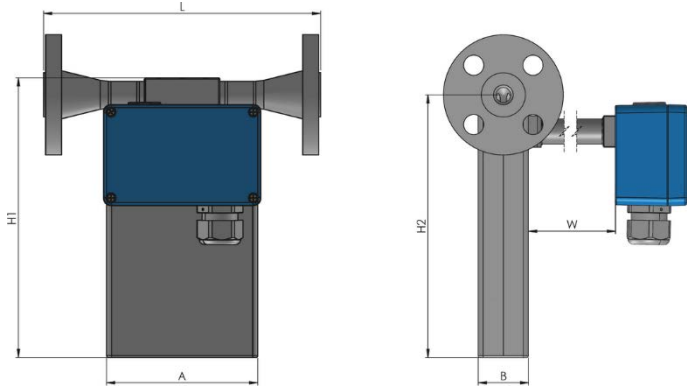
Mechanical Construction

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.

Manifold design with seals and flange connections

PM0: parallel/dual path

SMO: serial/single path



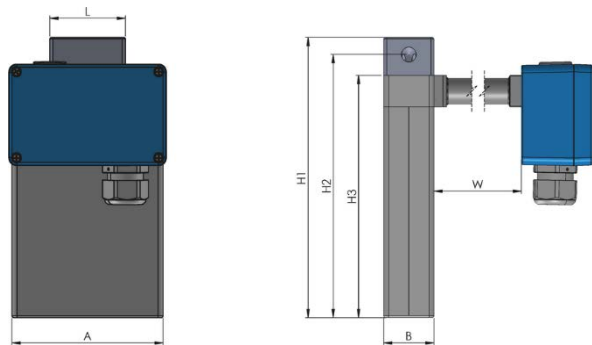
Dimensions on next page

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

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 and RHM02L
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

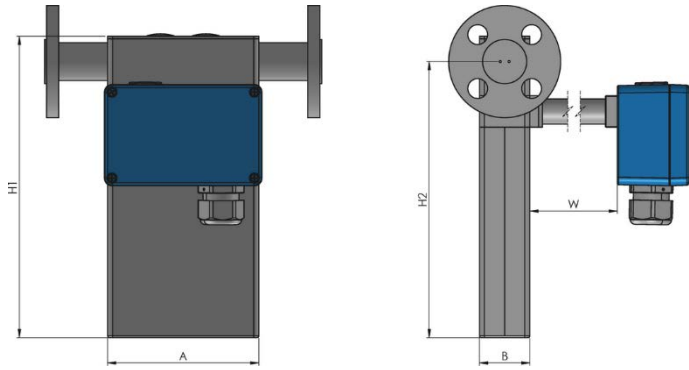
All dimensions are for standard products. For customization of face to face length and/or process connection types other than the ones listed on this page, please consult factory. Note that larger diameter flange process connections are always possible.

Mechanical Construction (continued)

Seal-less design with flange/hub connections

PFO: parallel/dual path

SFO: serial/single path

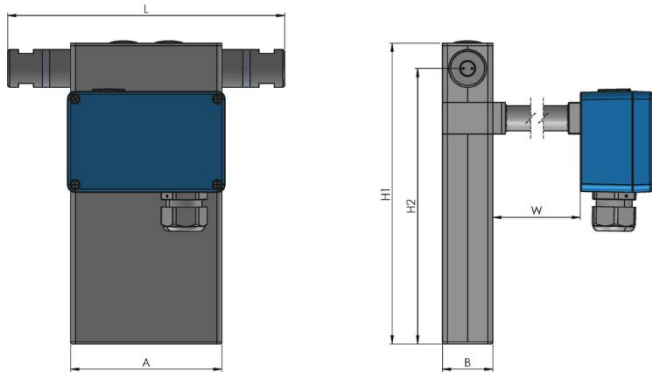


Meter will be supplied with a wetted material facing disc and 1.4571 (316Ti) stainless steel backing flange for some material selections (e.g. Tantalum)

Seal-less design with threaded connections

PFT: parallel/dual path

SFT: serial/single path



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)
- optionally available with integral RHE45 transmitter

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 configurations

NOTE: Junction boxes are supplied with M25 x 1.5 cable entries as standard. M20 x 1.5, 1/2" NPT, 3/4" NPT cable entries are optionally available and must be ordered separately.

Weight in standard manifold construction with female threads approx. 3.2 kg (7.1 lbs)
Weight in standard sealless construction and 150# flanges approx. 4.1 kg (9 lbs)
Shipping in carton box approx. 60 x 41 x 32 cm (24 x 16 x 13 in), gross weight with sealless construction, 150# standard flanges and RHE28 approx. 11 kg (24 lbs)

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.

Process Connection	Face to Face (L)		Order Code
	mm	in	
ANSI 1/2" 150#RF	220	8.66	A1
ANSI 1/2" 300#RF	220	8.66	A2
ANSI 1/2" 600#RF	220	8.66	A3
ANSI 1/2" 1500#RF	300	11.81	A6
ANSI 1/2" 1500#RTJ	300	11.81	R1
ANSI 1/2" 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
Grayloc® Hub 1" GR4 - only with PFO	300	11.81	H3
JIS RF10K 15A (1/2")	220	8.66	J1
JIS RF20K 15A (1/2")	220	8.66	J2
Sanitary 1/2" Triclamp DIN 32676 - only with SFO	220	8.66	S1

1. For other hub connections (e.g. Destec, Galperti, Techlok) please consult factory

Process Connection	Face to Face (L)		Order Code
	mm	in	
Female Thread G 1/4"	220	8.66	G1
Female Thread 1/4" NPT	220	8.66	N1
Swagelok® 1/4" Tube Fitting (SS-400-14W)	220	8.66	W1
Autoclave 3/8" MP (3/16"-18 UNF female thread)	220	8.66	P2

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

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)

Pressure Code for pmax of Measuring Loops

See pressure ratings page for ratings and codes

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) (RHM03L,04L have a wetted SuperDuplex crossover link)
- SHO Serial manif., pmax = 900 bar (13055 psi) (RHM03L,04L have a wetted SuperDuplex crossover link)
- SVO Serial manif., pmax = 1220 bar (20000 psi @ 50°C) - only RHM015L,02L (wetted 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 Measuring Loops

- M1 1.4571 (316 Ti stainless steel) - standard for RHM03L
- 35 1.4435 (316 L stainless steel) - standard for RHM015L, 04L
- M0 1.4539 (904L stainless steel)
- M3 2.4602 (Alloy C22) - PFO, SFO only
- 10 1.4410 (SuperDuplex)
- HP HP160 - RHM03L, 04L only

Process Connection

See mechanical construction pages for available connections and codes

Terminal Box Selection

- JM Coated aluminum TB, M25 cable entry (options available)
- SM SS 316 TB, M25 cable entry (options available)
- TM No TB. 2m fixed / integral PTFE cable to RHE
- J5 Coated aluminum TB for integral RHE45, one or two M12 sockets

Options Codes

See options listing for specific codes

Hazardous Area Certifications

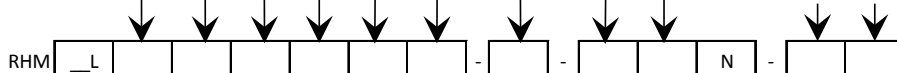
- NN Without Ex Approval
- A0 ATEX/IEC Approvals Zone 0: Ex II 1G Ex ia IIC T1...T6 Ga
- A1 ATEX/IEC Approvals Zone 1: Ex II 2G Ex ib IIC T1...T6 Gb
- C0 CSA Approvals USA-Canada Class I, Div. 1, Groups A, B, C, D

Pressure Design Compliance

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

Mass Flow, Density Calibration Selection

See performance page for code options



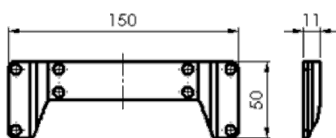
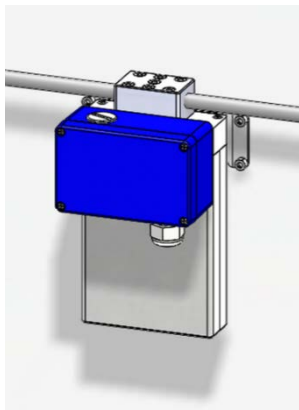
Options and Accessories

Options Codes	
HE	Electrical Heating Jacket (IP40, ordinary area only)
SM	Terminal Box and entire enclosure in SS 316
P2	Housing Purge ¼" NPT (2 pcs)
PD	Housing Purge ¼" 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

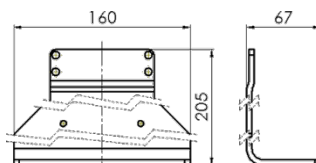
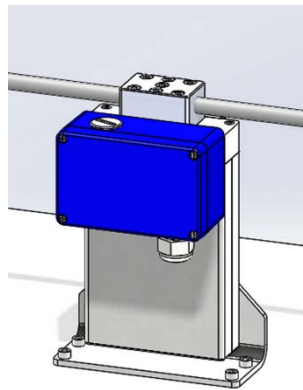
Options (order separately)	
ORHM-E1	½" NPT Terminal Box Cable Entry
ORHM-E2	M20 x 1.5 Terminal Box Cable Entry
ORHM-E3	¾" NPT Terminal Box Cable Entry

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)

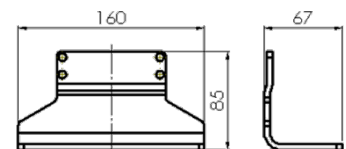
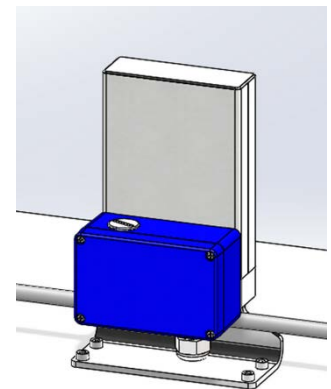
Mounting Bracket Accessory Details



Type M
Wall Mount



Type MF
Floor Mount



Type MG
Floor Mount

Transmitter Range



Any Rheonik Mass Flow Transmitter model can be combined with any 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.

See separate data sheet for the features of each transmitter style

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 our valued business partner.

Need a specific configuration for your plant - don't compromise with a "standard" product from elsewhere that will add extra cost to your installation. If we can't configure it from our extensive product range, our exclusive **AnyPipeFit Commitment** can have your flow sensor customized with any size or type process connection you need.

No matter what control system you use as the backbone in your enterprise, with our **AnyInterface Commitment**, you can be sure that connection and communication will not be a problem. Alongside a wide variety of discrete analog or digital signal connections, we can also provide just about any network/bus interface available (for example: HART, ProfibusDP, ProfiNet, EtherCAT, PowerLink, EtherNet/IP, CAN,) with our RHE4x family of transmitters. Rheonik RHE4X transmitters can connect to your system – no headache and no conversion needed.