VLM20
In-line Vortex Flowmeter

Description

The VLM20 In-line Vortex Flowmeter utilises three primary sensing elements to measure the mass flowrate of steam, liquids and gases:

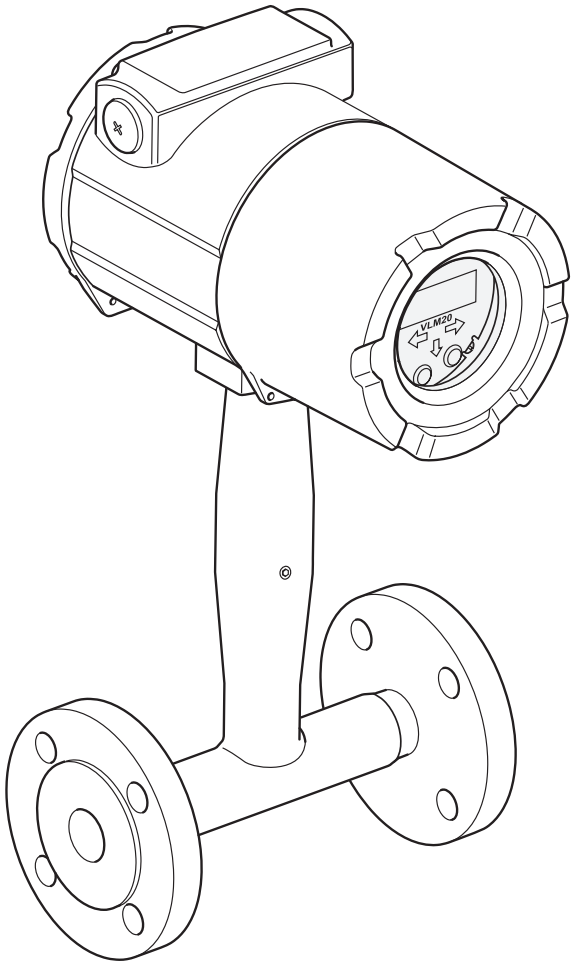
- Vortex shedding velocity sensor
- RTD temperature sensor
- Solid-state pressure transducer

Compliance

- Electromagnetic Compatibility Directive
- ATEX Directive
- Low Voltage Directive
- Pressure Equipment Directive

Principle of operation

Vortex flowmeters measure the flow of liquid, gas and steam by detecting the frequency at which vortices are alternately shed from a bluff body. According to proven laws of physics, the frequency at which the vortices are alternately shed is directly proportional to the flow velocity.
In-line vortex flowmeters measure flow by detecting the local velocity at a strategically located position within the pipe. The VLM20 detects the frequency at which vortices are alternately shed from the bluff body located within the sensor head.
The VLM20 uses the local velocity, along with other parameters, such as fluid type, pipe size and Reynolds number to calculate the average pipe velocity, and consequently, the volumetric flowrate.



VLM20 range and benefits

The **VLM20-V** delivers a direct reading of volumetric flowrate, generally the most cost-effective solution for liquid flow monitoring, in applications ranging from general water flows to hydrocarbon fuel flow measurement.

The **VLM20-VT** integrates a precision 1000 Ω platinum RTD temperature sensor that can be used to calculate and output a compensated mass reading. This device is typically used to measure flowrates of saturated steam.

The **VLM20-VTP** offers you flow computer functionality in a compact field device. This multivariable instrument incorporates temperature and pressure sensors to provide an instantaneous reading of the compensated mass flowrate of gases, liquids and steam. In addition to outputs for totalized mass and alarm settings, the field-configurable electronics deliver up to three analogue 4 - 20 mA outputs of five process measurements, including volumetric flowrate, mass flowrate, pressure, temperature and density.

The **VLM20-EM** Energy Monitoring option permits real-time calculation of energy consumption for a facility or process. The meter can be programmed to measure steam, hot water or chilled water. The VLM20-EM flowmeter monitors one side of the process, either sent or returned, and uses the input from a second separate temperature sensor on the opposite leg of the process to calculate the change in energy. Selectable energy units include BTU, joules, calories, Watt-hours, Megawatt-hours and Horsepower-hours. The local or remote electronics indicate two temperatures, delta T, mass total and energy total.

Approvals

"FM and FMC"	Class I, Division 1, Groups B, C and D	
	Class II/III, Division 1, Groups E, F and G	
	Type 4X and IP66, T6, Ta = -40 °C to +70 °C	
ATEX	S Temp.	II 2 G Ex db IIB + H2 T6...T2 Gb
		II 2 D Ex tb IIIB T85 °C Db
	H Temp.	II 2 G Ex db IIB + H2 85 °C...405 °C Gb
		II 2 D Ex tb IIIB T85°C Db
IECEx	Ex d IIB +H2 T6 Gb	
	EX tb IIIB T85°C Db, Ta= -40 °C to +60 °C	

Sizes and pipe connections

Flanged
DN15, DN20, DN25, DN40, DN50, DN80, DN100, DN150, DN200, DN250 and DN300
Flanged EN 1092-1 PN40 and PN100 connections
or
½", ¾", 1", 1½", 2", 3", 4", 6", 8", 10" and 12"
Flanged ASME 16.5 Class 150, 300 and 600 connections
Wafer type
DN15, DN20, DN25, DN40, DN50, DN80 and DN100 suitable for fitting between EN 1092-1 PN40 flanges
or
½", ¾", 1", 1½", 2", 3" and 4" suitable for fitting between ASME B16.5 Class 300 flanges

Technical data

Wetted materials		316L stainless steel, plus: • DuPont Teflon® based thread sealant on models with pressure transducer	
Application		Any gas, liquid or steam compatible with 316L stainless steel and other listed wetted materials. Not recommended for multi-phase fluids	
Temperature	**Process**	**S** option - **Standard** -200 °C to +260 °C (-330 to +500 °F) *Where ATEX is required the lower temperature is further limited to -40 °C (-40 °F).	
		H option - **High** +260 °C to +400 °C (+500 °F to +750 °F)	
Environmental	**Temperature ambient**	**Operating** -40 °C to +60 °C (-40 °F to +140 °F)	
		Storage -40 °C to +85 °C (-40 °F to +185 °F)	
	LVD	Electrical Safety EN61010-1:2010	
		Overvoltage Category	II
		Pollution Degree	2
	EMC	Emissions	Group 1, Class A (Suitable for Industrial Environments only)
		Immunity	Suitable for Industrial Environments
	Enclosure	NEMA 4X, IP66	

Technical data (continued)

	Full-scale operating pressue		Maximum over-range pressure	
Pressure transducer ratings	2 bar a	30 psi a	4 bar a	60 psi a
	7 bar a	100 psi a	14 bar a	200 psi a
	20 bar a	300 psi a	41 bar a	600 psi a
	34 bar a	500 psi a	64 bar a	1 000 psi a
	100 bar a	1 500 psi a	175 bar a	2 500 psi a

	Style connection	Rating
Pressure ratings	**Flanged**	ASME Class 150
		ASME Class 300
		ASME Class 600
		EN1092-1 PN40
		EN 1092-1 PN100, DN15 - DN200 only
	Wafer	For fitting between ASME Class 300 or EN1092-1 PN40 flanges

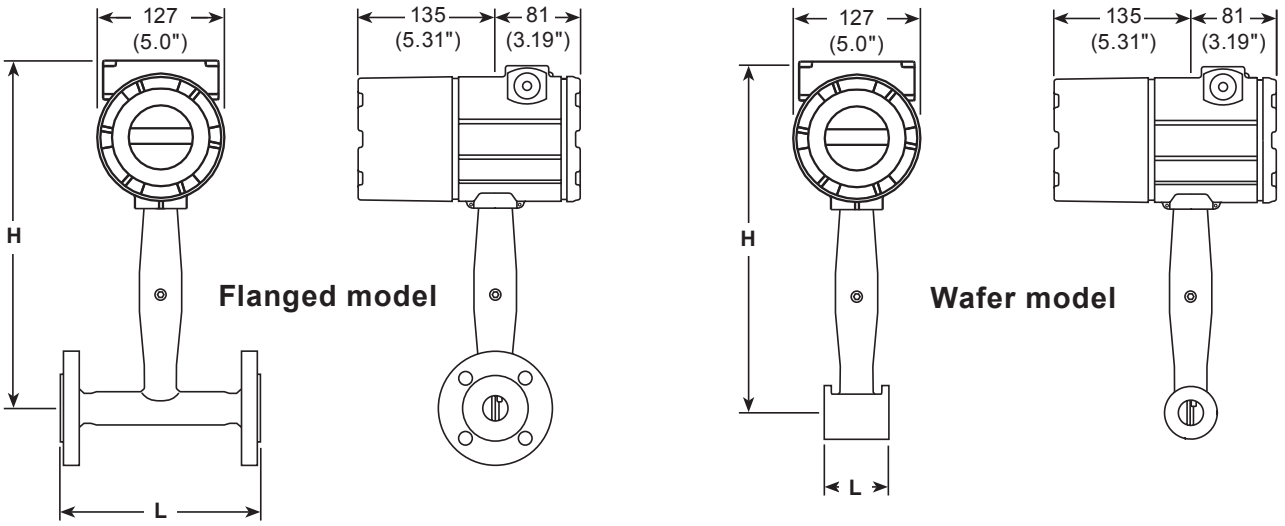
Power requirements	**DL** option - 12 to 36 Vdc, 25 mA, 1 W maximum, Loop powered (single output)	
	DH option - 12 to 36 Vdc, 300 mA, 9 W maximum, (multiple outputs)	
	AC option - 100 to 240 Vac, 50/60 Hz line power, 5 W maximum (multiple outputs)	
Display	Alphanumeric 2 line x 16 character LCD digital display	
	Six pushbuttons for full field configuration	
	Pushbuttons can be operated with magnetic wand without removal of the enclosure covers	
	Display can be mounted in 90 ° intervals for better viewing	
Output signals	**Analogue**	4 - 20 mA
	Alarm	Solid state relay, 40 Vdc
	Totalizer pulse	50 millisecond pulse, 40 Vdc
	Volumetric or Loop powered mass	One analogue, one totalizer pulse, HART®, scaled frequency output
	Multivariable option 1	Up to three analogue signals, three alarms, one totaliser pulse, HART®, scaled frequency output
	Multivariable option 2	Modus RTU or BACnet MS/TP compatible process monitoring
Conduit connections	**ATEX/IECEx/PED/FM/FMC version**	2 x M20 female ports
	FM/FMC version	2 x ¾" NPT female ports

Technical data (continued)

Performance specifications

Accuracy		Mass flowrate accuracy for gas and steam based on 50 - 100% of pressure range			
Process variables		**Liquids**	**Gas and steam**	**Repeatability**	**Stability over 12 months**
	Mass flowrate	±1% of rate	±1.5% of rate	±0.2% of rate	± 0.2% of rate
	Volumetric flowrate	±0.7% of rate	±1% of rate	±0.1% of rate	± Negligible
	Temperature	±1 °C (±2 °F)	±1 °C (±2 °F)	±0.1 °C (±0.2 °F)	± 0.5 °C (± 0.9 °F)
	Pressure	±0.3% of full-scale	±0.3% of full-scale	±0.05% of full-scale	± 0.1% of full-scale
	Density	±0.3% of reading	±0.5% of reading	±0.1% of reading	± 0.1% of reading
Response time		Adjustable from 1 to 100 seconds			

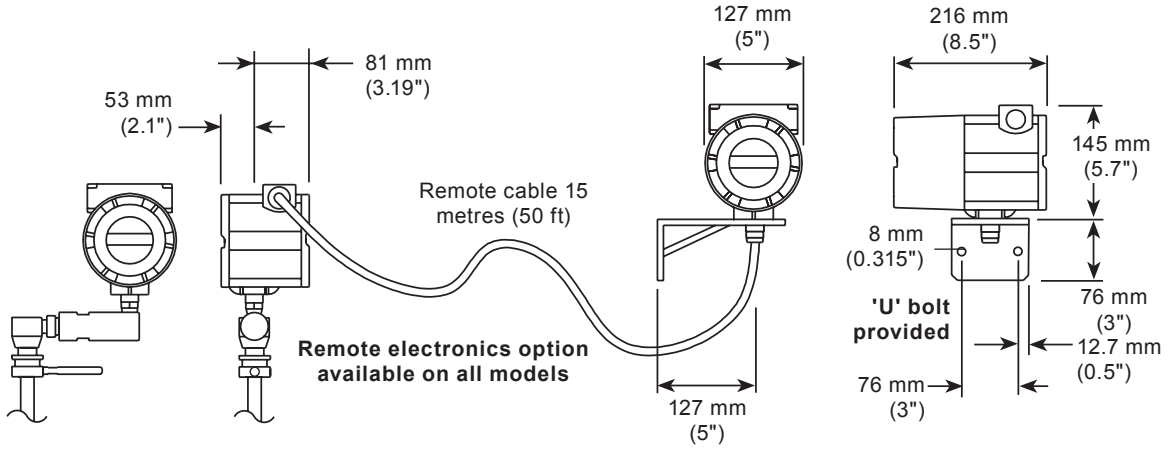
Dimensions (approximate) in mm and inches



		Flanged				Wafer			
		L		H		L		H	
Metric	**Imperial**	mm	inches	mm	inches	mm	inches	mm	inches
DN15	**½"**	200	7.90"	343	13.5"	65	2.56"	343	13.5"
DN20	**¾"**	200	7.90"	343	13.5"	65	2.56"	343	13.5"
DN25	**1"**	200	7.90"	343	13.5"	65	2.56"	343	13.5"
DN40	**1½"**	200	7.90"	351	13.8"	65	2.56"	351	13.8"
DN50	**2"**	200	7.90"	356	14.0"	65	2.56"	356	14.0"
DN80	**3"**	200	7.90"	371	14.6"	65	2.56"	371	14.6"
DN100	**4"**	250	9.84"	384	15.1"	65	2.56"	384	15.1"
DN150	**6"**	300	11.81"	411	16.2"				
DN200	**8"**	300	11.81"	437	17.2"				
DN250	**10"**	381	15.00"	462	18.2"				
DN300	**12"**	450	17.70"	488	19.2"				

Dimensions (approximate) in mm and inches

Remote electronics option



Weights (approximate) in Kgs and lbs

		Flanged					Wafer	
		Kg		lbs			Kg	lbs
Metric	**Imperial**	PN40	PN100	ASME 150	ASME 300	ASME 600	PN40	ASME 300
DN15	**½"**	6.0	6.9	12.0	13.0	14.0	4.2	9.2
DN20	**¾"**	6.8	8.6	13.3	15.3	16.3	4.3	9.5
DN25	**1"**	7.0	9.5	14.0	16.0	17.0	4.7	10.3
DN40	**1½"**	9.1	12.6	17.0	24.0	24.0	5.5	12.1
DN50	**2"**	10.9	16.0	22.0	26.0	28.0	6.4	14.1
DN80	**3"**	16.4	23.1	33.9	41.9	45.9	8.5	18.7
DN100	**4"**	22.3	33.1	48.2	69.2	88.2	10.6	23.4
DN150	**6"**	39.9	66.3	75.1	113.1	201.1		
DN200	**8"**	64.4	113.6	117.3	173.3	255.3		
DN250	**10"**	105.7		118.1	262.1	462.1		
DN300	**12"**	161.0		298.7	402.7	606.7		

Please note: Add 11 lb (5 kg) if the unit has remote electronics.

Typical Metric flowrates

Saturated steam (kg/h)

Pressure		Nominal pipe size										
		15 mm	20 mm	25 mm	40 mm	50 mm	80 mm	100 mm	150 mm	200 mm	250 mm	300 mm
0 bar g	Min.	3	5	8	19	32	72	126	286	500	786	1 113
	Max.	18	42	91	224	375	838	1 459	3 309	5 797	9 116	12 898
5 bar g	Min.	6	11	18	45	75	167	290	658	1 153	1 813	2 565
	Max.	95	224	485	1 192	1 992	4 455	7 754	17 581	30 799	48 434	68 530
10 bar g	Min.	8	15	24	59	99	222	387	877	1 537	2 417	3 419
	Max.	168	397	862	2 118	3 539	7 915	13 777	31 237	54 720	86 053	121 758
15 bar g	Min.	9	17	29	71	119	266	463	1 050	1 840	2 893	4 094
	Max.	241	569	1 236	3 036	5 073	11 347	19 750	44 779	78 444	123 360	174 543
20 bar g	Min.	11	20	33	81	136	304	529	1 199	2 100	3 303	4 673
	Max.	314	742	1 610	3 956	6 611	14 787	25 738	58 355	102 226	160 761	227 463
30 bar g	Min.	13	24	40	99	165	369	642	1 455	2 548	4 007	5 669
	Max.	463	1 092	2 370	5 822	9 729	21 763	37 880	85 884	150 451	236 599	334 766

Air (nm³/h) at 20 °C

Pressure		Nominal pipe size										
		15 mm	20 mm	25 mm	40 mm	50 mm	80 mm	100 mm	150 mm	200 mm	250 mm	300 mm
0 bar g	Min.	3	5	9	21	36	79	138	313	549	863	1 221
	Max.	28	66	142	350	584	1 307	2 275	5 157	9 034	14 207	20 102
5 bar g	Min.	7	13	21	52	87	194	337	764	1 339	2 105	2 979
	Max.	165	390	847	2 080	3 476	7 775	13 533	30 682	53 749	84 525	119 596
10 bar g	Min.	9	17	29	70	117	262	457	1 035	1 814	2 853	4 036
	Max.	304	716	1 554	3 819	6 381	14 273	24 844	56 329	98 676	155 178	219 563
15 bar g	Min.	11	21	34	85	142	317	551	1 250	2 190	3 444	4 873
	Max.	442	1 044	2 265	5 565	9 299	20 801	36 205	82 087	143 801	297 386	319 968
20 bar g	Min.	13	24	40	97	162	363	632	1 434	2 511	3 949	5 588
	Max.	582	1 373	2 979	7 318	12 229	27 354	47 612	107 949	189 105	297 386	420 775
30 bar g	Min.	16	29	48	118	198	442	770	1 745	3 057	4 807	6 801
	Max.	862	2 034	4 414	10 843	18 119	40 529	70 544	159 942	280 187	440 621	623 439

Typical Imperial flowrates

Saturated steam (lb/h)

Pressure		Nominal pipe size										
		½"	¾"	1"	1½"	2"	3"	4"	6"	8"	10"	12"
5 psi g	Min.	6.5	12	20	49	82	183	318	722	1 264	1 988	2 813
	Max.	52	122	265	650	1 087	2 431	4 231	9 594	16 806	26 429	37 395
100 psi g	Min.	15	27	46	112	187	419	728	1 652	2 893	4 550	6 438
	Max.	271	639	1 386	3 405	5 690	12 729	22 156	50 233	87 998	138 386	195 803
200 psi g	Min.	20	37	62	151	253	565	983	2 229	3 905	6 141	8 689
	Max.	493	1 163	2 525	6 203	10 365	23 184	40 354	91 494	160 279	252 055	356 635
300 psi g	Min.	24	45	74	182	304	680	1 184	2 685	4704	7 397	10 466
	Max.	716	1 688	3 664	9 000	15 040	33 642	58 556	132 763	232 575	365 747	517 499
400 psi g	Min.	28	51	85	209	349	780	1 358	3 079	5 393	8 481	12 000
	Max.	941	2 220	4 816	11 831	19 770	44 222	76 971	174 516	305 717	480 771	680 247
500 psi g	Min.	31	57	95	233	389	870	1 514	3 433	6 014	9 457	13 381
	Max.	1 170	2 760	5 988	14 711	24 582	54 987	95 710	217 001	380 148	597 812	845 850

Air (SCFM) at 70 °F

Pressure		Nominal pipe size										
		½"	¾"	1"	1½"	2"	3"	4"	6"	8"	10"	12"
5 psi g	Min.	1.8	3	5	13	22	50	87	198	347	546	773
	Max.	18	41	90	221	369	826	1 437	3 258	5 708	8 976	12 701
100 psi g	Min.	5	9	15	38	63	141	245	555	972	1 529	2 163
	Max.	138	325	704	1 730	2 890	6 466	11 254	25 515	44 698	70 292	99 456
200 psi g	Min.	7	13	21	52	86	193	335	761	1 332	2 059	2 965
	Max.	258	609	1 322	3 248	5 427	12 140	21 131	47 911	83 931	131 895	186 752
300 psi g	Min.	8	15	25	63	104	234	407	922	1 615	2 540	3 594
	Max.	380	896	1 944	4 775	7 978	17 847	31 064	70 431	123 375	19 025	274 529
400 psi g	Min.	10	18	29	72	120	269	467	1 060	1 857	2 920	4 132
	Max.	502	1 183	2 568	6 309	10 542	23 580	41 043	93 057	163 000	256 358	362 724
500 psi g	Min.	11	20	33	80	134	300	521	1 182	2 071	3 257	4 608
	Max.	624	1 472	3 195	7 849	13 115	28 034	51 063	115 775	203 000	318 941	451 272

Water flowrates

Size		m^3/hr		GPM	
		Minimum	Maximum	Minimum	Maximum
Nominal pipe size	DN15 ½"	0.23	5.0	1.0	22.0
	DN20 ¾"	0.30	9.1	1.3	40.0
	DN25 1"	0.50	15.0	2.2	67.0
	DN40 1½"	1.30	38.0	5.5	166.0
	DN50 2"	2.10	63.0	9.2	273.0
	DN80 3"	4.70	140.0	21.0	618.0
	DN100 4"	8.10	244.0	36.0	1 076.0
	DN150 6"	18.00	554.0	81.0	2 437.0
	DN200 8"	32.00	970.0	142.0	4 270.0
	DN250 10"	51.00	1 525.0	224.0	6 715.0
	DN300 12"	72.00	2 158.0	317.0	9 501.0

Sizing considerations

	Straight run piping requirements	Upstream	Downstream
Piping conditions	One 90 ° elbow before the flowmeter	10 D	5 D
	Two 90 ° elbows before the flowmeter	15 D	5 D
	Two 90 ° elbows out of plane before the flowmeter	25 D	5 D
	Reduction before the flowmeter	10 D	5 D
	Expansion before the flowmeter	20 D	5 D
	Partially open valve	25 D	5 D
	D = Internal diameter of the pipe - If there is not a sufficient straight run of pipe, a flow rectifier may be used to reduce the above diameter measurements. Consult your local Spirax Sarco representative or the factory for your specific application.		

Velocity range	Liquid	Maximum	9 metres/second	(30 feet/second)
		Minimum	0.3 metres/second	(1 feet/second)
	Gas or steam	Maximum	90 metres/second	(300 feet/second)
		Minimum	$\frac{6.1}{\sqrt{\text{density}\left(\frac{kg}{m^3}\right)}}$	$\frac{5}{\sqrt{\text{density}\left(\frac{lb}{ft^3}\right)}}$

How to order

Selection:

Category	Description		Suffix Code	Grey = Standard
Flowmeter	In-line multivariable mass vortex flowmeter		**VLM20**	**VLM20 -**
Electronics * Not available with loop powered option	Volumetric flowmeter for liquid		**V**	**V**
	Velocity and temperature sensors		**VT**	
	Velocity, temperature and pressure sensors		**VTP**	
	Velocity, temperature and external 4 - 20 mA input (T or P)		**VTEP**	
	Velocity, external RTD temperature input, external 4 - 20 mA input (T or P)		**VETEP**	
	Energy output option		**VTEM**	
	Energy output options with pressure sensor		**VTPEM**	
	Energy output options, temperature and external 4 - 20 mA input (T or P)		**VTEPEM**	
	Energy output options external RTD temperature input, external 4 - 20 mA input (T or P) *		**VETEPEM**	
Body size and type	DN15 ½" Nominal Bore	DN15 or DN20 connections are not available with body material in carbon steel	**04**	**24**
	DN20 ¾" Nominal Bore		**06**	
	DN25 1" Nominal Bore		**08**	
	DN40 1½" Nominal Bore		**12**	
	DN50 2" Nominal Bore		**16**	
	DN80 3" Nominal Bore		**24**	
	DN100 4" Nominal Bore		**32**	
	DN150 6" Nominal Bore		**48**	
	DN200 8" Nominal Bore		**64**	
	DN250 10" Nominal Bore		**80**	
	DN300 12" Nominal Bore		**96**	
Body material	Stainless steel 316L		**S**	**S**
	Carbon steel A105 - Not available if DN15 or DN20 connections are required		**C**	
Connection	Flanged	ASME Class 150	**150**	**40**
		ASME Class 300	**300**	
		ASME Class 600	**600**	
		EN 1092-1 PN40	**40**	
		EN 1092-1 PN100, DN15 - DN200 only	**100**	
	Wafer	For fitting between ASME Class 300 or EN 1092-1 PN40 flanges	**W**	
Electronics enclosure mounting	Local mount NEMA 4X, IP66 enclosure		**L**	**L**
	Remote electronics	Remote electronics NEMA 4X, IP66 25' cable with display	**R25**	
		25' (7.6 m) Armored cable with glands V meter only	**A25**	
		25' (7.6 m) Armored cable with glands VT, VTP meter only	**A25P**	
		Remote electronics NEMA 4X, IP66 50' cable with display	**R50**	
		50' (15.2 m) Armored cable with glands V meter only	**A50**	
		50' (15.2 m) Armored cable with glands VT, VTP meter only	**A50P**	

'How to order' continued on next page

How to order (continued)

Selection:

Category	Description		Suffix Code	Grey = Standard
Display option	Digital display		**D**	**D**
Power supply	12 - 36 Vdc, 25 mA, 1 W max. required on loop powered meters, 1HL only		**DL**	**DL**
	12 - 36 Vdc, 300 mA, 9 W max.	These options are for use with: 1H, 1M, 1B, 3H, 3M, 3B Output/Comms	**DH**	
	100 - 240 Vac, 50/60 Hz line power, 5 W max.		**AC**	
Output signal	Loop powered	One analogue output (4 - 20 mA), one pulse, HART® DL input power only	**1HL**	**1HL**
	One analogue output	4 - 20 mA, one alarm, one pulse, HART® DH or AC option only	**1H**	
		4 - 20 mA, one alarm, one pulse, MODBUS RTU DH or AC option only	**1M**	
		4 - 20 mA, one alarm, one pulse, BACnet MS/TP DH or AC option only	**1B**	
	Three analogue output	4 - 20 mA, three alarms, one pulse, HART® (VT, VTP only)	**3H**	
		4 - 20 mA, three alarms, one pulse, MODBUS RTU (VT, VTP only)	**3M**	
		4 - 20 mA, three alarms, one pulse, BACnet MS/TP (VT, VTP only)	**3B**	
Process temperature	Standard temperature -200 °C to +260 °C (-330 °F to +500 °F) *Where ATEX is required the lower temperature is limited to -40 °C (-40 °F)		**S**	**S**
	High temperature +260 °C to +400 °C (+500 °F to +750 °F)		**H**	
Pressure sensor	No pressure sensor		**P0**	**P0**
	Maximum 2 bar a (30 psi a), Proof 4 bar a (60 psi a)		**P1**	
	Maximum 7 bar a (100 psi a), Proof 14 bar a (200 psi a)		**P2**	
	Maximum 20 bar a (300 psi a), Proof 41 bar a (600 psi a)		**P3**	
	Maximum 34 bar a (500 psi a), Proof 64 bar a (1 000 psi a)		**P4**	
	Maximum 100 bar a (1 500 psi a), Proof 175 bar a (2 500 psi a)		**P5**	
Approvals	FM/FMC not CE marked		**S**	**A**
	PED and CE marked		**C**	
	ATEX/IECEx/PED and CE marked		**A**	
Face-to-face dimensions	Standard dimensions		**1**	**1**
	Supplied for retrofitting into the space left by either a PhD or VLM10 flowmeter		**2**	

Selection example: VLM20 - V - 24 - S - 40 - L - D - DL - 1HL - S - P0 - A - 1

How to order example:

1 off Spirax Sarco VLM20-V-24-S-40-L-D-DL-1HL-S-P0-A-1 in-line vortex flowmeter for installation between EN 1092 PN40 flanges.