

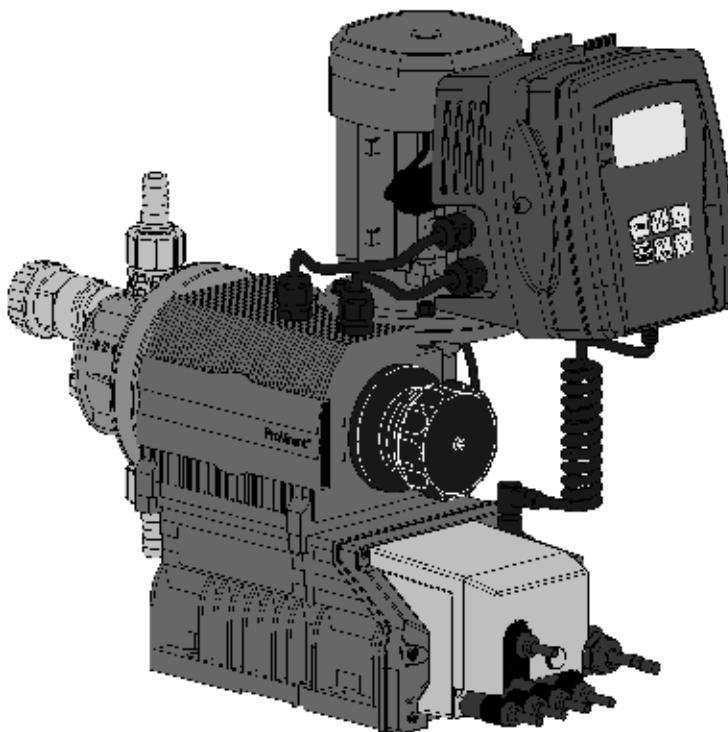
ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Overview: Sigma/ 2 control type (S2Cb)

The Sigma/2 motor diaphragm metering pumps are produced with a high-strength inner housing for parts subject to load as well as an additional plastic housing to protect against corrosion. The capacity range extends from 16.1 to 93.0 gph at a maximum backpressure of 232 to 58 psig. Stroke length is 0.20 in

Under defined conditions and when installed correctly, the reproducibility of the metering is better than $\pm 2\%$ at a stroke length of between 30 % and 100 % (instructions in the operating instructions manual must be followed).

In all motor-driven metering pumps without integrated overload protection, for safety reasons, suitable overload protection must be provided during installation.

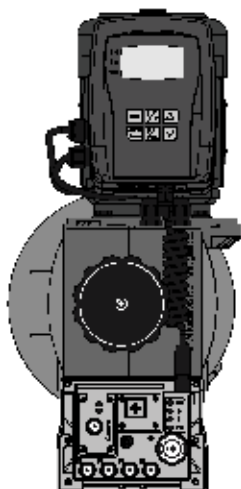


Sigma/ 2 Basic Type (S2Ba)

The Sigma/ 2 basic type is a motor-driven metering pump without internal electronics. Various NEMA 56C frame length motors can be used depending upon the application requirements. The Sigma 2 Basic pump is also suitable for use with inverter duty and DC motors for varying flow requirements.

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Sigma/ 2 control type (S2Cb)

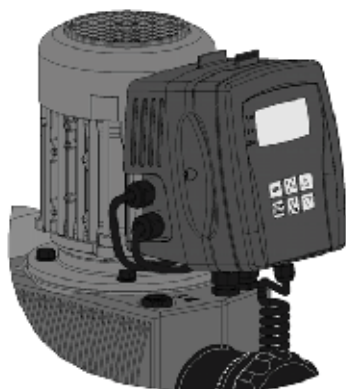


For optional control via contact or analog signals (e.g. 0/4 - 20 mA) the Sigma control type results in good adaptability, even in fluctuating metering requirements.

The microprocessor control is an optimum combination of speed control and stop & go operation, i.e. it works in a wide control field with customized fine adjustment. Moreover it enables an optimum metering result thanks to the metering behavior of the metering pump being matched to the chemicals or application.

The control system measures the movement and speed profile in conjunction with the power demand. This leads to a real reduction in the actually required power, which means an increase in efficiency.

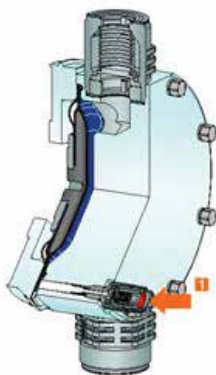
Detachable operating unit (HMI)



The operating unit (HMI) can be attached directly to the metering pump or mounted on the wall alongside the pump or completely removed. This provides the operator with a wide range of options for the integration of a metering system into the overall system that it is readily accessible and easy to use. Moreover, the removable operating unit offers additional protection against unauthorized operation of the metering pump or against changing of the pump settings.

The individual functions of the metering pump can be easily selected and adjusted with five program keys. An illuminated LCD display provides information about the relevant operating status. LEDs on the operating unit and the control unit indicate the active pump functions or the pump status.

Diaphragm rupture warning system



The liquid end has a patented multilayer safety diaphragm as standard and a visual diaphragm rupture indicator.

The diaphragm is coated on both sides with PTFE film. This coating ensures that no leakage to the outside occurs even if the diaphragm ruptures. If the diaphragm ruptures, feed chemical enters between the diaphragm layers and thus triggers a mechanical indication or an alarm via the sensor area. This concept ensures reliable metering - even under critical operating conditions.

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Sigma/ 2 control type (S2Cb)

Metering profiles

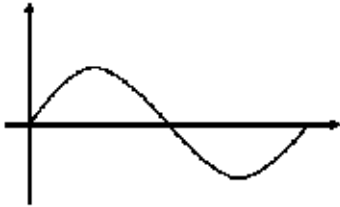


Diagram 1: Discharge stroke, suction stroke equal

Metering profiles ensure optimum metering results, thanks to the metering behavior of the metering pump being matched to the chemicals or application.

The stroke movement of the diaphragm pump is continuously measured and controlled, so that the stroke is executed according to the desired metering profile. The pump can be operated in normal mode (**Diagram 1**), with optimized discharge stroke (**Diagram 2**) or with optimized suction stroke (**Diagram 3**). Three typical metering profiles are shown schematically with the behavior over time.

In normal operating mode the time behavior for the suction stroke and the discharge stroke is similar (**Diagram 1**). In the mode with optimized discharge stroke (**Diagram 2**) the discharge stroke is lengthened while the suction stroke is executed as quickly as possible. This setting is, for example, useful for applications that require optimum mixing behavior and optimized chemical mixing.

In the mode with the optimized suction stroke (**Diagram 3**), the suction stroke is carried out as slowly as possible, which permits precise and trouble-free metering of viscous and gaseous media. This setting should also be chosen to minimize the NPSH value.

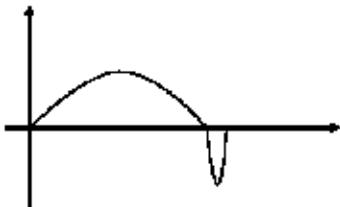


Diagram 2: long discharge stroke, short suction stroke

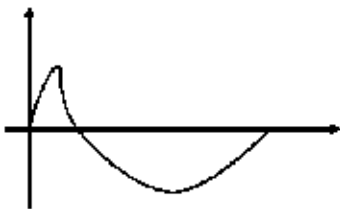


Diagram 3: short discharge stroke, long suction stroke

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Specifications (S2Ba and S2Cb)

General:

Maximum stroke length:	0.196" (5.0 mm) HM; 0.6" (15 mm) HK		
Power cord:	6 feet (2 m) 2 wire + ground (supplied on control versions)		
Stroke frequency control:	S2Ba: Constant speed or optional DC/SCR drive or AC inverter S2Cb: Microprocessor control version with innovative start/stop and variable speed control proportional to set frequency or external control signal.		
Stroke counting:	Standard on S2Cb		
Materials of construction			
Inner casing:	Cast aluminum		
Housing:	Glass-filled Luranyl™ (PPE)		
materials of construction:	Liquid End:	PVDF	316 SS
	Suct./Dis. Connectors:	PVDF	316 SS
	Seals:	PTFE	PTFE
	Check Balls:	Ceramic	SS
Viscosity ranges:	Liquid end version	Max. strokes/min	Viscosity (mPas)
	Standard	180	0-200
	With valve springs	130	200-500
	With valve springs and suction-side feed	90	500-1000*
	* Only when properly installed & adjusted		
Sound pressure level:	Sound pressure level LpA < 70 dB in accordance with EN ISO 20361:2010-10 at max. stroke length, max. stroke rate, max. back pressure (water)		
Drive:	Cam and spring-follower (lost motion)		
Lubrication:	Oil lubricated		
Recommended oil:	ISO VG 460, such as Mobil Gear Oil 634		
Oil quantity:	Approximately 0.6 quart (550 mL)		
ended oil change interval:	5,000 hours		
Warranty:	Two years on drive, one year on liquid end		
Factory testing:	Each pump is tested for rated flow at maximum pressure.		
Industry Standard:	CE approved, CSA available (standard in Canada), NSF/ANSI 61		

Sigma 2 Diaphragm:

<i>Diaphragm materials:</i>	PTFE faced EPDM with Nylon reinforcement and steel core		
<i>Liquid end options:</i>	Polyvinylidene Fluoride (PVDF) or 316 SS, with PTFE seals		
<i>Check valves:</i>	Single ball check, PVDF and SS versions. Optional springs available in Hastelloy C		
<i>Repeatability:</i>	When used according to the operating instructions, better than ±2%		
<i>Max. fluid operating temperatures:</i>	Material	Constant (Max. Backpressure)	Short Term (15 min. @ max.30 psi)
	PVDF	149°F (65°C)	212°F (100°C)
	316 SS	194°F (90°C)	248°F (120°C)
<i>Diaphragm failure indication:</i>	Visual indicator is mandatory. The delivery unit has a patented multilayer safety diaphragm as standard and a visual diaphragm rupture indicator.		
<i>Separation of drive from liquid end:</i>	An air gap with secondary safety diaphragm separates the drive from the liquid end to prevent cross contamination of oil and process fluid (with or without diaphragm failure indication).		
<i>Max. solids size in fluid:</i>	0.3 mm		
<i>Stroke length adjustment:</i>	Manual, in increments of 0.5%. Motorized stroke length adjustment is available.		

Sigma 2 Packed Plunger:

<i>Piston materials:</i>	Ceramic oxide; packing rings of PTFE, packing spring of 316 SS.		
<i>Liquid end options:</i>	316 SS with PTFE seals		
<i>Check valves:</i>	Double ball, stainless steel; optional springs (Hastelloy C4).		
<i>Repeatability:</i>	When used according to the operating instructions, better than ±0.5%		
<i>Max. fluid operating temperatures:</i>	Material	Constant	Short Term
	316 SS	392°F (200°C)	428°F (220°C)
<i>Stroke length adjustment:</i>	Manual, in increments of 0.2%. Motorized stroke length control is optional.		



ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Specifications (S2Ba and S2Cb) Cont.

Sigma 2 Basic Version

<i>Motor mounting flange:</i>	Fits all NEMA 56C frame motors (motor not included with pump)
<i>Gear ratios and stroke frequencies (with 1725 RPM motor):</i>	20:1 = 87 SPM, 11:1 = 158 SPM, 7.25:1 = 238 SPM
<i>Motor coupling:</i>	Flexible coupling included with pump
<i>Required Motor HP:</i>	1/3 HP (0.25 kW)
<i>Full load RPM:</i>	1750 RPM (60 Hz)
<i>Stroke sensor (optional):</i>	Hall effect - requires 5 VDC

Sigma 2 Control Version

<i>Control Function:</i>	At stroke frequencies equal to or greater than 33%, the integral AC variable frequency drive continuously varies the motor speed in a linear response to the incoming signal. At stroke frequencies less than 33%, the motor starts and stops according to a control algorithm to provide the desired stroke frequency. In the start-stop mode the motor speed is constant at approximately 580 RPM.
<i>Enclosure rating:</i>	IP 65
<i>Motor data:</i>	Totally enclosed, fan cooled (IP55); class F insulation; Manufacturer ATB; 0.25 kW (0.33 HP) 230 3 phase (1.2 A, 1690 rpm)
<i>Relay load</i>	
<i>Fault relay only (Option 1):</i>	Contact load: 250 VAC, 8 A, 50/60 Hz Operating life: > 200,000 switch functions
<i>Fault relay with pacing relay (Option 3):</i>	Fault Relay Contact load: 24 V, 8 A, 50/60 Hz Operating life: > 200,000 switch functions Pacing relay Residual impedance in ON-position ($R_{DS(on)}$): < 8 Ω Residual current in OFF-position: < 1 μ A Maximum voltage: 24 VDC Maximum current: < 100 mA (for pacing relay) Switch functions: 750x10 ⁶ Contact closure: 100 ms (for pacing relay)
<i>Air Humidity</i>	Max. air humidity*: 95% rel. humidity * non-condensing
<i>Fuse:</i>	Internal, 6.3 AT - (1.5 kA)
<i>Analog output signal:</i>	Max. impedance 300 Ω Isolated 4-20 mA output signal
<i>Bus interface options available:</i>	CANopen, PROFIBUS DP
<i>Relay cable (optional):</i>	6 feet (2 m) 3 wire (SPDT) 250 VAC, 2 A
<i>Pulse contact/remote pause contact:</i>	With voltage-free contact, or semiconductor sink logic control (not source logic) with a residual voltage of <700 mV. The contact load is approximately 0.5 mA at + 5 VDC. (Note: Semiconductor contacts that require >700 mV across a closed contact should not be used.)
<i>Contact input max. pulse frequency:</i>	25 pulses/sec
<i>Contact input impedance:</i>	10 kOhm
<i>Max. pulse memory:</i>	65,535 pulses
<i>Necessary contact duration:</i>	20ms
<i>Analog - current input burden:</i>	Approximately 120 Ohm
<i>Max. allowable input current:</i>	50 mA
<i>Input power requirements:</i>	single phase, 115-230 VAC

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Capacity Data (S2Ba)

Capacity data: Sigma/ 2 Basic Version

Pump Version	Capacity at Max. Backpressure				Max. Stroke Rate	Output per Stroke	Max. Suction Lift		Max. Suction Pressure		Suction/ Discharge Connector		Weight w/Motor (approx.)	
S2Ba HM	psig	(bar)	GPH	(L/h)	spm	mL/stroke	ft	(m)	psig	(bar)	in	(DN)	lbs	(kg)
16050 PVT	145	(10)	15.9	(60)	87	11.4	23	(7)	44	(3)	1/2 MNPT	(15)	33	(15)
16050 SST	232	(16)	15.1	(57)	87	11.4	23	(7)	44	(3)	1/2 FNPT	(15)	44	(20)
16090 PVT	145	(10)	28	(106)	158	11.4	23	(7)	44	(3)	3/4 MNPT	(15)	33	(15)
16090 SST	232	(16)	25.9	(98)	158	11.4	23	(7)	44	(3)	1/2 FNPT	(15)	44	(20)
16130 PVT	145	(10)	41.2	(156)	238	10.9	23	(7)	44	(3)	3/4 MNPT	(15)	33	(15)
16130 SST	232	(16)	39.1	(148)	238	10.9	23	(7)	44	(3)	1/2 FNPT	(15)	44	(20)
07120 PVT	100	(7)	39.6	(150)	87	27.4	16	(5)	15	(1)	3/4 MNPT	(25)	35	(16)
07120 SST	100	(7)	39.6	(150)	87	27.4	16	(5)	15	(1)	3/4 MNPT	(25)	53	(24)
07220 PVT	100	(7)	69.7	(264)	158	27.4	16	(5)	15	(1)	3/4 MNPT	(25)	35	(16)
07220 SST	100	(7)	69.7	(264)	158	27.4	16	(5)	15	(1)	3/4 MNPT	(25)	53	(24)
04350 PVT	58	(4)	111	(420)	238	29.4	16	(5)	15	(1)	1 MNPT	(25)	35	(16)
04350 SST	58	(4)	111	(420)	238	29.4	16	(5)	15	(1)	1 MNPT	(25)	53	(24)

Capacity Data (S2Cb)

Capacity data: Sigma/ 2 Control Version

Pump Version	Capacity at Max. Backpressure				Max. Stroke Rate	Output per Stroke	Max. Suction Lift		Max. Suction Pressure		Suction/ Discharge Connector		Weight w/Motor (approx.)	
S2Cb HM	psig	(bar)	GPH	(L/h)	spm	mL/stroke	ft	(m)	psig	(bar)	in	(DN)	lbs	(kg)
16050 PVT	145	(10)	16.1	(61)	90	11.4	23	(7)	44	(3)	1/2 MNPT	(15)	33	(15)
16050 SST	232	(16)	14.8	(56)	90	11.4	23	(7)	44	(3)	1/2 FNPT	(15)	44	(20)
16090 PVT	145	(10)	28.8	(109)	160	11.4	23	(7)	44	(3)	3/4 MNPT	(15)	33	(15)
16090 SST	232	(16)	26.2	(99)	160	11.4	23	(7)	44	(3)	1/2 FNPT	(15)	44	(20)
16130 PVT	145	(10)	35.9	(136)	200	10.9	23	(7)	44	(3)	3/4 MNPT	(15)	33	(15)
16130 SST	232	(16)	33	(125)	200	10.9	23	(7)	44	(3)	1/2 FNPT	(15)	44	(20)
07120 PVT	100	(7)	39.1	(148)	90	27.4	16	(5)	15	(1)	3/4 MNPT	(25)	35	(16)
07120 SST	100	(7)	39.1	(148)	90	27.4	16	(5)	15	(1)	3/4 MNPT	(25)	53	(24)
07220 PVT	100	(7)	71.6	(271)	160	27.7	16	(5)	15	(1)	3/4 MNPT	(25)	35	(16)
07220 SST	100	(7)	71.6	(271)	160	27.7	16	(5)	15	(1)	3/4 MNPT	(25)	53	(24)
04350 PVT	58	(4)	93	(352)	200	29.4	16	(5)	15	(1)	1 MNPT	(25)	35	(16)
04350 SST	58	(4)	93	(352)	200	29.4	16	(5)	15	(1)	1 MNPT	(25)	53	(24)

Materials In Contact With Chemicals

Liquid End	Suction/Discharge connector	Valve	Seals/ ball seat	Balls
PVT	PVDF (Polyvinylidene fluoride)	PVDF (Polyvinylidene fluoride)	PTFE/PTFE	Ceramic
SST	Stainless steel	Stainless steel	PTFE/PTFE	Stainless steel

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Identcode Ordering System (S2Ba)

S2Ba	Drive Type												
	HM	Main Drive, Diaphragm											
		Version Capacity:											
		16050	15.9 gph (60 l/h), 145 psi (10 bar)	07120	39.6 gph (150 l/h), 100 psi (7 bar)								
		16090	28.0 gph (106 l/h), 145 psi (10 bar)	07220	69.7 gph (264 l/h), 100 psi (7 bar)	Note: For SS versions see capacity data							
		16130	41.2 gph (156 l/h), 145 psi (10 bar)	04350	111 gph (420 l/h), 58 psi (4 bar)								
		Liquid end material:											
		PV	PVDF										
		SS	316 Stainless Steel										
		Seal:											
		T	PTFE seal										
		Diaphragm type:											
		S	Safety diaphragm w/ visual indicator										
		A	Safety diaphragm w/ pump stop function										
		Liquid end version:											
		0	Without valve springs										
		1	With 2 valve springs (Hastelloy C4, 1 psig)										
		Hydraulic connections:											
		0	No nuts, No inserts										
		7	PVDF clamping nut & insert										
		8	SS clamping nut & insert										
		Logo:											
		0	Standard with logo										
		Motor mount:											
		2	Without motor, with NEMA 56C flange										
		Enclosure rating:											
		0	Standard										
		Stroke sensor:											
0	Without stroke sensor (Standard)												
Stroke length adjustment:													
0	Manual (Standard)												
1	with 3P stroke positioning motor, 230 V 50/60 Hz												
2	with 3P stroke positioning motor, 115 V 50/60 Hz												
4	W/ stroke positioning motor 4-20 mA, 230 V 50/60 Hz												
6	W/ stroke positioning motor 4-20 mA, 115 V 50/60 Hz												
S2Ba	HM	16050	PV	T	S	0	7	0	2	0	0	0	

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Identcode Ordering System (S2Cb)

S2Cb	Drive Type																										
S2Cb	H	Main Drive, Diaphragm	Version: Capacity:																								
			16050	16.1 gph (61 l/h), 145 psi (10 bar)			07120	39.1 gph (148 l/h), 100 psi (7 bar)			Note: For SS versions see capacity data																
			16090	28.8 gph (109 l/h), 145 psi (10 bar)			07220	71.6 gph (271 l/h), 100 psi (7 bar)																			
			16130	35.9 gph (136 l/h), 145 psi (10 bar)			04350	93.0 gph (352 l/h), 58 psi (4 bar)																			
			Liquid end material:																								
			PV	PVDF																							
			SS	Stainless Steel																							
			Seal:																								
			T	PTFE seals																							
			Diaphragm type:																								
			S	Multi-layer safety diaphragm w/ visual indicator																							
			A	Multi-layer safety diaphragm w/ pump stop function																							
			Liquid end version:																								
			0	Without valve springs																							
			1	With 2 valve springs (hastelloy C4, 1 psig)																							
			Hydraulic connections:																								
			0	No Nuts, no inserts																							
			7	PVDF clamping nut & insert																							
			8	Stainless steel clamping nut & insert																							
			Logo:																								
			0	Standard with ProMinent logo																							
			Electrical Connection (± 10%):																								
			U	1ph, 115 V - 230 V 50/60Hz																							
			Cable and plug:																								
			8	Open end 3m UL/CSA 115/230V																							
			D	North American plug, 115 V																							
			X	Without cable																							
			Relay:																								
			0	No relay																							
			1	Fault indicating relay																							
			3	Option 1 + pacing relay																							
			8	4-20 mA output + fault/pacing relay																							
			Control variant:																								
			0	Manual + External with pulse control (mult/div)																							
			1	Manual + External with pulse control & analog																							
			6	*Option 1 + PROFIBUS® (M12 plug)																							
			Over Pressure Shut-off:																								
			0	Without over pressure shut-off																							
			Operating unit (HMI):																								
			S	HMI + 1.64' (0.5) cable																							
			1	HMI + 6.5' (2.0 m) cable																							
			2	HMI + 16.4' (5.0 m) cable																							
			X	Without HMI																							
			Access Code:																								
			0	Without access code																							
			1	Access code																							
			Language:																								
			EN	English																							
			approval:																								
			01	CE																							
			S2Cb	H	16050	PV	T	S	0	0	0	U	D	0	0	0	S	0	EN	01							

*With the option PROFIBUS®-DP no relay can be selected

ProMinent®

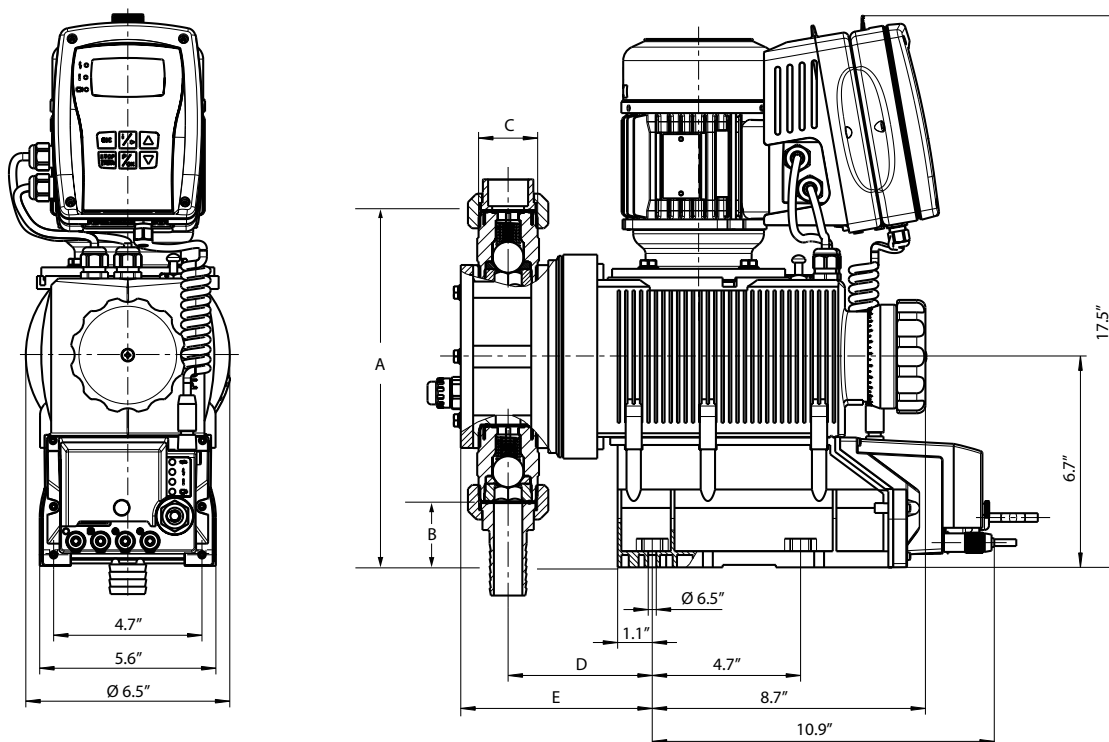
motor-driven
metering pumps



** Dimensions with diaphragm failure detector.

ProMinent® Sigma/ 2 Motor Diaphragm Metering Pumps

Dimensional Drawing: (S2Cb)



Dimensions in inches (mm)

Type Sigma 2	A	B	C*	D	E
<i>16050, 16090, 16130</i>					
PVT	10.1 (257)	6.95 (177)	DN 15	4.4 (111)	5.7 (144)
SS	10.9 (276)	8.2 (208)	DN 15	4.3 (110)	5.2 (133)
<i>07120, 07220</i>					
PVT	13.3 (337)	13.1 (332)	DN 25	4.6 (117)	6.1 (155)
SS	13.3 (337)	13.1 (332)	DN 25	4.6 (117)	5.8 (147)
<i>04350</i>					
PVT	14.3 (362)	14.1 (358)	DN25	4.6 (117)	6.1 (155)
SS	14.3 (362)	14.1 (358)	DN25	4.6 (117)	5.8 (147)

* Suction/ Discharge valve thread

Piping adapters provided according to technical data