

EN - english



Instructions for installation and operation

Flowsensor **FS109**



Dear customer,

Thank you very much for deciding in favour of the Flowsensor. Please read this installation and operation manual carefully before mounting and initiating the device and follow our advice. A riskless operation and a correct functioning of the data display are only guaranteed in case of careful observation of the described instructions and notes.

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<ul style="list-style-type: none"><input type="checkbox"/> Česká Republica / Czech Republic<input type="checkbox"/> BEKO TECHNOLOGIES s.r.o.<input type="checkbox"/> Mlýnská 1392<input type="checkbox"/> CZ - 562 01 Usti nad Orlici<input type="checkbox"/> Tel. +420 465 52 12 51<input type="checkbox"/> info.cz@beko.de	<ul style="list-style-type: none"><input type="checkbox"/> United Kingdom<input type="checkbox"/> BEKO TECHNOLOGIES LTD.<input type="checkbox"/> 2 West Court<input type="checkbox"/> Buntsford Park Road<input type="checkbox"/> Bromsgrove<input type="checkbox"/> GB-Worcestershire B60 3DX<input type="checkbox"/> Tel. +44 1527 575 778<input type="checkbox"/> beko@beko-uk.com	<ul style="list-style-type: none"><input type="checkbox"/> USA<input type="checkbox"/> BEKO TECHNOLOGIES CORP.<input type="checkbox"/> 900 Great SW Parkway<input type="checkbox"/> US - Atlanta, GA 30336<input type="checkbox"/> Tel. +1 (404) 924-6900<input type="checkbox"/> beko@bekousa.com

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1 Safety instructions



Please check whether this manual corresponds with the instrument type.

Please observe all notes indicated in this instruction manual. It contains essential information which have to be observed during installation, operation and maintenance. Therefore this instruction manual has to be read categorically by the technician as well as by the responsible user / qualified personnel before installation, initiation and maintenance.

This instruction manual has to be available at the operation site of the Flowsensor at any time.

In case of any obscurities or questions with regard to this manual or to the instrument please contact BEKO TECHNOLOGIES.



Warning !

Compressed air !

Contact with quickly or abruptly escaping compressed air or bursting parts of the system may cause severe injuries or death.

Measures:

- Do not exceed the maximum operation pressure (see type label)!
- Only use pressure-tight installation material!
- Avoid persons or objects being hit by escaping compressed air!



Warning!

Supply voltage !

Contact with supply voltage carrying non-insulated parts may cause an electric shock with injury and death.

Measures :

- Observe all applicable regulations for electrical installations (e.g. VDE 0100)!
- **Carry out maintenance work only when the system is pressureless!**
- All electric works are only allowed to be carried out by authorized qualified persons.



Warning !

Inadmissible operating parameters!

Undercutting or exceeding of limit values may cause danger to persons and material and may lead to functional and operational disturbances.

Measures:

- Do not exceed the maximum operation pressure (see type label)!
- Make sure that the Flowsensor is only operated within the admissible limit values indicated on the type label.
- Careful observation of the performance data of the Flowsensor in connection with the application.
- Do not exceed the admissible storage and transportation temperature.
- Carry out maintenance works and calibrations in regular intervals.

Further safety instructions:

- Also the applicable national regulations and safety instructions have to be observed during installation and operation.
- The Flowsensor is not allowed to be used in explosive areas.

Additional remarks:

- Use spanner flats (SW32/SW17) for mounting purposes!
- The Flowsensor is not allowed to be disassembled!



Attention !

Malfunctions at the Flowsensor

Faulty installation and insufficient maintenance may lead to malfunctions of the Flowsensor which may affect the measuring results and which may lead to misinterpretations.

2 Field of application

- The Flowsensor is a consumption measuring instrument for measurements within the admissible operating parameters (see Technical Data).
- The Flowsensor measures the following parameters:
 - Volume flow
 - Consumption
 - Velocity

By default the volume flow is set in cfm, the consumption is set in cf (ft³) and the velocity is set in ft/min. Other units can be programmed by BEKO TECHNOLOGIES on customers request.


- By default the Flowsensor measures in air
If requested by the customer the sensor can be programmed to other gases by BEKO TECHNOLOGIES: Nitrogen, Argon, Helium, Carbon Dioxide, Oxygen
- The Flowsensor is mainly used in compressed air plants
- The Flowsensor is not suitable for application in explosive areas.

3 Special features

- Depth scale for accurate mounting
- Usable in pipe diameters from 1/4"
- Easy mounting under pressure
- 4...20 mA analogue output
- Pulse output

Technical data

4 Technical data

	
Parameters	Standard settings: cfm, cf (ft ³) and ft/min Other units can be programmed by BEKO TECHNOLOGIES GMBH on customers request. Volume flow: m ³ /min, l/min, l/s, m ³ /h Mass flow: kg/s, kg/min, kg/h Consumption: l, m ³ , kg
Measuring principle	Calorimetric measurement
Sensor	Pt45, Pt1000
Measuring medium	air, gases
Operating temperature	-22... 284 °F probe tube -22... 176 °F housing
Air humidity of the meas. medium	Max. 90% RH (no water drops)
Operating pressure	up to 725 psig
Housing material	Synthetic material PC + ABS
Material of the probe tube and the screwing	Stainless steel 1.4301
Protection class	IP65
Dimensions	see dimensional drawing on page 7
Screwing thread	G½" (ISO 228/1)
Weight	1,38 lbs

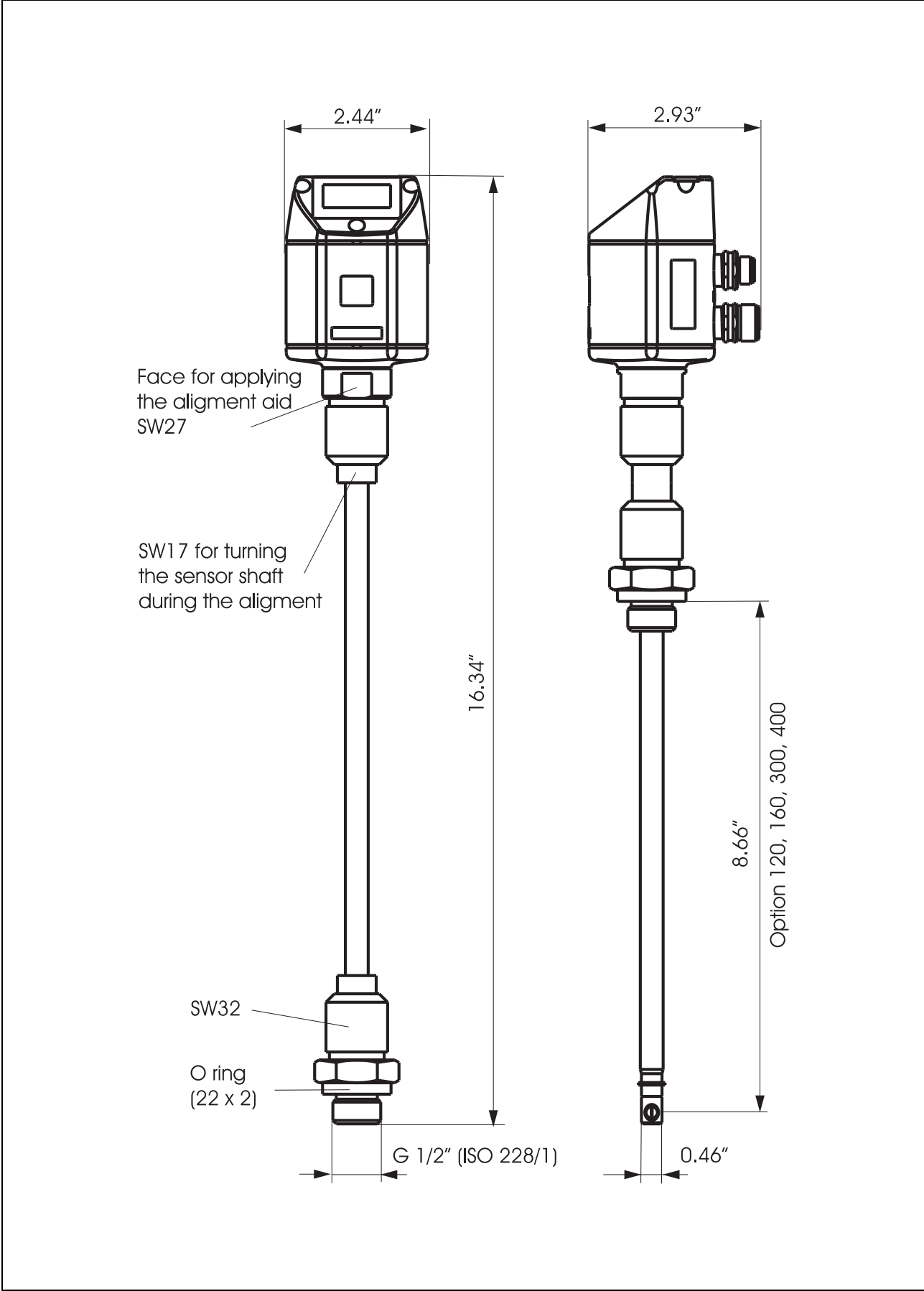
Power supply	12 up to 30 VDC Supply via DD109 or via optional mains unit
Power input	max. 80 mA at 24 VDC

Analogue output:	4... 20 mA (burden < 500 Ohm) Scaling: 0 to maximum volume flow (see pages 13 - 14) Accuracy: 0.06 mA
Pulse output	1 pulse per consumption unit (see pulse diagram page 13) max. voltage height pulse +P = +VB aktive signal max. current I = 10 mA

Accuracy (with measuring section)	± 3% m.v. ± 2% m.v. (option via 5 point ISO precision calibration)
Accuracy (without measuring section)	± 4% m.v. ± 3% m.v. (option via 5 point ISO precision calibration)

BEKO supplies measuring sections for FS 109 Flowsensors on request (see page 15)

5 Dimensional drawing


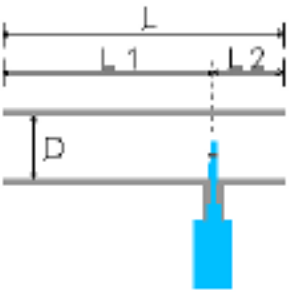
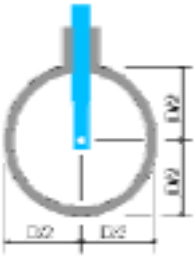


Determination of the installation point

6 Determination of the installation point

In order to keep the accuracies indicated in the data sheets the sensor has to be positioned centrally into a straight piece of pipe at a place with undisturbed flow course.

A welded nozzle with ball valve is required for a mounting under pressure.

	<p>The mounting procedure is explained by means of the indicated pipe model. The following connection is required for mounting:</p> <p>Ball valve G$\frac{1}{2}$" for the connection of FS109 DN 15 Passage ball valve minimum $\Phi 15\text{mm}$</p>
	<p>An undisturbed flow course is granted if there is a sufficiently long section in front of the sensor (inlet section L1) and behind the sensor (outlet section L2) which is absolutely straight, without any edges, seams, bends and so on.</p> <p>The design of the outlet section has also to be observed carefully since disturbance points cause turbulences which not only are effective towards the air flow but also contrary to the flow direction. Details can be taken from the table in chapter 7</p> <p>BEKO supplies measuring sections for FS109 Flowsensors on request (see page 15)</p>
	<p>The sensor has to be inserted centrally into a straight piece of pipe.</p>

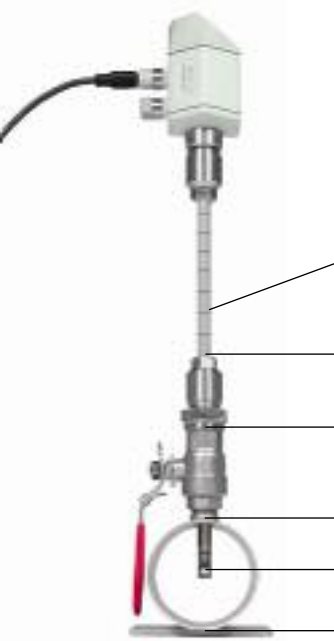
7 Table of inlet and outlet sections

The following table shows the necessary equalizing sections in relation to existing obstructions. The table gives the respective minimum values which are required. If it's not possible to observe the indicated equalizing sections considerable deviations in measuring results must be expected.

Flow obstruction in front of the measuring section	Minimum length inlet section (L1)	Minimum length outlet section (L2)
Slight curve (bend < 90°)	12 x D	5 x D
Reduction (pipe narrows towards the meas. section)	15 x D	5 x D
Expansion (pipe expands towards the meas. section)	15 x D	5 x D
90° bend or T piece	15 x D	5 x D
2 bends @ 90° on one level	20 x D	5 x D
2 bends @ 90° 3-dimensional change of direction	35 x D	5 x D
Lock valve	45 x D	5 x D

8 Installation at ball valve

8.1 Determination of the insertion depth of the Flowsensors



The sensor head has to be mounted in the center of the pipe. For this purpose the probe shaft has a scale. In order to find out the right position please determine the insertion depth by means of the drawing at the left hand side.

Insertion depth = $x + y$
 $x = dA/2$

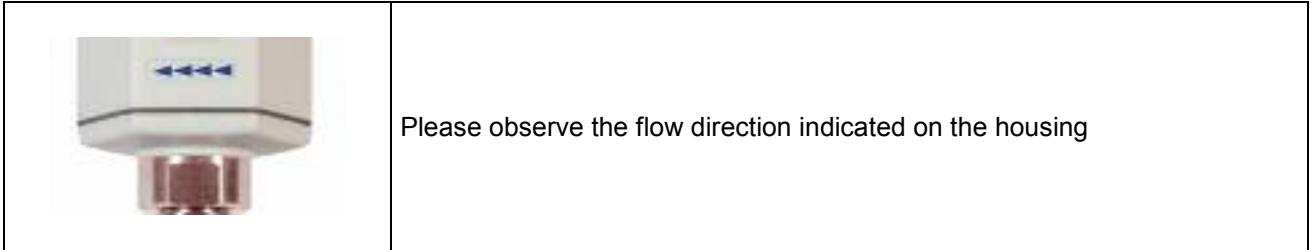
Scaling on the shaft

Reference level for reading the insertion depth at the scale

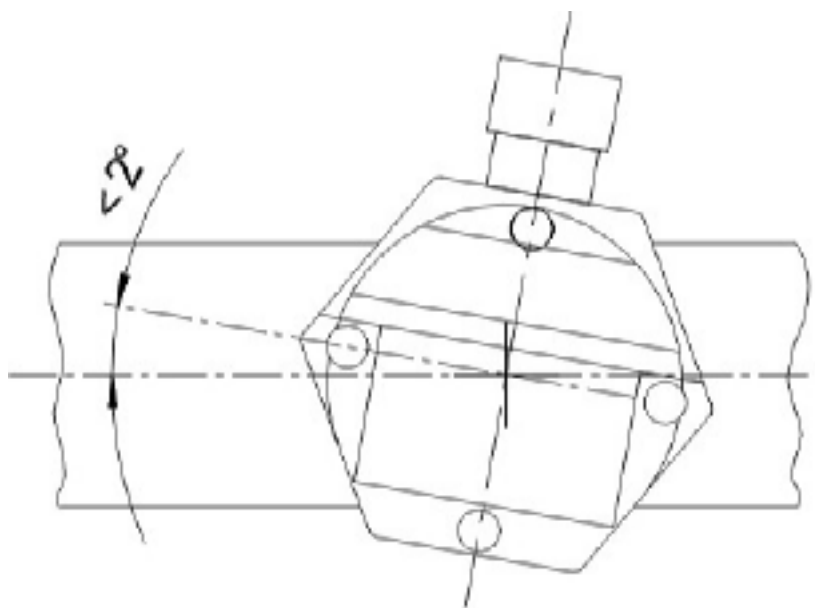
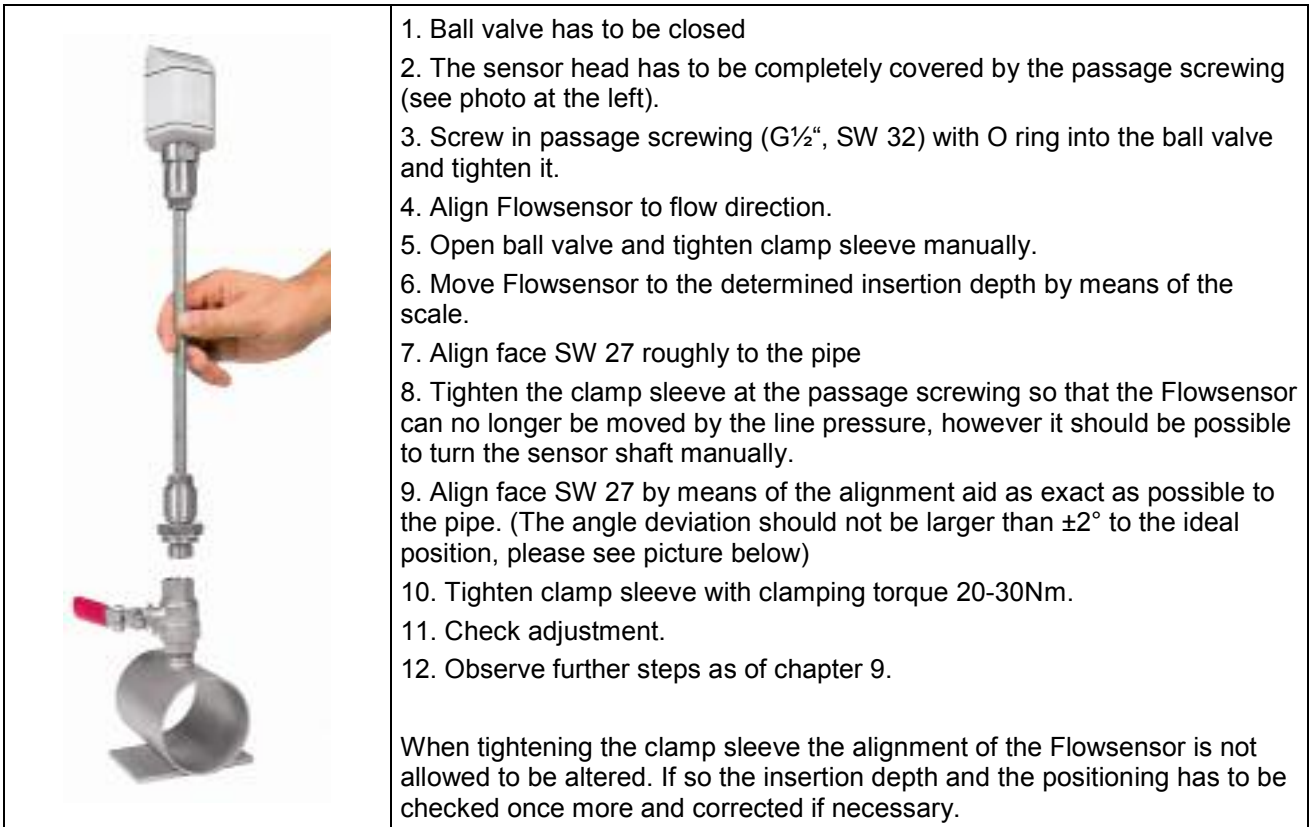
$dA =$ Outer diameter of the pipe

Installation at ball valve

8.2 Installation position of the Flowsensors



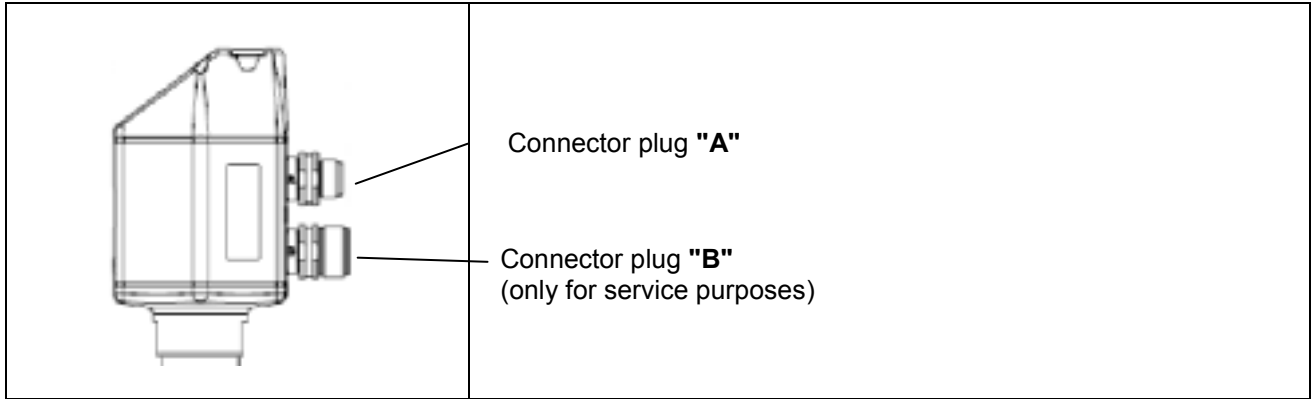
8.3 Installation of the Flowsensor



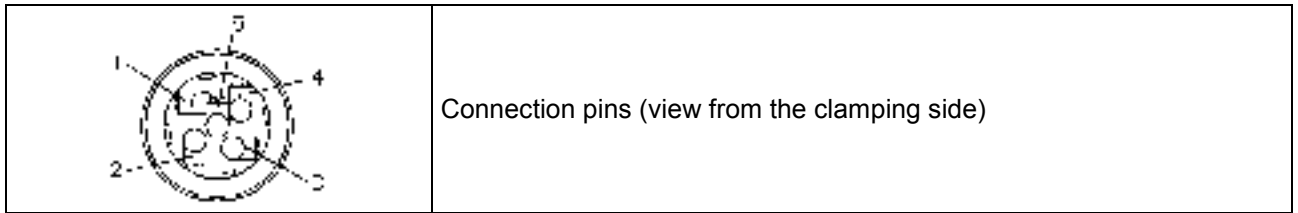
8.4 Removal of the Flowsensors

1. Hold the Flowsensor
2. Release the clamp sleeve (SW 17) at the passage screwing
3. Pull out the probe slowly until the value "10" can be read at the scale
4. Close ball valve
5. Release passage screwing (SW 32) and unscrew the Flowsensor

9 Connector plug Flowsensor



9.1 Connection pins connector plug M12



9.2 Pin assignment connector plug M12

	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
Connector plug A	SDI	-VB	+VB	+I 4... 20 mA	+P pulse
Connection cable A 0554.0104 (5 m = 16,4 ft) 0554.0105 (10 m = 32,9 ft)	brown	white	blue	black	grey
Connector plug B*	NC	NC	NC	NC	NC

9.3 Legend to pin assignment

SDI	Digital signal (internal data transfer)
-VB	Negative supply voltage 0V
+VB	Positive supply voltage 12... 30 VDC smoothed
+I	Positive 4... 20 mA signal
+P pulse	Pulse output +VB
NC	Not connected

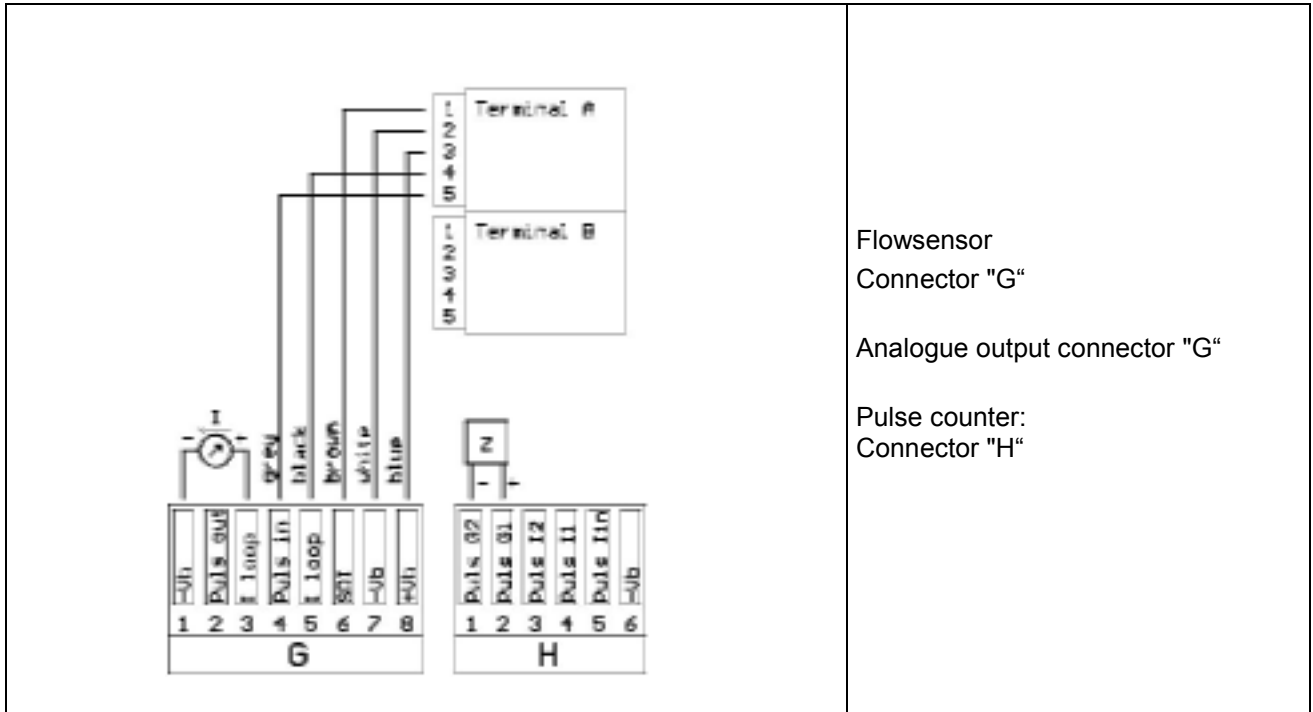
Connection to the Data Display DD109

10 Connection to the Data Display DD109

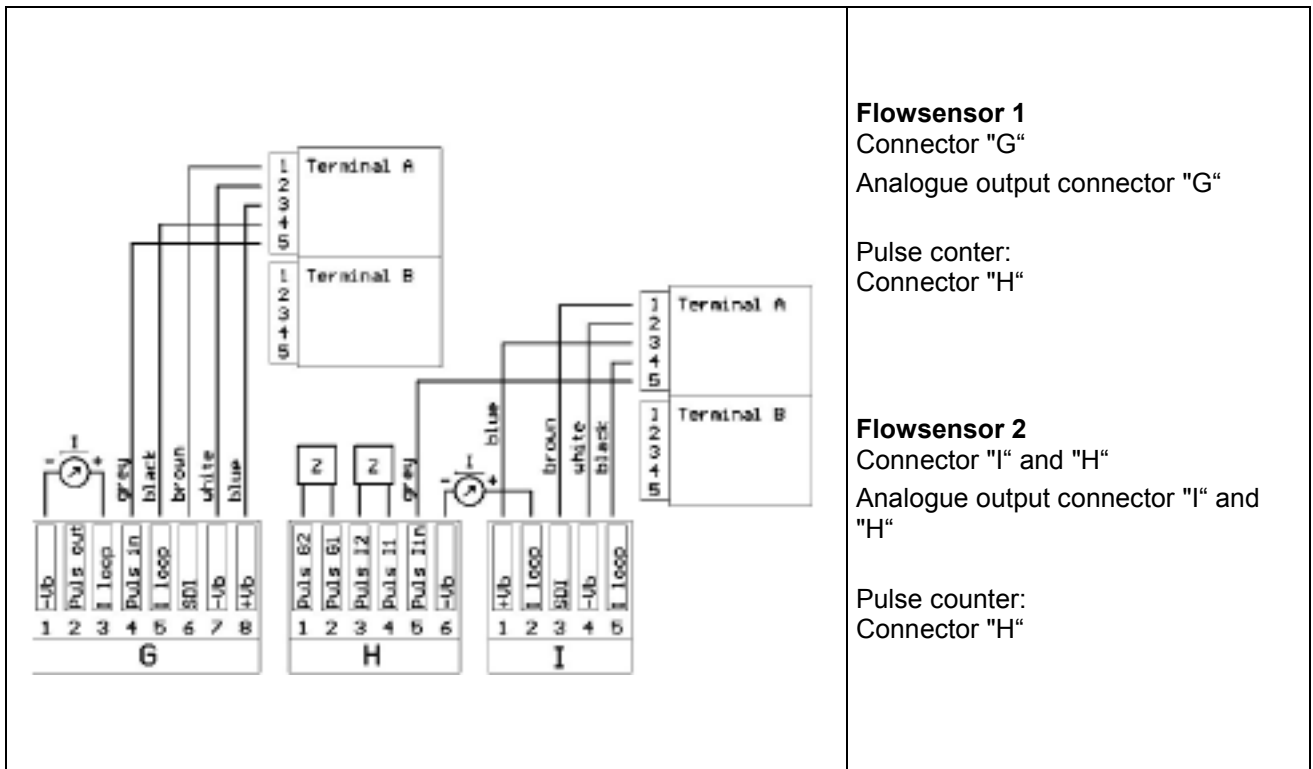
10.1 Connection via connector plug

In case of the full set Flowmeter II it is just necessary to connect the cable of the Data Display with connector "A" of the Flowsensors.

10.2 Connection of a Flowsensor to the Data Display

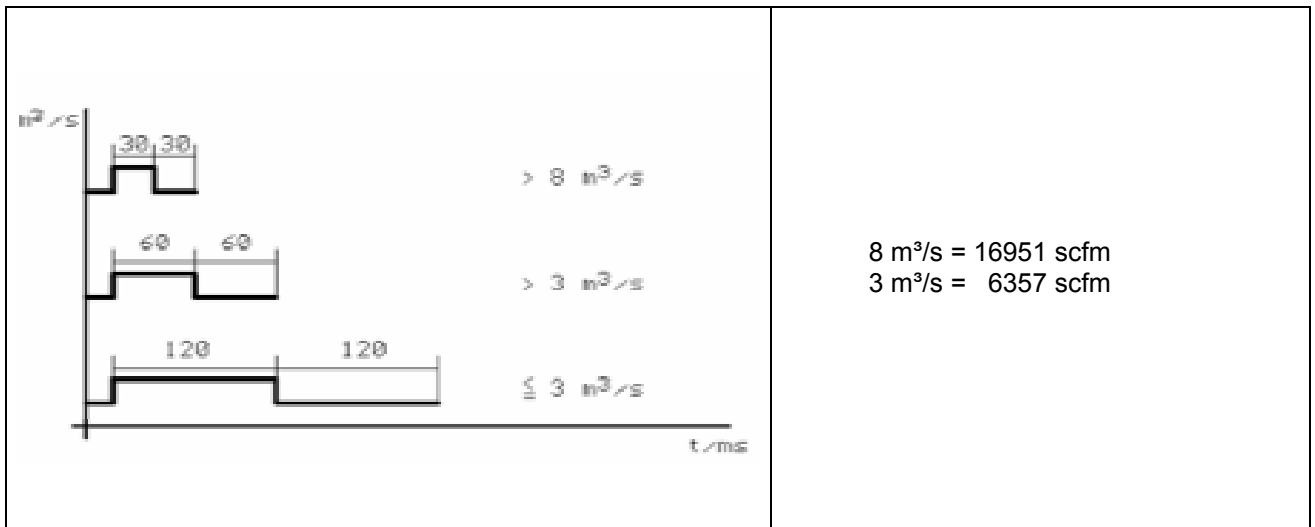


10.3 Connection of two Flowsensors to the Data Display



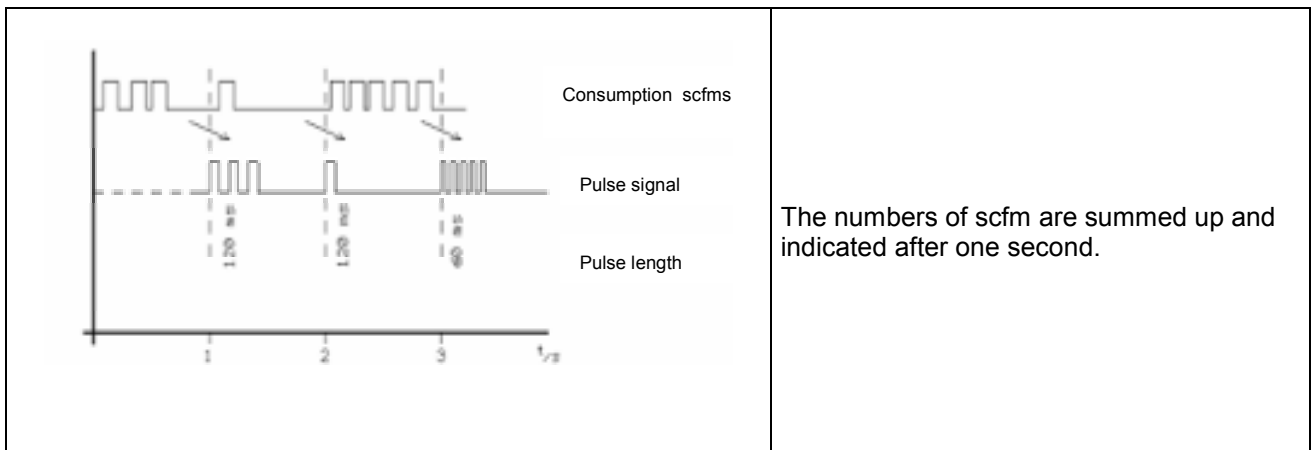
11 Pulse output signal indication

11.1 Pulse lengths depending on consumption

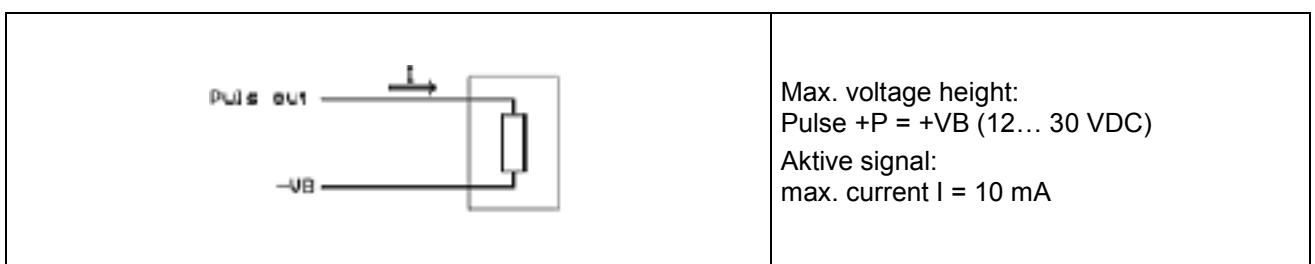


Volume flow [scfm]	Pulse length [ms]	max. consumption [scfm]
* 6357	120	6357
> 6357	60	16951
> 16951	30	33902

11.2 Internal pulse receiver



11.3 Pulse output



Measuring ranges depending on the inner diameter of the pipe

12 Measuring ranges depending on the inner diameter of the pipe

12.1 Determination of the inner diameter of the pipe

- Determination of the inner diameter of the pipe:
1. Labeling on the pipe (e.g. 60.3 x 3.6 results in an inner diameter of 53.1mm) = (e.g. 2,37" x 0,14" results in an inner diameter of 2,09")
 2. Measurement by means of a thickness meter
 3. Information in the documentation of the piping network

12.2 Input of the inner diameter of the pipe

Before the initial operation, please enter the exact inner diameter of the pipe via the keypad of the Data Display DD109 (see instruction manual Data Display DD109)

12.3 Table max. values of the measuring range inner pipe diameter ¼" to 2 ½"

The Flowsensor FS109 works up to a maximum flow velocity of 607 ft/sec. and is preset to an inner pipe diameter of 2 inches.

This corresponds to an analogue output 4... 20 mA of 705 SCFM (other units please see table)

Inner diameter of the pipe		Volume flow					Mass flow					
Inch	mm	m³/h	m³/min	l/min	l/s	scfm	kg/h	kg/min	kg/s	m/s	PLF	
¼"	6.0	9.4	0.2	156.9	2.6	5.5	11.2	0.187	0.003	185.0	0.500	
	10.0	30.1	0.5	501.3	8.4	17.7	35.7	0.596	0.010	185.0	0.575	
	13.6	61.9	1.0	1032.0	17.2	36.5	73.6	1.227	0.020	185.0	0.640	
	15.0	77.7	1.3	1294.6	21.6	45.8	92.3	1.539	0.026	185.0	0.660	
½"	16,1	91,0	1,5	1516,3	25,3	53,6	108,1	1,802	0,030	185,0	0,671	
	¾"	21,7	177,8	3,0	2963,9	49,4	104,7	3,523	0,059	185,0	0,722	
1"	25.0	243.9	4.1	4064.7	67.7	143.6	289.9	4.831	0.081	185.0	0.746	
	26.0	265.2	4.4	4420.0	73.7	156.2	315.2	5.254	0.088	185.0	0.750	
	27.3	294.7	4.9	4912.0	81.9	173.6	350.3	5.838	0.097	185.0	0.756	
	28.5	323.3	5.4	5388.7	89.8	190.4	384.3	6.405	0.107	185.0	0.761	
	30.0	361.1	6.0	6018.0	100.3	212.7	429.2	7.153	0.119	185.0	0.767	
1 ¼"	32.8	436.7	7.3	7278.2	121.3	257.2	519.0	8.651	0.144	185.0	0.776	
	36.0	531.5	8.9	8858.0	147.6	313.0	631.7	10.528	0.175	185.0	0.784	
	36.3	541.1	9.0	9017.7	150.3	318.7	643.1	10.718	0.179	185.0	0.785	
1 ½"	39.3	639.8	10.7	10664.1	177.7	376.9	760.5	12.675	0.211	185.0	0.792	
	40.0	663.7	11.1	11061.3	184.4	390.9	788.8	13.147	0.219	185.0	0.793	
	41.8	728.4	12.1	12140.1	202.3	429.0	865.8	14.430	0.240	185.0	0.797	
	43.1	777.3	13.0	12955.6	215.9	457.9	923.9	15.399	0.257	185.0	0.800	
	45.8	882.2	14.7	14702.8	245.0	519.6	1048.5	17.475	0.291	185.0	0.804	
2"	50.0	1059.2	17.7	17653.8	294.2	623.9	1259.0	20.983	0.350	185.0	0.810	
	51.2	1112.1	18.5	18534.2	308.9	655.0	1321.8	22.029	0.367	185.0	0.811	
	53.1	1197.6	20.0	19959.9	332.7	705.4	1423.4	23.724	0.395	185.0	0.812	
	54.5	1263.1	21.1	21052.1	350.9	744.0	1501.3	25.022	0.417	185.0	0.813	
	57.5	1414.7	23.6	23577.7	393.0	833.2	1681.4	28.024	0.467	185.0	0.818	
	60.0	1544.1	25.7	25735.3	428.9	909.5	1835.3	30.588	0.510	185.0	0.820	
	64.2	1774.3	29.6	29572.1	492.9	1045.1	2108.9	35.149	0.586	185.0	0.823	
	76.1	2511.2	41.9	41854.0	697.6	1479.1	2984.8	49.747	0.829	185.0	0.829	
2 ½"	65.0	1821.0	30.4	30350.6	505.8	1072.6	2164.4	36.074	0.601	185.0	0.824	
	70.3	2137.9	35.6	35631.1	593.9	1259.2	2541.0	42.350	0.706	185.0	0.827	
	71.1	2186.8	36.4	36446.6	607.4	1288.0	2599.2	43.320	0.722	185.0	0.827	

Calculations referred to the standard DIN1945/ISO 1217 (68 °F, 1000mbar)

12.4 Table max. values of the measuring range inner pipe diameter 3" to 10"

Inner diameter of the pipe		Volume flow					Mass flow				
Inch	mm	m ³ /h	m ³ /min	l/min	l/s	scfm	kg/h	kg/min	kg/s	m/s	PLF
3"	80.0	2778.6	46.3	46309.6	771.8	1636.6	3302.6	55.043	0.917	185.0	0.830
	82.5	2958.5	49.3	49308.5	821.8	1742.6	3516.4	58.607	0.977	185.0	0.831
	84.9	3133.1	52.2	52219.1	870.3	1845.4	3724.0	62.067	1.034	185.0	0.831
4"	90.0	3525.1	58.8	58751.8	979.2	2076.3	4189.9	69.831	1.164	185.0	0.832
	100.0	4357.2	72.6	72620.3	1210.3	2566.4	5178.9	86.315	1.439	185.0	0.833
	107.1	5003.9	83.4	83398.4	1390.0	2947.3	5947.5	99.126	1.652	185.0	0.834
5"	110.0	5278.6	88.0	87976.0	1466.3	3109.1	6274.0	104.566	1.743	185.0	0.834
	125.0	6824.5	113.7	113741.6	1895.7	4019.6	8111.5	135.191	2.253	185.0	0.835
	133.7	7807.5	130.1	130125.4	2168.8	4598.6	9279.9	154.664	2.578	185.0	0.835
6"	150.0	9839.0	164.0	163984.1	2733.1	5795.2	11694.5	194.908	3.248	185.0	0.836
	159.3	11096.9	184.9	184948.4	3082.5	6536.1	13189.6	219.826	3.664	185.0	0.836
	182.5	14581.9	243.0	243032.3	4050.5	8588.8	17331.8	288.863	4.814	185.0	0.837
8"	190.0	15805.1	263.4	263418.0	4390.3	9309.2	18785.6	313.093	5.218	185.0	0.837
	200.0	17533.5	292.2	292224.7	4870.4	10327.2	20839.9	347.332	5.789	185.0	0.838
	206.5	18691.7	311.5	311527.9	5192.1	11009.4	22216.5	370.276	6.171	185.0	0.838
10" *)	250.0	27428.8	457.1	457145.9	7619.1	16155.5	32601.2	543.354	9.056	185.0	0.839
	260.4	29793.8	496.6	496562.7	8276.0	17548.5	35412.2	590.204	9.837	185.0	0.840

Calculations referred to the standard DIN1945/ISO 1217 (68 °F, 1000mbar)

*) The maximum possible inner diameter for the standard probe 8.66 inches is depending on the installation length of the ball valve (please see drawing on page 9)

13 Maintenance

Cleaning of the sensor

The sensor can be cleaned by carefully moving it to and fro in distilled water or isopropanol.



Attention:

Do not touch the surface of the sensor plate.

Avoid mechanical impact on the sensor (e. g. by means of a sponge or a brush).

If the soiling cannot be removed the sensor has to be inspected and maintained by the manufacturer.

14 Calibration/ Adjustment

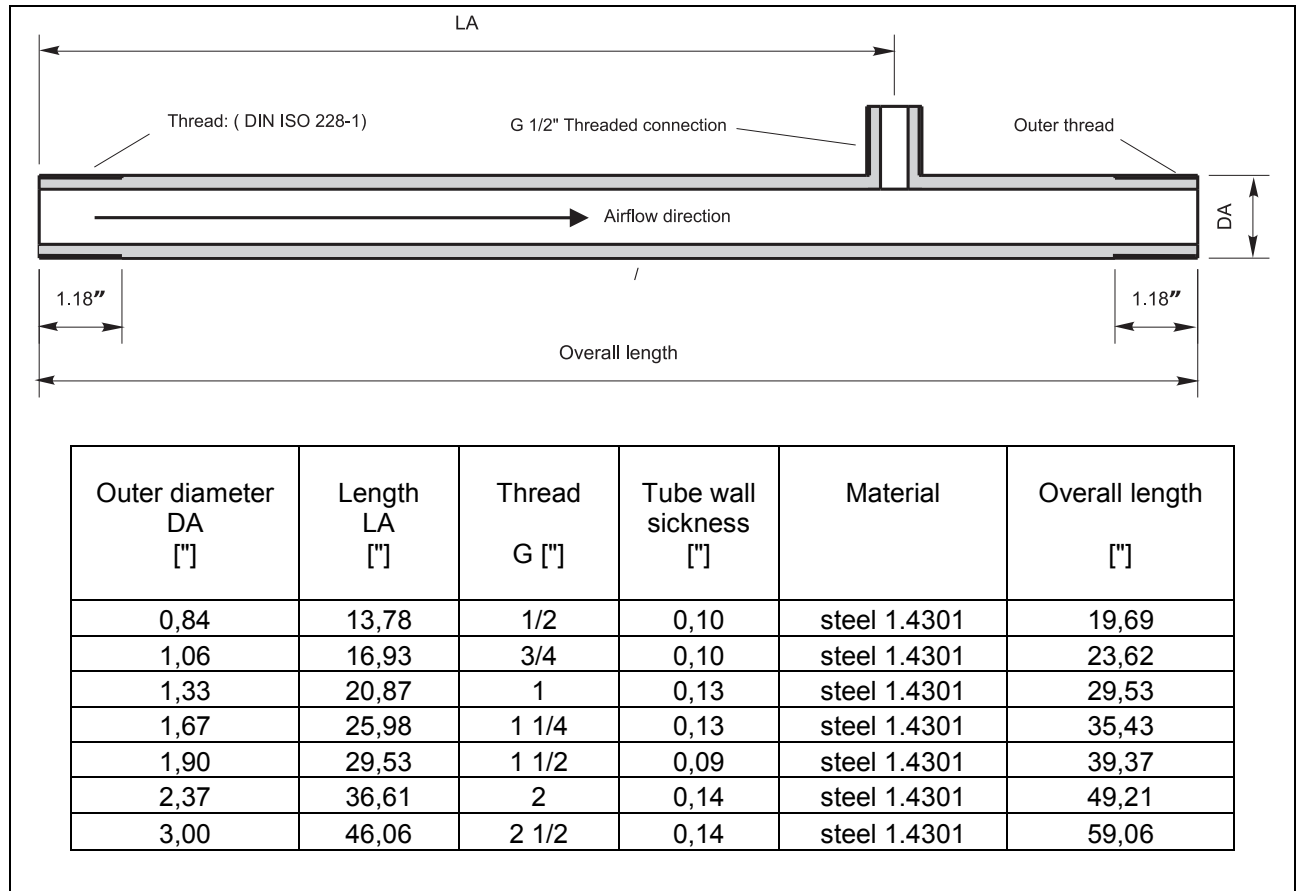
We recommend an annual calibration resp. adjustment at the manufacturer.

Please observe the attached inspection certificate.

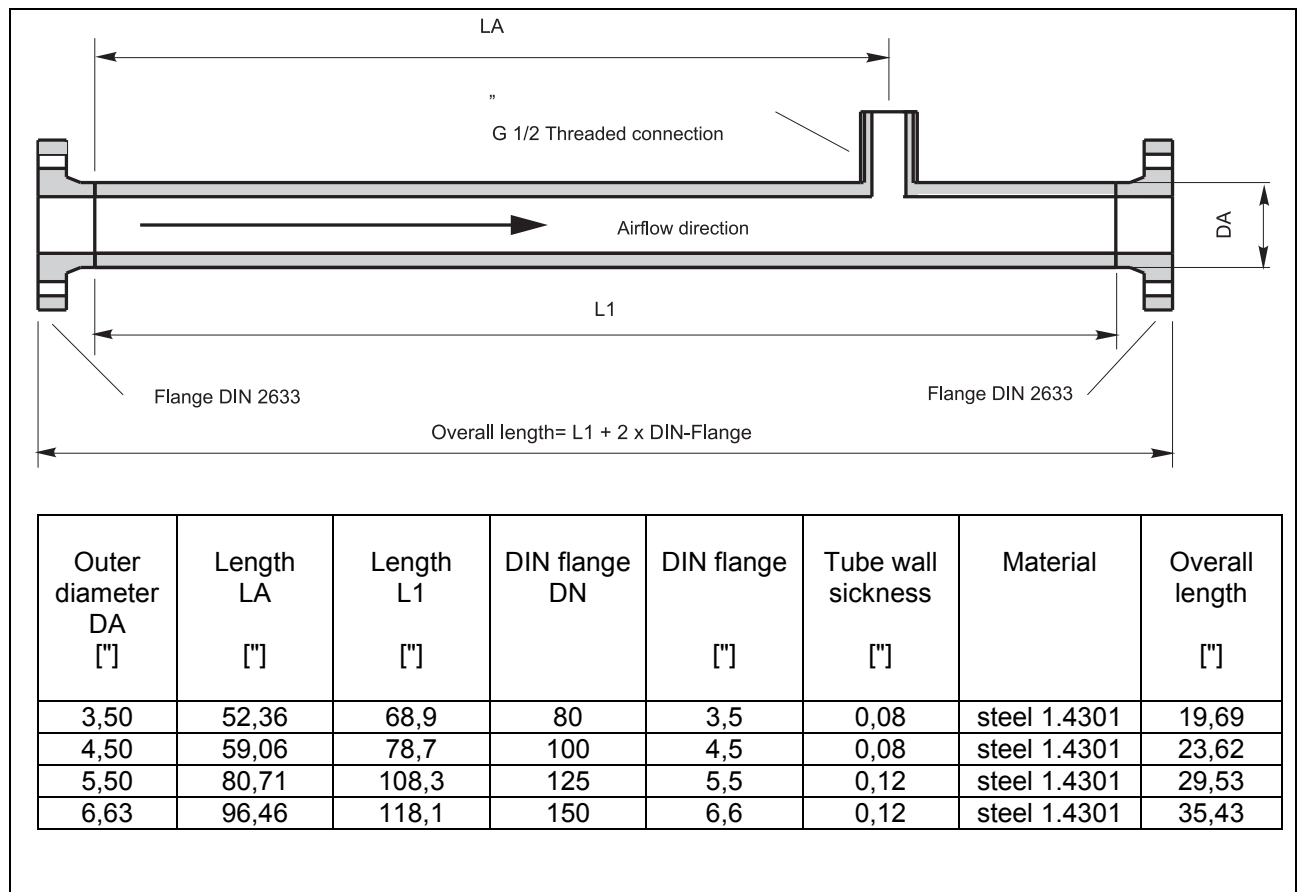
Measuring sections for the Flowsensor FS109

15 Measuring sections for the Flowsensor FS109

15.1 Measuring sections with outer thread



15.2 Measuring sections with flange connection



16 Conformity declaration

BEKO TECHNOLOGIES GMBH
41468 Neuss, GERMANY
Tel: +49 2131 988-0
www.beko.de



EG-Konformitätserklärung

Wir erklären hiermit, dass die nachfolgend bezeichneten Produkte in der von uns gelieferten Ausführung den Anforderungen der einschlägigen Normen entsprechen:

Produktbezeichnung:	FS109
Spannungsversorgung:	12 - 30 VDC
Druckvarianten:	Betriebsdruck bis 50 bar
Produktbeschreibung und Funktion:	Sensor zur Messung des Volumenstroms in Druckluftsystemen

Niederspannungs-Richtlinie 2006/95/EG

Mit einer Nennspannung von max. 30 VDC fällt das Produkt nicht in den Anwendungsbereich der Niederspannungsrichtlinie (dort Artikel 1).

EMV-Richtlinie 2004/108/EG

Angewandte Normen: Störaussendung:
EN 61326:1997 + A1:1998 + A2:2001 + A3:2003

Störfestigkeit:
EN 61326:1997 + A1:1998 + A2:2001 + A3:2003

Die Produkte sind mit dem abgebildeten Zeichen gekennzeichnet:



Diese Erklärung bezieht sich nur auf die Produkte in dem Zustand, in dem sie in Verkehr gebracht wurden; nicht vom Hersteller angebrachte Teile und/oder nachträglich vorgenommene Eingriffe bleiben unberücksichtigt.

Neuss, 30.03.2009

BEKO TECHNOLOGIES GMBH

A handwritten signature in black ink, appearing to read "Christian Riedel".

i.V. Christian Riedel
Leiter Qualitätsmanagement

BEKO TECHNOLOGIES GMBH
41468 Neuss, GERMANY
Phone: +49 2131 988-0
www.beko.de



EC Declaration of Conformity

We herewith declare that the product indicated in the following in the version supplied by us corresponds with the requirements of the relevant standards:

Product designation:	FS109
Voltage supply:	12 - 30 VDC
Pressure versions:	Operating pressure up to 50 bar
Product description and function:	Sensor for measurement of the volume flow in compressed air systems

Low voltage directive 2006/95/EG

With a nominal voltage of maximum 30 VDC the product is not subject to the scope of the low voltage directive (article 1).

EMV directive 2004/108/EG

Applied standards:	Emitted interference: EN 61326:1997 + A1:1998 + A2:2001 + A3:2003
	Interference resistance: EN 61326:1997 + A1:1998 + A2:2001 + A3:2003

The products are labeled with the indicated mark:



This declaration only refers to the products in the state in which they are put into circulation, parts which are not attached by the manufacturer and/or subsequently taken interventions stay unconsidered.

Neuss, 30.03.2009

BEKO TECHNOLOGIES GMBH

i.V. Christian Riedel
Head of Quality Management

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Technical changes and errors excepted.
FS 109_manual_en_2009-03