

Flowmeter FUE 380 with approval

The 2-track flowmeter Riels FUE 380 comes as battery or mains-powered and is designed to measure water flow in district heating plants, local networks, boiler stations, substations, chiller plants and other general water applications.

The flowmeter FUE380 is approved according to energy meter standards EN 1434 class 2, OIML R 75 class 2 and MID class 2. Metrological parameters are protected against manipulation. The type-approved flowmeter version is named FUE 380. For a standard flowmeter type FUS380 without a type approval, see separate FUS380 chapter.

Technically, the meter types FUS380 and FUE380 are completely identical, only difference is the calibration limit and the type approval for custody transfer.

Benefits

- Battery-powered up to 6 years
- 115/230V mains-powered with back-up battery option in case of mains power failure
- Fast measuring frequency 20 Hz/0.5 Hz (230 V AC/Battery)
- Easy one-button straight forward display
- 2-track measuring principle for optimum accuracy
- Compact or remote mounting
- Measures on all district water qualities and water conductivities
- No pressure drop
- Long-term stability
- 2 galvanically isolated digital outputs for easy connection to a calculator (potential-free)
- Bidirectional measurement, with 2 totalizers and outputs
- Dynamic range $Q_i:Q_p$ up to 1:50/100 or max. range $Q_i:Q_s$ up to 1:400
- Modbus RTU/RS232, RS485

Design

The 2-track design of Riels FUE380 ensures maximum accuracy under short inlet conditions. The flowmeter consists of a flow sensor pipe, 4 transducers/transducer cables and an approved transmitter Riels FUE080. The unit is available in a compact or a remote version with up to 30 meter distance from flowmeter to transmitter. When ordering a compact version the transducer cables are pre-mounted and ready for installation. Compact mounting is only possible up to 120 °C (248 °F). The sensor must be isolated to protect transmitter from heat. The transmitter is available in an IP67/NEMA 4X/6 enclosure.

Application

The main application for Riels FUE380 is measurement of water flow or water flow in energy meter systems for custody transfer in district heating networks or chilled water.

Combined with an energy calculator and a pair of temperature sensors, Riels FUE380 can be used as part of an energy meter system. For this purpose Riels offers energy calculator Riels FUE950.

Integration

The flowmeter digital output is often used as input for an energy meter or as input for digital systems for remote reading. Riels FUE380 has two digital output functions that can be individually selected, and optional Modbus RTU communication modules.

Pulse output rate is defined when ordering.

If the flowmeter forms part of an energy meter system for custody transfer, no further approvals are needed, except possible local approvals on the flowmeter.



FUE380 MI-004 approval

The Riels FUE380 program is type-approved according to international energy meter standard EN1434. On 1 November 2006 the MI-004 energy meter directive became effective providing that all energy meters with a MI-004 verification label can be sold across the EU borders.

The FUE380 are MI-004 verified and labeled products according to Directive 2004/22/EC of the European Parliament and Council of March 31, 2004 on measuring instruments (MID), Annex MI- 004 in sizes from DN 50 to DN 1200.

The MID certification is obtained as module B + module D approvals according to the above-mentioned directive.

Module B: Type approval according to EN1434:2006

Module D: Quality insurance approval of production

The MID system label with the approval information is placed on the side of the transmitter and on the sensor. An example of the product label is shown below:

FUE380	
SYSTEM No.	7ME3410-xxxx-xxxx
	123456N123
Transmitter	7ME345
	123456N123
Sensor	ASExxxxxxx 123456N123
qs	280 m ³ /h
qp	100 m ³ /h
Pulse Value	100 l/Pulse
Pulse Width	100 ms
Cable Length	5 m
Cal. Factor	1.0349026
SW Vers.	1.02
Prod. Year	2009
© ambient	-10 .. +55 °C
Certification No.	DK-0200-MI004-005
Accuracy Class:	2
Environmental Class:	E2, M1
CE M09 0200	
Flow Instruments A/S	
Made in Denmark	

FUE380 transmitter MID label

FUE380	
Sensor	ASExxxxxxx 123456N123
Dimension	DN 125
Press. Rating	PN40 PT60 bar
qs	280 m ³ /h
qp	100 m ³ /h
qi	2 m ³ /h
Cable Length	5 m
Cal. Factor	1.0349026
© ambient	-10 .. +55 °C
© water	+15 .. +200 °C
Prod. Year	2009
SYSTEM No.	7ME3410-xxxx-xxxx
	123456N123
Certification No.	DK-0200-MI004-005
Accuracy Class:	2
Environmental Class:	E2, M1
CE M09 0200	
CE 0200 EN13480	
Flow Instruments A/S	
Made in Denmark	

FUE380 sensor MID label

Configuration Riels FUE380 type-approved

Selection guide riels FUE380, type-approved flowmeter

DN	Q _s (m ³ /h)	Q _{max} (m ³ /h) (105 % of Q _s)	Q _p (m ³ /h)	Q _i (m ³ /h) (1:50 of Q _p) ⁴⁾	Q _i (m ³ /h) (1:100 of Q _p) ⁴⁾	Schleichmenge- nunterdrückung (m ³ /h)	Schleichmenge- nunterdrückung (% of Q _{max})	Typischer Impulswert ¹⁾ (l/pulse)
50	30	31.5	15 ²⁾	0.3	0.15	0.075	0.24	1
50	45	47.25	15 ²⁾	0.3	0.15	0.075	0.16	1
50	45	47.25	30 ³⁾	-	0.30	0.150	0.32	1
65	50	52.5	25 ²⁾	0.5	0.25	0.125	0.24	1
65	72	75.6	25 ²⁾	0.5	0.25	0.125	0.17	1
65	72	75.6	50 ³⁾	-	0.50	0.250	0.33	1
80	80	84	40 ²⁾	0.8	0.40	0.200	0.24	2.5
80	120	126	40 ²⁾	0.8	0.40	0.200	0.16	2.5
80	120	126	80 ³⁾	-	0.80	0.400	0.32	2.5
100	120	126	60 ²⁾	1.2	0.60	0.300	0.24	2.5
100	180	189	60 ²⁾	1.2	0.60	0.300	0.16	2.5
100	180	189	120 ³⁾	-	1.20	0.600	0.32	2.5
125	200	210	100 ²⁾	2.0	1.00	0.500	0.24	2.5
125	280	294	100 ²⁾	2.0	1.00	0.500	0.17	2.5
125	280	294	200 ³⁾	-	2.00	1.000	0.34	2.5
150	300	315	150 ²⁾	3.0	1.50	0.750	0.24	10
150	420	441	150 ²⁾	3.0	1.50	0.750	0.17	10
150	420	441	300 ³⁾	-	3.00	1.500	0.34	10
200	500	525	250 ²⁾	5.0	2.50	1.250	0.24	10
200	700	735	250 ²⁾	5.0	2.50	1.250	0.17	10
200	700	735	500 ³⁾	-	5.00	2.500	0.34	10
250	800	840	400 ²⁾	8.0	4.00	2.000	0.24	10
250	1120	1176	400 ²⁾	8.0	4.00	2.000	0.17	10
250	1120	1176	800 ³⁾	-	8.00	4.000	0.34	10
300	1120	1176	560 ²⁾	11.2	5.60	2.800	0.24	50
300	1560	1638	560 ²⁾	11.2	5.60	2.800	0.17	50
300	1560	1638	1120 ³⁾	-	11.20	5.600	0.34	50
350	1500	1575	750 ²⁾	15.0	7.50	3.750	0.24	50
350	2100	2205	750 ²⁾	15.0	7.50	3.750	0.17	50
350	2100	2205	1500 ³⁾	-	15.00	7.500	0.34	50
400	1900	1995	950 ²⁾	19.0	9.50	4.750	0.24	50
400	2660	2793	950 ²⁾	19.0	9.50	4.750	0.17	50
400	2660	2793	1900 ³⁾	-	19.00	9.500	0.34	50
500	2950	3097.5	1475 ²⁾	29.5	14.75	7.375	0.24	100
500	4130	4336.5	1475 ²⁾	29.5	14.75	7.375	0.17	100
500	4130	4336.5	2950 ³⁾	-	29.50	14.750	0.34	100
600	4300	4515	2150 ²⁾	43.0	21.50	10.750	0.24	100
600	6020	6321	2150 ²⁾	43.0	21.50	10.750	0.17	100
600	6020	6321	4300 ³⁾	-	43.00	21.500	0.34	100
700	5800	6090	2900 ²⁾	58.0	29.00	14.500	0.24	100
700	8120	8526	2900 ²⁾	58.0	29.00	14.500	0.17	100
700	8120	8526	5800 ³⁾	-	58.00	29.000	0.34	100
800	7600	7980	3800 ²⁾	76.0	38.00	19.000	0.24	100
800	10 640	11 172	3800 ²⁾	76.0	38.00	19.000	0.17	100
800	10 640	11 172	7600 ³⁾	-	76.00	38.000	0.34	100
900	10 000	10 500	5000 ²⁾	100.0	50.00	25.000	0.24	100
900	14 000	14 700	5000 ²⁾	100.0	50.00	25.000	0.17	100
900	14 000	14 700	10 000 ³⁾	-	100.00	50.000	0.34	100
1000	12 000	12 600	6000 ²⁾	120.0	60.00	30.000	0.24	100
1000	16 800	17 640	6000 ²⁾	120.0	60.00	30.000	0.17	100
1000	16 800	17 640	12 000 ³⁾	-	120.00	60.000	0.34	100
1200	18 000	18 900	9000 ²⁾	180.0	90.00	45.000	0.24	100
1200	25 200	26 460	9000 ²⁾	180.0	90.00	45.000	0.17	100
1200	25 200	26 460	18 000 ³⁾	-	180.00	90.000	0.34	100

Dynamic range Q_i:Q_p: better than 1:100 or 1:50 according to EN 1434, OIML R 75 class 2 and MID class 2.

Q_i (Q_{min}) means the minimal and Q_p (Q_{nom}) the nominal flow rate according to the approval requirements.

Q_s is the highest operatable flow rate. The maximum flow rate (Q_{max}) is 105 % of Q_s. The low flow cut-off is 50 % of Q_s.

Q_i, Q_p and Q_s are shown on the system nameplate of the FUE380.

In order to obtain best pulse output resolution in the range Q_{min} to Q_s of approx. 100 Hz at Q_s, two or three flow values for every dimension can be selected at ordering. Therefore the ordering data table also shows Q_p (Q_n). This flow rate is between Q_i (Q_{min}) and Q_s and indicates the normal or typical flow according to the approval requirements.

1) In connection with FUE950 - other pulse values - see Selection and Ordering data table.

2) EN 1434 and MID flow values

3) OIML R 75 and MID flow values

4) The minimum flow (Q_i) should be checked in the PIA-selector or product master data base (PMD)

Technical specifications

Pipe design	2-track sensor with flanges and inline transducers wet-calibrated from factory
Nominal size welded version (DN 50 ... DN 80 in bronze)	DN 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 500, 600, 700, 800, 900, 1000, 1200
Pressure rate	PN 16, PN 25, PN 40 EN 1092-1
Pipe material	<ul style="list-style-type: none"> • DN 100 ... DN 1200: Carbon Steel EN 1.0345/P235 GH, painted in light-gray. • DN 50 ... DN 80: Die-cast bronze G-CuSn10/W2.1050.01 (EN1982)
Transducer design	<ul style="list-style-type: none"> • DN 100 ... DN 1200: Inline version and welded onto the pipe • DN 50 ... DN 80: Screwed into the pipe
Transducer material	Stainless steel (AISI 316/1.4404)/brass (CuZn36Pb2As)
Sensor operating conditions	
Storage	-40 ... +85 °C (-40 ... +185 °F)
Media/surface temperature	<p>DN 100 ... DN 1200:</p> <ul style="list-style-type: none"> • Remote: 2 ... 200 °C (35.6 ... 392 °F) MID: min. +15 °C/+59 °F <p>DN 50 ... DN 80:</p> <ul style="list-style-type: none"> • Remote: 2 ... 150 °C (35.6 ... 302 °F) MID: min. +15 °C/+59 °F <p>DN 50 ... DN 1200:</p> <ul style="list-style-type: none"> • Compact: 2 ... 120 °C (35.6 ... 248 °F) MID: min. +15 °C/+59 °F
Degree of protection	Sensor connection IP67/NEMA 4X/6
Electromagnetic compatibility	
<ul style="list-style-type: none"> • Emitted interference • Noise immunity • MID 	<p>To EN 61000-6-4</p> <p>To EN 61000-6-2</p> <p>Environment class E2 and M1</p>
Max. flow velocity at Q _s	DN 50 ... DN 1200: 9 m/s (29.5 ft/s)

Transmitter - The transmitter related to this system is the FUE080.

Sensor cable

Cable length	Max. 30 m (98.4 ft) between transmitter and sensor
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Certificates and approvals

Conformity certificate	The devices are supplied as standard with a Certificate of Conformity on CD
Material certificate	Material certificate according EN 10204-3.1 is optionally available
Calibration report	A standard calibration report is shipped with every flowmeter. Extended accredited ISO/IEC 17025 calibration certificates optionally available
Approvals	<ul style="list-style-type: none"> • EN 1434 and OIML R 75 Class 2 (PTB approval based on EN1434) • MID class 2 approval and certification

The sensors are approved according to EU directive 97/23/EC dated 29 May 1997 regarding fluid group I, classified in category III. Design according to EN 13480 (PED Directive).

Type-dependent settings

Flow value	Predefined according to EN 1434 / OIML R 75 / MID
Approval	Country specific
Flow rate v _r	0.02 ... 9 m/s (0.065 ... 29.5 ft/s)
Output A	Preset: Forward pulses
Output B	Preset: Alarm
Pulse value A & B (depending on DN value)	Preset: See scheme - previous page Preset for Riels FUE950 or free selectable depending on flow rate (Q _s)
Pulse width	Preset: 5 ms
Flow unit setup	Preset: m ³ /h
Volume unit setup	Preset: m ³

Riels FUE380 uncertainty

To ensure continuous accurate measurement, flowmeters must be calibrated. The calibration is conducted at Riels flow facilities accredited according to ISO/IEC 17025 by DANAK or UKAS.

The accreditation body DANAK has signed the ILAC MRA agreement (International Laboratory Accreditation Corporation - Mutual Recognition Arrangement). Therefore the accreditation ensures international traceability and recognition of the test results in 39 countries worldwide, including the US (NIST traceability).

A standard calibration certificate with Q_n as selected flow is shipped with each FUS380. This production calibration protocol consists of 2 × 3 points at Q_r, 10 % Q_p and Q_p (max. 4 200 m³/h).

Typical accuracy Riels FUE380:

$$\pm(0.5 + 0.02 Q_p/Q) [\%]$$

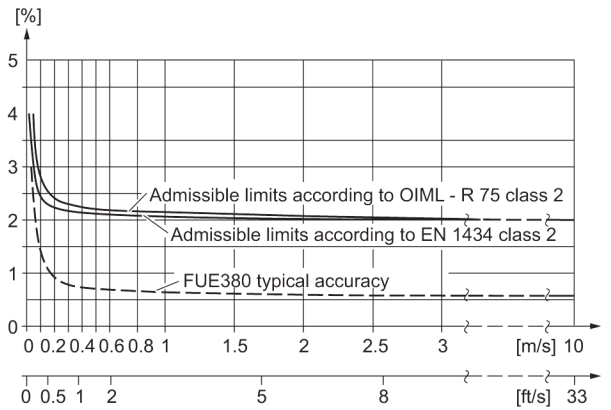
Q_p according to EN 1434/OIML requirements.

Example: DN 100, $Q_p = 60 \text{ m}^3/\text{h}$ at $Q = 1.2 \text{ m}^3/\text{h}$:

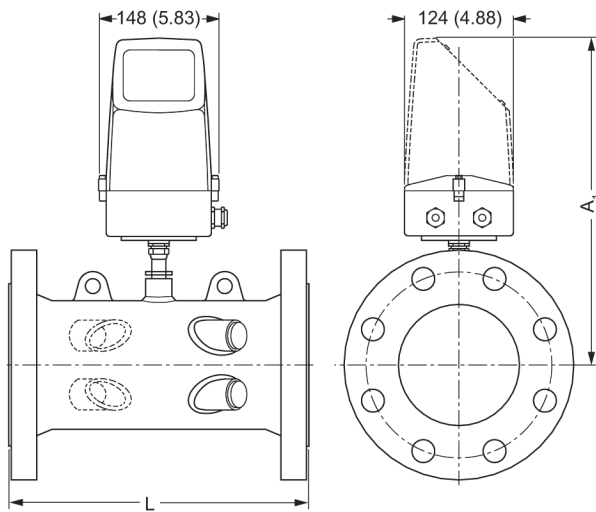
Accuracy at $1.2 \text{ m}^3/\text{h} = \text{typical } 1.5 \%$

Riels FUE380 fulfils the requirements

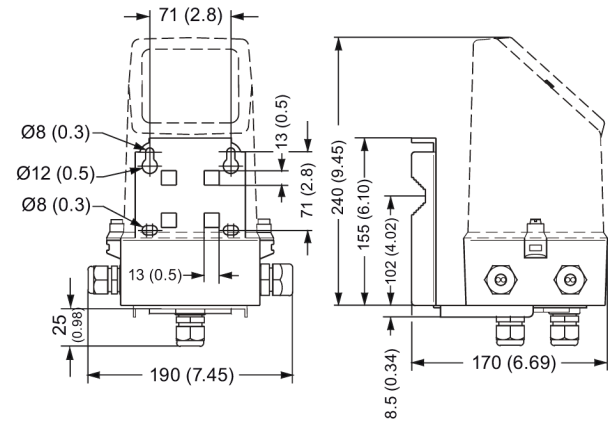
$E_f = \pm (2 + 0.02 Q_p/Q)$ max. $\pm 5 \%$, according to EN 1434 and OIML R 75, class 2 or MID class 2 requirements.



Dimensional drawings



Transmitter IP67/NEMA 4X/6, wall mounting



Dimensions in mm (inch)

Pipe Dimensions for FUS380 and FUE380

Nennweite DN	PN 16		PN 25		PN 40			Hebevorrichtung
	L mm	Gewicht kg	L mm	Gewicht kg	L mm	Gewicht kg	A1 mm	
50	-	-	-	-	300 +0/-2	10	350	No
65	-	-	-	-	300 +0/-2	15	360	No
80	-	-	-	-	350 +0/-3	18	370	No
100	350 +0/-2	15	-	-	350 +0/-3	18	375	No
125	350 +0/-2	18	-	-	350 +0/-3	24	380	No
150	500 +0/-3	28	-	-	500 +0/-3	34	390	No
200	500 +0/-3	38	500 +0/-3	47	500 +0/-3	55	414	No
250	600 +0/-3	60	600 +0/-3	76	600 +0/-3	91	440	No
300	500 +0/-3	66	500 +0/-3	81	-	-	466	Yes
350	550 +0/-3	94	550 +0/-3	121	-	-	495	Yes
400	600 +0/-3	124	600 +0/-3	153	-	-	507	Yes
500	625 +0/-3	176	625 +0/-3	235	-	-	558	Yes
600	750 +0/-3	244	750 +0/-3	292	-	-	609	Yes
700	875 +0/-3	258	875 +0/-3	416	-	-	660	Yes
800	1000 +0/-3	338	1000 +0/-3	562	-	-	710	Yes
900	1230 +6/-6	475	1300 +6/-6	835	-	-	810	No
1000	1300 +6/-6	594	1370 +6/-6	1078	-	-	910	No
1200	1360 +6/-6	860	-	-	-	-	1110	No

Notes:

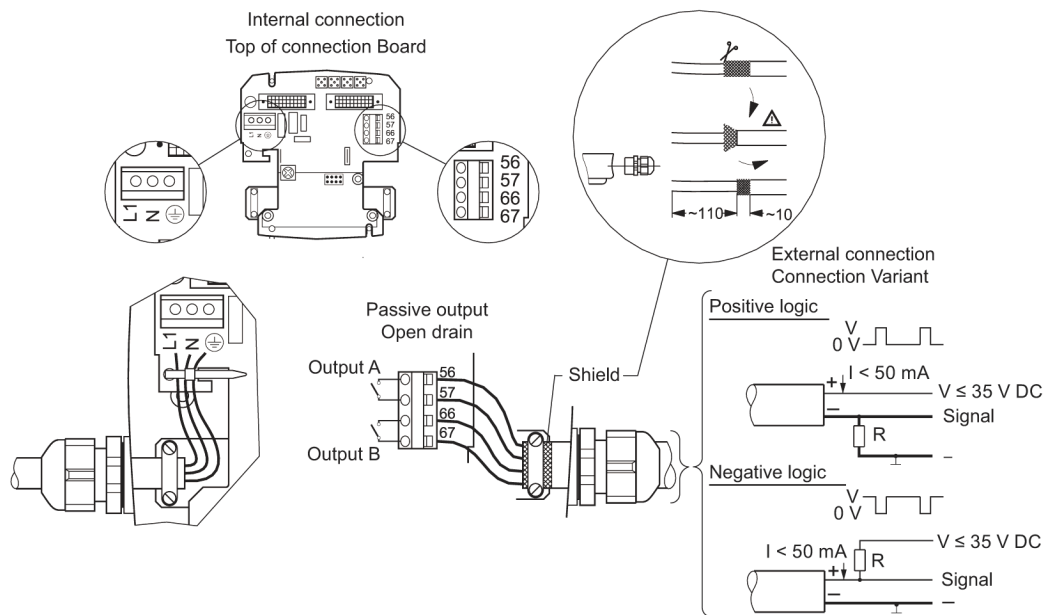
- Weight for transmitter/electronics 1.5 kg
- - Means not available
- All weights are approximate
- For flange values - see norm EN 1092-1

Nennweite inch	PN 16		PN 25		PN 40			Hebevorrichtung
	L inch	Gewicht lb	L inch	Gewicht lb	L inch	Gewicht lb	A1 inch	
2	-	-	-	-	11.81 +0/-0.08	22	14	No
2½	-	-	-	-	11.81 +0/-0.08	33	14.4	No
3	-	-	-	-	13.78 +0/-0.08	40	14.8	No
4	13.77 +0/-0.08	33	-	-	13.77 +0/-0.12	40	15	No
5	13.77 +0/-0.08	40	-	-	13.77 +0/-0.12	53	15.2	No
6	19.68 +0/-0.12	62	-	-	19.68 +0/-0.12	75	15.6	Yes
8	19.68 +0/-0.12	84	19.68 +0/-0.12	104	19.68 +0/-0.12	121	16.30	Yes
10	23.62 +0/-0.12	132	23.62 +0/-0.12	168	23.62 +0/-0.12	201	17.32	Yes
12	19.68 +0/-0.12	146	19.68 +0/-0.12	179	-	-	18.35	Yes
14	21.65 +0/-0.12	207	21.65 +0/-0.12	267	-	-	19.8	Yes
16	23.62 +0/-0.12	273	23.62 +0/-0.12	337	-	-	19.96	Yes
20	24.61 +0/-0.12	419	24.61 +0/-0.12	538	-	-	21.97	Yes
24	29.53 +0/-0.12	668	29.53 +0/-0.12	805	-	-	23.98	Yes
28	34.45 +0/-0.12	796	34.45 +0/-0.12	1217	-	-	25.98	Yes
32	39.37 +0/-0.12	1089	39.37 +0/-0.12	1698	-	-	27.95	Yes
36	48.43 +0/-0.24	1047	51.18 +0/-0.24	1841	-	-	32.4	No
40	51.18 +0/-0.24	1310	53.94 +0/-0.24	2376	-	-	36.4	No
48	53.54 +0/-0.24	1892	-	-	-	-	44.4	No

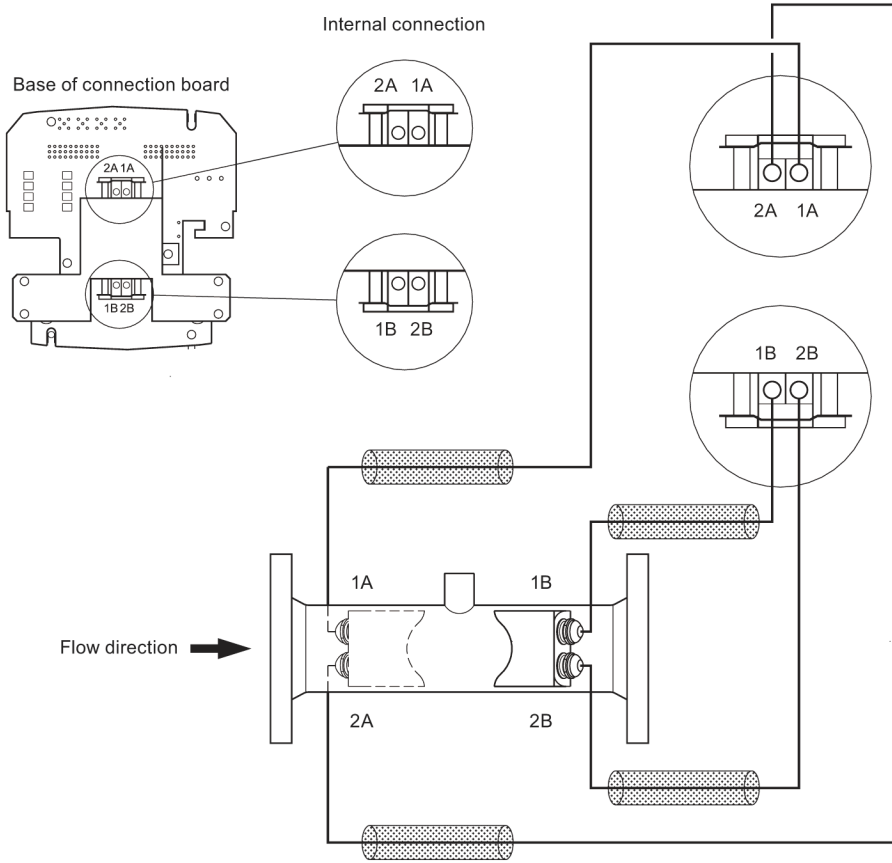
Notes:

- Weight for transmitter/electronics 3.3 lb
- - Means not available
- All weights are approximate
- For flange values - see norm EN 1092-1

Schematics



Electrical connection of transmitter Riels FUS/FUE380



Electrical connection of sensor Riels FUS/FUE380