



## RHM 40

# Coriolis Mass Flow Meter for Demanding Applications

General Flow Control / Plant Balance / Terminal Transfer / Mixing  
and Batching / High Temperature Fluids / Barge, Ship, Rail Car and  
Truck Filling





## Features

- Typical measuring range up to 1500 kg/min (3306.93 lb/min)
- Pressure ratings up to 433 bar (6280 psi)
- Temperature ratings from -196 to +350 °C (-320 to +662 °F)
- Mass flow uncertainty down to 0.1 %
- Repeatability down to 0.05 %
- 4 kHz measurement updates and response time of less than 10 ms when used with RHE 40 Series transmitters
- Accurately measure flow rates down to 20 kg/min
- The Rheonik **AnyPipeFit Commitment** provides custom process connection type and size flexibility on any meter to suit your existing plant, saving time and expense on installation costs
- Approved for use in hazardous areas
- SS304 Stainless steel enclosure, SS 316L optional
- Integral and remote transmitter versions available

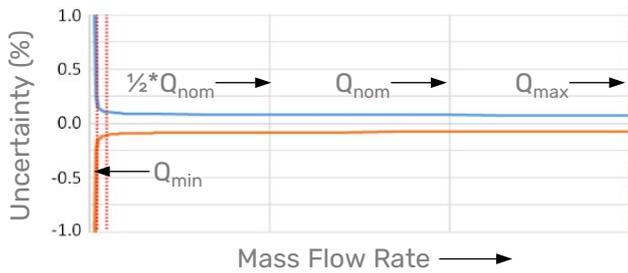
## General Specification Overview

<b>Nominal Flow (<math>Q_{nom}</math>)*</b>	1200 kg/min (2645.6 lb/min)
<b>Maximum Flow (<math>Q_{max}</math>)*</b>	1500 kg/min (3306.9 lb/min)
<b>Typical Minimum Flow (<math>Q_{min}</math>)*</b>	20 kg/min (44.1 lb/min)
<b>Serial Tube / Single Path</b>	Flow rates $Q_{max}$ , $Q_{nom}$ and $Q_{min}$ for "serial" sensors will be 50 % of the above listed parallel/dual path version.
<b>Operating Temperature</b>	Fluid temperature range options cover applications from -196 °C to +350 °C (-320 °F to +662 °F). For integral transmitter versions please refer to transmitter datasheet
<b>Ambient Temperature</b>	-50 °C to +80 °C (-60 °F to +180 °F) (standard)
<b>Pressure Ratings</b>	Up to 433 bar / 6280 psi - dependent upon material
<b>Electrical Connection Sensor w/o Integral Transmitter</b>	M20 x 1.5 standard cable entry for JM, SM terminal box versions Optional entries available : ½" NPT or M25 x 1.5 (only for SM) or ¾" NPT (only for SM) Max. cable length to remote RHE transmitter 100 m / 328 ft
<b>Sensor Enclosure Materials</b>	Stainless steel 304 (standard), SS 316L (optional) Coated aluminum terminal box, SS 316L terminal box (optional)
<b>Enclosure Type</b>	Protection class IP66 (IP66 is mostly equivalent to NEMA 4X) Optionally IP66-IP67 (IP67 declared by manufacturer, IP67 is mostly equivalent to NEMA 6)
<b>Wetted Materials</b>	Flow tubes SS 316Ti, SuperDuplex or Alloy C22 Tantalum - Consult Factory Additional/customer specific materials available upon request
<b>Process Connections</b>	Nearly any - The Rheonik <b>AnyPipeFit Commitment</b> covers a wide range of process connections types and sizes. Consult factory for types/sizes not listed in this data sheet on the Mechanical Construction pages
<b>Pressure Rating Compliance</b>	Europe - PED: Pressure Equipment Directive
<b>Certifications and Approvals</b>	ATEX / IECEx Approvals for Zone 0, 1, 2 (details see page 12) North American Approvals Class I, Div. 1, 2, Gr. A,B,C,D, Zone 0, 1, 2 Custody transfer approval (OIML R117) American Bureau of Shipping (ABS) DNV approval for marine applications
<b>Testing and Inspection</b>	All sensors are hydro tested, calibrated and supplied with a traceable calibration certificate. Customized calibration and testing services are available
<b>Project Documentation and QA, Services</b>	Rheonik offers a 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 WPS-WPQR, WQS, NDT, test &amp; quality plans, functional testing, calibration procedures, customized packing, factory acceptance etc.</li> <li>• Painting to project specification</li> <li>• Start up and commissioning services on/offshore</li> </ul>
<b>Options</b>	Enclosure heating for high temperature applications Cleaning for oxygen service , ... For more consult factory

\* At  $Q_{nom}$  pressure drop across a parallel tube sensor will be approximately 0.5 bar (7.3 psi) for H<sub>2</sub>O. Sensors can be operated at higher flow rates up to  $Q_{max}$  but pressure drop will be higher. Typical Minimum Flow  $Q_{min}$  is the recommended lowest flow rate for an accurate measurement. Sensors will measure flow rates lower than  $Q_{min}$  but uncertainty will increase beyond 1 % of rate.

The flow rate 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.

## Calibration Options



Order Code	General Accuracy Calibration
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A	Standard - 0.20 % Uncertainty
B	Premium - 0.15 % Uncertainty

Order Code	High Accuracy Calibration
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G	Premium Plus - 0.10 % Uncertainty
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Order Code	Focused Calibration
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1	0.10 % Low Flow Calibration* Requires RHE 40 Series transmitter
X	Customized Calibration** Consult factory

\* Low flow calibration focuses on the range from  $\frac{1}{2}Q_{nom}$  downwards to lower flow rates than on other calibrations. Often used for low pressure gas or very viscous liquids

\*\* Customized calibration uses specific calibration points according to customer requirements

**Reference conditions:**

18-24°C Water @ 1-3 bar

Order Code	Density Calibration / Performance (Liquid)
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N	No Density Calibration
S	Standard $\pm 0.001$ kg/l Uncertainty
D	Enhanced $\pm 0.0005$ kg/l Uncertainty Requires High Accuracy or Focused Calibration Option

### Uncertainties and flow measurement turn-down

The turn down capability from  $Q_{nom}$  of the flow sensor is driven mainly by its zero point stability. At the very low end of the measuring range the uncertainty ( $u$ ) is dominated by zero point stability.

- Zero point stability of a standard sensor with General Accuracy Calibration is: 0.15 kg/min (0.33 lbs/min).
- Zero point stability of a Gold Line sensor with High Accuracy or Focused Calibration is 0.12 kg/min (0.27 lbs/min).
- For flow  $Q \geq$  ZP stability / (Base Calibration uncertainty/100)  $\rightarrow u =$  calibration uncertainty
- For flow  $Q <$  ZP stability / (Base Calibration uncertainty/100)  $\rightarrow u =$  (zero stability/Q) \* 100

### Uncertainties from environmental and process conditions

If sensors are not zeroed at operating conditions, minor additional uncertainties can arise from elevated temperatures and pressures:

- $\pm 0.000383$  % of maximum flow per °C
- $\pm 0.000007$  % of maximum flow per bar.

Process temperature effect on density:

- Additional uncertainty of  $\pm 0.000136$  g/cm<sup>3</sup> per °C difference from calibration temperature with standard density calibration
- Additional uncertainty of  $\pm 0.000015$  g/cm<sup>3</sup> per °C difference from calibration temperature with enhanced density calibration.
- This effect can be mitigated by a simple field density adjustment at operating conditions.

Process pressure effect on mass flow:

The effect of pressure on flow measurement is 0.001232 % of rate per bar. Compensation is possible by pressure sensor input (analog input or digital write) or manual value entry into the transmitter.

Process pressure effect on density:

- The effect of pressure on density measurement is 0.0 g/cm<sup>3</sup> per bar. Compensation is possible by pressure sensor input (analog input or digital write) or manual value entry into the transmitter.

*Premium Plus, Low Flow and Enhanced Density Calibration are only available in SS 316 material, P1 lower pressure and N1 temperature range.*

*Applying Premium Plus calibration to higher pressure, special materials and/or non-standard temperature models will show higher zero uncertainties (up to 3 times higher than standard sensor).*

### Flow Measurement Repeatability

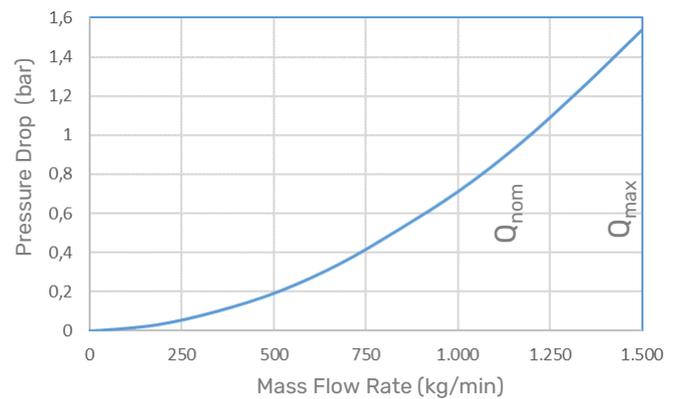
Standard Sensors  $\pm 0.1$  % of rate  
Gold Line Sensors  $\pm 0.05$  % of rate

### Temperature Measurement

Better than  $\pm 1$  °C

## Pressure Drop

Every Coriolis flow sensor generates pressure drop across its inlet and outlet when in use. The amount of pressure drop generated is mainly a function of the flow velocity within its tubes and the flowing viscosity of the stream.



0 – 1500 kg/min water, sensor with P1 pressure rating.  
Higher viscosities create higher pressure drop

## Measurement Tube Materials and 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 ( $p_{max}$  see table to the right), the connection block/manifold ( $p_{max}$  indicated in the Mechanical Construction section) or the process connection (for  $p_{max}$  see published standards or manufacturer information).

### Note:

The material of the process connection of sealless sensor versions is usually the same as the measurement loops however could be different in special cases on PFT.

Order Code	Material	50°C / 122°F	120°C / 248°F	210°C / 410°F	350°C / 662°F
P1	SS 316Ti (standard)	164 2379	147 2132	127 1842	107 1552
P1	Alloy C22	213 3089	189 2741	161 2335	133 1929
P2	SuperDuplex*	258 3742	242 3510	210 3046	n/a
P3	SuperDuplex*	433 6280	380 5511	343 4975	n/a

\* Note minimum operating temperature for SuperDuplex stainless steel is -40 °C

Units: bar / psi

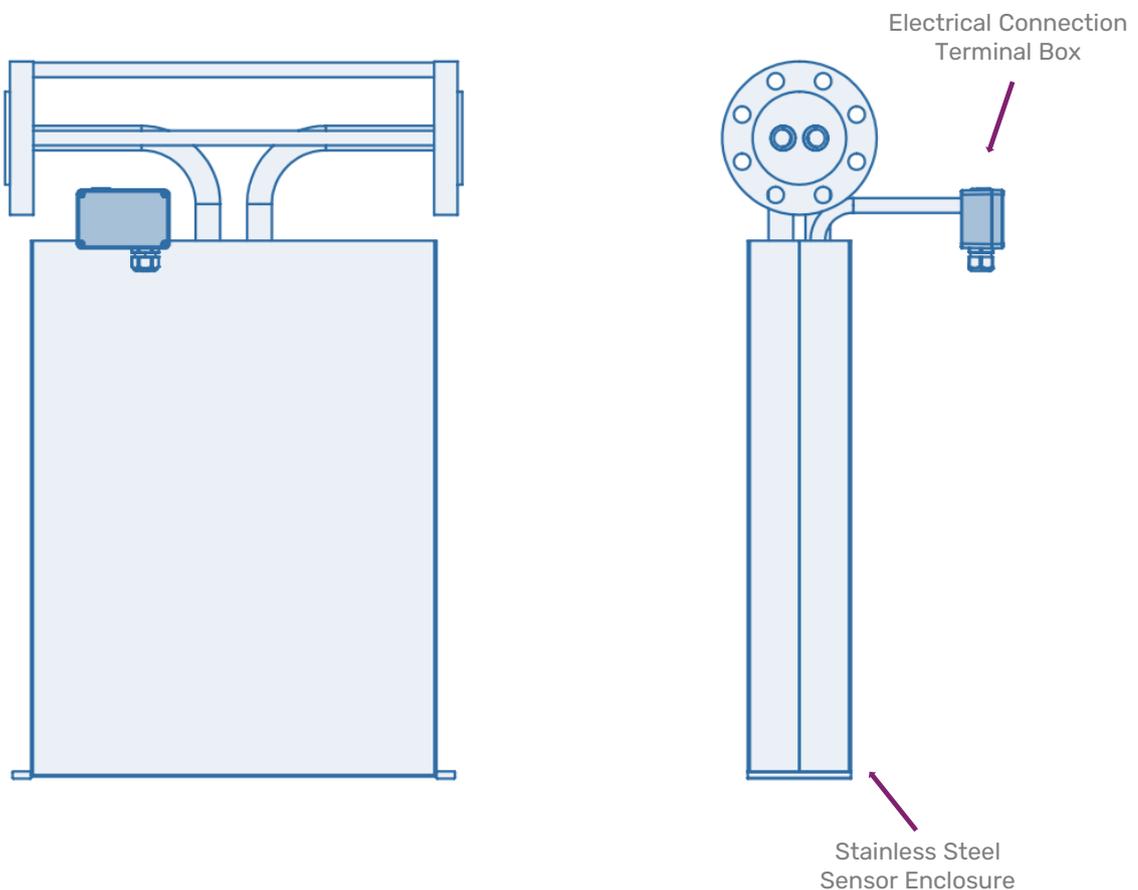
### Other Materials

Other wetted materials may be possible for chemical compatibility, lower pressure drop, abrasion allowance, other application specific requirements. Rheonik can provide nearly any material for the wetted parts.  
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 internal tubes are connected end to end, creating a single path through which all fluid flows.

In sealless designs, the measurement tubes are continuous between the process connections and do not have seals.



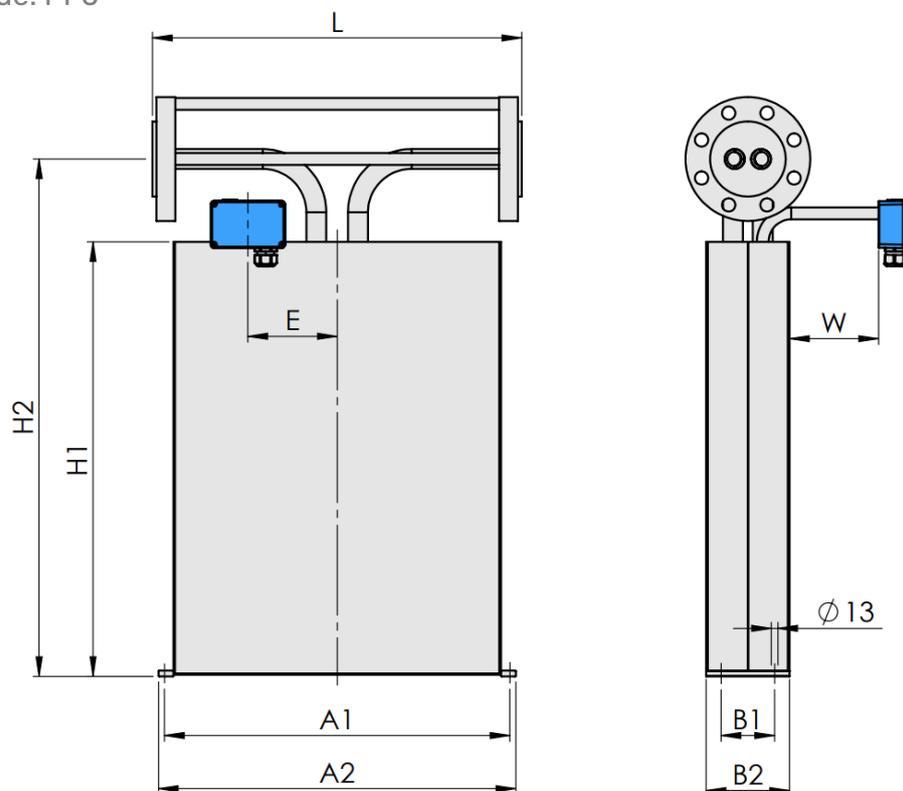
### Note

All dimensions in the following pages are for standard design products. For customization of face to face length and/or process connection types other than the ones listed on the following page, please consult factory. Note that larger diameter flange process connections are always possible. The tolerance of the process connections is  $\pm 3$  mm.

## Sealless design with flanged process connections

Parallel tube / dual measurement path

Order Code: PF0



PF0 Process Connection	Dim. L mm / in	Order Code
Flange ANSI 3" 150# RF/SF	725 / 28.54	A1
Flange ANSI 3" 300# RF/SF	725 / 28.54	A2
Flange ANSI 3" 600# RF/SF	725 / 28.54	A3
Flange ANSI 3" 900# RTJ	725 / 28.54	R6
Flange ANSI 3" 1500# RTJ	725 / 28.54	R1
Flange ANSI 3" 2500# RTJ	725 / 28.54	R2
Flange DIN DN80/PN40 Form B1	725 / 28.54	D1
Flange DIN DN80/PN100 Form B2	725 / 28.54	D2
Flange JIS B 2220 RF 10k 80A (3")	725 / 28.54	J1
Flange JIS B 2220 RF 20k 80A (3")	725 / 28.54	J2

PF0 Dimensions	mm	in
A1	690	27.17
A2	720	28.35
B1	143	5.63
B2	180	7.09
H1	963	37.91
H2	1153	45.39
E	250	9.84
W	150	5.91

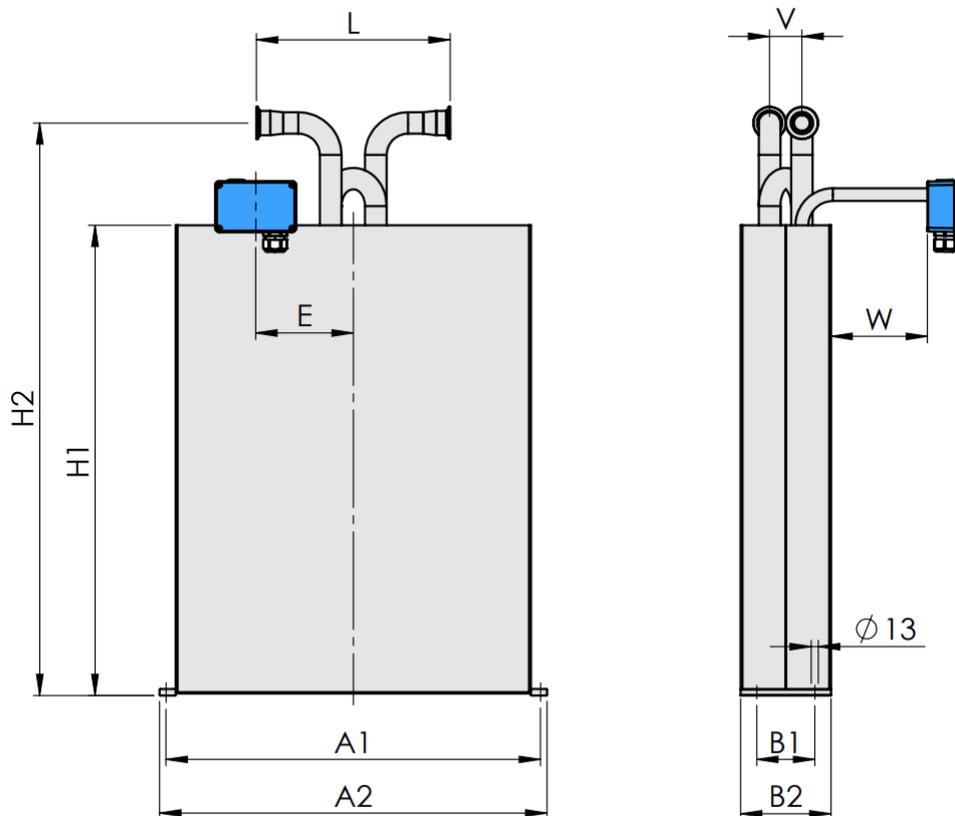
## Weights and Shipping Dimensions

- Approx. weight with 3" 150# flanges:  
~140 kg / 309 lb
- Shipping in wooden crate as per ISPM 15:  
~150 x 100 x 71 cm (60 x 40 x 28 in)
- Gross weight with RHE28, packing:  
~180 kg / 397 lb

## Sealless design with Sanitary process connections

Serial tube / parallel measurement path

Order Code: SF0



SF0 Process Connection	Dim. L mm / in	Order Code
Sanitary 2" Triclamp, DIN 32676	400 / 11.81	S4
Sanitary NW50, DIN 11851	400 / 11.81	S9

SF0 Dimensions	mm	in
A1	690	27.17
A2	720	28.35
B1	143	5.63
B2	180	7.09
H1	963	37.91
H2	1153	45.39
E	250	9.84
W	150	5.91

## Weights and Shipping Dimensions

- Approx. weight with Sanitary NW50:  
~140 kg / 309 lb
- Shipping in wooden crate as per ISPM 15:  
~150 x 100 x 71 cm (60 x 40 x 28 in)
- Gross weight with RHE28, packing:  
~180 kg / 397 lb

## Electrical Connection to Transmitter Compatibility

Electrical connection option selections are compatible with the transmitter range according to the following table. Note that economical blind front versions of some transmitters are available where displays and keypads are not required. The wide range of Rheonik sensors and transmitters provide tremendous options for system designers and end users alike.

Sensor Connection Options	Order Code						
		JM	SM	S9	TM	J5	J9
	RHE 21	✓	✓	—	✓	—	—
	RHE 26	✓	✓	—	✓	—	—
	RHE 27	✓	✓	—	✓	—	—
	RHE 28	✓	✓	—	✓	—	—
	RHE 42	✓	✓	—	✓	—	—
	RHE 45	—	—	—	—	✓	—
	RHE 46	✓	✓	—	✓	—	—
	RHE 49	—	—	✓	—	—	✓

# RHM 40 Part Number Code

## Temperature Range

- N1 -20 to +120°C (-4 to +248°F)
- 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 Range of Measurement Loops @ 120°C / 248°F

See pressure ratings page 5 for ratings and codes

## Construction Type - $p_{max}$ indications refer to 120°C / 248°F

- PF0 Parallel tube, sealless - only with flange
- SF0 Serial tube, sealless - only with sanitary connections and Material M1

## Material of Measuring Loops

- M1 316Ti / EN 1.4571 / UNS S31635
- 10 SuperDuplex / EN 1.4410 / UNS S32750 - only for PF0
- M3 Alloy C22 / EN 2.4602 / UNS N06022. For PED please consult PED Advisor Sheet
- M4 Tantalum / (no EN) / UNS R05200 - only for Type P1-PF0. For PED please consult PED Advisor Sheet

## Process Connection

See mechanical construction pages for available connections and codes

## Electrical Connection to Transmitter

- JM Terminal Box coated Aluminum - M20 x 1.5 cable entry, see Accessories for others - not with Haz. Area A0
- J5 Alu Box ready for integrated RHE45 - temperature restrictions apply - only Haz. Area NN
- J9 Alu Box ready for integrated RHE49 - temperature restrictions apply
- SM Terminal Box in SS316 - M20 x 1.5 cable entry, see Accessories for others
- S9 SS316 Box ready for integrated RHE49 and entire Enclosure/Housing in SS316 - temperature restrictions apply
- TM Integral PTFE Cable to RHE, 2m - not with H4, A0. C0 only with N1, NA

## Options Codes

See options listing for specific codes

## Hazardous Area Certifications (details see page 12)

- NN Without Ex Approval
- A2 ATEX/IECEx Approvals Zone 2
- A1 ATEX/IECEx Approvals Zone 1 - requires suitably rated RHE
- A0 ATEX/IECEx Approvals Zone 0 - requires Elec. Conn. SM, suitably rated RHE
- C2 CSA Approval US-Canada Class I, Zone 2, Gas IIC - requires suitably rated RHE - not with Temp. H4
- C0 CSA Approval US-Canada Class I, Div. 1 / Zone 0, Gas IIC - requires suitably rated RHE

## Pressure Design Compliance

- NN Rheonik standard design based on EN codes (no PED - not for sales into EU)
- PE Conformity according to the Pressure Equipment Directive (PED)

## Performance Certification

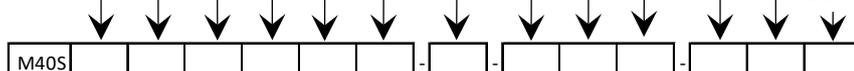
- NN No Performance Certification
- R7 Custody transfer certification for liquids OIML R117 - requires RHE4x

## Mass Flow, Density Calibration Selection

See performance page 4 for code options

## Manufacturing Instruction Codes

See instructions listing for specific codes (next page)



## Options Codes

Order Codes	
NN	Without Option
H1	Heating for Housing, Steam - Connection DN25 PN40
H2	Heating for Housing, Steam - Connection 1" ANSI 150 RF
H3	Heating for Housing, Steam - Connection 1" ANSI 300 RF
SB	Housing and base plate in SS 316 - check with factory for lead time
T1	Terminal box with cable entry upwards/gas installation

List multiple options in the sensor part number in the same order as the above list

## Manufacturing Instructions

Order Code	
N	No additional manufacturing instructions
O	Special Cleaning, fat free
S	Sea-worthy packing
7	Upgrade to dual rating IP66/67 - <i>only available with electrical connection SM</i>

List multiple options in the sensor part number in the same order as the above list

## Options

Order Code ORHM-...	
E1	Terminal box cable entry adapted to ½" NPT
E2	Terminal box cable entry adapted to M25 x 1.5 ( <i>only with electrical connection SM</i> )
E3	Terminal box cable entry adapted to ¾" NPT ( <i>only with electrical connection SM</i> )
E5	Terminal box prepared for M20 x 1.5 cable gland in SS 316L ( <i>only with electrical connection SM</i> )
E6	Terminal box prepared for ½" NPT cable entry in SS 316L ( <i>only with electrical connection SM</i> )
TP	Separate stainless steel TAG plate ( <i>TAG Information only</i> )
TC	Stainless steel type label ( <i>includes TAG and all other sensor information</i> )

Standard cable entry on JM, SM terminal box is M20 x 1.5.

## Hazardous Area Certifications

Order Code	Zone / Division	Approval	Labeling
A2	Zone 2	ATEX IECEX	⊕ Ex II 3G Ex ec IIC T6...T1 Gc Ex ec IIC T6...T1 Gc
A1	Zone 1	ATEX IECEX	⊕ Ex II 2G Ex ib IIC T6...T1 Gb Ex ib IIC T6...T1 Gb
A0	Zone 0	ATEX IECEX	⊕ Ex II 1G Ex ia IIC T6...T1 Ga Ex ia IIC T6...T1 Ga
C2	Zone 2	USA Canada	Class I, Zone 2, AEx nA IIC T6...T1 Gc, Ex nA IIC T6...T1 Gc
C0	Div 1, Zone 0	USA Canada	Class I, Div 1, Groups A, B, C and D T6...T1; Class I, Zone 0, AEx ia IIC T6...T1 Ga, Ex ia IIC T6...T1 Ga



## 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 RHE 40 Series family of transmitters. Rheonik RHE 40 Series transmitters can connect to your system – no headache and no conversion needed.

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