

RHM 02, 03 & 04

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 25 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

	RHM 02	RHM 03	RHM 04
Nominal Flow (Q_{nom})*	2 kg/min (4.4 lb/min)	5 kg/min (13.2 lb/min)	10 kg/min (33 lb/min)
Minimum Flow (Q_{min})*	0.050 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 M20 x 1.5 (standard), M25 x 1.5, ½" NPT, ¾" NPT (optional) Max. cable length to remote RHE transmitter 100 m / 330 ft		
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		

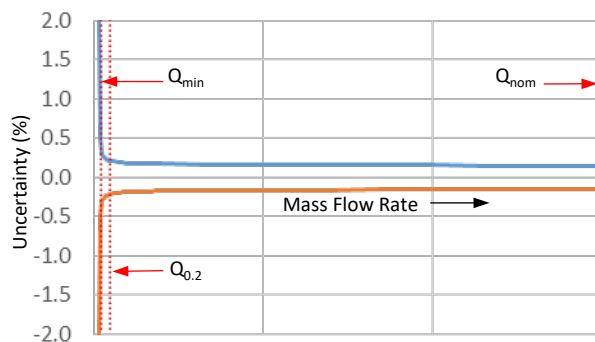
* At Q_{nom} , pressure drop across a parallel tube sensor will be approximately 1 – 3 bar (15 – 44 psi) for H₂O. Sensors can be operated at higher flow rates but pressure drop will be higher. Q_{min} is the recommended lowest flow rate. Sensors will measure flow rates lower than Q_{min} , but uncertainty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

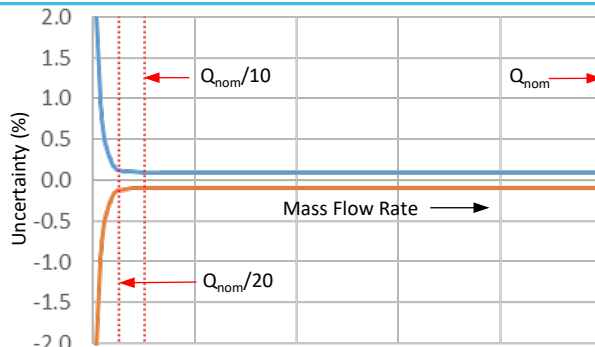
A	0.5 % Uncertainty ±0.5 % uncertainty between Q_{nom} and Q_{min}
B	0.2 % Uncertainty ±0.2 % uncertainty between Q_{nom} and $Q_{0.2}$



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 $(Q_{nom}/10)$

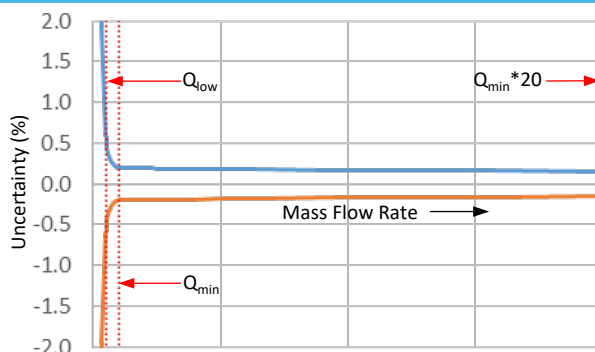
Only for sensors with standard temperature and pressure range
Customized calibration services are available – consult factory



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



	RHM 02	RHM 03	RHM 04
Q_{nom}	2 kg/min (4.4 lb/min)	5 kg/min (13.2 lb/min)	10 kg/min (33 lb/min)
Q_{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)
$Q_{0.2}$	0.10 kg/min (0.22 lb/min)	0.25 kg/min (0.55 lb/min)	0.5 kg/min (1.10 lb/min)
Q_{low}	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 (RHM 02L, 03L, 04L)

N	No Live Density Calibration
S	Standard +/- 0.01 kg/liter uncertainty between 500 and 1400 kg/m3
D	Enhanced +/- 0.005 kg/liter uncertainty between 500 and 1400 kg/m3

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 02		RHM 03		RHM 04	
P1	316 L		316 Ti		316 L	
	bar	psi	bar	psi	bar	psi
50 °C / 122 °F	300	4350	270	3916	170	2465
120 °C / 248 °F	250	3625	240	3481	150	2175
210 °C / 410 °F	230	3335	200	2900	120	1740
350 °C / 662 °F	195	2828	170	2466	100	1450
P2	Super Duplex		904 L			
	bar	psi	bar	psi		
50 °C / 122 °F	630	9135	372	5395		
120 °C / 248 °F	540	7830	300	4351		
210 °C / 410 °F	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 / P3 - 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				
50 °C / 122 °F	1070	15520				
120 °C / 248 °F	900	13055				
210 °C / 410 °F	720	10445				
P4 - Super Duplex	bar	psi	bar	psi	bar	psi
50 °C / 122 °F	1379	20000	1379	20000	1379	20000
120 °C / 248 °F	1220	17695	1220	17695	1220	17695
210 °C / 410 °F	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.

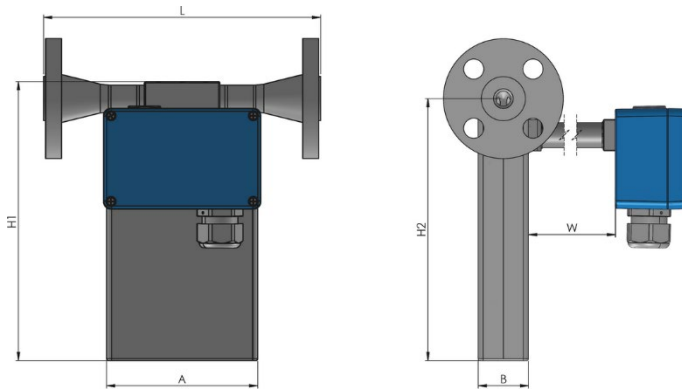
Contact factory with specification for assessment and availability.

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, SM0: serial/single path



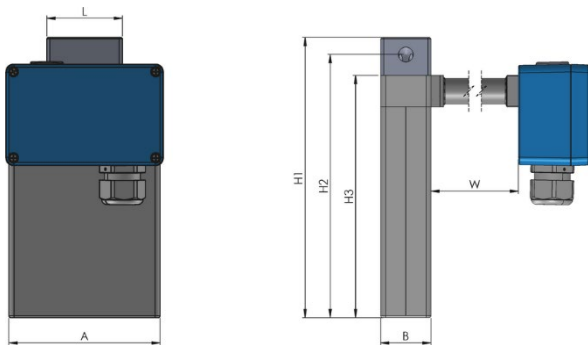
Dimensions on next page

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

Manifold design with seals and threaded connections

PM0/PH0/PV0: parallel/dual path

SM0/SH0/SV0*: 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 (⅝"-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	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

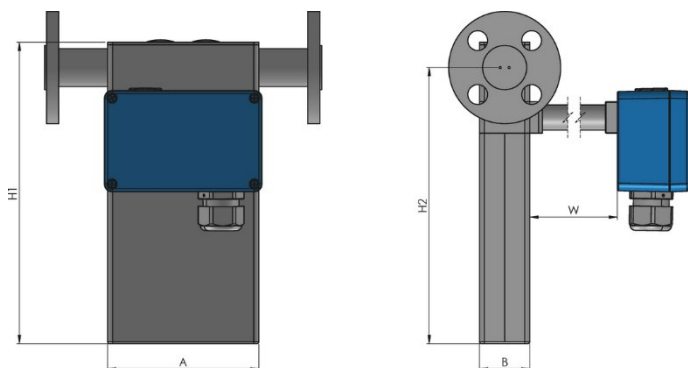
*PH0, PV0, SH0, SV0 manifolds are not recommended with E2 temperature range

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)

Seal-less design with flange/hub connections

PFO: parallel/dual path, SFO: serial/single path

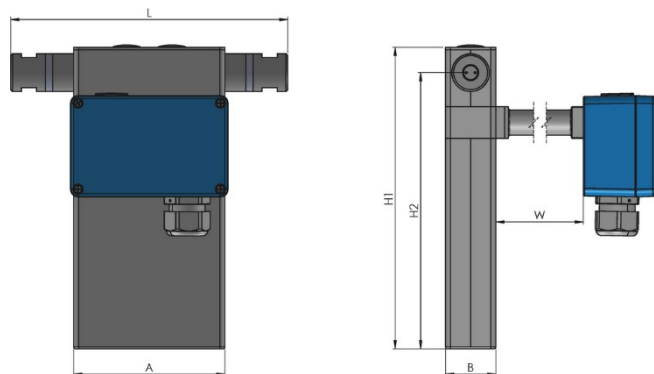


Meter will be supplied with a wetted material facing disc and 1.4571 (316Ti) stainless steel backing flange for some material selections (e.g. Tantalum)

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
Grayloc® Hub 1" GR4 - only with PFO	300	11.81	H3
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

Seal-less design with threaded connections

PFT: parallel/dual path, SFT: serial/single path



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 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

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

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

- only for remote 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 M20 x 1.5 cable entries as standard.
M25 x 1.5, ½" NPT, ¾" 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)

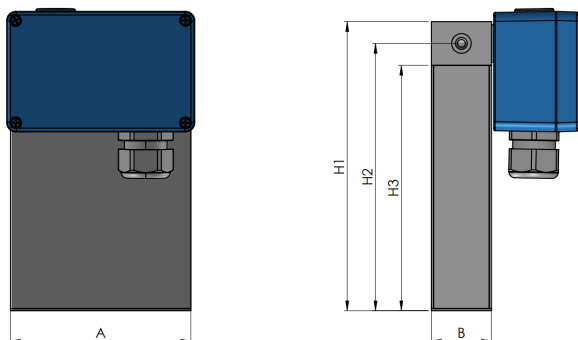
Dimensions	mm	in
A	120	4.72
B	40	1.57
H1 (PM0, PH0, PV0)	222	8.74
H1 (SM0, SH0, SV0)	267	10.51
H1 (PFO, SFO, PFT, SFT)	239	9.41
H2	208	8.19
H3	192	7.56

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.

RHM 04 Version For Hydrogen Dispensers Mechanical Construction

Sealless design with Autoclave thread connections

PMT: parallel/dual path



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)
Terminal boxes are supplied with M20 x 1.5 cable entries as standard

Process Connection	Face to Face (L)		Order Code
	mm	in	
Autoclave $\frac{3}{8}$ " MP ($\frac{9}{16}$ "-18 UNF female thread)	120	4.72	P1

Dimensions	mm	in
A	120	4.72
B	40	1.57
H1 (PMT)	192	7.56
H2 (PMT)	178	7.01
H3 (PMT)	163	6.42

	Flow Tube Pressure Rating	
P2 - Sandvik HP160	bar	psi
50°C / 122°F	630	9135
120°C / 248°F	540	7830
210°C / 410°F	410	5945
P3 - Sandvik HP160	bar	psi
50°C / 122°F	1070	15520
120°C / 248°F	900	13050
210°C / 410°F	723	10485

Options and Accessories

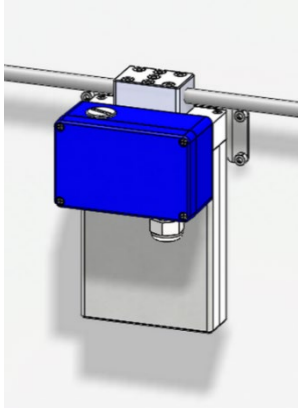
Options Codes	
SM	Terminal Box and entire enclosure in SS 316
P2	Housing Purge ¼" NPT (2 pcs)
PD	Housing Purge ¼" NPT, with Integrated Rupture Disk
RD	Rupture Disk on Housing
FK	FFKM Manifold O-Ring Seals instead of Standard
FO	FVMQ Manifold O-Ring Seals instead of Standard

Options (order separately)	
ORHM-E1	½" NPT Terminal Box Cable Entry
ORHM-E2	M25 x 1.5 Terminal Box Cable Entry (only with SM Electrical Connection)
ORHM-E3	¾" NPT Terminal Box Cable Entry

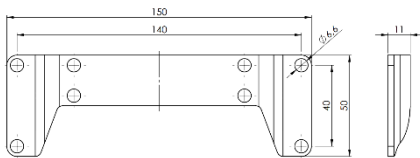
Accessories	
ORHMS-M	Wall mounting bracket (highly recommended for low flow installations)
ORHMS-MF	Floor mounting bracket standard
ORHMS-MG	Floor mounting bracket upside down installation (not for serial manifold versions)

Options and Accessories (continued)

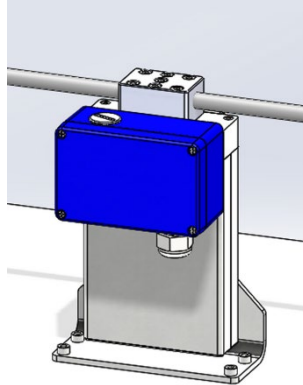
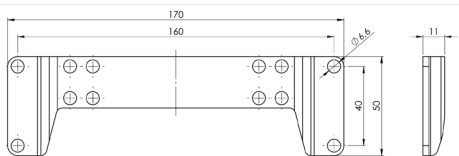
Mounting Brackets for special Installation requirements



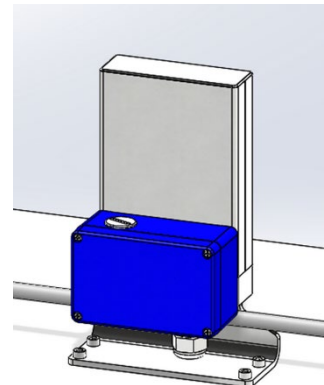
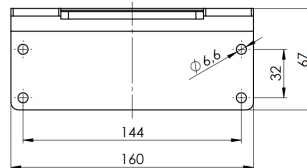
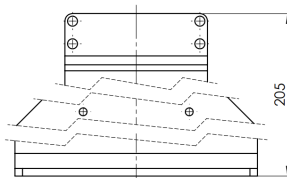
M
Wall Mount,
all Types except PMT



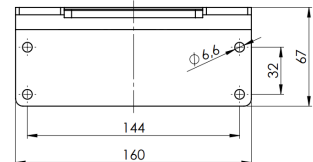
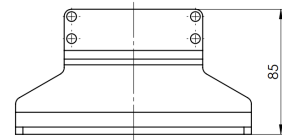
M
Wall Mount,
Type PMT



MF
Floor Mount

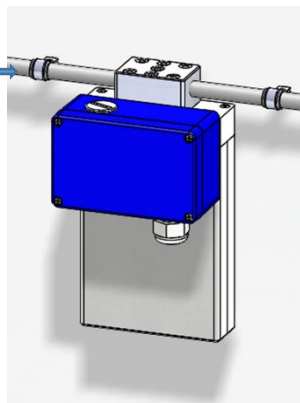


MG
Floor Mount



Standard / Usual Installation Without Mounting Brackets

Pipe supports



RHM 02, 03 & 04 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

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 manif., pmax = 540 bar (7830 psi) (RHM03L,04L have a wetted SuperDuplex crossover link)

SH0 Serial manif., pmax = 900 bar (13055 psi) (RHM03L,04L have a wetted SuperDuplex crossover link)

SV0 Serial manif., pmax = 1220 bar (20000 psi @ 50°C) - only RHM015L,02L (wetted SuperDuplex crossover link)

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 Measuring Loops

M1	1.4571 (316 Ti stainless steel) - standard for RHM03L
35	1.4435 (316 L stainless steel) - standard for RHM02L, 04L
M0	1.4539 (904L stainless steel)
M3	2.4602 (Alloy C22) - PF0, 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 for operation with RHE20/40
JO	Coated aluminum TB, M25 cable entry for operation with RHE16
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
A2	ATEX/IEC Approvals 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]

Mass Flow, Density Calibration Selection

See performance page for code options



RHM 04 Version For Hydrogen Dispensers Part Number Code

Temperature Range

NA -50 to +120°C (-58 to +248°F)

Pressure Code for pmax of Measuring Loops (pmax @ 120°C / 248°F)

P2 Pmax = 540 bar

P3 Pmax = 900 bar

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

PMT Parallel, sealless, pmax = 900 bar. Connection part material SS316

Material of Measuring Loops

HP Sandvik HP160®

Process Connection

P1 Autoclave 3/8" MP (9/16-18 UNF female thread)

Terminal Box Selection

JM Coated aluminum TB, M25 cable entry for operation with RHE20/40

SM SS 316 TB, M25 cable entry (options available)

Options Codes

See options listing for specific codes

Hazardous Area Certifications

NN Without Ex Approval

A2 ATEX/IEC Zone 2: Ex II 3G Ex nA IIC T1...T6 Gc

A1 ATEX/IEC Zone 1: Ex II 2G Ex ib IIC T1...T6 Gb

A0 ATEX/IEC Zone 0: Ex II 1G Ex ia IIC T1...T6 Ga - only with Term. Box SM

C2 CSA Approvals US-Canada Class I, Zone 2, Gas IIC

C0 CSA Approvals US-Canada Class I, Div. 1, Groups A,B,C,D / Zone 1, Gas IIC

Pressure Design Compliance

NN No specific design compliance required

SE PED (SEP) [Europe]

Performance Certification

NN No Performance Certification

R9 OIML R139 approval for gas dispensers

MH MID MI002 approval for gas metering

Mass Flow Calibration

A Better 0.20% uncertainty

Density Calibration

N No direct density

M04S NA PMT HP P1 - - - - A N

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. Economical blind front versions of some transmitters are available where displays and keypads are not required. The wide range of sensors and transmitters provide tremendous options for system designers and end users alike.

About Rheonik

Rheonik has but one 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 that provide value to our customers. 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 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 and versatile product range, our exclusive **AnyPipeFit Commitment** can have your flow sensor customized with any size/type of process connection and face to face dimension 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 and 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 40 Series family of transmitters. Rheonik 40 Series transmitters can connect to your system – no headache and no conversion needed.