

+GF+ SIGNET 7000/7001 Vortex Flow Sensors

3-7000.099 (C - 12/00)



Features

- Six sizes in the range 1/2 to 2"
- No moving parts or machined surfaces
- Injection-molded plastic construction
- Excellent surface-finish quality
- +/- 1% of reading accuracy
- End connector options include BCF/IR, Socket Fusion or Solvent Cement Socket
- All HP or high-purity versions are lot-traceable, molded in a dedicated high purity environment, precleaned for ultrapure service, and double-bagged in PA6/PE packaging
- Vibration-noise protection
- Standard sensor output: Frequency or 4 to 20 mA
- Integral transmitters with local displays and many additional features are available as accessories, or select from a wider variety of panel-mount flow instrumentation
- Reverse polarity protected

Application

- Process Flow
- UPW Distribution
- RO/DI Skids
- Process Cooling Water
- Neutralization Systems
- Waste Water Effluent
- Scrubber Control
- Chemical Delivery
- Accurate Batching

Options

	Signet Flow Monitors							
	8350	5090	5091	5100	5500	5600	9010	5075
Vortex Sensors								
3-7000 (Freq. Output)	●				●	●	●	●
3-7001 (4-20mA Out.)			●				●	

Description

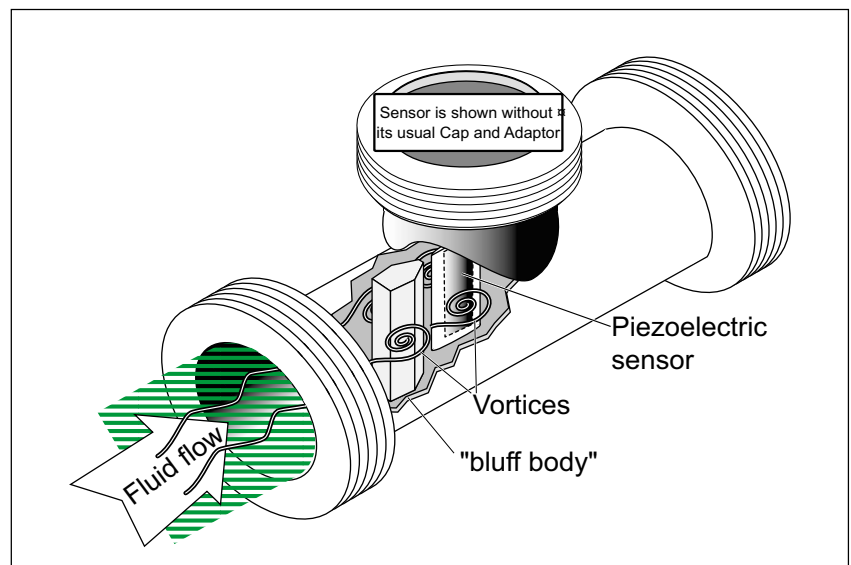
+GF+ SIGNET Vortex Flow Sensors provide extremely accurate and reliable flow measurement with no moving parts. PVC, PP, PVDF & SYGEF HP-PVDF material choices accommodate applications ranging from chemical delivery to deionized water distribution. The sensors are injection-molded to achieve a smooth surface finish for cleanliness and better chemical compatibility, that also drastically reduces manufacturing

inconsistencies and in-service particulation associated with machined surfaces. A variety of end connector options simplify installation and allow unparalleled configuration versatility. The sensors feature either frequency output or fixed 4 to 20 mA current output, and can be used with +GF+ SIGNET's comprehensive offering of flow instrumentation to achieve enhanced system functionality.

Principle of Operation

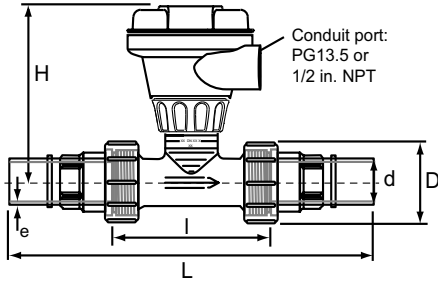
Vortex Flow Sensors 1/2 to 2"

Vortex flow sensors use a naturally occurring phenomenon in which whirling masses of liquid, or vortices, are shed downstream of a stationary object within a flow stream, and at a frequency directly proportional to the velocity of the flow stream. Each vortex causes a local pressure fluctuation that can be detected. +GF+ SIGNET Vortex Flow Sensors, 1/2 to 2", develop vortices around a narrow bluff body and direct them to an encapsulated piezoelectric sensor. The electrical impulse signal from the sensor is amplified and conditioned, producing an extremely accurate and reliable output that is strictly proportional to the fluid flow rate.



Dimensions

HP BCF/IR True Union

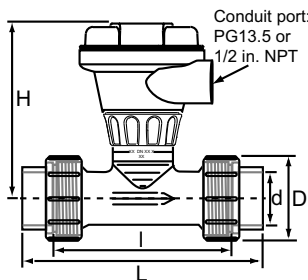


HP BCF/IR True Union

d	Closest		DN		D		L		I		H		e
	mm	inch size	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	
20	1/2	15	47	1.85	226	8.90	90	3.54	117	4.61	1.9		
25	3/4	20	57	2.24	236	9.29	100	3.94	120	4.72	1.9		
32	1	25	64	2.52	248	9.76	110	4.33	123	4.84	2.4		
40	1-1/4	32	78	3.07	286	11.26	110	4.33	127	5.00	2.4		
50	1-1/2	40	89	3.50	298	11.73	120	4.72	132	5.20	3.0		
63	2	50	109	4.29	317	12.48	130	5.12	139	5.47	3.0		

- HP BCF/IR True Union supplied with white FPM o-rings.
- All HP Sensors are 100% cleaned, inspected and double-bagged in heat-sealed PA6/PE liners.

HP Socket Fusion True Union PVDF Socket Fusion PP Socket Fusion



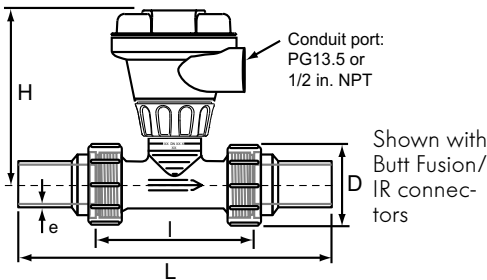
Dimension L ± 3 mm (±0.1 in.)

HP Socket Fusion True Union; PVDF and PP, Socket Fusion

d	Closest		DN		D		L		I		H	
	mm	Inch size	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20	1/2	15	47	1.85	128	5.04	90	3.54	117	4.61		
25	3/4	20	57	2.24	142	5.59	100	3.94	120	4.72		
32	1	25	64	2.52	156	6.14	110	4.33	123	4.84		
40	1-1/4	32	78	3.07	160	6.30	110	4.33	127	5.00		
50	1-1/2	40	89	3.50	176	6.93	120	4.72	132	5.20		
63	2	50	109	4.29	194	7.64	130	5.12	139	5.47		

- HP Socket Fusion True Union supplied with black FPM o-rings.
- All HP Sensors are 100% cleaned, inspected and double-bagged in heat-sealed PA6/PE liners.

PVDF Butt Fusion/IR PP Butt Fusion/IR

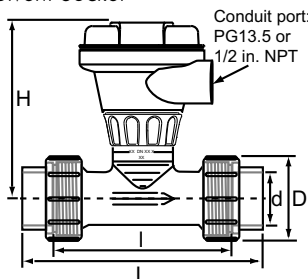


Dimension L ± 3 mm (±0.1 in.)

PVDF & PP Butt Fusion/IR connectors

d	Closest		DN		D		L		I		H		e
	mm	Inch size	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	
20	1/2	15	47	1.85	196	7.72	90	3.54	117	4.61	1.9		
25	3/4	20	57	2.24	212	8.35	100	3.94	120	4.72	1.9		
32	1	25	64	2.52	228	8.98	110	4.33	123	4.84	2.4		
40	1-1/4	32	78	3.07	234	9.21	110	4.33	127	5.00	2.4		
50	1-1/2	40	89	3.50	250	9.84	120	4.72	132	5.20	3.0		
63	2	50	109	4.29	266	10.47	130	5.12	139	5.47	3.0		

PVC Sch 80 Solvent Socket PVC Metric Solvent Socket



Dimension L ± 3 mm (±0.1 in.)

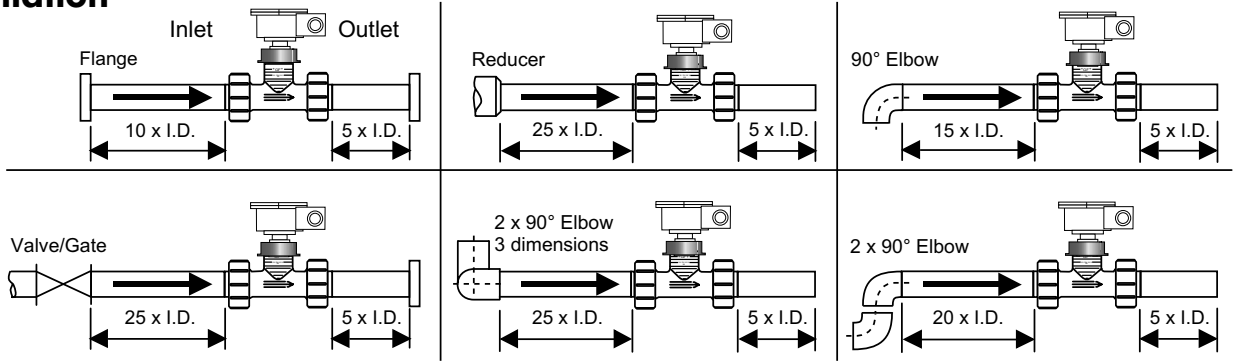
PVC Sch 80 Solvent Socket

Inch size	D		L		I		H	
	mm	inch	mm	inch	mm	inch	mm	inch
1/2	43	1.69	128	5.04	90	3.54	117	4.61
3/4	53	2.09	144	5.67	100	3.94	120	4.72
1	60	2.36	160	6.30	110	4.33	123	4.84
1-1/4	74	2.91	168	6.61	110	4.33	127	5.00
1-1/2	83	3.27	188	7.40	120	4.72	132	5.20
2	103	4.06	212	8.35	130	5.12	139	5.47

PVC Metric Solvent Socket

d	Closest		DN		D		L		I		H	
	mm	Inch size	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
20	1/2	15	43	1.69	136	5.35	90	3.54	117	4.61		
25	3/4	20	53	2.09	150	5.91	100	3.94	120	4.72		
32	1	25	60	2.36	166	6.54	110	4.33	123	4.84		
40	1-1/4	32	74	2.91	166	6.54	110	4.33	127	5.00		
50	1-1/2	40	83	3.27	186	7.32	120	4.72	132	5.20		
63	2	50	103	4.06	196	7.72	130	5.12	139	5.47		

Installation



- Six common installation configurations are shown as guidelines to help you select the best location in your piping system for a vortex flow sensor. Always maximize distance between sensors and pump sources.
- All mounting angles are acceptable in either horizontal or vertical pipe runs, with upward flow preferred in the case of vertical runs. Install the sensor with the arrow pointing in the direction of the flow. These flow sensors are not for bi-directional operation.
- Observe minimum Reynold's Number and backpressure requirements.

Reynold's Number

- A Reynold's Number is a dimensionless number used to determine the effects of viscosity, specific gravity, and velocity on flow sensor performance. To maintain system accuracy, a Reynold's Number greater than 7,500 is required.

Reynold's Number,

$$R_e = 3162.76 \times Q \times S_g / (\mu \times ID)$$

where: Q = Flow rate in GPM

S_g = Specific Gravity

μ = Dynamic Viscosity in Centipoise (cP)

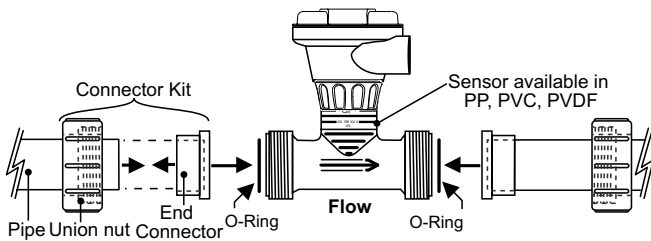
ID = pipe inside diameter in inches

Installation - End Connector Kit Options

Fusion Socket or Solvent Cement Socket

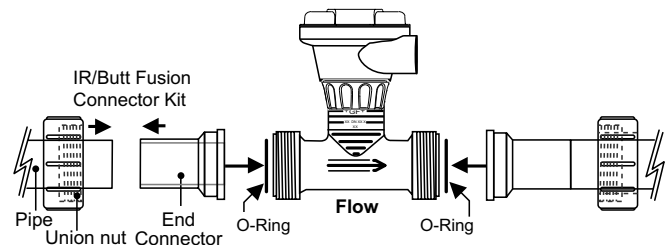
- Fusion socket version: in SYGEF HP-PVDF, PVDF, or PP. A George Fischer Socket Fusion Joining Machine is required to install the end connectors on the pipeline. Refer to the joining machine manual for installation details.
- Solvent socket version: available in PVC. Follow the PVC cement manufacturer's recommendations for preparation and installation.

NOTE: Except HP, union connections sold separately.



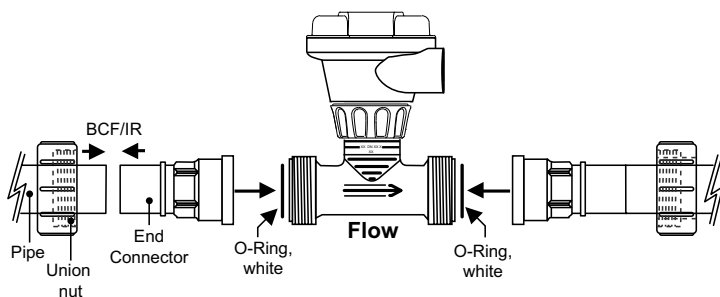
IR/Butt Fusion

- Available in PVDF or PP. A George Fischer IR weld or Butt Fusion Joining Machine is required to install the end connections. Refer to the IR weld or butt fusion joining machine manual for installation details.



BCF/IR Fusion

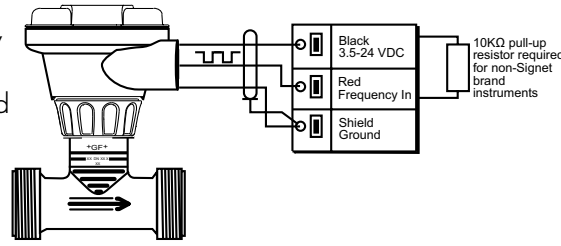
- A George Fischer SYGEF HP BCF/IR Fusion Joining Machine is required to install the end connections. Refer to the SYGEF BCF/IR fusion joining machine manual for installation details.



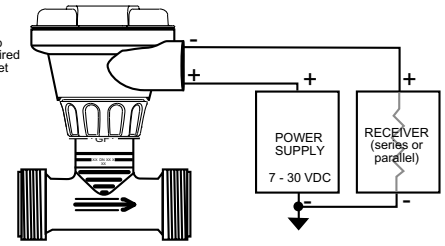
Wiring

Frequency Output Models

- DC sensor power supplied by +GF+ SIGNET instrument
- Use the 2535/2536 input card setting when wiring to the +GF+ SIGNET 9010 Intelk-Pro Flow Controller



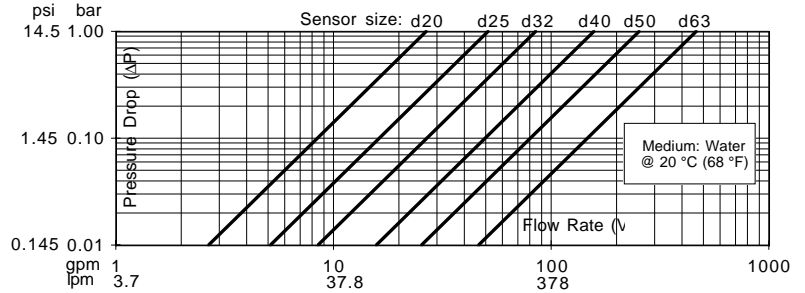
4-20mA Current Output Models



Backpressure Calculation

- Minimum downstream pipe backpressure levels (full pipes) are required to prevent cavitation within the sensor. The minimum back pressure is calculated by the following formula: $2.7 \times \Delta P + 1.3 \times P_o$ (ΔP = Pressure drop across sensor. P_o = Water saturation vapor pressure at operating temperature.)
1. Using Pressure Drop Graph, find ΔP by locating your maximum flow rate on specific sensor size line.
 2. Using the Water Saturation Vapor Pressures Chart, find P_o at operating temperature.
 3. Calculate minimum back pressure needed using formula.

Pressure Drop Graph



Water Saturation Vapor Pressures at Operation Temperatures

°C	-20	-10	0	10	20	25	30	40	50	65
°F	-4	14	32	50	68	77	86	104	122	149
Po (bar)	0.001	0.003	0.006	0.012	0.023	0.32	0.042	0.074	0.123	0.25
Po (psia)	0.014	0.038	0.088	0.178	0.338	0.458	0.614	1.067	1.784	3.626

Technical Data

Wetted materials:

Sensor: PVC, PP, PVDF, or SYGEP HP PVDF
 Union O-Rings: FPM or EPDM

Pipe size range:

Metric PP/PVDF: d20 to 63 mm, DN15 to 50 mm
 PVC, Sch80: 0.5 to 2.0 in.

Linear Flow range:

d20 to d25 (0.5 to 0.75 in.) sensors: 0.5 to 4 m/s (1.6 to 13 ft/s)
 d32 to d40 (1.0 to 1.25 in.) sensors: 0.4 to 4 m/s (1.3 to 13 ft/s)
 d50 to d63 (1.5 to 2.0 in.) sensors: 0.3 to 4 m/s (1.0 to 13 ft/s)

NOTE: Below these velocity ranges, Vortex output is non-linear.

Enclosure:

Rating: NEMA 4X/IP65
 Material: PC/PBT blend of resins
 Seals (2): Buna-N (NBR)

Electrical:

Accuracy: ±1% of reading @ 25 °C
 Repeatability: ±0.5% of reading @ 25 °C
 Immunity: EN50082-2
 Emissions: EN55011

Reverse polarity protection

Electrical - Frequency Output Model

Power: 3.5 to 24 VDC, regulated, 1.5 mA max
 Output type: Open-collector NPN transistor,
 10 mA max sink,
 24 VDC max pull-up voltage, 0 to 300 Hz (size dependent),
 50% duty cycle, non-isolated

Electrical - Current Output Model

Power: 7 to 30 VDC, regulated, 20 mA max

Current loop (2-wire):

Loop impedance: 1 Ω maximum at 7 VDC
 300 Ω maximum at 12 VDC
 800 Ω maximum at 24 VDC
 1000 Ω maximum at 30 VDC

4-20 mA output fixed from 0 to 13 fps

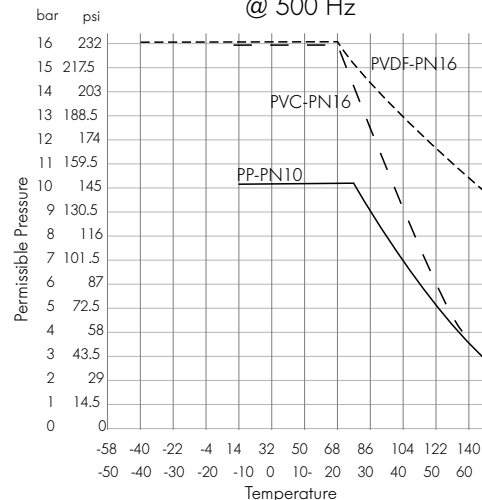
Resolution: 6 μA

Environmental

Maximum media press./temp.:

PVDF: 16 bar @ 0 °C, 9.8 bar @ 65 °C
 (232 psi @ 32 °F, 144 psi @ 149 °F)
 PP: 10 bar @ 0 °C, 2.9 bar @ 65 °C
 (145 psi @ 32 °F, 12.4 psi @ 149 °F)
 PVC: 16 bar @ 0 °C, 3.7 bar @ 60 °C
 (232 psi @ 32 °F, 54 psi @ 140 °F)
 Storage temp.: -15 to 80 °C (5 to 176 °F)
 Relative humidity: 0 to 95%, non-condensing

Max. vibration: 1mm or 1g double amplitude @ 500 Hz



Standards and Approvals

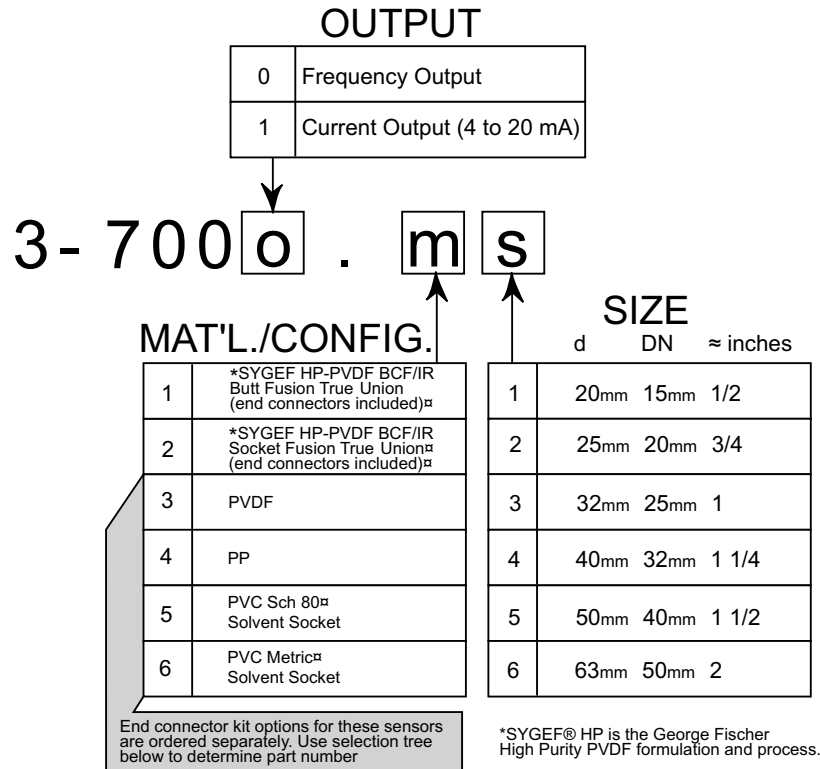
- Manufactured under ISO 9001
- CE

Ordering Information

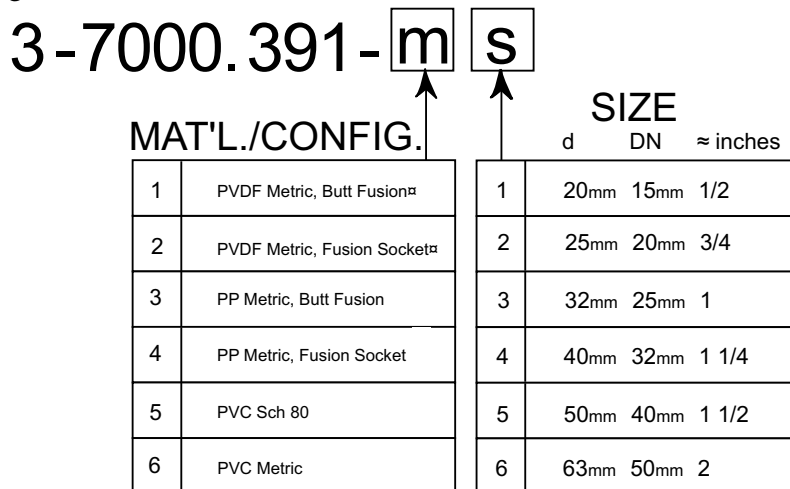
Ordering Notes:

- +GF+ SIGNET Vortex Flow Sensors and End Connector Kits are ordered separately, except the high purity versions in SYGEF HP-PVDF, which are sold fully assembled with end connectors, cleaned and double bagged.
- All PP and PVDF Vortex Flow Sensors are shipped with FPM O-rings, and PVC Vortex Flow Sensors are shipped with EPDM O-rings. O-ring kits of 2 each are available in both materials.

Sensor Ordering Tree



Connector Kit Ordering Tree



Ordering Information (continued)

Vortex Flow Sensors Frequency Output

Mfr. Part No.	Code	Description
3-7000-11	159 000 106	VxF HP-Butt d20, 0.5"
3-7000-12	159 000 107	VxF HP-Butt d25, 0.75"
3-7000-13	159 000 108	VxF HP-Butt d32, 1.0"
3-7000-14	159 000 109	VxF HP-Butt d40, 1.25"
3-7000-15	159 000 110	VxF HP-Butt d50, 1.5"
3-7000-16	159 000 111	VxF HP-Butt d63, 2.0"
3-7000-21	159 000 112	VxF HP SKT d20, 0.5"
3-7000-22	159 000 113	VxF HP SKT d25, 0.75"
3-7000-23	159 000 114	VxF HP SKT d32, 1.0"
3-7000-24	159 000 115	VxF HP SKT d40, 1.25"
3-7000-25	159 000 116	VxF HP SKT d50, 1.5"
3-7000-26	159 000 117	VxF HP SKT d63, 2.0"
3-7000-31	159 000 118	VxF PVDF d20, 0.5"
3-7000-32	159 000 119	VxF PVDF d25, 0.75"
3-7000-33	159 000 120	VxF PVDF d32, 1.0"
3-7000-34	159 000 121	VxF PVDF d40, 1.25"
3-7000-35	159 000 122	VxF PVDF d50, 1.5"
3-7000-36	159 000 123	VxF PVDF d63, 2.0"
3-7000-41	159 000 124	VxF PP d20, 0.5"
3-7000-42	159 000 125	VxF PP d25, 0.75"
3-7000-43	159 000 126	VxF PP d32, 1.0"
3-7000-44	159 000 127	VxF PP d40, 1.25"
3-7000-45	159 000 128	VxF PP d50, 1.5"
3-7000-46	159 000 129	VxF PP d63, 2.0"
3-7000-51	159 000 130	VxF Sch80 PVC 0.5"
3-7000-52	159 000 131	VxF Sch80 PVC 0.75"
3-7000-53	159 000 132	VxF Sch80 PVC 1.0"
3-7000-54	159 000 133	VxF Sch80 PVC 1.25"
3-7000-55	159 000 134	VxF Sch80 PVC 1.5"
3-7000-56	159 000 135	VxF Sch80 PVC 2.0"
3-7000-61	159 000 136	VxF MetricPVC d20
3-7000-62	159 000 137	VxF MetricPVC d25
3-7000-63	159 000 138	VxF MetricPVC d32
3-7000-64	159 000 139	VxF MetricPVC d40
3-7000-65	159 000 140	VxF MetricPVC d50
3-7000-66	159 000 141	VxF MetricPVC d63

End Connector Kits

Mfr. Part No.	Code	Description
3-7000.391-11	159 000 611	PVDF Butt d20, 0.5"
3-7000.391-12	159 000 612	PVDF Butt d25, 0.75"
3-7000.391-13	159 000 613	PVDF Butt d32, 1.0"
3-7000.391-14	159 000 614	PVDF Butt d40, 1.25"
3-7000.391-15	159 000 615	PVDF Butt d50, 1.5"
3-7000.391-16	159 000 616	PVDF Butt d63, 2.0"
3-7000.391-21	159 000 605	PVDF SKT d20, 0.5"
3-7000.391-22	159 000 606	PVDF SKT d25, 0.75"
3-7000.391-23	159 000 607	PVDF SKT d32, 1.0"
3-7000.391-24	159 000 608	PVDF SKT d40, 1.25"
3-7000.391-25	159 000 609	PVDF SKT d50, 1.5"
3-7000.391-26	159 000 610	PVDF SKT d63, 2.0"

Vortex Flow Sensor 4 to 20 mA Current Output

Mfr. Part No.	Code	Description
3-7001-11	159 000 148	VxC HP-Butt d20, 0.5"
3-7001-12	159 000 149	VxC HP-Butt d25, 0.75"
3-7001-13	159 000 150	VxC HP-Butt d32, 1.0"
3-7001-14	159 000 151	VxC HP-Butt d40, 1.25"
3-7001-15	159 000 152	VxC HP-Butt d50, 1.5"
3-7001-16	159 000 153	VxC HP-Butt d63, 2.0"
3-7001-21	159 000 154	VxC HP SKT d20, 0.5"
3-7001-22	159 000 155	VxC HP SKT d25, 0.75"
3-7001-23	159 000 156	VxC HP SKT d32, 1.0"
3-7001-24	159 000 157	VxC HP SKT d40, 1.25"
3-7001-25	159 000 158	VxC HP SKT d50, 1.5"
3-7001-26	159 000 159	VxC HP SKT d63, 2.0"
3-7001-31	159 000 160	VxC PVDF d20, 0.5"
3-7001-32	159 000 161	VxC PVDF d25, 0.75"
3-7001-33	159 000 162	VxC PVDF d32, 1.0"
3-7001-34	159 000 163	VxC PVDF d40, 1.25"
3-7001-35	159 000 164	VxC PVDF d50, 1.5"
3-7001-36	159 000 165	VxC PVDF d63, 2.0"
3-7001-41	159 000 166	VxC PP d20, 0.5"
3-7001-42	159 000 167	VxC PP d25, 0.75"
3-7001-43	159 000 168	VxC PP d32, 1.0"
3-7001-44	159 000 169	VxC PP d40, 1.25"
3-7001-45	159 000 170	VxC PP d50, 1.5"
3-7001-46	159 000 171	VxC PP d63, 2.0"
3-7001-51	159 000 172	VxC Sch80 PVC 0.5"
3-7001-52	159 000 173	VxC Sch80 PVC 0.75"
3-7001-53	159 000 174	VxC Sch80 PVC 1.0"
3-7001-54	159 000 175	VxC Sch80 PVC 1.25"
3-7001-55	159 000 176	VxC Sch80 PVC 1.5"
3-7001-56	159 000 177	VxC Sch80 PVC 2.0"
3-7001-61	159 000 178	VxC MetricPVC d20
3-7001-62	159 000 179	VxC MetricPVC d25
3-7001-63	159 000 180	VxC MetricPVC d32
3-7001-64	159 000 181	VxC MetricPVC d40
3-7001-65	159 000 182	VxC MetricPVC d50
3-7001-66	159 000 183	VxC MetricPVC d63

O-Ring Kits

Mfr. Part No.	Code	Description
3-7000.390-01	159 000 563	O-ring, d20, 0.5", EPDM
3-7000.390-02	159 000 564	O-ring, d25, 0.75", EPDM
3-7000.390-03	159 000 565	O-ring, d32, 1.0", EPDM
3-7000.390-04	159 000 566	O-ring, d40, 1.25", EPDM
3-7000.390-05	159 000 567	O-ring, d50, 1.5", EPDM
3-7000.390-06	159 000 568	O-ring, d63, 2.0", EPDM
3-7000.390-07	159 000 569	O-ring, d20, 0.5", FPM
3-7000.390-08	159 000 570	O-ring, d25, 0.75", FPM
3-7000.390-09	159 000 571	O-ring, d32, 1.0", FPM
3-7000.390-10	159 000 572	O-ring, d40, 1.25", FPM
3-7000.390-11	159 000 573	O-ring, d50, 1.5", FPM
3-7000.390-12	159 000 574	O-ring, d63, 2.0", FPM

Ordering Information (continued)

End Connector Kits (continued)

Mfr. Part No.	Code	Description
3-7000.391-31	159 000 599	PP Butt d20, 0.5"
3-7000.391-32	159 000 600	PP Butt d25, 0.75"
3-7000.391-33	159 000 601	PP Butt d32, 1.0"
3-7000.391-34	159 000 602	PP Butt d40, 1.25"
3-7000.391-35	159 000 603	PP Butt d50, 1.5"
3-7000.391-36	159 000 604	PP Butt d63, 2.0"
3-7000.391-41	159 000 593	PP SKT d20, 0.5"
3-7000.391-42	159 000 594	PP SKT d25, 0.75"
3-7000.391-43	159 000 595	PP SKT d32, 1.0"
3-7000.391-44	159 000 596	PP SKT d40, 1.25"
3-7000.391-45	159 000 597	PP SKT d50, 1.5"
3-7000.391-46	159 000 598	PP SKT d63, 2.0"
3-7000.391-51	159 000 581	Sch80 PVC SKT 0.5"
3-7000.391-52	159 000 582	Sch80 PVC SKT 0.75"
3-7000.391-53	159 000 583	Sch80 PVC SKT 1.0"
3-7000.391-54	159 000 584	Sch80 PVC SKT 1.25"
3-7000.391-55	159 000 585	Sch80 PVC SKT 1.5"
3-7000.391-56	159 000 586	Sch80 PVC SKT 2.0"
3-7000.391-61	159 000 587	MetricPVC SKT d20
3-7000.391-62	159 000 588	MetricPVC SKT d25
3-7000.391-63	159 000 589	MetricPVC SKT d32
3-7000.391-64	159 000 590	MetricPVC SKT d40
3-7000.391-65	159 000 591	MetricPVC SKT d50
3-7000.391-66	159 000 592	MetricPVC SKT d63

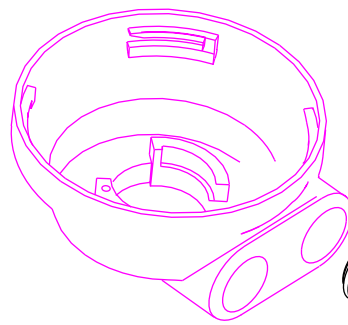
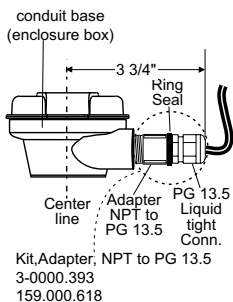
O-Ring Kits (continued)

Mfr. Part No.	Code	Description
3-7000.390-13	159 000 575	O-ring, d20, 0.5", FPM-HP
3-7000.390-14	159 000 576	O-ring, d25, 0.75", FPM-HP
3-7000.390-15	159 000 577	O-ring, d32, 1.0", FPM-HP
3-7000.390-16	159 000 578	O-ring, d40, 1.25", FPM-HP
3-7000.390-17	159 000 579	O-ring, d50, 1.5", FPM-HP
3-7000.390-18	159 000 580	O-ring, d63, 2.0", FPM-HP

Accessories

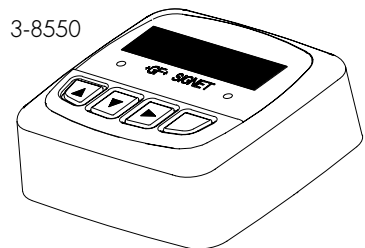
Mfr. Part No.	Code	Description
3-8550-1	159 000 210	Flow Transmitter for Field Mount
3-8550-2	159 000 212	Flow Transmitter w/ 2 Relays for Field Mount
3-8550-3	159 000 214	2-Channel Flow Transmitter for Field Mount
3-8050	159 000 184	Universal Adapter Kit
3-0000.393	159 000 618	Liquid Tight Connector Kit with PG 13.5 to NPT Adapter
3-8055	159 000 629	HPV/IVS Retro Kit

Dimensions of Adapter & Liquid Tight Connector as Mounted



3-0000.393

3-8550



Engineering Specifications

- The flow sensor shall use an encapsulated, non-moving piezoelectric sensor to detect the flow rate.
- The sensor shall be available in models usable in pipe sizes from outside diameter d20 to 63 mm, inside diameter DN 15 to 50 mm.
PVC units shall also be available in Schedule 80, 0.5 to 2 inches.
- The sensor output shall be a current loop with impedance not to exceed 1000Ω with a 30 VDC supply, or an open-collector non-isolated NPN transistor with 10 mA maximum sink with a 24 VDC maximum pull-up voltage at 50% duty cycle.
- Measurement accuracy shall be ±1% of reading @ 25°C (77°F).
- Measurement repeatability shall be ±0.5% of reading @ 25°C (77°F).
- The operating range of the sensor shall accommodate nominal flow rates from 0.3 to 4 m/s (1 to 13 ft/s) depending on size.
- The sensor body shall be made of injection-molded PVDF, PP or PVC.
- The sensor shall attach to a pipe via true-union couplings. End connector options for pipe connection shall include infrared (IR) or socket fusion for PVDF or PP construction, or solvent cement sockets for PVC construction.
- The system shall be manufactured under ISO 9001-certified processes, and shall meet appropriate CE standards, including EN50082-2 for EMI immunity and EN55011 for EMI emissions. System housings shall be sealed to IP65/NEMA 4X rating.
- The flow sensor shall be +GF+ SIGNET Vortex Flow Sensor.

For more information on these products, please contact your local sales company:

A	Georg Fischer Rohrleitungssysteme GmbH, Sandgasse 16, A-3130 Herzogenburg, Tel. 02782/56 43-0, Fax 02782/51 56
AUS	George Fischer Pty Ltd., Suite 3, 41 Stamford Road, Oakleigh Victoria 3166, Tel. 00613/956 80 966, Fax 00613, 956 80 988
B/L	Georg Fischer N.V./S.A., Digue du Canal 109-111 – Vaartdijk 109-111, B-1070 Bruxelles/Brussel, Tél. 02/556 40 20, Fax 02/524 34 26
CH	Georg Fischer Rohrleitungssysteme (Schweiz) AG, Amsler-Laffon-Strasse 1, Postfach, CH-8201 Schaffhausen, Tel. 052/631 30 26, Fax 052/631 28 97
D	Georg Fischer GmbH, Daimlerstraße 6, Postfach 1154, D-73093 Albershausen, Tel. 07161/302-0, Telex 7278 67, Fax 07161/302259
DK	Georg Fischer A/S, Klintehøj Vænge 17, DK-3460 Birkerød, Tel. 42/81 1975, Fax 42/81 1622
E	Georg Fischer S.A., Sistemas de tuberías para la industria, Calle Isla de la Palma, 32 – Nave 1, E-28700 San Sebastián de los Reyes (Madrid), Tel. 91/663 80 00, Fax 91/663 81 76
F	George Fischer S.A., 105-113, rue Charles Michels, B.P.174, F-93208 Saint-Denis Cedex 1, Tél. 1/4922 13 41, Fax 1/4922 13 00
GB	George Fischer Sales Limited, Paradise Way, Coventry, CV2 2ST, Tel. 01203/53 55 35, Telex 330032, Fax 01203/53 04 50-51
I	Giorgio Fischer S.p.A., Via Sondrio 1, I-20063 Cernusco S/N (MI), Agente generale di vendita Tufira S.r.l., Tel. 02/92 18 61, Fax 02/92 14 07 85
J	Kubota George Fischer Ltd., 2-47, Shikitsuhigashi, 1-chome, Naniwa-ku, Osaka 556, Tel. 6/648 28 38, Telex 52677 85, Fax 6/648 25 65
N	Georg Fischer A.S., Bygdøy Allé 23, Postboks 3223 Elisenberg, N-0208 Oslo 2, Tel. 22/44 41 10, Fax 22/43 40 19
PRC	Georg Fischer Piping Systems, Ltd., No. 218 Kang Qiao Dong Road, Pudong Shanghai 201319 Tel. 121 58 13 33 33, Fax 231 58 13 33 66
RA	George Fischer Inc., Lavalle 2614, 1640 Martinez Buenos Aires, Tel. 01/798 74 01, Fax 01/798 40 74
NL	Georg Fischer N.V., Lange Veenteweg 19, Postbus 35, NL-8160 AA Epe, Tel. 0578678222, Fax 0578621768
S/SF	Georg Fischer AB, Box 113, S-12523 Älvsjö-Stockholm, Tel. 08/7274700, Fax 08/7492370
SGP	George Fischer Pte. Ltd., 15 Kaki Bukit Road 2, KB Warehouse Complex, SGP-417 845 Singapore/Singapore, Tel. 74706 11, Fax 74705 77
USA*	George Fischer Inc., 2882 Dow Ave., Tustin, CA 92780-7285, Tel. 714/731-8800, Toll Free 800/854-4090, Fax 714/731-4688, e-mail: info@us.piping.georgefischer.com, Internet: http://www.us.piping.georgefischer.com

*Serving North, Central, and South America

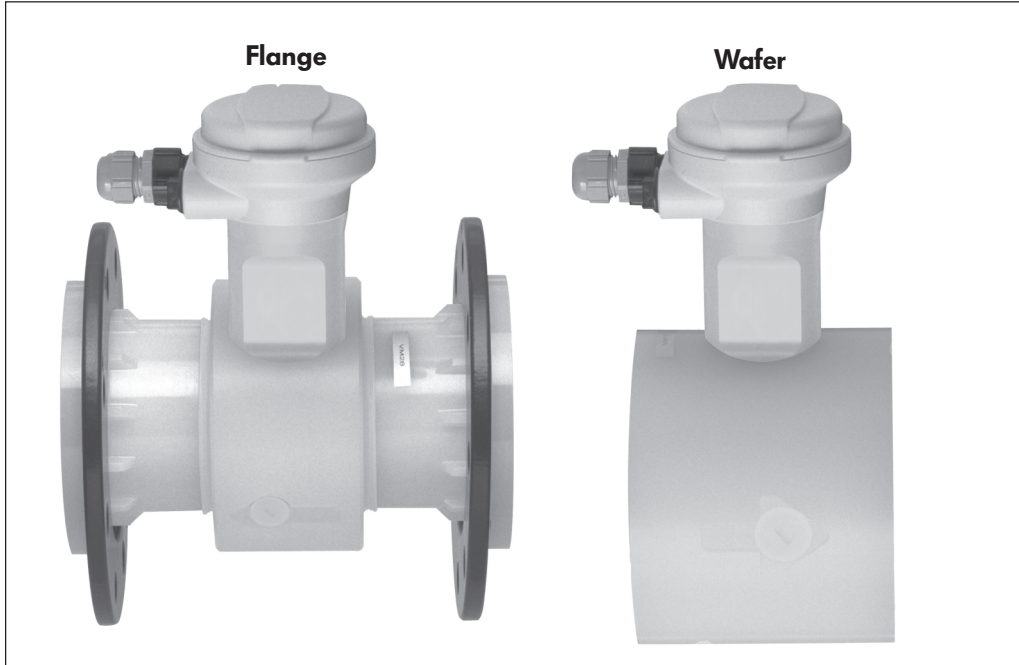
+GF+ SIGNET

Signet Scientific Company, 3401 Aerojet Avenue, El Monte, CA 91731-2882 U.S.A. • Tel. (626) 571-2770 • Fax (626) 573-2057
For Worldwide Sales and Service, visit our website: gfsignet.com • e-mail: info@gfsignet.com



+GF+ SIGNET 7002 Vortex Flow Sensors

3-7002,099 (A-6/00)



Features

- No Moving Parts
- Ultrasonic Detection
- Unaffected by Vibration
- 20:1 Turndown Ratio
- $\pm 1\%$ of Reading Accuracy
- PVDF sizes 3-inch & 4-inch (d90/DN80, d110/DN 100)
- Factory Tested and Calibrated
- Frequency and 4 to 20mA output in every sensor
- Field replaceable electronics module
- All high-purity versions are lot traceable, cleaned for ultrapure service, and double-bagged in PA6/PE packaging
- Wafer and Flanged connection options
- Integral transmitters with local displays and many additional features are available as accessories, or select from a wider variety of panel-mount flow instrumentation
- Terminal Block inside Sensor Cap for easy wiring
- Reverse polarity protected

Description

+GF+ SIGNET 7002 Vortex Flow Sensors provide extremely accurate and reliable flow measurement with no moving parts. Utilizing ultrasonic pick-up technology, these sensors are unaffected by normal piping system vibrations and have an excellent turndown ratio. PVDF and High-Purity PVDF versions, sizes 3-inch and 4-inch (d90/DN80, d110/DN100), are available in wafer and flange configurations and should be your first choice for flow measurement

applications from chemical delivery to UPW distribution. The sensors feature frequency and 4 to 20 mA output, and can be used with +GF+ SIGNET's comprehensive offering of flow instrumentation to achieve enhanced system functionality.

Options

Vortex Sensor	Signet Flow Monitors			
	8550	5075	5090	5091
3-7002	•	•	•	•
	5100	5500	5600	9010

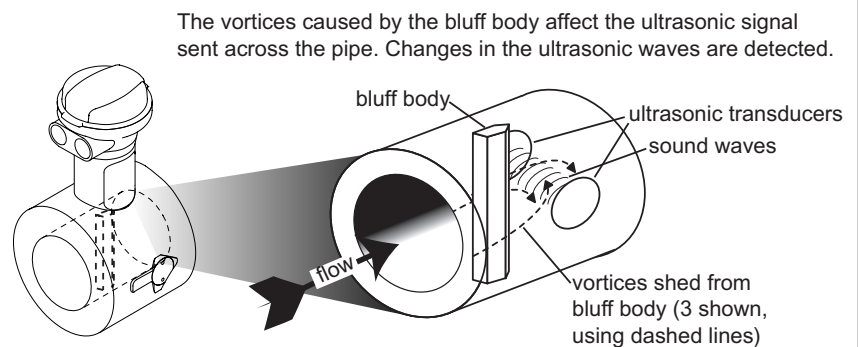
Application

- Process Flow
- UPW Distribution
- RO/DI Skids
- Waste Water Effluent
- Scrubber Control
- Chemical Delivery
- Accurate Batching

Principle of Operation

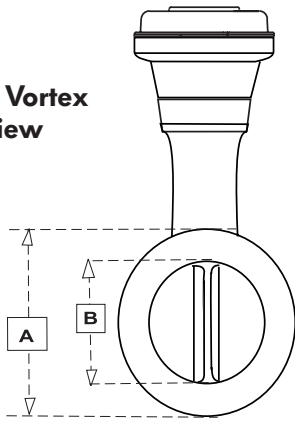
Vortex Flow Sensors 3 & 4"

Vortex flow sensors use a naturally occurring phenomenon in which whirling masses of liquid, or vortices, are shed downstream of a stationary object within a flow stream, and at a rate directly proportional to the velocity of the flow stream. +GF+ SIGNET Vortex Flow Sensors, sizes 3" and 4", utilize a state-of-the-art ultrasonic technique for detecting the vortices which are developed around a narrow bluff body within the sensor. Factory calibration and electronic conditioning produce an extremely accurate and reliable output that is strictly proportional to the fluid flow rate.



Dimensions

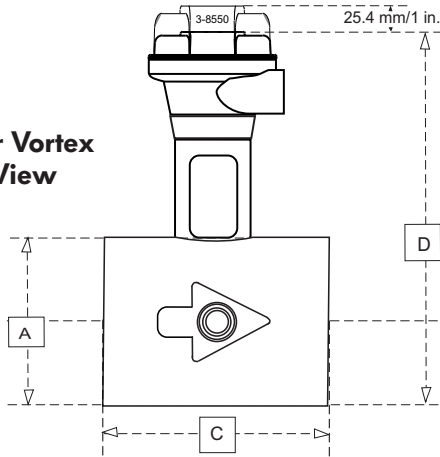
Wafer Vortex End View



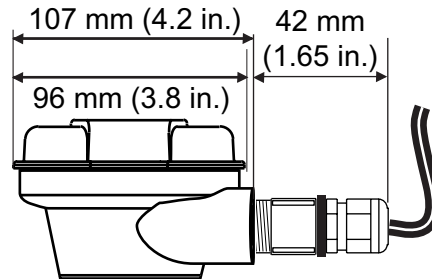
Wafer Vortex Sensor Dimensions

Size	A		B		C		D	
	mm	inch	mm	inch	mm	inch	mm	inch
DN80 (3")	133.1	5.24	78.0	3.07	108.0	4.25	251.7	9.91
DN100 (4")	158.0	6.22	96.0	3.78	127.0	5.00	277.1	10.91

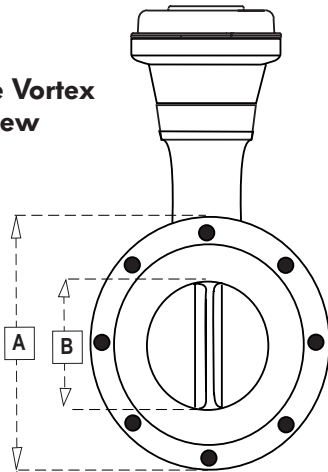
Wafer Vortex Side View



NOTE: The height (D) increases by 25.4 mm (1 inch) when fitted with the 8550 Flow Transmitter.



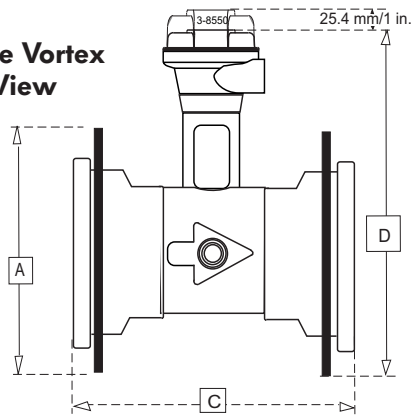
Flange Vortex End View



Flange Vortex Sensor Dimensions

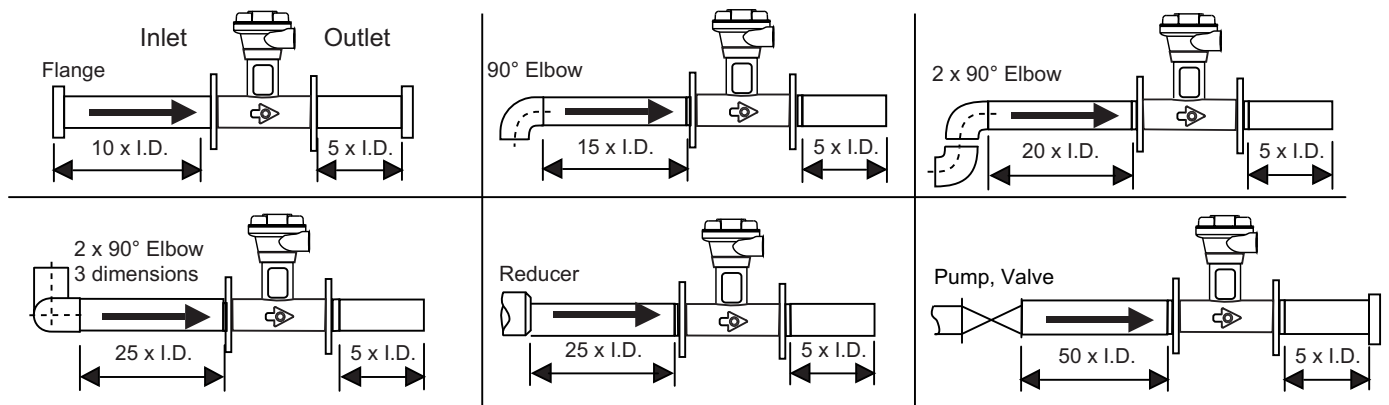
Size	A		B		C		D	
	mm	inch	mm	inch	mm	inch	mm	inch
DN80 (3")	196.9	7.75	78.0	3.07	199.9	7.87	287.0	11.3
DN100 (4")	228.6	9.00	96.0	3.78	249.9	9.84	322.6	12.7

Flange Vortex Side View



NOTE: The height (D) increases by 25.4 mm (1 inch) when fitted with the 8550 Flow Transmitter.

Installation



- Six common installation configurations are shown as guidelines to help you select the best location in your piping system for a vortex flow sensor. Always maximize distance between sensors and pump sources.
- All mounting angles are acceptable in either horizontal or vertical pipe runs, with upward flow preferred in the case of vertical runs. Install the sensor with the arrow pointing in the direction of the flow. These flow sensors are not for bi-directional operation.
- Observe minimum Reynold's Number and backpressure requirements. (see below)

Backpressure Calculation

- Minimum downstream pipe backpressure levels are required to prevent cavitation within the sensor. The minimum back pressure is calculated by the following formula:

$$2.7 \times \Delta P + 1.3 \times P_o$$

ΔP = Pressure drop across sensor.

P_o = Water saturation vapor pressure at operating temperature.

1. Using Pressure Drop Graph, find ΔP by locating your maximum flow rate on specific sensor size line.
2. Using the Water Saturation Vapor Pressures Chart, find P_o at operating temperature.
3. Calculate minimum back pressure needed using formula.

Reynold's Number

- A Reynold's Number is a dimensionless number used to determine the effects of viscosity, specific gravity, and velocity on flow sensor performance. To maintain system accuracy, a Reynold's Number greater than 16,000 for 3-inch (d90/DN80) and 20,000 for 4-inch (d110/DN100) are required.

Reynold's Number,

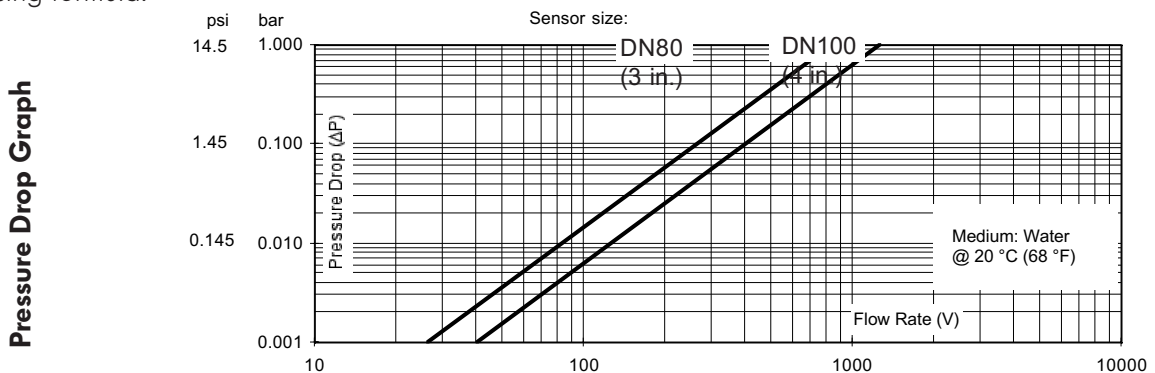
$$R_e = 3162.76 \times Q \times S_g / (\mu \times ID)$$

where: Q = Flow rate in GPM

S_g = Specific Gravity

μ = Dynamic Viscosity in Centipoise (cP)

ID = pipe inside diameter in inches

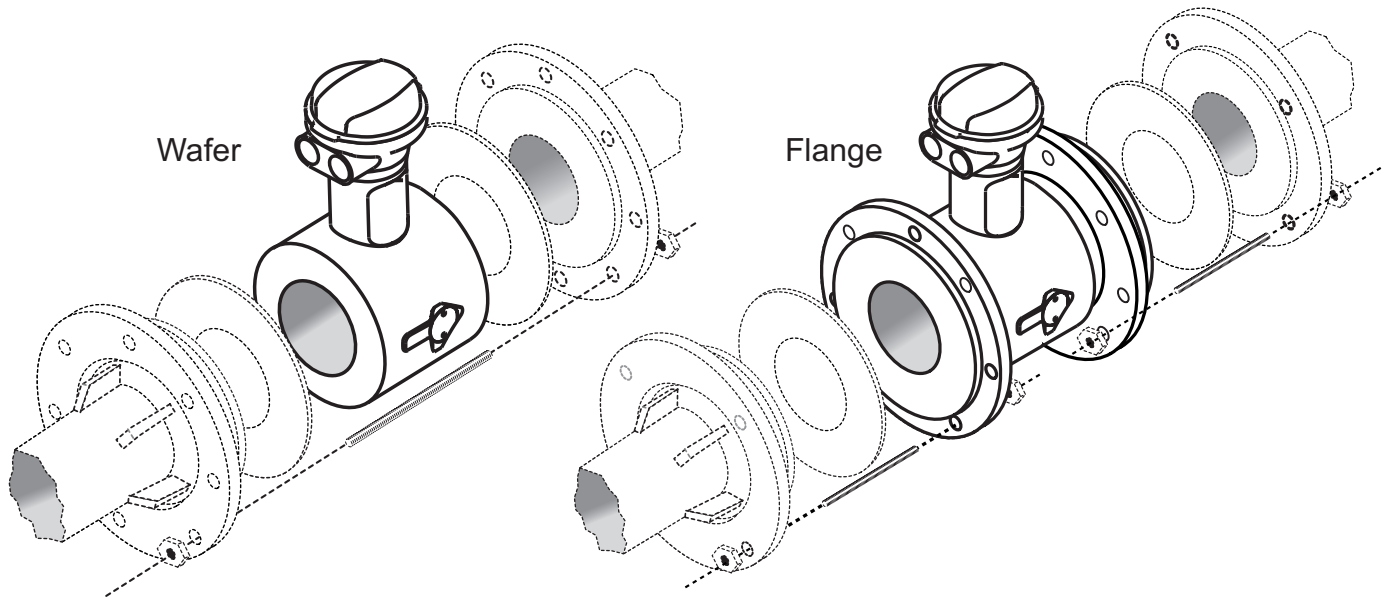


Water Saturation Vapor Pressures at Operating Temperatures

°C	-20	-10	0	10	20	25	30	40	50	65
°F	-4	14	32	50	68	77	86	104	122	149
P _o (bar)	0.001	0.003	0.006	0.012	0.023	0.32	0.042	0.074	0.123	0.25
P _o (psia)	0.014	0.038	0.088	0.178	0.338	0.458	0.614	1.067	1.784	3.626

Installation

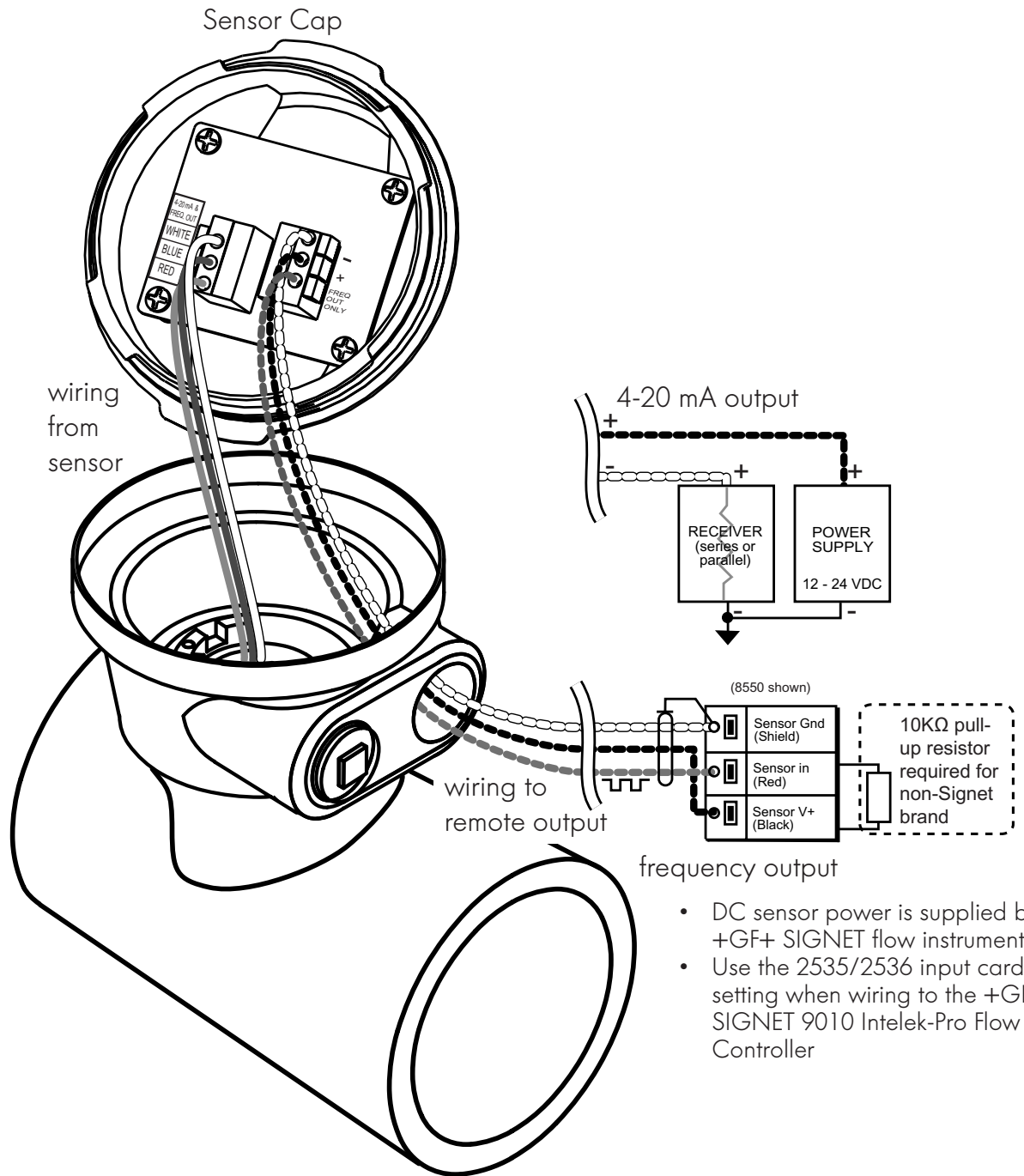
- Proper alignment of the sensor with gaskets and flanges is necessary to assure a uniform flow profile through the sensor.
- Space flanges in the piping system according to the length of the vortex flow sensor body.
- Observe torque recommendations.
- Mounting hardware, gaskets and piping system components (shown with broken lines in the diagrams below) are not furnished with the vortex flow sensors.



Sensor	Config.	# of Bolts	Bolt Diameter	Approximate Bolt Length	Required Torque
3" Flange	ISO	16	M16 (5/8" - 11)	70 mm (2.75")	40 ± 5 N•m (30 ± 4 lbf•ft)
3" Flange	ANSI	8	M16 (5/8" - 11)	70 mm (2.75")	40 ± 5 N•m (30 ± 4 lbf•ft)
4" Flange	ISO	16	M16 (5/8" - 11)	80 mm (3.00")	45 ± 5 N•m (33 ± 4 lbf•ft)
4" Flange	ANSI	16	M16 (5/8" - 11)	80 mm (3.00")	45 ± 5 N•m (33 ± 4 lbf•ft)
3" Wafer	ISO	8	M16 (5/8" - 11)	180 mm (7.50")	25 N•m (18.5 lbf•ft)
3" Wafer	ANSI	4	M16 (5/8" - 11)	180 mm (7.50")	25 N•m (18.5 lbf•ft)
4" Wafer	ISO	8	M16 (5/8" - 11)	220 mm (8.50")	30 N•m (22 lbf•ft)
4" Wafer	ANSI	8	M16 (5/8" - 11)	220 mm (8.50")	30 N•m (22 lbf•ft)

- For flange versions: Bolt length approximations shown in the table above include width dimensions for two flange adapters, two flange rings and a gasket, all typical of +GF+ SYGEF-PVDF piping system components, plus nuts and washers.
- For wafer versions: If the application requires operation outside the range 15 to 35° C (59 to 95° F), then the accessory Spring Kit (3-7002.391) is necessary to relieve the forces due to thermal expansion of PVDF material and/or to prevent leakage during cooling. And if necessary, each bolt must be fitted with a die spring. The accessory spring kit contains four (4) springs, so two kits may be required. Check the table above to determine the number of bolts for your configuration. Bolt length approximations shown in the table above include sensor length, width dimensions for two each flange adapters, flange rings and gaskets, all typical of +GF+ SYGEF-PVDF piping system components, plus nuts and washers. If the accessory Spring Kit will be used, bolt length requirements increase by 60 mm (2.5 inches.)

Wiring



- DC sensor power is supplied by +GF+ SIGNET flow instruments
- Use the 2535/2536 input card setting when wiring to the +GF+ SIGNET 9010 Inteltek-Pro Flow Controller

Technical Data

Wetted materials:

Sensor body: PVDF

Pipe size

d90/DN80 (3 in.) and d110/DN100 (4 in.)

Linear Flow Range:

Turndown Ratio: 20:1

d90/DN80 (3 in.) Reynold's Number ≥ 16000 :

0.2 to 4 m/s (0.66 to 13 ft/s)

3" scale range: 0 to 303 gpm (0-1146 lpm)

d110/DN100 (4 in.) Reynold's Number ≥ 20000 :

0.2 to 4 m/s (0.66 to 13 ft/s)

4" scale range: 0 to 459 gpm (0-1736 lpm)

NOTE: Below these velocity ranges, Vortex output is non-linear.

Enclosure:

Rating: NEMA 4X/IP65

Material: Valox® (PBTP)

Weight:

Wafer 3 in./DN80 4.50 lb (2.0 kg)

4 in./DN 100 7.00 lb. (3.2 kg)

Flange 3 in./DN80 11.00 lb. (5.0 kg)

4 in./DN100 16.00 lb. (7.3 kg)

Vibration resistance:

Excellent: at least 1g in every axis up to 500 Hz. (The ultrasonic pickup is unaffected by normal piping system vibrations.)

Electrical:

Accuracy: $\pm 1\%$ of reading

Repeatability: $\pm 0.25\%$ of reading

Response Time: 1 second first order response
5 seconds settled to 1%

Reverse polarity protection

Power requirements:

Frequency Out: 5 to 24 VDC, regulated, 30 mA maximum

Current Out: 12 to 24 VDC

Open Collector output: NPN transistor, 10 mA max sink, 30 VDC max pull-up voltage, 0 to 100 Hz, 50% duty cycle, non-isolated, < 100 Hz at maximum range.

Current Output (2-wire):

4 to 20 mA output factory-set from 0 to 4 m/s (0 to 13 ft/s)

3" scale range: 0 to 303 gpm (0-1146 lpm)

4" scale range: 0 to 459 gpm (0-1736 lpm)

(Custom ranges available from factory)

Max. Loop impedance: 1Ω at 12 VDC

600Ω at 24 VDC

Resolution: $2.5\mu A$

Environmental

Rating: NEMA 4X/IP65

Maximum Media Pressure/Temperature

Flange Vortex Sensor:

10 bar @ 30 °C, 2.0 bar @ 120 °C

(145 psi @ 86 °F, 94 psi @ 248 °F)

Wafer Vortex Sensor:

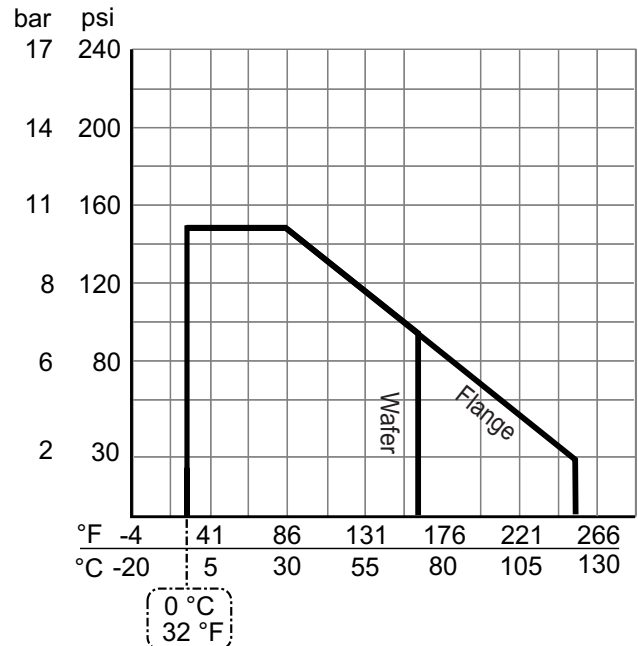
10 bar @ 30 °C, 6.5 bar @ 70 °C

(145 psi @ 86 °F, 94 psi @ 158 °F)

Ambient Operating temperature: 0 to 70 °C (32 to 158 °F)

Storage temperature: -15 to 80 °C (5 to 176 °F)

Relative humidity: 0 to 95%, non-condensing



Wafer Vortex Sensor: 10 bar @ 30 °C, 6.5 bar @ 70 °C
(145 psi @ 86 °F, 94 psi @ 158 °F)

Flange Vortex Sensor: 10 bar @ 30 °C, 2 bar @ 120 °C
(145 psi @ 86 °F, 30 psi @ 248 °F)

Standards and Approvals

CE

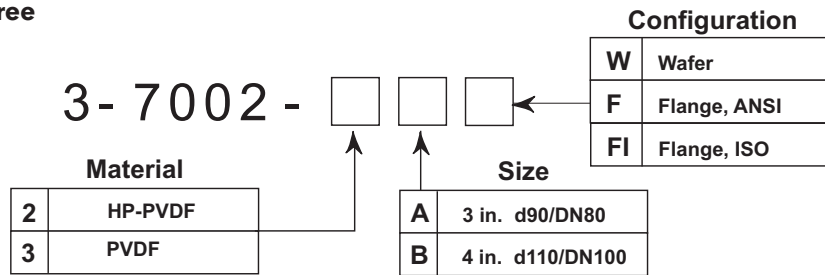
Manufactured under ISO 9001 and ISO 14001

Ordering Information

Ordering Notes:

- Assembly parts such as gaskets, nuts and bolts are not included.
- For wafer versions only, accessory Spring Kit(s) may be required. See "Installation" on page 4 for details.

Sensor Ordering Tree

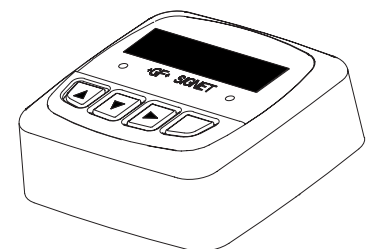
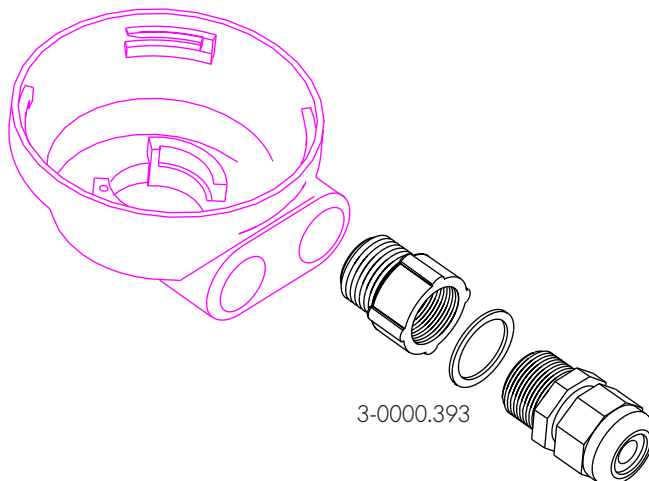


+GF+ SIGNET 7002 Vortex Flow Sensors

Mfr. Part No.	Code	Description
3-7002-2AF	159 000 657	High-Purity 3" (d90/DN80) Flange, ANSI
3-7002-2AFI	159 000 658	High-Purity 3" (d90/DN80) Flange, ISO
3-7002-2AW	159 000 661	High-Purity 3" (d90/DN80) Wafer
3-7002-2BF	159 000 662	High-Purity 4" (d110/DN100) Flange, ANSI
3-7002-2BFI	159 000 663	High-Purity 4" (d110/DN100) Flange, ISO
3-7002-2BW	159 000 666	High-Purity 4" (d110/DN100) Wafer
3-7002-3AF	159 000 667	Standard PVDF 3" (d90/DN80) Flange, ANSI
3-7002-3AFI	159 000 668	Standard PVDF 3" (d90/DN80) Flange, ISO
3-7002-3AW	159 000 671	Standard PVDF 3" (d90/DN80) Wafer
3-7002-3BF	159 000 672	Standard PVDF 4" (d110/DN100) Flange, ANSI
3-7002-3BFI	159 000 673	Standard PVDF 4" (d110/DN100) Flange, ISO
3-7002-3BW	159 000 676	Standard PVDF 4" (d110/DN100) Wafer

Accessories

Mfr. Part No.	Code	Description
3-8550-1	159 000 210	Flow Transmitter for Field Mount
3-8550-2	159 000 212	Flow Transmitter with 2 Relays for Field Mount
3-8550-3	159 000 214	2-Channel Flow Transmitter for Field Mount
3-8050	159 000 184	Universal Adapter Kit
3-0000.393	159 000 618	Liquid Tight Connector Kit with PG 13.5 to NPT Adapter
3-7002.391	159 000 692	Spring Kit (includes four (4) springs)



3-8550-x

Engineering Specifications

- The flow sensor shall use an ultrasonic pick-up to detect vortices in the flow stream.
- The sensor shall be unaffected by normal piping system vibrations.
- The sensor shall provide frequency and 4 to 20 mA outputs.
- Accuracy of the flow sensor shall be $\pm 1\%$ of reading.
- The sensor shall accommodate a minimum 20:1 turndown ratio.
- The flow sensor body shall be constructed of PVDF.
- Piping system connection options shall include wafer and flanged configurations.
- The sensor shall be manufactured under ISO 9001 and ISO 14001, and shall meet CE standards.
- The enclosure rating of the sensor shall be NEMA 4X/IP65.
- The flow sensor shall be +GF+ SIGNET 7002 Vortex Flow Sensor.

For more information on these products, please contact your local sales company:

A	George Fischer Rohrleitungssysteme GmbH, Sandgasse 16, A-3130 Herzogenburg, Tel. 02782/56 43-0, Fax 02782/51 56
AUS	George Fischer IPS Pty Ltd., 186-190 Kingsgrove Road, Kingsgrove, NSW 2208, Tel. 02 9554 3977, Fax 02 9502 2561
B/L	George Fischer N.V./S.A., Digue du Canal 109-111 – Vaardijk 109-111, B-1070 Bruxelles/Brussel, Tél. 02/556 40 20, Fax 02/524 34 26
CH	George Fischer Rohrleitungssysteme (Schweiz) AG, Amsler-Laffon-Strasse 1, Postfach, CH-8201 Schaffhausen, Tel. 052/631 3026, Fax 052/631 2897
D	Georg Fischer GmbH, Daimlerstraße 6, Postfach 1154, D-73093 Albershausen, Tel. 07161/302-0, Telex 727867, Fax 07161/302259
DK	Georg Fischer A/S, Klintehøj Vænge 17, DK-3460 Birkerød, Tel. 42/81 1975, Fax 42/81 1622
E	George Fischer S.A., Sistemas de tuberías para la industria, Calle Isla de la Palma, 32 – Nave 1, E-28700 San Sebastián de los Reyes (Madrid), Tel. 91/663 80 00, Fax 91/663 81 76
F	George Fischer S.A., 105-113, rue Charles Michels, B.P.174, F-93208 Saint-Denis Cedex 1, Tél. 1/4922 1341, Fax 1/4922 1300
GB	George Fischer Sales Limited, Paradise Way, Coventry, CV2 2ST, Tel. 01203/53 55 35, Telex 330032, Fax 01203/53 04 50-51
I	Giorgio Fischer S.p.A., Via Sondrio 1, I-20063 Cernusco S/N (MI), Agente generale di vendita Tufira S.r.l., Tel. 02/92 18 61, Fax 02/92 14 07 85
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