

Thermal Mass Flow Controllers for PV Applications

- Best-in-class accuracy and repeatability
- Compact robust design and stable performance
- Multigas option
- Customized solutions (OEM)

For PVD & CVD process automation, diffusion treatment of c-Si!



Applications

Thin Film PV

- Compound CIGS
- Thin film Si
- Thin film CdTe
- Organic dye-sensitized



Crystalline Silicon PV

- Polycrystalline Si
- Single-crystalline Si



Thin Film Deposition

Thin Film Deposition

AR Coating

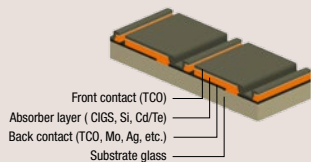
Diffusion Treatment

Physical Vapor Deposition (PVD)

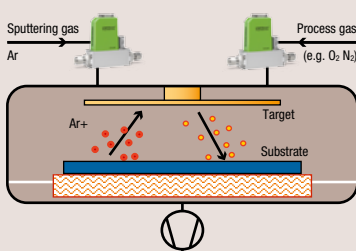
Thin film PV: coating of front/back contacts and absorber layers

- Process repeatability & performance stability
- Non-aggressive inert gases (best suitable for thermal measurement principle)
- Success record with existing customers

Typical structure of thin film PV cell



- Sputter and process gases injection (Ar, O₂, N₂)



Chemical Vapor Deposition (CVD)

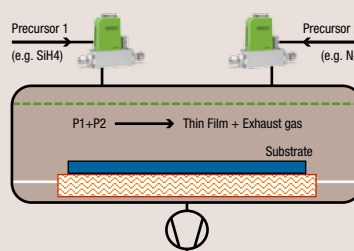
c-Si: deposition of SiO₂ and Si₃N₄ layers; thin film Si: absorber layer

- Best accuracy and repeatability
- Robust performance due to large bypass channel cross-section (0.9 x 1.5 mm²)
- Incoming gas filtering for even better protection from clogging

No Clogging!

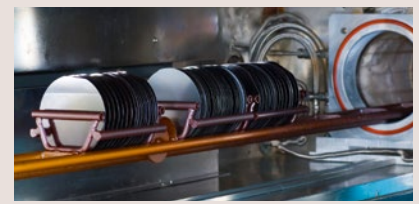


- SiH₄ injection (PECVD) or carrier gas injection (bubbler vaporizer systems for MOCVD)



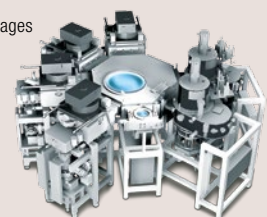
Diffusion Furnace

- Repeatability, accuracy, stability
- Flows up to 200 slm (OEM)
- Technology advantage with non-aggressive, inert gases

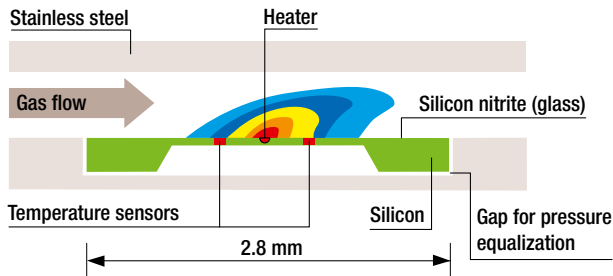


Reasons for Success

- Repeatability
- Accuracy
- Long term stability
- Low price due to technology advantages

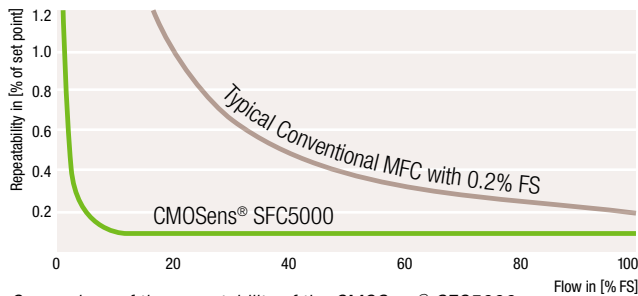


High Performance Measurement Principle

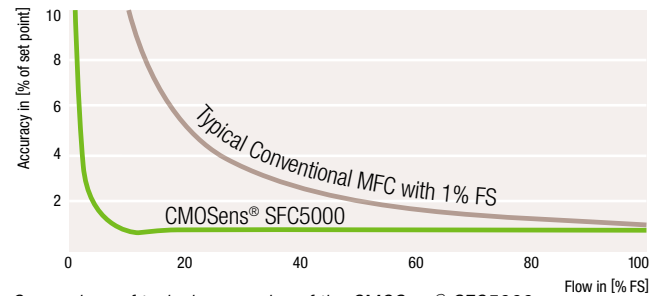


Integrated flow measurement principle

**Excellent repeatability,
highest accuracy!**



Comparison of the repeatability of the CMOSens® SFC5000 device compared to a typical mass flow controller (MFC)



Comparison of typical accuracies of the CMOSens® SFC5000 device compared to a typical mass flow controller (MFC)

Specifications

Model	SFC5400		SFC5300 (OEM)
Flow range ¹	0...10 slm	20...100 slm	0...10 slm
Repeatability, % of reading ²	0.1 % s.p.	0.2 % s.p.	0.2 % s.p.
Repeatability, % of full scale ²	0.01 % FS	0.02 % FS	0.02 % FS
Accuracy, % of reading ³	0.8 % s.p.	1 % s.p.	2 % s.p.
Accuracy, % of full scale ³	0.08 % FS	0.1 % FS	0.2 % FS
Pressure drop at full flow	<2 bar	<3 bar	<2 bar
Interface (Input, Output)	digital (RS485, IO...Link) and analog (0...5 VDC, 0...10 VDC or 4...20 mA)		digital (RS485, IO...Link) and analog (0...5 VDC, 0...10 VDC or 4...20 mA)
Settling time	<50 ms	<100 ms	<100 ms
Available calibrations	Air, N ₂ , H ₂ , He, O ₂ , Ar, CH ₄ , SF ₆ , C ₄ F ₈ and others on request		Air, N ₂ , H ₂ , He, O ₂ , Ar, CH ₄ and others on request
Gastype switchable by software	yes	yes	yes
Power supply nominal	15.0...24.0 Vdc		15.0...24.0 Vdc
Electric connector	Sub-D 9pin		Sub-D 9pin
Mounting, gas connection	Downmount, Swagelok, VCR, VCO		Downmount
Max. working pressure ⁴	10 bar		10 bar
Operation temperature ⁴	0...50 C°		0...50 C°

¹ slm = standard liters per minute, ^{2,3} whichever is bigger, ⁴ different ranges on request

SENSIRION AG
Laubisruetistrasse 50
CH- 8712 Staefa ZH
Switzerland

phone: +41 44 306 40 00
fax: +41 44 306 40 30
www.sensirion.com
info@sensirion.com

Sensirion Inc., USA
phone: +1 805 409 4900
info_us@sensirion.com

Sensirion Korea Co. Ltd.
phone: +82 31 345 0031 3
info@sensirion.co.kr

Sensirion Japan Co. Ltd.
phone: +81 3 3444 4940
info@sensirion.co.jp

Sensirion China Co. Ltd.
phone: +86 755 8252 1501
info@sensirion.com.cn

To find your local representative, please visit www.sensirion.com/locations