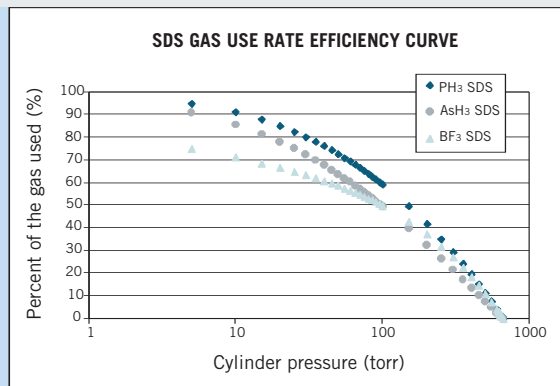


# Safe Delivery Source (SDS™) Series

## Low Pressure Mass Flow Controllers for SDS

- » Unit SDS MFCs make SDS gases a cost-effective solution for ion implant and future CVD applications
- » Safe, precise, reliable, and inexpensive flow control at the lowest practical SDS pressures
- » Makes it possible to use up to 95% of SDS cylinder contents
- » Available with RS485 and analog interface



SDS gas use rate efficiency curve

### Features at a glance

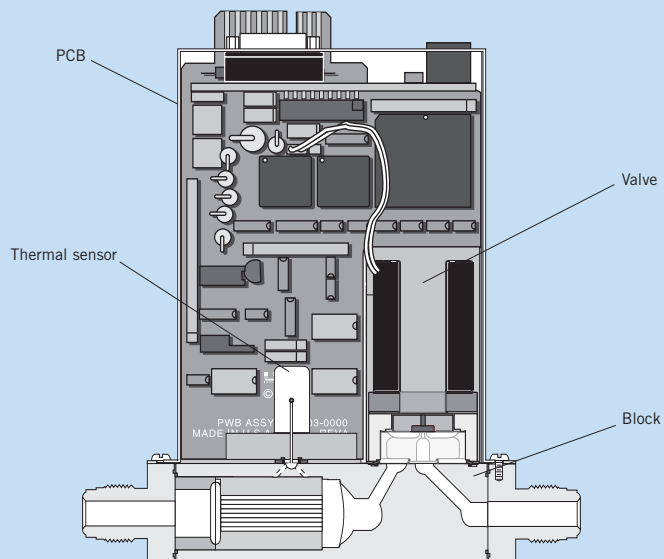
- Full scale flow at 8 torr (N<sub>2</sub> equivalent). Minimum operating pressure of 2.5 torr
- Response time of less than 3 seconds at 15 torr
- Purge flow of 200 sccm/psi
- 100% tested to pressure and flow specifications
- Outstanding leak integrity specified to  $1 \times 10^{-10}$  atm-cc/sec (He) and typically tested to better than  $2 \times 10^{-12}$
- Same size as standard MFCs which makes retrofits much easier. Can be simply swapped out for existing MFCs. For best performance, always consult your implanter supplier when upgrading to SDS.
- Utilizes thermal mass flow sensors, insensitive to gas pressure and temperature changes, and able to operate in molecular flow
- Adapted from the field proven technology of the 1660/8160 family of mass flow products
- All metal sealed
- 3 year warranty

### SDS™

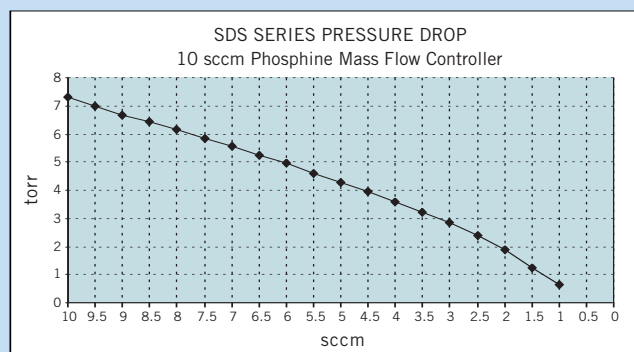
Unit SDS Series mass flow controllers are the first MFCs to routinely control ion implanter gas flow at supply pressures below 50 torr. This capability makes SDS gas delivery systems much more cost effective because they can deliver nearly 60% more gas

from each SDS cylinder. The new SDS process brings arsine, phosphine and other pure dopants to ion implanters adsorbed on a solid medium within the gas cylinder. Because the gas is adsorbed rather than simply pressurized within the cylinder, the gas remains below atmospheric pressure. This minimizes the possibility of dangerous leaks. The cylinders also contain up to fifteen times the amount of dopant of conventional pressurized sources.

The amount of gas which can be extracted from an SDS source is highly dependent on pressure. This is illustrated in the SDS desorbed species information in Figure 1. It is readily apparent from this that most of the gas contained in the source is released at pressures below 100 torr. In an implanter, the cylinder is connected to the vacuum ion source through an MFC to accurately and automatically control the flow rate. The minimum cylinder pressure that can be reached is limited by the highest conductance the MFC can achieve at the desired flow rate. Most conventional MFCs require a 50 torr differential pressure at 5 sccm. At 50 torr, only about 65% of the contents of the cylinder can be extracted from the adsorbent medium at normal operating temperatures.



Typical mass flow controller cutaway view



This graph demonstrates Celerity Unit SDS Series MFCs minimal pressure drop. These models control 100% full scale flow to 8 torr and continues to control flows beyond that.

Celerity's unique SDS MFCs can deliver 10 sccm with only 8 torr differential pressure. At 8 torr, up to 95% of the contents of the cylinder can be extracted. These MFCs will deliver usable amounts of species to 2.5 torr. Additional gas made available from each cylinder with SDS MFCs translates directly into a very significant cost savings. Less frequent replacement of gas bottles reduces ion implanter down-time. The payback period for converting to Unit's SDS Series MFCs is often only a few months. They also generate a constant stream of species cost savings that will continue through the years.

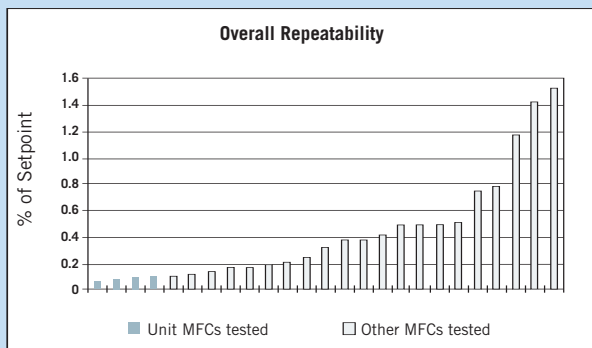
- Real time in situ reranging, monitoring, diagnostics and trouble-shooting to reduce equipment downtime and cost of ownership
- User-friendly Windows-based virtual interface software to monitor and control up to 32 MFCs daisy chained together
- Models 1663 and 8163 drop-in replacement for analog MFCs
- Available with dual analog connector: cardedge and choice of 9 pin or 15 pin 'D' connector

## The Celerity advantage

- Digital control, analog, and RS485 communications
- Accuracy of  $\pm 1\%$  of setpoint compared to  $\pm 1\%$  of full scale for models 1662 and 8162.
- Superior accuracy required for CVD applications using pure dopant source
- High resolution calibration control that utilizes a 32 point calibration table for each gas resulting in a ten-fold improvement in accuracy
- Programmable turn-on response time from less than 1 second up to 20 seconds to meet your process requirements

## Communications options

All unit digital products have the ability to communicate via analog, RS485, DeviceNet, and PROFIBUS. A variety of connector options are available to meet interface requirements.



In independent testing, Unit MFCs had the best repeatability of those tested. Lower values indicate better performance.

## CrossChek™ metrology system



Celerity's world-class CrossChek calibration methodology maintains SPC-verified calibration accuracy with  $\pm 3$  sigma limit (99.7% confidence level) compared to  $\pm 1$  or 2 sigma limits (67% to 95% confidence level) for other manufacturers.

CrossChek calibration methodology provides ongoing verification of production calibration standards. This ensures consistent and repeatable accuracy performance within  $\pm 3$  sigma of published specifications. No other flow control company offers the same guarantee.

## 24/7 service and support

Celerity is unmatched in the industry for service and support. We have worldwide service locations with calibration, application support, and repair capabilities, operating 24 hours a day, 7 days a week. Celerity's website also provides updated application and technical support.

Visit us at [www.celerity.net](http://www.celerity.net).

## Warranty

- 3 year standard warranty
- Extended warranty option available

## SDS Series Low Pressure Mass Flow Controllers for SDS Safe Delivery Source

### Performance

Settling time (to within 2% of setpoint):	
Fast start	< 3.0 sec at 15 torr and < 1.0 sec > 700 torr (per SEMI E17-91)
Soft start	Linear 20% per sec (0 to 100% in 5 sec)
Accuracy ( $\pm 3\sigma$ per SEMI E56-96):	
Model 1662/1662L/8162/8162L	$\pm 1\%$ full scale
Model 1663/8163 series:	$\pm 0.35\%$ setpoint < 35% full scale $\pm 1\%$ setpoint > 35% full scale
Repeatability (full scale)	$\pm 0.15\%$ (per SEMI E56-96)
Linearity (full scale)	$\pm 0.5\%$ (per SEMI E27-92)
Inlet pressure coefficient	0.0025% per psi (N <sub>2</sub> )
Ambient temp. coefficient	Zero: 0.03% F.S. per °C; Span: 0.5% F.S. per °C
Leak integrity	$1 \times 10^{-10}$ atm-cc/sec (He) (per SEMI E16-90)
Automatic zero	1662/8162/8262 (optional); 1663/8163 (user programmable in software)
Zero drift	$\leq 0.6\%$ per year without auto zero
Thermal siphoning/ Attitude sensitivity	< 0.1% full scale (30 psi SF <sub>6</sub> )

### Operating limits

Standard flow range	2 sccm to 200 sccm* (N <sub>2</sub> equivalent)
Min. pressure at F.S. flow	4 torr for 2 sccm to 25 sccm ranges (N <sub>2</sub> equivalent); 10 torr for 50 sccm to 200 sccm ranges (N <sub>2</sub> equivalent)
Operating pressure range	2.5 torr to 15 psig
Control range (full scale)	2-100%
Valve leak rate	$\approx 1\%$ full scale
Gases	AsH <sub>3</sub> , PH <sub>3</sub> , BF <sub>3</sub> , SiF <sub>4</sub> , Ar, Xe, N <sub>2</sub> O and N <sub>2</sub>
Ambient temp. range	0-50°C (32-122°F)
Differential operating pressure	1.33-207 kPa typ. (10 torr—30 psid typ.)
Max. operating pressure	1,135 kPa (150 psi) in purge cycle
Max. overrange pressure	3,500 kPa (500 psig)
Proof Pressure	1,400 kPa (2,000 psig)
Warm-up period	30 minutes
Mounting position	Any position
Valve	Normally closed or normally open solenoid

\*Models 1662L and 8162L control flow up to 25 sccm

### Electrical characteristics

Input/Output signal:	
Setpoint input	0-5 VDC linearly proportional to required flow
Output monitor	0-5 VDC linearly proportional to flow rate
Valve off	External: TTL signal
Auto shut-off	Setpoint < 2% full scale commands valve off
Power controller:	
1662/8162/8262 (analog)	+15 VDC (100 mA max.); -15 VDC (200 mA max.)
1663/8163 (RS485)	+15 VDC (160 mA max.); -15 VDC (160 mA max.)
Power consumption	1662/8162/8262 = 4.5 watts max., 1663/8163 = 5 watts max.
Mating connector	20 pin cardedge 3M 3461-0001 or equiv. with lockdowns (optional), 15 Pin 'D' UDU-15 AMP745184 or equiv., 9 pin 'D' UDS9 or equiv.
CE certified	Immune to radiated energy 10 V/m, 30-850 mHz

### Mechanical characteristics

Surface finish	Model 1662/1663 (SDS): 10μ inch Ra Model 8162/8163/8262 (SDS): 4μ inch Ra
Fittings	1/4" VCR®
Valve position	Downstream
Materials:	
Wetted components	316L SS/K-M45/Nickel/7 MO+ (per SEMI #2249A)
Weight	1.2 kg (2.65 lbs)

### Calibration references

Traceability	National Institute of Standards and Technology (N.I.S.T.)
Standard temp. and pressure	0°C and 760 mm Hg (per SEMI E12-96)

Specifications and features are subject to change without notice.

All specifications reflect nitrogen calibration using Molbloc/Molbox™ transfer standards.

Calibration by primary standards and surrogate gases is available as an additional charge option.

CrossChek™ calibration methodology maintains SPC-verified calibration accuracy with  $\pm 3\sigma$  limit (99.7% confidence level).

# SDS Series Product Configuration

<b>C</b>	<b>1662</b>	Safe Delivery Source, Mass Flow Controller
	<b>1662L</b>	Safe Delivery Source, Mass Flow Controller, 4 Torr
	<b>1663</b>	Safe Delivery Source, RS485 Digital Interface, Mass Flow Controller
	<b>1664</b>	Safe Delivery Source, Network Interface (DeviceNet)
	<b>8162</b>	Safe Delivery Source, Mass Flow Controller, Ultraclean (4Ra)
	<b>8162L</b>	Safe Delivery Source, Mass Flow Controller, Ultraclean (4Ra), 4 Torr
	<b>8163</b>	Safe Delivery Source, Mass Flow Controller, Ultraclean (4Ra)
	<b>8164</b>	Safe Delivery Source, Network Interface (DeviceNet), Ultraclean (4Ra)
	<b>8262</b>	Safe Delivery Source, Mini-style, Ultraclean (4Ra)
	<b>8563</b>	Safe Delivery Source, RS485 Digital Interface, Ultraclean (4Ra) available in DB Seal only
	<b>8564</b>	Safe Delivery Source, Network Interface (DeviceNet), Ultraclean (4Ra) available in DB Seal only

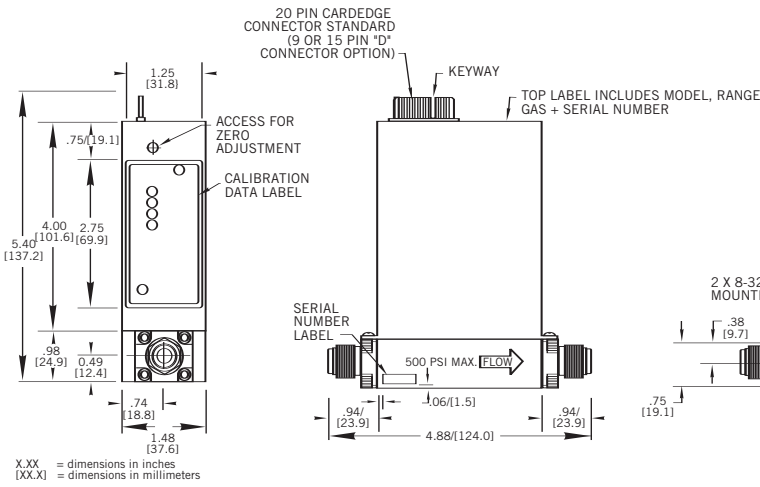
  

<b>A</b>	Auto Shut-off
<b>X</b>	No Auto Shut-off
<b>F</b>	Fast Start < 1 Second Response
<b>XXXX</b>	Gas (See Gas Chart for Configuration) (example: 0013=Nitrogen)
<b>XXXX</b>	Range: 2 sccm-200 sccm N <sub>2</sub> (example: 010C=10 sccm)
<b>DB</b>	Downported—C Seal
<b>WB</b>	Downported—W Seal
<b>4R</b>	1/4" VCR Fitting (Not available on 8563 nor 8564)
<b>HOV</b>	Horizontal or Vertical Mounting Attitude (Standard)
<b>HOS</b>	Horizontal or Side
<b>V</b>	Vacuum Downstream Pressure
<b>M M</b>	Metal O-Ring/Metal Seat
<b>B</b>	15 Pin "D" Connector (UDB15) Brooks Pin-out 0-5 VDC (1662, 1662L, 8162, 8162L, 8262, 8562)
<b>D</b>	DeviceNet Connector (1664, 8164, 8564 only)
<b>E</b>	Cardedge Connector 0-5 VDC (1662, 1662L, 1663, 8162, 8162L)
<b>K</b>	15 Pin "D" Connector (UDK15) 0-5 VDC, MKS Compatible (1662, 1662L, 8162)
<b>L</b>	Cardedge Lockdown Connector 0-5 VDC (1662, 1662L, 8162)
<b>U</b>	15 Pin "D" Connector (UDU15) 0-5 VDC (1662, 1662L, 1663, 8162, 8563)
<b>T</b>	9 Pin "D" Connector (UDU9) Unit 0-5 VDC (1662, 1662L, 1663, 8162)
<b>M</b>	15 Pin "D" Connector with MKS Pin-out 0-5 VDC (8262 only)
<b>XXXX</b>	Customer Special Request (CSR) Consult Factory
<b>C</b>	Normally Closed (Standard)
<b>S</b>	Standard (Valve Downstream)
<b>A</b>	Auto-Zero Enabled
<b>X</b>	Auto-Zero Disabled
<b>10E</b>	16μ inch Ra Finish (1662, 1662L, 1663)
<b>04E</b>	4μ inch Ra Finish (8162, 8162L, 8262)
<b>00</b>	0° C Reference Calibration (Standard)

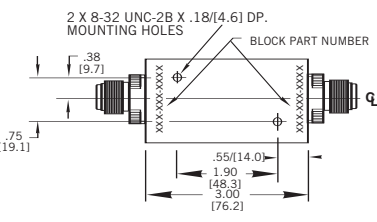
  

Example:

C	1662	A	F	0013	100C	4R	HOV	V	M	M	U	XXXX	C	S	X	10E	00
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Fitting type	Overall	Inlet	Outlet
1/4" VCR Male	4.88 in./124.0 mm	0.94 in./23.9 mm	0.94 in./23.9 mm
Downported 'C' Bore	4.14 in./105.2 mm	0.57 in./14.5 mm	0.57 in./14.5 mm
Downported 'C'	4.14 in./104.9 mm	0.57 in./14.5 mm	0.57 in./14.5 mm
Downported 'W'	4.14 in./104.9 mm	0.57 in./14.5 mm	0.57 in./14.5 mm



NOTE: For dimension drawings of products not listed here, please visit our website at [www.celerity.net](http://www.celerity.net). Click on "products & solutions", on "technical data", on "Unit MFC drawings", then select the product drawing file to download the pdf.



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