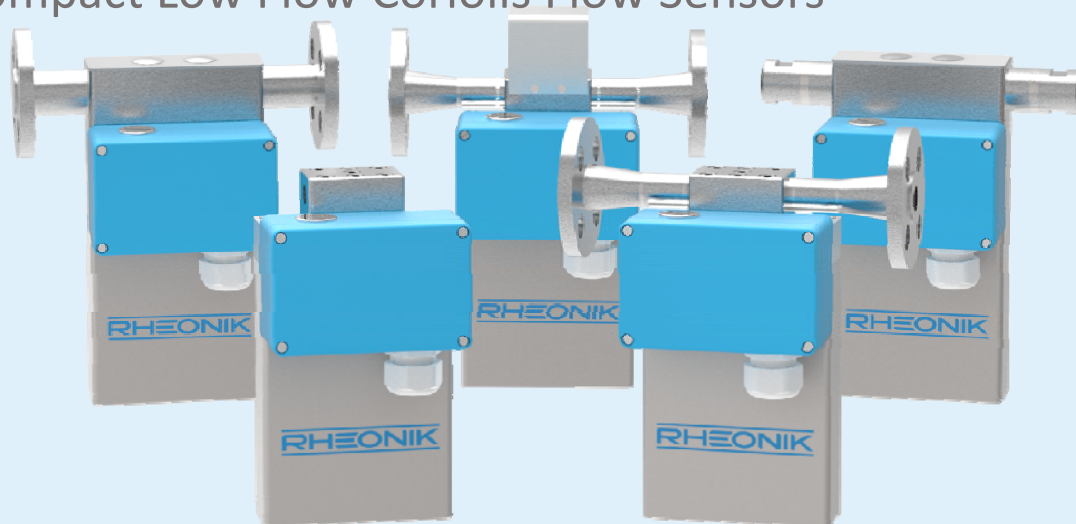


RHM 015L/02L/03L/04L

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 316** 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

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

General Specification Overview

	RHM015L	RHM02L	RHM03L	RHM04L
Nominal Flow (Q_{nom})* (Standard Parallel/Dual Tube Versions)	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})* (Standard Parallel/Dual Tube Versions)	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})* (Standard Parallel/Dual Tube Versions)	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} are 50% of the above parallel/dual tube versions			
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	1.4301 / 304 stainless steel (standard), 1.4571 / 316Ti stainless steel (optional) Epoxy coated aluminum electrical box (standard), 1.4571 / 316Ti stainless steel (optional)			
Enclosure Type	Protection class IP 66 / NEMA 4 (standard), NEMA 4X, IP68/69K (optional)			
Wetted Materials	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) Canada – CRN			
Certifications and Approvals	IECEX / ATEX zone 2, 1 and 0 North American Approvals for Class 1, Div 1/2 American Bureau of Shipping (ABS) marine approval for use on 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 3 bar (40 psi) for H₂O. 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.

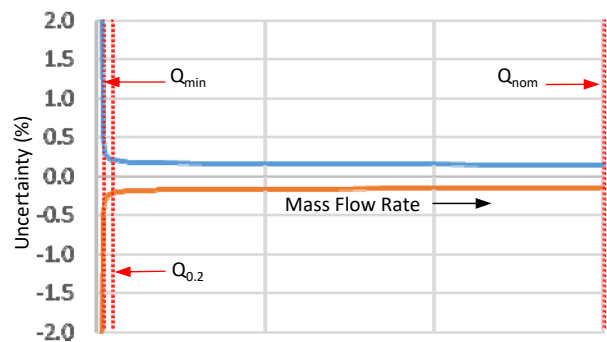
* The flow specifications above relate to standard pressure parallel tube sensor versions. Models with higher pressure ratings have increased wall thickness and will have higher pressure drops and lower Q_{nom} values.

Measurement Performance

Standard Calibration Options

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

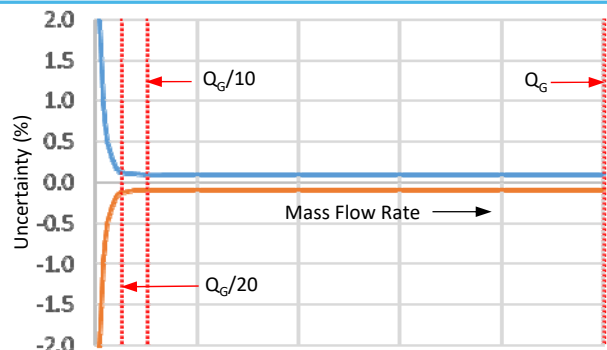
Higher pressure units may have lower Q_{nom} values due to reduced tube ID



Goldline Calibration Options

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 $(Q_G/10)$

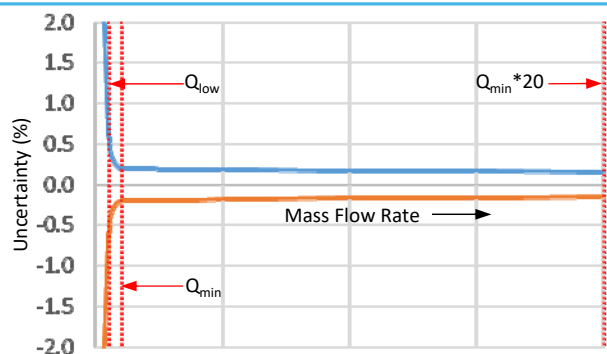
Customized calibration services are available – consult factory



Low Flow Calibration Options

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}

* Low flow calibration is not available with RHM02L



	RHM015L	RHM02L	RHM03L	RHM04L
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_{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_{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)
$Q_{0.2}$	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_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_{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

Density Performance

Density calibration can be provided with the RHM04L sensor only

N	Density/volume flow indication is available using RHE FixDens function (no density calibration)
D	Standard density calibration with water - 1% uncertainty of reading (500 to 1400 kg/m³)
3	Advanced density calibration - 0.2% uncertainty of reading (500 to 1400 kg/m³)

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*								
SS 904L	bar	psi	bar	psi	bar	psi	bar	psi
50°C / 122°F	362	5250	612	8875	270	3915	170	2465
120°C / 248°F	300	4350	540	7830	200	2900	150	2175
210°C / 410°F	250	3625	463	6715	160	2320	120	1740
350°C / 662°F	200	2900	384	5570	150	2175	100	1450

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								
Alloy C22	bar	psi	bar	psi	bar	psi	bar	psi
50°C / 122°F	612	8875	622	9020	616	8935	608	8820
120°C / 248°F	540	7830	540	7830	540	7830	540	7830
210°C / 410°F	463	6715	470	6815	465	6745	459	6660
350°C / 662°F	384	5570	390	5655	387	5615	382	5540

PH**								
Sandvik HP160					bar	psi	bar	psi
50°C / 122°F					1070	15520	1070	15520
120°C / 248°F					900	13055	900	13055
210°C / 410°F					723	10485	723	10485

P3***								
Super Duplex	bar	psi	bar	psi	bar	psi	bar	psi
50°C / 122°F	1070	15520	1070	15520	1070	15520	1070	15520
120°C / 248°F	900	13055	900	13055	900	13055	900	13055
210°C / 410°F	720	10445	720	10445	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	16680	1156	16680	1156	16680	1169	16680

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.

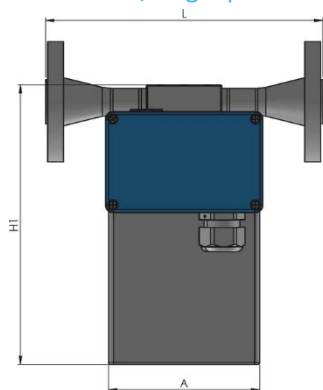
Mechanical Construction

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.

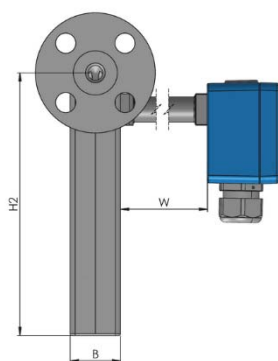
Manifold design with seals and flange connections

PMO: parallel/dual path

SMO: serial/single path



Dimensions on next page

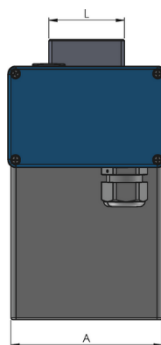


Process Connection	Face to Face (L)		Order Code
	mm	in	
ANSI ½" 150#RF	220	8.66	A1
ANSI ½" 300#RF	220	8.66	A2
ANSI ½" 600#RF	220	8.66	A3
ANSI ½" 1500#RF	300	11.81	A6
ANSI ½" 1500#RTJ	300	11.81	R1
DIN DN15/PN40	220	8.66	D1
DIN DN15/PN100	220	8.66	D2
DIN DN15/PN160	220	8.66	D3
JIS RF10K 15A (½")	220	8.66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

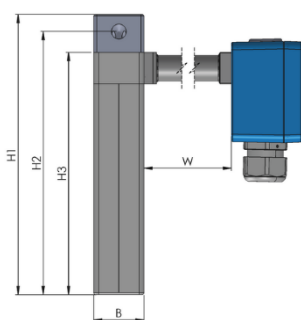
Manifold design with seals and threaded connections

PMO/PHO/PVO: parallel/dual path

SMO/SHO: serial/single path



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) <i>Only with PHO, PVO, SHO</i>	70	2.76	P2

Standard Seal Types

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

Temperature Range	PMO	SMO	PHO	SHO	PVO
N1	FKM	FKM	FFKM	FFKM	FFKM
NA	FVQM	FVQM	FVQM	FVQM	FVQM
E2*	FFKM	FFKM	N/A	N/A	N/A

For other process specific seal types and seals for higher temperature ranges, please contact factory

*PHO, PVO, SHO is not available with E2 temperature range as standard.

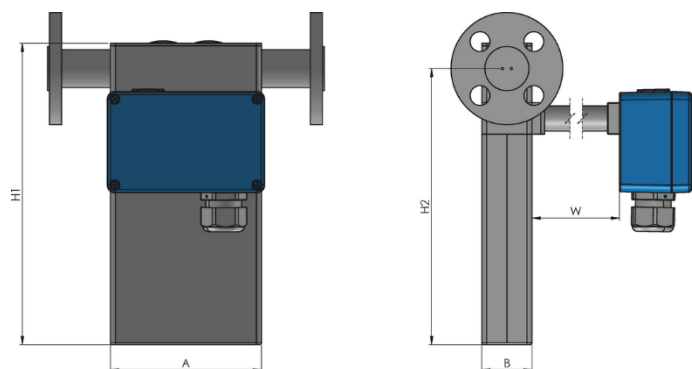
All dimensions are for standard products. For customization of face to face length and/or process connection types other than the ones listed on this page, please consult factory. Note that larger diameter flange process connections are always possible.

Mechanical Construction

Seal-less design with flange connections

PFO: parallel/dual path

SFO: serial/single path

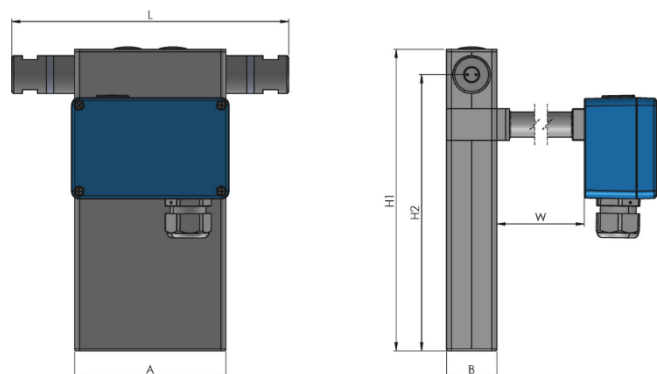


Meter will be supplied with a wetted material facing disc and 1.4571 (316Ti) stainless steel backing flange for some material selections (e.g. Tantalum)

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

Seal-less design with threaded connections

PFT: parallel/dual 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)	267	10.51
H1 (PFO, SFO, PFT)	239	9.41
H2	208	8.19
H3	192	7.56

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

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

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

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

Model Number

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))

PM0 Parallel manifold, pmax = 540 bar (7830 psi)
PH0 Parallel manifold, pmax = 900 bar (13055 psi)
PV0 Parallel manifold, pmax = 1220 bar (17695 psi)
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
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

Material of Wetted Parts

M0 Measuring tubes: 1.4539 (904L), manifold and/or connection: 1.4571 (316Ti). Seals (if fitted) dependent upon temp. range selected.
M3 Measuring tubes and connection: 2.4602 (Alloy C22) - PFO, SFO only
3M Measuring tubes: 2.4602 (Alloy C22), manifold and connection: 1.4571 (316Ti). Seals dependent upon temp. range selected.
M4 Measuring tubes and connection: Tantalum - PFO only
01 Measuring tubes: 1.4410 (SuperDuplex), manifold and connection: 1.4571 (316Ti). Seals dependent upon temp. range selected.
10 Measuring tubes and connection: 1.4410 (SuperDuplex) - PFO, SFO, PFT only
HP Measuring tubes: HP160, manifold and/or connection: 1.4571 (316Ti). Seals (if fitted) dependent upon temp. range selected.

Process Connection

See mechanical construction pages for available connections and codes

Transmitter Interconnect Type

JM Coated Alu. JB, M25 cable entry (options available), 2 x PT1000, 11 terminal, RHE16/2x, not for zone 0
SM 1.4571 (316Ti) SS JB, M25 cable entry (options available), 2 x PT1000, 11 terminal, RHE16/2x, reqd. for zone 0
TM 2m Fixed / Integral Teflon Cable, 2 * PT1000, RHE16/2x, not for zone 0
J6 Coated Alu. JB, M25 cable entry (options available), 2 x PT1000, 11 terminal, RHE16, Ordinary area/ATEX zone 2 only
JO Coated Alu. JB, M25 cable entry (options available), 2 x PT100, 11 terminal, RHE07/08/11/12/14/16, not for zone 0
SC 1.4571 (316Ti) SS JB, M25 cable entry (options available), 2 x PT100, 11 terminal, RHE07/08/11/12/14/16, not for zone 0
C6 Coated Alu. JB, M25 cable entry (options available), for RHE16 compact mount, 2 x PT1000 - limited temp. N1/NA range only
C2 Coated Alu. JB, M12 8 pin socket, for RHE16 compact mount, 2 x PT1000 - limited temp. N1/NA range only

Options Codes

See options listing for specific codes

Hazardous Area Certifications

NN Without Ex Approval
A0 ATEX approval Zone 0: Ex II 1G Ex ia IIC T1...T6 Ga
A1 ATEX approval Zone 1: Ex II 2G Ex ia IIC T1...T6 Gb
A2 ATEX rating Zone 2: Ex II 3G Ex ic IIC T1...T6
C1 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]
CA CRN (Alberta Province) [Canada]
CR CRN (All other Provinces) [Canada]

Performance Certification

N No Performance Certification
O Custody Transfer according to OIML

Mass Flow Calibration Selection

See measurement performance page for code options

Density Calibration

See measurement performance page for availability/code options

Additional Manufacturing Instructions

NN No manufacturing instructions
DY Dye penetrant inspection
XR X-ray test - PFT, PM0 with flange only
OC Oil/grease free cleaning - seal-less types only
HC Water-free cleaning (dried after calibration)
SP Marine packing

RHM

Options, Accessories and Spare Parts

Options	
HE	Electrical Heating Jacket (IP40, ordinary area only)
H1	Steam/Oil Heating Jacket
SH	Housing in 1.4571 (316Ti) SS
P2	Housing Purge ½" NPT (2 pcs)
PD	Housing Purge ½" NPT, with Integrated Rupture Disk
RD	Rupture Disk on Housing
FO	FVMQ Manifold O-Ring Seals for gas applications below 0°C Pmax = 1000 bar @ -50°C, Tmax = +120°C
CO	321 SS Manifold O-Ring Seals for very high temperature and cryogenic applications Pmax = 100 bar
ORHM-E1	½" NPT Terminal Box Cable Entry (order separately)
ORHM-E2	M20 x 1.5 Terminal Box Cable Entry (order separately)
ORHM-E3	¾" NPT Terminal Box Cable Entry (order separately)

Accessories	
ARHM04S-M	Wall mounting bracket (highly recommended for low flow installations)
ARHM04S-MF	Floor mounting bracket for liquid fluids
ARHM04S-MG	Floor mounting bracket for gaseous fluids
ARHM04S-CM	M23 Plug with 5m ARHE-C4 cable

Spare Parts	
SP-RHM04L-SEP	PTFE Seal Maintenance Kit incl. Bolts
SP-RHM04L-SEF	FVQM Seal Maintenance Kit incl. Bolts
SP-RHM04L-SEM	SS 321 Seal Maintenance Kit incl. Bolts

Transmitter Range



RHE08



RHE11



RHE12



RHE14



RHE16



RHE26



RHE27

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.