Zertifiziertes QM-System
DIN EN ISO 9001
Zertifikat-Nr. 01017

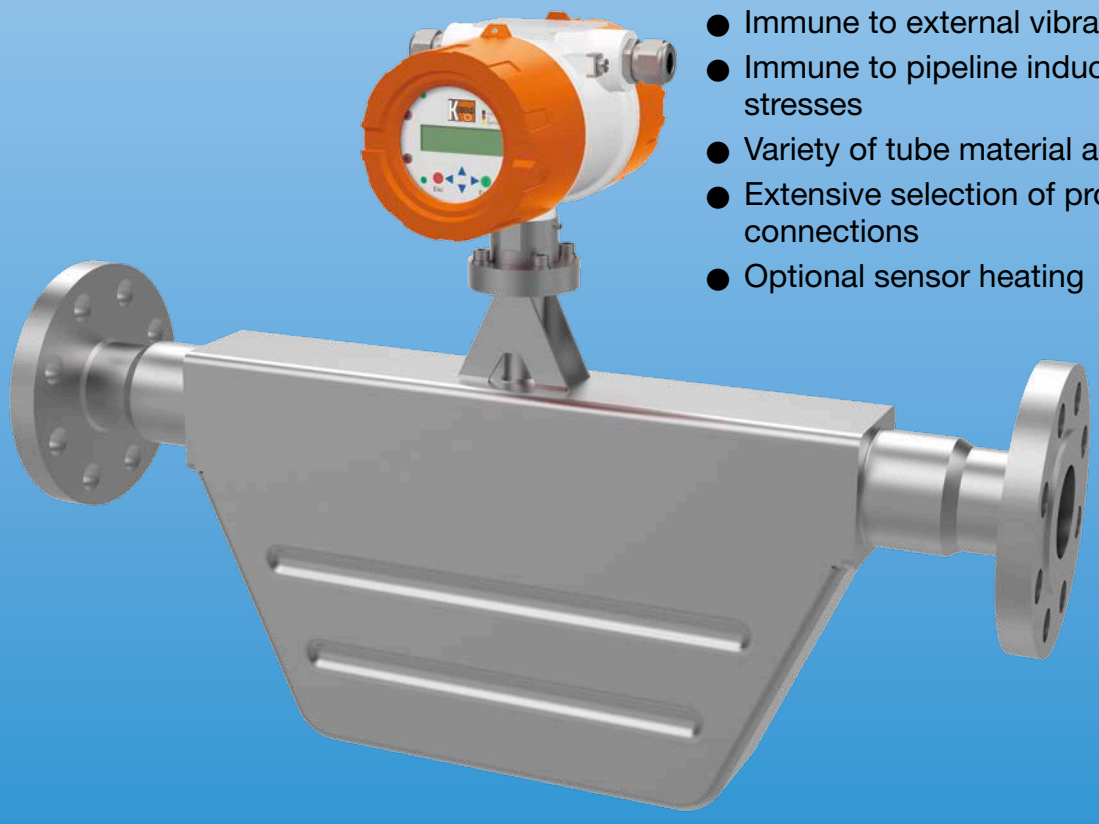
Coriolis Mass Flow Meter

Standard device for all applications

measuring • monitoring • analysing

TMU

- 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



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1/05 - 2023

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 (2nd Generation)
Coriolis dual-pipe tubes TMU-X008 to 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 ... +80 °C -40 ... +176 °F
Process temperature:	-50 ... +220 °C/260 °C* -58 ... +428 °F/500 °F* *(260 °C / 500 °F max. 1 h)
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
$_{C}CSA_{US}$:	Class I, Zone 0, Div.1 and Div.2 AEx ia IIC T5-T2 Ga
NEPSI:	Ex ia II C T2…T6 Ga/Gb
Ships approval:	DNV / ABS

No responsibility taken for errors;
subject to change without prior notice.

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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. IP 20 (to be mounted in min. IP54 ATEX certified protective cabinet)
Power supply:	19 ... 36 V_{DC} / 24 V_{AC} (+5% ... -20%), 50/60 Hz 90 ... 265 V_{AC}, 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

No responsibility taken for errors;
subject to change without prior notice.

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. kg/h [lbs/min]	Nominal (Δp = 1 bar) kg/h [lbs/min]	Zero point stability (of range) kg/h [lbs/min]
TMU-x008	600 [22,0]	330 [12,1]	0,06 [0,002]
TMU-x010	2500 [91,9]	1150 [42,3]	0,25 [0,01]
TMU-x015	12000 [440,9]	5250 [192,9]	1,2 [0,04]
TMU-x025	30000 [1102,3]	20000 [734,9]	3 [0,1]
TMU-x040	60000 [2204,6]	55000 [2020,9]*	6 [0,2]
TMU-x050	80000 [2939,4]	74000 [2719,0]	8 [0,3]

*Δp = 0,87 bar

Measuring ranges for approvals

Type	ABS [1)] [kg/h]	DNV [1)] [kg/h]
TMU-x008	N/A	0 ... 600
TMU-x010	N/A	0 ... 2500
TMU-x015	600 ... 12000 [2)4)]	0 ... 12000
TMU-x025	1500 ... 30000 [2)4)]	0 ... 30000
TMU-x040	3000 ... 60000 [2)4)]	0 ... 60000
TMU-x050	4000 ... 80000 [3)4)]	0 ... 80000

[1)] Must be used with approved transmitter (UMC3) for system approval.
[2)] Measuring accuracy ±0.1 % ±ZP
[3)] Measuring accuracy ±0.15 % ±ZP
[4)] Repeatability ±0.05 % ± ½ZP

Necessary data for the sizing of the meter

		Nominal	Minimum	Maximum	Unit
Medium:					
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.

No responsibility taken for errors;
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1/05 - 2023

Order details Sensor (Example: **TMU-S 008 6010 A 0 0 A 0 1 0 0 K**)

Type/ Wetted materials	Meter line size	Process connection / Installation length	Containment option	Heating / Cooling
TMU-S = stainless steel 1.4404 / 1.4571 **TMU-H** = Hastelloy C-22 2.4602	**008** = 60 ... 600 kg/h	**6010** = ¼" NPT (f) / 320 mm **6030** = ½" NPT (f) / 320 mm **301B** = DN10 PN40 Form B1 DIN EN 1092-1 / 300 mm **201R** = ½" Class 150 RF ASME B16.5-2003 / 300 mm **221R** = ½" Class 300 RF ASME B16.5-2003 / 310 mm **241R** = ½" Class 600 RF ASME B16.5-2003 / 330 mm	**A** = Stainless steel **X** = Special, customer specified	**0** = without **A** = Heating plate **X** = Special, customer specified
	010 = 250 ... 2500 kg/h	**6010** = ¼" NPT (f) / 380 mm **6030** = ½" NPT (f) / 380 mm **301B** = DN10 PN40 Form B1 DIN EN 1092-1 / 390 mm **305B** = DN15 PN40 Form B1 DIN EN 1092-1 / 410 mm **309B** = DN25 PN40 Form B1 DIN EN 1092-1 / 410 mm **201R** = ½" Class 150 RF ASME B16.5-2003 / 380 mm **221R** = ½" Class 300 RF ASME B16.5-2003 / 390 mm **241R** = ½" Class 600 RF ASME B16.5-2003 / 390 mm **202R** = ¾" Class 150 RF ASME B16.5-2003 / 380 mm **222R** = ¾" Class 300 RF ASME B16.5-2003 / 380 mm **242R** = ¾" Class 600 RF ASME B16.5-2003 / 390 mm **203R** = 1" Class 150 RF ASME B16.5-2003 / 380 mm **223R** = 1" Class 300 RF ASME B16.5-2003 / 380 mm **243R** = 1" Class 600 RF ASME B16.5-2003 / 400 mm		
	015 = 1200 ... 12 000 kg/h	**6030** = ½" NPT (f) / 460 mm **305B** = DN15 PN40 Form B1 DIN EN 1092-1 / 500 mm **309B** = DN25 PN40 Form B1 DIN EN 1092-1 / 500 mm **321B** = DN50 PN40 Form B1 DIN EN 1092-1 / 500 mm **201R** = ½" Class 150 RF ASME B16.5-2003 / 460 mm **221R** = ½" Class 300 RF ASME B16.5-2003 / 460 mm **241R** = ½" Class 600 RF ASME B16.5-2003 / 460 mm **202R** = ¾" Class 150 RF ASME B16.5-2003 / 480 mm **222R** = ¾" Class 300 RF ASME B16.5-2003 / 490 mm **242R** = ¾" Class 600 RF ASME B16.5-2003 / 500 mm **203R** = 1" Class 150 RF ASME B16.5-2003 / 490 mm **223R** = 1" Class 300 RF ASME B16.5-2003 / 500 mm **205R** = 1 ½" Class 150 RF ASME B16.5-2003 / 600 mm **225R** = 1 ½" Class 300 RF ASME B16.5-2003 / 600 mm		

No responsibility taken for errors;
subject to change without prior notice.

Order details Sensor (Example: **TMU-S 008 6010 A 0 0 A 0 1 0 0 K**) (continued)

Type/ Wetted materials	Meter line size	Process connection / Installation length	Containment option	Heating / Cooling
TMU-S = stainless steel 1.4404 / 1.4571 **TMU-H** = Hastelloy C-22 2.4602	**025** = 3000 ... 30 000 kg/h	**309B** = DN 25 PN 40 Form B1 DIN EN 1092-1 / 600 mm **317B** = DN 40 PN 40 Form B1 DIN EN 1092-1 / 600 mm **321B** = DN 50 PN 40 Form B1 DIN EN 1092-1 / 600 mm **203R** = 1" Class 150 RF ASME B16.5-2003 / 650 mm **223R** = 1" Class 300 RF ASME B16.5-2003 / 660 mm **243R** = 1" Class 600 RF ASME B16.5-2003 / 675 mm **205R** = 1 ½" Class 150 RF ASME B16.5-2003 / 650 mm **225R** = 1 ½" Class 300 RF ASME B16.5-2003 / 660 mm **245R** = 1 ½" Class 600 RF ASME B16.5-2003 / 675 mm **206R** = 2" Class 150 RF ASME B16.5-2003 / 650 mm **226R** = 2" Class 300 RF ASME B16.5-2003 / 660 mm **246R** = 2" Class 600 RF ASME B16.5-2003 / 675 mm	**A** = Stainless steel **X** = Special, customer specified	**0** = without **A** = Heating plate **X** = Special, customer specified
	040 = 6000 ... 60 000 kg/h	**317B** = DN 40 PN 40 Form B1 DIN EN 1092-1 / 800 mm **321B** = DN 50 PN 40 Form B1 DIN EN 1092-1 / 800 mm **331B** = DN 80 PN 40 Form B1 DIN EN 1092-1 / 850 mm **205R** = 1 ½" Class 150 RF ASME B16.5-2003 / 900 mm **245R** = 1 ½" Class 600 RF ASME B16.5-2003 / 900 mm **206R** = 2" Class 150 RF ASME B16.5-2003 / 900 mm **226R** = 2" Class 300 RF ASME B16.5-2003 / 900 mm **228R** = 3" Class 300 RF ASME B16.5-2003 / 900 mm		
	050 = 8000 ... 80 000 kg/h	**317B** = DN 40 PN 40 Form B1 DIN EN 1092-1 / 800 mm **321B** = DN 50 PN 40 Form B1 DIN EN 1092-1 / 800 mm **331B** = DN 80 PN 40 Form B1 DIN EN 1092-1 / 850 mm **335B** = DN 100 PN 16 Form B1 DIN EN 1092-1 / 850 mm **205R** = 1 ½" Class 150 RF ASME B16.5-2003 / 900 mm **245R** = 1 ½" Class 600 RF ASME B16.5-2003 / 900 mm **206R** = 2" Class 150 RF ASME B16.5-2003 / 900 mm **226R** = 2" Class 300 RF ASME B16.5-2003 / 900 mm **208R** = 3" Class 150 RF ASME B16.5-2003 / 900 mm **248R** = 3" Class 600 RF ASME B16.5-2003 / 900 mm **210R** = 4" Class 150 RF ASME B16.5-2003 / 900 mm **230R** = 4" Class 300 RF ASME B16.5-2003 / 900 mm		

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Order details Sensor (Example: **TMU-S 008 6010 A 0 0 A 0 1 0 0 K**) (continued)

Connection for heating / cooling	Transmitter mounting / Process temperature / Sensor cable connection	Approvals
0 = without **A** = Ermeto EO12 **B** = Swagelok® 12mm **C** = DN15 PN40 Form B1 DIN EN 1092-1 **D** = ½" Class 150 RF ASME B16.5-2003 **E** = ½" NPT (f) **F** = DN25 PN40 Form B1 DIN EN 1092-1 **G** = 1" Class 150 RF ASME B16.5-2003 **H** = 1" NPT (f) **X** = Special, customer specified	**A** = Integral mounted transmitter , -20...100 °C (-4...212°F), IP67 [8] **B** = Integral mounted transmitter , -20...150 °C (-4...302°F), IP67 [8] **C** = Remote mounted transmitter, -50...100 °C (-58...212°F), Junction box via ½" NPT (f), IP67 **D** = Remote mounted transmitter, -50...180 °C (-58...356°F), Junction box via ½" NPT (f), IP67 **E** = Remote mounted transmitter, -50...260 °C (-58...500°F), Junction box via ½" NPT (f), IP67 **F** = Remote mounted transmitter, -50...100 °C (-58...212°F), Junction box via M20x1,5, IP67 **G** = Remote mounted transmitter, -50...180 °C (-58...356°F), Junction box via M20x1,5, IP67 **H** = Remote mounted transmitter, -50...260 °C (-58...500°F), Junction box via M20x1,5, IP67 **K** = Remote mounted transmitter, -50...100 °C (-58...212°F), Connector (Harting Han® R 23), IP67 **L** = Remote mounted transmitter, -50...180 °C (-58...356°F), Connector (Harting Han® R 23), IP67 **M** = Remote mounted transmitter, -50...260 °C (-58...500°F), Connector (Harting Han® R 23), IP67 **N** = Remote mounted transmitter, not specified, without junction box [3] [4] **X** = Special, customer specified	**0** = without **B** = NEPSI Ex ia IIC T6...T2 Ga/Gb [1] **D** = CSA Class I Zone 0/Div1+2 AEx ia IIC T5…T2 Ga/Gb / Group A,B,C,D [1] **K** = KCS (Korea) Ex ia IIC T6…T2 Ga/Gb [1] **L** = ATEX / IECEx / UKEX II 1/2G Ex ia IIC T2...T6 Ga/Gb [1] **S** = Ships approval DNV / ABS [1] [2] [6] [7] **U** = ATEX Component certificate II 1G Ex ia IIC T6...T2 Ga [1] [5] **9** = Multiple approvals B, D, K, L [1]

Calibration flow	Calibration density	Supplementary equipment	Design
1 = Standard, 3-point **2** = 10-point **3** = External lab **X** = Special, customer specified	**0** = without **1** = Standard, 3-point **2** = 5-point [9] **X** = Special, customer specified	**0** = without **X** = Special, customer specified	**K** = Kobold

[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".

[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] Not for ship approval.

[9] Not for device line size 008

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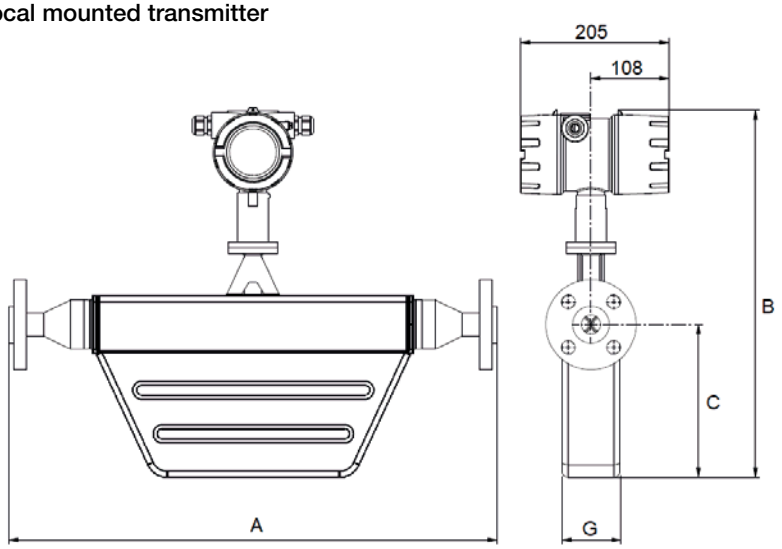
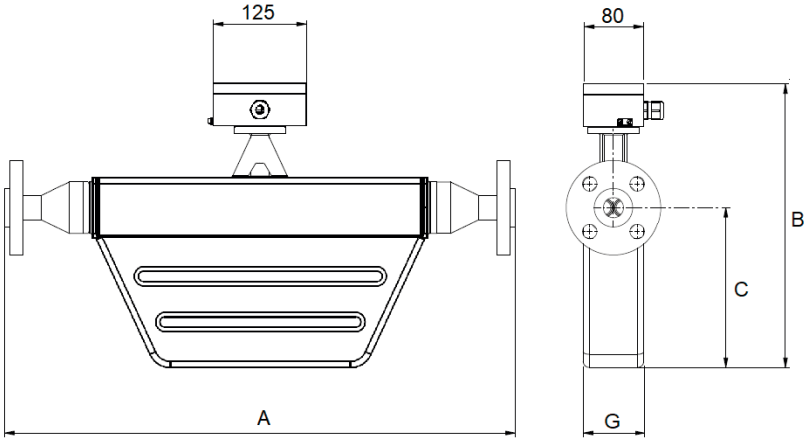
Dimensions

Local mounted transmitter



Remote mounted transmitter



	B					C	D
	Local mounted transmitter		Remote mounted transmitter				
	-40 °C ... 100 °C (-40 °F ... 212 °F)	-40 °C ... 150 °C (-40 °F ... 302 °F)	-40 °C ... 100 °C (-40 °F ... 212 °F)	-40 °C ... 180 °C (-40 °F ... 356 °F)	-40 °C ... 260 °C (-40 °F ... 500 °F)		
Type	**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”.

Heated sensors

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

M-Zert
Zertifiziertes QM-System
DIN EN ISO 9001
Zertifikat-Nr. 01017

Coriolis Mass Flow Meter

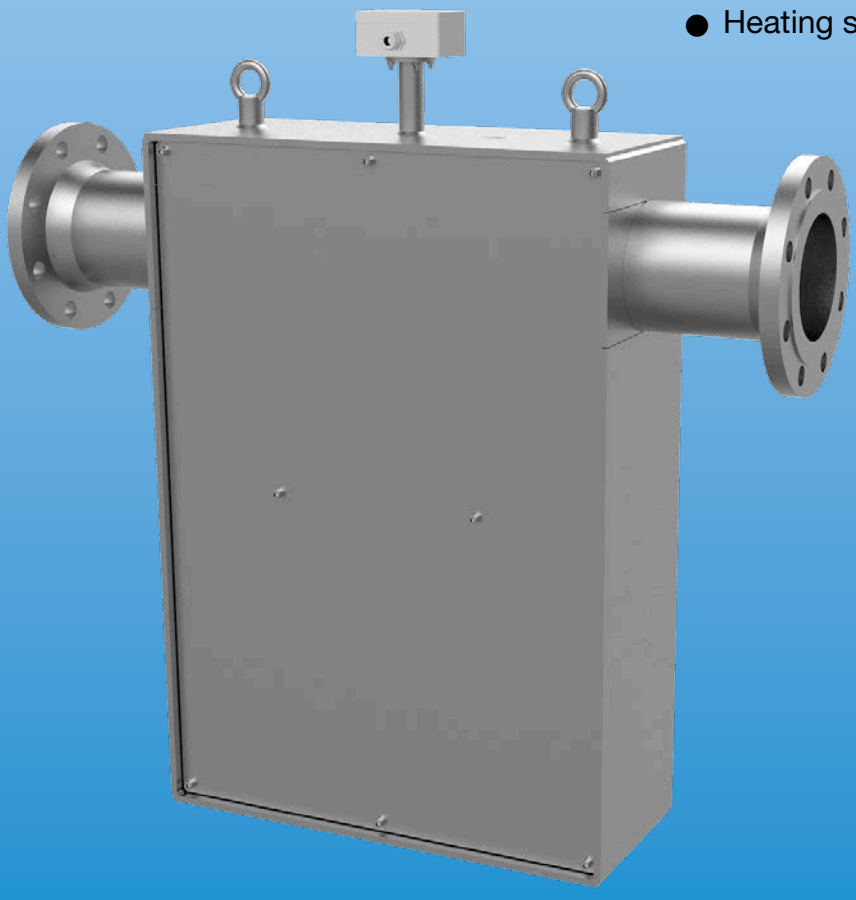
Standard device for all applications

KOBOLD

measuring
•
monitoring
•
analysing

TMU - HIGH FLOW

- High flow rates up to 2200 t/h
- Process connections up to DN400 / 16“
- Pressure resistant up to 40 bar
- Heating system (optional)



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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.

TMU High Flow Coriolis Mass Flow Meter are used where high flow values in piping systems up to 400 mm / 32 inch and up to 2,200 t/h have to be measured safely and accurate.

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

Coriolis dual-pipe tubes
TMU-X080 … TMU-X300
(X denotes tube material)

Accuracy

Liquid:	0.15 % of actual flowrate ± ZP stability
Gas:	0.5 % of actual flowrate ± ZP Stability
Wetted parts:	316TI/1.4571 316L/1.4404 Hastelloy C-22 Others on request
Process connection:	Flanges: DIN / ASME / JIS 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:	IP65 (EN 60529)

Certificates and Approvals

ATEX/IECEx/UKEX:	II 1/2G Ex ia IIC T2…T6 Ga/Gb
$_{C}CSA_{US}$:	Class I, Zone 0, Div.1 and Div.2 AEx ia IIC T5-T2 Ga
NEPSI:	Ex ia II C T2…T6 Ga/Gb
Ships approval:	DNV / ABS

No responsibility taken for errors;
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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_{DC} / 24 V_{AC} (+5%...-20%), 50/60 Hz 90…265 V_{AC}, 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

Type of protection: Ex d

Type of protection signal output:

- Ex [ia Ga] intrinsically safe
- Non-intrinsically safe

Rack mount design (RM):

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

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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. kg/h [lbs/min]	Nominal (Δp = 1 bar) kg/h [lbs/min]	Zero point stability (of range) kg/h [lbs/min]
TMU-x080 [1]	120000 [4409.2]	118000 [4335.7]	12 [0.4]
TMU-x100 [2]	200000 [7348.6]	200000 [7348.6]	20 [0.7]
TMU-x150 [2]	460000 [16901.8]	460000 [16901.8]	46 [1.7]
TMU-x200 [3]	700000 [25720.2]	700000 [25720.2]	70 [2.6]
TMU-x250	1500000 [55114.6]	1350000 [49603.2]	150 [5.5]
TMU-x300	2200000 [80834.8]	1900000 [69811.9]	220 [8.1]

[1] Δp = 0.95 bar
[2] Δp = 0.93 bar
[3] Δp = 0.66 bar

Measuring ranges for approvals

Type	ABS [1] [2] [kg/h]	DNV [3] [kg/h]
TMU-x080	6000…120000	0…120000
TMU-x100	10000…200000	0…200000
TMU-x150	23000…460000	0…460000
TMU-x200	35000…700000	0…700000
TMU-x250	N / V	N / V
TMU-x300	N / V	N / V

[1] Must be used with approved transmitter (UMC3) for system approval.
[2] Measuring accuracy ±0.15 % ±NP Repeatability ±0.05 % ± ½NP
[3] Must be used with approved transmitter (UMC4) for system approval.

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.

No responsibility taken for errors; subject to change without prior notice.
1/05 - 2023

Order Details Sensor (Example: **TMU-S 080 321B A 0 0 A 0 1 0 0 K**)

Type/ Wetted materials	Meter line size	Process connection / Installation length	Containment option	Heating / Cooling
TMU-S = Stainless steel 1.4404 / 1.4571 **TMU-H** = Hastelloy C-22 2.4602	**080** = 25000…120000 kg/h	**321B** = DN50 PN40 Form B1 DIN EN 1092-1 / 1150 mm **321D** = DN50 PN40 Form D DIN EN 1092-1 / 1150 mm **331B** = DN80 PN40 Form B1 DIN EN 1092-1 / 1196 mm **331D** = DN80 PN40 Form D DIN EN 1092-1 / 1196 mm **335B** = DN100 PN16 Form B1 DIN EN 1092-1 / 1184 mm **335D** = DN100 PN16 Form D DIN EN 1092-1 / 1184 mm **340B** = DN125 PN16 Form B1 DIN EN 1092-1 / 925 mm **345B** = DN150 PN16 Form B1 DIN EN 1092-1 / a. Anfrage **206R** = 2" Class 150 RF ASME B16.5-2003 / 1200 mm **246R** = 2" Class 600 RF ASME B16.5-2003 / 1225 mm **208R** = 3" Class 150 RF ASME B16.5-2003 / 1218 mm **248R** = 3" Class 600 RF ASME B16.5-2003 / 1243 mm **210R** = 4" Class 150 RF ASME B16.5-2003 / 1230 mm **230R** = 4" Class 300 RF ASME B16.5-2003 / 1250 mm **211R** = 5" Class 150 RF ASME B16.5-2003 / 1000 mm **231R** = 5" Class 300 RF ASME B16.5-2003 / 1000 mm **212R** = 6" Class 150 RF ASME B16.5-2003 / on request **232R** = 6" Class 300 RF ASME B16.5-2003 / on request **XXXX**= Special, customer specified	**A** = Stainless steel **X** = Special, customer specified	**0** = without **B** = Heater / cooler **X** = Special, customer specified
	100 = 30000…200000 kg/h	**331B** = DN80 PN40 Form B1 DIN EN 1092-1 / 1350 mm **331D** = DN80 PN40 Form D DIN EN 1092-1 / 1350 mm **335B** = DN100 PN16 Form B1 DIN EN 1092-1 / 1350 mm **335D** = DN100 PN16 Form D DIN EN 1092-1 / 1350 mm **345B** = DN150 PN16 Form B1 DIN EN 1092-1 / 1090 mm **345D** = DN150 PN16 Form D DIN EN 1092-1 / 1090 mm **208R** = 3" Class 150 RF ASME B16.5-2003 / 1375 mm **248R** = 3" Class 600 RF ASME B16.5-2003 / 1413 mm **210R** = 4" Class 150 RF ASME B16.5-2003 / 1400 mm **230R** = 4" Class 300 RF ASME B16.5-2003 / 1420 mm **212R** = 6" Class 150 RF ASME B16.5-2003 / 1154 mm **232R** = 6" Class 300 RF ASME B16.5-2003 / 1173 mm **XXXX**= Special, customer specified		

No responsibility taken for errors;
subject to change without prior notice.

Order Details Sensor (Example: **TMU-S 080 321B A 0 0 A 0 1 0 0 K**) (continued)

Type/ Wetted materials	Meter line size	Process connection / Installation length	Containment option	Heating / Cooling
TMU-S = Stainless steel 1.4404 / 1.4571	**150** = 60000 ... 460000 kg/h	**335B** = DN100 PN16 Form B1 DIN EN 1092-1 / 1700 mm **335D** = DN100 PN16 Form D DIN EN 1092-1 / 1700 mm **345B** = DN150 PN16 Form B1 DIN EN 1092-1 / 1725 mm **345D** = DN150 PN16 Form D DIN EN 1092-1 / 1725 mm **350B** = DN200 PN16 Form B1 DIN EN 1092-1 / 1448 mm **350D** = DN200 PN16 Form D DIN EN 1092-1 / 1448 mm **210R** = 4" Class 150 RF ASME B16.5-2003 / 1770 mm **230R** = 4" Class 300 RF ASME B16.5-2003 / 1775 mm **212R** = 6" Class 150 RF ASME B16.5-2003 / 1796 mm **232R** = 6" Class 300 RF ASME B16.5-2003 / 1815 mm **213R** = 8" Class 150 RF ASME B16.5-2003 / 1525 mm **233R** = 8" Class 300 RF ASME B16.5-2003 / 1545 mm **XXXX** = Special, customer specified	**A** = Stainless steel **X** = Special, customer specified	**0** = without **B** = Heater / cooler **X** = Special, customer specified
TMU-H = Hastelloy C-22 2.4602	**200** = 150000 ... 700000 kg/h	**345B** = DN150 PN16 Form B1 DIN EN 1092-1 / 2175 mm **345D** = DN150 PN16 Form D DIN EN 1092-1 / 2175 mm **350B** = DN200 PN16 Form B1 DIN EN 1092-1 / 2175 mm **350D** = DN200 PN16 Form D DIN EN 1092-1 / 2175 mm **356B** = DN250 PN16 Form B1 DIN EN 1092-1 / 1850 mm **356D** = DN250 PN16 Form D DIN EN 1092-1 / 1850 mm **212R** = 6" Class 150 RF ASME B16.5-2003 / 2225 mm **232R** = 6" Class 300 RF ASME B16.5-2003 / 2250 mm **213R** = 8" Class 150 RF ASME B16.5-2003 / 2270 mm **233R** = 8" Class 300 RF ASME B16.5-2003 / 2275 mm **214R** = 10" Class 150 RF ASME B16.5-2003 / 1925 mm **234R** = 10" Class 300 RF ASME B16.5-2003 / 1957 mm **XXXX** = Special, customer specified		

No responsibility taken for errors;
subject to change without prior notice.

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Order Details Sensor (Example: **TMU-S 080 321B A 0 0 A 0 1 0 0 K**) (continued)

Type/ Wetted materials	Meter line size	Process connection / Installation length	Containment option	Heating / Cooling
TMU-S = Stainless steel 1.4404 / 1.4571 **TMU-H** = Hastelloy C-22 2.4602	**250** = 300 000 ... 1 500 000 kg/h	**350B** = DN200 PN16 Form B1 DIN EN 1092-1 / 2275 mm **356B** = DN250 PN16 Form B1 DIN EN 1092-1 / 2275 mm **363B** = DN300 PN16 Form B1 DIN EN 1092-1 / 1925 mm **213R** = 8" Class 150 RF ASME B16.5-2003 / 2350 mm **233R** = 8" Class 300 RF ASME B16.5-2003 / 2375 mm **214R** = 10" Class 150 RF ASME B16.5-2003 / 2348 mm **234R** = 10" Class 300 RF ASME B16.5-2003 / 2375 mm **215R** = 12" Class 150 RF ASME B16.5-2003 / 1975 mm **235R** = 12" Class 300 RF ASME B16.5-2003 / 2025 mm **XXXX** = Special, customer specified	**A** = Stainless steel **X** = Special, customer specified	**0** = without **B** = Heater / cooler **X** = Special, customer specified
	300 = 400 000 ... 2 200 000 kg/h	**355B** = DN250 PN10 Form B1 DIN EN 1092-1 / 2875 mm **362B** = DN300 PN10 Form B1 DIN EN 1092-1 / 2875 mm **369B** = DN350 PN10 Form B1 DIN EN 1092-1 / 2875 mm **375B** = DN400 PN10 Form B1 DIN EN 1092-1 / 2200 mm **214R** = 10" Class 150 RF ASME B16.5-2003 / 2950 mm **234R** = 10" Class 300 RF ASME B16.5-2003 / 3008 mm **215R** = 12" Class 150 RF ASME B16.5-2003 / 3000 mm **235R** = 12" Class 300 RF ASME B16.5-2003 / 3030 mm **216R** = 14" Class 150 RF ASME B16.5-2003 / 3000 mm **236R** = 14" Class 300 RF ASME B16.5-2003 / 3050 mm **217R** = 16" Class 150 RF ASME B16.5-2003 / a. Anfrage **XXXX** = Special, customer specified		

No responsibility taken for errors;
subject to change without prior notice.

Order Details Sensor (Example: **TMU-S 080 321B A 0 0 A 0 1 0 0 K**) (continued)

Connection for heating / cooling	Transmitter mounting / Process temperature / Sensor cable connection	Approvals
0 = without **A** = Ermeto EO12 **B** = Swagelok® 12mm **C** = DN15 PN40 Form B1 DIN EN 1092-1 **D** = ½" Class 150 RF ASME B16.5-2003 **E** = ½" NPT (f) **F** = DN25 PN40 Form B1 DIN EN 1092-1 **G** = 1" Class 150 RF ASME B16.5-2003 **H** = 1" NPT (f) **X** = Special, customer specified	**A** = Integral mounted transmitter, -20...100 °C (-4...212°F), IP65 [1] **B** = Integral mounted transmitter , -20...150 °C (-4...302°F), IP65 [1] **C** = Remote mounted transmitter, -50...100 °C (-58...212°F), Junction box via ½" NPT (f), IP65 **D** = Remote mounted transmitter, -50...180 °C (-58...356°F), Junction box via ½" NPT (f), IP65 **E** = Remote mounted transmitter, -50...260 °C (-58...500°F), Junction box via ½" NPT (f), IP65 **F** = Remote mounted transmitter, -50...100 °C (-58...212°F), Junction box via M20x1,5, IP65 **G** = Remote mounted transmitter, -50...180 °C (-58...356°F), Junction box via M20x1,5, IP65 **H** = Remote mounted transmitter, -50...260 °C (-58...500°F), Junction box via M20x1,5, IP65 **K** = Remote mounted transmitter, -50...100 °C (-58...212°F), Connector (Harting Han® R 23), IP65 **L** = Remote mounted transmitter, -50...180 °C (-58...356°F), Connector (Harting Han® R 23), IP65 **M** = Remote mounted transmitter, -50...260 °C (-58...500°F), Connector (Harting Han® R 23), IP65 **N** = Remote mounted transmitter, not specified , Without junction box [2] [3] **X** = Special, customer specified	**0** = without **B** = NEPSI Ex ia IIC T6...T2 Ga/Gb [4] **D** = CSA Class I Zone 0/Div1+2 AEx ia IIC T5…T2 Ga/Gb / Group A,B,C,D [4] **K** = KCS (Korea) Ex ia IIC T6…T2 Ga/Gb [4] **L** = ATEX / IECEx / UKEX II 1/2G Ex ia IIC T2...T6 Ga/Gb [4] **S** = Ships approval DNV / ABS [4] [5] [6] [7] [9] **U** = ATEX Component certificate II 1G Ex ia IIC T6...T2 Ga [4] [8] **9** = Multiple approvals B, D, K, L

Calibration flow	Calibration density	Supplementary equipment	Design
1 = Standard, 3-point **2** = 10-point **3** = External lab **X** = Special, customer specified	**0** = without **1** = Standard, 3-point **2** = 5-point **X** = Special, customer specified	**0** = without **X** = Special, customer specified	**K** = Kobold

[1] Not for ships approval. Not for OIML R117-1.
[2] Temperature specification is applicable for whole device only.
[3] applicable only with approval "U".
[4] Must be used with approved transmitter for system approval.
[5] Includes ATEX and IECEx approvals. See "Requirements for the ship approval".
[6] Only in combination with 3.1 certificate.
[7] Only in combination with a remote mounted transmitter.
[8] Applicable only with sensor configuration “N”.

No responsibility taken for errors; subject to change without prior notice.
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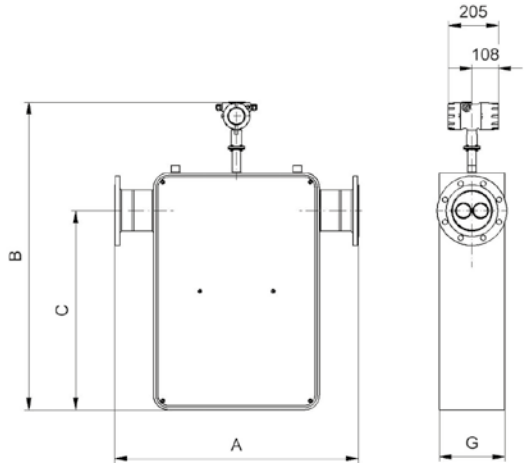
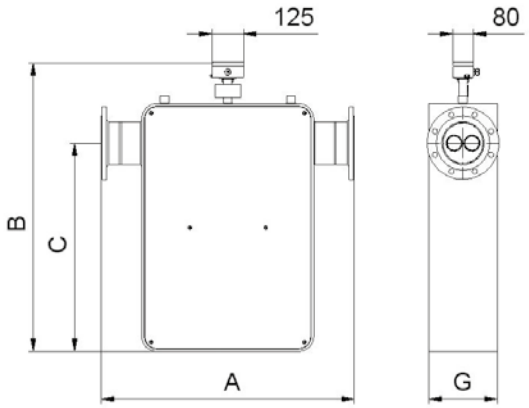
Dimensions

Local mounted transmitter



Remote mounted transmitter



	B					C	D
	Local mounted transmitter		Remote mounted transmitter				
	-40 °C ... 100 °C (-40 °F ... 212 °F)	-40 °C ... 150 °C (-40 °F ... 302 °F)	-40 °C ... 100 °C (-40 °F ... 212 °F)	-40 °C ... 180 °C (-40 °F ... 356 °F)	-40 °C ... 260 °C (-40 °F ... 500 °F)		
Type	**mm [inch]**	**mm [inch]**	**mm [inch]**	**mm [inch]**	**mm [inch]**	**mm [inch]**	**mm [inch]**
TMU-x080	1241 [48.9]	1343 [82.9]	1110 [43.7]	1212 [47.7]	1312 [51.7]	800 [31.5]	250 [9.8]
TMU-x100	1261 [49.6]	1363 [53.7]	1130 [44.5]	1232 [48.5]	1332 [52.4]	1070 [42.1]	270 [10.6]
TMU-x150	1591 [62.6]	1693 [66.7]	1460 [57.5]	1562 [61.5]	1662 [65.4]	1070 [42.1]	380 [15.0]
TMU-x200	1751 [68.9]	1853 [73.0]	1620 [63.8]	1722 [67.8]	1822 [71.7]	1210 [47.6]	400 [15.7]
TMU-x250	1891 [74.4]	1993 [78.5]	1760 [69.3]	1862 [73.3]	1962 [77.2]	1300 [51.2]	550 [21.7]
TMU-x300	1896 [74.6]	1998 [78.7]	1765 [69.5]	1867 [73.5]	1967 [77.4]	1400 [55.1]	510 [20.1]

Installation length dimension "A" see Order details sensor.

Heated sensors

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

No responsibility taken for errors;
subject to change without prior notice.

Zertifiziertes QM-System
DIN EN ISO 9001
Zertifikat-Nr. 01017

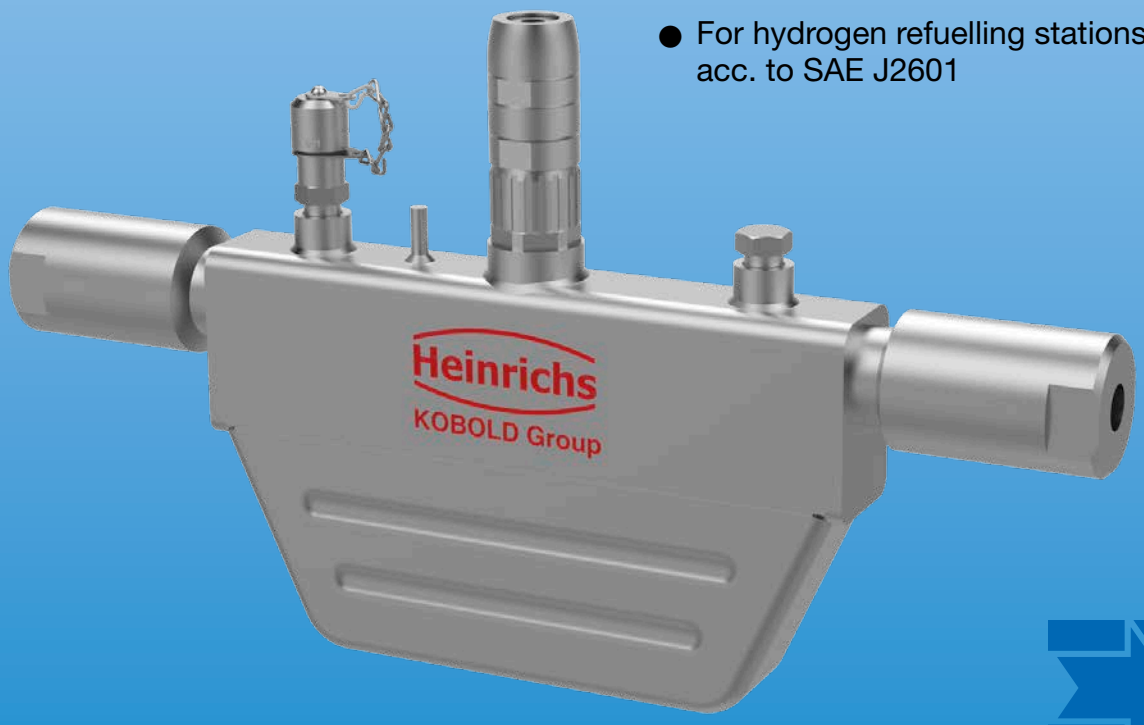
Coriolis Mass Flow Meter

For high pressure and hydrogen dispenser applications, up to 1000 bar

measuring • monitoring • analysing

TMU-W

- Outstanding accuracy
- Robustness against vibrations
- Working pressure up to 1000 bar
- Measuring ranges up to 960 kg/h
- OIML R139:2018 approval
- For hydrogen refuelling stations acc. to SAE J2601



S5

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+49(0)6192 23398
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www.kobold.com

1/06 - 2023

Function

The TMU-W product line was specially developed for hydrogen filling applications for dispensing stations.

During fuelling process, extremely high zero point and long term stability are required.

Its special design provides the highest possible stability and unrivalled measuring accuracy to the user.

Special materials and sophisticated engineering design methods such as FEM, CFD, FSI etc. were used to fulfil this task.

Optimized for use in slim hydrogen dispensers of the latest state-of-the-art generation.

Technical Details

Sensor system: TMU-W

Coriolis dual-pipe design

TMU-W004, TMU-W006

Accuracy

Liquid:	0.1 % of actual flowrate ± ZP stability
Gas:	0.5 % of actual flowrate ± ZP stability
OIML R139:2018:	Class 2 (only TMU-W004)
Wetted parts:	316TI/1.4571
Process connection:	6MF 9/16-18 UNF optional: ½" NPT (f), Hofer ⅞"
Sensor containment:	1.4301 stainless steel
Ambient temperature:	-40 °C…+80 °C -40 °F…+176 °F (acc. to OIML R139: -40°C…+55°C)
Process temperature:	-50 °C …+60 °C -58 °F…+212 °F (acc. to OIML R139: -40°C…+55°C)
Process pressure:	TMU-W004: max. 1000 bar TMU-W006: max. 500 bar
Ingress protection:	IP67 (EN 60529) / NEMA 6

Certificates and Approvals

ATEX / IECEx / UKCA:	II 1/2G Ex ia IIC T2…T6 Ga/Gb
NEPSI:	Ex ia IIC T2…T6 Ga/Gb
OIML:	R139:2018

No responsibility taken for errors;
subject to change without prior notice.

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Available Transmitters UMC4 / UMC4-RM

Transmitter mounting:	Field housing 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)
Ambient temperature:	-20 °C … +60 °C (acc. to OIML R139: -40 °C … +55 °C)
Power supply:	90…265 V_{AC}, 50/60 Hz (not for OIML R139) 19…36 V_{DC}

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, temperature.
Binary:	passive via optocoupler Pulse duration: 50 ms adjustable range 0,1…2000 ms
Status:	passive via optocoupler Forward-/Reverse, MIN/MAX flow rate, 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 (RM):

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

Measuring ranges:

TMU-W004:	max. 4 kg/min H_2 (P_{nom} 1000 bar), with OIML R139:2018 approval
TMU-W006:	max. 16 kg/min H_2 (P_{nom} 500 bar)

No responsibility taken for errors;
subject to change without prior notice.

Necessary data for the sizing of the meter

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

Order Details Sensor (Example: **TMU-W004 6010 A 00 K 0 1 0 0 K**)

Model	Wetted materials / Measuring range / P_{Nom}	Process connection / Installation length / P_{Nom}	Sensor containment
TMU-	**W004** = Stainless steel 316TI / 14571 / 4 kg/min H_2 / 1000 bar	**6010** = ¼" NPT (f) / 347 mm / 500 bar **6030** = ½" NPT (f) / 347 mm / 500 bar **4550** = Hofer 7/8" / 347 mm / 500 bar **4500** = 6MF 9/16-18 UNF / 347 mm / 1000 bar **XXXX**= Special, customer specified	**A** = Stainless steel (1.4301) Overpressure blow out, N_2 filling nozzle, N_2 filled
	W006 = Stainless steel 316TI / 14571 / 16 kg/min H_2 / 500 bar [2]	**6010** = ¼" NPT (f) / 400 mm / 500 bar **6030** = ½" NPT (f) / 400 mm / 500 bar **4550** = Hofer 7/8" / 400 mm / 500 bar **4500** = 6MF 9/16-18 UNF / 400 mm / 500 bar **XXXX**= Special, customer specified	

Heating / Cooling	Transmitter mounting / Process temperature / Electrical connection	Approvals
00 = without	**K** = Remote mounted transmitter (IP67) / -50…100 °C (-58…212 °F) / Connector (Harting Han® R 23) [2] **X** = Special, customer specified	**0** = without **L** = ATEX / IECEx / UKCA II 1/2G Ex ia IIC T2...T6 Ga/Gb **B** = NEPSI Ex ia IIC T2…T6 Ga/Gb

Calibration flow	Calibration density	Supplementary equipment	Design
1 = Standard, 3-point **3** = External lab **7** = OIML R139:2018. Hydrogen [1] **X** = Special, customer specified	**0** = without	**0** = without **1** = Certificate of compliance with the order 2.1 **2** = Test report 2.2 **B** = Inspection certificate 3.1 with material certificate (DIN EN 10204:2004) **X** = Special, customer specified	**K** = Kobold

[1] Must be used with approved UMC4 transmitter for system approval.
[2] Not for OIML R139:2018. Hydrogen.

No responsibility taken for errors; subject to change without prior notice.
1/06 - 2023

Order Details Transmitter (Example: **UMC4-E11A00K**)

Model	Mounting / Conduit port opening	Display / interface board	Power supply
UMC4-	**E** = remote mount, without junction box , Transmitter with 5 m cable / M20 x 1,5 [1] **D** = remote mount, with junction box / M20 x 1,5 [1] **F** = remote mount, via screw terminals, rack mount version / without	**1** = Integral within transmitter housing, for ambient temperature up to 60 °C	**1** = 90…265 V_{AC}, 50/60 Hz [3] [4] **2** = 19…36 V_{DC}, 24 V_{AC} (+5%…-20%), 50/60 Hz

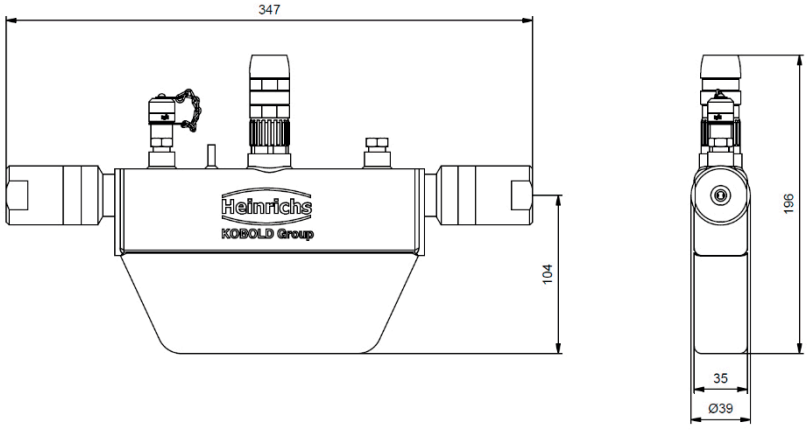
Outputs	Approvals	Type of protection (signal output)	Design
A = Analogue output 1: 4 … 20 mA with HART® Analogue output 2: 4 … 20 mA Pulse output: passive Status output: passive	**0** = without **2** = ATEX, IECEx II (1)2G Ex d [ia Ga] IIC T4-T3 Gb NEPSI Ex db [ia Ga] IIC T4/T3 Gb terminal compartment Ex d / -20…60 °C [3] **3** = ATEX, IECEx II (1)3G Ex ec [ia Ga] IIC T6..T3 Gc Rack mount design / -20…55 °C [2]	**0** = Without Approval [5] **1** = Intrinsically safe Ex [ia Ga] **2** = Not intrinsically safe	**K** = Kobold

In the table are only options listed, which are relevant for the use of the UMC4 transmitter with a TMU-W sensor.

[1] Includes mounting bracket for wall and 2" pipe.
[2] Only for option F
[3] Not for option F
[4] Not for OIML R139:2018 (TMU-W)
[5] Only for approval "0"

Dimensions [mm]

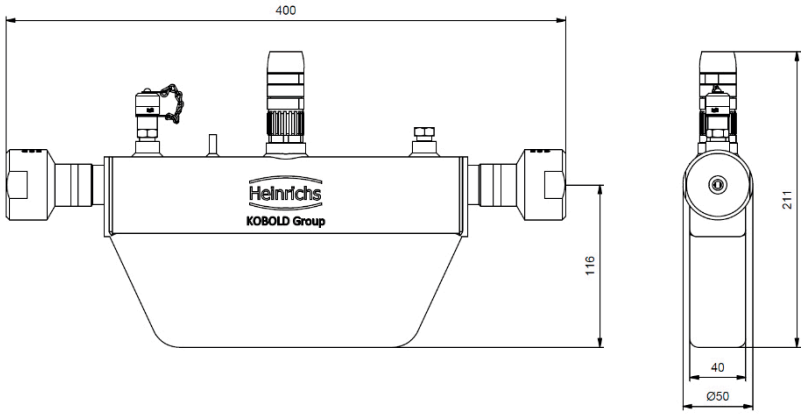
TMU-W004



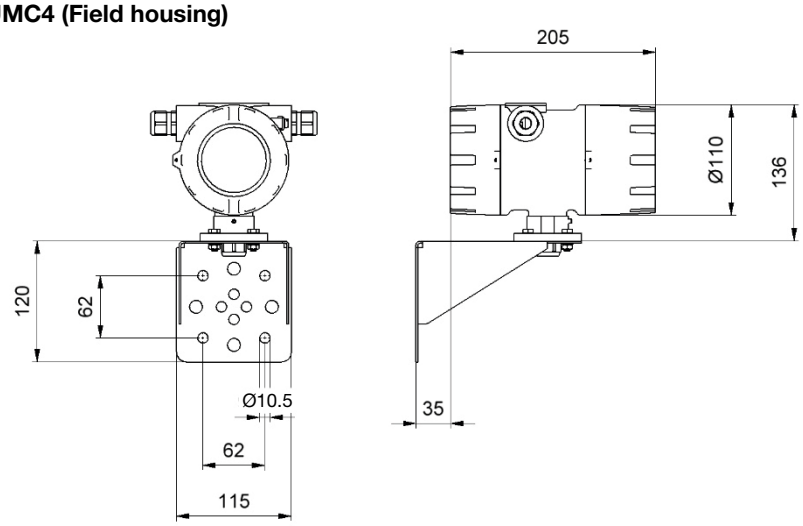
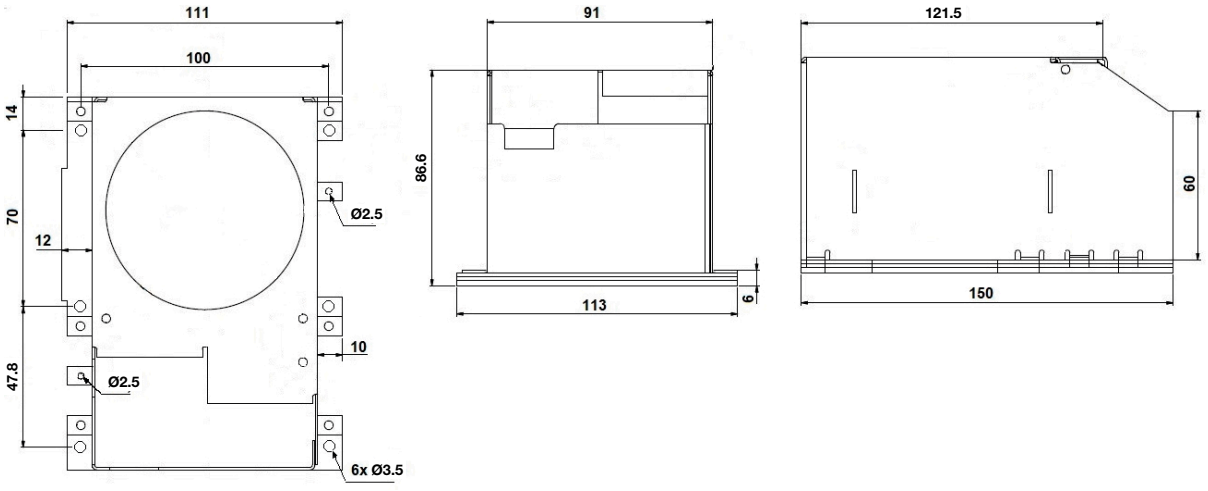
No responsibility taken for errors;
subject to change without prior notice.

Dimensions [mm] (continued)

TMU-W006



UMC4 (Field housing)



UMC4-RM (Rack mount design)