
# GFC-TN | Thermal Gas Flow Controller

## ECONOMICAL SOLUTION

An economical thermal solution, servicing broader applications and markets. Pivotal Systems' GFC-TN offers a thermal MFC solution for a wide flow range from 2 SCCM to 500 SLM. At Pivotal Systems, we aim to significantly enhance fab productivity and capital efficiency by utilizing our innovative solutions.

### Benefits of GFC-TN

- Wide flow range 2 SCCM–500 SLM
- Economical solution
- Communications available in Analog, RS-485, DeviceNET, EtherCAT, Profibus, and Profinet

### Key Features

- No fixed orifice
- Multi-gas configurable with 350+ gases supported

PIVOTAL
SYSTEMS

Preliminary Spec 10-141-301 Rev A Updated November 2025

# GFC-TN Specifications

| | | |
|---|---|---|
| Performance | Flow Range (N2 Equivalent) | 2 sccm-500,000 sccm (500 slm) F.S. |
| | Flow Accuracy | For bin sizes ≤50 slm: ±1% of Setpoint at 25-100% F.S. & ±0.25% of F.S. at 2-25% F.S.<br>For bin sizes >50 slm: ±2% F.S. |
| | Repeatability | ±0.15% F.S. |
| | Response Time | N2 Eqv flow rates 2~50 sccm: 1.5s to ±1% F.S. from target SP for 10-100% F.S.<br>N2 Eqv flow rates 50 sccm-50 slm: 1s to ±1% F.S. of target SP for 10-100% F.S.<br>N2 Eqv flow rates 50 slm-500 slm: 3s to ±2% F.S of target SP for 10-100% F.S. |
| | Leak Integrity | Viton: ≤ 1E-8 atm·cc/sec (He)<br>Metal: ≤ 1E-10 atm·cc/sec (He) |
| | Leak by Rate | <0.5% F.S. for N/O and N/C valve types |
| Operating Conditions | Differential Pressure Range | For 2 sccm-5 slm: 0.05-0.28 MPa (7.25-40.61 psid)<br>For 5-23 slm: 0.07-0.25 MPa (10.15-36.26 psid)<br>For 23-50 slm: 0.14-0.28 MPa (20.30-40.61 psid)<br>For 50-200 slm: 0.15-0.30 MPa (21.75-43.51 psid)<br>For 200-500slm 0.20-0.30 MPa (29-43.51 psid)<br>Low pressure drops can be customized |
| | Maximum Operating Pressure | 0.48 MPa (~70psid), high operating pressure version can be customized |
| | Proof Pressure | 1.03 MPa (~150psig), high pressure resistance version can be customized |
| | Operating Temperature | Standard: 5-45°C |
| | Temperature Coefficient | <0.05% F.S. / °deg C |
| | Valve Type | For 2 sccm-50 slm: Normally Open (N/O), Normally Closed (N/C)<br>For 50 slm-500 slm: Normally Closed (N/C) |
| Materials | Wetted Surface Finish | 5 µin Ra |
| | Wetted Surface Material | SUS 316L (other materials such as Aluminum available for specific applications)<br>PCTFE or PFA valve seats |
| | Seals | Stainless Steel 316L, PTFE or PFA, PKM, FFKM |
| Electrical | ECAT | +24 VDC with M8 5-pin connector |
| | DeviceNet | +24 VDC with M12 5-pin connector |
| | Analog and RS-485 | 0-5V, 0-10V, or 4-20mA I/O, Supports ±15 VDC 9-pin OR 24 VDC 9-pin |
| | ProfiBus-DP | Supports 24 VDC 9-pin and Profibus I/O 9-pin |
| | ProfiNet | +24 VDC with M8 5-pin connector |

# GFC-TN Product Description Codes

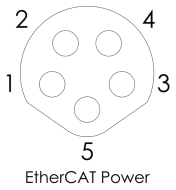
| Code | Description | Option | Option Description |
|---|---|---|---|
| I | Base Model | GTN | GFC-TN, Thermal GFC |
| II | Application | ST | Standard Application (5°C-45°C) |
| | | HT | High Temperature Application (60°C-120°C) |
| | | LT | Low Temperature Application (-40°C-Room Temperature) |
| III | Configurability | C | Multi-Gas Standard Bins (Calibrated with N2) |
| | | X | Gas Configured |
| IV | Bin Size | PS60-010C | Bin-0: N2 Eqv 10 sccm |
| | | PS61-030C | Bin-1: N2 Eqv 30 sccm |
| | | PS62-100C | Bin-2: N2 Eqv 100 sccm |
| | | PS63-300C | Bin-3: N2 Eqv 300 sccm |
| | | PS64-001L | Bin-4: N2 Eqv 1,000 sccm |
| | | PS65-003L | Bin-5: N2 Eqv 3,000 sccm |
| | | PS66-005L | Bin-6: N2 Eqv 5,000 sccm |
| | | PS67-010L | Bin-7: N2 Eqv 10,000 sccm |
| | | PS68-030L | Bin-8: N2 Eqv 30,000 sccm |
| | | PS69-050L | Bin-9: N2 Eqv 50,000 sccm |
| | | XXXX XXXX | Special Semi Gas Code and Range. For N2 Equivalent 51,000-500,000 sccm (51-500slm), gas configured is the only option |
| V | Fittings | 01 | 1/4" VCR male |
| | | 02 | 1.125" C-seal |
| | | 03 | 1.125" W-seal |
| | | 12 | 1/4" Swagelok tube fitting male |
| | | 13 | 3/8" Swagelok tube fitting male |
| | | 14 | 1.5" C-seal |
| | | 15 | 1.5" W-seal |
| | | 16 | 1/2" Swagelok tube fitting male |
| | | 17 | 1/2" VCR male |
| | | 18 | 8mm Swagelok tube fitting male- available by request only |
| | | 19 | 10mm Swagelok tube fitting male- available by request only |
| | | | TM6 fitting |
| | | | TM8 fitting |
| VI | Valve Configuration | C | Normally Closed (N/C) |
| | | O | Normally Open (N/O)* |
| VII | Seals | F | FKM (Default) |
| | | M | Metal |
| VIII | Communcation & Power Supply Options | AW | Analog, 4-20mA, 24V Power Supply |
| | | AX | Analog, 0-5 VDC, 24 V Power Supply |
| | | AY | Analog, 4-20mA, ±15V Power Supply |
| | | AZ | Analog, 0-5 VDC, ±15V Power Supply |
| | | DU | RS485, 24V Power Supply |
| | | DZ | RS485, ±15V Power Supply |
| | | EZ | ECAT |
| | | NZ | DeviceNet |
| | | PZ | ProfiBus |
| | | RZ | ProfiNet |
| IX | Special Requests | XXXX | Customer Special Request Number |

* Normally Open (N/O) configuration is only available on bin sizes up to 50 slm

| Sample Standard Application Model Code | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| I | II | III | IV | V | VI | VII | VIII | IX |
| GTN | ST | C | PS61-030C | 01 | C | F | NZ | XXXX |

# GFC-TN Communication Protocols

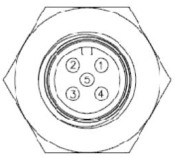
## EtherCAT



EtherCAT Power

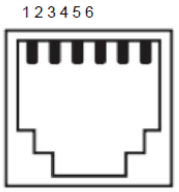
| Pin | Signal |
|---|---|
| 1 | +24 VDC |
| 2 | CASE GND |
| 3 | PWR COM |
| 4 | RS485B |
| 5 | RS485A |

## DeviceNet



| Pin | Signal |
|---|---|
| 1 | Drain |
| 2 | V+ |
| 3 | V- |
| 4 | CAN_H |
| 5 | CAN_L |

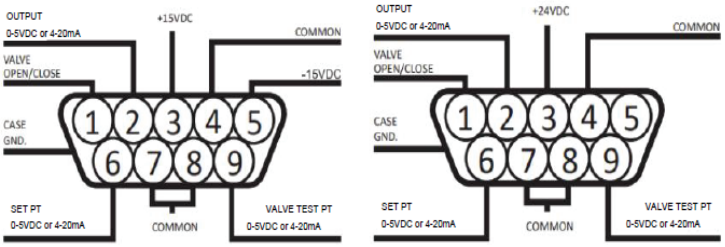
## RS-485



RS485 interface definition diagram

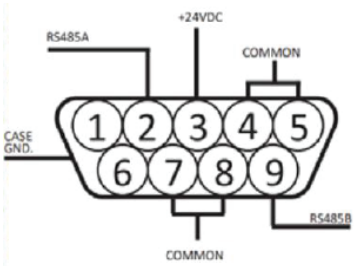
| Pin | Signal |
|---|---|
| 1 | No connection |
| 2 | No connection |
| 3 | RS485B |
| 4 | RS485A |
| 5 | No connection |
| 6 | No connection |

## Analog

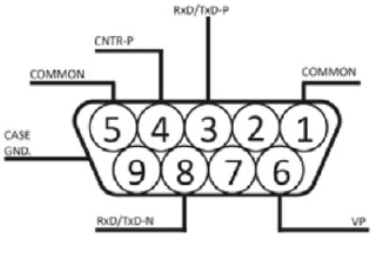


9-pin power interface definition diagram (±15 VDC) 9-pin power interface definition diagram (±24 VDC)

## Profibus



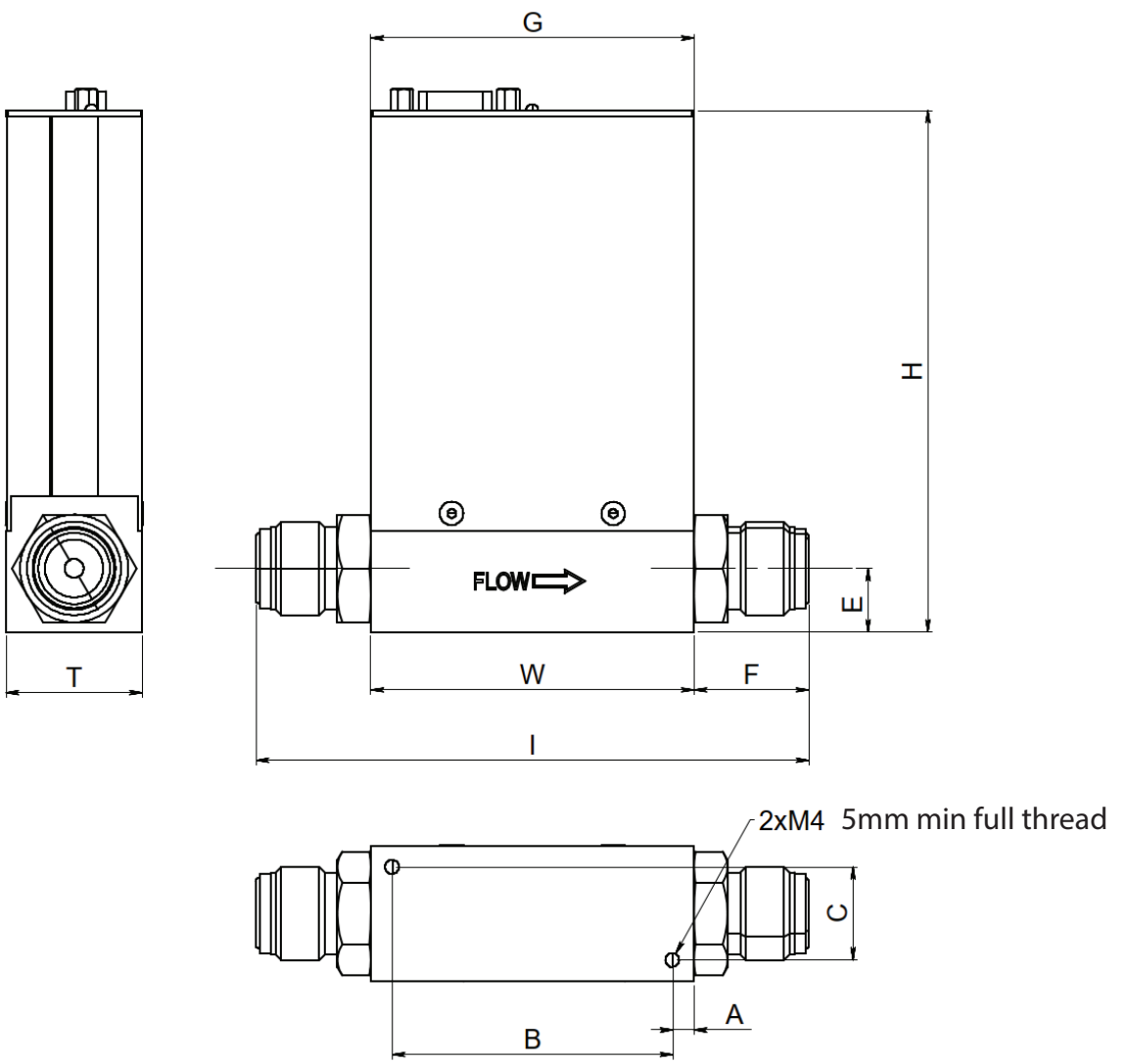
9Pin power interface definition diagram



9Pin communication interface definition diagram

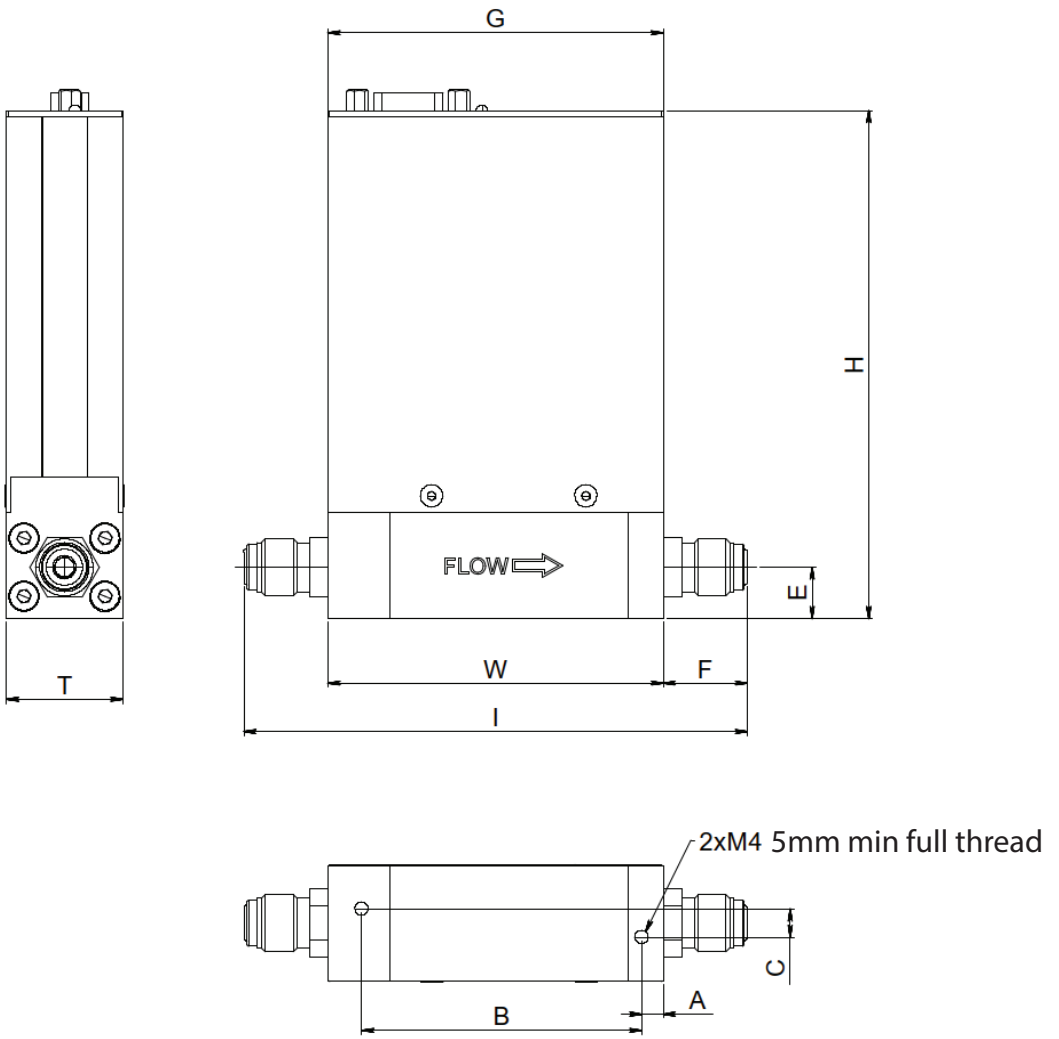
# GFC-TN VCR/Tube with Viton Dimensions

| Fittings | Seal Type | Flow Range (N2 Eqv)<br>L: 2~5000 sccm<br>M: 3~50 slm<br>H: 30~200 slm<br>UH: 50~500 slm | H | T | W | I | A | B | C | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4SW | Viton | M | 123.4 | 32 | 76 | 113 | 5 | 66 | 22 | 15 | 18.5 | 76 |
| 1/4VCR | Viton | M | 123.4 | 32 | 76 | 124 | 5 | 66 | 22 | 15 | 24 | 76 |
| 1/2VCR | Viton | M | 123.4 | 32 | 76 | 130 | 5 | 66 | 22 | 15 | 27 | 76 |
| 10MM | Viton | L;M | 123.4 | 32 | 76 | 116 | 5 | 66 | 22 | 20 | 20 | 76 |
| 1/4SW | Viton | L | 123.4 | 32 | 76 | 124 | 3.5 | 69 | 18.3 | 12.7 | 24 | 76 |
| TM6 | Viton | L | 123.4 | 32 | 76 | 114.2 | 3.5 | 69 | 18.3 | 12.7 | 19 | 76 |
| 1/4VCR | Viton | L | 123.4 | 32 | 76 | 124 | 3.5 | 69 | 18.3 | 12.7 | 24 | 76 |
| TM8 | Viton | L | 123.4 | 32 | 76 | 121 | 3.5 | 69 | 18.3 | 12.7 | 22.5 | 76 |
| 3/8SW | Viton | H | 150.5 | 38 | 95 | 135 | 16 | 63 | 25.5 | 15 | 20 | 95 |
| 10MM | Viton | UH | 150.5 | 38 | 133.5 | 173.5 | 16 | 101.5 | 25.5 | 20 | 20 | 133.5 |
| 1/2VCR | Viton | UH | 150.5 | 38 | 133.5 | 187.5 | 16 | 101.5 | 25.5 | 20 | 27 | 133.5 |



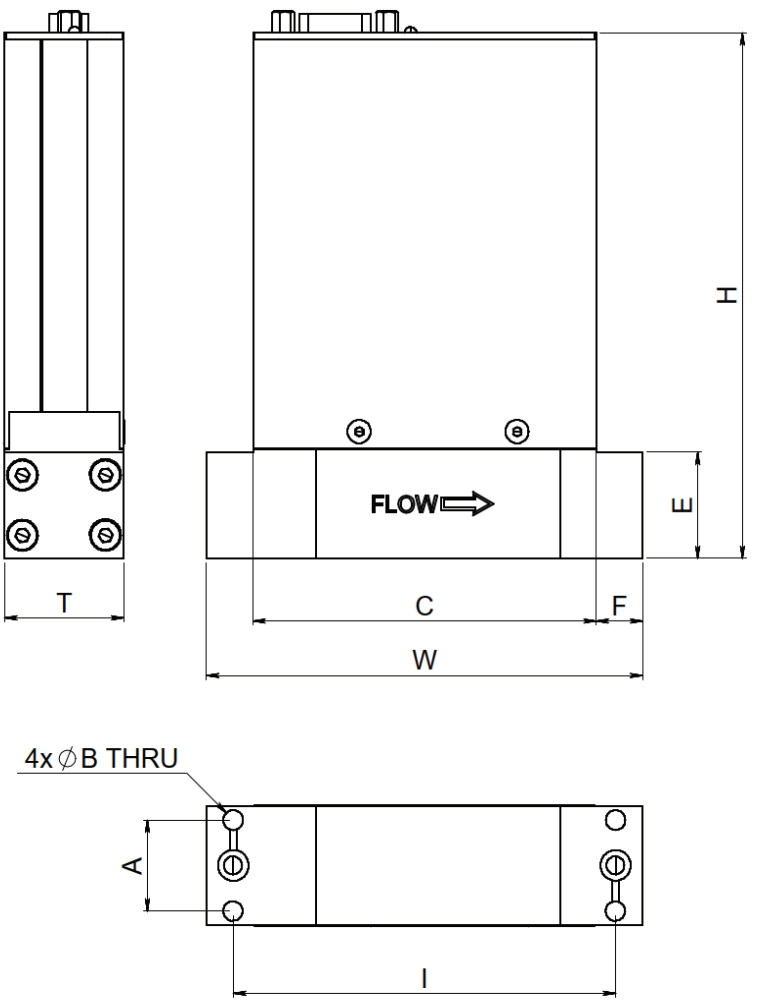
# GFC-TN VCR Swagelok with Metal Seals Dimensions

| Fittings | Seal Type | Flow Range (N2 Eqv)<br>L: 2~5000 sccm<br>M: 3~50 slm<br>H: 30~200 slm<br>UH: 50~500 slm | H | T | W | I | A | B | C | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4VCR | Metal | L;M | 125.7 | 28.6 | 82.6 | 124 | 3.5 | 69 | 7 | 12.7 | 20.7 | 82.6 |
| 1/2VCR | Metal | L;M | 125.7 | 28.6 | 82.6 | 174.8 | 5.3 | 69 | 7 | 12.7 | 46.1 | 82.6 |
| 1/2VCR | Metal | H | 150.5 | 38 | 90 | 132 | 32.2 | 25.5 | 25.5 | 18.5 | 21 | 80 |
| 1/2VCR | Metal | UH | 150.5 | 38 | 133.5 | 193 | 22 | 90 | 25.5 | 15 | 30 | 133.5 |



# GFC-TN IGS Dimensions

| Fittings | Seal Type | Flow Range (N2 Eqv) L: 2~5000 sccm M: 3~50 slm H: 30~200 slm UH: 50~500 slm | H | T | W | I | A | B | C | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C-SEAL and W-SEAL | Metal | L;M | 125.7 | 28.6 | 82.6 | 92 | 21.7 | 4.7 | 82.6 | 25.4 | 11.2 |
| C-SEAL | Metal | H | 150 | 38 | 107 | 92 | 30 | 5.5 | 94 | 30 | 13 |



# GFC-TN Gas Table

| Gas List | | | | |
|---|---|---|---|---|
| $((CH_3)_3Si)_2NH$ | $C_2ClF_5$ | $i\text{-}C_4H_{10}$ | $CClF_3$ | $F_2$ |
| $(CF_3CO)_2O$ | $C_2F_4$ | $n\text{-}C_4H_{10}$ | $Cd(CH_3)_2$ | $Ga(C_2H_5)_3$ |
| $(CH_3)_2CO$ | $C_2F_6$ | $C_4H_4O$ | $CD_4$ | $Ga(CH_3)_3$ |
| $(CH_3)_2O$ | $C_2H_2$ | $1,2\text{-}C_4H_6$ | $CF_3COOH$ | $Ge(C_2H_5)_4$ |
| $(CH_3)_4H_4Si_4O_4$ | $trans\text{-}C_2H_2Cl_2$ | $1,3\text{-}C_4H_6$ | $CF_3I$ | $Ge(OCH_3)_4$ |
| $(Si(CH_3)_3)_2O$ | $C_2H_2F_2$ | $1\text{-}C_4H_8$ | $CF_3OF$ | $GeCl_4$ |
| $(Si(CH_3)_2(OCH_3))_2O$ | $C_2H_2F_4$ | $cis\text{-}2\text{-}C_4H_8$ | $CF_4$ | $GeF_4$ |
| Air | $C_2H_3Br$ | $trans\text{-}2\text{-}C_4H_8$ | $CH_2Cl_2$ | $GeH_4$ |
| $Al(C_2H_5)_3$ | $C_2H_3Cl$ | $iso\text{-}C_4H_8$ | $CH_2F_2$ | $H_2$ |
| $Al(C_4H_9)_3$ | $C_2H_4$ | $C_4H_9OH\text{-}1$ | $CH_3Br$ | $H_2O$ |
| $Al(CH_3)_3$ | $C_2H_4O$ | $cyclo\text{-}C_5F_8$ | $CH_3CHO$ | $H_2S$ |
| Ar | $C_2H_5Cl$ | $C_5H_{12}$ | $CH_3Cl$ | $H_2Se$ |
| $As(CH_3)_3$ | $C_2H_5I$ | $i\text{-}C_5H_{12}$ | $CH_3CN$ | HBr |
| $As(OC_2H_5)_3$ | $C_2H_5OH$ | $C_5H_2F_6O_2$ | $CH_3F$ | HCHO |
| $AsCl_3$ | $C_2H_6$ | $C_5H_5N$ | $CH_3I$ | HCl |
| $AsH_3$ | $C_2HCl_2F_3$ | $cyclo\text{-}C_5H_8$ | $CH_3OH$ | HCN |
| $B(CH_3)_3$ | $C_2HCl_3$ | $C_6F_6$ | $CH_4$ | He |
| $B(i\text{-}OC_3H_7)_3$ | $C_2HF_5$ | $cyclo\text{-}C_6H_{12}$ | $CHCl_2F$ | HF |
| $B(OC_2H_5)_3$ | $C_2N_2$ | $C_6H_{14}$ | $CHCl_3$ | HI |
| $B(OCH_3)_3$ | $C_3F_6$ | $p\text{-}C_6H_4(CH_3)_2$ | $CHClF_2$ | $IF_5$ |
| $B_2H_6$ | $C_3F_6O$ | $C_6H_5CH_3$ | $CHF_3$ | $In(C_2H_5)_3$ |
| $B_5H_9$ | $C_3F_8$ | $C_6H_5CHCH_2$ | $Cl_2$ | $In(CH_3)_3$ |
| $BBr_3$ | $C_3H_4$ | $C_6H_6$ | ClCN | Kr |
| $BCl_3$ | $1,2\text{-}C_3H_4$ | $cyclo\text{-}C_7H_{14}$ | $ClF_3$ | $MoF_6$ |
| $BF_3$ | $C_3H_6$ | $n\text{-}C_7H_{16}$ | CO | $N(C_2H_5)_3$ |
| $Br_2$ | $cyclo\text{-}C_3H_6$ | $CBr_2F_2$ | $CO_2$ | $N(CH_3)_3$ |
| $C(CH_3)_4$ | $C_3H_8$ | $CBrF_3$ | $COF_2$ | $N_2$ |
| $C_2Cl_2F_4$ | $C_3HF_7$ | $CCl_2F_2$ | COS | $N_2O$ |
| $C_2Cl_3F_3$ | $1,3\text{-}C_4F_6$ | $CCl_3F$ | $CS_2$ | $N_2O_4$ |
| $C_2ClF_3$ | $C_4F_8$ | $CCl_4$ | $D_2$ | Ne |
| $ND_3$ | $Si(CH_3)_2(OCH_3)_2$ | $Zn(CH_3)_2$ | 10% $PH_3$ in Ar | 2% $B(CH_3)_3$ in $H_2$ |
| $NF_3$ | $Si(CH_3)_4$ | 0.05% $B_2H_6$ in Ar | 15% $PH_3$ in Ar | 0.01% $B(OCH_3)_3$ in $H_2$ |
| $NH(C_2H_5)_2$ | $Si(CH_3)Cl_3$ | 0.5% $B_2H_6$ in Ar | 5% $SiH_2Cl_2$ in Ar | 0.001% $B_2H_6$ in $H_2$ |
| $NH(CH_3)_2$ | $Si(OC_2H_5)_4$ | 1% $B_2H_6$ in Ar | 2% $SiH_4$ in Ar | 0.01% $B_2H_6$ in $H_2$ |
| $NH_2(C_2H_5)$ | $Si(OCH_3)_4$ | 5% $B_2H_6$ in Ar | 5% $SiH_4$ in Ar | 0.05% $B_2H_6$ in $H_2$ |
| $NH_2(CH_2CHCH_2)$ | $Si_2(CH_3)_6$ | 15% $B_2H_6$ in Ar | 8% $SiH_4$ in Ar | 0.1% $B_2H_6$ in $H_2$ |
| $NH_2(CH_3)$ | $Si_2Cl_6$ | 0.5% $C_3H_6$ in Ar | 10% $SiH_4$ in Ar | 0.2% $B_2H_6$ in $H_2$ |
| $NH_3$ | $Si_2H_6$ | 0.5% $C_3H_8$ in Ar | 15% $SiH_4$ in Ar | 0.5% $B_2H_6$ in $H_2$ |
| NO | $SiCl_3F$ | 4% $CH_4$ in Ar | 20% $SiH_4$ in Ar | 1% $B_2H_6$ in $H_2$ |
| $NO_2$ | $SiCl_4$ | 10% $CH_4$ in Ar | 40% $SiH_4$ in Ar | 2% $B_2H_6$ in $H_2$ |
| NOCl | $SiF_4$ | 10% CO in Ar | $C_4H_{10}$ mixture | 3% $B_2H_6$ in $H_2$ |
| $O_2$ | $SiH(CH_3)_3$ | 10% $GeH_4$ in Ar | 4% $O_2$ in $CF_4$ | 5% $B_2H_6$ in $H_2$ |
| $O_3$ | $SiH[N(CH_3)_2]_3$ | 30% $GeH_4$ in Ar | 8% $O_2$ in $CF_4$ | 10% $B_2H_6$ in $H_2$ |
| $P(CH_3)_3$ | $SiH_2(C_2H_5)_2$ | 2% $H_2$ in Ar | 9% $O_2$ in $CF_4$ | 20% $B_2H_6$ in $H_2$ |
| $P(OC_2H_5)_3$ | $SiH_2(CH_3)_2$ | 3% $H_2$ in Ar | 17% $O_2$ in $CF_4$ | 1% $BCl_3$ in $H_2$ |
| $P(OCH_3)_3$ | $SiH_2[NH(C_4H_9)]_2$ | 4% $H_2$ in Ar | 20% $O_2$ in $CF_4$ | 5% $C_3H_8$ in $H_2$ |

# GFC-TN Gas Table

| Gas List | | | | |
|---|---|---|---|---|
| $PCl_3$ | $SiH_2Cl_2$ | 5% $H_2$ in Ar | 5% $O_2$ in $CF_4$ | 1% CO and 24% $CO_2$ in $H_2$ |
| $PF_3$ | $SiH_2F_2$ | 7% $H_2$ in Ar | 4% Ar in $CH_4$ | 1% CO, 25% $CO_2$ and 4% $N_2$ in $H_2$ |
| $PH_2(t\text{-}C_4H_9)$ | $SiH_3(CH_3)$ | 8% $H_2$ in Ar | 2% $C_4H_{10}$-N, 4% $C_3H_8$ and 6% $C_2H_6$ in $CH_4$ | 3% CO and 22% $CO_2$ in $H_2$ |
| $PH_3$ | $SiH_4$ | 15% $H_2$ in Ar | 10% $H_2$ in $CH_4$ | 1% $GeH_4$ in $H_2$ |
| $PO(OCH_3)_3$ | $SiHCl_3$ | 45% He in Ar | 0.06% $AsH_3$ in $H_2$ | 1.5% $GeH_4$ in $H_2$ |
| $POCl_3$ | $Sn(CH_3)_4$ | 1% NO in Ar | 0.1% $AsH_3$ in $H_2$ | 8% $GeH_4$ in $H_2$ |
| $ReF_6$ | $SO_2$ | 1% $O_2$ in Ar | 0.7% $AsH_3$ in $H_2$ | 10% $GeH_4$ in $H_2$ |
| $Sb(CH_3)_3$ | $T_2$ | 5% $O_2$ in Ar | 1% $AsH_3$ in $H_2$ | 0.005% $H_2S$ in $H_2$ |
| $SbCl_5$ | $Te(CH_3)_2$ | 15% $O_2$ in Ar | 2% $AsH_3$ in $H_2$ | 2% HCl in $H_2$ |
| $Se(CH_3)_2$ | $TiCl_4$ | 20% $O_2$ in Ar | 5% $AsH_3$ in $H_2$ | 10% HCl in $H_2$ |
| $SeF_6$ | $UF_6$ | 1% $PH_3$ in Ar | 7% $AsH_3$ in $H_2$ | 4% $N_2$ in $H_2$ |
| $SF_4$ | $WF_6$ | 3% $PH_3$ in Ar | 10% $AsH_3$ in $H_2$ | 5% $N_2$ in $H_2$ |
| $SF_6$ | Xe | 4% $PH_3$ in Ar | 15% $AsH_3$ in $H_2$ | 30% $O_2$ in $H_2$ |
| $Si(CH_3)(OCH_3)_3$ | $Zn(C_2H_5)_2$ | 5% $PH_3$ in Ar | 50% $AsH_3$ in $H_2$ | 0.001% $PH_3$ in $H_2$ |
| 0.1% $PH_3$ in $H_2$ | 5% $CH_4$ in He | 1% $AsH_3$ in $N_2$ | 10% $H_2$ in $N_2$ | 8.6% Ar in $NF_3$ |
| 0.12% $PH_3$ in $H_2$ | 30% $C_2H_4$ in He | 7% $AsH_3$ in $N_2$ | 50% $H_2$ in $N_2$ | 9.4% Ar in $NF_3$ |
| 0.5% $PH_3$ in $H_2$ | 24% $CO_2$ and 1% CO in He | 0.05% $B_2H_6$ in $N_2$ | 10% $H_2S$ in $N_2$ | 5% $F_2$ in $NF_3$ |
| 1% $PH_3$ in $H_2$ | 1% $F_2$ in He | 0.1% $B_2H_6$ in $N_2$ | 30% $H_2S$ in $N_2$ | 4% $H_2$ in $O_2$ |
| 2% $PH_3$ in $H_2$ | 5% $F_2$ in He | 0.5% $B_2H_6$ in $N_2$ | 10% $H_2Se$ in $N_2$ | 20% He in $O_2$ |
| 3% $PH_3$ in $H_2$ | 10% $F_2$ in He | 0.8% $B_2H_6$ in $N_2$ | 20% $NH_3$ in $N_2$ | 30% He in $O_2$ |
| 5% $PH_3$ in $H_2$ | 20% $F_2$ in He | 1% $B_2H_6$ in $N_2$ | 10% NO in $N_2$ | 50% He in $O_2$ |
| 10% $PH_3$ in $H_2$ | 10% $GeH_4$ in He | 2% $B_2H_6$ in $N_2$ | 20% $O_2$ in $N_2$ | 1% $B_2H_6$ in $SiH_4$ |
| 15% $PH_3$ in $H_2$ | 20% $GeH_4$ in He | 3% $B_2H_6$ and 3% $H_2$ in $N_2$ | 0.1% $PH_3$ in $N_2$ | 10% $N_2$ in $SiH_4$ |
| 20% $PH_3$ in $H_2$ | 4% $H_2$ in He | 4% $B_2H_6$ in $N_2$ | 0.5% $PH_3$ in $N_2$ | 0.3% $PH_3$ in $SiH_4$ |
| 50% $PH_3$ in $H_2$ | 4.5% $H_2$ in He | 5% $B_2H_6$ in $N_2$ | 0.8% $PH_3$ in $N_2$ | 0.5% $PH_3$ in $SiH_4$ |
| 10% $Si_2H_6$ in $H_2$ | 4.5% $H_2$(1.017) in He(1.426) | 0.5% $BCl_3$ in $N_2$ | 1% $PH_3$ in $N_2$ | 0.8% $PH_3$ in $SiH_4$ |
| 1% $SiH_3(CH_3)$ in $H_2$ | 5% $H_2$ in He | 1% $BCl_3$ in $N_2$ | 2% $PH_3$ in $N_2$ | 1% $PH_3$ in $SiH_4$ |
| 10% $SiH_3(CH_3)$ in $H_2$ | 3% $O_2$ in He | 3% $BCl_3$ in $N_2$ | 3% $PH_3$ in $N_2$ | 2% $PH_3$ in $SiH_4$ |
| 20% $SiH_3(CH_3)$ in $H_2$ | 10% $O_2$ in He | 0.05% $C_3H_6$ in $N_2$ | 4% $PH_3$ in $N_2$ | 5% $PH_3$ in $SiH_4$ |
| 2% $SiH_4$ in $H_2$ | 20% $O_2$ in He | 0.02% CO in $N_2$ | 5% $PH_3$ in $N_2$ | 8% $PH_3$ in $SiH_4$ |
| 5% $SiH_4$ in $H_2$ | 30% $O_2$ in He | 0.1% CO in $N_2$ | 8% $PH_3$ in $N_2$ | 15% $PH_3$ in $SiH_4$ |
| 10% $SiH_4$ in $H_2$ | 0.8% $PH_3$ in He | 1% CO in $N_2$ | 10% $PH_3$ in $N_2$ | 20% $PH_3$ in $SiH_4$ |
| 50% $SiH_4$ in $H_2$ | 1% $PH_3$ in He | 20% $CO_2$ in $N_2$ | 15% $PH_3$ in $N_2$ | 25% $PH_3$ in $SiH_4$ |
| 20% $SiHCl_3$ in $H_2$ | 3% $PH_3$ in He | 20% $F_2$ in $N_2$ | 2% $SiH_4$ in $N_2$ | 50% $PH_3$ in $SiH_4$ |
| 25% $SiHCl_3$ in $H_2$ | 4% $PH_3$ in He | 1% $GeH_4$ in $N_2$ | 4% $SiH_4$ in $N_2$ | 8% $PH_3$ in $H_2$ |
| 40% $SiHCl_3$ in $H_2$ | 5% $PH_3$ in He | 10% $GeH_4$ in $N_2$ | 5% $SiH_4$ in $N_2$ | |
| 0.4% $Zn(CH_3)_2$ in $H_2$ | 10% $PH_3$ in He | 1% $H_2$ in $N_2$ | 8% $SiH_4$ in $N_2$ | |
| 0.5% Ar in He | 5% $SiH_3(CH_3)$ in He | 3% $H_2$ in $N_2$ | 10% $SiH_4$ in $N_2$ | |
| 2.5% $B(CH_3)_3$ in He | 2% $SiH_4$ in He | 3.5% $H_2$ in $N_2$ | 15% $SiH_4$ in $N_2$ | |
| 0.1% $BCl_3$ in He | 3% $SiH_4$ in He | 3.9% $H_2$ in $N_2$ | 20% $SiH_4$ in $N_2$ | |
| 1% $BCl_3$ in He | 20% $SiH_4$ in He | 3.9% $H_2$(1.017) in $N_2$ | 50% $SiH_4$ in $N_2$ | |
| 5% $BCl_3$ in He | 40% $SiH_4$ in He | 4% $H_2$ in $N_2$ | 25% $SiHCl_3$ in $N_2$ | |
| 2.7% $C_2H_4$ in He | 50% $SiH_4$ in He | 5% $H_2$ in $N_2$ | 5% Xe in Ne | |
| 3% $C_2H_4$ in He | 0.7% $AsH_3$ in $N_2$ | 9.4% $H_2$ in $N_2$ | 15% Xe in Ne | |

# The Future of Flow Control is Now.

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