

Gas Cabinet Systems

GAS100 Series

Installation and Operation Manual

First General Technology Inc.

FGT

FGT

Essential Instructions

Read this page before proceeding!

FGT designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining FGT products.

- Read all instructions prior to installing, operating and servicing the products. If this instruction manual is not the correct manual, telephone 886-6-2632460 and the requested manual will be provided. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your FGT representative for clarification.
- Follow all warnings, cautions and instruction marked on and supplied with the products.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate update, program and maintain the products.
- When replacement parts are required, ensure that qualified people use replacement parts specified by FGT. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result inn fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

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1.Specifications

Model GAS100-series Gas Cabinet Systems accurately measures and controls gas flow supply to piping systems.

This instrument is used for Gas Rack control in a wide range of application including various

1-1. Specifications

Model	GAS100-S	GAS100-A
Function Type	Semi-auto	Full-auto
GAS Type	Normal,Special,Toxicity,Inertia Gas	
Piping Level	BA or EP Level	
Operature Pressure	±0.25 % FS	
Proof Pressure	200PSIG	
Leak rate	1 x 10-9 atm.cc/sec or less	
Working temperature Range	0-50℃	
Materials of parts in contact w/gases	Body:SUS316 Valve seat:Viton™(Option Buna™ or Kalrez™ or Teflon™)	
Joint	Standard:1/4 compression Option: 1/8 compression,1/4 VCR™,3/8 Compression,VCR™	
Electrical connections	3-Wire male connector per standards	
required power supply	AC100-240 V/50A	

1-2. Unit of Flow

Our GAS100-series Systems is based on the SEMIIE12-91(semi-standard).

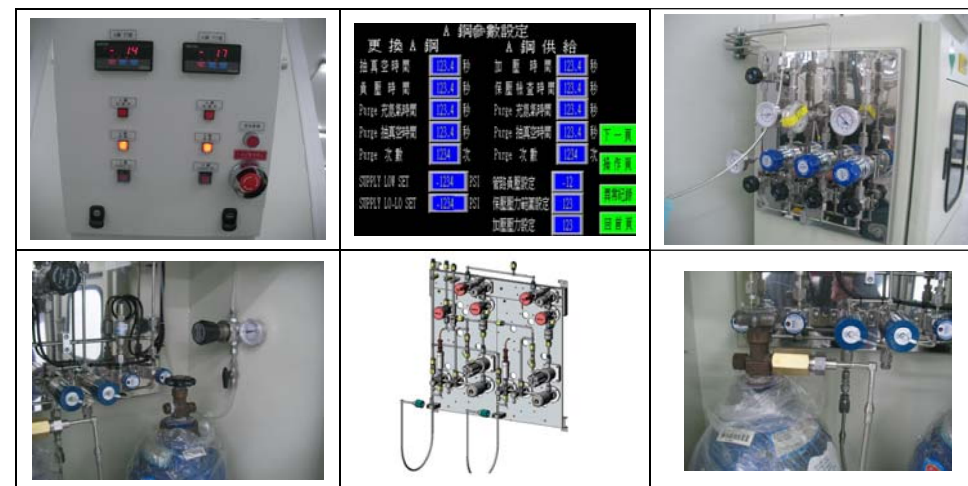
The applied unit is PSI (Standard pounds per square inch). The status of this gas is the same as the reference(normal) conditions of 0°C, 101.325kPa(abs). If the applied

Pressure unit and definition thereon differ, inquire us of it or give us your instructions. If the unit you require is a unit or unit approved by the current measuring law, we will make a production on the basis of the unit you require.

2. Principle of Operation

The GAS100-Series Gas Cabinet system for Ideal for the fastest gas cabinet or gas rack product is designed to supply all inert process gases for the new 300 mm Fabs and for the latest technology application. Automatic gas cylinder cabinets with low pressure fast automatic exchange of cylinders under conditions. The design to free to set the Alarm mode. The Multi-alarm setting function help to prepare gas rack in standby

- To supply inert gas with an economic solution
- To increase uptime on the point of use
- To increase quality and purity specifications using process gas on site
- To reduce handling cost
- To increase safety and eliminate human hazards during cylinder changes



3.. Standard configuration and Wiring Connection

3-1. Standard Configuration



WARNING

Do not operate this instrument in excess of the specifications. Failure to heed this warning may result in serious personal injury and / or damage to the equipment

Venturi Service Nitrogen

- Pressure = 75/100 Psi

UHP Purge nitrogen

- Pressure = 100 Psi

Clean Dry Air(Pneumatic for Valves)

- Pressure = 90 Psi@ 1SLM Max.

Vent

- Connected to appropriate scrubber

Power Requirements

- Single phase,85~240VAC,1200VA,50/60Hz

Mechanical Connection (Fig-5)

- Interchangeable with most popular mass flow controller .Fig-5

Vent

- Connected to appropriate scrubber

Leak Integrity

- 1×10^{-9} Atm. CC/sec helium or less

Power Requirements

- Single phase,85~240VAC,1200VA,50/60Hz

Electrical Connection(Fig-1)

- D-type:Dsub 15-pin connector, Mating connector supplier.

Ambient temperature Limits

- Operating:5 ~ 65°C (40 to 150°F)
- No-Operating:-25 to 100°C (-13 to 212°F)
- Range. Consult factory for details.

Working Pressure

- 10~200 psi maximum

3-2. Electric connection Diagram

Electrical Connection(Fig-1)

Power Supply: Connections Pin out

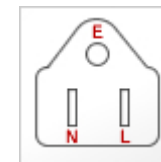


Fig-1

Pin No.	Signal
N	AC100~240 V Power Source
L	Power Source COM
E	Ground COM



CAUTION

* Because differential Countries use different electrical systems requirements, please follow to use the plug-in connector with national standards and policy rule.

4.Installation and Piping

For design and piping construction of the instrument and piping of the system including the flow and Pressure controller, fully read the following matter and perform job with particular attention being paid.


4-1.Storage and Application environment

Applying this instrument near the equipment such as high frequency induction furnace or in the place in which various power systems are concentrated may easily intrude noise in to Gas Cabinet Controller, thereby interfering normal operation.

Avoid storage or application outdoor in direct contact with wind-rain or dusts. Avoid application under the environment in which drops of water directly fall, or dusts have been accumulated, or in the atmosphere having a high temperature or corrosive gases. The application in these places may deteriorate or corrode the electronic parts or cause a connection fault of the cable connection unit.

Avoid storage or application in a place in which the ambient temperature exceeds 65°C or vibrations occur. When using the controller with gas being actually flowed, the gas temperature and ambient temperature must be within 5~65 °C.

Application out of this range may cause damages of the performance. So pay particular attention to it.

 **CAUTION:** When installing this instrument, avoid the environment in which an ambient noise generating source exists, and drops of water or dusts have accumulated, or the atmosphere in which a high temperature and corrosive gas exist. Ignoring it may cause a critical malfunction.

4-2. Washing of The Piping System

Fully internally wash the pipes and applications (such as the pressure regulator, pressure gauge and stop valve) used for piping system before the application thereof. Mixing of dusts, rusts, oil and water makes an intrusion of these substances into the gas cabinet systems, thus causing an internal clogging, deterioration in performance and erroneous operation..



CAUTION: Never wash the piping system after incorporation of this instrument.

Ignoring it may cause a critical malfunction.

4-3.In-line Filter

It is recommended that an In-Line be installed upstream from the controller to prevent the possibility of any foreign material entering the flow sensor or control valve. The filtering element should be replaced periodically or ultrasonically cleaned. When applying the air fed out of the compressor or fan, a large quantity of oil mist or drops of water may intrude. So mount an oil filter or water-eliminating filter on the front stage.

Recommended filter size	
Maximum flow	Filter size
10~500SLM	0.4 μ

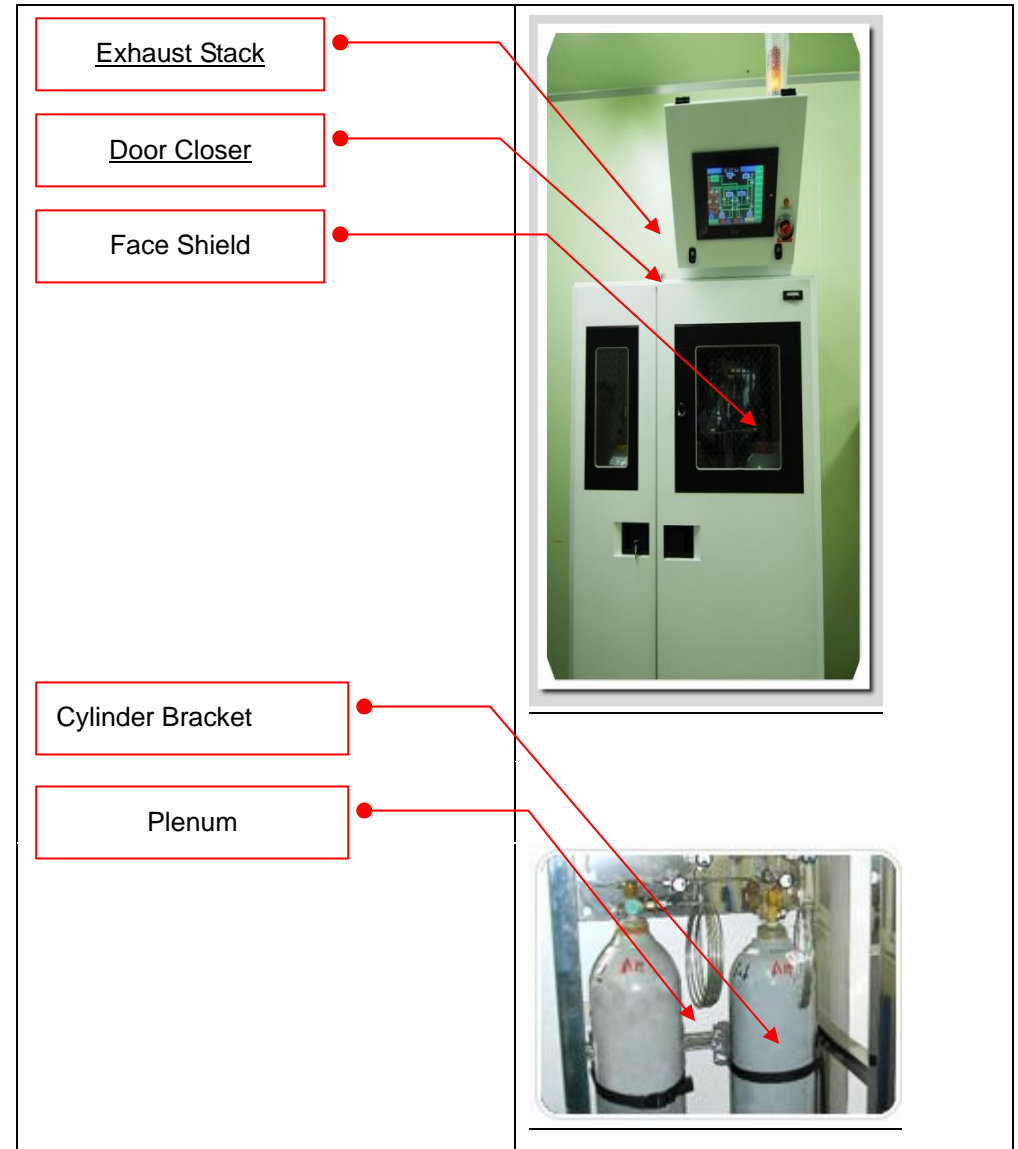
4-4.Combined Use of Cylinder Cabinet Specifications

Cabinet Model	Exhaust Dust Diameter size mm	Windows Open			Windows closed(m3/h)	
		Flow(m3/h)	Velocity(m/s)	Windows Opening(dm2)	Max Flow	Min Flow
One Cyl.	150	170	2.5	4.6	100	34
Two Cyl.	150	440	6.6	12.0	330	237
Three Cyl.	200	610	5.1	16.8	475	300

⚠ CAUTION: Maximum flow is with fully-open damper on door. Minimum is with closed damper. Exhaust sizing should be based on maximum flow. Minimum static pressure requirement at cabinet exhaust is 10mm V.P.

Cylinder Cabinet Features	Description
Door Closer	Self-closing windows and door.
Face shield	Extremely tough polycarbonate sheet improves viewing angle while protecting operator's face and eyes from injury.
Cylinder Bracket	Bracket holds cylinders. Equipped with a safety strap.
Plenum	Eliminates dead air volume behind the cylinders. Improves exhaust efficiency. Used with adjustable shelves.
Filter	Filter diffuses air throughout the cabinet.
Floor Material	Durable, corrosion-proof, non-skid material prevents damage to cabinet floor. Also helps secure cylinder scale for easy cylinder removal and replacement.
Fire Sprinkler head	70°C actuation temperature.
Window	Large opening provides maximum visibility through 1/4" wire reinforced approved safety glass.
Steel Construction	Cabinet are 3 mm, all-welded construction. Powder coated white. Salt spray tested.
Door	Self-closing, self-latching door with gasket provides tight seal to eliminate leaks, comes with lock as standard.

4-5.Two Cylinder Cabinet



4-6.Technology Data

Max inlet pressure	Outlet pressure	Wetted regulator material	Wetted valve material	Working Temp.
3400Psi	0~29Psi	Body 316L SS	Body 316L SS	-40℃
	0~101Psi	Seal Kel-F 81	Seal Kel-F 81	To
		Diaph.316L SS	Diaph. Elgiloy	+65℃

4-7.Component features

Component Features	Description
Regulator with pressure relief valve	Regulator relief valve protects low pressure downstream components if delivery pressure exceeds gauge maximum pressure.
Pigtail	Enables reliable, flexible connection to gas cylinder valve, permitting vertical adjustment of ± 50 mm. Pigtail design and configuration is specific for each gas.
Inlet filter	Stainless steel 0.4μ high pressure pre filter protect system components from contamination and damage by particulate matter
High Pressure Isolation(HPI) Valve	2-way, 3-port valve isolates regulator and low-pressure side of manifold purge gas during purging operations.
High Pressure Ventilation(HPV) Valve	Ventilates process gas from high pressure side of manifold during purging operations and in emergencies.
Low Pressure Ventilation(LPVP) Valve	Used during cylinder change to enable ventilation of process gas at reduced pressure. Also enables maintenance purge of regulator and downstream process lines.
Low Pressure Ventilation(LPI) Valve	This valve isolates gas panel from downstream process equipment. Enables manifold and regulator to be purged without contamination of downstream process gas lines.
Check Valve	Prevents backflow of gases into gas panel.
Purge Gas Inlet(PGI)	Controls flow purge gas into pigtail and manifold during purging. Check valve prevents backflow of process gas to purge gas source.
Pneumatic Emergency Shut-off(ESO) Valve	Pneumatically operated, normally closed valve enables manual shutdown of process gas flow. ESO valve is typically actuated by and IGS gas monitor, automatically shutting off gas in case of excess flow., exhaust system failure, fire or if toxic gas is detected.(Option)

4-8.Gas source system

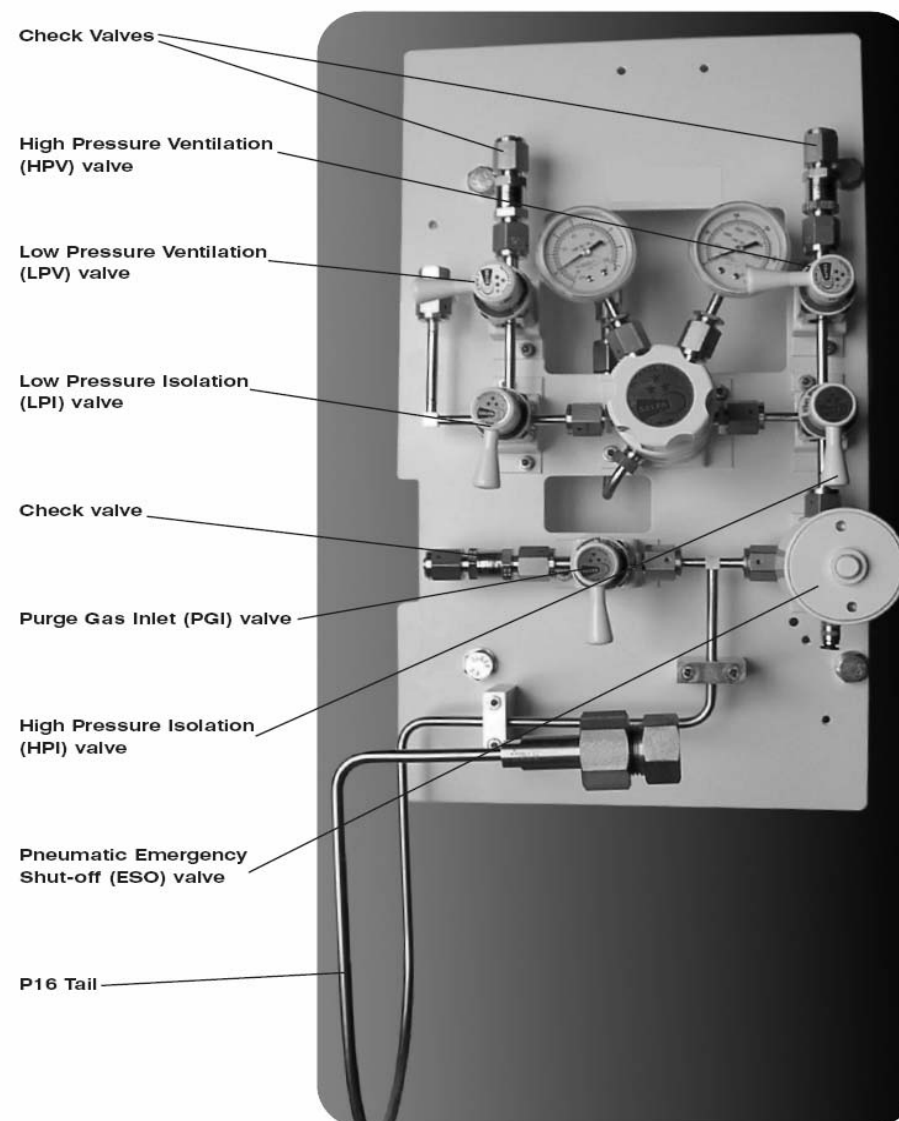


Table 4-1 Conversion Factors(Nitrogen Base)

When operating Model GAS100-Series Gas Cabinet Systems correctly, design the piping system so that the pressure difference between the inlet and outlet. If a mass flow controller is operated on a gas other than the gas it was calibrated with, a scale shift will occur in the relationship between the output signal and the mass flow rate. This is due to the difference in heat capacities between the two gases. This scale shift can be approximated by using the ratio of the molar specific heat of the two gases. Or sensor conversion factor. A list of sensor conversion factors is given in **Table 4-1** to change to a new gas. Multiply the output reading by the ratio of the gas factor for the desired gas to the gas factor for the calibration gas.

It is generally accepted that the mass flow rate derived from this equation is only accurate to $\pm 5\%$. The sensor conversion factors given in **Table 4-1** are calculated based on a gas temperature of 21°C and pressure of one Atmosphere. The specific heat of most gases are not strongly pressure and temperature dependent, however gas conditions that vary widely from these reference conditions may cause an additional error due to the change in specific heat due to temperature or pressure.

Actual Gas Flow and Operational Pressure Calculated

$$\text{Actual gas flow rate} = \text{Output reading} \times \frac{\text{factor of the new gas}}{\text{factor of the calibrated gas}}$$

Example :

- The controller is calibrated for nitrogen.
- The desired gas is carbon dioxide.
- The output is reading is 75 sccm when carbon dioxide is flowing
- Then $75 \times 0.78 = 58.50$ sccm

In order to calculate the conversion factor for a gas mixture the following formula should be used.

Sensor	100				
Conversion	P1		P2		Pn
Factor	sensor	+	sensor	+	sensor
Mixture	conversion		conversion		conversion
	factor 1		factor 2		factor n

Where, P1 = percentage (%) of gas 1 (by volume)

P2 = percentage (%) of gas 2 (by volume)

P_n = percentage (%) of gas n (by volume)

Example :

- The desired gas is 20% Helium (He) and 80% Chlorine (Cl) by volume.
- The desired full scale flow rate of the mixture is 20 slpm.
- Sensor conversion factor for the mixture is

$$\frac{\text{Mixtu}}{\text{Factor}} = \frac{100}{\frac{20}{1.39} + \frac{80}{0.83}} = 0.903$$

Air equivalent flow = $20/903 = 22.15$ slpm air

Subject J-850-308 Rev.19	Formula	Gas factor	Diff. factor	Density (kg/m³)	Recommended	Approved	Not recommended
1 Acetylene (Ethyne)	C2H2	0.615	0.970	1.173	Viton	Epdm/Buna/Teflon-	-
2 Air	Air	0.998	1.018	1.293	Viton	Epdm/Buna/Teflon-	-
3 Allene	C3H4	0.478	1.199	1.767	Buna	-	-
4 Ammonia	NH3	0.786	0.781	0.771	Epdm	Buna/Teflon-Kalrez	Viton
5 Argon	Ar	1.395	1.195	1.784	Viton	Epdm/Buna/Teflon-	-
6 Arsine	AsH3	0.794	1.661	3.478	Teflon-Kalrez	K	-
7 Boron Trichloride	BCl3	0.443	2.044	5.227	Teflon-Kalrez*	-	-
8 Boron Trifluoride	BF3	0.579	1.569	3.025	Teflon-Kalrez	Viton	-
9 Bromine Pentafluoride	BrF5	0.287	2.502	7.806	Teflon	Viton	Viton/Epdm/Buna
10 Bromine Trifluoride	BrF3	0.439	2.214	6.108	Teflon	Kalrez	Viton/Epdm/Buna
11 Bromotrifluoroethylene	C2BrF3	0.326	2.397	7.165	Viton	Kalrez	-
12 Bromotrifluoromethane (f-13B1)	CBrF3	0.412	2.303	6.615	Buna	Buna	Viton/Kalrez
13 1,3-Butadiene	C4H6	0.384	1.413	2.491	Viton	Epdm	Buna/Epdm
14 Butane	C4H10	0.297	1.467	2.593	Viton	Teflon-Kalrez	Epdm
15 1-Butene	C4H8	0.294	1.435	2.503	Viton	Kalrez	Buna/Epdm
16 CIS-2-Butene	C4H8	0.320	1.435	2.503	Buna	Kalrez	-
17 Trans-2-Butene	C4H8	0.291	1.435	2.503	-	-	-
18 Carbon Dioxide	CO2	0.773	1.255	1.977	Buna*	-	Viton/Epdm
19 Carbon Disulfide	CS2	0.638	1.650	3.393	Viton	Kalrez	Buna/Epdm
20 Carbon Monoxide	CO	0.995	1.000	1.250	Viton	Kalrez	-
21 Carbon Tetrachloride	CCl4	0.344	2.345	6.860	Viton	Buna/Epdm/Kalrez	Buna/Epdm
22 Carbon Tetrafluoride (f-14)	CF4	0.440	1.770	3.926	Viton	Kalrez	-
23 Carbonyl Fluoride	COF2	0.567	1.555	2.045	Viton	Kalrez	-
24 Carbonyl Sulfide	COS	0.680	1.463	2.680	Viton	-	-
25 Chlorine	Cl2	0.876	1.598	3.214	Viton	-	Buna/Epdm
26 Chlorine Dioxide	ClO2	0.693	1.554	3.011	Viton	Kalrez	Buna/Epdm
27 Chlorine Trifluoride	ClF3	0.433	1.812	4.125	Kalrez	Kalrez	Viton/Buna/Epdm
28 Chlorodifluoromethane (f-22)	CHClF2	0.505	1.770	3.906	Epdm	-	Viton/Buna/Teflon
29 Chloroform (Trichloromethane)	CHCl3	0.442	2.066	5.340	Viton	Kalrez	Buna/Epdm
30 Chloropentafluoroethane (f-115)	C2ClF5	0.243	2.397	7.165	Epdm	Kalrez	Buna
31 Chlorotrifluoroethylene	C2ClF3	0.337	2.044	5.208	Teflon	-	-
32 Chlorotrifluoromethane (f-13)	CClF3	0.430	1.985	4.912	Kalrez	-	-
33 2-Chlorobutane	C4H9Cl	0.234	1.818	4.134	-	-	-
34 Cyanogen	(CN)2	0.498	1.366	2.322	Kalrez	-	-
35 Cyanogen Chloride	ClCN	0.618	1.480	2.730	Kalrez	-	-
36 Cyclobutane	C4H8	0.387	1.413	2.491	Buna	-	-
37 Cyclopropane	C3H6	0.505	1.224	1.877	Buna	-	-
38 Deuterium	D2	0.995	0.397	0.177	Viton	-	-

Table 4-1 Conversion Factors(Nitrogen Base) Continued

Seipec J-525-508 Rev.13	Formula	Gas factor	Odor factor	Density (kg/m³)	Recommended	Approved	Not recommended
39 Diborene	B ₂ H ₆	0.448	1.000	1.235	Kalrez	-	-
40 Dibromodifluoromethane (1-12B2)	CBr ₂ F ₂	0.363	2.652	8.768	Viton	-	-
41 1,2-Dibromotetrafluoroethane (1-114B2)	C ₂ Br ₂ F ₄	0.215	2.905	10.530	Teflon	Viton/Buna/Kalrez	Epdm
42 Dichlorodifluoroethane (1-12)	C ₂ Cl ₂ F ₂	0.390	2.099	5.492	Buna	-	Viton/Teflon/Kalrez/
43 Dichlorodifluoromethane (1-21)	CHCl ₂ F	0.456	1.985	4.912	Kalrez	-	Viton/Buna/Epdm
44 Dichlorosilane	SiH ₂ Cl ₂	0.442	1.897	4.506	Kalrez	-	-
45 Diethylsilane	C ₄ H ₁₂ Si	0.183	1.775	3.940			
46 2,2-Dichloro-1,1,1-Trifluoroethane	C ₂ HCl ₂ F ₃	0.259	2.336	6.829			
47 1,2-Dichloroethane (Ethylene dichloride)	C ₂ H ₄ Cl ₂	0.382	1.879	4.419	Kalrez	-	-
48 1,2-Dichlorotetrafluoroethane (1-114)	C ₂ Cl ₂ F ₄	0.231	2.449	7.479	Buna	Epdm	-
49 1-1-Difluoro-1-Chloroethane	C ₂ H ₃ ClF ₂	0.341	1.957	4.776	Buna	-	-
50 1,1-Difluoroethane	CH ₃ CHF ₂	0.415	1.536	2.940	Kalrez	-	-
51 1,1-Difluoroethylene	CH ₂ =CF ₂	0.458	1.512	2.860	Viton	-	-
52 Difluoromethane (1-32)	CF ₂ H ₂	0.627	1.360	2.411	?	?	?
53 Dimethylamine	(CH ₃) ₂ NH	0.370	1.269	2.013	Kalrez	-	-
54 Dimethyl ether	(CH ₃) ₂ O	0.392	1.281	2.055	Viton	Buna/Epdm/Kalrez	-
55 2,2-Dimethylpropane	C(CH ₃) ₄	0.247	1.613	3.244	Buna	-	-
56 Disilane	Si ₂ H ₆	0.332	1.493	2.779	Teflon	-	-
57 Ethane	C ₂ H ₆	0.490	1.038	1.357	Viton	Buna/Kalrez	Epdm
58 Ethanol	C ₂ H ₆ O	0.394	1.282	2.057			
59 Ethylacetylene	C ₄ H ₆	0.365	1.384	2.388	Buna	-	-
60 Ethyl Chloride	C ₂ H ₅ Cl	0.408	1.516	2.879	Viton	Buna/Kalrez	Epdm
61 Ethylene	C ₂ H ₄	0.619	1.000	1.261	Viton	Buna/Kalrez	Epdm
62 Ethylene Oxide	C ₂ H ₄ O	0.589	1.254	1.965	Kalrez	-	Viton/Buna/Epdm
63 Fluorine	F ₂	0.924	1.163	1.695	Teflon	-	-
64 Fluoroform (1-23)	CHF ₃	0.529	1.584	3.127	Kalrez*	-	-
65 Germane	GeH ₄	0.640	1.653	3.418	Teflon/Kalrez	-	Viton
66 Germanium Tetrachloride	GeCl ₄	0.268	2.766	9.574	Kalrez*		
67 Haloethane	C ₂ H ₅ BrClF ₃	0.257	2.654	8.814			
68 Helium	He	1.386	0.378	0.178	Viton	Buna/Epdm/Kalrez	-
69 Hexafluoroacetone	C ₃ F ₆ O	0.219	2.434	7.414	-	-	-
70 Hexafluorobenzene	C ₆ F ₆	0.632	2.577	8.309			
71 Hexafluoroethane (1-115)	C ₂ F ₆	0.255	2.219	6.139	Buna	-	-
72 Hexafluoropropylene (HFP)	C ₃ F ₆	0.249	2.312	6.663	Buna	-	-
73 Hexamethyldisilane (HMDS)	(CH ₃) ₆ Si ₂	0.139	2.404	7.208	Kalrez	-	-
74 Hexane	C ₆ H ₁₄	0.204	1.757	3.847	Viton	Buna/Kalrez	Epdm
75 Hydrogen	H ₂	1.008	0.269	0.090	Viton	Buna/Epdm/Kalrez	-
76 Hydrogen Bromide	HBr	0.987	1.695	3.645	Viton	Epdm/Kalrez	Buna

Table 4-1 Conversion Factors(Nitrogen Base) Continued

Seipec J-525-508 Rev.13	Formula	Gas factor	Odor factor	Density (kg/m³)	Recommended	Approved	Not recommended
77 Hydrogen Chloride	HCl	0.983	1.141	1.639	Viton	Kalrez	Buna
78 Hydrogen Cyanide	HCN	0.744	0.973	1.179	Kalrez	-	-
79 Hydrogen Fluoride	HF	0.998	0.845	0.893	Kalrez	-	Viton/Buna/Epdm
80 Hydrogen Iodide	HI	0.953	2.144	5.789	Kalrez	-	-
81 Hydrogen Selenide	H ₂ Se	0.837	1.695	3.613	Kalrez	-	-
82 Hydrogen Sulfide	H ₂ S	0.850	1.108	1.539	Teflon/Kalrez	Epdm	Viton/Buna
83 Iodine Pentafluoride	IF ₅	0.283	2.819	9.907	Teflon	-	Viton/Buna/Epdm
84 Isobutane	C ₄ H ₁₀	0.260	1.440	2.596	Kalrez*	-	-
85 Isobutene	C ₄ H ₈	0.289	1.435	2.503	Kalrez*	-	-
86 Isopentane	C ₅ H ₁₂	0.211	1.605	3.222	-	-	-
87 Krypton	Kr	1.382	1.729	3.708	Viton	-	-
88 Methane	CH ₄	0.763	0.763	0.717	Buna/Viton	Kalrez	Viton/Epdm
89 Methylacetylene	C ₃ H ₄	0.473	1.196	1.782	Kalrez	-	-
90 Methyl Bromide	CH ₃ Br	0.646	1.834	4.236	-	-	-
91 3-Methyl-1-butene	C ₅ H ₁₀	0.252	1.584	3.127	-	-	-
92 Methyl Chloride	CH ₃ Cl	0.687	1.347	2.308	Kalrez	-	Viton/Buna/Epdm
93 Methyl Fluoride	CH ₃ F	0.761	1.102	1.518	-	-	-
94 Methyl Mercaptan	CH ₄ S	0.588	1.313	2.146	-	-	-
95 Methyl Silane	CH ₃ Si	0.393	1.283	2.061			
96 Methyl Trichlorosilane	CH ₃ Cl ₃ Si	0.267	2.310	6.675			
97 Methyl Vinyl Ether	C ₃ H ₆ O	0.377	1.435	2.567	Kalrez	-	-
98 Monoethylaniline	C ₂ H ₇ NO	0.305	1.477	2.728			
99 Monoethylamine (CH ₃ CH ₂ NH ₂)	C ₂ H ₇	0.359	1.269	2.013	Kalrez	-	-
100 Monomethylamine	CH ₃ NH ₂	0.565	1.067	1.420	Kalrez	-	-
101 Neon	Ne	1.398	0.847	0.902	Viton	Buna/Epdm/Kalrez	-
102 Nickel Carbonyl	Ni(CO) ₄	0.212	2.371	7.008	-	-	-
103 Nitric Oxide	NO	0.995	1.030	1.339	Kalrez*	Viton	-
104 Nitrogen	N ₂	1.000	1.000	1.251	Viton	Buna/Epdm/Kalrez	-
105 Nitrogen Dioxide	NO ₂	0.758	1.713	2.052	Kalrez	-	-
106 Nitrogen Trifluoride	NF ₃	0.501	1.598	3.168	Teflon	-	Kalrez
107 Nitrogen Trioxide	N ₂ O ₃	0.443	1.649	3.389	-	-	-
108 Nitrosyl Chloride	NOCl	0.644	1.529	2.913	Kalrez	-	-
109 Nitrous Oxide	N ₂ O	0.752	1.259	1.964	Buna	-	-
110 Octafluorocyclobutane	C ₄ F ₈	0.169	2.672	8.933	-	-	-
111 Oxygen	O ₂	0.988	1.067	1.429	Viton	Epdm/Kalrez	Buna
112 Oxygen Difluoride	OF ₂	0.672	1.388	2.402	-	-	-
113 Ozone	O ₃	0.738	1.310	2.138	Viton	Epdm/Kalrez	Buna
114 Perchloryl Fluoride	ClO ₃ F	0.448	1.095	4.571	-	-	-

4-10.Gas Connection

The standard joints of the GAS100-Series Gas Cabinet Systems are 1/4" VCR (or Swagelok™) or the equivalent on both of the inlet and outlet.

4-11.Installation

When designing the piping system employing the Gas Cabinet System, pay particular attention to that this instrument may have to be removed for maintenance jobs such as inspection and disassembling washing. Take into full consideration the arrangement having a space enabling easy removing and reinstallation piping jobs. During installing this instrument, pay particular attention so that no foreign matters intrude from the inlet or outlet. Hold attaching the protective caps on the both ends until the installation.

【Installation procedure】

- E. Install Model GAS100-Series Gas Cabinet Systems in a clean-dried place in which no impacts and vibration occur.
- F. Secure a sufficient space allowing span or zero-point adjustments.
- G. Perform piping so that it can be easily removed for request for maintenance service to us.

 **CAUTION: Applying toxic gas may cause a contamination or corrosion in**

the Gas Cabinet Systems due to a piping leak or improper

purging. Before the application, fully check to ensure that no

leaks exist in the piping, and perform purging with dried N₂ gas.

- H. There exist no limits for instillation posture. However, apply Model GAS100-Series Gas Cabinet Systems at the physically no forcible status. Install it levelly. In the case of other installation postures, perform zero-point adjustment after the warming-up. When installing Model GAS100-Series Controller, existence of an angle piping just in front of the controller worsens the accuracy a little.

5.Operation Procedure

- Check to ensure that the piping system connection, cable connection and wirings are correct.
- Securely open the Gas Rack with the solenoid valve and manual stop valve so that gas will flow into there.
- Turn ON the power switch and perform warming-up at least for 1 minutes. The electric panel will be full on. The pressure meter turn run the data by automation.




【Span high Pressure valve procedure】

The supply of pneumatic pressure regulator valve of the pressure value is observed to maintain the range 72~100 Psi. If not, please adjust the pressure regulating valve within this range. Visual non-pressure conditions found in the original gas source, open the manual valve supply of Nitrogen in the piping system.

5.1.Operation Electric Panel




5.1. Operation Electric Panel

【GAS100-S】

【Cylinder-A Empty】	
1	<p>When the PT value show Lo LOW in Cylinder bottles, the button lights of 【Cylinder-A】 bottles turn on, Alarm buzzer sound, the red lights push to shutdown, that meant 【Cylinder-A】 is zero. Please replace the cylinder-A and fixed pigtail to complete. Push the button of the name 【Sandy by】</p> 
2	<p>The button 【Sandy by】 of 【Cylinder-A】 lights, such as 【Cylinder-B】 in the gas supply in the state, then the 【Cylinder-A】 will be in the waiting situation.</p> 
3	<p>When 【Cylinder-B】 bottles is zero, the value of PT turn run Lo Low pressure signal. The button of the name 【Cylinder-B】 lights. The button 【Sandy by】 of 【Cylinder-A】 will be auto run to 【Cylinder-A】 in the gas supply</p> 

5.1.Operation Electric Panel

【GAS100-S】

【Cylinder-B Empty】	
1	<p>When the PT value show Lo LOW in Cylinder bottles, the button lights of 【Cylinder-B】 bottles turn on, Alarm buzzer sound, the red lights push to shutdown, that meant 【Cylinder-B】 is zero. Please replace the cylinder-B and fixed pigtail to complete. Push the button of the name 【Sandy by】</p> 
2	<p>The button 【Sandy by】 of 【Cylinder-B】 lights, such as 【Cylinder-A】 in the gas supply in the state, then the 【Cylinder-B】 will be in the waiting situation.</p> 
3	<p>When 【Cylinder-B】 bottles is zero, the value of PT turn run Lo Low pressure signal. The button of the name 【Cylinder-A】 lights. The button 【Sandy by】 of 【Cylinder-B】 will be auto run to 【Cylinder-B】 in the gas supply</p> 

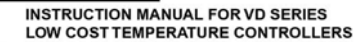
【Light Alarm Situation】

1 【Green Light】:When the action is normal or running,the 【Green Light】 turn on

【Buzzer Sound】:When the action is shutdown or Fault ALARM,the 【Buzzer Sound】 turn on

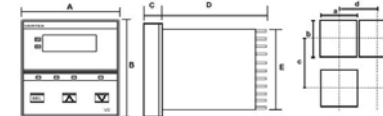
【PT Meter

【PT Meter



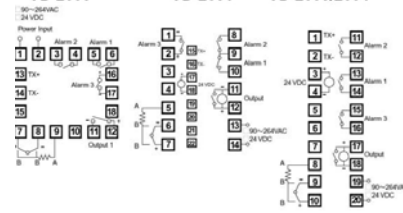
- (1)PV – Process Value/Parameter indicator
- (2)SV – Setting Value indicator
- (3)C1 – Control output status indicator
- (4)A1 – Alarm 1 output status indicator
- (5)A2 – Alarm 2 output status indicator
- (6)A3 – Alarm 3 output status indicator

- PANEL CUTOUT:

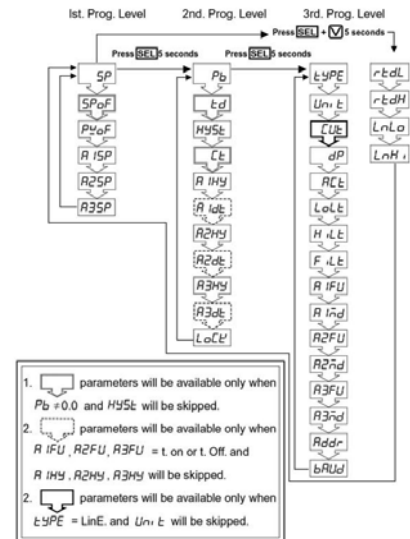


Model	A	B	C	D	E	a	b	c	d
VD-2600	48	48	6	100	45	45 \pm 0.5	45 \pm 0.5	60	48
VD-2601	72	72	9	80	67	68 \pm 0.5	68 \pm 0.5	90	72
VD-2603	96	48	9	80	45	92 \pm 0.5	45 \pm 0.5	48	120
VD-2604	96	96	10	80	91	92 \pm 0.5	92 \pm 0.5	120	96

VD-2601 VD-2603/2604



■ PROGRAMMING LEVEL PARAMETERS:



CODE	DESCRIPTION	RANGE	Default
5P	Set point value of control	LoLr - HiLi	500
5P _{oF}	Set point offset. Offset (manual reset) value for P control only	-1000-1000 (-100.0-100.0)	0
P _{oF}	Process value offset. Use to offset the PV indication from the actual PV	-1000-2000 (-100.0-200.0)	0
R15P	Alarm 1 setting value	-1999-9999	10
R25P	Alarm 2 setting value	-1999-9999	10
R35P	Alarm 3 setting value	-1999-9999	10

SECOND PROGRAMMING LEVEL PARAMETERS (PID LEVEL)			
CODE	DESCRIPTION	RANGE	Default
P_b	Proportional band variable. Set to 0.0 for ON/OFF control mode.	0.0-300.0%	0.0
t_d	Derivative (Rate). When $P_b = 0.0$, this parameter will not appear.	0-900sec	0
HYS_L	Hysteresis for ON/OFF control action on output. When $P_b \neq 0.0$ this parameter will not appear.	0-2000 (0.0-200.0)	1
t_c	Proportional cycle time of control output. When $P_b = 0.0$ this parameter will not appear. Set to 15 or 20 for relay output Set to 1 or 2 for SSR output Set to 0 for current output.	0-100sec	15

5.1.Operation Electric Panel

【GAS100-S】

【PT Meter】

R2dL	Delay time of alarm 2 action when R2FU =LoN or t.OFF	99 MM, 59 SS, 99 HH, 59MM.																							
R3HJ	Hysteresis of alarm 3 action. When R3FU =LoN or t.OFF, R3HJ is not displayed.	0-2000	1																						
R3dL	Delay time of alarm 3 action when R3FU =LoN or t.OFF	99 MM, 59 SS, 99 HH, 59MM.																							
	Parameter lock. This security feature locks out selected levels or single parameters prohibiting tampering and inadvertent programming changes.																								
	<table><thead><tr><th>SETTING</th><th>DESCRIPTION</th></tr></thead><tbody><tr><td>0000</td><td>All parameters are locked.</td></tr><tr><td>0001</td><td>Only SP is adjustable.</td></tr><tr><td>0010</td><td>USER (level) and A1(parameter) are adjustable.</td></tr><tr><td>0011</td><td>USER · PID(level) and A1 · A2 (parameter) are adjustable.</td></tr><tr><td>0100</td><td>USER · PID · OPTI(level) and A1 · A2(parameter) are adjustable.</td></tr><tr><td>1000</td><td>Additional A3(parameter). All parameter you can find out, but can't adjustable.</td></tr><tr><td>1001</td><td>Additional A3(parameter), only SP is adjustable.</td></tr><tr><td>1010</td><td>USER(level) and A1(parameter) are adjustable.</td></tr><tr><td>1011</td><td>USER · PID (level) and A1 · A2 · A3 (parameter) are adjustable.</td></tr><tr><td>1100</td><td>All parameters in all level are opened.</td></tr></tbody></table>			SETTING	DESCRIPTION	0000	All parameters are locked.	0001	Only SP is adjustable.	0010	USER (level) and A1(parameter) are adjustable.	0011	USER · PID(level) and A1 · A2 (parameter) are adjustable.	0100	USER · PID · OPTI(level) and A1 · A2(parameter) are adjustable.	1000	Additional A3(parameter). All parameter you can find out, but can't adjustable.	1001	Additional A3(parameter), only SP is adjustable.	1010	USER(level) and A1(parameter) are adjustable.	1011	USER · PID (level) and A1 · A2 · A3 (parameter) are adjustable.	1100	All parameters in all level are opened.
SETTING	DESCRIPTION																								
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1100	All parameters in all level are opened.																								
LoCL			0100																						

THIRD PROGRAMMING LEVEL PARAMETERS (OPTION LEVEL)

CODE	DESCRIPTION	RANGE	Default
tYPE	Input type selection.		
	J	-50 ~ 1000	-50 ~ 1032
	K	-50 ~ 1370	-50 ~ 2496
	T	-270 ~ 400	-454 ~ 752
	E	-50 ~ 750	-58 ~ 1382
	B	0 ~ 1800	32 ~ 3272
	R	0 ~ 1750	32 ~ 3182
	S	0 ~ 1750	32 ~ 3182
	N	-50 ~ 1300	-58 ~ 2372
	C	-50 ~ 1800	-58 ~ 3272
	D-PT	-200 ~ 850	-328 ~ 1652
	J-PT	-200 ~ 650	-328 ~ 1202
	LINE	-1999 ~ 9999	
UnE	Unit of process value. This parameter is not displayed when tYPE =LinE	0°C: Degrees C 0°F: Degrees F	°C
LUt	Used to specify the process value when linear input (type=Line) signal is out of range. None = This function is not used. Lo = The process value will be limited to LoL when input signal is lower than the scale range. Hi = The process value will be limited to HiL when input signal is higher than the scale range.	nonE, Lo Hi, Hi, Lo	nonE
	LoHi = The process value will be limit within the range of LoL to HiL when input signal is out of scale.		
dP	Decimal Point selection. 0000: No decimal point. 000.0: 0.1 resolution. 00.00: 0.01 resolution, used for linear input only. 0.000: 0.001 resolution, used for linear input only. After change decimal point, make sure all other setting of parameters are correct.	0000 000.0 00.00 0.000	0000





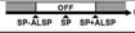
RcL	Control Output action.	rEv: Reverse action for heating. d = Direct action for cooling	rEv
LoL	Low limit of span or range. Set the low limit lower than the lowest expected SV and PV display.	Full range.	0
HiL	High limit of span or range. Set the high limit higher than highest expected SV and PV display.	Full range.	1000
F.Lt	Input signal filter.	0.0-99.9	10.0
R1FU	Alarm 1 function. Refer to alarm function section for detail.	nonE, Hi, Lo, dH, dL, bd, Hi, bd, Lo, t.on, t.oFF	d.FH
R1nd	Alarm 1 mode. Refer to alarm mode section for detail.	nonE, Stdy, Lath, StLa HH:mm, mm:SS	nonE
R2FU	Alarm 2 function. Refer to alarm function section for detail.	nonE, Hi, Lo, dH, dL, bd, Hi, bd, Lo, t.on, t.oFF	d.FH
R2nd	Alarm 2 mode. Refer to alarm mode section for detail.	nonE, Stdy, Lath, StLa HH:mm, mm:SS	nonE
R3FU	Alarm 3 function. Refer to alarm function section for detail.	nonE, Hi, Lo, dH, dL, bd, Hi, bd, Lo, t.on, t.oFF	d.FL
R3nd	Alarm 3 mode. Refer to alarm mode section for detail.	nonE, Stdy, Lath, StLa HH:mm, mm:SS	nonE
Rdd	Address of controller when communication with master device.	0-255	0
bRUd	Communication baud rate. 2.4k=2400bps, 4.8k=4800 bps, 9.6k=9600 bps, 19.2k=19200 bps	2.4k, 4.8k, 9.6k, 19.2k	9.6k

Scaling for Linear Input

1. Press the **[SEL]** and **[DOWN]** keys simultaneously for 5 seconds to access "LnLo" parameter.
2. Adjust "LnLo" setting to correspond the low scale and after adjustment press **[SEL]** key once to access "LnHi" parameter.
3. Adjust "LnHi" setting to correspond the high scale and after adjustment press **[SEL]** key once for normal operation.

CODE	DESCRIPTION	RANGE	DEFAULT
rEdL	Low Scale of PT100	Not adjustable	0.0
rEdH	High Scale of PT100	Not adjustable	800.0
LnLo	Low Scale of Linear Input	-1999-9999 (-199.9-999.9)	0.0
LnHi	High Scale of Linear Input	-1999-9999 (-199.9-999.9)	100.0



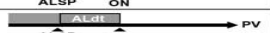
ALARM FUNCTION

A1FU2FU3FU	ALARM TYPE	ALARM OUTPUT OPERATION
nonE	Alarm function OFF	Output OFF
H	PV high alarm	
Lo	PV low alarm	
d.FH	Deviation high alarm	
d.FL	Deviation low alarm	
bdH	Band high alarm	

5.1.Operation Electric Panel

【GAS100-S】

【PT Meter】

bdLo	Band low alarm	
t.on	PV high alarm with delay time	
t.oFF	PV low alarm with delay time	

ALARM FUNCTION

ALMD	DESCRIPTION
nonE	Normal alarm mode
Stdy	Standby mode when selected, in any alarm function, prevents an alarm on power on. The alarm is enabled only when the process value reach alarm set point. Also known as "Startup inhibit" and is useful for avoiding alarm trips during startup.
LrLH	Latch mode. When selected, the alarm output and indicator latch as the alarm occurs. The alarm output and indicator will be energized even if the alarm condition has been cleared unless the power is shut off.
St.LA	Standby and latch mode
HH:MM	99 Hours 59 Minutes
MM:SS	99 Minutes 59 Seconds

The controller can also be set to ON/OFF, P and PD control mode. Set Pb = 0 for ON/OFF control mode. The Hysteresis (dead band) of ON/OFF control can be set as follow:



■ ERROR MESSAGE AND TROUBLESHOOTING

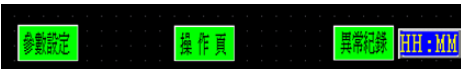
SYMPTOM	PROBABLE	SOLUTION
oPEr	-Sensor break error -Sensor not connected	-Replace sensor -Check the sensor is connected correctly
Keypad no function	-Keypads are locked -Keypads defective	-Set "LoCL" to a proper value -Replace keypads
No heat or output	-No heater power or fuse open -Output device defective or incorrect output used	-Check output wiring and fuse -Replace output device
All LED's and display not light	-No power to controller -SMPS failure	-Check power lines connection -Replace SMPS
Process Value changed abnormally	-Electromagnetic Interference (EMI) or Radio Frequency Interference (RFI)	-Suppress arcing contacts in system to eliminate high voltage spike sources. Separate sensor and controller wiring from "dirty" power lines. Ground heaters
Entered data lost	-Fail to enter data to EEPROM	-Replace EEPROM

* VERTEX 2007-A

VERTEX is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual.




5.1.Operation Electric Panel

【GAS100-A】

【Touch Panel】		
1	【Main Page】 【參數設定】 :It meat Data set 【操作頁】 :It meat operator set 【異常記錄】 :It meat error record	
2	【參數設定】 :Push it. It will be change to Password page 【操作頁】 :Push it. It will be change to operator page 【異常記錄】 :Push it. It will be change to Error page	
3	*Display time: Touch Screen operation when no one is 2 minutes after the start time into the protected screen, if to operate the machine, press guard the LCD screen of any one position, that is set to enter the password, enter the correct password, enter 【操作頁】 to 【Main Page】	

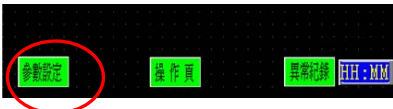


5.1.Operation Electric Panel

【GAS100-A】

【Cylinder-A Setting】		
1	【Cylinder-A】 is change	
2	【抽真空時間】 :Push it. It will set to Vacuum Time. 【負壓時間】 :Push it. It will set to Negative Pressure Time 【Purge 充氮氣時間】 :Push it. It will set to Nitrogen time. 【Purge 抽真空時間】 :Push it. It will set to Vacuum time.	
3	【加壓時間】 :Push it. It will set to increase pressure Time. 【保壓檢查時間】 :Push it. It will set to keep up Pressure Time 【Purge 充氮氣時間】 :Push it. It will set to Nitrogen time. 【Purge 抽真空時間】 :Push it. It will set to Vacuum time. 【Purge 次數】 :Push it. It will set to frequency.	
4	【Supply Low Set】 :Push it. It will set to PT1 Low Set. 【Supply Lo-Lo Set】 :Push it. It will set to PT1 Lo-Lo Set. 【管路負壓設定】 :Push it. It will set to negative pressure in vacuum piping systems. 【保壓壓力範圍設定】 :Push it. It will set to keep up pressure set. 【加壓壓力設定】 :Push it. It will set to increase pressure set.	

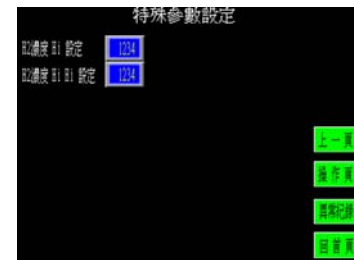
5.1.Operation Electric Panel

【GAS100-A】

【Cylinder-B Setting】		
1	【Cylinder-B】 is change	
2	<p>【抽真空時間】:Push it. It will set to Vacuum Time.</p> <p>【負壓時間】:Push it. It will set to Negative Pressure Time</p> <p>【Purge 充氮氣時間】:Push it. It will set to Nitrogen time.</p> <p>【Purge 抽真空時間】:Push it. It will set to Vacuum time.</p>	
3	<p>【加壓時間】:Push it. It will set to increase pressure Time.</p> <p>【保壓檢查時間】:Push it. It will set to keep up Pressure Time</p> <p>【Purge 充氮氣時間】:Push it. It will set to Nitrogen time.</p> <p>【Purge 抽真空時間】:Push it. It will set to Vacuum time.</p> <p>【Purge 次數】:Push it. It will set to frequency.</p>	
4	<p>【Supply Low Set】:Push it. It will set to PT1 Low Set.</p> <p>【Supply Lo-Lo Set】:Push it. It will set to PT1 Lo-Lo Set.</p> <p>【管路負壓設定】:Push it. It will set to negative pressure in vacuum piping systems.</p> <p>【保壓壓力範圍設定】:Push it. It will set to keep up pressure set.</p> <p>【加壓壓力設定】:Push it. It will set to increase pressure set.</p>	

5.1.Operation Electric Panel

【GAS100-A】

【Specail Date Setting】		
1	<p>【H2 濃度 Hi 設定】:Push it. It will set value to PPM concentration in Hi</p> <p>【H2 濃度 Hi Hi 設定】:Push it. It will set value to PPM concentration in Hi Hi</p>	

5.1.Operation Electric Panel

【GAS100-A】

【Operating Setting】

1	<p>【手動模式I】:Push it. It will set value to manual function 【A 鋼供氣】:Push it. It will set to supply Cylinder-A. 【A 鋼 ON_LINE】:Push it. It will set to change Cylinder-A in ON_LINE. 【更換A 鋼】:Push it. It will set to change Cylinder-A. 【B 鋼供氣】:Push it. It will set to supply Cylinder-B.. 【B 鋼 ON_LINE】:Push it. It will set to change Cylinder-B in ON_LINE. 【更換B 鋼】:Push it. It will set to change Cylinder-B.</p>	
2	<p>Push【手動模式】The HMI will auto to show manual Windows. Push 【A 鋼】 and 【確認】.The windows will auto to close. The Windows will into Cylinder-A to set manual function. The operator can set the valve in the piping system of Cylinder-A.</p>	
3	<p>Push【手動模式】The HMI will auto to show manual Windows. Push 【B 鋼】 and 【確認】.The windows will into Cylinder-B to set manual function. The operator can set the valve in the piping system of Cylinder-B.</p>	

5.1.Operation Electric Panel

【GAS100-A】

【Operating Setting】

1	<p>Push 【Valve】 The HMI will auto to show manual Windows. Push 【OPEN】 and 【CLOSE】.The valve will auto to close or Open.</p>	
2	<p>Push 【手動】 The HMI will auto to jump out of manual Windows. Push 【取消】.The windows will auto to cancel the manual situation. The Cylinder A and B will auto to cancel the manual situation.</p>	
3	<p>Push 【手動】 The HMI will auto to show to out of manual situation. If the cylinder have supplied to piping. The system will auto to jump to 【供氣中】.Then any cylinder will show in windows. It will show to you the issue. The system will ask you to change to manual situation by any cylinder.</p> <p>⚠CAUTION :The solenoid valve of V5 need to open before the solenoid valve of V5 in any cylinder.</p>	

5.1.Operation Electric Panel

【GAS100-A】

【Operating Setting】

1	<p>Push【A 鋼供給】The HMI will auto to show the Windows. 【請將新鋼瓶裝上】 It meant installing the newest cylinder into. Installing your new cylinder before you push the button 【確認】. Then, push 【確認】.The system will auto to run the step :increase pressure->keep up pressure->purge in action.</p>	
2	<p>The 【A 鋼供給完成】 show red color to mean the cylinder-A finish to purge and supply the gas into.</p>	
3	<p>Push 【A 鋼 ON_LINE】 The system will auto to check the value of PT and pressure of the cylinder. The action finish to show 【請將鋼瓶閥打開】. It meant to the system to prepare to open the valve. Push 【確認】 to check and open the valve.</p>	

5.1.Operation Electric Panel

【GAS100-A】

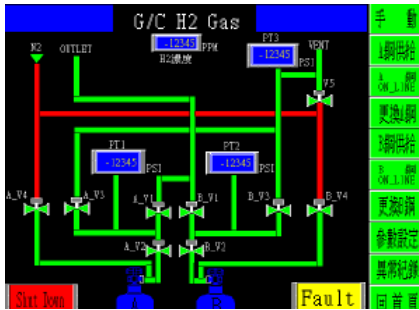


【Operating Setting】

1	<p>【A 鋼 ON_LINE STANDBY BY】 The HMI will auto to show the Windows. It meant the cylinder-A on line and standby by. Push 【確認】 will auto to check the value of PT and the pressure of cylinder again.</p>	
2	<p>【A 鋼 ON_LINE STANDBY BY】 running will install to sandy by in cylinder-A. When the cylinder-B finish to zero. The Cylinder-A will auto to supply the gas.</p>	
3	<p>【空瓶】 The cylinder-B is Zero. The button will show to red color in the windows.</p>	

5.1.Operation Electric Panel

【GAS100-A】

【Operating Setting】

1	<p>【Shut Down】 The HMI will auto to show the Windows. It meant the system have some issue and record this issue time in error list. Please solve the alarm of shut down and push the reset it.</p> <p>【Fault】 The HMI will auto to show the Windows. It meant the system have some issue and record this issue time in error list. Please solve the alarm of fault and push the reset it.</p>	
2	<p>Push【異常記録】to know which issue and solve it. It meant any system alarm to list.</p>	
3	<p>Push 【確認】 to clean any list.</p> <p>Push 【静音】 to close the buzzer sound</p> <p>Push 【復歸】 to rest the system.</p>	

6.Troubleshooting

6.1 Troubleshooting and actions for quality assurance, and cautions for maintenance

Trouble	Possible Cause	Check/corrective Actions
PT value no show	PT value set to fault	Chick the PT sensor or any piping system
Buzzer sound	Chick your cylinder in stall	Install the cylinder again
	Chick your supply gas to HPI and HP valve	Open the valve and chick full system.
	The valve is not opening	Chick your operate to open any valve.
	Electric lights issue	Replace printed circuit board. please contact to +886-6-2632460 to service.
Power issue	PT LO,LOLO,HI,HIHI	Reset the PT value into the correct value.
	Did not install power cable	Plug in the power again
	Electric break down	Open the break again
Leaky piping	Ground fault	please contact to +886-6-2632460 to service.
	Valve issue	Disassemble and repair valve.
	Cylinder connection	Re-install the pigtail and cylinder

6.2 Cautions for maintenance

6-2-1.Zero-point and span calibrations

If you have a reference pressure and flow meter, perform both adjustment and calibration of the zero-point and span. If you do not have the meter, adjust only the zero-point. Or contact to us

6-2-2.Joint washing of the inlet and outlet

Remove the joints for washing thereof in an environment as clean as possible so that no dusts will enter the main machine. Never disassemble the sensor and valve.
(With regard to the disassembling, it is difficult to warrant the initial performance.)

7.Product Warranty

The warrant period shall be one (1) year after the shipment.

If a malfunction of the products you purchased occurs because of our responsible reasons, it will be charge-free repaired in our factory. The range of the warrant shall be limited to the main machine. Any damages caused by the malfunction of the main machine can not be compensated by us.

If a malfunction of the main machine occurs due to the following reasons, even within the warrant period, it will be onerously repaired by us.

- A. Malfunctions due to erroneous applications, repairs or remodeling
- B. (Including the case in which the manufacturing specifications differs from the application conditions.)
- C. Malfunctions due to the falling after the purchase.
- D. Malfunctions caused by natural disasters such as fire, earthquake, water disaster and lightning stroke, or riots or wars.
- E. Malfunctions caused by mixing-in of foreign matters out of the piping.
- F. Malfunctions caused by the peculiar problems due to combinations with other built-in equipment.



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