TRIO-MASS

Mass Flowmeter based on the Coriolis Principle for the Simultaneous Measurements of Mass, Density and Temperature

D184S068U02 Rev. 0 / 09/99

Fig. 1

Essential Components

- Meter Primary, size 1/4” to 6” / DN 6 to DN 150
- Converter in a Compact or Remote Design
- Selectable process connections and pressure ratings
- Fluid wetted parts made of stainless steel or Hastelloy C4

Technical Features

- Measurement of mass flow, density and temperature
- High measurement accuracy
  Mass to 0.15 % of rate
  Density to 1 g/l
- High fluid temperature ranges to 180 °C
- Two current outputs and one pulse output

Applications

- Chemicals, e.g. solvents, deionized water
- Petrochemicals, e.g. benzine, crude products
- Food Industry, e.g. oils, fats, juices
- Pharmaceuticals e.g. cosmetics, chemicals
- Paper Industry, e.g. additives
- Power Plants, e.g. heating oil, hot water

Coriolis-Mass Flowmeters are utilized for high accuracy mass flow and density measurements. The fluid need not be conductive.

Principle of Operation

The TRIO-MASS is an economical and uncomplicated Fischer & Porter Mass Flowmeter with a new integrally or remote mounted DSP converter. The Compact Design reduces the installation and wiring costs. The flowrate information is displayed locally and the installation in your system may be space-saving.

The TRIO-MASS operates according to the Coriolis Principle. The design offers the following advantages:

- Space-saving, rugged design.
- Wide meter size range from 1/4” to 6” / DN 6 to DN 150.
- A variety of process connections.
- Two current outputs for flowrate and density in conjunction with a pulse output (all are galvanically isolated from each other).
- Contact in- and output.
- HART-Protocol.
- Ex-Approval, output circuit Ex “e” or Ex “ib”.
- Allowable fluid temperature 180 °C.
- Lighted, 2 line display plus data entry without opening the meter using a Magnet Stick.

Mass Converter with Digital Signal Processing (DSP)
The converter for the compact TRIO-MASS incorporates a digital signal processor (DSP) with which it is possible to measure the mass flow and density value to the highest precision.

Excellent long term stability and reliability are the results of the new DSP converter design.

The self diagnostic functions included for the flowmeter primary and the converter coupled with absolute zero stability are the essential advantages, which are required if reliance on the measurements is to be assured.

The TRIO-MASS converter provides advantages especially

- when mass flowrate is to be metered to the highest accuracy.
- when the fluid density must be determined.
- when the components of a recipe are to be mixed together.
- for the metering of non-conductive fluids or highly viscous, solids loaded liquids .
- in batch filling systems.

Principle of Operation
When masses flow through a vibrating pipe, Coriolis forces are generated which bend and twist the pipe. These very small pipe deformations are measured by optimally mounted sensors and electronically evaluated. Because the measured phase shift of the sensor signals is proportional to the mass flowrate, the Coriolis Mass Flowmeter measures the mass flowrate in the flowmeter directly. The metering principle is independent of the density, temperature, viscosity, pressure and conductivity.

The metering tubes always vibrate at resonance, The resonant frequency during operation is a function of the meter tube geometry, the material characteristics of the flowmeter and the mass of the fluid in the metering tube which is also vibrating. It provides an accurate measure of the density of the fluid being metered. In summary, it is possible to simultaneously measure the mass flowrate, fluid density and temperature with the Coriolis Mass Flowmeter.

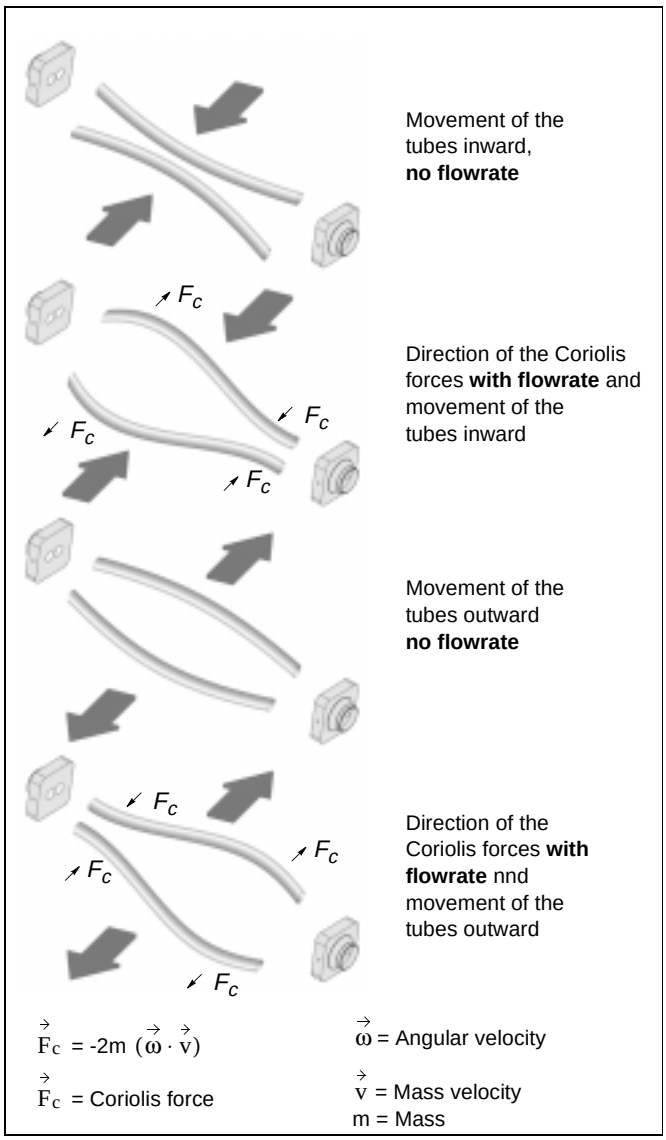


Fig. 2 Simplified Representation of the Coriolis Forces

System Design

The flowmeter primary consists of two one piece, formed meter tubes oriented in parallel. A twist and bend resistant mounting structure which connects the in- and outlet of the flowmeter is especially designed to isolate the meter tube from external forces and moments.

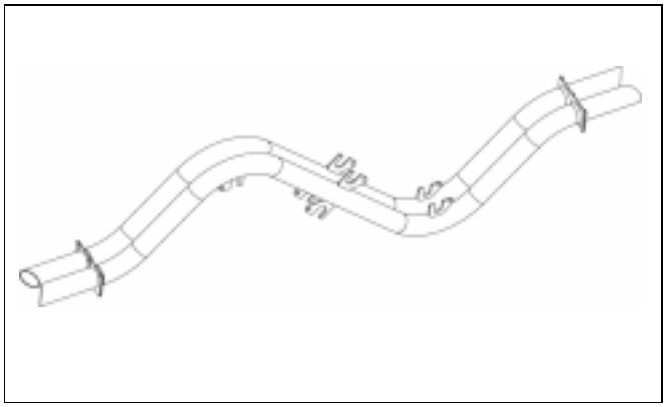


Fig. 3 TRIO-MASS Parallel Meter Tube Design

The in- and outlet ends of the meter tube are welded to flow splitters. Therefore there is no direct connection to the process connections. This approach minimizes the effects of external vibrations on the measurements.

Long life is assured by elimination of weld seams in the highly stressed areas and by hard silver soldering under vacuum the mounts for the meter tube , driver and sensor. Exceptional long term stability is assured by the vacuum stress relieving of the meter tubes.

Straightforward installations, wide flow ranges and a variety process connections and last but not least, the quick amortization of the costs make the TRIO-MASS an instrument which can be optimally applied in production processes.

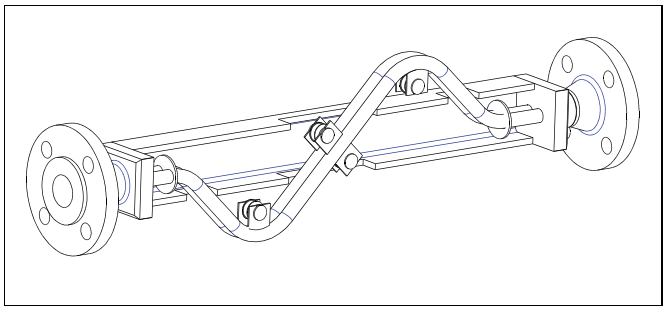


Fig. 4 Double Tube Flowmeter Primary TRIO-MASS

Assembly and Installation Requirements
The flowmeter primary can be installed in any arbitrary orientation. The flowrate is measured independently for each flow direction. Fittings such as valves, gates, sight glasses etc. are to be installed in a manner to avoid no cavitation.

In order to support the weight of the flowmeter primary and to attain good metering results for higher gas content fluids it is recommended that the pipeline up- and downstream of the flowmeter be supported.

Specifications
Flowmeter Primary TRIO-MASS

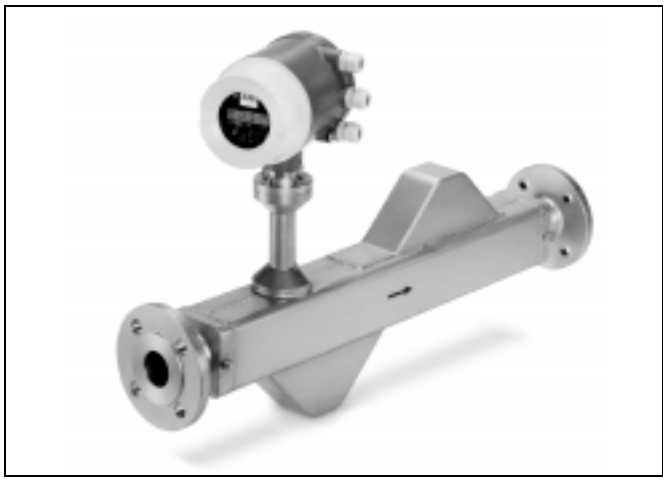


Fig. 5 Flowmeter Primary TRIO-MASS

Meter Sizes
"B"(1/4"/DN6);"C"(3/8"/DN10);"D"(1/2"/DN15); "E" (3/4"/DN20); "F"(1"/DN25");"G"(1-1/2"/DN40);"H"(2"/DN50); "I"(2-1/2"/DN65);"J"(3"/DN80);"K"(4"/DN100);"L"(6"/DN150)

Flow Ranges

Meter Size			Nom. Flow Range [kg/min]	Nom. Flow Range [t/h]	Max. Flow Range [kg/min]
	Inch	DN			
"B"	1/4	6	0 to 11	0 to 0.66	0 to 13
"C"	3/8	10	0 to 18	0 to 1.08	0 to 25
"D"	1/2	15	0 to 45	0 to 2.70	0 to 60
"E"	3/4	20	0 to 75	0 to 4.50	0 to 100
"F"	1	25	0 to 125	0 to 7.50	0 to 160
"G"	1 1/2	40	0 to 365	0 to 21.9	0 to 475
"H"	2	50	0 to 710	0 to 42.6	0 to 920
"I"	2 1/2	65	0 to 1450	0 to 87.0	0 to 1890
"J"	3	80	0 to 1890	0 to 113.4	0 to 2460
"K"	4	100	0 to 3200	0 to 192	0 to 4160
"L"	6	150	0 to 8500	0 to 510	0 to 11000

Density Range
0.5 kg/dm^3 to 3.5 kg/dm^3

Accuracy, Flowrate
± 0.4 % of rate ± 0.01% of Q_{nom}
± 0.25 % of rate ± 0.01% of Q_{nom}
± 0.15 % of rate ± 0.01% of Q_{nom}

Reproducibility, Flowrate
0.1 % of rate

Accuracy, Density
Standard calibration ± 5 g/l
Expanded density calibration ± 1 g/l

Reproducibility, Density
± 0.1 g/l

Materials
Fluid wetted parts
Stn. stl. 316 Ti / 1.4571
Hastelloy C4 / 2.4610
Housing
Stn. stl. 304 / 1.4301

Fluid Temperature
Standard: -50 °C to 180 °C

Ambient Temperature
-20 °C to +60 °C

Process Connections
Flanges DIN/ANSI
Tri-Clamp ISO 2852
Food Industry Fitting DIN 11851

Pressure Rating
PN 16, PN 40
CL 150, CL 300

Accuracy, Temperature
-50 °C to +180 °C < 1.5 °C
-20 °C to +120 °C ± 0.5 °C

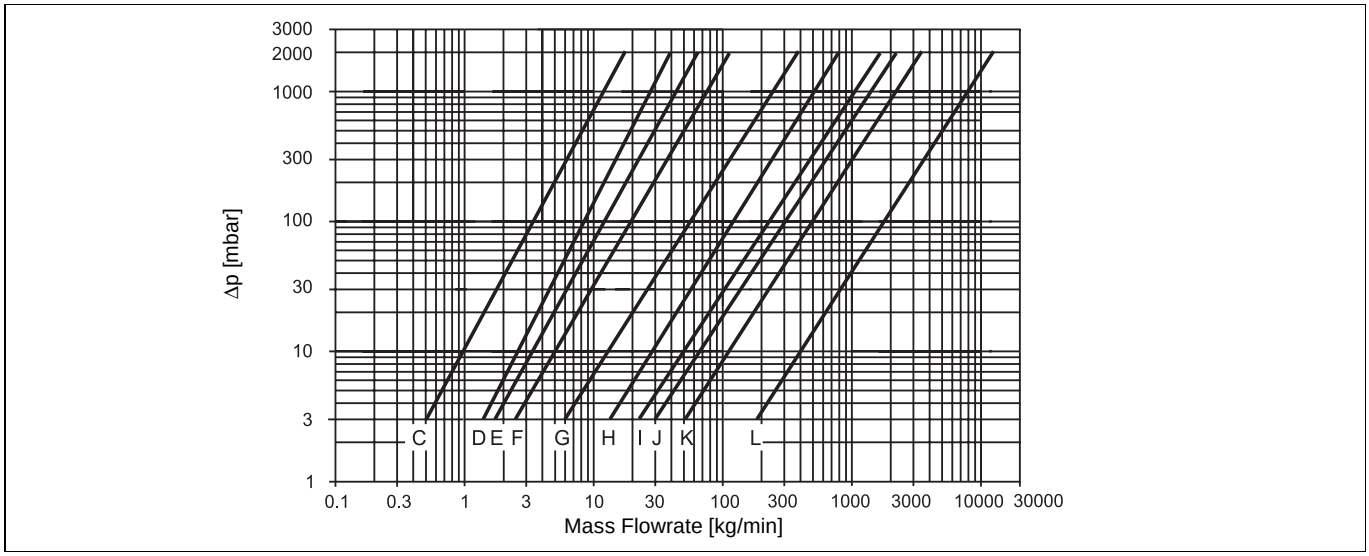
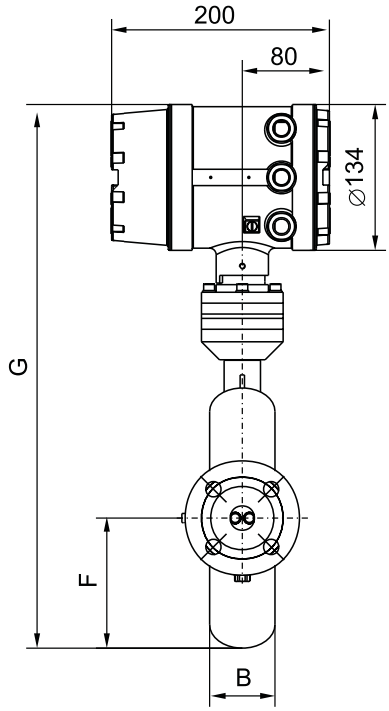
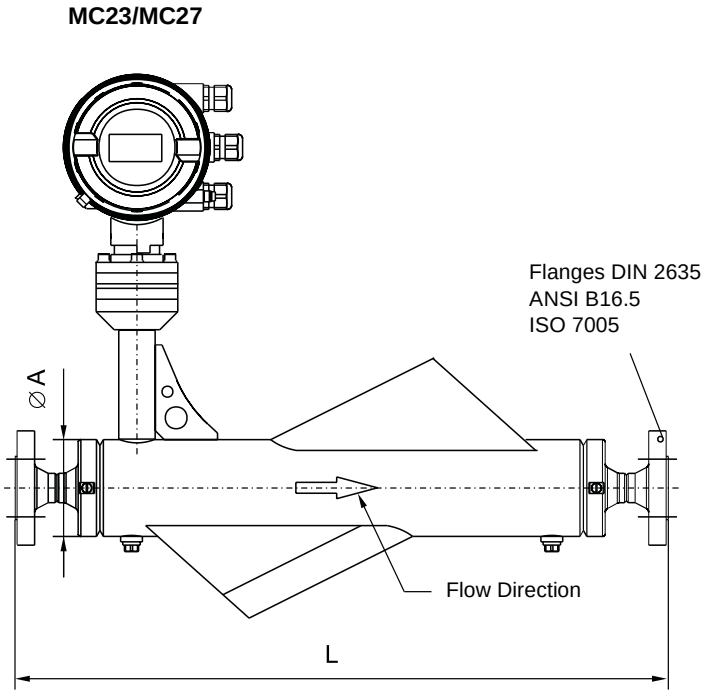


Fig. 6 Pressure Drop Curve TRIO-MASS

Dimensions
Flanged Design





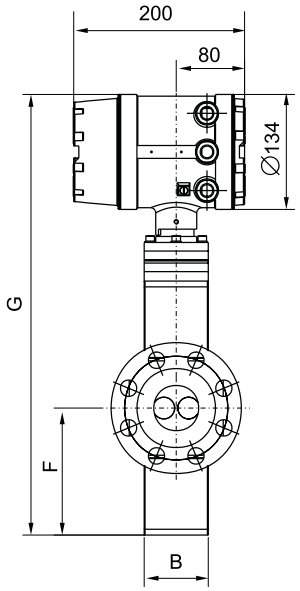
Meter Size Inch	DN	A	F	B	G (MC23)	G (MC27)	Process Conn. Inch / DN	L DIN 2635 (PN 40)	L ANSI CL 150 ISO PN 20	L ANSI CL 300 ISO PN 50	Weight ca. kg
("B") 1/4	6	60	83	45	425	449	10	493			9
							1/2 / 15	578	593	603	
("C") 3/8	10	60	83	45	425	449	10	493			9
							1/2 / 15	578	593	603	
("D") 1/2	15	76	93	45	443	467	10	653			11
							1/2 / 15	578	593	603	11
							3/4 / 20	683	703	713	13
("E") 3/4	20	89	114	60	470	494	1/2 / 15	693	708	718	15
							3/4 / 20	598	618	628	15
							1 / 25	698	728	738	16
("F") 1	25	89	114	60	470	494	3/4 / 20	758	778	788	16
							1 / 25	658	688	698	16
							1-1/2 / 40	808	838	893	19

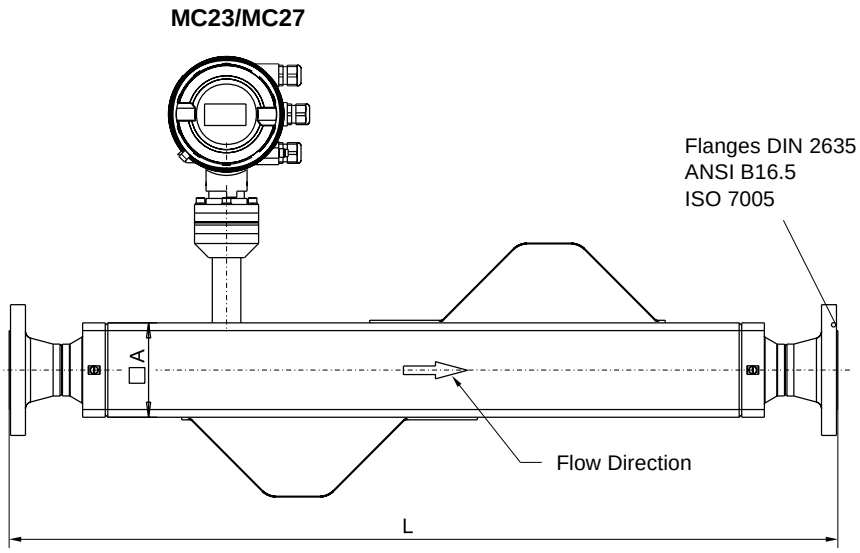
All dim's in mm

ISO Projection Method E

Fig. 7 Dimensions, 1/4" to 1" / DN 6 to 25, Flanged Design

Dimensions
Flanged Design





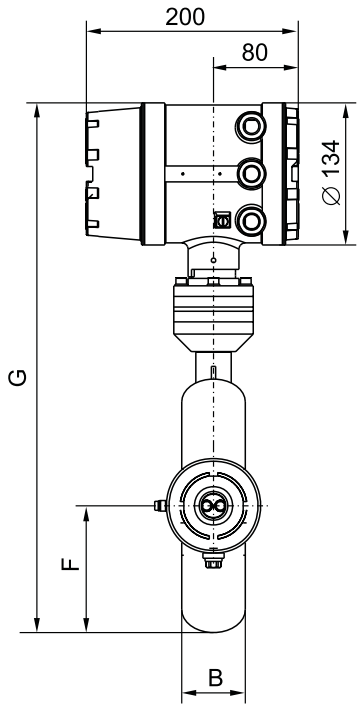
Meter Size Inch	DN	A	F	B	G (MC23)	G (MC27)	Process Conn. Inch / DN	L DIN 2633 (PN 40)	L DIN 2635 (PN 40)	L ANSI CL 150 ISO PN 20	L ANSI CL 300 ISO PN 50	Weight ca. kg
("G") 1-1/2	40	90	129	64	486	511	1 / 25		879	910	922	20
							1-1/2 / 40		780	810	825	22
							2 / 50		940	970	980	23
("H") 2	50	110	149	80	515	540	1-1/2 / 40		1045	1075	1090	32
							2 / 50		940	970	980	34
							2-1/2 / 65		1100	1135	1145	38
("I") 2-1/2	65	130	164	97	541	566	2 / 50		1220	1250	1260	43
							2-1/2 / 65		1100	1135	1145	47
							2-1/2 / 65 Hast. C4 / 2.6410		1100	1220	1230	48
							3 / 80		1220	1240	1260	50
("J") 3	80	140	186	108	568	593	2-1/2 / 65		1330	1365	1375	56
							3 / 80		1220	1240	1260	58
							4 / 100	1450	1480	1500	1520	69
("K") 4	100	170	215	131	612	637	3 / 80		1640	1660	1680	84
							4 / 100	1450	1480	1500	1520	91
6 ("L")	150	250	285	190	722	747	6 / 150	2000	2040	2070	2090	190

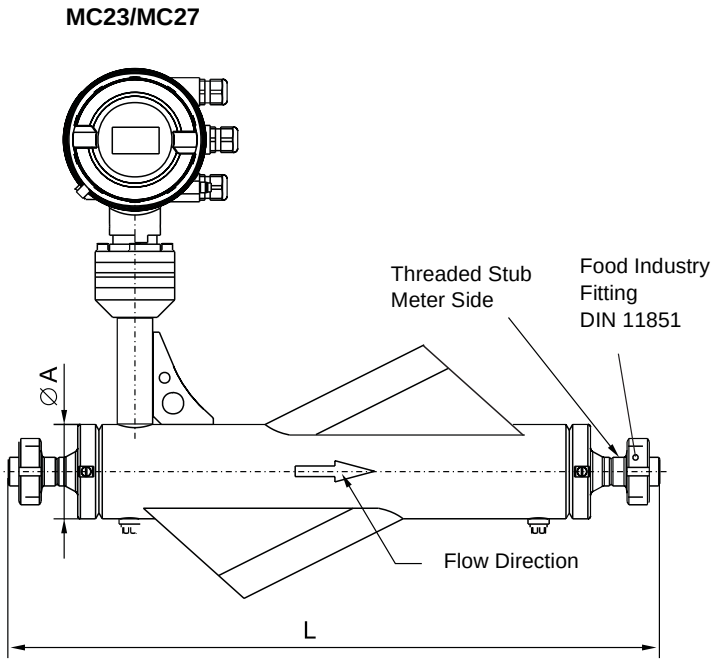
All dim's in mm

ISO Projection Method E

Fig. 8 Dimensions, 1-1/2" to 6" / DN 40 to 150, Flanged Design

Dimensions
Food Industry Fitting DIN 11851





						Process Conn.	L	Weight
Meter Size DN	A	F	B	G (MC23)	G (MC27)	DN	DIN 11851	ca. kg
6 (“B”)	60	83	45	425	449	10	506	7
						15	586	
10 (“C”)	60	83	45	425	449	10	506	7
						15	586	
15 (“D”)	76	93	45	443	467	10	666	9
						15	586	
						20	691	
20 (“E”)	89	114	60	470	494	15	701	13
						20	606	
						25	709	
25 (“F”)	89	114	60	470	494	20	766	14
						25	670	
						40	830	

All dim’s in mm

ISO Projection Method E

Fig. 9 Dimensions, DN 6 to 25, Food Industry Fittings DIN 11851

Specifications
Converter

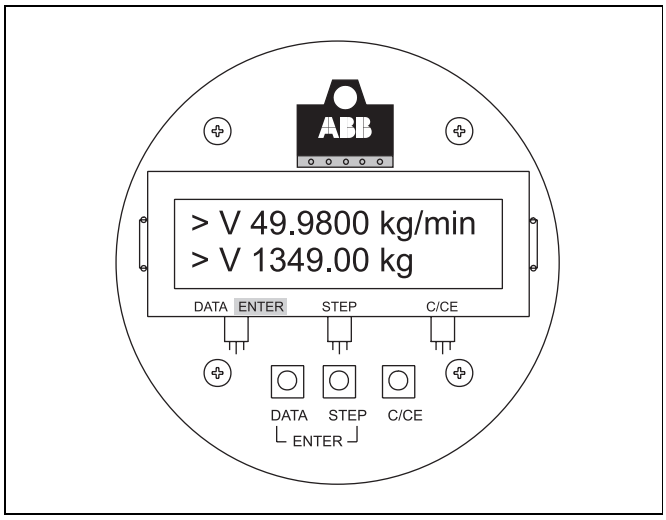


Fig. 10 Converter Keypad and Display

Measurement Range
Infinitely adjustable

Protection Class
IP 67

Electrical Connectors
Cable connectors M20 x 1.5

Supply Power

High voltage	85 to 253 V AC
Low voltage	24 V AC / 24 V DC
Frequency	47 to 64 Hz

Power
< 15 VA

Response Time
For a 0 - 99 % step change (corresp. 5 τ) $\geq$ 1 s

Ambient Temperature
-20 °C to 60 °C

Design
Field mount housing in cast light metal, painted
Center section: RAL 7012, dark gray
Cover: RAL 9002, light gray

Forward/Reverse Flow Metering
The flow direction is indicated in the display by a direction arrow and is signaled by a optocoupler for an external alarm.

Display
2x16-character LCD-Dot-Matrix display with LED background lighting. Both lines can be user configured for the indication of mass flowrate, volume flowrate, density or temperature. Flow totalization, 7-digit with overflow counter in mass or volume engineering units.

Parameter Settings
Data can be entered in a number of different languages using the 3 buttons on the converter.

The converter housing can be rotated in 180° steps. There are four positions into which the display can be mounted to assure optimum readability. In the multiplex mode the flowrate in %, direct reading engineering units, bargraph display, totalizer value forward or reverse, TAG-No. can be alternately displayed in addition to the display selections for the 1st and 2nd lines.

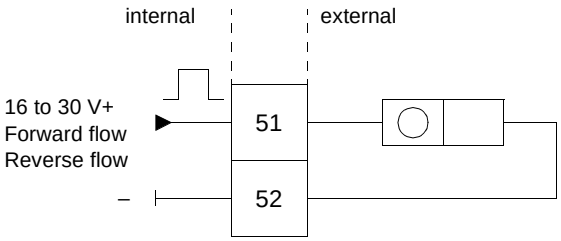
Data Protection
All data are stored in an NV-RAM for 10 years without supplementary power when the instrument is turned off or during a power outage. Additional process information safeguards are provided by a serial EEPROM in the converter utilizing a data up- or download procedure.

! Note:

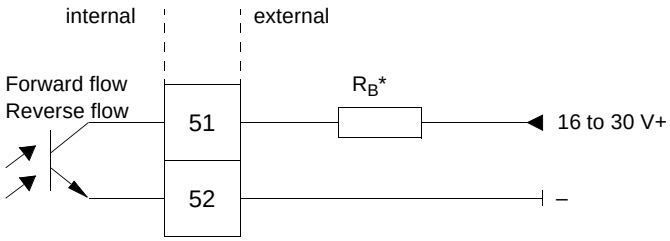
The instrument satisfies the NAMUR-Recommendations “EMC-Guidelines for Manufacturers and Users of Electronic Instruments and Systems, Part 1”, 5/93 and EMC-Guidelines 89/336/EWG (EN 50081-1, EN 50082-2), and the Low-Voltage-Guidelines 73/23/EWG (EN 61010-1).

Connection Examples for Peripherals (Szandard)

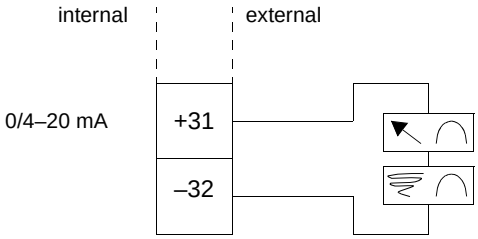
Scaled Pulse active



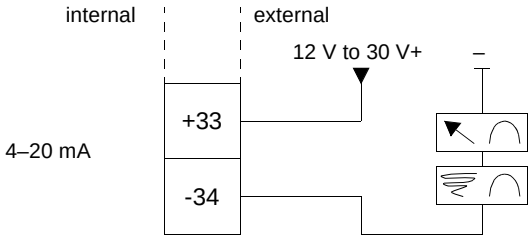
Scaled Pulse passive, optocoupler



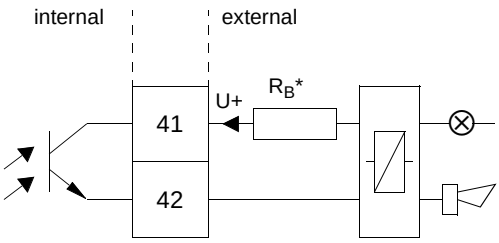
Current Output 1 active



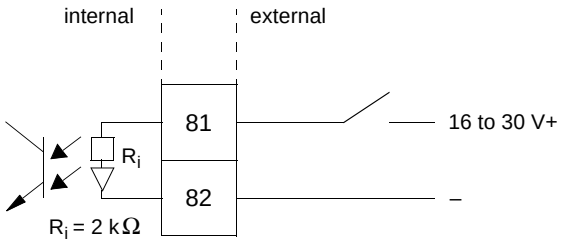
Current Output 2 passive



Contact output for System Monitor, Max.-Min.-Alarm, Empty Pipe Detector or Forward/Reverse direction signal
Function software selectable



Contact Input for External Totalizer Reset and External Zero Return
Function software selectable

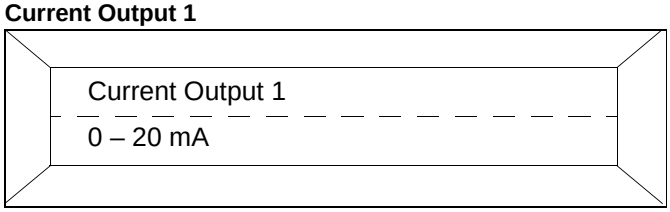


$$*R_B \geq \frac{U_{CE}}{I_{CE}}$$

Fig. 11

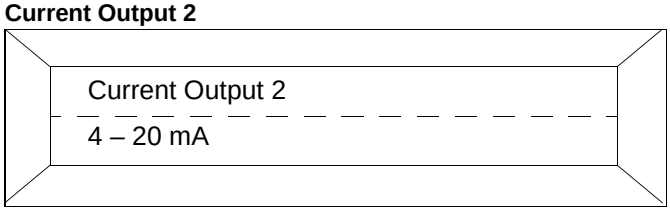
Output Signals

Current Output 1



Function: active
0/4 - 20 mA, selectable
Load: $0\Omega \le R_B \le 560\Omega$ (Ex $0\Omega \le R_B \le 300\ \Omega$)
Terminals: 31/32
For output of mass flowrate, volume flowrate, density and temperature.
User selectable in the software.

Current Output 2



Function: passive
Output current 4 - 22 mA
Load: $0\Omega \le R_B \le 600\Omega$ (Ex $0\ \Omega \le R_B \le 300\ \Omega$)
Source voltage: $12\ V \le Uq \le 30\ V$ (Ex $14\ V \le Uq \le 21\ V$)
Terminals: 33/34
For output of mass flowrate, volume flowrate, density and temperature.
User selectable in the software.

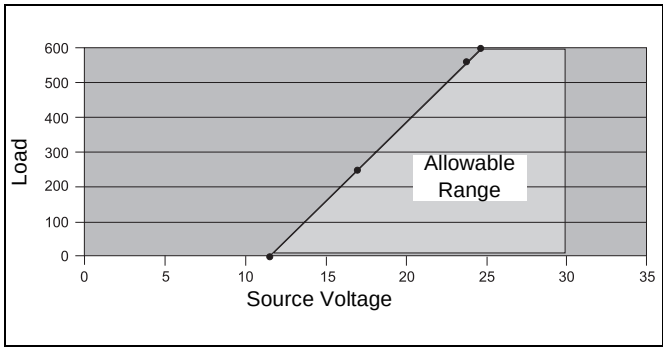
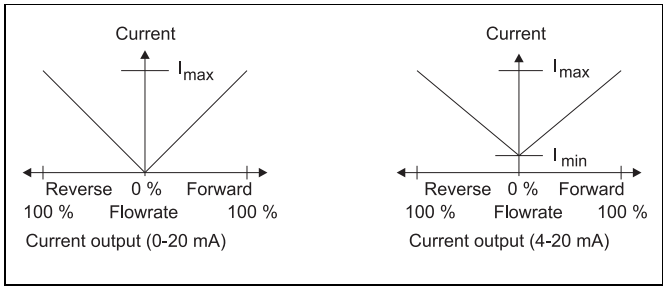
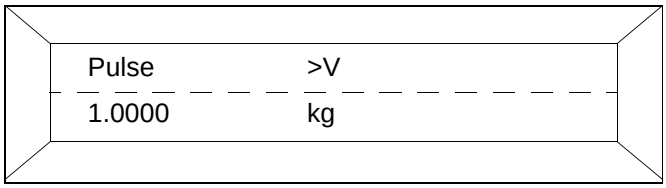


Fig. 12 Allowable Source Voltage as a Function of the Load Resistance at I_{max} = 22 mA (non-EEx)





Scaled Pulse Output
Scaled pulse output (max. 5 kHz) with selectable pulse factor between 0.001 – 1000 pulses per selected engineering unit. The pulse width can be set from 0.1 to 2000 ms. The output is galvanically isolated from Current Output 1 and from Current Output 2.

Design	passive	active
Terminals	51, 52	51, 52
"closed" "high"	$0\ V \le UCE_L \le 2\ V$ $2\ mA \le ICE_L \le 220\ mA$	$16\ V \le UCE_H \le 30\ V$ $2\ mA \le ICE_H \le 220\ mA$
"open" "low"	$16\ V \le UCE_H \le 30\ V$ $0\ mA \le ICE_H \le 0.2\ mA$	$0\ V \le UCE_L \le 2\ V$ $0\ mA \le ICE_L \le 0.2\ mA$
fmax	5 kHz	5 kHz
Pulse width	0.1 ms - 2000 ms	0.1 ms - 2000 ms

Ex-Design (Passive)	Ex "e"	Ex "ib" (Namur
Terminals	51,52	51,52
"closed"	$0\ V \le UCE_L \le 2\ V$ $2\ mA \le ICE_L \le 20\ mA$	
		$R_i = 1\ k\Omega$
"open"	$16\ V \le UCE_H \le 30\ V$	
		$R_i = 11\ k\Omega$

Contact Output
The following functions can be assigned in the software:

System Monitor: Active or idle contact
Empty Pipe: Active or idle contact
Forward/Reverse Direction: closed for forward direction
Max-Min Alarm: Active or idle contact
Terminals: 41, 42
"closed" $0\ V \le UCE_L \le 2\ V$
$2\ mA \le ICE_L \le 220\ mA$

"open" $16\ V \le UCE_H \le 30\ V$
$0\ mA \le ICE_H \le 0.2\ mA$

Contact Input
The following functions can be assigned in the software:

Ext. Zero Return. When the meter tube empties the output signals can be turned off.
Ext. Totalizer Rest. The internal totalizers can be reset from an external contact.
Terminals: 81, 82
"On" $16\ V \le U_{KL} \le 30\ V$
"Off" $0\ V \le U_{KL} \le 2\ V$

$R_i = 2k\Omega$

Specifications
Converter, Standard

HART®-Protocol

The HART®-Protocol provides for communication between a process control system, handheld terminal and a field instrument. If communication using the HART®-Protocol is required, the serial data link option is not available. The digital communication utilizes an ac signal superimposed on Current Output 1 which does not affect any other instruments connected to the output. This feature is only available with in the 4–20 mA current output mode.
Terminals: 31/32

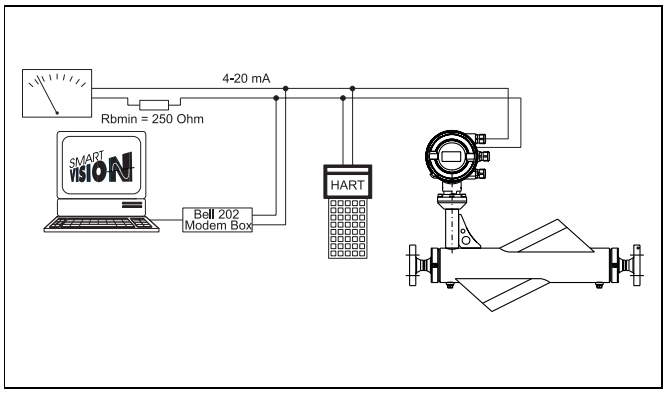


Fig. 13 Communication with HART-Protocol

Transmission Mode
FSK-Modulation on the 4–20 mA current output per Bell 202 Standard.

Baudrate
1200 Baud

Format
Logic 1: 1200 Hz; Logic 0: 2200 Hz

Cable
AWG 24 twisted

Max. Cable Length
1500 m

Max. Signal Amplitude
1.2 mApp

Load Current Output
Min. > 250 Ω , max. < 560 Ω

Ex: Min. > 250 Ω , max. < 300 Ω

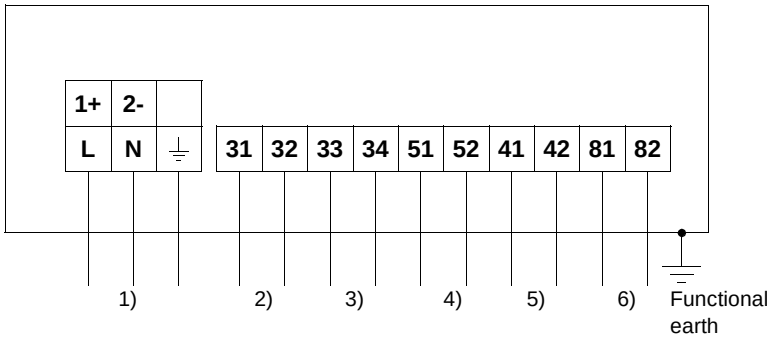
Ordering Information

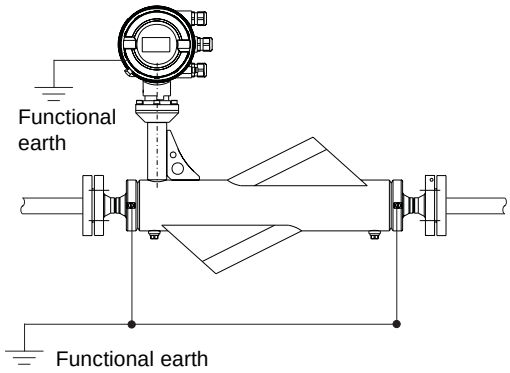
Ordering Number	MC2																	
Design (Flowmeter Primary/Converter)																		
Compact Design		**3**																
Ex, Compact Design		**7**																
Certifications, Flowmeter Primary																		
None			**A**															
CENELEC-Approval			**B**															
Certifications, Materials																		
None				**1**														
3.1B per EN 10204				**2**														
Meter Tube Material																		
Stn. stl. 316 Ti / 1.4571					**1**													
Hastelloy C4 / 2.4610					**4**													
Flow Ranges [kg/min] Nominal	Maximum	**Meter Size**	**Inch**	**DN nom.**														
0 - 11	0 - 13	"B"	1/4	6 [1]			**B**											
0 - 18	0 - 25	"C"	3/8	10			**C**											
0 - 45	0 - 60	"D"	1/2	15			**D**											
0 - 75	0 - 100	"E"	3/4	20			**E**											
0 - 125	0 - 160	"F"	1	25			**F**											
0 - 365	0 - 475	"G"	1 1/2	40			**G**											
0 - 710	0 - 920	"H"	2	50			**H**											
0 - 1450	0 - 1890	"I"	2 1/2	65			**I**											
0 - 1890	0 - 2460	"J"	3	80			**J**											
0 - 3200	0 - 4160	"K"	4	100			**K**											
0 - 8500	0 - 11000	"L"	6	150 [1]			**L**											
Process Connection Size (see Dimensions for available combinations)																		
DN 10		3/8"						**10**										
DN 15		1/2"						**15**										
DN 20		3/4"						**20**										
DN 25		1"						**25**										
DN 40		1 1/2"						**40**										
DN 65		2"						**50**										
DN 65		2 1/2"						**65**										
DN 80		3"						**80**										
DN 100		4"						**1H**										
DN 150		6"						**1F**										
Process Connection Type (see Dimensions for available combinations)																		
Flanged DIN PN 16									**D**									
Flanged DIN PN 40									**F**									
Flanged DIN PN 100 [1]									**H**									
Flanged ANSI CL 150									**P**									
Flanged ANSI CL 300									**Q**									
Flanged ANSI CL 600 [1]									**R**									
Tri-Clamp [1]									**U**									
Food Industry Fitting DIN 11851 [1]									**V**									
Housing (Flowmeter Primary)																		
Standard										**1**								
Heating/Cooling																		
None											**1**							
Calibration																		
Flowrate forward ± 0.40 % of rate /Density (± 5 g/l)												**A**						
Flowrate forward ± 0.25 % of rate /Density (± 5 g/l)												**B**						
Flowrate forward ± 0.15 % of rate /Density (± 5 g/l)												**C**						
Instrument Tag																		
German													**G**					
English													**E**					
French)													**F**					
Design Level																		
Specified by F&P														*****				
Operating Mode/Software Options																		
Standard software (mass flow and density measurements)															**A**			
Outputs in addition to Current Output I (active), Contact Output (passive) and Contact Input (passive)																		
Current Output 2 (passive), Pulse Output (active) [not available for Ex option]																**A**		
Current Output 2 (passive), Pulse Output (passive)																**B**		
Communication																		
None																	**0**	
HART-Protocol																	**1**	
Supply Power																		
High voltage	85 to 253 V AC																	**G**
Low voltage	24 V AC / 24 V DC																	**K**

1) in preparation

* Remote Design in preparation

Interconnection Diagram





1) Supply Power
High voltage 85 V AC to 253 V AC Terminals L, N, ⏚
Low voltage 24 V AC / 24 V DC Terminals: 1+, 2-
Frequency 47 to 64 Hz

2) Current Output 1, software selectable
Function: active
Terminals: 31, 32, 0/4 - 20 mA,
(0 Ω ≤ R_B ≤ 560 Ω)

3) Current Output 2, software selectable
Function: passive
Terminals: 33, 34, 4 - 20 mA, 0 Ω ≤ R_B ≤ 600 Ω
Source voltage: 12 ≤ Uq ≤ 30 V

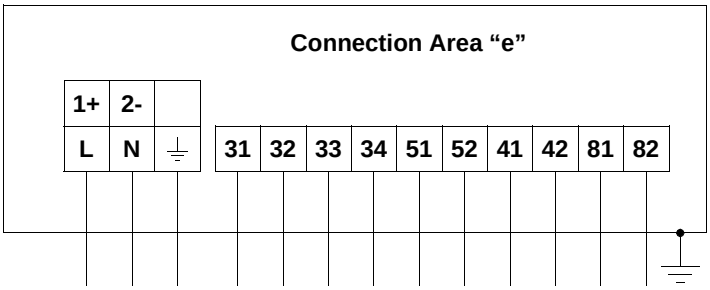
4) Pulse Output, passive
Terminals: 51, 52
fmax: 5 kHz, pulse width 0.1 ms - 2000 ms
Setting range: 0.001 - 1000 pulses/unit
"closed" 0 V ≤ UCE_L ≤ 2 V, 2 mA ≤ ICE_L ≤ 220 mA
"open" 16 V ≤ UCE_H ≤ 30 V, 0 mA ≤ ICE_H ≤ 0.2 mA
In a NAMUR-contact design for connection to a switch amplifier:
per DIN 19234

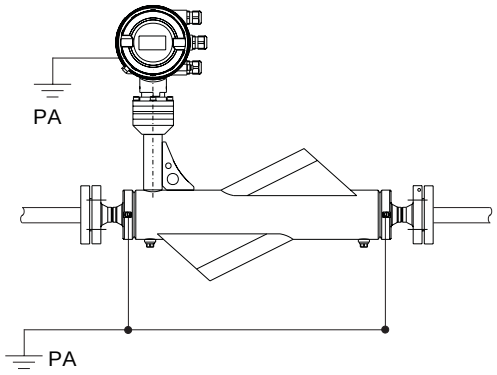
5) Contact Output, passive
Terminals: 41, 42
"closed" 0 V ≤ UCE_L ≤ 2 V, 2 mA ≤ ICE_L ≤ 220 mA
"open" 16 V ≤ UCE_H ≤ 30 V, 0 mA ≤ ICE_H ≤ 0.2 mA
In a NAMUR-contact design for connection to a switch amplifier:
per DIN 19234

6) Contact Input, passive
Terminals: 81, 82
"On" 16 V ≤ U_{KL} ≤ 30 V
"Off" 0 V ≤ U_{KL} ≤ 2 V
R_i = 2 kΩ

Fig. 14 Interconnection Diagram

Interconnection Diagram





1) Supply Power
High voltage 85 V AC to 253 V AC Terminals L, N, PA
Low voltage 24 V AC / 24 V DC Terminals: 1+, 2-
Frequency 47 to 64 Hz

2) Current Output 1, software selectable
Function: active
Terminals: 31, 32, 0/4 - 20 mA,
(0 Ω ≤ R_B ≤ 300 Ω)

3) Current Output 2, software selectable
Function: passive
Terminals: 33, 34, 4 - 20 mA, 0 Ω ≤ R_B ≤ 300 Ω
Source voltage: 12 ≤ Uq ≤ 20 V

4) Pulse Output, passive
Terminals: 51, 52
fmax: 5 kHz, pulse width 0.1 ms - 2000 ms
Setting range: 0.001 - 1000 pulses/unit
“closed” 0 V ≤ UCE_L ≤ 2 V, 2 mA ≤ ICE_L ≤ 20 mA
“open” 16 V ≤ UCE_H ≤ 30 V, 0 mA ≤ ICE_H ≤ 0.2 mA
In a NAMUR-contact design for connection to a switch amplifier:
per DIN 19234

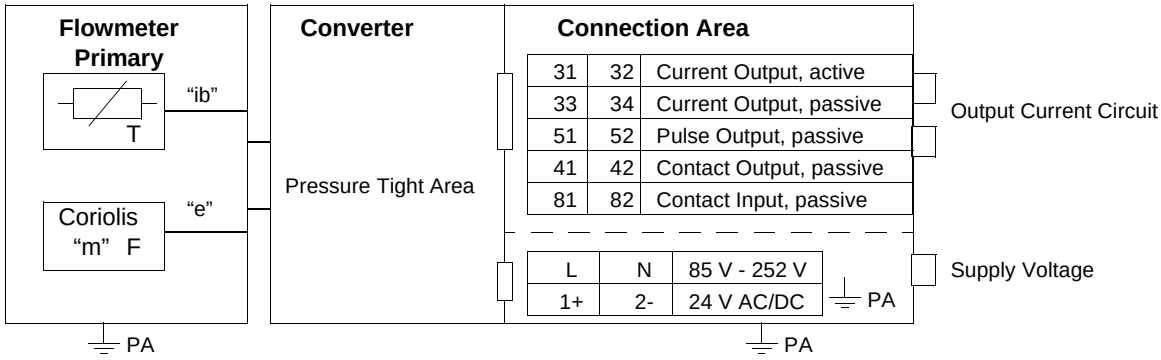
5) Contact Output, passive
Terminals: 41, 42
“closed” 0 V ≤ UCE_L ≤ 2 V, 2 mA ≤ ICE_L ≤ 20 mA
“open” 16 V ≤ UCE_H ≤ 30 V, 0 mA ≤ ICE_H ≤ 0.2 mA
In a NAMUR-contact design for connection to a switch amplifier:
per DIN 19234

6) Contact Input, passive
Terminals: 81, 82
“On” 16 V ≤ U_{KL} ≤ 30 V
“Off” 0 V ≤ U_{KL} ≤ 2 V
I_{IN} ≤ 10 mA

Note:
Within the Ex-Area the protection ground may not be connected. For measurement reasons the PA should be identical to the pipeline potential if possible. An additional ground connection of the protection ground PE to the connection terminals may not be made.

Fig. 15 Interconnection Diagram Ex-Design

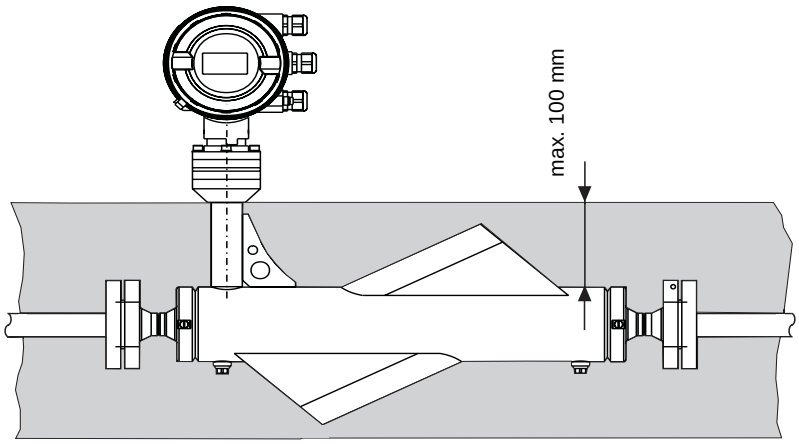
Information for Safe Operation in the Ex-Zone



- Safety Classification
  II 1/2G EEx emd [ib] IIC T6 for meter sizes ≥ 2" / DN 50
  II 2G EEx emd [ib] IIC T6 for meter sizes ≥ 1-1/2" / DN 40
  TÜV ATEX 1443X
- Ambient temperature -20 °C to +60 °C
- The Temperature Classes, which are a function of the ambient and fluid temperatures, are listed in the EC-Type Examination Certificate.
- The converter supply voltage specifications are listed on the Instrument Tag.
- The safety classification for the converter outputs is determined by the external circuits connected to it and can be specified as "intrinsically safe" or "non-intrinsically safe". A combination of "intrinsically safe" and "non-intrinsically safe" is not permissible. The test voltage specification for the output circuits for both classifications is U_M = 60 V.
- The safety relevant specifications for intrinsically safe circuits are listed in the EC-Type Examination Certificate.
- Care should be exercised to assure that the supply voltage connections are properly covered. The connection area may be opened with the intrinsically safe option.
- It is recommended that the appropriate cable connectors included with the shipment be used for the output circuits for the appropriate safety classification: Intrinsically safe → blue; Non-intrinsically safe → black.
- The flowmeter primary and the converter housing are to be connected to the Potential Equalization. For intrinsically safe current outputs Potential Equalization must exist in the entire circuit.
- If the flowmeter primary is to be insulated, the insulation thickness should not exceed 100 mm. The converter housing may not be insulated.
- The corrosion resistance of the meter tube material to the fluid being metered must be considered.

Insulation

The pipeline and the flowmeter primary insulation should be installed as shown. The max. insulation thickness is 100 mm .



Note:
The temperature specifications in the Ex-Approval must be observed.

Fig. 16

Safety Relevant Specifications for the In- and Outputs

<table>
<tr><td>Output Circuit</td><td colspan="6">Intrinsically Safe EEx ib IIC/IIB</td><td>Non-intrinsically Safe
U_M = 60 V</td></tr>
<tr><td rowspan="5">Current Output
active
Terminals 31/32</td><td colspan="6">U_O = 20 V</td><td rowspan="5">U_B = 30 V
I_B = 30 mA</td></tr>
<tr><td>I_O</td><td>P_O</td><td colspan="2">EEx ib IIC</td><td colspan="2">EEx ib IIB</td></tr>
<tr><td>[mA]</td><td>[mW]</td><td>C_O [nF]</td><td>L_O [mH]</td><td>C_O [nF]</td><td>L_O [mH]</td></tr>
<tr><td>100</td><td>500</td><td>217</td><td>3,8</td><td>1400</td><td>14,8</td></tr>
<tr><td colspan="6">Curve: linear
Internal capacitance C_I = 2.4 nF, internal inductance L_I = 0.17 mH
Only for connection to passive, intrinsically safe circuits or
intrinsically safe circuits with the following maximum values: U_I = 60 V
Terminal 32 is to be connected to PA.</td></tr>
<tr><td>Current Output
passive
Terminals 33/34</td><td colspan="6">U_I = 30 V C_I = 2.4 nF
I_I = 100 mA L_I = 0.17 mH
Terminal 34 is to be connected to PA.</td><td>U_B = 30 V
I_B = 30 mA</td></tr>
<tr><td>Contact Output
Terminals 41/42
Pulse Output
Terminals 51/52</td><td colspan="6">U_I = 15 V C_I = 2.4 nF
I_I = 30 mA L_I = 0.17 mH
P_I = 115 mW</td><td>U_B = 30 V
I_B = 220 mA</td></tr>
<tr><td>Contact Input
passive
Terminals 81/82</td><td colspan="6">U_I = 30 V C_I = 2.4 nF
I_I = 250 mA L_I = 0.17 mH
P_I = 1.1 W</td><td>U_B = 30 V
I_B = 10 mA</td></tr>
</table>

Special Requirements:
The output circuits are designed to be connected to either intrinsically safe or non-intrinsically safe circuits. A combination of intrinsically safe and non-intrinsically safe circuits is not permissible. For intrinsically safe current outputs Potential Equalization must exist in the entire circuit.
The test voltage for non-intrinsically safe circuits is U_M = 60 V.

The intrinsically safe contact outputs and puls outputs can be internal (Terminals 41/42, 51/52) configured as NAMUR-Contacts for connection to a NAMUR-Amplifier.

The converter will be shipped with block cable entries. In the signal outputs are configured as intrinsically safe circuits it is recommended that the included light blue caps be utilized for the corresponding cable entries.

Questionnaire
Coriolis Mass Flowmeter TRIO-MASS

Customer:	**Date:**	
Mr./Mrs./Ms.:	**Department:**	
Telephone:	**Telefax:**	
Fluid:	Gas content:	Liquid content:
Flowrate: (Min, Max, Operating Value)	kg/h	
Density: (Min, Max, Operating Value)	kg/m^3	
Dyn. Viscosity: (Min, Max, Operating Value)	mPas / CP	
Fluid Temperature: (Min, Max, Operating Value) **Ambient Temperature:**	°C °C	
Pressure: (Min, Max, Operating Value)	bar	
Flow Conditions:	☐ Constant	☐ Pulsating
Batch Operation:	☐ Yes	☐ No
Concentration Calculations:	☐ Yes	☐ No
Ex-Protection:	☐ Yes	☐ No
Supply Power:	High voltage: ☐ 85 V AC to 253 V AC	Low voltage: ☐ 24 V AC / 24 V DC
Electrical Outputs:		**Communication:**
	☐ Current Output I: 0/4–20 mA	☐ Serial Data Link RS 485
	☐ Current Output II: 4–20 mA	
	☐ Pulse Output, active ☐ Pulse Output, passive	☐ HART
Additional Information: Pipeline diameter	. . . . . mm	. . . . . inch

TRIO-MASS

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