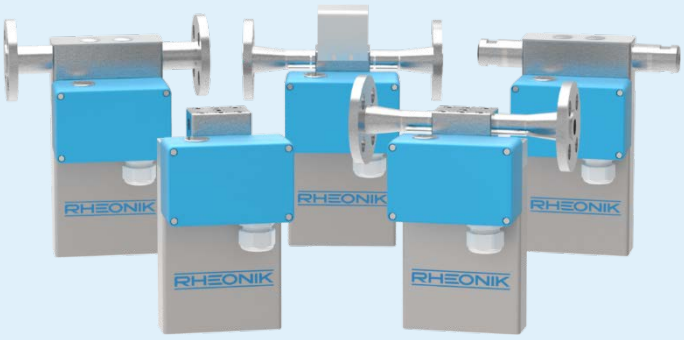


RHM 015L/02L/03L/04L

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
Nominal Flow (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)
Maximum Flow (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)
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_{max}, Q_{min} will be 50% of the above listed parallel/dual tube version of the same size			
Operating Temperature	Temperature range options cover applications from -196°C to 350°C (-320°F to 662°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 (300m application dependent)			
Sensor Enclosure Materials	304 stainless steel (standard), 316 stainless steel (optional) Epoxy 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) 100% Tantalum UNS R05200 (ideal for hydrochloric acids) 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			
Process Connections	Nearly any - **the RHEONIK Connectivity Promise**. Consult factory for types not listed			
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), ATEX rating for zone 2 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: ▪ 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 3 bar (40 psi) for H_20. 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.

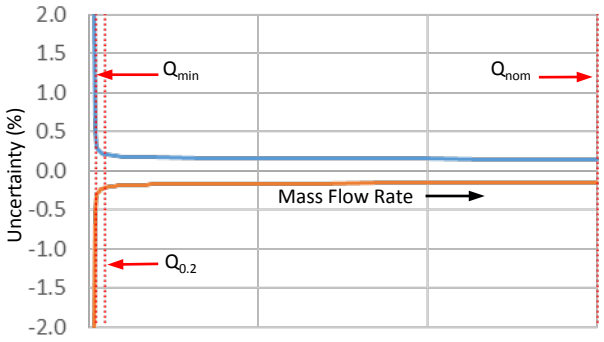
* The flow specifications above relate to standard pressure parallel tube sensor versions. Models with higher pressure ratings have increased wall thickness and will have higher pressure drops and lower Q_{nom} values.

Measurement Performance

Standard Calibration A or B

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

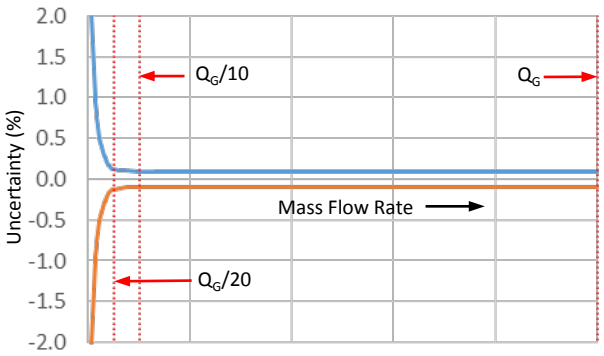
Higher pressure units may have lower Q_{nom} values due to reduced tube ID



Goldline (Selected Sensor) Calibration G or P

G	**0.12% Uncertainty** ±0.12% uncertainty between Q_G and (Q_G/20)
P	**0.1% Uncertainty** ±0.1% uncertainty between Q_G and (Q_G/10)

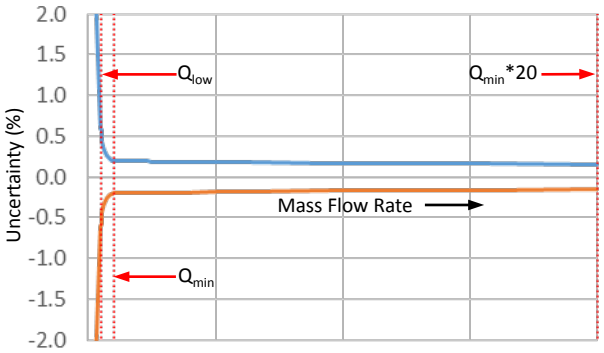
Only for sensors with standard temperature and pressure range
Customized calibration services are available – consult factory



Low Flow (Selected Sensor) Calibration C or 1

C	**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	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)

Flow Measurement Repeatability

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

Density Performance Options

Density calibration can be provided with the RHM02L/03L/04L sensor only

N	Density/volume flow indication is available using RHE FixDens function (no density calibration)
S	Standard density calibration, 0.5% uncertainty of reading
D	Advanced density calibration, 0.2% uncertainty of reading

Temperature Performance

Better than ±1°C

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	**904 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
P1 - Tantalum	bar	psi			bar	psi		
50°C / 122°F	196	2845			160	2320		
120°C / 248°F	150	2175			123	1785		
210°C / 410°F	122	1770			99	1435		
P2 - SS 904L							bar	psi
50°C / 122°F							332	4815
120°C / 248°F							319	4625
210°C / 410°F							281	4075
350°C / 662°F							231	3350
P2 - Alloy C22	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				
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. Inconel, Monel, 304 stainless steel, others) may be possible for chemical compatibility, lower pressure drop, abrasion allowance, other application specific requirements.

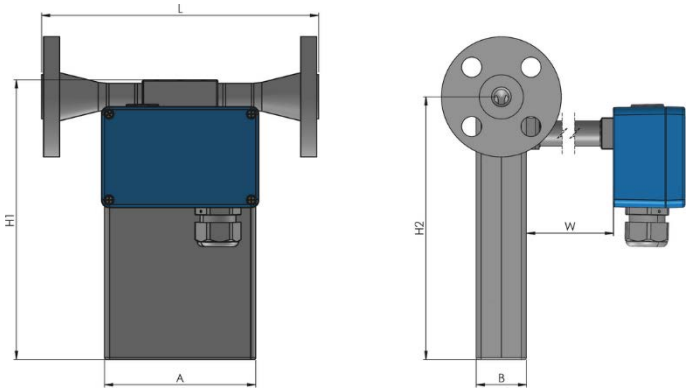
Contact factory with specification for assessment and availability.

Mechanical Construction

Sensors are manufactured with two internal measurement tubes arranged side by side. In parallel or dual path sensors (order code P*xx*), these tubes are connected in parallel and the flowing fluid is split equally between them. In serial or single path sensors (order code S*xx*), 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
SM0: serial/single path

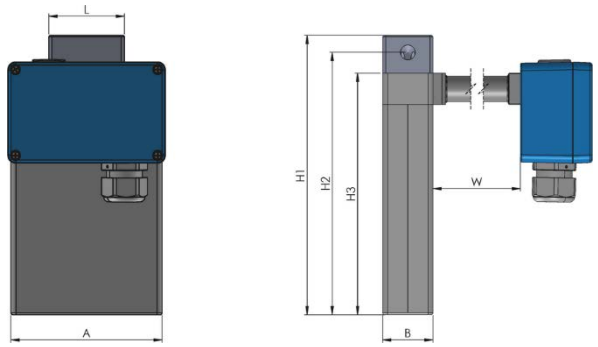


Dimensions on next page

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
SM0/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 (⁹⁄₁₆"-18 UNF female thread)	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	SM0	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

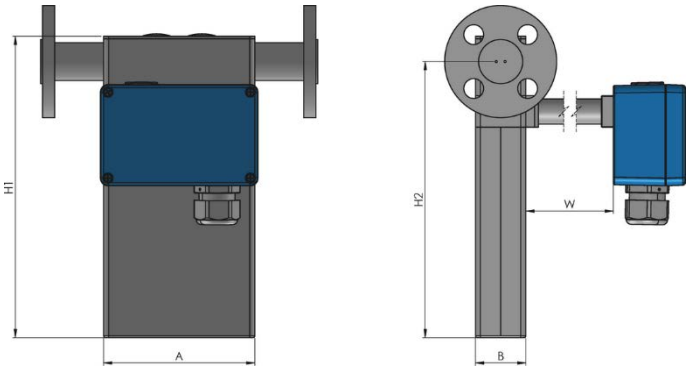
**PH0, PV0, SH0, SV0 manifolds are not recommended with E2 temperature range*

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

PF0: parallel/dual path
SF0: serial/single path

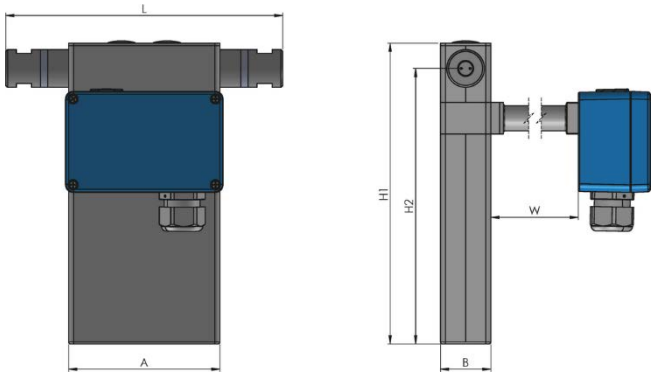


Meter will be supplied with a wetted material facing disc and 1.4571 (316Ti) stainless steel backing flange for some material selections (e.g. Tantalum)

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 SF0*	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 (⁹⁄₁₆"-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 (PF0, SF0, 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

- PM0 Parallel manifold, pmax = 540 bar (7830 psi)
- PH0 Parallel manifold, pmax = 900 bar (13055 psi)
- PV0 Parallel manifold, pmax = 1220 bar (17695 psi, 20000 psi @ 50°C)
- SM0 Serial manifold, pmax = 540 bar (7830 psi). Contains wetted 1.4410 (SuperDuplex) crossover link
- SH0 Serial manifold, pmax = 900 bar (13055 psi). Contains wetted 1.4410 (SuperDuplex) crossover link
- SV0 Serial manif., pmax = 1220 bar (17695 psi, 20000 psi @ 50°C). Contains 1.4410 (SuperDuplex) cross. link (RHM015L only)
- PF0 Parallel path, seal-less for flange and hub connections
- PFT Parallel path, seal-less for thread connections
- SF0 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 RHM015L, 02L
- M1 Measuring tubes: 1.4571 (316 Ti) - Standard for RHM03L
- 35 Measuring tubes: 1.4435 (316 L) - Standard for RHM04L
- M3 Measuring tubes: 2.4602 (Alloy C22) - PF0, SF0 only
- M4 Measuring tubes and connection: Tantalum - RHM015L, 03L with PF0 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, 2A, A1, C1
- SM SS316 terminal box, for remote RHE2x, only with Haz. Area NN, 2A, A1, A0, C1
- TM 2m fixed / integral PTFE cable, for remote RHE16/2x, only with Haz. Area NN, 2A, A1, C1
- JO Coated Alu TB, for remote RHE16, only with Haz. Area NN, 2A
- C6 Coated Alu TB, for RHE16 compact mount, only with N1, NA temperature, Haz. Area NN, 2A

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
- 2A ATEX Rating Zone 2: Ex II 3G Ex nA IIC T1-T6 Gc
- 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

Density Calibration

See performance page for availability/code options

Options and Accessories

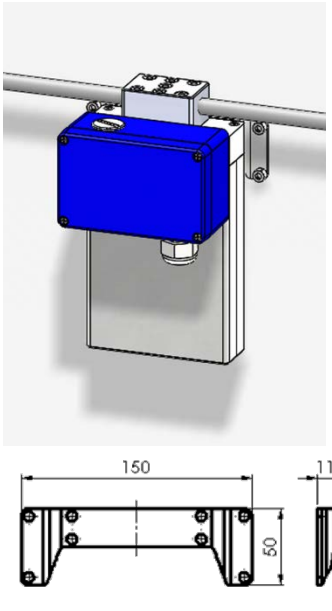
Options Codes	
HE	Electrical Heating Jacket (IP40, ordinary area only)
H1	Steam/Oil Heating Jacket
SH	Entire Enclosure in 316 SS
P2	Housing Purge ½" NPT (2 pcs)
PD	Housing Purge ½" NPT, with Integrated Rupture Disk
RD	Rupture Disk on Housing
FK	FFKM Manifold O-Ring Seals instead of Standard
FO	FVMQ Manifold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

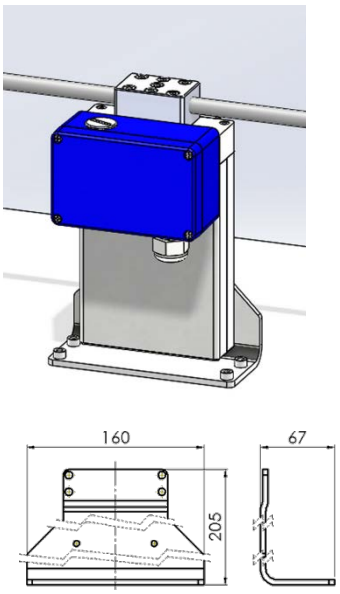
Accessories	
ORHMS-M	Wall mounting bracket (highly recommended for low flow installations)
ORHMS-MF	Floor mounting bracket for liquid fluids
ORHMS-MG	Floor mounting bracket for gaseous fluids

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…)

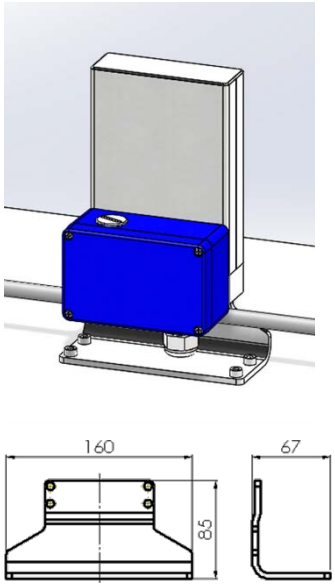
Mounting Bracket Accessory Details



Type M
Wall Mount



Type MF
Floor Mount (liquid)



Type MG
Floor Mount (gas)

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.