

# Coriolis Mass Flow Meter

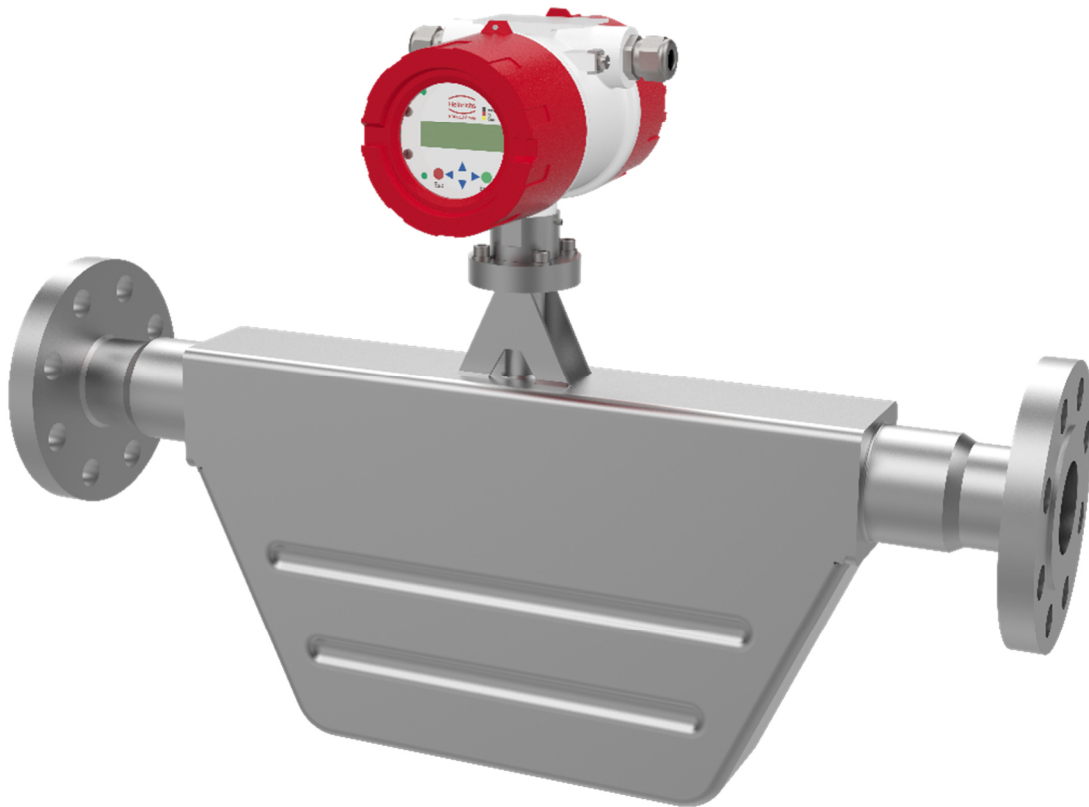
Mass-Flow Meter for standard applications

TMU

## Technical information

2<sup>nd</sup> Generation

- Extreme compact lightweight design.
- Measuring ranges from 60 kg/h to 80 000 kg/h.
- Immune to external vibrations.
- Immune to pipeline induced stresses.
- Variety of tube material available.
- Extensive selection of process connections.
- Optional sensor heating.



## Function

The TMU Coriolis flow Sensors utilize the Coriolis principle for the direct measurement of mass flow.

The sensor possesses two parallel-arranged tubes, which are continuously force-vibrated at their resonance frequency. When a fluid or gas passes through the tubes, the mass flow momentum in conjunction with the Coriolis effect invokes a change in the tubes deflection, causing the inlet and outlet legs of the tubes to twist out of phase.

Coupled with a UMC transmitter, the phase shift is captured and evaluated. The derived linear output is proportional to the mass-flow.

The TMU Coriolis Mass Flow Sensors are designed for measuring the mass flow, density and calculated volume flow of almost all liquid and gaseous media.

Available as a standard configuration with a variety of process connections, the TMU sensors are optimised for the use in innumerable applications common to chemical, petrochemical, oil and gas, food and pharmaceutical industries.

The TMU Series also has a proven track record for use in precise dosing systems as well as in loading and unloading applications.

## Technical Details

### Sensor system: TMU (2. Generation)

Coriolis dual-pipe tubes  
TMU-X008 bis TMU-X050  
(X denotes tube material)

#### Accuracy

Liquid: 0.1 % of actual flowrate  
± ZP stability

Gas: 0.5 % of actual flowrate  
± ZP stability

#### Wetted parts:

- 316TI/1.4571
- 316L/1.4404
- Hastelloy C-22
- Tantalum
- Others on request

#### Process connection:

- Flanges: DIN / ASME / JIS
- Thread: G / NPT
- Others on request

Sensor containment: 1.4301 Stainless Steel

Ambient temperature: -40 °C...+80 °C  
-40 °F...+176 °F

Process temperature: -50 °C ...+220 °C/260 °C\*  
-58 °F...+428 °F/500 °F\*  
\*(260 °C / 500 °F max. 1h)

Process pressure: Dependant on sensor size.

Ingress protection: IP67 (EN 60529) / NEMA 6

#### Certificates and Approvals

ATEX/IECEX/UKEX: II 1/2G Ex ia IIC T2...T6 Ga/Gb

cCSAus: Class I, Zone 0, Div.1 and Div.2  
AEx ia IIC T5-T2 Ga

NEPSI: Ex ia II C T2...T6 Ga/Gb

OIML (with UMC3): R117-1 Type Approval

Ships approval: DNV / ABS

## Available Transmitters UMC4 / UMC4-RM

### Transmitter mounting:

- Field housing local mounted or remote mounted via junction box (½"NPT(f), M20x1,5) or connector (Harting Han® R23). IP67 (EN60529) / NEMA6
- Rack-mount design (RM) remote, via screw terminals. IP20 (to be mounted in min. IP54 ATEX certified protective cabinet)

### Power supply:

- 19...36 V<sub>DC</sub> / 24 V<sub>AC</sub> (+5%...-20%), 50/60 Hz
- 90...265 V<sub>AC</sub>, 50/60 Hz

### Outputs:

Each output circuit is galvanically isolated from each other as well as to ground.

Analogue: 1x 4...20 mA, passive, with HART®  
1x 4...20 mA, passive  
Mass flow, volume flow, density, temperature

Binary: passive via optocoupler  
Pulse duration: 50 ms  
adjustable range 0,1...2000 ms

Status: passive via optocoupler  
Forward-/Reverse flow, MIN/MAX flow rate, MIN/MAX density, MIN/MAX temperature, alarm, second pulse output( phase shifted to pulse 1 by 90°).

**Certificate and Approvals for UMC4 / UMC4-RM**



**Field housing:**

ATEX / IECEx: II (1)2G Ex d [ia Ga] IIC T4-T3 Gb  
 NEPSI: Ex db [ia Ga] IIC T4/T3 Gb

Terminal compartment: Ex d

- Type of protection signal output:
- Ex [ia Ga] intrinsically safe
  - Non-intrinsically safe



**Rack mount design:**

ATEX / IECEx: II (1)3G Ex ec [ia Ga] IIC T6..T3 Gc

(to be mounted in min. IP54 ATEX certified protective cabinet)

- Type of protection signal output:
- Ex [ia Ga] intrinsically safe
  - Non-intrinsically safe

**Process pressure range**

All device sizes are available with standard flanges according to pressure ratings class 150 / 300 and PN40. Depending on the sensor size, other nominal sizes with higher pressure ratings are possible on request.

For further information, please contact our sales department.

**Standard - Measuring ranges**

Type	Measuring range max.		Nominal ( $\Delta p=1\text{bar}$ )		Zero point stability (of range)	
	kg/h	[lbs/min]	kg/h	[lbs/min]	kg/h	[lbs/min]
TMU-x008	600	[22,0]	330	[12,1]	0,06	[0,002]
TMU-x010	2.500	[91,9]	1.150	[42,3]	0,25	[0,01]
TMU-x015	12.000	[440,9]	5.250	[192,9]	1,2	[0,04]
TMU-x025	30.000	[1.102,3]	20.000	[734,9]	3	[0,1]
TMU-x040	60.000	[2.204,6]	55.000	[2.020,9]*	6	[0,2]
TMU-x050	80.000	[2.939,4]	74.000	[2.719,0]	8	[0,3]

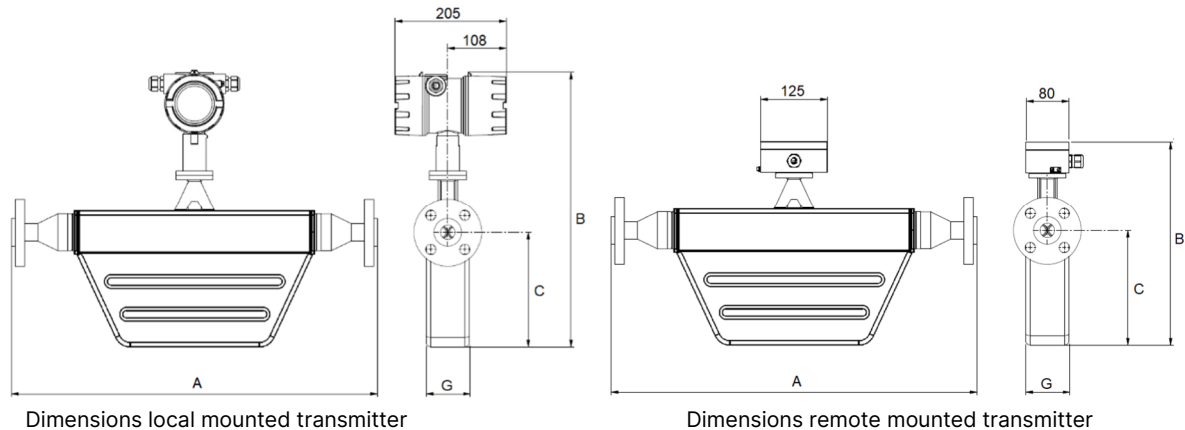
\* $\Delta p = 0,87\text{bar}$

**Measuring ranges for approvals**

Type	ABS <sup>1)</sup>	DNV <sup>1)</sup>	OIML <sup>1)</sup>
	[kg/h]	[kg/h]	[kg/h]
TMU-x008	N / A	0...600	N / A
TMU-x010	N / A	0...2.500	N / A
TMU-x015	600 ... 12.000 <sup>2),4)</sup>	0...12.000	600...9.000
TMU-x025	1.500...30.000 <sup>2),4)</sup>	0...30.000	1.500...30.000
TMU-x040	3.000...60.000 <sup>2),4)</sup>	0...60.000	3.000...60.000
TMU-x050	4.000...80.000 <sup>3),4)</sup>	0...80.000	4.000...80.000

1) Must be used with approved transmitter (UMC3) for system approval.  
 2) Measuring accuracy  $\pm 0.1\% \pm ZP$   
 3) Measuring accuracy  $\pm 0.15\% \pm ZP$   
 4) Repeatability  $\pm 0.05\% \pm \frac{1}{2}ZP$

## Dimensions



Type	Local mounted transmitter		Remote mounted transmitter				
	mm / inch	mm / inch	mm / inch	mm / inch	mm / inch	mm / inch	mm / inch
TMU-x008	318 / 12,52	418 / 16,46	233 / 9,17	333 / 13,11	433 / 17,04	82 / 3,23	35 / 1,38
TMU-x010	338 / 13,31	438 / 17,24	245 / 9,65	345 / 13,58	445 / 17,52	100 / 3,94	40 / 1,57
TMU-x015	408 / 16,06	508 / 20,00	315 / 12,40	415 / 16,34	515 / 20,28	160 / 6,30	60 / 2,36
TMU-x025	469 / 18,46	569 / 22,40	376 / 14,80	476 / 18,74	576 / 22,68	211 / 8,31	80 / 3,15
TMU-x040	628 / 24,72	728 / 28,66	535 / 21,06	635 / 20,00	735 / 28,94	312 / 12,28	136 / 5,35
TMU-x050	628 / 24,72	728 / 28,66	535 / 21,06	635 / 20,00	735 / 28,94	312 / 12,28	136 / 5,35

Installation length dimension "A" see "Order details" on page 5.

### Heated sensors

Sensors equipped with heating plates can have different dimensions depending on the mounted heating plate and the associated connection.

### Necessary data for the sizing of the meter

Medium:	_____			
	Nominal	Minimum	Maximum	Unit
Flow rate:	_____	_____	_____	_____
Process pressure:	_____			
□ abs. / □ gauge.	_____	_____	_____	_____
Process temperature:	_____			
Density:	_____			
(at process condition)	_____	_____	_____	_____
Viscosity:	_____			
(at process condition)	_____	_____	_____	_____

### Requirements for the ship approval

For the use of the sensor in combination with the ship approval the following conditions according to **DNV Rules: DNVGL RU Ship Pt.4 Ch.6 Sec.1** have to be fulfilled:

- Max. process temperature: 150°C
- Max. process pressure: 16 Bar
- Materials 1.4401 (AISI 316) or 1.4404 (AISI 316L) cannot be used for salt water applications.
- Only in combination with 3.1 Certificate (DIN EN 1024:2004).
- Only in combination with approved remote mounted transmitter.

If you have different requirements for a measuring device, please contact our sales department.

## Order details sensor

Example: TMU-S008-301B-A00-A0-10-0-H

Model code		Description
<b>TMU</b>		
<b>- Wetted materials</b>		
<b>S</b>	Stainless steel	1.4404 / 1.4571
<b>H</b>	Hastelloy C-22	2.4602
<b>Meter line size and process connection</b>		
<b>008</b>		60...600 kg/h
<b>- Process connection</b>		
		<b>Installation length</b>
<b>6010</b>	1/4" NPT (f)	320 mm
<b>6030</b>	1/2" NPT (f)	320 mm
<b>301B</b>	DN10 PN40 Form B1 DIN EN 1092-1	300 mm
<b>201R</b>	1/2" Class 150 RF ASME B16.5-2003	300 mm
<b>221R</b>	1/2" Class 300 RF ASME B16.5-2003	310 mm
<b>241R</b>	1/2" Class 600 RF ASME B16.5-2003	330 mm
<b>010</b>		250...2500 kg/h
<b>- Process connection</b>		
		<b>Installation length</b>
<b>6010</b>	1/4" NPT (f)	380 mm
<b>6030</b>	1/2" NPT (f)	380 mm
<b>301B</b>	DN10 PN40 Form B1 DIN EN 1092-1	390 mm
<b>305B</b>	DN15 PN40 Form B1 DIN EN 1092-1	410 mm
<b>309B</b>	DN25 PN40 Form B1 DIN EN 1092-1	410 mm
<b>201R</b>	1/2" Class 150 RF ASME B16.5-2003	380 mm
<b>221R</b>	1/2" Class 300 RF ASME B16.5-2003	390 mm
<b>241R</b>	1/2" Class 600 RF ASME B16.5-2003	390 mm
<b>202R</b>	3/4" Class 150 RF ASME B16.5-2003	380 mm
<b>222R</b>	3/4" Class 300 RF ASME B16.5-2003	380 mm
<b>242R</b>	3/4" Class 600 RF ASME B16.5-2003	390 mm
<b>203R</b>	1" Class 150 RF ASME B16.5-2003	380 mm
<b>223R</b>	1" Class 300 RF ASME B16.5-2003	380 mm
<b>243R</b>	1" Class 600 RF ASME B16.5-2003	400 mm
<b>015</b>		1200...12000 kg/h
<b>- Process connection</b>		
		<b>Installation length</b>
<b>6030</b>	1/2" NPT (f)	460 mm
<b>305B</b>	DN15 PN40 Form B1 DIN EN 1092-1	500 mm
<b>309B</b>	DN25 PN40 Form B1 DIN EN 1092-1	500 mm
<b>321B</b>	DN50 PN40 Form B1 DIN EN 1092-1	500 mm
<b>201R</b>	1/2" Class 150 RF ASME B16.5-2003	460 mm
<b>221R</b>	1/2" Class 300 RF ASME B16.5-2003	460 mm
<b>241R</b>	1/2" Class 600 RF ASME B16.5-2003	460 mm
<b>202R</b>	3/4" Class 150 RF ASME B16.5-2003	480 mm
<b>222R</b>	3/4" Class 300 RF ASME B16.5-2003	490 mm
<b>242R</b>	3/4" Class 600 RF ASME B16.5-2003	500 mm
<b>203R</b>	1" Class 150 RF ASME B16.5-2003	490 mm
<b>223R</b>	1" Class 300 RF ASME B16.5-2003	500 mm
<b>205R</b>	1 1/2" Class 150 RF ASME B16.5-2003	600 mm
<b>225R</b>	1 1/2" Class 300 RF ASME B16.5-2003	600 mm
<b>025</b>		3000...30000 kg/h
<b>- Process connection</b>		
		<b>Installation length</b>
<b>309B</b>	DN25 PN40 Form B1 DIN EN 1092-1	600 mm
<b>317B</b>	DN40 PN40 Form B1 DIN EN 1092-1	600 mm
<b>321B</b>	DN50 PN40 Form B1 DIN EN 1092-1	600 mm
<b>203R</b>	1" Class 150 RF ASME B16.5-2003	650 mm
<b>223R</b>	1" Class 300 RF ASME B16.5-2003	660 mm
<b>243R</b>	1" Class 600 RF ASME B16.5-2003	675 mm
<b>205R</b>	1 1/2" Class 150 RF ASME B16.5-2003	650 mm
<b>225R</b>	1 1/2" Class 300 RF ASME B16.5-2003	660 mm
<b>245R</b>	1 1/2" Class 600 RF ASME B16.5-2003	675 mm
<b>206R</b>	2" Class 150 RF ASME B16.5-2003	650 mm
<b>226R</b>	2" Class 300 RF ASME B16.5-2003	660 mm
<b>246R</b>	2" Class 600 RF ASME B16.5-2003	675 mm

<b>040</b>		6000...60000 kg/h	
<b>- Process connection</b>		<b>Installation length</b>	
<b>317B</b>	DN40 PN40 Form B1 DIN EN 1092-1	800 mm	
<b>321B</b>	DN50 PN40 Form B1 DIN EN 1092-1	800 mm	
<b>331B</b>	DN80 PN40 Form B1 DIN EN 1092-1	850 mm	
<b>205R</b>	1½" Class 150 RF ASME B16.5-2003	900 mm	
<b>245R</b>	1½" Class 600 RF ASME B16.5-2003	900 mm	
<b>206R</b>	2" Class 150 RF ASME B16.5-2003	900 mm	
<b>226R</b>	2" Class 300 RF ASME B16.5-2003	900 mm	
<b>228R</b>	3" Class 300 RF ASME B16.5-2003	900 mm	
<b>050</b>		8000...80000 kg/h	
<b>- Process connection</b>		<b>Installation length</b>	
<b>317B</b>	DN40 PN40 Form B1 DIN EN 1092-1	800 mm	
<b>321B</b>	DN50 PN40 Form B1 DIN EN 1092-1	800 mm	
<b>331B</b>	DN80 PN40 Form B1 DIN EN 1092-1	850 mm	
<b>335B</b>	DN100 PN16 Form B1 DIN EN 1092-1	850 mm	
<b>205R</b>	1½" Class 150 RF ASME B16.5-2003	900 mm	
<b>245R</b>	1½" Class 600 RF ASME B16.5-2003	900 mm	
<b>206R</b>	2" Class 150 RF ASME B16.5-2003	900 mm	
<b>226R</b>	2" Class 300 RF ASME B16.5-2003	900 mm	
<b>208R</b>	3" Class 150 RF ASME B16.5-2003	900 mm	
<b>248R</b>	3" Class 600 RF ASME B16.5-2003	900 mm	
<b>210R</b>	4" Class 150 RF ASME B16.5-2003	900 mm	
<b>230R</b>	4" Class 300 RF ASME B16.5-2003	900 mm	
<b>- Containment option</b>			
<b>A</b>	Stainless steel		
<b>X</b>	Special, customer specified		
<b>Heating / Cooling</b>			
<b>0</b>	without		
<b>A</b>	Heating plate		
<b>X</b>	Special, customer specified		
<b>Connection for heating / cooling</b>			
<b>0</b>	without		
<b>A</b>	Ermeto EO12		
<b>B</b>	Swagelok 12mm		
<b>C</b>	DN15 PN40 Form B1 DIN EN 1092-1		
<b>D</b>	½" Class 150 RF ASME B16.5-2003		
<b>E</b>	½" NPT (f)		
<b>F</b>	DN25 PN40 Form B1 DIN EN 1092-1		
<b>G</b>	1" Class 150 RF ASME B16.5-2003		
<b>H</b>	1" NPT (f)		
<b>X</b>	Special, customer specified		
<b>- Transmitter mounting</b>			
<b>A</b>	Integral mounted transmitter	Process temperature	Sensor cable connection
<b>B</b>	Integral mounted transmitter	-20...100°C (-4...212°F)	- IP67 (9)
<b>C</b>	Remote mounted transmitter	-20...150°C (-4...302°F)	- IP67 (9)
<b>D</b>	Remote mounted transmitter	-50...100°C (-58...212°F)	Junction box via ½" NPT (f) IP67
<b>E</b>	Remote mounted transmitter	-50...180°C (-58...356°F)	Junction box via ½" NPT (f) IP67
<b>F</b>	Remote mounted transmitter	-50...260°C (-58...500°F)	Junction box via ½" NPT (f) IP67
<b>G</b>	Remote mounted transmitter	-50...100°C (-58...212°F)	Junction box via M20x1,5 IP67
<b>H</b>	Remote mounted transmitter	-50...180°C (-58...356°F)	Junction box via M20x1,5 IP67
<b>K</b>	Remote mounted transmitter	-50...260°C (-58...500°F)	Junction box via M20x1,5 IP67
<b>L</b>	Remote mounted transmitter	-50...100°C (-58...212°F)	Connector (Harting Han® R 23) IP67
<b>M</b>	Remote mounted transmitter	-50...180°C (-58...356°F)	Connector (Harting Han® R 23) IP67
<b>N</b>	Remote mounted transmitter	-50...260°C (-58...500°F)	Connector (Harting Han® R 23) IP67
<b>X</b>	Remote mounted transmitter	not specified	Without junction box (3), 4)
<b>X</b>	Special, customer specified		
<b>Approvals</b>			
<b>0</b>	without		
<b>B</b>	NEPSI	Ex ia IIC T6...T2 Ga/Gb	1)
<b>D</b>	CSA Class I Zone 0/Div1+2	AEx ia IIC T5...T2 Ga/Gb / Group A,B,C,D	1)
<b>K</b>	KCS (Korea)	Ex ia IIC T6...T2 Ga/Gb	1)
<b>L</b>	ATEX / IECEx / UKEX	II 1/2G Ex ia IIC T2...T6 Ga/Gb	1)
<b>S</b>	Ships approval	DNV / ABS	1), 2), 6), 7)
<b>U</b>	ATEX Component certificate	II 1G Ex ia IIC T6...T2 Ga	1), 5)
<b>9</b>	Multiple approvals	B, D, K, L	1)
<b>- Calibration flow</b>			
<b>1</b>	Standard, 3-point		
<b>2</b>	10-point		
<b>3</b>	External lab		
<b>7</b>	7-point, OIML-calibration (R117-1)		
<b>X</b>	Special, customer specified (8)		

Calibration density	
0	without
1	Standard, 3-point
2	5-point 10)
X	Special, customer specified
Supplementary equipment	
0	without
X	Special, customer specified
Design	
H	Heinrichs
K	Kobold

**Notes:**

- 1) Must be used with approved transmitter for system approval.  
Order cable glands separately.
- 2) Includes ATEX and IECEx approvals. See **Requirements for the ship approval** on page 4
- 3) Temperature specification is applicable for whole device only.
- 4) Applicable only with approval "U".
- 5) Applicable only with sensor configuration "N"
- 6) Only in combination with 3.1 certificate.
- 7) Only in combination with a remote mounted transmitter. Only for approved process conditions. See documentation.
- 8) Must be used with approved UMC3 transmitter for system approval. Only for device line sizes 015, 025, 040, 050. Varied measuring range. See Measuring ranges for approvals on page 3
- 9) Not for ship approval.
- 10) Not for device line size 008