

## GAS CORRECTION FACTORS FOR THERMAL-BASED MASS FLOW CONTROLLERS

### FLOW MEASUREMENT, CONTROL & VERIFICATION

- Thermal & Pressure-based Mass Flow Controllers & Meters
- In Situ Flow Verifiers
- Flow Ratio Controllers
- Flow-related Products



The following table lists theoretical gas correction factors for various gases with respect to Nitrogen for thermal-based mass flow controllers. Please note that a non-linearity may exist between a Nitrogen calibration and the actual flow of process gases.

Gas	Symbol	Specific Heat, CP cal/g°C	Density g/l @ 0°C	Conversion Factor
Air	---	0.240	1.293	1.00
Ammonia	NH <sub>3</sub>	0.492	0.760	0.73
Argon	Ar	0.1244	1.782	1.39
Arsine	AsH <sub>3</sub>	0.1167	3.478	0.67
Boron Trichloride	BCl <sub>3</sub>	0.1279	5.227	0.41
Bromine	Br <sub>2</sub>	0.0539	7.130	0.81
Carbon Dioxide	CO <sub>2</sub>	0.2016	1.964	0.70*
Carbon Monoxide	CO	0.2488	1.250	1.00
Carbon Tetrachloride	CCl <sub>4</sub>	0.1655	6.86	0.31
Carbon Tetrafluoride (Freon - 14)	CF <sub>4</sub>	0.1654	3.926	0.42
Chlorine	Cl <sub>2</sub>	0.1144	3.163	0.86
Chlorodifluoromethane (Freon - 22)	CHClF <sub>2</sub>	0.1544	3.858	0.46
Chloropentafluoroethane (Freon - 115)	C <sub>2</sub> ClF <sub>5</sub>	0.164	6.892	0.24
Chlorotrifluoromethane (Freon - 13)	CClF <sub>3</sub>	0.153	4.660	0.38
Cyanogen	C <sub>2</sub> N <sub>2</sub>	0.2613	2.322	0.61
Deuterium	D <sub>2</sub>	1.722	0.1799	1.00
Diborane	B <sub>2</sub> H <sub>6</sub>	0.508	1.235	0.44
Dibromodifluoromethane	CBr <sub>2</sub> F <sub>2</sub>	0.15	9.362	0.19
Dichlorodifluoromethane (Freon - 12)	CCl <sub>2</sub> F <sub>2</sub>	0.1432	5.395	0.35
Dichlorofluoromethane (Freon - 21)	CHCl <sub>2</sub> F	0.140	4.592	0.42
Dichloromethylsilane	(CH <sub>3</sub> ) <sub>2</sub> SiCl <sub>2</sub>	0.1882	5.758	0.25
Dichlorosilane	SiH <sub>2</sub> Cl <sub>2</sub>	0.150	4.506	0.40
1,2-Dichlorotetrafluoroethane (Freon - 114)	C <sub>2</sub> Cl <sub>2</sub> F <sub>4</sub>	0.160	7.626	0.22

<b>1,1-Difluoroethylene</b> (Freon - 1132A)	C <sub>2</sub> H <sub>2</sub> F <sub>2</sub>	0.224	2.857	0.43
<b>2,2-Dimethylpropane</b>	C <sub>5</sub> H <sub>12</sub>	0.3914	3.219	0.22
<b>Ethane</b>	C <sub>2</sub> H <sub>6</sub>	0.4097	1.342	0.50
<b>Fluorine</b>	F <sub>2</sub>	0.1873	1.695	0.98
<b>Fluoroform</b> (Freon - 23)	CHF <sub>3</sub>	0.176	3.127	0.50
<b>Freon - 11</b>	CCl <sub>3</sub> F	0.1357	6.129	0.33
<b>Freon - 12</b>	CCl <sub>2</sub> F <sub>2</sub>	0.1432	5.395	0.35
<b>Freon - 13</b>	CClF <sub>3</sub>	0.153	4.660	0.38
<b>Freon - 13 B1</b>	CBrF <sub>3</sub>	0.1113	6.644	0.37
<b>Freon - 14</b>	CF <sub>4</sub>	0.1654	3.926	0.42
<b>Freon - 21</b>	CHCl <sub>2</sub> F	0.140	4.592	0.42
<b>Freon - 22</b>	CHClF <sub>2</sub>	0.1544	3.858	0.46
<b>Freon - 23</b>	CHF <sub>3</sub>	0.176	3.127	0.50
<b>Freon - 113</b>	C <sub>2</sub> Cl <sub>2</sub> F <sub>3</sub>	0.161	8.360	0.20
<b>Freon - 114</b>	C <sub>2</sub> Cl <sub>2</sub> F <sub>4</sub>	0.160	7.626	0.22
<b>Freon - 115</b>	C <sub>2</sub> ClF <sub>5</sub>	0.164	6.892	0.24
<b>Freon - 116</b>	C <sub>2</sub> F <sub>6</sub>	0.1843	6.157	0.24
<b>Freon - C318</b>	C <sub>4</sub> F <sub>8</sub>	0.1866	8.93	0.164
<b>Freon - 1132A</b>	C <sub>2</sub> H <sub>2</sub> F <sub>2</sub>	0.224	2.857	0.43
<b>Helium</b>	He	1.241	0.1786	1.45
<b>Hexafluoroethane</b> (Freon - 116)	C <sub>2</sub> F <sub>6</sub>	0.1843	6.157	0.24
<b>Hydrogen</b>	H <sub>2</sub>	3.419	0.0899	1.01
<b>Hydrogen Bromide</b>	HBr	0.0861	3.610	1.00
<b>Hydrogen Chloride</b>	HCl	0.1912	1.627	1.00
<b>Hydrogen Fluoride</b>	HF	0.3479	0.893	1.00
<b>Isobutylene</b>	C <sub>4</sub> H <sub>8</sub>	0.3701	2.503	0.29
<b>Krypton</b>	Kr	0.0593	3.739	1.543
<b>Methane</b>	CH <sub>4</sub>	0.5328	0.715	0.72
<b>Methyl Fluoride</b>	CH <sub>3</sub> F	0.3221	1.518	0.56
<b>Molybdenum Hexafluoride</b>	MoF <sub>6</sub>	0.1373	9.366	0.21
<b>Neon</b>	Ne	0.246	0.900	1.46
<b>Nitric Oxide</b>	NO	0.2328	1.339	0.99
<b>Nitrogen</b>	N <sub>2</sub>	0.2485	1.250	1.00
<b>Nitrogen Dioxide</b>	NO <sub>2</sub>	0.1933	2.052	**
<b>Nitrogen Trifluoride</b>	NF <sub>3</sub>	0.1797	3.168	0.48

<b>Nitrous Oxide</b>	N <sub>2</sub> O	0.2088	1.964	0.71
<b>Octafluorocyclobutane</b> (Freon - C318)	C <sub>4</sub> F <sub>8</sub>	0.1866	8.93	0.164
<b>Oxygen</b>	O <sub>2</sub>	0.2193	1.427	0.993
<b>Pentane</b>	C <sub>5</sub> H <sub>12</sub>	0.398	3.219	0.21
<b>Perfluoropropane</b>	C <sub>3</sub> F <sub>8</sub>	0.194	8.388	0.17
<b>Phosgene</b>	COCl <sub>2</sub>	0.1394	4.418	0.44
<b>Phosphine</b>	PH <sub>3</sub>	0.2374	1.517	0.76
<b>Propane</b>	C <sub>3</sub> H <sub>8</sub>	0.3885	1.967	0.36
<b>Propylene</b>	C <sub>3</sub> H <sub>6</sub>	0.3541	1.877	0.41
<b>Silane</b>	SiH <sub>4</sub>	0.3189	1.433	0.60
<b>Silicon Tetrachloride</b>	SiCl <sub>4</sub>	0.1270	7.580	0.28
<b>Silicon Tetrafluoride</b>	SiF <sub>4</sub>	0.1691	4.643	0.35
<b>Sulfur Dioxide</b>	SO <sub>2</sub>	0.1488	2.858	0.69
<b>Sulfur Hexafluoride</b>	SF <sub>6</sub>	0.1592	6.516	0.26
<b>Trichlorofluoromethane</b> (Freon - 11)	CCl <sub>3</sub> F	0.1357	6.129	0.33
<b>Trichlorosilane</b>	SiHCl <sub>3</sub>	0.1380	6.043	0.33
<b>1,1,2-Trichloro - 1,2,2-Trifluoroethane</b> (Freon - 113)	CCl <sub>2</sub> FCF <sub>2</sub> <i>or</i> C <sub>2</sub> Cl <sub>3</sub> F <sub>3</sub>	0.161	8.360	0.20
<b>Tungsten Hexafluoride</b>	WF <sub>6</sub>	0.0810	13.28	0.25
<b>Xenon</b>	Xe	0.0378	5.858	1.32
** <a href="#">Consult MKS Instruments</a>				
<b>Note:</b> Standard pressure is defined as 760 mmHg (14.7 psia). Standard temperature is defined as 0°C.				

[Find gas correction factors for ionization vacuum gauges here.](#)

#### Need help?

Contact an Application Specialist by [sending an email to MKS Instruments](#) or call **978-645-5500**.

