ULVAC

MODEL GI-M2
METAL IONIZATION VACUUM GAUGE

MODEL GI-D7 / GI-N8
IONIZATION VACUUM GAUGE

INSTRUCTION MANUAL

This manual is for the ion gauges of serial numbers.
GI-M2 : S/N 32000G～, T3200G～
GI-D7 : S/N 32001G～, T3001G～
GI-N8 : S/N 30001G～, T3001G～

Read this manual carefully before using this gauge and keep it at your hand for immediate reference.

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Before Use of This Vacuum Gauge

Upon receipt of this pump, make sure it is the correct model you ordered and that it is free from damage in transit.

⚠WARNING	Read this instruction manual before installing, operating, inspecting, or maintaining the product and fully understand the safety precautions, specifications and operating procedures regarding the product.
⚠WARNING	The copyright of this instruction manual is held by ULVAC, Inc. You are prohibited from copying any portion of this instruction manual without the consent of ULVAC Inc. You are also prohibited from disclosing or transferring this instruction manual to third parties without the express written consent of ULVAC Inc.
⚠CAUTION	The contents described in this instruction manual are subject to change without prior notice because of changes in specifications or because of product improvements.

Safety Denotations

⚠WARNING	Safety symbols are used throughout this instruction manual to call the operator's attention to safety. The terminology used in safety symbols is classified below.

⚠DANGER	Indicate status of urgency of danger when failure to comply with DANGER results in serious personal injury or death The work ignoring this warning will lead to serious damage to human life or factory facility (including this equipment) at a high probability.
⚠WARNING	Indicate status of danger when failure to comply with WARNING results in serious worker's injury or death. The work ignoring this warning will cause possibility leading to serious damage to human life or factory facility (including this equipment)
⚠CAUTION	Indicate status of danger when failure to comply with WARNING results in minor injury or moderate damage. The work ignoring this warning will cause possibility leading to minor damage to worker or breakage to equipment or necessary to adjust.
✔ Note	Direct hazard is not existed, describe the necessity to know from the viewpoint of worker's safety or correct and safe operation of equipment

Safety Cautions

For safe use of this gauge, be sure to read this manual and the following safety cautions.

⚠WARNING	**Turn off power.** If the gauge is damaged, immediately turn off the power. Otherwise, fire or electric shock can result. For safety reasons, contact your local ULVAC representative or ULVAC JAPAN.
⚠WARNING	**Turn off power.** If the gauge gets unusually hot or gives out smoke, immediately turn off the power. Otherwise, fire can result. For safety reasons, contact your local ULVAC representative or ULVAC JAPAN.
⚠WARNING	**Turn off power.** Whenever you touch or may touch the sensor head terminal on the rear of the controller, turn off the power to the gauge. A grid voltage of 150 VDC is applied to the sensor head terminal. If you touch it when power is turned on, you will get electric shock.
⚠WARNING	**Turn off power.** Whenever you touch or may touch the sensor head pin, turn off the power to the gauge. A grid voltage of 150 VDC is applied to the sensor head terminal. If you touch it when power is turned on, you will get electric shock.
⚠CAUTION	**Beware of high temperature.** Do not touch the sensor head surface, which is very hot during and immediately after operation. If you touch it, you may get burned.
⚠CAUTION	**Turn off power.** Turn off the power before replacing a fuse. If it is replaced with the power turned on, you may get electric shock.
⚠CAUTION	**Turn off power.** Before installing the gauge, unplug the power cable.
⚠CAUTION	**Use fuse of specified rating.** Do not use a fuse other than specified one nor short the fuse holder. Damage or fire can result.
⚠CAUTION	**Check line voltage.** Before turning on power to the gauge, make sure the vacuum gauge operating voltage and the supply voltage are in agreement. Connection with an incorrect power can damage the vacuum gauge or fire.
⚠CAUTION	**Be cautious with operating environment.** Do not connect the sensor head to an environment where pressure exceeds atmospheric pressure. If the pressure in the sensor head exceeds atmospheric pressure, the sensor head will be damaged and the sensor head will pop out from the connection, causing damage or injury to human body and other hazards. In that event, provide an isolation valve or other so that the pressure in the sensor head does not exceed atmospheric pressure.
⚠CAUTION	**Don't disassemble.** Do not disassemble the vacuum gauge (controller, sensor head cable, and sensor head)
⚠CAUTION	**Don't modify.** Do not modify the vacuum gauge (controller, sensor head cable, and sensor head). If it is modified, its action is not warranted. Also fire or electric shock can result.
⚠CAUTION	**Check connection.** For safety reasons, connect the grounding terminal of the controller to ground.

⚠CAUTION	**Be cautious with operating environment.** Do not use the gauge where it may splashed with water. If it is wetted, trouble, earth leakage or fire can result.
⚠CAUTION	**Ensure ventilation.** Do not plug the port for the fan and ventilation port. If it is plugged, heat will be contained inside, resulting in damage. The vacuum gauge will not indicate a normal value either.
⚠CAUTION	**Keep out foreign matter.** If metal fragments or combustible material are admitted into the gauge through the fan or ventilation port, remove them. Otherwise, the vacuum gauge may be damaged.
⚠CAUTION	**Use rated cable.** The rating of the supplied cable is 125 V 10A. If it is used at above the rating, it will break.
⚠CAUTION	**Beware of impact.** Do not give an impact to the sensor head.
⚠CAUTION	**Comply with operating conditions.** Use the gauge in the specified environment.
⚠CAUTION	**Maintenance** Aluminum electrolytic capacitor, cooling fan and relay contact are used for the electric circuit in the sensor unit. Generally, the life expectancy of the aluminum electrolytic capacity is limited and the higher the surrounding temperature, the shorter the life. It is recommended to replace the aluminum electrolytic capacitor , cooling fan once every three years or at the time or repair or overhaul to prevent components from being damaged.
⚠CAUTION	**Caution in repacking** When shipping the gauge, repack it in the same way as on delivery. It is shipped bare, it may be damaged.
⚠CAUTION	**Disposal** When discarding the vacuum gauge, comply with your local regulations. If the gauge was used in an environment that can cause hazards to human body, have it disposed of by an authorized specialist in disposal. Customer shall be responsible for the cost relating to disinstallation.
⚠CAUTION	**Check connection.** The contact output capacity is 100 VAC 0.5 A ,24VDC/1A(resistance load). If a higher power is made/broken, do not use the vacuum gauge contact, but use a switch with a higher capacity in conjunction. (Use below 24 VDC is recommended.)
⚠CAUTION	**Connector life such as sensor cable** The female connector used for the sensor cable used in this instrument has alimited life.If the current load is large, so please refrain from connecting and disconnecting connectors as much as possible.If the connector is overloarded, the contact of the connector will be worse and it will not be usable._

Revision history

Date	No.	Reason
Sep.11,2008	02	GI-D7 : Analog Output of GI-TL3 Compatibility added
May.12,2009	03	Correction of errors
Sep.15,2010	04	Added fuse type
Jun.25,2012	05	Correction of errors
Apr.5,2013	06	GI-M2 : Added LOG output
Sep.18,2013	07	Correction of errors
Dec.2,2019	08	GI-D7 : Added Pressure protecting function switching
Apr,28.2023	09	Added Torr specification S/N GI-D7/N8 : Correct Measurement pressure range GI-D7/N8 : Correct Pressure protecting function

Contents

Contents

1.FEATURES OF GI-Series

The ionization vacuum gauge GI series consists of three following models.

①Metal Ionization Vacuum Gauge GI-M2

The Model GI-M2 is a hot cathode ionization vacuum gauge for pressure measurement that uses the M type sensor head, which is smaller than that of the predecessor model B-A type ionization vacuum gauge and consumes less power.

The measurable pressure range is 5.00×10^{-8} to 9.99×10^{0} Pa. (3.70×10^{-10} to 7.40×10^{-2} Torr.)

The sensor head cable becomes the 150 degrees Celsius heat resistance specifications by default.

②Ionization Vacuum Gauge GI-D7

It is a hot cathode ionization vacuum gauge to use a sensor head for used triode ionization vacuum gauge (WIT) and a sensor head for used B-A type ionization vacuum gauge (WIB) for many years.

③Ionization Vacuum Gauge GI-N8

It is a hot cathode ionization vacuum gauge to use a sensor head for used for triode ionization vacuum gauge.

It can measure a pressure range of 4.00×10^{-9} to 6.00×10^{-1} Pa. (3.00×10^{-11} to 4.50×10^{-3} Torr.)

The degas method adopts an electron bombardment system method.

2.SPECIFICATIONS AND COMPONENTS

2.1.Standard Specifications

Name	Model GI-M2 metal ionization vacuum gauge	Model GI-D7 ionization vacuum gauge	Model GI-N8 ionization vacuum gauge
Compatible sensor head	1 pc		
Pressure display	Mantissa part 3 digits, exponent part 2 digits digital display □.□□ ×10□□ ※1)		
Compatible sensor head	M-11,M-12,M-13,M-14, M-15	WIT-G type, WIB-G type, WIB-N3	WIN-Gtype, WIN-N2, WIN-N3
Measurement pressure range	5.00×10^{-8} — 9.99×10^{0} (Pa) 3.00×10^{-10} — 7.40×10^{-2} (Torr)	WIT : 1.30×10^{-5}— 6.70×10^{-1} (Pa) 1.00×10^{-7}— 4.50×10^{-3} (Torr) WIB : 1.30×10^{-6}— 1.30×10^{-2} (Pa) 1.00×10^{-8}— 1.00×10^{-4} (Torr)	4.00×10^{-9} — 6.60×10^{-1} (Pa) 3.00×10^{-11} — 9.99×10^{-4} (Torr)
Measurement accuracy	Within ±15%		
Operating potential	Grid potential: 150(V), Filament potential: 25(V), Collector potential:0(V)		
Emission current	10μA, 1.0mA ※2)	WIT: 0.595mA WIB: 1.0mA	0.5mA, 5.0mA ※3)
Sensor head sensitivity	0.06 Pa^{-1}	WIT: 0.139 Pa^{-1} WIB: 0.083 Pa^{-1}	0.153 Pa^{-1}
Pressure protecting function	9.99×10^{-0} Pa ※4) 7.40×10^{-2} Torr	WIT: 9.99×10^{-1} Pa 4.50×10^{-3} Torr WIB: 2.00×10^{-1} Pa 2.00×10^{-3} Torr	6.60×10^{-1} Pa 9.99×10^{-4} Torr
Degassing function	Direct electrical heating of grid AC Power 1.5VA	Direct electrical heating of grid AC Power 1.5VA	Electron bombardment system. ※5) 500V、5mA
	Normal mode : Operates according to DEGAS ON/OFF signal. Auto OFF mode : When this mode is set, degassing is automatically turned off after a preset time by setting an arbitrary time of 01 to 99 minutes		
Function	Settiong of range hold、Selection of filament、Setting of sensitivity		
Sampling time	100msec		
Analog output	Each digit mantissa part linear output, All measurement ranges pseudo-log. Output, Designated range hold linear output, LOG Output		
	Resolution : 10mV Output impedance : Approx. 100 ohms		
Setpoint	Two points can be set independently. Relay contact output (COM, a contact, b contact for each setting). Contact capacity AC: $125V_{MAX}$, $0.5A_{MAX}$ / DC: $24V_{MAX}$, $1.0A_{MAX}$		
Control input signal	Control changeover, Filament ON/OFF, Filament 2/1, Degas ON/OFF, Range hold, External protecting		
Control output signal	Analog output (0-10V), BDC output, Power condition, Filament ON/OFF, Emission setting, Degas ON/OFF, Emission valid OK/NG		
RS-232C	9600／ 19200／ 38400 bps		
Operating temperature range	10 ～ 40℃		
Operating humidity range	15 ～ 80% (No condensation)		

Power requirements	AC100V±10V 50/60Hz		
Power consumption	60VA	120VA	65VA
Fuse	BS.SEMKO EWM 3.15A (Fuji Terminal Industry) (2 pc)		
Outside dimensions	240W × 380D × 99H (mm)		
Weight	5.6kg	5.7kg	5.8kg

※1) Pressure display can set that mantissa part 2 digits, exponent part 2 digits digital display (□.□□ × 10□□).
※2) 10 μA and 1.0 mA are automatically changed over depending on pressure, 1.0 mA is available when the pressure measurement value is 0.79×10^{-2} Pa or less
※3) Emission current of 5.0 mA is available under a pressure of 6.6×10^{-4} Pa or less.
※4) When use a tungsten filament, it is necessary to do pressure protection of a set point of functioning in 9.9×10^{-3} Pa
※5) Available under a pressure of 1.3×10^{-4} Pa or less.

2.2. Standard Accessories

External input/output connector	57-30500: DDK or equivalent	1 pc.
Power cable	125 V, 7 A, 3-pin cable, 3 m long	1 pc.
Quick manual	Ordinary paper	1pc

This gauge does not come with the RS-232C communication cable.
Use a commercially available RS-232C cable (cross type).

2.3. Options

Sensor head	Refer to P.87 ～ for the each sensor head details. Refer to P.87 ～ for the demontions details.
Sensor head cable	Refer to P.90 ～ for the details.
Inspection record	
Calibration certificate	Calibration certificate, JCSS Calibration certificate

3. NOMENCLATURE AND FUNCTIONS OF COMPONENTS

3.1. Operation Switch

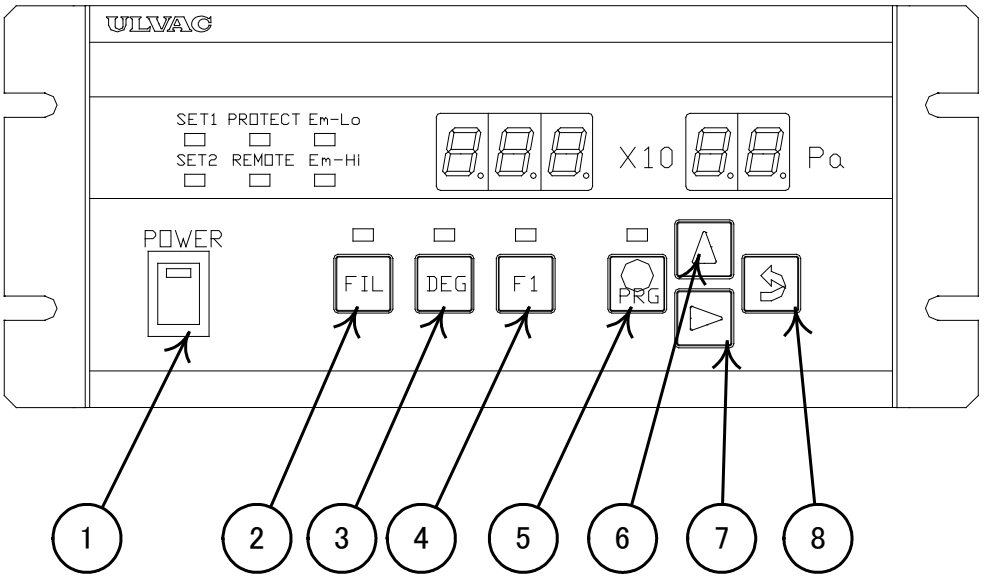


Fig. 3-1 Operation switch panel

Name (Inscription)		Function
①	Power switch (POWER)	Pressing the top of the POWER switch turns on power and pressing the bottom turns it off. When the power is on, the LED in the switch is lit.
②	Filament key (FIL)	Used to turn on/off the filament. The first press on the key turns on the filament and a second press turns it off.
③	Degas key(DEG)	Used to turn on/off degassing. The first press on the key turns on degassing and a second press turns it off. Degassing is automatically turned off after a preset time when used in the auto OFF mode.
④	Functionkey (F1) (GI-N8 Only)	Changes over the emission current 0.5/5 mA. Set at 0.5 mA when measurement is started. Can be changed over to 5 mA at 5.0×10^{-6} Pa (5.0×10^{-6} Torr) or less.
		Subtracts the ion current background by X-rays. Key in continuously for 2 seconds or more. Activated at 2.0×10^{-10} Pa. (2.0×10^{-10} Torr.)
⑤	Program key (O PRG)	Switch to change over to the setting mode. Holding down the switch for 2 seconds or more changes over the measurement mode/setting mode.
⑥	UP switch(Δ)	Each press on the switch increments a value by one.
⑦	SHIFT switch(▷)	Shifts a value to the right.
⑧	ENTER switch (⏎)	Used to store a set value in memory. A set value cannot be changed unless this switch is pressed because it is not stored in EEPROM.

3.2. Front Panel Lamps

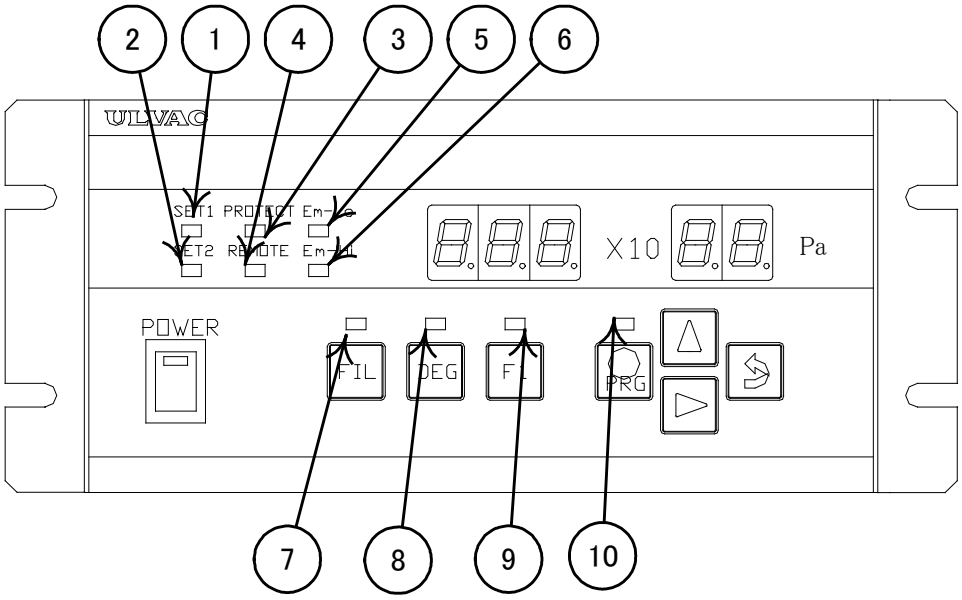


Fig. 3-2 Front panel lamps

Name (Inscription)		Function
①	SET-1 lamp (SET1)	Lit when set point 1 is activated.
②	SET-2 lamp (SET2)	Lit when set point 2 is activated.
③	EXT-PROTECT lamp (PROTECT)	Lit when filament protection is activated by an external input signal.
④	REMOTE lamp (REMOTE)	Lit when the gauge is set in the REMOTE status by external control (external I/O, RS-232C).
⑤	Emission state lamp (10μA)	GI-M2: Lit when emission current is 10 μA. GI-N8: Lit when emission current is 0.5 mA. GI-D7: Not used.
⑥	Emission state lamp (1mA)	GI-M2: Lit when emission current is 1 mA. GI-N8: Lit when emission current is 5mA. GI-N7: Not used.
⑦	Filament lamp	Lit: when the filament is ON and the emission current is normal. Blink: When the filament is ON and the emission current is abnormal.
⑧	DEGAS lamp	Lit when degassing is ON.
⑨	F1 lamp (GI-N8 Only)	Lit when background processing function by soft X-ray is effective (X-Ray).
⑩	PROGRAM lamp	Lit when in the program setting mode.

3.3. Front Panel Measurement Value Display/Set Value Indicator

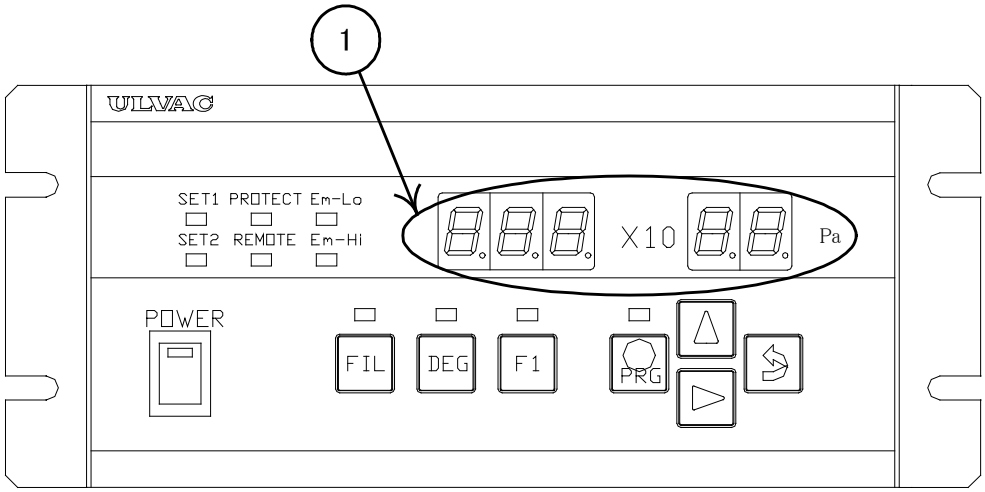
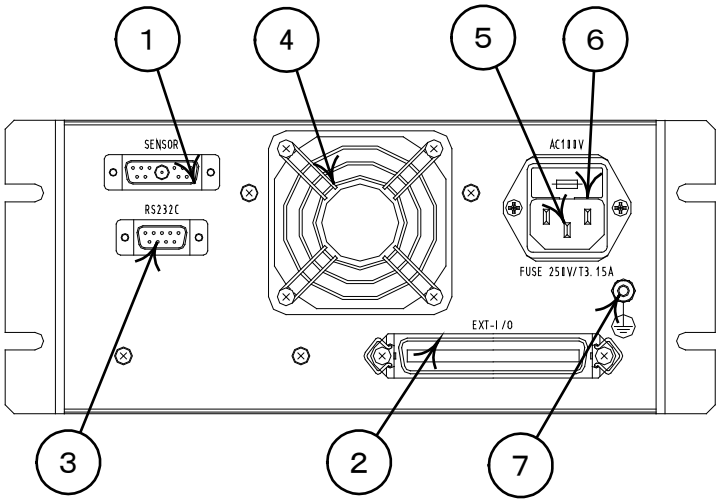


Fig. 3-3 Front panel measurement value display/set value indicator

Status		Function
①	When in the measurement mode	Displays the pressure measurement value.
	When in the program set mode	Displays the set value of each program.

3.4. Rear Panel

GI-M2



GI-D7 ／ GI-N8

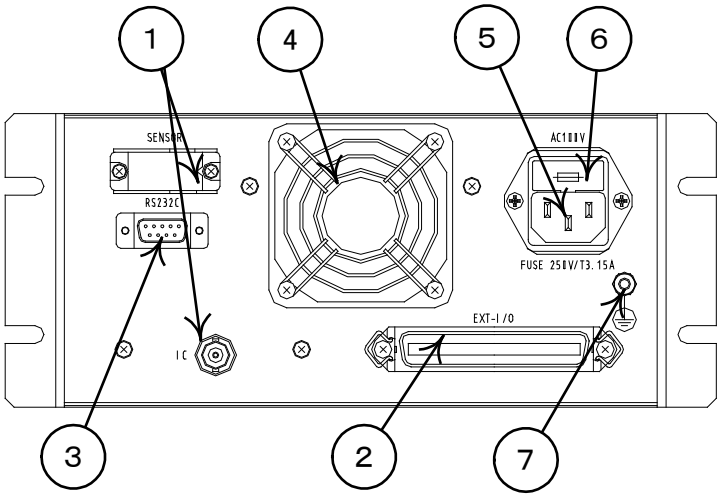


Fig. 3-4 Rear panel

	Name (Inscription)	Function
①	Sensor connector (SENSOR)	Connector for connecting the sensor head cable. (multi-core/coaxial compound cable)
②	External input/output connector (EXT-I/O)	I/O connector for data and signals (57 series 50-pin receptacle)
③	RS-232C communication connector (RS-232C)	Connector for communication (D-sub 9-pin pin connector)
④	Heat radiation fan	Fan for radiating (blowing out) the heat in the gauge.
⑤	Power inlet connector (AC100V)	Connector for connecting 3-core power cord with grounding terminal.
⑥	Power fuse holder (FUSE)	Fuse (2-ampere rapid action type) for protecting the gauge from over-current.
⑦	Ground terminal (GND)	Ground terminal for this gauge. Attach M4 solder less terminal before use. Analog ground, digital ground and frame ground are common.

3.5. EXT-I/O Connector

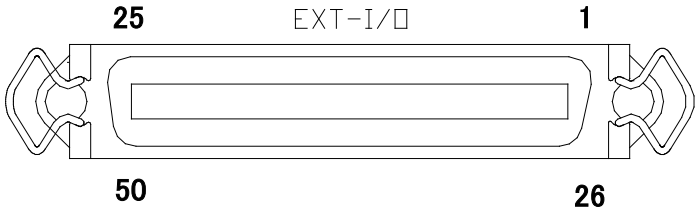


Fig. 3-5 Input/output connector pin assignment

Terminal No.	Signal identification		Terminal No.	Signal identification	
1	SET COM	(OUT-PUT)	26	SET2 COM	(OUT-PUT)
2	SET1 a contact	(OUT-PUT)	27	SET 2 a contact	(OUT-PUT)
3	SET1 b contact	(OUT-PUT)	28	SET2 b contact	(OUT-PUT)
4			29		
5	EXT-OUT COM	(OUT-PUT)	30	PRESSURE･DATA $\overline{\text{A−b0}}$	(OUT-PUT)
6	POWER $\overline{\text{ON}}$ ／ OFF	(OUT-PUT)	31	PRESSURE･DATA $\overline{\text{A−b1}}$	(OUT-PUT)
7	FILAMENT $\overline{\text{ON}}$ ／ OFF	(OUT-PUT)	32	PRESSURE･DATA $\overline{\text{A−b2}}$	(OUT-PUT)
8	EMISSION ※1) $\overline{\text{Em-Hi}}$ ／ Em-Lo	(OUT-PUT)	33	PRESSURE･DATA $\overline{\text{A−b3}}$	(OUT-PUT)
9	UNIT $\overline{\text{Pa}}$	(OUT-PUT)	34	PRESSURE･DATA $\overline{\text{B−b0}}$	(OUT-PUT)
10	DEGAS $\overline{\text{ON}}$ ／ OFF	(OUT-PUT)	35	PRESSURE･DATA $\overline{\text{B−b1}}$	(OUT-PUT)
11	EMISSION･VALID $\overline{\text{OK}}$ ／ NG	(OUT-PUT)	36	PRESSURE･DATA $\overline{\text{B−b2}}$	(OUT-PUT)
12	DATA･VALID $\overline{\text{Lo}}$ ／ Hi	(OUT-PUT)	37	PRESSURE･DATA $\overline{\text{B−b3}}$	(OUT-PUT)
13	PRESSURE･DATA $\overline{−}$／ ＋	(OUT-PUT)	38	PRESSURE･DATA $\overline{\text{C−b0}}$	(OUT-PUT)
14	PRESSURE･DATA $\overline{\text{C−b3}}$	(OUT-PUT)	39	PRESSURE･DATA $\overline{\text{C−b1}}$	(OUT-PUT)
15	PRESSURE･DATA $\overline{\text{D−b0}}$	(OUT-PUT)	40	PRESSURE･DATA $\overline{\text{C−b2}}$	(OUT-PUT)
16			41		
17	DEGAS $\overline{\text{ON}}$ ／ OFF	(IN-PUT)	42	LOCAL／ $\overline{\text{REMOTE}}$	(IN-PUT)
18	EXT-PROTECT $\overline{\text{ON}}$ ／ OFF	(IN-PUT)	43	FILAMENT $\overline{\text{ON}}$ ／ OFF	(IN-PUT)
19	EXT- 5V INPUT-COM	(IN-PUT)	44	EMISSION ※2) $\overline{\text{Em-Hi}}$ ／ Em･Lo	(IN-PUT)
20	EXT-24V INPUT-COM	(IN-PUT)	45	FILAMENT $\overline{2}$／ 1	(IN-PUT)
21			46	REC-HOLD $\overline{\text{ON}}$ ／ OFF X-RAY ※3)	(IN-PUT)
22			47		
23	GND		48	GND	
24	GND (REC-OUT-)		49	GND	
25	REC-OUT+	(OUT-PUT)	50		

- A, B, C and D in PRESSURE DATA A-b0 and later correspond to «A. B × 10 ± DC» of the indicator. Refer to "10. EXTERNAL INNPUT/OUTPUT" for more information.
- Digital output common is pin 5 by standard setting.
- The digital input power is the internal power by standard setting.
- Digital input common is 23, 24, 48, and 49.
- □ of signal identification (e.g. $\overline{\text{ON}}$) indicates the LOW status (short, negative logic).

※1) Em-Hi: 1mA(GI-M2)、5mA(GI-N8) 、 Em-Lo:10μA(GI-M2)、0.5mA(GI-N8)
※2) Use it only in GI-N8.
※3) As for REC-HOLD, GI-M2/GI-D7, X-RAY are functions in GI-N8.

3.6. View when the Bottom Panel in Controller is opened

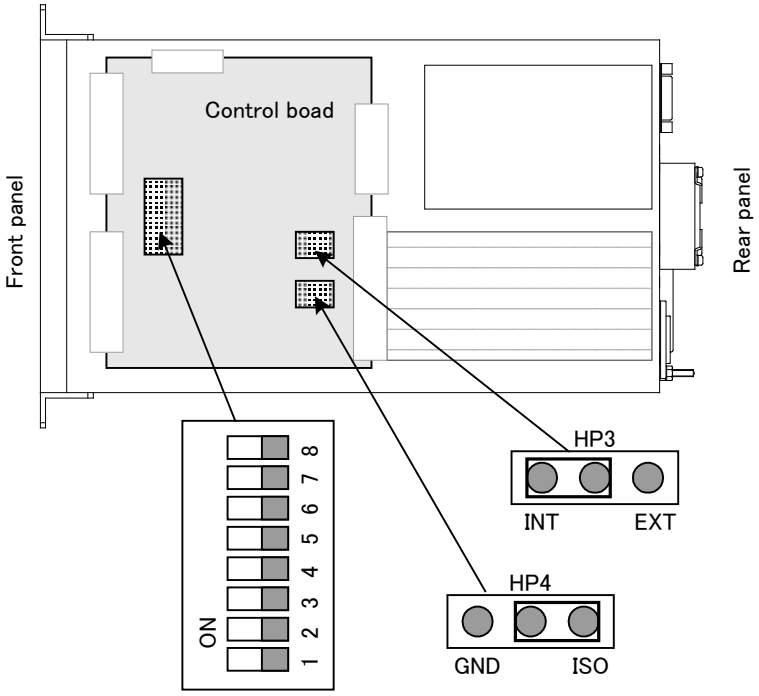


Fig. 3-6 View when bottom panel in controller is opened

Name (Inscription)		Function		
①	Internal DIP switch※2) (DS1)	Switch for settings.		
		DIP switch No.	ON	OFF
		1	Mantissa part 2 digits display	Mantissa part 3 digits display
		2 ※1)	Pressure protection function 9.9E-3 Pa (7.4×10^{-5} Torr)	ressure protection function 10 Pa (7.4×10^{-2} Torr)
		3	Not used	Not used
		4	Not used	Not used
		5	Used in system setting. The setting cannot be changed.	
		6		
		7		
		8		
②	External input switching jumper (HP3)	Jumper for selecting whether the internal power supply (5 V) or the external power supply is to be used to pull up the external input photocoupler. See P. 64		
③	External output switching jumper (HP4)	Jumper for selecting whether the common line of the external output open collector (emitter common) is to be connected to pin 5 of the external I/O connector or to the internal ground. See page 60		

※1) Use it only in GI-M2. Turn it on at the time of tungsten filament use.
※2) When the factory shipment, it is set entirely by OFF.

4.INSTALLATION

WARNING	Turn off power.

4.1. Preliminary Operation

① Unpack the gauge and check quantities. (See page 7 for the accessories.)
② Check components to see if they are damaged.

CAUTION	Beware of high temperature.
	Ensure ventilation.
	Keep out foreign matter.
	Be cautious with operating environment.
	Check connection.

4.2. Installing the controller

・ Install the controller on a panel or other.
See page 86 for the mounting hole.

4.3. Installing the sensor head

Install the sensor head to the gauge port or flange of a vacuum system.

4.3.1. Measuring position

The gauge measures the static pressure in the position where the sensor head is connected. If there is a flow, source of outgas, or an intense source of electrons or ions in the vacuum system, the measurement value will be affected by them. Select the measuring position carefully and install the gauge in a position where measurement is least affected by them.

Notice that if the sensor head is subjected to vibration, heat radiation, intense electromagnetic field or intense radiation, correct pressure measurement may not be made.

4.3.2. Installing the sensor head

- Install the sensor hrad in such a way that the sensor head mounting opening is parallel with the flow of gas. See to it that wspecially gas dose not enter the sensor head in the form of beam. (See Fig. 4-1)
- Mont the filament so that it is perpendicular to garallel with the amplitude direction of vibration if vibration is at a high level.
- O-rings used for installing the sensor head should be as free of outgas as possible. Use of a meteral that releases much outgas for connection of the sensor head, such as rubber pipw or grease, ban be a cause of error.
- If the filament is fubjected to a strong impact or vivration sideways when it is slacked by teat, it may break or contact with the grid electrode.

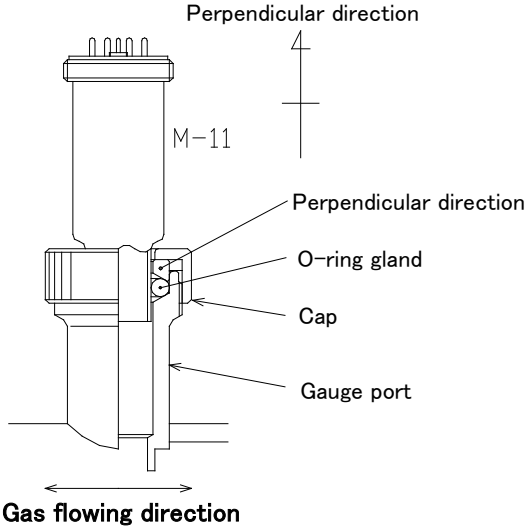
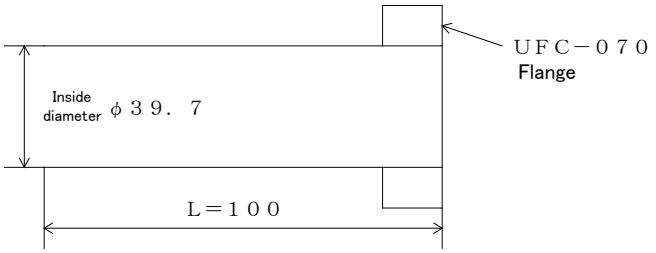


Fig. 4-1 Installation of sensor head

4.3.3. Installation of WIB-N3、WIN-N2/N3 (GI-D7、GI-N8)

If the nude gauge is used, use a pipe 39.7 mm or more in inside diameter. Contact of the filament with the outside wall of the pipe can be a cause of controller failure.



(Pipe used as example: OD 42.7 mm, wall thickness 1.5 mm, length 100 mm)

Fig. 4-2 Reference drawing for mounting nude gauge to short tube

4.4. Connecting the controller and sensor head

Connect the sensor head, sensor head cable and controller as shown in Fig. 4-2.

- Fix the cable so that no undue force is exerted to the connections between the sensor head and sensor head cable and between the controller and sensor head cable.
- Lay the sensor head cable away from power lines, if possible. Otherwise, noise may appear.
- If the sensor head cable moves, frictional electricity may be generated between the conductor and insulator and this may be a cause of error when the measured pressure is low.
- Avoid installation in a high temperature (above cable specification temperature) or high humidity place. The sensor head cable temperature is 150°C as standard. Pressure can be measured while baking with the gauge connected to the sensor head.
- Normally, the controller ground and the sensor head ground (outside wall) are connected by means of the sensor head cable. If there is a potential difference between the ground of the controller installation place and that of the sensor head installation place (due to connection of the connector screw and sensor head setscrew), measurement error may arise. In that event, install either of them afloat using an auxiliary wire or decrease the ground resistance.

CAUTION OF USE: M-type sensor head and nude gauge

Connect the GND terminal of the controller to the ground terminal in the place where the controller is installed. When the nude sensor is used, the vacuum piping and the ground of the controller are at the same potential (due to contact of the connector shell with the shell clamp and flange).

If the ground potential differs between the two, the pressure measurement may be in error. If this is the case, mount the controller electrically afloat and ground the vacuum chamber or mount the sensor by insulating it from the vacuum chamber and ground the controller.

CAUTION OF INSTALLATION:

If the potential level differs between the control ground and sensor head ground (outside wall), normal emission current will not be obtained and normal pressure measurement may not be made.

If the sensor head is connected/disconnected when there is a potential difference, you may get electric shock. (The connectors on both ends of the sensor head cable are at the same potential as their ground.)

Before connecting/removing the cable, turn off the power and make sure there is no potential difference.

Connect/remove the cable by holding the connector body. Connecting/removing the cable by the cable can be a cause of disconnection or poor contact.

4.4.1. Connection of controller (GI-M2) and sensor head

CAUTION	If a heater is wound around the connector and heated,the connector and cable may be melted. Do not wrap the heater around the connector.

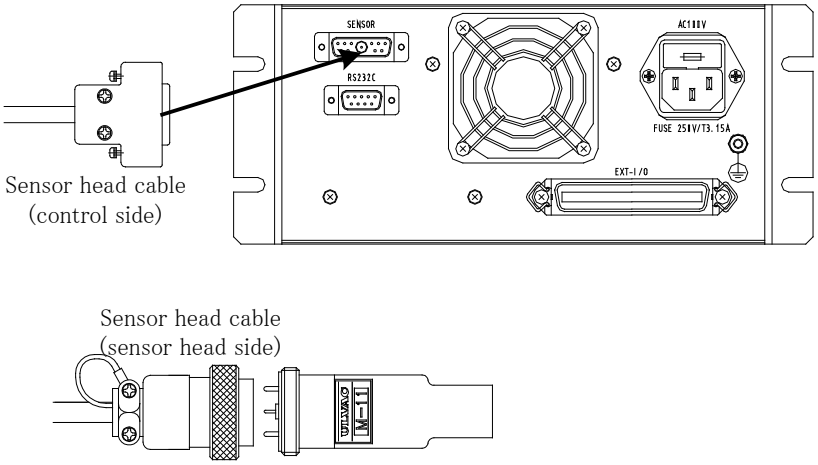


Fig. 4-3 Connection of controller (GI-M2) and sensor head

Avoid installation in a place where temperature (above specified cable temperature) or humidity is high. The standard operating temperature for the sensor head cable is 150°C. Pressure can be measured during baking, with the cable connected to the sensor head.

4.4.2. Connection of control and sensor head cable (GI-D7/GI-N8)

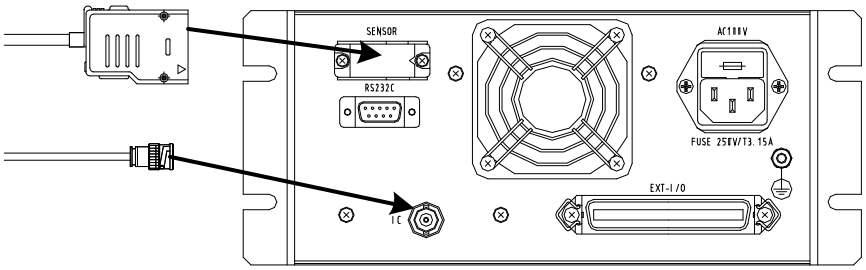


Fig. 4-4 Conection of sensor head cable and GI-D7/N8

The sensor head cable is not heat resistant. If the sensor connector area is heated to above 100°C (in baking or others), disconnect the connector.

4.4.3.Connection of sensor head and sensor head cable (GI-D7/GI-N8)

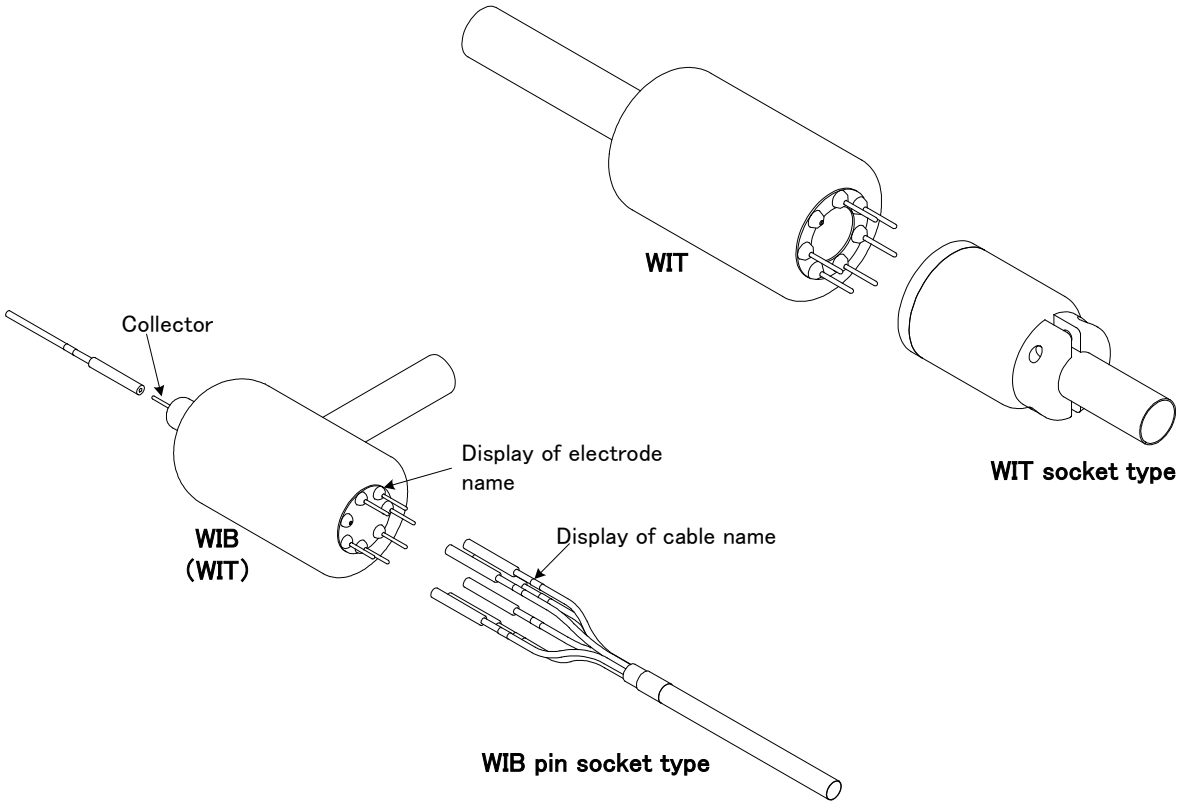
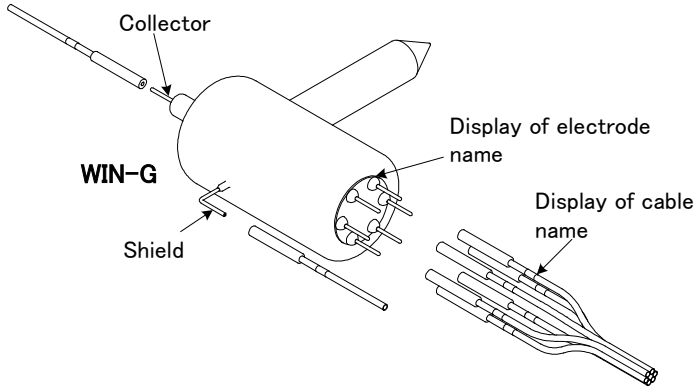


Fig. 4-5 WIT connection

Electrode name	Sensor head name (WIB)	Sensor head name (WIT)	Cable name	
FIlament	F (2x2places)	F(2places)	F1, F2	F1、F2 (One set with each 2) WIT is only F1
Glit	G(2places)	G(2places)	G	One set with each 2
Collector	Non sign	P(2places)	C	Connect a Co-axial cable

Fig. 4-6 WIB (WIT) Connection



WIN-G pin socket type

Electrode name	Sensor head name (WIN-G)	Cable name	
Filament	F (2x2places)	F1, F2	F1, F2 (One set with each 2)
Glit	G(2places)	G	Only use 1place.
Shield	(Non sign)	S	
Collector	(Non sign)	C	Connect a Co-axial cable

Fig. 4-7 WIN-G Connection

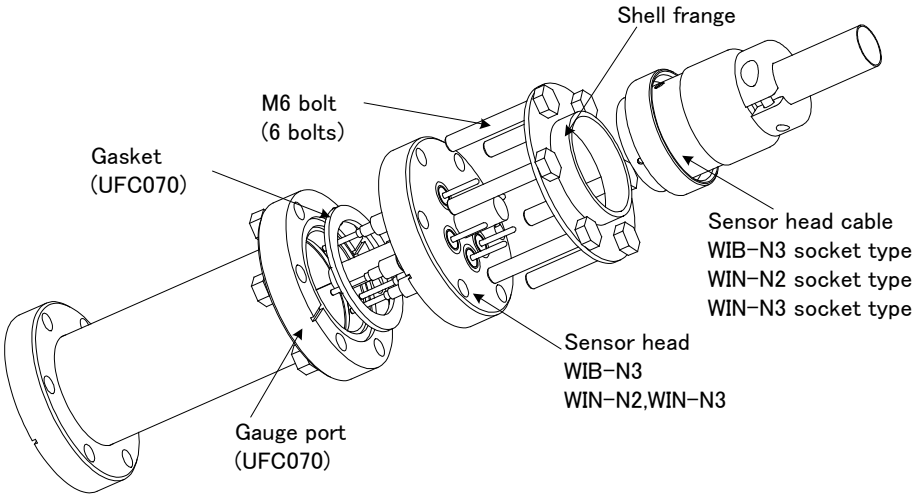


Fig. 4-8 WIB-N3, WIN-N Connection

The shell flange is attached to the sensor head cable.

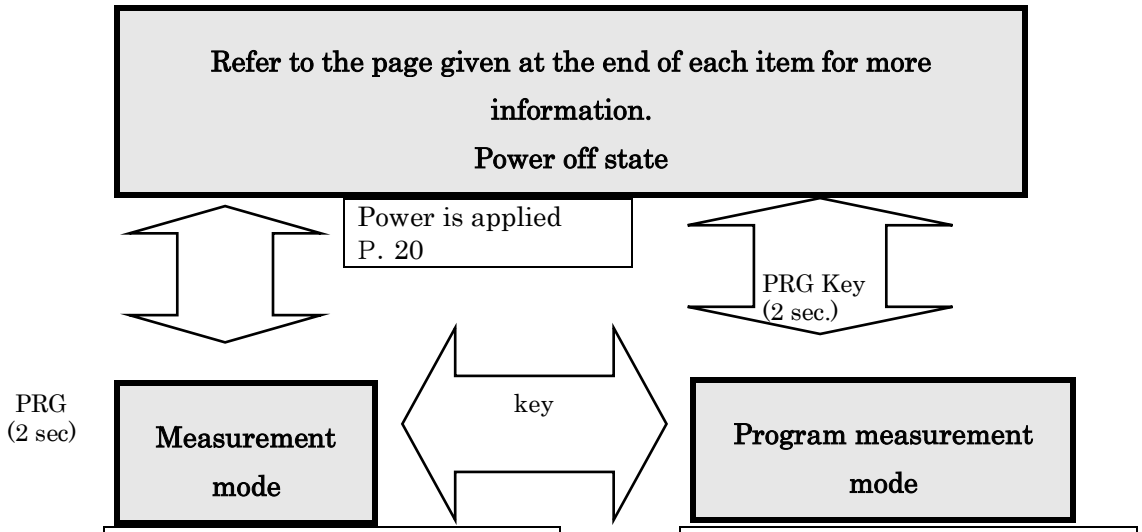
A gasket for port installation, the M6 bolt please prepare to separately.

5.FLOW OF PROGRAM RUN

To set sensitivity factor, set points 1 and 2, range, degas, filament, recorder and baud rate, follow the instructions in Sections 8 and higher. The initial setting can be made from the front panel or RS-232C. Here, the method of entry from the front panel is described.

WARNIN	Turn off power
	Check line voltage.
	Be cautious with operationg enbiroment

The flow of the display unit operation is as follows



FIL ON／OFF	P. 21
DEGAS ON／OFF	P. 22
Emission current (GI-N8 only)	P. 23

When pressure protection is activated	P. 24
When EXT-PROTECT is activated	P.24

Sensor head selection	P. 28
Sensitivity factor setting	P. 29
Set point 1and 2 setting	P. 30
Range changeover selection	P. 31
Range changeover setting	P. 31
DEGAS selection	P. 32
DEGAS setting	P. 32
Filament 1／2 selection	P. 33
Analog selection	P. 34
Analog setting	P. 34
Activated filament	P. 35
Baud rate setting	P. 35

In this manual, procedures are shown with white characters on black background, as shown below.

POW－①

[POW－①] means

POW－①

So refer to this item.

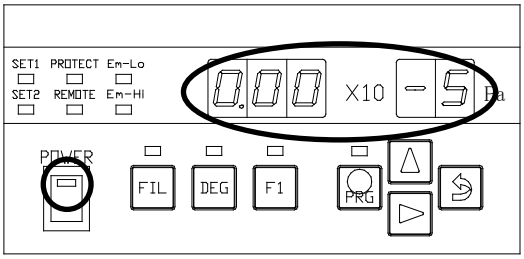
6.STARTING UP GAUGE (SUPPLY OF POWER)

Turn on the power switch on the front panel of the controller to feed power. POW-① appears and setup is completed.

CAUTION	Check connection. Check pressure.

POW－①

The ○ portion in the left figure lights.
(GI-D7 dose not turn on Em-Lo/Ezm-Hi.)



GI-M2
[*0. 0 0 −10*] is displayed on the segment indicator.

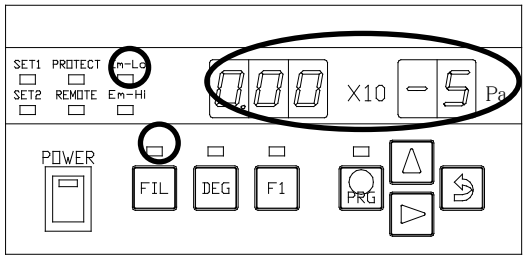
GI-D7 ・ SnS1(WIT) setting
[*0. 0 0 −7*] is displayed on the segment indicator.

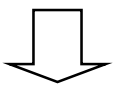
GI-D7 ・ SnS2(WIB) setting
[*0. 0 0 −8*] is displayed on the segment indicator.

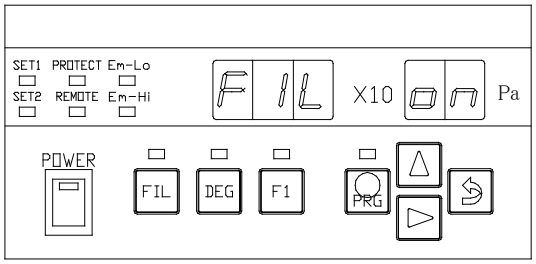
GI-N8
[*0. 0 0 −11*] is displayed on the segment indicator.

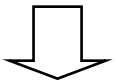
7.FRONT PANEL OPERATION

7.1. Filament ON/OFF

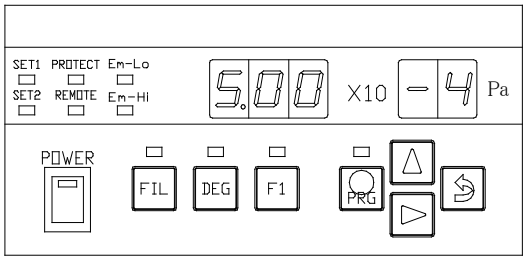


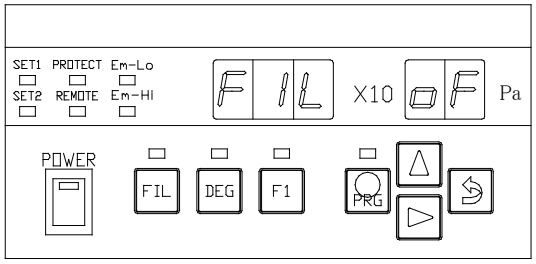






About 4 sec.





MESU－①

The first press on the FIL key turns on the filament and a second press turns it off.

When the filament is turned on, the segment indicator displays [*FIL on*] and the (MESU-② status) is set up.

If the filament is on and the emission current is flowing normally, the lamp above the FIL key lights and measurement starts (MESU-② status).

If the filament is on but emission current is not flowing normally, the lamp above the FIL key blinks.

MESU－②

Pressure is displayed on the segment indicator when in the measurement status.

(Example) Display in the left figure → 5.00×10^{-4} Pa

MESU－③

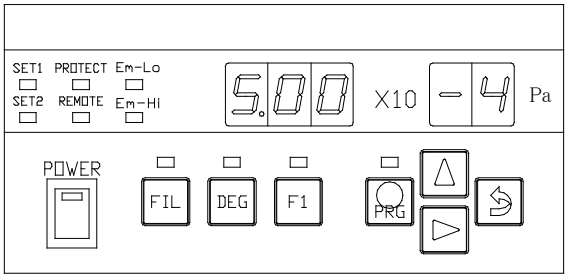
Turning on the filament sets up the MESU-① status after displaying [*FIL oF*].

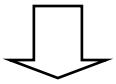
CAUTION:

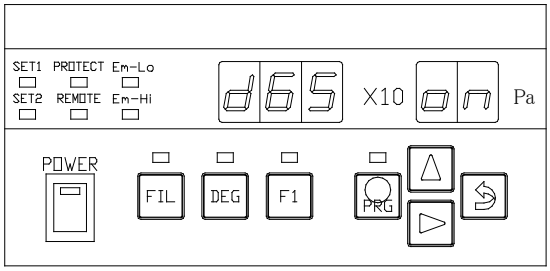
If the emission current value is not normal, refer to "Troubleshooting".
Before turning on the filament, make sure the pressure is in the measurable pressure range using another vacuum gauge.
If pressure rises above the measurable pressure range, the filament will automatically be turnedoff and [*Err. 13*] will be displayed on the segment indicator.

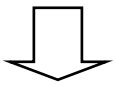
7.2. Degassing ON/OFF

→Refer to P.32









DEG－①

A single press on the DEGAS key when in the MESU-② status (left figure) turns on DEGAS. A second press on the key turns off DEGAS.

① Manual mode

Turning on DEGAS lights the LED marked with ○ in the left figure and the DEG-② status is set up after displaying [*dGS on*] on the segment indicator.

DEGAS can be operated only when the filament is on.

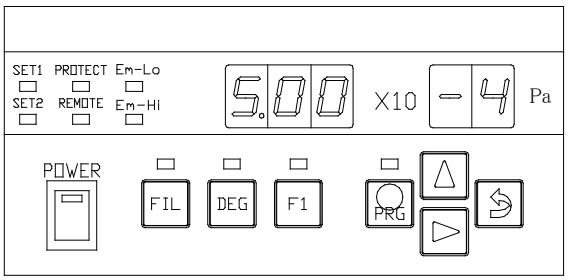
If the FIL key is pressed during degassing, degassing will be turned off simultaneously with the filament.

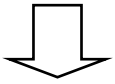
② Auto OFF mode

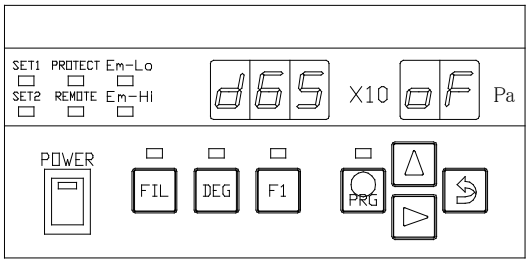
Turning ON DEGAS lights the LED marked with ○ in the left figure and the [DEG-② status] is set up after displaying [*dGS on*] on the segment indicator.

DEGAS is automatically turned off when the time set by the program has elapsed.

DEGAS can be turned off when in the auto OFF mode or before the set time elapses. If DEGAS is turned off in the midway, the set time counts will be reset.







DEG－②

GI-M2 / GI-D7

Pressure is displayed on the segment indicator during degassing, too

(Example) Display in the left figure → 5.00×10^{-4} Pa

GI-N8

DEGAS movement does not perform a pressure measurement.

DEG－③

Turning off DEGAS sets up the (MESU-② status) after displaying [*dGS oF*] on the segment indicator.

CAUTION:

GI-M2 / GI-D7

Degassing can be performed in all measurable pressure ranges. If degassing is performed at a high pressure, the sensor head may be contaminated, contrary to your expectation. It is recommended to perform it at a pressure below 10^{-4} Pa (10^{-6} Torr).

DEGAS can work even that the time of abnormality an emission electric current.

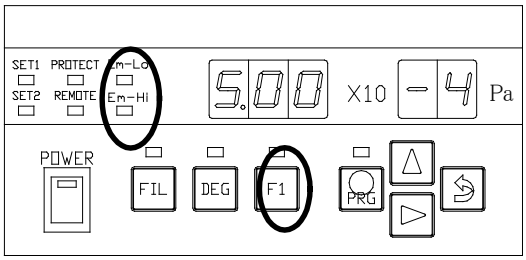
GI-N8

Pressure is not measured during degassing. See to it that pressure in the piping does not rise noticeably during degassing. (Filament protection circuit is invalid.)

Degassing can be actuated when measured pressure is 6.6×10^{-4} Pa (1.0×10^{-6} Torr) or less.

The setpoint output is OFF during degassing.

7.3.Emission Current (GI-N8 Only)



F1—①

The emission current is 0.5 mA when power is ON.

A single press on the [F1] key sets the emission current to 5.0 mA. A second press on the key sets the emission current to 0.5 mA.

The emission current is indicated on the [0.5mA or 5.0mA] lamp on the front panel.

The emission current 5.0 mA cannot be changed over unless the measured pressure is below 6.6×10^{-4} Pa (5.0×10^{-6} Torr).It will automatically be changed over to 0.5 mA if pressure rises above 6.6×10^{-4} Pa (5.0×10^{-6} Torr) when pressure is being measured at 5.0 mA.

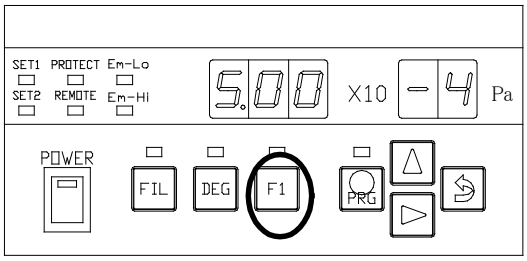
If the pressure lowers, the emission current will not be changed over automatically.

When power is on, the emission current setting is stored in memory even if the filament is turned off, but it will be changed over to 0.5 mA when the power is turned off.

The pressure in the sensor head will change with change of the filament temperature immediately after the emission current is changed over from 0.5 mA to 5.0 mA. The reference value does not change because the time required for the pressure to be stabilized varies with the environment under which the sensor head is used.

7.4. X-Ray Function ON/OFF (GI-N8 Only)

→Refer to P.58



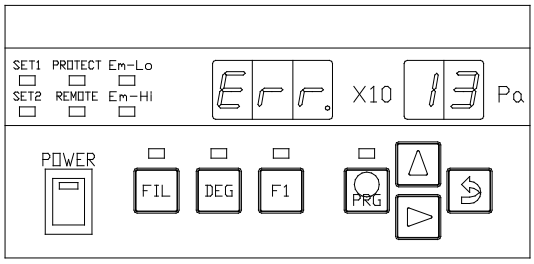
UNDR－①

Holding down the F1 key for two seconds turns on the X-Ray action. A second press on the key (for two seconds or more) turns off the X-Ray action.

The lamp above the F1 key lights when the X-Ray action is actuated.

Available under a pressure of 3.0×10^{-8} Pa (2.0×10^{-10} Torr) or less.

7.5. When Pressure Protection Is Activated



PRT－①

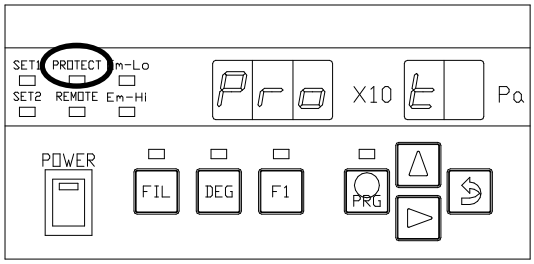
If pressure protection is activated by pressure rise during measurement and the filament is turned off, [*Err. 13*] will light on the segment indicator.

0 volt is outputted as measurement value.

To make measurement again, press the ENT key to set up the (MESU-① status) and check pressure by a Pirani gauge or other and turn on the filament again.

Refer to STANDARD SPECIFICATION (P.6) for more imformation.

7.6. When EXT-PROTECT Is Activated



PRT－②

If the EXT-PROTECT signal of external input signal pin 18 is given, the LED marked with ○ in the left figure will light and [*Pro t*] will light on the segment indicator.

0 volt is outputted as measurement value.

To make measurement again, reset the external input signal to set up the MESU-① status.

7.7.Display when an error occurs

No	Content
Err.11	Filament broken
Err.12	The setting value exceeds the setting range
Err.13	Pressure protect

Err.14	Filament broken during DEGAS

8.SETTING

8.1.Setting operation

To set sensitivity factor, set points, range changeover, degassing, filament, recorder output and baud rate, make settings according to the explanations in 8.1 and higher.

These settings can be entered from the front panel or through the communication RS-232C. Here, items to be entered from the front panel are explained.

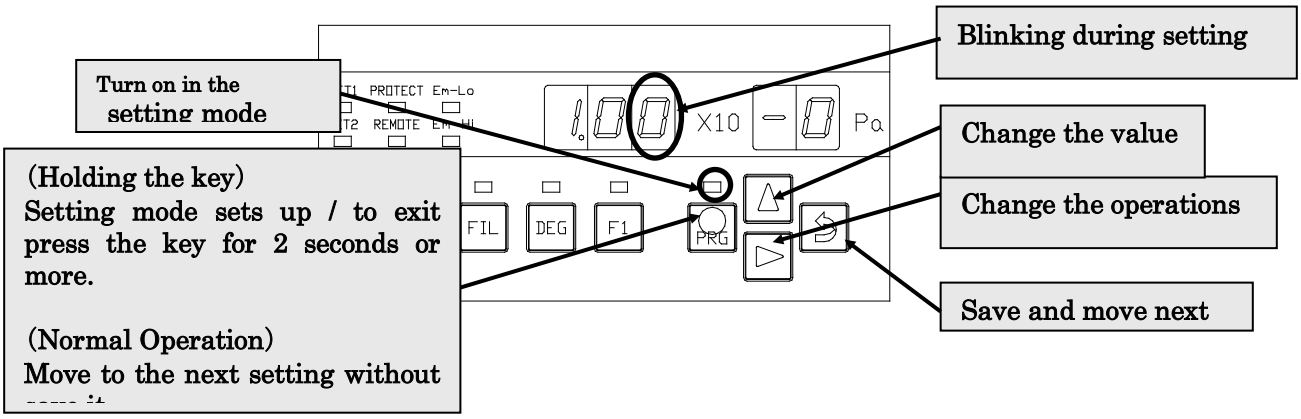
A set status and set values are retained even after the power is turned off and are effective at the next startup.

Holding down the [○ PRG] key for 2 seconds or more from the POW-① or MESU-① status sets up the setting mode. (to SENS-①)

When the setting mode is set up, the LED above the [○ PRG] key in the figure below lights.

If the setting is not changed, press the [○ PRG] key, If the change of the set point is saved, press the [⇒(ENTER)] key to transfer control to the next.

To exit the setting mode, hold down the [○ PRG] key for 2 seconds or more to revert to the measurement mode, and the LED above the [○ PRG] key will go off.



Inputs from the front panel are not feasible when in the [REMOTE] status. Always reset them before input, because the keys on the front panel are locked when in the [REMOTE] status.

If the [⇒(ENTER)] key is pressed after entering a numeric value out the settable range, [*Err 12*] error will be displayed for about 1 second. Enter a settable value again.

8.2.INITIAL SETTING

Table. 8-1 Factory Set Values

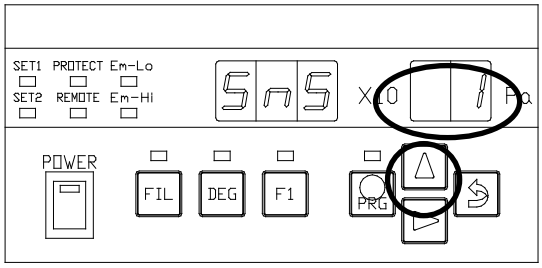
Mode		Set value		
		GI-M2	GI-D7	GI-N8
Sensor head setting	*SEn*	*Not used*	*SnS 1*	*Not used*
Sensitivity factor set value	*SEn (1)*	*6.00 -2*	*8.00 -2*	*1.53 -1*
SETPOINT-1	*SEt-1*	*1.00 -0*	*5.00 -3*	*1.00 -3*
SETPOINT-2	*SEt-2*	*1.00 -1*	*5.00 -4*	*1.00 -4*
Range changeover set value	*rAn (1)*	*-8*	*-7*	*-8*
Degas auto OFF set value	*dGS (1)*	*01*	*01*	*01*
Filament	*FIL*	*FIL 1*	*FIL 1*	*FIL 1*
Analog output	*rEC*	*rEC 1*	*rEC 1*	*rEC 1*
REC-HOLD set value	*rEC*	*-8*	*-7*	*-8*
Activated filament setting	*Act*	*Not used*	*Not used*	*Act 1*
Baud rate	*bPS*	*960 0*	*960 0*	*960 0*

8.3.Selection Of Sensor Head(GI-D7 Only)

Choose the kind of the sensor head to use. The set point as follows.

SnS:1 ⇒ WIT

SnS:2 ⇒ WIB



SNS－①

The ○ portion in the left figure blinks after the segment indicator displays [*SnS___*] for about 1 second. Each time the [Δ] key is pressed, the ○ portion in the left figure displays [*SnS__1*] ⇒ [*SnS__2*] cyclically.

When WIT is used, press the [⇒ (ENTER)] key with the [*SnS__1*] selected, to transfer control to the SENS-① status.

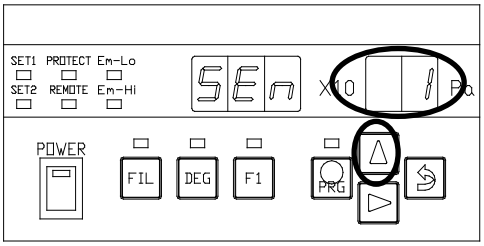
When WIB is used, press the [⇒ (ENTER)] key with the [*SnS__2*] selected, to transfer control to the SENS-① status.

8.4.Selecting the Sensitivity Factor Function

→ Refer to P. 36

Set a sensitivity factor. The set point as follows.

	GI-M2	GI-D7	GI-N8
SEn:1	N2	N2	N2
SEn:2	Ar	Ar	H2
SEn:3	Any value	Any value	Any value



SENS－①

The ○ portion in the left figure blinks after the segment indicator displays [*SEn* ___] for about 1 second. Each time the [Δ] key is pressed, the ○ portion in the left figure repeats displaying [*SEn__1*] ⇒ [*SEn__2*] ⇒ [*SEn__3*] ⇒ [*SEn__1*] ... cyclically.

To use the sensitivity factor for N2, press the [⇒(ENTER)] key, with [*SEn__1*] [*SEn__2*] selected, to transfer control to the SET1-① status.

To use the sensitivity factor for OTHER, press the [⇒(ENTER)] key, with [*SEn__3*] selected, to transfer control to the SET1-② status.

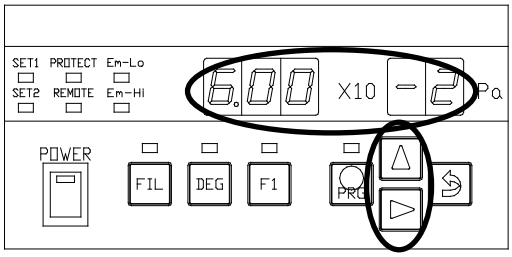
CAUTION:
When setting a sensitivity factor, the set point action may change over depending on the set value the moment the N2 setting is changed over to Ar setting or OTHER setting. It is recommended to change the setting in the POW-① status or by stopping components from which signal is received. Check the set point set value and sensitivity factor set value before changing the setting.

8.5.Setting the Sensitivity Factor Function

→Refer to P. 36

Setting the sensitivity factor function. The set point as follows.

	GI-M2	GI-D7	GI-N8
Setting range	6.00×10^{-1} ～ 6.00×10^{-3}	7.47×10^{-1} ～ 1.66×10^{-2}	2.00×10^{-0} ～ 2.00×10^{-2}



SENS－②

The ○ portion in the left figure blinks. Each press on the [Δ] key changes the numeric value of the blinking portion.

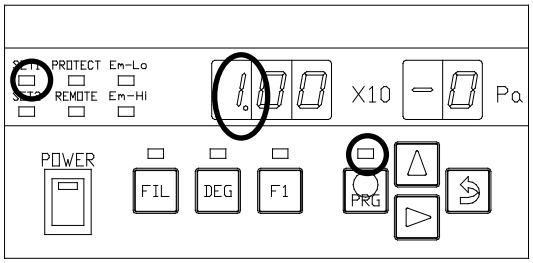
When a desired value is displayed, press the [⇒(ENTER)] key to transfer control to the SEN-① status.

8.6.Setting of Set Point 1/2

→ Refer to P. 38

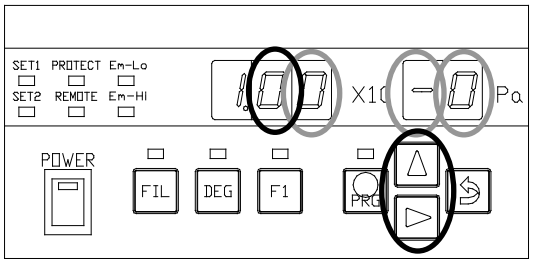
Setting of set point 1/2. The set point as follows.

	GI-M2	GI-D7	GI-N8
Setiing range	9. 99×10^{-0}～ 5. 00×10^{-8}	WIT selection 6. 79×10^{-1}～ 1. 00×10^{-5} WIB selection 2. 00×10^{-2}～ 1. 00×10^{-6}	6. 60×10^{-1}～ 4. 00×10^{-9}



SET1－①

The ○ portion in the left figure blinks after [*SE t －1*] is displayed for about 1 second.



SET1－②

Each time the [Δ] is pressed, the numeric value of the blinking portion changes. When a desired value is displayed, press the [⇒(ENTER)] key to transfer control to the set point 2 (SET1-①) status.

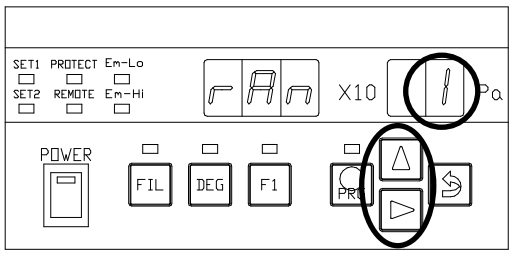
Set the SET2 equally successively. When a desired value is displayed, press the [⇒(ENTER)] key to transfer control to the set point 2 (RAN-①) status.

8.7. Selection of Range Changeover Function

→ Refer to P. 39

Setting of range changeover function.

rAn:1 ⇒ AUTO RANGE MODE
rAn:2 ⇒ RANGE HOLD MODE



RAN－①

The ○ portion in the left figure blinks after the segment indicator displays [*r A n ____*] for about 1 second. Each time the [Δ] is pressed, the ○ portion in the left figure displays [*r A n __1*] ⇔ [*r A n __2*] cyclically.

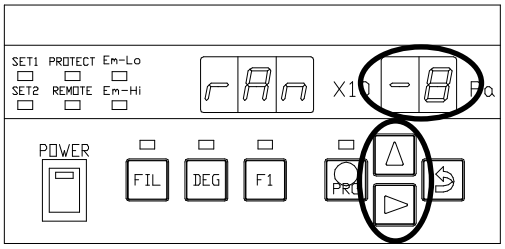
To use range AUTO(HOLD), press the [⇒(ENTER)] key with[*r A n __1*] [*r A n __2*] selected, to transfer control to the DGS-① status.

8.8. Setting of Range HOLD

→ Refer to P. 39

Setting of range HOLD. The set point as follows.

	GI-M2	GI-D7	GI-N8
Setting range	－0 ～ －8	－1 ～ －7	－1 ～ －9



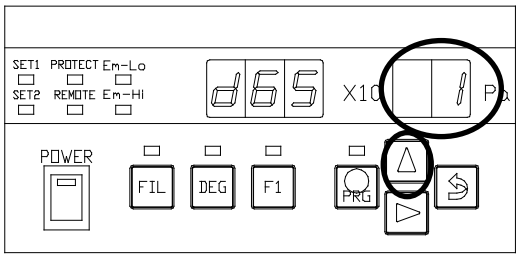
RAN－②

Each time the [Δ] key is pressed, the numeric value of the blinking portion changes. When a desired numeric value is displayed, press the [⇒ (ENTER)] key to transfer control to the DGS-① status.

8.9. Selection Of DEGAS Function

→ Refer to P. 40

Setting of DEGAS function
dGS:1 ⇒ MANUAL MODE
dGS:2 ⇒ AUTO MODE



DGS－①

The ○ portion in the left figure blinks after the segment indicator displays [*d G S ____*] for about 1 second. Each time the [Δ] key is pressed, the ○ position on the segment indicator displays [*d G S __1*] ⇔ [*d G S __2*] cyclically.

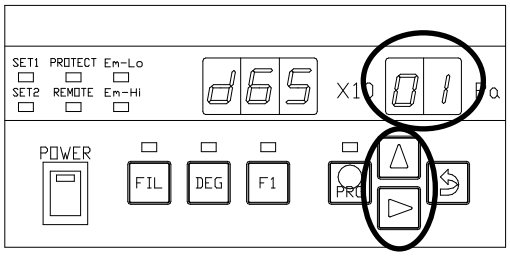
To use DEGAS MANUAL, press the [⇒ (ENTER)] key, with [*d G S __1*] selected, to transfer control to the FIL-① status.

To use DEGAS AUTO, press the [⇒ (ENTER)] key, with [*d G S __2*] selected, to transfer control to the DGS-② status.

8.10. Setting of DEGAS Function

→ Refer to P. 40

Set the numeric value of DEGAS auto OFF.
Settable numeric values are <u>01 to 99 minutes</u>.



DGS－②

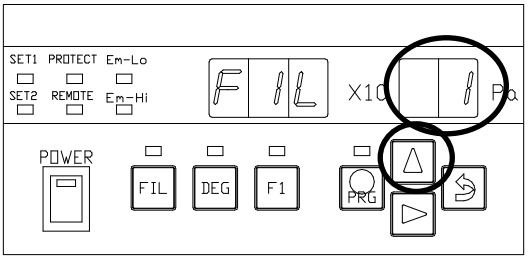
The ○ portion in the left figure blinks. Each time the [Δ] key is pressed, the numeric value of the blinking portion changes. When a desired numeric value is displayed, press the [⇒ (ENTER)] key to transfer control to the FIL-① status.

8.11. Setting of Filament 1/2

→ Refer to P. 41

Select filament 1 or 2.

FIL:1 ⇒ Filament 1
FIL:2 ⇒ Filament 2



FIL－①

The ○ portion in the left figure blinks after the segment indicator displays [*F I L ____*] for about 1 second. Each time the [Δ] key is pressed, the ○ portion of the segment indicator in the left figure displays [*F I L __1*] ⇔ [*F I L __2*] cyclically.

To use filament 1, press the [⇒(ENTER)] key, with [*F I L __1*] selected, to transfer control to the REC-① status.

To use filament 2, press the [⇒(ENTER)] key, with [*F I L __2*] selected, to transfer control to the REC-② status.

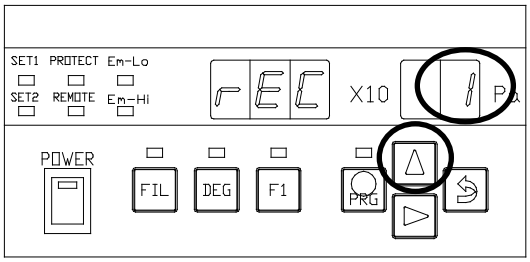
8.12.Selection of Analog Function

→ Refer to P. 42

Setting of analog function. The set point as follows.

	GI-M2	GI-D7	GI-N8
rEC:1	Eeach-digit linear output mode		
rEC:2	Pseudo-logarithmic mode		
rEC:3	Range hold liniea mode		
rEC:4	logarithmic mode	GI-D6 compatibility output mode	Not used
rEC:5	Not used	GI-TL3 compatibility output mode	Not used

REC－①



The ○ portion in the left figure blinks after the segment indicator displays [*r E C ____*] for about 1 second. Each time the [Δ] key is pressed, the ○ portion of the segment indicator in the left figure displays [*r E C __ 1*]⇒[*r E C __ 2*]⇒[*r E C __ 3*]⇒[*r E C __ 1*] ・・ cyclically.

To use recorder LIN(LOG), press the [⇒ (ENTER)] key, with [*r E C __ 1*] selected, to transfer control to the BPS-① status.

To use analog REC-HOLD, press the [⇒ (ENTER)] key, with [*r E C __ 3*] selected, to transfer control to the REC-② status.

8.13. Setting of Analog Function

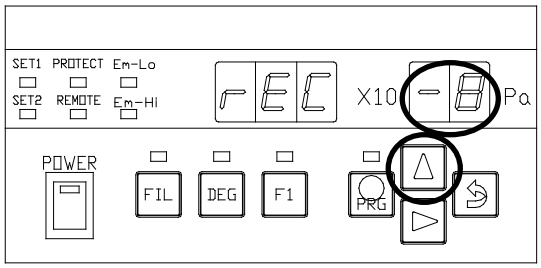
→ Refer to P. 42

Set the REC-HOLD numeric values. The set point as follows.

	GI-M2	GI-D7	GI-N8
Setting range	-0 ～ -8	-1 ～ -7	-1 ～ -9

Settable numeric values are sensitivity factor N2. This setting range will change if a sensitivity factor other than N2 is designated or if sensitivity setting is entered.

REC－②



Each time the [Δ] key is pressed, the numeric value of the blinking portion changes. When a desired value is displayed, press the [⇒(ENTER)] key to transfer control to the BPS-① status.

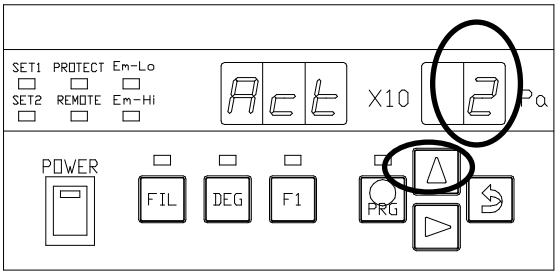
8.14.Setting of Activated Filament(GI-N8 only)

→ Refer to P. 35

Here, the filament activating action is set.

Filament activating action invalid (OFF): Act_1
Filament activating action valid (ON): Act_2

Act－①



The ○ portion in the left figure blinks.
Each time the [Δ] key is pressed, the numeric value of the blinking portion changes [・・⇒1⇒2⇒1⇒・・].
When a desired value is displayed, press the [⇒(ENTER)] key to transfer control to the BPS-① status.

If filament activating action valid (ON) is specified here, exit the set mode, press the Fil key to perform activating action. A second press on the Fil key stops activation.

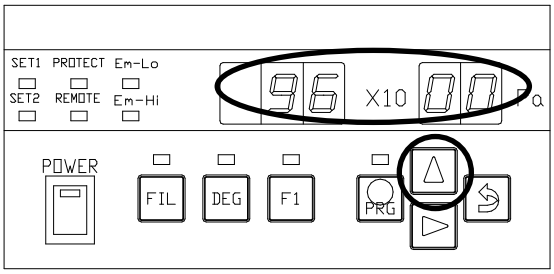
Activation will automatically end in about 30 minutes, when measurement is ready.

8.15. Setting of Baud Rate

→ Refer to P. 66

Setting of Baud Rate of RS－232C.

BPS－①



The ○ portion in the left figure blinks after the segment indicator displays [*bPS* ____] for about 1 second. Each time the [Δ] key is pressed, the ○ portion of the segment indicator displays [*96 00*]⇒[*192 00*]⇒[*384 00*]⇒[*96 00*]・・ cyclically.

When a desired value is displayed, press the [⇒(ENTER)] key to transfer control to the SEN-① status.

9. FUNCTIONS

9.1. Setting of Sensitivity

9.1.1. Setting of sensitivity

The ion gauge ionizes gas molecules, measures the ion current produced and converts it into a pressure. Since the ratio of ionization varies with the type of gas molecules, the amount of ions produced changes under the same pressure. Its correction is made by the sensitivity setting.

9.1.2. Setting of sensitivity

The sensitivity setting value is entered in the form of □.□□× 10-□.
Sensitivity can be entered from the front panel or through the communication (RS-232C).
The numerical value that can set as follows.

	GI-M2	GI-D7	GI-N8
Setting range	6.00×10^{-1} ~ 6.00×10^{-3}	7.47×10^{-1} ~ 1.66×10^{-2}	2.00×10^{-0} ~ 2.00×10^{-2}

When the input of an invalid value, it is converted into the nearest effective value. [Err. 12] is displayed on the segment indicator only in the front panel setting.

Sensitivity can be entered from the front panel or through the communication (RS-232C). The finally set value is saved.

9.1.3. Details of sensitivity set values

"Sensitivity" referred to here is the total sensitivity obtained by multiplying the sensitivity constant (K) of the ULVAC sensor head (M type) for nitrogen by the relative sensitivity (Srj) for various types of gases, where the sensitivity for nitrogen is given as 1. This gauge is available with the N2 mode, Ar mode, and OTHER mode as standard.

The each sensitivity set value ($Srj(N_2)$)of ULVAC sensor head as follows.

	GI-M2	GI-D7	GI-N8
Sensitivity set value of ULVAC sensor head Srj(N2)	0.06 Pa^{-1}	0.0827 Pa^{-1}	0.153 Pa^{-1}

In case of GI-M2 as follows

N_2 : 6.00×10^{-2} Pa^{-1} = $Srj(N_2)$

Ar : 8.04×10^{-2} Pa^{-1} ≒ $Srj(N_2)$ × Srj = 0.06×1.34

OTHER : $Srj(N_2)$ × Srj=0.06 × Srj Pa^{-1}

OTHER mode is used when measuring the pressure in a vacuum chamber in which gas other than nitrogen gas (nearly equivalent to air) and argon gas are the major components.

To use this mode, obtain the relative sensitivity (Srj) of the gas to be measured from Table. 13-1, multiply it by sensitivity constant $Srj(N_2)$ of the sensor head and enter the product.

Notice:
Relative sensitivity is the value when the atmospheric gas to be measured is 100%. If the partial pressure percentage of the atmospheric gas differs, error will result. If the sensitivity of individual sensor heads is known in the measurement of nitrogen gas, the relative sensitivity is given as "1.00", and it is multiplied by the sensitivity of individual sensor; thereby more accurate measurement can be made by setting in the same manner as above.

9.1.4.Example for sensitivity set values

The list of the calculation result :Sensitivity of sensor head Srj(N_2) × relative sensitivity Srj

Table. 9-1 Sensitivity Factor Reference

GI-M2 : 0.06 Pa^{-1}

Molecule	Input value	Molecule	Input value	Molecule	Input value
He	1.33E-02	NH_3	3.87E-02	H_2S	1.32E-01
Ne	2.15E-02	H_2O	7.50E-02	HCl	9.90E-02
Ar	8.04E-02	CO	5.70E-02	CO_2	8.10E-02
Kr	1.13E-01	N_2	6.00E-02	N_2O	9.96E-02
Xe	1.50E-01	NO	7.02E-02	Sfe	1.50E-01
H_2	2.95E-02	O_2	5.27E-02	Hg	1.98E-01
D_2	2.40E-02	Air	5.82E-02	CH_4	9.48E-02

GI-D7 : 0.083 Pa^{-1}

Molecule	Input value	Molecule	Input value	Molecule	Input value
He	1.83E-02	NH_3	5.35E-02	H_2S	1.83E-01
Ne	2.97E-02	H_2O	1.04E-01	HCl	1.37E-01
Ar	1.11E-01	CO	7.89E-02	CO_2	1.12E-01
Kr	1.56E-01	N_2	8.30E-02	N_2O	1.38E-01
Xe	2.08E-01	NO	9.71E-02	Sfe	2.08E-01
H_2	4.08E-02	O_2	7.30E-02	Hg	2.74E-01
D_2	3.32E-02	Air	8.05E-02	CH_4	1.31E-01

GI-N8 : 0.153 Pa^{-1}

Molecule	Input value	Molecule	Input value	Molecule	Input value
He	3.38E-02	NH_3	9.87E-02	H_2S	3.37E-01
Ne	5.48E-02	H_2O	1.91E-01	HCl	2.52E-01
Ar	2.05E-01	CO	1.45E-01	CO_2	2.07E-01
Kr	2.88E-01	N_2	1.53E-01	N_2O	2.54E-01
Xe	3.83E-01	NO	1.79E-01	Sfe	3.83E-01
H_2	7.52E-02	O_2	1.34E-01	Hg	5.05E-01
D_2	6.12E-02	Air	1.48E-01	CH_4	2.42E-01

9.2. Set Point

9.2.1. What is the set point?

The set point function outputs a signal of whether a pressure being measured has come down below a certain pressure value.

The operating state can be checked by the lighting of the LED on the front panel or in the form of relay contact from the external I/O connector or by reading the status when the communication (RS-232C) is used.

The relay rated load of the setpoint output is [AC: 125 V_{MAX}, 0.5 A_{MAX}, DC: 24 V_{MAX}, 1 A_{MAX}].

9.2.2. Setting of set point

In the case of 3-digits display, the set point value is entered in the form of □.□□ × 10□□.

In the case of 2-digits display, the set point value is entered in the form of □.□ × 10□□.

The settable values are as follows:

	GI-M2	GI-D7	GI-N8
Setting range	9.99×10^{-0}～5.00×10^{-8}	WIT selection 6.79×10^{-1}～ 1.00×110^{-5} WIB selection 2.00×10^{-2}～ 1.00×10^{-6}	6.60×10^{-1}～ 4.00×10^{-9}

When the input of an invalid value, the value is not updated. [*Err. 12*] is displayed on the segment indicator only in the front panel setting.

The value entered last will be saved from front panel or RS-232C.

9.2.3. Internal processing

When measurement pressure was less than setting pressure.

Set point ON: setting pressure≧measured pressure value

9.2.4. Set point activating conditions

The set point action is activated only when the filament is ON and the emission current is normal. If the emission current is not normal, that is, [Em. Valid NG], When measurement pressure value was less than a set point, it won't be activated.

9.2.5. Set point action when range hold is active

The set point action is active in all measurable pressure ranges even when used in the range hold mode.

9.3. Setting of Range Changeover

9.3.1. Setting of range changeover

Range changeover functions include the following two modes.

① Auto range mode
Changes over all pressure measurable ranges automatically.

② Range hold mode
Prohibit a range change to the pressure range that is lower than indication, the BCD output, an analog output (only LIN mode). The pressure measurement does not influence a set point output function, because it is performed in all measure.

9.3.2. Setting of range hold

The range hold value is entered in the form of ×10□□.
The settable values are as follows:

	GI-M2	GI-D7	GI-N8
Setting range	-0 ～ -8	-1 ～ -7	-1 ～ -9

When the input of an invalid value, the value is not updated. [*Err. 12*] is displayed on the segment indicator only in the front panel setting.
The value entered last will be saved from front panel or RS-232C.

9.3.3. Range hold and recorder output

The analog output using range hold for is as follows:

① LINER MODE

② Linear outputs in proportio

(Example) When range hold value $\times 10^{-3}$ is set

Pressure value [Pa]	Displayed value (3 digits) [Pa]	Analog output (LIN) [V]	BCD output [Pa]
5.00×10^{-2}	5.00×10^{-2}	5.00	5.0×10^{-2}
1.00×10^{-2}	1.00×10^{-2}	1.00	1.0×10^{-2}
5.00×10^{-3}	5.00×10^{-3}	5.00	5.0×10^{-3}
1.00×10^{-3}	1.00×10^{-3}	1.00	1.0×10^{-3}
5.00×10^{-4}	0.50×10^{-3}	0.50	0.5×10^{-3}
1.00×10^{-4}	0.10×10^{-3}	0.10	0.1×10^{-3}
5.00×10^{-5}	0.05×10^{-3}	0.05	0.0×10^{-3}
1.00×10^{-5}	0.01×10^{-3}	0.01	0.0×10^{-3}
5.00×10^{-6}	0.00×10^{-3}	0.00	0.0×10^{-3}
1.00×10^{-6}	0.00×10^{-3}	0.00	0.0×10^{-3}

③ Pseudo-logarithmic mode
Outputs are pseudo-logarithmic in all pressure ranges regardless of the range hold value.

④ REC-HOLD mode
Outputs are in the REC-HOLD mode regardless of the range hold value.

9.4.DEGAS

9.4.1. What is DEGAS?

"DEGAS" means dissociating the molecules adsorbed to the sensor head electrode, by heat. By a model, there are two kinds of methods.

GI-M2／GI-D7

Molecules adsorbed to the sensor head electrode are released by heating.

GI-N8

This gauge uses the electron bombardment system for degassing. Electron bombardment system releases the gas occluded to the grid by applying a high voltage of 700 to 500 volts and bombards the grid surface with thermions emitted from the filament.

9.4.2. Setting of DEGAS mode

The following two degassing modes are available.

①Manual mode

A single press on the DEGAS switch turns ON degassing and a second press turns OFF degassing. (DEGAS is active from the time when the DEGAS switch is pressed to the time when it is pressed for a second time.)

②Timer mode

A single press on the DEGAS switch turns ON degassing. It is automatically turned OFF when an arbitrarily designated time elapses.

If it is desired to turn it OFF before the time elapses, press the DEGAS switch, and degassing will be turned OFF.

9.4.3. Setting of timer mode

The time value in the timer mode is entered in the form of □□ minutes.

Settable values are as follows.

01 to 99 [min]

When the input of an invalid value, the value is not updated. [*Err. 12*] is displayed on the segment indicator only in the front panel setting.

Inputs can be made from the front panel or through the communication (RS-232C).

The finally entered value is saved.

Pressing the [⇒(ENTER)] key on the front panel during automatic degassing will display the remaining automatic degassing time.

9.4.4. Degassing movement conditon

GI-M2／GI-D7

Degassing is not active unless the filament is ON. Degassing is feasible as long as the filament is ON even if the emission current is not normal, that is, [Em. Valid NG].

Degassing is feasible in all measurable ranges, but if it is conducted in a high-pressure region, the sensor head may be contaminated.

It is recommended to conduct degassing at a pressure of 10^{-4} Pa (10^{-6} Torr) or less.

GI-N8

Degassing is not active unless the filament is ON.

Pressure instructions value can work only in less than 1.3×10^{-4}Pa (1.0×10^{-6} Torr).

9.4.5. Degassing operation

Degassing operation can be entered from the front panel or the external I/O connector or through the communication (RS-232C).

However, degassing from an external I/O connector is not active in the timer mode even if it is set in the timer mode from the front panel or through the communication (RS-232C) (manual operation in this case).

9.4.6.Instructions in DEGAS

GI-M2／GI-D7

The whole DEGAS movement operates a pressure measurement, too. There is the case that pressure rise by DEGAS occurs by the state of the measurement head, pressure at the movement. As a result, ON/OFF of the set point output varies with it.When the pressure protection is activated, [*Err. 13*] is displayed on the front panel segment and it becomes OFF automaticaly.

GI-N8

Degassing is so programmed that full power is attained in about five minutes. The filament may appear not lit immediately after degassing is actuated, but this is not a trouble.

Pressure is not being measured during degassing. The filament protection circuit is invalid. See to it that abrupt pressure rise does not occur during degassing operation.The set point output is invalid (OFF) during degassing action.

The set point output is invalid (OFF) during degassing action.

With a glass tube, make sure the blue shield wire is connected to the S terminal of the sensor head. The glass tube may be bored and vacuum may be broken.

Note that the glass tube wall will be heated to a high temperature (about 140°C in the vicinity of filament) during degassing.

During degassing, the filament may be turned ON/OFF at intervals of several seconds. At this time, discharge is taking place in the sensor head and the protection of the degas control circuit is actuated at intervals of several seconds. The ON/OFF intervals prolongs as the sensor head interior is cleaned and the filament will stay lit as usual.

9.5. Filament Changeover

When the sensor head has two filaments, choose one either. When the sensor head has one filament, set to the filament 1. The filaments can be changed over from the front panel or external I/O connector or through the communication (RS-232C).

9.5.1. Filament changeover and external output

When the filament is changed over when the filament is ON, it will be OFF →ON. As a result, indication・output will be in the initial state.

・Indication/BCD : 0.00×10^{-x}Pa (Initial state)
・Analog output : 0.00V
・Set point : OFF

CAUTION:
Change over the filament with the filament turned OFF, if possible.

9.5.2. Cautions in filament chageover

When the filament is changed over, the gas adsorbed to the filament and filament stem will be released for some time after the filament has lit and the pressure will rise temporarily.

The sensitivity of the sensor head depends on the distance between the filaments, grid and ion collector electrode. The sensitivity differs slightly because the distance between filaments 1 and 2 and the grid differs. As a result, the measured pressure output value will also differ slightly (within the measurement accuracy).

9.6.Changeover of Analog Output

Analog output of the measurement pressure can choose three kinds (four kinds) of follows.

Voltage values on order of several mV are low in accuracy because the recorder output is 12-bit DAC.

	GI-M2	GI-D7	GI-N8
rEC:1	Eeach-digit linear output mode	Eeach-digit linear output mode	Eeach-digit linear output mode
rEC:2	Pseudo-logarithmic mode	Pseudo-logarithmic mode	Pseudo-logarithmic mode
rEC:3	Range hold liniea mode	Range hold liniea mode	Range hold liniea mode
rEC:4	logarithmic mode	GI-D6 compatibility output mode	Not used
rEC:5	Not used	GI-TL3 compatibility output mode	Not used

9.6.1.Setting of analog mode

The analog mode is set in the form of LOG, LIN or REC-HOLD HOL-□□.

Inputs can be set from the front panel or through the communication (RS-232C).

REC-HOLD can be turned ON/OFF from an external I/O connector.

The value that can set with the REC - HOLD mode as follows.

	GI-M2	GI-D7	GI-N8
Setting range	-0 ～ -8	-1 ～ -7	-1 ～ -9

Selecting the sensitive factor. When it was input appointment or the sensitivity setup anything other than N2 of the sensitivity factor, the above setting range changes.

When the input of an invalid value, the value is not updated. [*Err. 12*] is displayed on the segment indicator only in the front panel setting.

The value entered last will be saved from front panel or RS-232C.

REC - HOLD setting from external IO (GI-M2 / GI-D7)

While it is input by I/O, it is set by REC-HOLD.

The input cancellation back returns to setting just before that.

9.6.2.Measurement value output in each status

Table. 9-2 gives the measurement value output status in various statuses that can occur in measurement.

Table. 9-2 Measurement Value Output Status

Status	Measurement value output voltage
Filament OFF	0.00V
Filament ON [Em.Valid OK]	Voltage corresponding to measured pressure
Filament ON [Em.Valid NG]	0.00V
When pressure protection is activated (Filament is OFF)	0.00V
DEGAS ON (GI-N8)	Voltage corresponding to operating condition (max 10V)
Filament Activation (GI-N8)	

9.6.3.LIN output in each status

It outputs a same value voltage of mantissa of pressure display value. The output voltage has hysteresis by the pressure that increased and the pressure that decreased. In the linear mode, this cannot be identified if the range differs because the output is propotional only to the mantissa part.

Pressure display value (Pa)	Output voltage (V)
0.80×10^{-X}	0.80
1.00×10^{-X}	1.00
2.00×10^{-X}	2.00
9.99×10^{-X}	9.99

To identify the digit of pressure, use either the recorder output LOG mode or read the analog output of the mantissa part in the linear mode and, at the same time, read the exponent pat of the digital output (BCD output).
In this case, however, the value may not be read correctly at the range changeover point because the physical change time differs between the recorder output and digital output (BCD output).

The measured value output voltage is converted to a pressure value as shown below.

P：Pressure value (Pa)
V：Analog output voltage (V)
S：Measured pressure range

$$P=V\times10^{-S}\ (Pa)$$

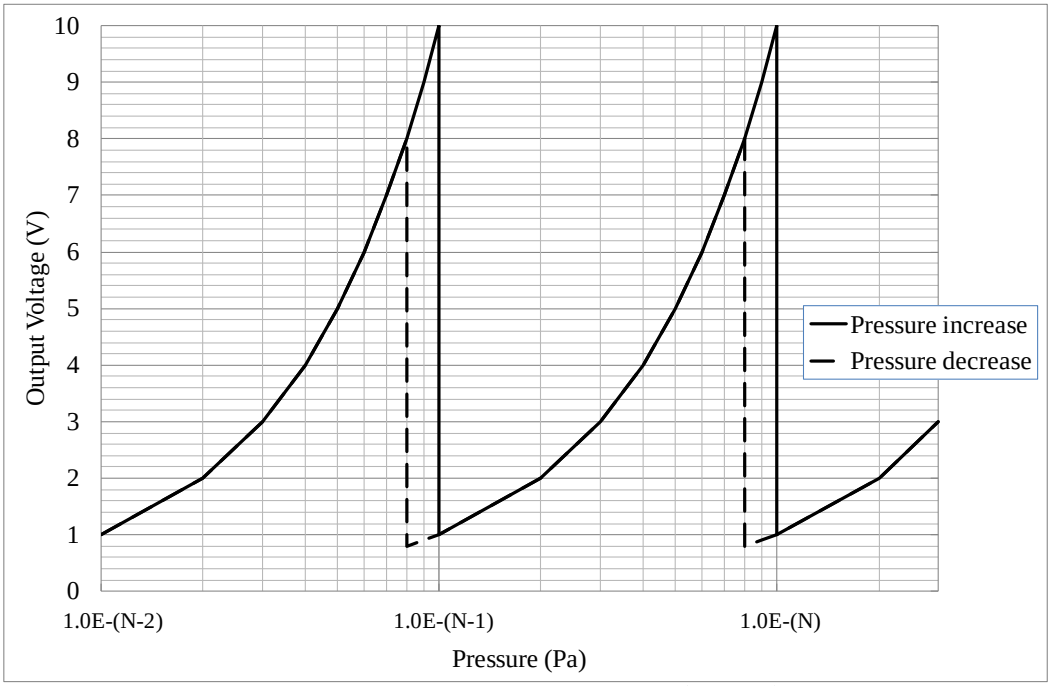


Fig. 9-1 Analog output graph (Linear)

9.6.4. Pseudo-LOG output

The entire measurable pressure range is outputted pseudo-logarithmically by an analog voltage of 0 to 10 volts. The output voltage has hysteresis by the pressure that increased and the pressure that decreased.

The table below gives the relationship between pressure and output voltage.

GI-M2 Pseudo-LOG OUTPUT

Table. 9-3 Measured Pressure Value Table (GI-M2)

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
9.90×10^{-0}	8.99	1.00×10^{-4}	4.10
1.00×10^{-0}	8.10	5.00×10^{-5}	3.50
5.00×10^{-1}	7.50	1.00×10^{-5}	3.10
1.00×10^{-1}	7.10	5.00×10^{-6}	2.50
5.00×10^{-2}	6.50	1.00×10^{-6}	2.10
1.00×10^{-2}	6.10	5.00×10^{-7}	1.50
5.00×10^{-3}	5.50	1.00×10^{-7}	1.10
1.00×10^{-3}	5.10	5.00×10^{-8}	0.50

Displayed pressure value (Torr)	Output voltage (V)	Displayed pressure value (Torr)	Output voltage (V)
5.00×10^{-2}	8.99	1.00×10^{-6}	4.10
1.00×10^{-2}	8.10	5.00×10^{-7}	3.50
5.00×10^{-3}	7.50	1.00×10^{-7}	3.10
1.00×10^{-3}	7.10	5.00×10^{-8}	2.50
5.00×10^{-4}	6.50	1.00×10^{-8}	2.10
1.00×10^{-4}	6.10	5.00×10^{-9}	1.50
5.00×10^{-5}	5.50	1.00×10^{-9}	1.10
1.00×10^{-5}	5.10	5.00×10^{-10}	0.50

Table. 9-4 Hysteresis by the pressure that increased and decreased

Increae		Decrease	
Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
1.00×10^{-1}	7.10	1.00×10^{-1}	7.10
0.90×10^{-1}	7.09	9.00×10^{-2}	6.90
0.80×10^{-1}	7.80	8.00×10^{-2}	6.80

The measurement output voltage can be converted to a pressure value using the following equation.

P:Pressure value (Pa)
V:Measured output voltage (V)
E:V from which decimal point is rounded down (V)

GI-M2: $P=10(V-E)\times10^{-(8-E)}(Pa)$

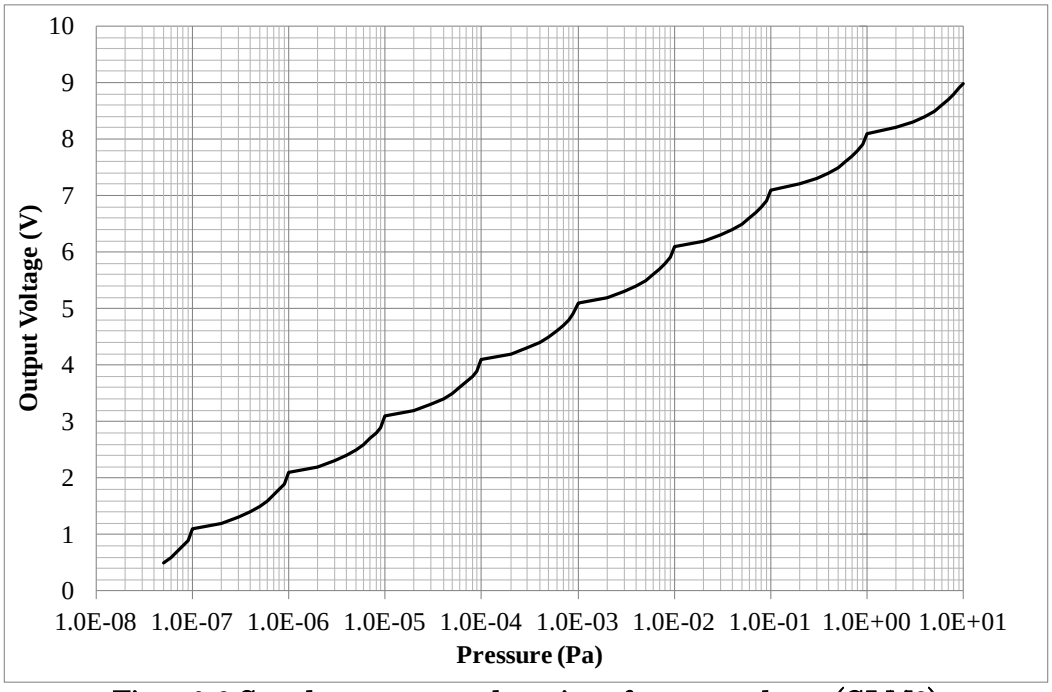
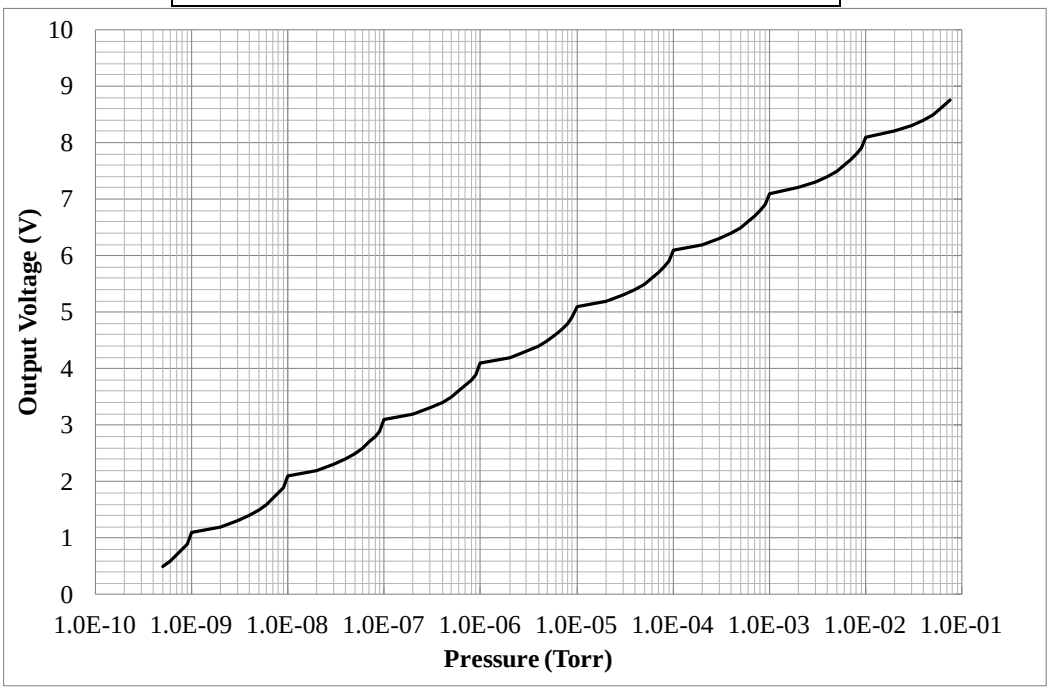


Fig. 9-2 Supplementary explanation of output voltage (GI-M2)

The measurement output voltage can be converted to a pressure value using the following equation.

P:Pressure value (Torr)
V:Measured output voltage (V)
E:V from which decimal point is rounded down (V)

GI-M2: $P=10^{(V-E)}\times10^{-(8-E)}$ (Torr)



GI-D7 Pseudo-LOG OUTPUT

Table. 9-5 Measured Pressure Value Table (GI-D7)

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
$6.70x10^{-1}$	6.67	$5.00x10^{-4}$	3.50
$1.00x10^{-1}$	6.10	$1.00x10^{-4}$	3.10
$5.00x10^{-2}$	5.50	$5.00x10^{-4}$	2.50
$1.00x10^{-2}$	5.10	$1.00x10^{-5}$	2.10
$5.00x10^{-3}$	4.50	$5.00x10^{-6}$	1.50
$1.00x10^{-3}$	4.10	$1.30x10^{-6}$	1.13

Displayed pressure value (Torr)	Output voltage (V)	Displayed pressure value (Torr)	Output voltage (V)
$1.00x10^{-3}$	6.10	$5.00x10^{-7}$	2.50
$5.00x10^{-4}$	5.50	$1.00x10^{-7}$	2.10
$1.00x10^{-4}$	5.10	$5.00x10^{-8}$	1.50
$5.00x10^{-5}$	4.50	$1.00x10^{-8}$	1.10
$1.00x10^{-5}$	4.10	$5.00x10^{-9}$	0.50
$5.00x10^{-6}$	3.50	$1.30x10^{-9}$	0.13
$1.00x10^{-6}$	3.10		

Table. 9-6 Hysteresis by the pressure that increased and decreased

Increae		Decrease	
Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
1.00×10^{-1}	6.10	1.00×10^{-1}	6.10
0.90×10^{-1}	6.09	9.00×10^{-2}	5.90
0.80×10^{-1}	6.80	8.00×10^{-2}	5.80

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Pa)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

GI-D7: $P=10^{(V-E)}\times10^{-(7-E)}$ (Pa)

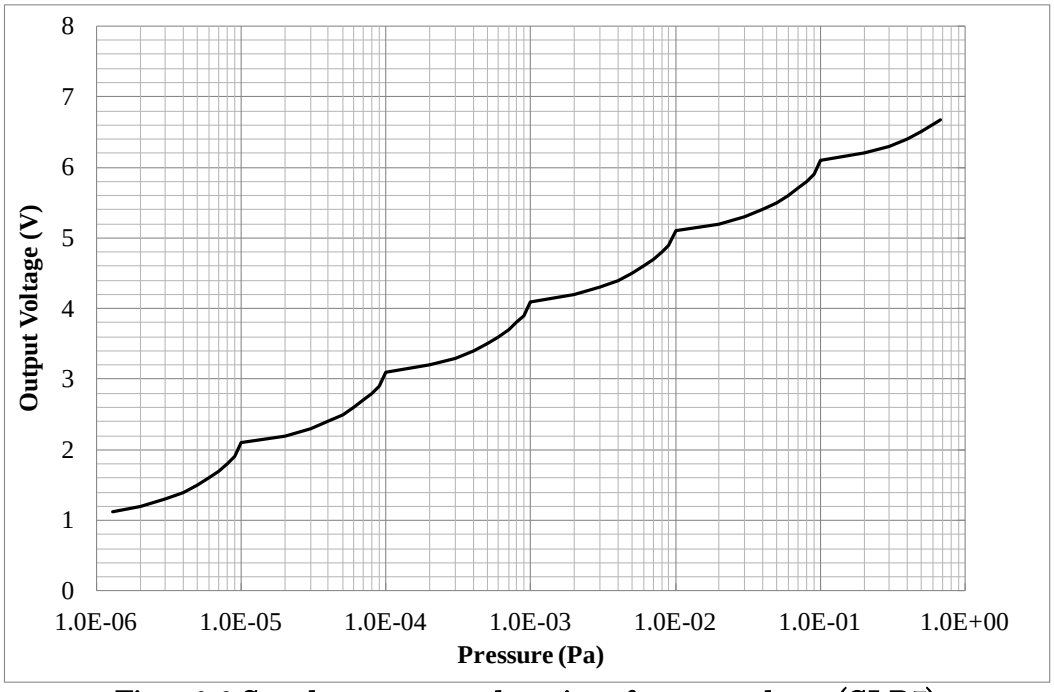
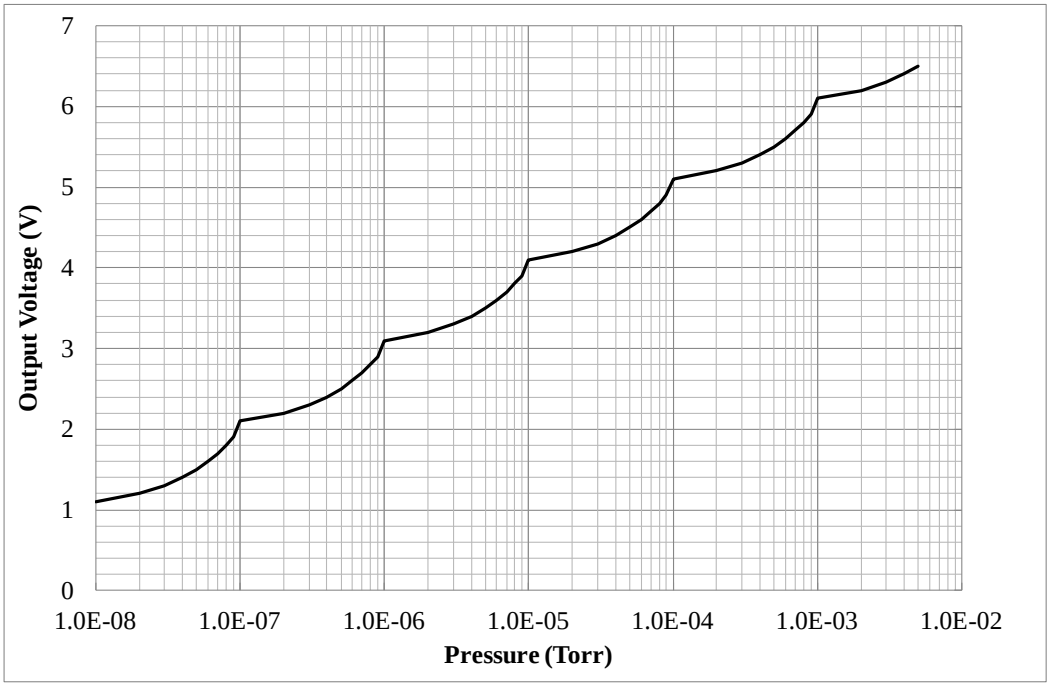


Fig. 9-3 Supplementary explanation of output voltage (GI-D7)

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Torr)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

GI-D7: $P=10^{(V-E)}\times10^{-(7-E)}$ (Torr)



GI-N8 Pseudo-LOG OUTPUT

Table. 9-7 Measured Pressure Value Table (GI-N8)

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
6.60×10^{-1}	9.66	1.00×10^{-5}	5.10
1.00×10^{-1}	9.10	5.00×10^{-5}	4.50
5.00×10^{-2}	8.50	1.00×10^{-6}	4.10
1.00×10^{-2}	8.10	5.00×10^{-7}	3.50
5.00×10^{-3}	7.50	1.00×10^{-7}	3.10
1.00×10^{-3}	7.10	5.00×10^{-8}	2.50
5.00×10^{-4}	6.50	1.00×10^{-8}	2.10
1.00×10^{-4}	6.10	4.00×10^{-9}	1.40
5.00×10^{-5}	5.50		

Table. 9-8 Hysteresis by the pressure that increased and decreased

Increae		Decrease	
Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
1.00×10^{-1}	9.10	1.00×10^{-1}	9.10
0.90×10^{-1}	9.09	9.00×10^{-2}	8.90
0.80×10^{-1}	9.80	8.00×10^{-2}	8.80

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Pa)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

GI-N8: $P=10(V-E)\times10^{-(10-E)}$ (Pa)

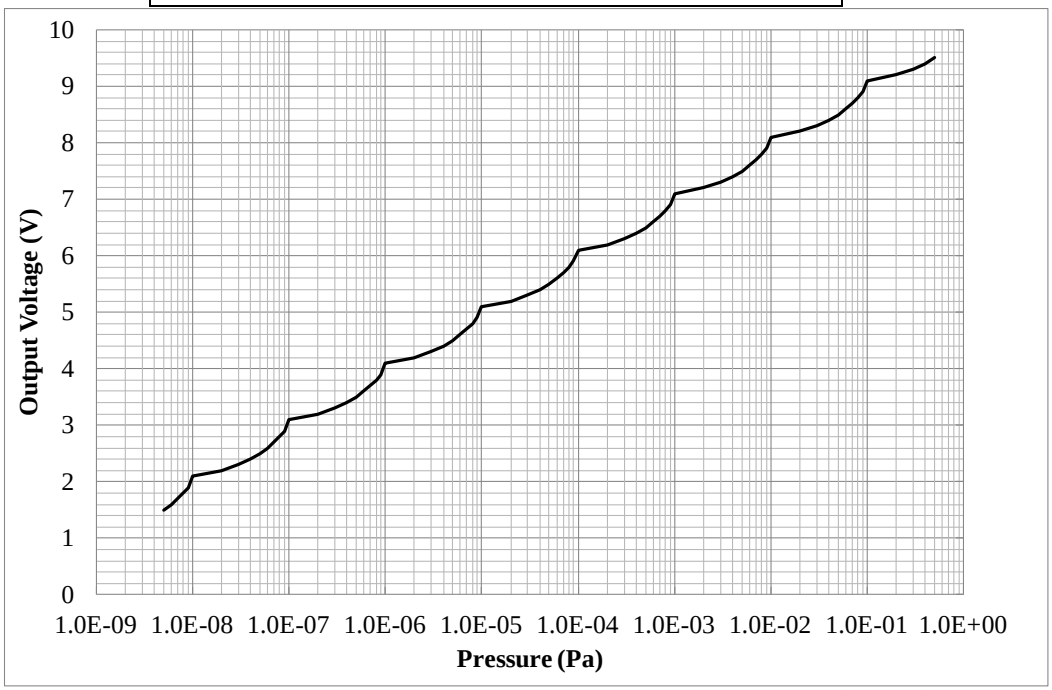


Fig. 9-4 Supplementary explanation of output voltage (GI-N8)

9.6.5. Range Hold Linear Output (REC-HOLD)

As in the LIN mode, the mantissa part 3-digits display A. BC and 2-digits display A. BG are outputted as A. BC [V] and A. BG [V] respectively, but above the specified range of REC-HOLD, it is outputted as FULL (10 V) and, below the specified range, the action is the same as when range hold is activated in the LIN range.

(Example) When REC-*HOLD by 10^{-4}

A. BC$\times 10^{-3}$ ⇒ 10. 00(V)
A. BC$\times 10^{-4}$ ⇒ A. BC(V)
A. BC$\times 10^{-5}$ ⇒ 0. AB(V)
A. BC$\times 10^{-6}$ ⇒ 0. 0A(V)
A. BC$\times 10^{-7}$ ⇒ 0. 00(V)

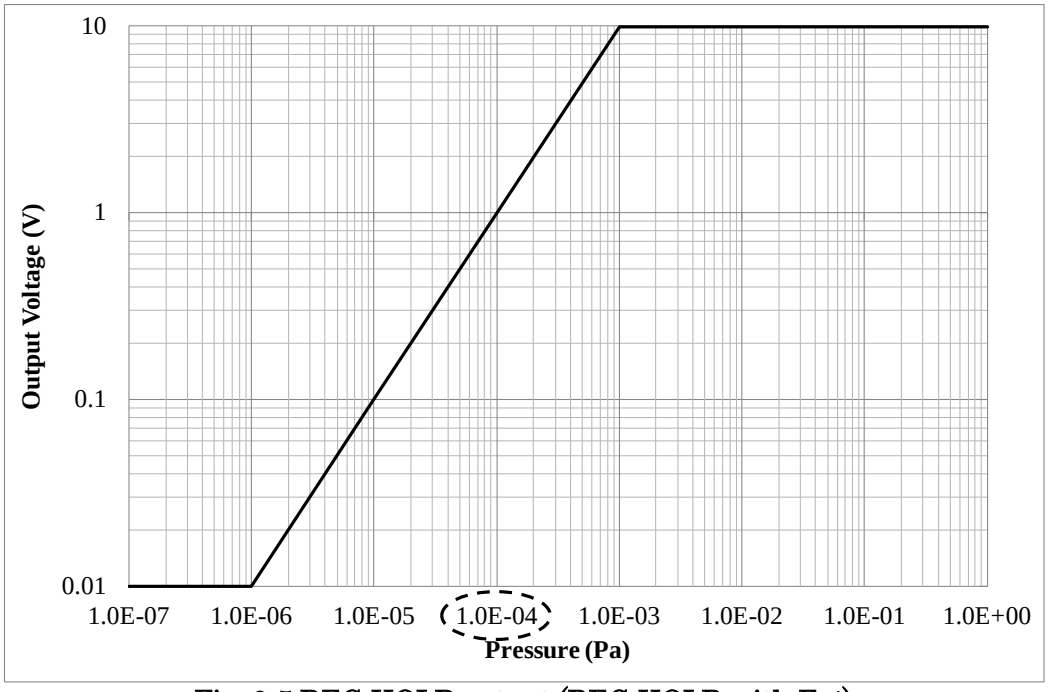


Fig. 9-5 REC-HOLD output (REC-HOLD with E-4)

9.6.6.Logarithmic Output (GI-M2)

✔ Note	Voltage values on order of several mV are low in accuracy because the recorder output is 12-bit DAC.

The table below gives the relationship between pressure and output voltage.

Table. 9-9 Measurement value outputs (GI-M2)

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
9.90×10^{-0}	9.00	1.00×10^{-4}	4.00
1.00×10^{-0}	8.00	5.00×10^{-5}	3.70
5.00×10^{-1}	7.70	1.00×10^{-5}	3.00
1.00×10^{-1}	7.00	5.00×10^{-6}	2.70
5.00×10^{-2}	6.70	1.00×10^{-6}	2.00
1.00×10^{-2}	6.00	5.00×10^{-7}	1.70
5.00×10^{-3}	5.70	1.00×10^{-7}	1.00
1.00×10^{-3}	5.00	5.00×10^{-8}	0.70
5.00×10^{-4}	4.70		

Displayed pressure value (Torr)	Output voltage (V)	Displayed pressure value (Torr)	Output voltage (V)
7.40×10^{-2}	8.87	1.00×10^{-6}	4.00
1.00×10^{-2}	8.00	5.00×10^{-7}	3.70
5.00×10^{-3}	7.70	1.00×10^{-7}	3.00
1.00×10^{-3}	7.00	5.00×10^{-8}	2.70
5.00×10^{-4}	6.70	1.00×10^{-8}	2.00
1.00×10^{-4}	6.00	5.00×10^{-9}	1.70
5.00×10^{-5}	5.70	1.00×10^{-9}	1.00
1.00×10^{-5}	5.00	3.00×10^{-10}	0.48
5.00×10^{-6}	4.70		

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Pa)
V: Measured output voltage (V)

$$P=10^{\wedge}(V-8) \Leftrightarrow V=\log P+8$$

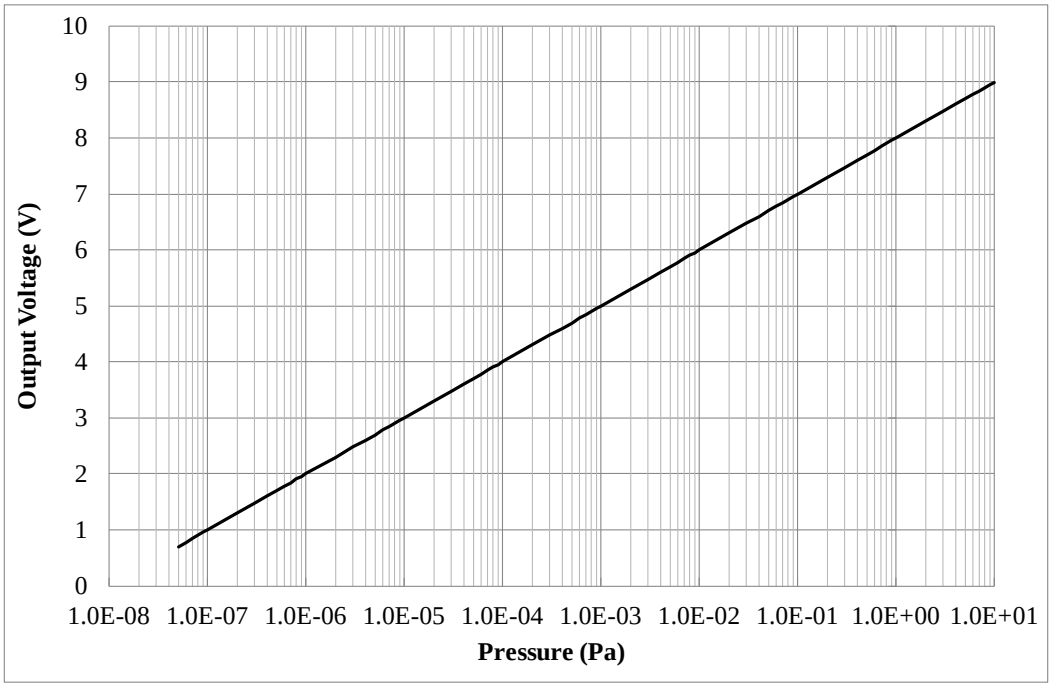


Fig. 9-6 LOG output

9.6.7.GI-D6 Compatibility output（GI-D7 Only）

The table below gives the relationship between pressure and output voltage.

When chose WIT

Table. 9-10 Measurement value outputs

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
$9.99x10^{-1}$	4.99	$1.00x10^{-4}$	1.10
$1.00x10^{-1}$	4.10	$5.00x10^{-5}$	0.50
$5.00x10^{-2}$	3.50	$1.30x10^{-5}$	0.13
$1.00x10^{-2}$	3.10		
$5.00x10^{-3}$	2.50		
$1.00x10^{-3}$	2.10		
$5.00x10^{-4}$	1.50		

Displayed pressure value (Torr)	Output voltage (V)	Displayed pressure value (Torr)	Output voltage (V)
$1.00x10^{-3}$	4.10	$5.00x10^{-7}$	0.50
$5.00x10^{-4}$	3.50	$1.30x10^{-7}$	0.13
$1.00x10^{-4}$	3.10		
$5.00x10^{-5}$	2.50		
$1.00x10^{-5}$	2.10		
$5.00x10^{-6}$	1.50		
$1.00x10^{-6}$	1.10		

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Pa)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

$$P=10(V-E)\times 10^{-(5-E)} \quad (Pa)$$

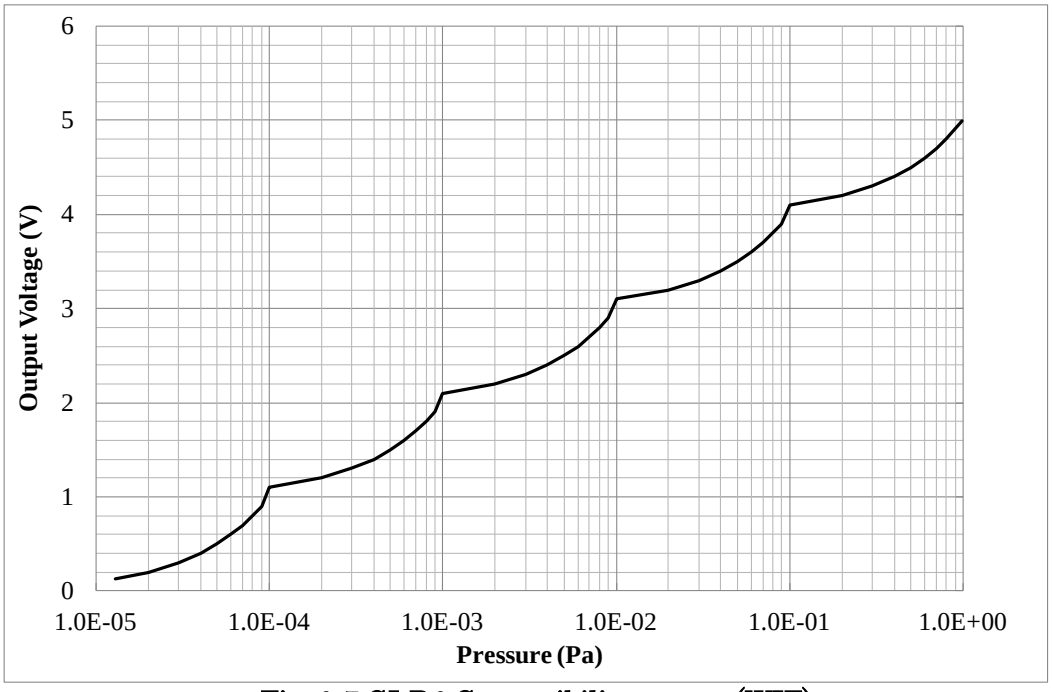
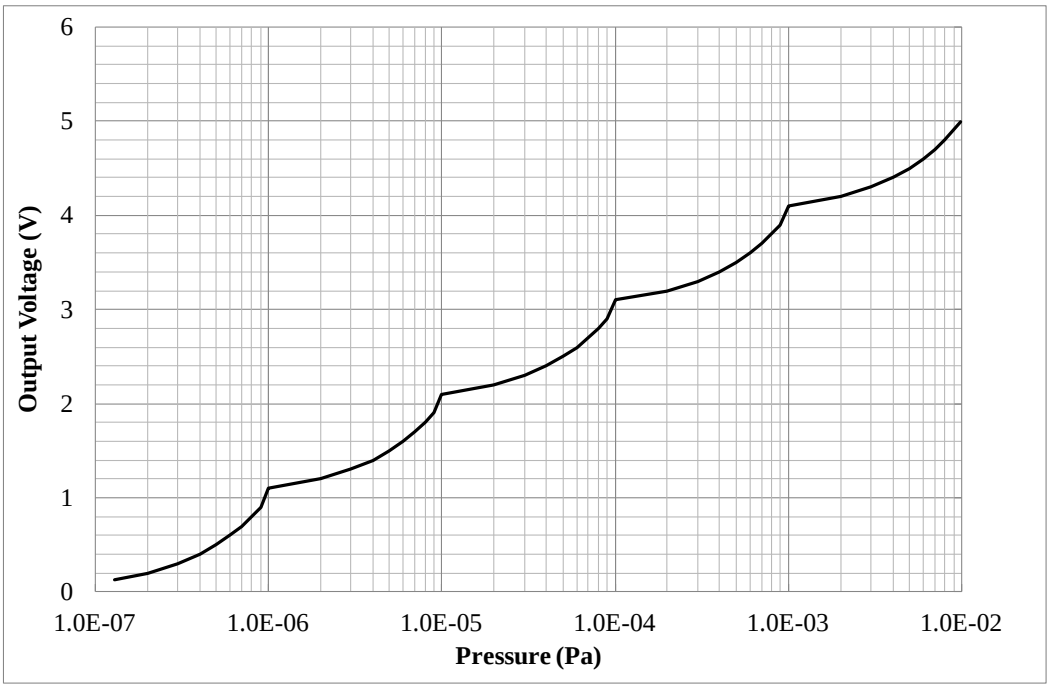


Fig. 9-7 GI-D6 Compatibility output (WIT)

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Torr)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

$$P=10^{(V-E)}\times 10^{-(5-E)} \quad \text{(Torr)}$$



When chose WIB

Table. 9-11 Measurement value outputs

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
$2.00x10^{-1}$	5.20	$1.00x10^{-4}$	2.10
$1.00x10^{-1}$	5.10	$5.00x10^{-5}$	1.50
$5.00x10^{-2}$	4.50	$1.00x10^{-5}$	1.10
$1.00x10^{-2}$	4.10	$5.00x10^{-6}$	0.50
$5.00x10^{-3}$	3.50	$1.30x10^{-6}$	0.13
$1.00x10^{-3}$	3.10		
$5.00x10^{-4}$	2.50		

圧力表示値(Torr)	出力電圧(V)	圧力表示値(Torr)	出力電圧(V)
$2.00x10^{-3}$	5.20	$1.00x10^{-6}$	2.10
$1.00x10^{-3}$	5.10	$5.00x10^{-7}$	1.50
$5.00x10^{-4}$	4.50	$1.00x10^{-7}$	1.10
$1.00x10^{-4}$	4.10	$5.00x10^{-8}$	0.50
$5.00x10^{-5}$	3.50	$1.30x10^{-8}$	0.13
$1.00x10^{-5}$	3.10		
$5.00x10^{-6}$	2.50		

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Pa)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

$$P=10(V-E)\times10^{-(6-E)}\ (Pa)$$

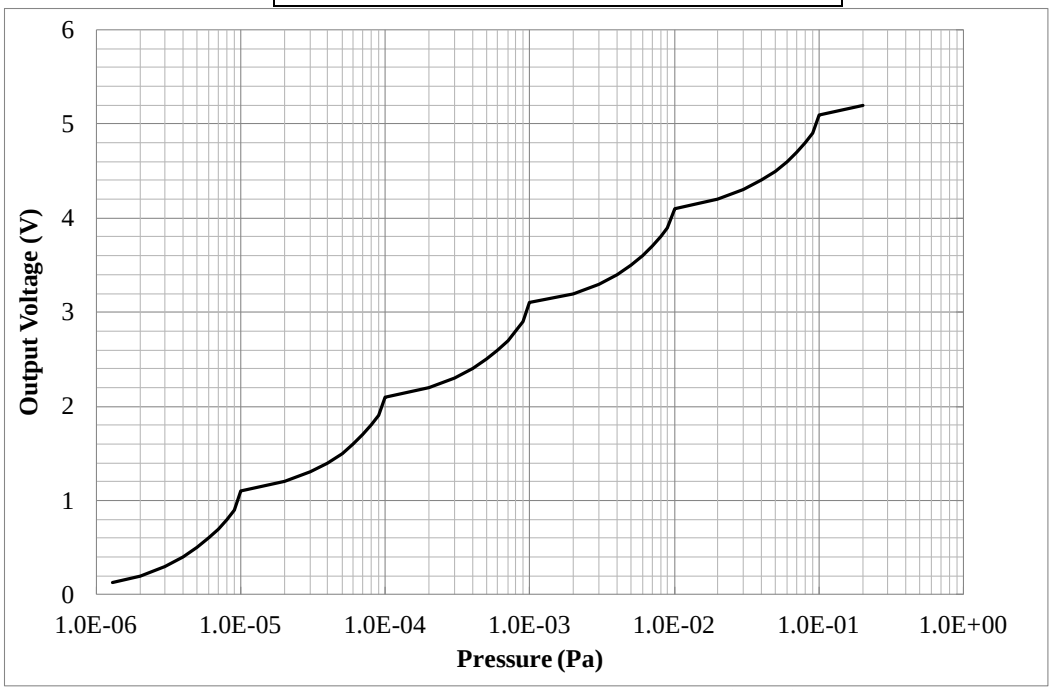
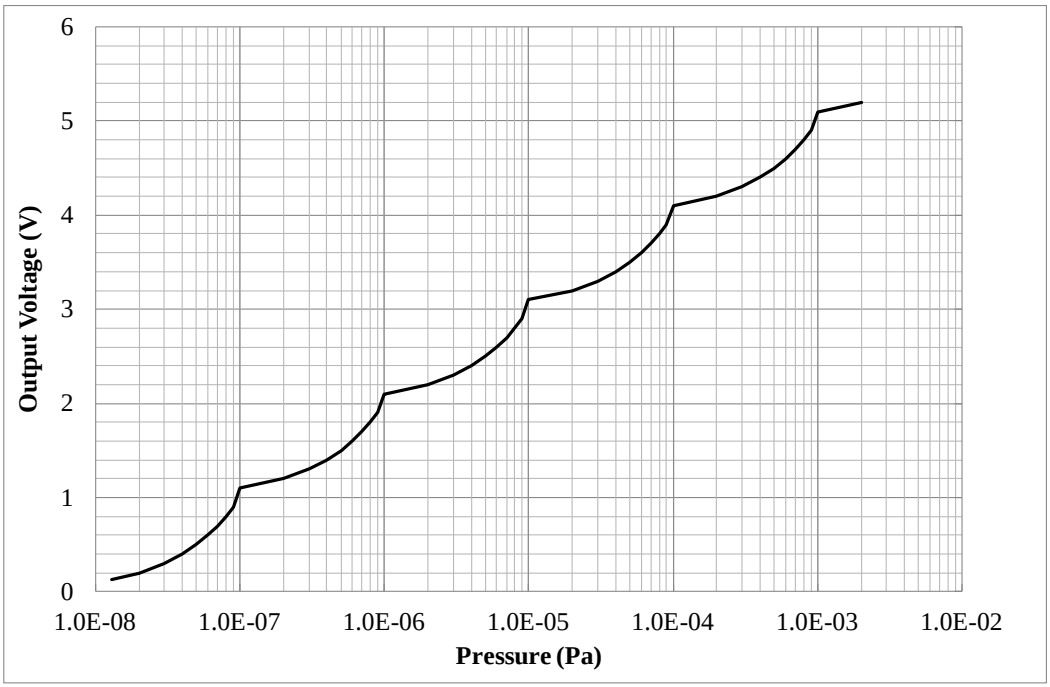


Fig. 9-8 GI-D6 Compatibility output (WIB)

The measurement output voltage can be converted to a pressure value using the following equation.

P: Pressure value (Torr)
V: Measured output voltage (V)
E: V from which decimal point is rounded down (V)

$$P=10^{(V-E)}\times10^{-(6-E)}\ (\text{Torr})$$



9.6.8.GI-TL3 Compatibility output (GI-D7 Only)

The table below gives the relationship between pressure and output voltage.

Table. 9-12 Measurement value outputs

Displayed pressure value (Pa)	Output voltage (V)	Displayed pressure value (Pa)	Output voltage (V)
$6.00x10^{-1}$	9.56	$2.00x10^{-3}$	4.60
$4.00x10^{-1}$	9.20	$1.00x10^{-3}$	4.00
$2.00x10^{-1}$	8.60	$6.00x10^{-4}$	3.56
$1.00x10^{-1}$	8.00	$4.00x10^{-4}$	3.20
$6.00x10^{-2}$	7.56	$2.00x10^{-4}$	2.60
$4.00x10^{-2}$	7.20	$1.00x10^{-4}$	2.00
$2.00x10^{-2}$	6.60	$6.00x10^{-5}$	1.56
$1.00x10^{-2}$	6.00	$4.00x10^{-5}$	1.20
$6.00x10^{-3}$	5.56	$2.00x10^{-5}$	0.60
$4.00x10^{-3}$	5.20	$1.00x10^{-5}$	0.00

Displayed pressure value (Torr)	Output voltage (V)	Displayed pressure value (Torr)	Output voltage (V)
$4.00x10^{-3}$	9.20	$1.00x10^{-5}$	4.00
$2.00x10^{-3}$	8.60	$6.00x10^{-6}$	3.56
$1.00x10^{-3}$	8.00	$4.00x10^{-6}$	3.20
$6.00x10^{-4}$	7.56	$2.00x10^{-6}$	2.60
$4.00x10^{-4}$	7.20	$1.00x10^{-6}$	2.00
$2.00x10^{-4}$	6.60	$6.00x10^{-7}$	1.56
$1.00x10^{-4}$	6.00	$4.00x10^{-7}$	1.20
$6.00x10^{-5}$	5.56	$2.00x10^{-7}$	0.60
$4.00x10^{-5}$	5.20	$1.00x10^{-7}$	0.00
$2.00x10^{-5}$	4.60		

P: Pressure value (Pa)
V: Measured output voltage (V)

$$P=10^{(V/2-5)} \ (Pa)$$

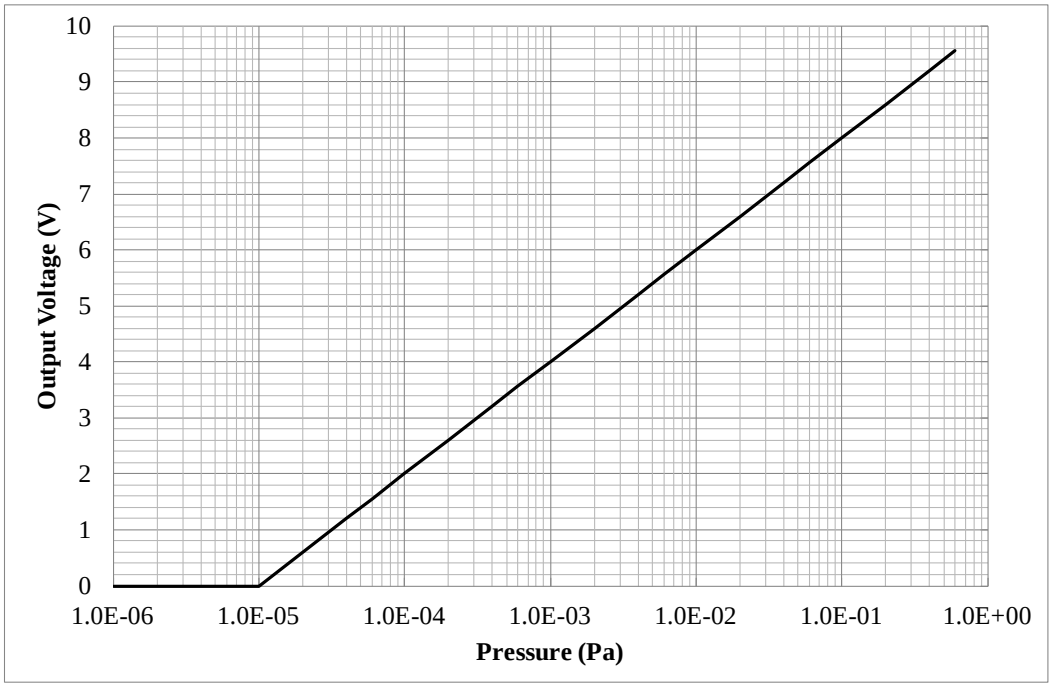
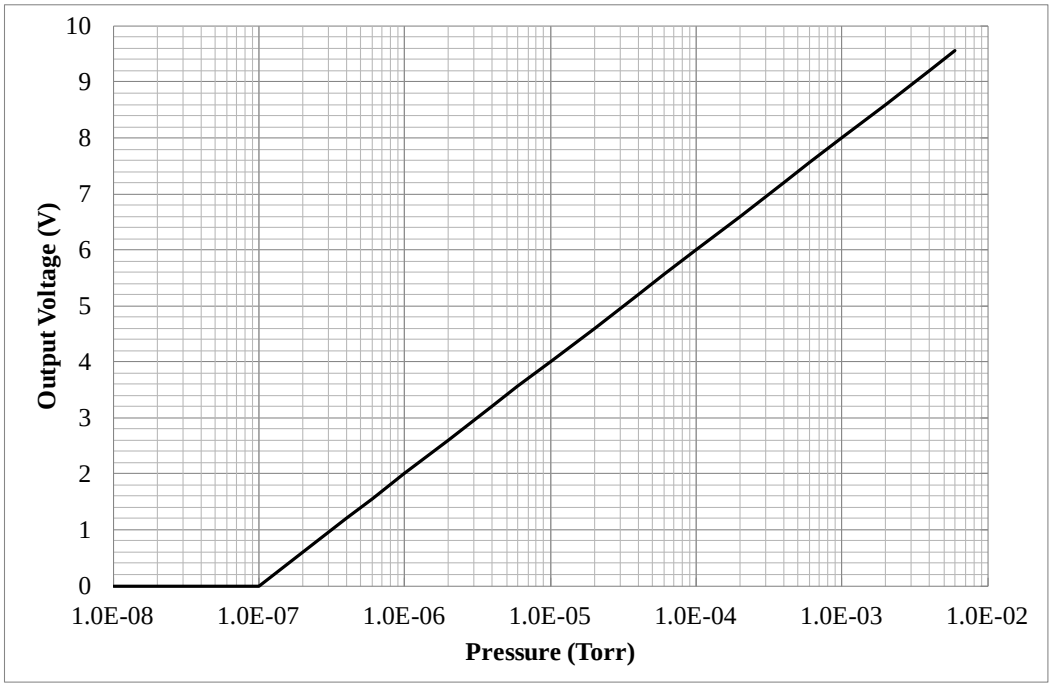


Fig. 9-9 LOG output

P: Pressure value (Torr)
V: Measured output voltage (V)

$$P=10^{(V/2-7)} \ (Torr)$$



9.7. X-Ray Function (GI-N8 Only)

The X-Ray function can hold the background error of the ionic current value (pressure signal) due to soft X-rays.

9.7.1.What is X-Ray mode setting?

Holding down the F1 key for two seconds or more turns ON X-Ray. A second press (two seconds or more) on the key turns OFF X-Ray. (X-Ray is activated from the time when the key is pressed to the time when it is pressed for a second time.)

9.7.2.How to actuate X-Ray function

(1) Actuating conditions

The X-Ray function is not actuated unless the filament is ON.

When X-Ray is actuated, the lamp in the F1 key lights.

Pressing the FIL key when X-Ray is ON turns OFF the X-Ray mode and filament.

(2) Operation

X-Ray operation can be entered from the front panel or external I/O connector (X-Ray).

(3) Notice

The X-Ray function is not actuated unless pressure comes down to below 3.0×10^{-5} Pa (2.0×10^{-10} Torr) and will be turned OFF automatically if the pressure rises to above 3.0×10^{-8} Pa (2.0×10^{-10} Torr).

CAUTION:	X-Ray function can be actuated only when the filament is turned ON. If DEGAS is actuated when the X-Ray function is actuated, the X-Ray action will stop and the DEGAS mode will be executed. The X-Ray action will be restored when DEGAS is turned OFF. (when the pressure after degassing is below 3.0×10^{-8} Pa(2.0×10^{-10} Torr)) X-Ray action is not accepted during degassing action. When the X-Ray action is actuated, pressure measurement data are updated at intervals of five seconds. The filament protecting action against abrupt pressure rise will be disabled.

9.8.Filament Activation (GI-N8 Only)

9.8.1.Actuating conditions

When the filament of a nude gauge (WIN-N type) is replaced, the filament is activated to activate the oxide coated on the filament.

(If the filament is supplied as mounted on the sensor head, this step is not required because it has been factory treated.)

9.8.2.Operation

Install the sensor head to the pumping system and make sure using another vacuum gauge that the pressure is within the measured pressure on the gauge.

Select Act_2 in the setting mode.

After selecting Act_2, turn ON the filament switch on the front panel. Activation will end about 30 minutes later and the filament will be turned OFF automatically.

The FIL lamp at upper right of the front panel blinks during activation.

Upon completion of activation, the setting is automatically corrected to Act_1 (invalid).

9.8.3.What is filament activation?

The standard sensor head for this gauge uses a tungsten wire filament (hot cathode). Tungsten is an excellent material for filaments and is widely used in a variety of applications, including vacuum gauge sensor heads.

However, tungsten is subject to rapid wear in oxygen or water vapor at a high temperature.

Therefore, if the vacuum gauge is used in a place where the partial pressure of oxygen or water vapor is high, the filament life will be extremely shorter than with nitrogen or inert gas though the measured pressure is the same.

The work coefficient ϕ of an oxide-coated filament is lower than that of a pure tungsten wire. Therefore, power to be supplied to the filament to obtain the same emission current is smaller. This means that the heat generated by the filament is smaller.

Lower filament temperature is not only desirable in terms of longer life, but also reduces outgassing by heating and disturbance to others when pressure in an ultrahigh pressure region is measured.

10. EXTERNAL INPUTS/OUTPUTS

Signals are exchanged with outside through the EXT-I/O connector on the rear panel, except through RS-232C.

Table. 10-1 A list of EXT-I/O functions

Terminal No.	Signal identification	Terminal direction	Signal contents
1	SET1 COM	Out	Relay output (AC125V/0.5A、DC24V/1A max)
2	SET1 a contact		
3	SET1 b contact		
4			
5	EXT－OUT COM	Out	External digital output GND
6	POWER $\overline{\text{ON}}$ ／ OFF	Out	Reading of ON/OFF of the main power supply
7	FILAMENT $\overline{\text{ON}}$ ／ OFF	Out	State reading of the filament
8	EMISSION $\overline{\text{Em-Hi}}$ ／ Em-Lo	Out	The setting reading of the emission current
9	UNIT $\overline{\text{Pa}}$	Out	The setting reading of the pressure unit
10	DEGAS $\overline{\text{ON}}$ ／ OFF	Out	State reading of the DEGAS movement
11	EMISSION･VALID $\overline{\text{OK}}$ ／ NG	Out	Validity of emission current
12	DATA･VALID $\overline{\text{Lo}}$ ／ Hi	Out	It works during output data update
13	PRESSURE･DATA $\overline{\text{－}}$／ ＋	Out	The pressure value output（BCD outut）
14	PRESSURE･DATA $\overline{\text{C－b3}}$		
15	PRESSURE･DATA $\overline{\text{D－b0}}$		
16			
17	DEGAS $\overline{\text{ON}}$ ／ OFF	In	A control input of the DEGAS movement
18	EXT-PROTECT $\overline{\text{ON}}$ ／ OFF	In	Eternal protect input（Forced filament OFF）
19	EXT- 5V INPUT-COM	In	Power supply input for eternal control inputs
20	EXT-24V INPUT-COM		
21			
22			
23	GND		Eternal control input GND（D-GND）
24	GND （REC－OUT － ）		Analog output GND（A-GND）
25	REC－OUT ＋	Out	The pressure value output （analog output）
26	SET2 COM	Out	Relay output (AC125V/0.5A、DC24V/1A max)
27	SET2 a接点		
28	SET2 b接点		
29			
30	PRESSURE･DATA $\overline{\text{A－b0}}$	Out	Pressure output（BCD output）
31	PRESSURE･DATA $\overline{\text{A－b1}}$		
32	PRESSURE･DATA $\overline{\text{A－b2}}$		
33	PRESSURE･DATA $\overline{\text{A－b3}}$		
34	PRESSURE･DATA $\overline{\text{B－b0}}$		
35	PRESSURE･DATA $\overline{\text{B－b1}}$		
36	PRESSURE･DATA $\overline{\text{B－b2}}$		
37	PRESSURE･DATA $\overline{\text{B－b3}}$		

38	PRESSURE･DATA C−b0		
39	PRESSURE･DATA C−b1		
40	PRESSURE･DATA C−b2		
41			
42	LOCAL／ REMOTE	In	ON(effective)/OFF(Invalidity) of the IO control input Regular ON input is necessary at the time of the IO control.
43	FILAMENT ON ／ OFF	In	A control input of the filament lighting
44	EMISSION Em-Hi ／ Em-Lo	In	A control input of the emission current value(GI-N8)
45	FILAMENT 2／ 1	In	A control input of filament 1/2
46	REC-HOLD ON ／ OFF X-RAY	In	The control input of the REC-HOLD function(GI-M2/D7) A control input of a X-RAY function(GI-N8)
47			
48	GND		GND for control inputs（D-GND）
49	GND		
50			

A, B, C and D in PRESSURE DATA A-b0 and later correspond to «A. B × 10 ± DC» of the indicator. Refer to "10. EXTERNAL INNPUT/OUTPUT" for more information.

□ of signal identification (e.g. ON) indicates the LOW status (short, negative logic).

10.1. Set Point Output

The internal relay is actuated (reversed) when the set value becomes lower than the set point set value. The output is a relay contact output and one transfer (COM, a contact, b contact) is outputted per set point.

The contact capacity is

AC:125V_{MAX}, 0. 5A_{MAX}

DC: 24V_{MAX}, 1. 0A_{MAX}

However, it is recommended to use it at below 24 VDC so as not to bring the noise source into the GI-M2 gauge (for safety of the connector wiring).

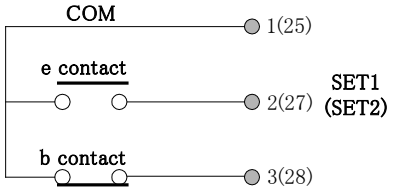


Fig. 10-1 Set point internal circuit

AC:125V_{MAX}, 0. 5A_{MAX}

DC: 24V_{MAX}, 1. 0A_{MAX}

However, it is recommended to use it at below 24 VDC so as not to bring the noise source into the GI-M2 gauge (for safety of the connector wiring).

10.2. External Digital Output

The operating state, such as measured pressure value, filament ON/OFF status, DEGAS ON/OFF status, etc. are outputted to outside as digital signals (negative logic).

The output form is the open collector output. Output rating is [24V_{MAX},50mA_{MAX},saturation voltage 1V]

The standard setting of emitter common is pin 5 «EXT-OUT COM» of the EXT-I/O connector.

CAUTION:
«EXT-OUT COM» is normally insulated from internal ground. To use it on common ground, open the bottom panel of the controller and connect "HP4" installed on the rear panel side to 1-2side by means of a jumper wire. "HP4" installed on the rear panel side to GND side by means of a jumper wire. See P.13.

Fig. 10-1 shows the digital output internal circuit.

"HP4" on the board has been connected to the ISOside by means of a jumper wire before shipment from the factory.

CAUTION:
ANALOG GND and DIGITAL GND are common inside.

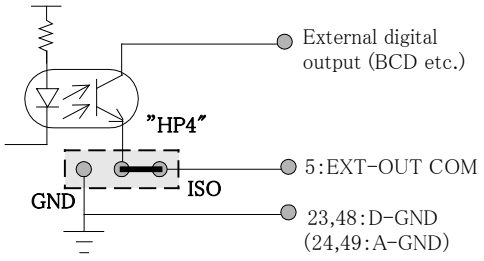


Fig. 10-2 Digital output internal circuit

The measured output value is outputted by the BCD code. The relationship between the displayed value and the output data is as shown below.

In the mantissa part 3-digits display, the 2nd digit of the decimal point is not outputted (truncated).

When the displayed value is (A. B × 10 ± DC):

Data of A is outputted by the BCD code at the output terminals of A-b0 to A-b3, where A-b0 is the least significant bit of the four-digit numeral.

Data of B is outputted by the BCD code at the output terminals of B-b0 to B-b3, where B-b0 is the least significant bit of the four-digit numeral.

Data of C is outputted by the BCD code at the output terminals of C-b0 to C-b3, where C-b0 is the least significant bit of the four-digit numeral.

Data of D is outputted by the BCD code at the output terminals of D-b0 to D-b3, where D-b0 is the least significant bit of the four-digit numeral.

Data valid of the display value (A. B × 10 ± DC) and data rewriting time chart are as shown in Fig. 10-2 Data valid signal (strobe signal) actuation chart and Fig. 10-3 Data rewriting time chart-1.

Data are outputted at intervals of about 100 ms, in which data are rewritten at intervals of 1 ms.

CAUTION:
If data are loaded during data rewriting (DATA VALID Hi), correct displayed values cannot be loaded.

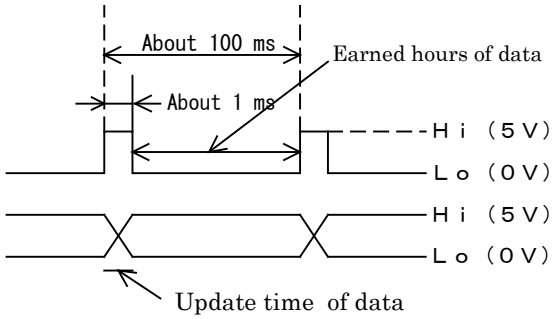


Fig. 10-3 Data valid signal (strobe signal) actuating chart

In order to terminate all data change within the DATA-VALID signal time, set the load resistor below the following value:

Load resistance below 48 kΩ at 24 V

Load resistance below 10 kΩ at 5 V

10.3. External Control Input

Used when turning ON/OFF the filament, degassing or other from outside. By an inputmethod, it changes HP3 jumper setting of inside. Refer to 13
When the factory shipment, it is set by internal 5V power supply use.

	IO conector	HP3 jumper wire
Internal 5V power	—	INT
External 5V power	19 EXT- 5V	EXT
External 24V power	20 EXT- 24V	EXT

①When 5V internal power supply is used

The setting is jumper setting of HP3.
Connect the ANALOG terminal or DIGITAL GND terminal (23, 24, 48, 49) and each signal by means of a relay contact or open collector.

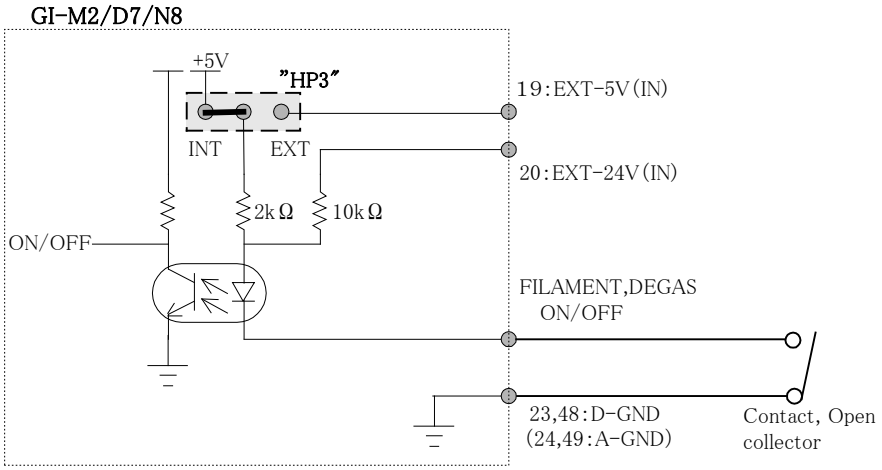


Fig. 10-4 External control using internal power supply

CAUTION	If power is supplied from the outside in the internal power setting, it will break down.

②When external 5V or 24V power supply is used

Accept a power supply to use, and lay a power supply on EXT -5V INPUT (the 19th PIN) or the EXT -24V INPUT (the 20th Pin) terminal.
When use 5V or 24V power supply, set jumper setting of HP3 EXT.

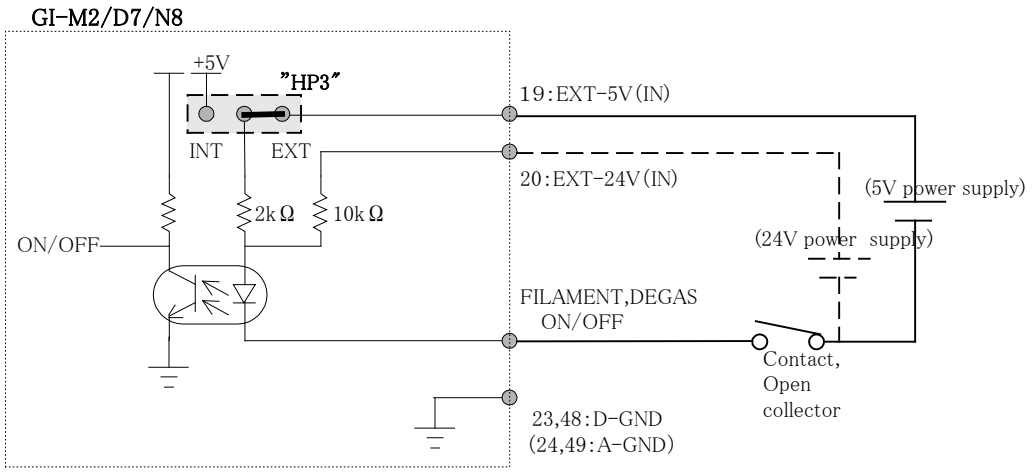


Fig. 10-5 External control using external power supply

10.4.Method of External Control

For external control, follow the time chart in Fig. 10-5.

① Before external operation, select the REMOTE mode.

② Then perform filament ON/OFF and DEGAS ON/OFF operation in that order.
However, DEGAS is not turned ON unless the filament is ON.

③ Upon completion of all operations, change over the mode to LOCAL.

CAUTION:
Do not input each operation simultaneously. If inputted simultaneously, either operation may not be actuated. Provide a time difference between actions.

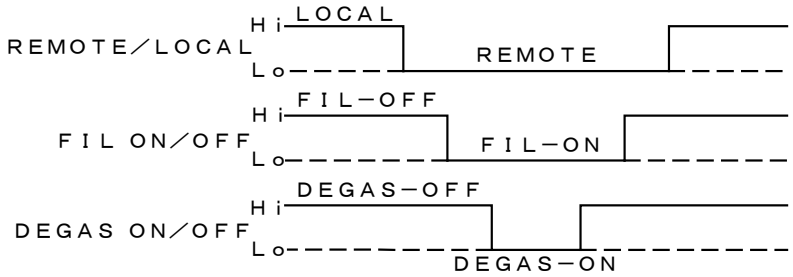


Fig. 10-6 Method of External Control

10.5.External Protect Input (EXT-PROTECT)

The filament can be protected with EXT-PROTECT from outside. In this case, it is active regardless of the REMOTE/LOCAL status.

If EXT-PROTECT is restored with the filament turned ON in the LOCAL mode, the filament will be turned OFF. Turn it ON again.

If the filament is turned ON in the REMOTE mode and the EXT-PROTECT is turned OFF, the filament will be turned ON.

11. HOW TO USE COMMUNICATION (RS-232C)

11.1. Communication Specifications

11.1.1. Key specifications

Communication system	Half duplex
Data bit length	8 bits
Stop bit length	1 bit
Code	ASCII
Baud rate	9600, 19200, 38400 bps
Return key processing	C_R code processing
Transmission distance	15m

The send command terminates with C_R.

11.1.2. Baud rate setting

Refer to "8.12 Baud Rate Setting".

It is factory set at 9600 bps.

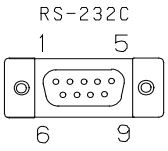
11.1.3. Communication cable/connector

※ The connector is located on the rear of the gauge.

11.1.3.1.Output signal connector

Output connector : Dsub 9S (female, screw size M2.6)

Signal and assignment: (complies with RS-232C standard)



Pin No.	Signal identification
2	Receive data (RD)
3	Transmit data (TD)
5	Ground for signal (GND)

11.1.3.2.Connecting the communication cable

This gauge does not come with the RS-232C communication cable.

Use a commercially available RS-232C cable (cross type).

Host computer side Pin No.	GI-M2 side Pin No.
2	2
3	3
5	5

11.2.Send Command Format

"Command"+"parameter"+C_R(Terminal)

The parameter of the movement explanation inside of the next clause shows the following.

－ : No set point (No send data)

XX : Arbitrary set point

Send back when state setting and the establishment of the value succeeded,"OK", it failed in "NG".

11.3. List of Commands

Command	Parameter	Response	Explanation of function
'RE'	–	'OK' or 'NG'	Sets remote status
'LO'	–	'OK' or 'NG'	Sets local status
'GS'	–	'GI-xx'	Reads control status
'FO'	–	'OK' or 'NG'	Turns OFF filament
'F1'	–	'OK' or 'NG'	Turns ON filament
'FA'	–	'OK' or 'NG'	Selects filament - 1
'FB'	–	'OK' or 'NG'	Selects filament - 2
'D0'	–	'OK' or 'NG'	Turns OFF degassing
'D1'	–	'OK' or 'NG'	Turns ON degassing
'DA'	–	'OK' or 'NG'	Selects degassing AUTO mode use ON
'DB'	–	'OK' or 'NG'	Selects degassing AUTO mode use OFF
'DS'	'*XX*'	'OK' or 'NG'	Sets degassing AUTO mode time in 'XX' minutes
'EM'	–	'OK' or 'NG'	Reads emission valid status
'ES'	–	'05' or '50'	Reads emission status (GI-N8)
'E0'	–	'OK' or 'NG'	Selects emission current 0.5mA (GI-N8)
'E1'	–	'OK' or 'NG'	Selects emission current 0.5mA (GI-N8)
'SA'	–	'OK' or 'NG'	Sets sensitivity factor (N_2)
'SB'	–	'OK' or 'NG'	Sets sensitivity factor (Ar)
'SE'	'*X.XX*E±*XX*'	'OK' or 'NG'	Sets sensitivity factor
'R1'	–	'*X.XX*E-*XX*'	Reads data of setpoint-1
'R2'	–	'*X.XX*E-*XX*'	Reads data of setpoint-2
'S1'	'*X.XX*E-*XX*'	'OK' or 'NG'	Sets setpoint-1
'S2'	'*X.XX*E-*XX*'	'OK' or 'NG'	Sets setpoint-2
'SP'	–	'1-*X*/2-*X*	Reads setpoint-1 and -2 status
'LI'	–	'OK' or 'NG'	Selects analog "LIN"
'LG'	–	'OK' or 'NG'	Selects analog " Pseudo-LOG"
'LH'	–	'OK' or 'NG'	Selects analog "REC-HOLD"
'L4'	–	'OK' or 'NG'	Selects Analog "LOG output" (GI-M2)
'L6'	–	'OK' or 'NG'	Selects Analog "GI-D6 compatibility output" (GI-D7)
'L3'	–	'OK' or 'NG'	Selects Analog "GI-TL3 compatibility output" (GI-D7)
'LS'	'E-*XX*'	'OK' or 'NG'	Sets range hold linear output value (range)
'RP'	–	'X.XXE-XX'	Reads measured pressure data
'PR'	–	'ON' or 'OF'	Reads EXT-PROTECT status
'RS'		'*XXXXXXX*'	Reads action status

11.4. Explanation of Command Action

11.4.1. Changing over remote/local control

Command	Parameter	Response	Explanation of function
'RE'	—	'OK' or 'NG'	Sets remote status
'LO'	—	'OK' or 'NG'	Sets local status

Send 'RE' command when the remote control is used in the remote (RS-232C) mode.
After recept 'RE', lit when in the LED of "REMOTE" on a front panel and send back 'OK'.
When the remote control by the communication, a front panel and the input from IO are invalid.
Send 'LO' when it finish the remote control by communications.

Use the following control commands after the ,`'RE ' sending.

11.4.2. Reading the connection model

Command	Parameter	Response	Explanation of function
'GS'	—	'GI-*xx*'	Reads control status

Send back the model (the model name).
Send back 'GI-M2'、'GI-D7'

11.4.3. Control of filament

→ Refer to P. 41

Command	Parameter	Response	Explanation of function
'FO'	—	'OK' or 'NG'	Turns OFF filament
'F1'	—	'OK' or 'NG'	Turns ON filament
'FA'	—	'OK' or 'NG'	Selects filament-1
'FB'	—	'OK' or 'NG'	Selects filament-2

Turning ON/OFF the filament.
When it dose not appoint filament 1/2, it turns on a set filament last.
It is memorized, and the setting of filament 1/2 is reflected at the time of the front panel operation by the main body.
By a `RS' command, the reading of the set point of the filament is possible.

11.4.4. Control of degassing

→Refer to P.32

Command	Parameter	Response	Explanation of function
'D0'	—	'OK' or 'NG'	Turns OFF degassing
'D1'	—	'OK' or 'NG'	Turns ON degassing
'DA'	—	'OK' or 'NG'	Selects degassing AUTO mode use ON
'DB'	—	'OK' or 'NG'	Selects degassing AUTO mode use OFF
'DS'	'*XX*'	'OK' or 'NG'	Sets degassing AUTO mode time in 'XX' minutes

Degassing is active after the filament is ON.
Setting of AUTO・MODE time is 0 1～9 9 min. Send 'DS*XX*' (*XX*:01-99) command.
When it dose not set, it uses the value that is finished with the setting of the main body.
It is memorized, and this setting is reflected at the time of the front panel operation by the main body.

11.4.5. Reading the emission valid signal

Command	Parameter	Response	Explanation of function
'EM'	—	'OK' or 'NG'	Reads emission valid status
'ES'	—	'05' or '50'	Reads emission status (GI-N8)
'E0'	—	'OK' or 'NG'	Selects emission current 0.5mA (GI-N8)
'E1'	—	'OK' or 'NG'	Selects emission current 0.5mA(GI-N8)

Send back the emission valid. Send back 'NG' when the filament OFF.
GI-N8 can read about setting and conditons of emission current and at the time, it points at "05":0.5mA、"50":5mA.

11.4.6. Setting the sensitivity

→ Refer to P. 36

Command	Parameter	Response	Explanation of function
'SA'	—	'OK' or 'NG'	Sets sensitivity factor (N_2)
'SB'	—	'OK' or 'NG'	Sets sensitivity factor (A_r)
'SE'	'*X.XX*E±*XX*'	'OK' or 'NG'	Sets sensitivity factor

	GI-M2	GI-D7	GI-N8
'SA'	N2	N2	N2
'SB'	Ar	Ar	H2
'SE'	'X.XXE±XX'	'X.XXE±XX'	'X.XXE±XX'

It is memorized, setting of value 'SE *X.XXE±XX*' by the main body.
It is reflected at the time of the front panel / IO operation.

11.4.7. Setting and reading the set point

→ Refer to P. 38

Command	Parameter	Response	Explanation of function
'R1'	—	'*X.XXE-XX*'	Reads data of set point-1
'R2'	—	'*X.XXE-XX*'	Reads data of set point-2
'S1'	'*X.XXE-XX*'	'OK' or 'NG'	Sets set point-1
'S2'	'*X.XXE-XX*'	'OK' or 'NG'	Sets set point-2
'SP'	—	'1-*X*/2-*X*'	Read the status of setpoint-1 and -2

Reading of setting and setting value of the set point.
It is reflected at the time of the front panel / IO operation.
The state of the set point is ON: 1, OFF: 0 is set by X of reply data `1-X/2-X'.

11.4.8. Setting analog output

→ Refer to P. 42

Command	Parameter	Response	Explanation of function
'LI'	—	'OK' or 'NG'	Selects analog "LIN"
'LG'	—	'OK' or 'NG'	Selects analog "Pseudo-LOG"
'LH'	—	'OK' or 'NG'	Selects analog "REC-HOLD"
'L4'	—	'OK' or 'NG'	Selects analog "LOG" (GI-M2)
'L6'	—	'OK' or 'NG'	Selects analog "GI-D6" compatibility output" (GI D7)
'L3'	—	'OK' or 'NG'	Selects analog "GI-TL3" compatibility output" (GI-D7)
'LS'	'E-*XX*'	'OK' or 'NG'	Selects range hold linear output (range)

Set an analog output method.
The set point of the `LS' command sets the range which is ,` E-XX '.
It is reflected at the time of the front panel / IO operation.

11.4.9. Reading the measured pressure value and action status

Command	Parameter	Response	Explanation of function
'RP'	—	'*X.XXE-XX*'	Reads measured pressure data
'PR'	—	'ON' or 'OF'	Reads EXT-PROTECT status
'RS'		'*XXXXXXX*'	Reads action status

Send back `0.00E-XX ` for a ,` RP' command in filament OFF.
The `PR' command send back in an input state of EXT-PROTECT of IO.
ON: There is INPUT, OFF: There is not INPUT.
'RS'command respose details:
X1 + X2 + X3 + ... + X7 and data of seven items (X:0/1) is one set, and it is replied.

The details of data are as follows.

Items		0	1
X1	Fil 2/1 (Setting condition)	Fil2	Fil1
X2	Fil ON/OFF	OFF	ON
X3	Em Valid	NG	OK
X4	DeGas ON/OFF	OFF	ON
X5	PROTECT (Pressure protection)	OFF	ON
X6	SetPoint2 ON/OFF	OFF	ON
X7	SetPoint1 ON/OFF	OFF	ON

11.5. Cautions in Operation

(1) Operation from the front panel is not accepted after the remote status is set up by RS-232C communication.
(2) Operation from an external input is not accepted after the remote status is set up by RS-232C communication.
However, EXT-PROTECT is active.
(3) If the filament is ON (including degassing ON) when the remote status is set up by RS-232C communication, the action will be turned OFF.
(4) If the filament is ON (including degassing ON) when the remote status is reset from the remote status to the local status through RS-232C communication, control returns to the local status after turning OFF the action.
(5) If the RS-232C remote status is set up from the host computer and the power to the host computer is turned OFF before it is reset to the local status, the vacuum gauge side holds the remote status. To reset it, enter a local command from the host computer again or turn OFF the power to the vacuum gauge.

12. TROUBLESHOOTING

In case of trouble, take corrective actions referring to this troubleshooting chart.
Before troubleshooting, turn off the power.

Turn off power.

● Turning On the power dose not light the display.

Possible cause	Corrective action
The power cord is disconnected.	Check the 3-pin outlet plug and inlet connector on the rear panel of the controller for connection, and reconnect it.
The power cord is broken.	Check the 3-pin power cord wires for continuity and insulation using a circuit tester.
The line voltage is below the specified range.	Check if the line voltage is within the specified range using a circuit tester. (line voltage: 100 VAC ± 10V)
The fuse in the main power supply has blown out.	Take out the fuse box by turning the screw with a Philips screwdriver and check for continuity using a circuit tester. When the fuse has blown out: If the cause is a momentary overcurrent, the problem can be solved by replacing the fuse, but if an overcurrent is flowing for other cause, it will blow out again. Locate the real cause of trouble from other items.
The power line in the controller is disconnected.	Disconnection or short has occurred in the power line in the controller (inline filter, wiring, power switch, transformer, switching power supply, etc.) Contact ULVAC for inspection and repair.
Trouble has occurred in the controller due to erroneous wiring of external I/O connector.	Element in the controller was damaged by erroneous wiring of the wire to the external I/O connector. Or the line voltage drops. Correct the wiring. Contact ULVAC for inspection and repair.
The cable between the power supply board and controller board is disconnected. The cable between the controller power supply board and the display board is disconnected.	The cable was disconnected by vibration in transit. Remove the top and bottom panels of the controller to check where it is disconnected. Reconnect the disconnected cable.
CPU is out of control due to external noise.	Turn ON the power again to start up CPU normally. Examine the corrective action against noise separately.

● Pressure cannot be measured by turning ON the filament.(The [FIL]lamp on the front panel is blinking.)

Possible cause	Corrective action
The emission current value is not normal.	Examine the real cause from other items. →P. 79
The filament has blown out.	Check the wiring between the filament and electrode for continuity with a circuit tester. (See page 87.) Change over the filament to the other. If the filament blows out after operation above the measurable pressure range for many hours, the sensor head interior may be contaminated. In this case, the emission current value may not be normal even if the other filament is in continuity. In this case, replace the sensor head.
Insulation between the electrodes of the sensor head has failed.	Check insulation between the electrodes of the sensor head and between the electrodes and the outside wall. (The Megger indication should be infinite.)(See page 87.) If insulation failure is verified, replace the sensor head.
The sensor head cable is disconnected or insulation failure has occurred.	Check insulation between electrodes of the sensor head using a Megger. Also check the connector at both ends for continuity using a circuit tester. (See page 90～.) Note: After checking the ion collector (coaxial contact) for insulation using a Megger, short the points measured by the Megger to discharge the charge. If it is reconnected without discharging, the DC amplifier of the controller may be damaged. Replace or repair the sensor head cable.
The sensor head is contaminated or its filament has worn out.	Replace the sensor head with another one and check the symptom again. If OK with another sensor head, the sensor head is faulty. Replace the sensor head.
GND potential is fluctuating.	Check control ground and ground of the sensor head mounted position by a circuit tester or oscilloscope. Take actions to improve the GND wiring or install the controller or sensor head afloat.
Filament protection is activated because of high pressure.	Check pressure using another type of vacuum gauge, e.g. Pirani gauge.

● Pressure cannot be measured with the filament turned ON.(The [FIL] lamp on the panel is lit.)

Possible cause	Corrective action
Insulation between the electrodes of the sensor head has failed.	Check insulation between the electrodes of the sensor head and between the electrodes and the outside wall using a Megger. (The Megger indication should be infinite.) (See page 87) If insulation failure is verified, replace the sensor head.
The sensor head cable is disconnected or insulation has failed.	Check insulation between electrodes of the sensor head using a Megger. Also check the connector at both ends for continuity using a circuit tester. (See page 90～.) Note: After checking the ion collector (coaxial contact) for insulation using a Megger, short the points measured by the Megger to discharge the charge. If it is reconnected without discharging, the DC amplifier of the controller may be damaged. Replace or repair the sensor head cable.
Sensor head sensitivity has lowered noticeably.	Change the sensor head with another one and check the symptom. If OK with another sensor head, the sensor head is faulty. Replace the sensor head.

● The filament is turned OFF immediately after it is turned ON or the filament cannot be turned ON.

Possible cause	Corrective action
Filament protection is activated because of high pressure.	Check pressure using another type of vacuum gauge, e.g. Pirani gauge.
EXT-PROTECT is activated.	If the [PROT] lamp on the front panel is lit, external protection input is activated. Reset the PROTECT signal. Turn off the FIL ON signal and then turn it ON again.
Remote operation status is set up from RS-232C.	If the [REMOTE] lamp on the front panel is lit, remote operation status is set up. At this time, operation from the front panel and external I/O connector are not feasible. Turn on the filament through RS-232C. Reset [REMOTE] and select front panel operation.
Remote operation status is set up by external I/O connector.	If the [REMOTE] lamp on the front panel is lit, remote operation status is set up. At this time, operation from the front panel is not feasible. Turn on the filament form the external I/O connector. Reset [REMOTE] and select front panel operation.

● Measured pressure differs largely from expected value.

Possible cause	Corrective action
Sensor head cable has blown out or insulation has failed, resulting in leakage current.	Check insulation between electrodes of the sensor head. Also check continuity using a circuit tester. (See page 90～.) Note: After making insulation test of the ion collector line (coaxial contact) by a Megger, short the portion checked with a Megger by means of a jumper wire to discharge the charge. If the sensor head cable is connected to the measuring unit without taking this action, the sensor head may fail. If the cable is found defective, replace or repair it.
Insulation failure has occurred between electrodes of the sensor head, resulting in leakage current.	Check insulation between electrodes of the sensor head and outside wall by a Megger. (The Megger indication must be infinite.) (See page 87.) If the sensor head is found defective, replace or repair it.
Sensor head is contaminated or sensitivity has lowered markedly.	Change the sensor head with another one and check symptom. If there is no problem with another sensor head, the problem is in the sensor head now used.
Gas being measured is not nitrogen or air. The sensitivity setting is incorrect.	The controller and sensor head are normal. If measurement is made using gas other than nitrogen or air, set the sensitivity factor. (See page 29.)
The actual pressure differs from the expected value.	Check with another vacuum gauge.

● Measurement value drifts.

Possible cause	Corrective action
Sensor head is contaminated or sensitivity has lowered markedly.	Change the sensor head with another one and check the symptom. If there is no problem with another sensor head, the problem is in the sensor head now used.
Sensor head cable is vibrating.	If the sensor head cable is always subjected to vibration, the indicated value may drift because of the friction electromotive force in the sensor head cable. Re-examine the method of laying the cable.
Sensor head cable is electromagnetically induced (by external noise).	Check the place of laying the sensor head cable or make check by turning off a component that can be a source of noise. If the sensor head cable is responsible, re-examine the method of laying cable. Also examine measures against noise.
Line voltage is fluctuating.	Check line voltage by a circuit tester. (line voltage: 100 VAC ± 10 V)
Filament is turned ON above the measurable pressure range.	Check pressure using a Pirani gauge or other vacuum gauge. If the pressure is too high, gas cannot be ionized normally and the ion current generated will apparently be on the same order as that when pressure is low. Thus, the filament protecting function is not activated.
GND potential is fluctuating.	Check control ground and ground of the sensor head mounted position by a circuit tester or oscilloscope. Take actions to improve the GND wiring or install the controller or sensor head afloat.
Sensor head cable has blown out or insulation failure has occurred, resulting in leakage current.	Check insulation between electrodes of the sensor head cable using a Megger. Also check continuity across the connector using a circuit tester. (See page 90～.) Note: After checking the ion collector (coaxial contact) for insulation using a Megger, short the portions checked with Megger by means of a jumper wire. If the cable is connected to the sensor head without shorting them, the sensor head may fail. If the cable is found defective, replace or repair it.
Insulation failure has occurred between electrodes of the sensor head or leakage current has occurred.	Check insulation between electrodes of the sensor head and the outside wall using a Megger. (Megger indication should be infinite.) (See page 87.) If insulation failure is confirmed, replace the sensor head with a new one.

● Set point signal is not given.

Possible cause	Corrective action
[SET*] lamp on front panel is lit.	Check continuity between output contacts using a circuit tester, with external devices disconnected. If the contact is not in continuity though actuated, the relay has failed. Contact ULVAC for inspection and repair.
	The minimum operating current of the relay used for output is 10 mA. At a current below this value, relay may not be in continuity electrically though mechanically actuated.
Signal drops momentarily because the emission current of the sensor head can hardly be obtained normally.	If the emission current is momentarily NG, the set point will also be turned OFF simultaneously. Replace the sensor head with a new one.
Erroneous wiring or broken wire of the EXT-I/O connector.	Correct the wiring and check continuity using a circuit tester. (See page 12.)

● Control operation from I/O connector cannot be performed.

Possible cause	Corrective action
Erroneous wiring or broken wire of the EXT-I/O connector.	Correct the wiring and check continuity using a circuit tester. (See page 12.)
Erroneous operating procedure	Perform operation in the REMOTE status. (See page 65.)
Photocoupler current is too low or cannot be flown.	The circuit does not feed 10mA current to the photocoupler. When an external power supply is used, make sure the current capacity is sufficient and check if resistance is too high by wiring. If the filament signal is turned ON/OFF using a relay, make sure the minimum operating current of the relay is not more than 10 mA.
Failure of input circuit	Contact ULVAC for inspection and repair.

● Digital output cannot be read.

Possible cause	Corrective action
Erroneous wiring or broken wire of the EXT-I/O connector.	Correct the wiring and check continuity using a circuit tester. (See page12.)
Erroneous wiring or broken wire of the EXT-I/O connector common wiring.	Common setting before shipment is pin 5. Each digital output signal is turned ON/OFF between common electrodes. Connect output common to pin 5, or change the common setting or connect GND and pin 5 in the connector by means of a jumper wire. (See page 60.)
No voltage is outputted if output signal is not connected by pull-up method.	Voltage cannot be read with the type that does not use the pull-up method.
Polarity of electrode to be connected is incorrect.	When relay contact input unit is used, it is often the case that one side is connected to the power supply. In this case, connect the common side of the gauge to the minus side of the power supply and each signal to the plus side. If an inverse voltage is applied, the internal element may fail.
Line voltage connected is not correct.	100VAC power is connected to some units. In this case, the internal element will fail.
Failure of output circuit	Contact ULVAC for inspection and repair.

● Display and analog output differ.

Possible cause	Corrective action
Incorrect recorder output mode is selected.	Set a correct mode.(See page42.)
Recorder output is shifted as a whole.	The recorder output may shift for a potential difference if it exists between GND on the signal reading side and GND of the vacuum gauge. Improve GND or add an isolation amplifier.

● Dispay and BCD output differ.

Possible cause	Corrective action
Erroneous wiring or broken wire of the EXT-I/O connector.	Correct the wiring and check continuity using a circuit tester. (See page 12.)
Data rewriting time has been read.	BCD output is rewritten at intervals of 100 ms. The value is not correct during rewriting (1 ms). Perform processing by DATA VALID signal. (See page 60.)

● Communication cannot be established.

Possible cause	Corrective action
Cable specifications differ.	RS-232C cables include the straight type and cross type. Use the cross type for this gauge. (See page 66.)
Erroneous wiring or broken wire of cable	Correct the wiring and check continuity using a circuit tester. (See page 66.)
Condition setting is not correct.	Check to see if settings, such as baud rate, parity, data bit, stop bit, etc., are correct. (See page 66.) When a terminal (CR) is not set definitely, a command is not received.

● An error is displayed

Possible cause	Corrective action
The filament is broken during DEGAS	[*Err. 14*] is displayed. Use the other filament.
Pressure is in state that it is higher than the measurement range.	[*Err. 13*] is displayed. Remove it in "→(ENTER). Confirm pressure in other Pirani vacuum gauges. →P. 24 When pressure is normal, please check a Sensor head or a sensor head cable. (Refer to a Precious section)
A set point is not appropriate.	[*Err. 12*] is displayed. Input again a set point after confirmation. →P. 26
The filament is broken	[*Err. 11*] is displayed. Use the other filament.

12.1. Causes of No Emission Current and Corrective Actions

The table below gives the causes of no stabilized emission current and corrective actions.

Possible cause	Corrective action
Pressure is high	Check pumping system.
Filament burnout	Replace sensor head.
Filament wear	Replace sensor head.
Contamination in sensor head	Replace sensor head.
Poor contact or burnout of sensor head cable	Re-connect or replace cable.
Failure of power supply circuit in controller	Repair controller.

Basic conditions under which emission current flows include the following five.

1. Pressure within a measurement range
2. Required bias voltage is applied between the filament and grid.
3. Filament temperature is at the required level.
4. Filament has a required surface area.
5. Grid has a required clean surface area.

Emission current will not flow if any of these conditions is not met.

13.APPENDIX

13.1.Principles of Operation

When gas molecules collide with particles having energy above a certain level, they emit electrons and are turned into ions. This phenomenon is called gas ionization.
To ionize gas, the filament is heated and the generated thermoelectrons are accelerated. Since the frequency of thermoelectrons and gas molecules colliding with each other is in proportion to gas density, the density of the gas molecules (gas pressure) can be known from the number of ions produced if ions are formed at a fixed ratio by collision.
The following relationship holds between the number of thermoelectrons emitted from the filament (emission current: Ie), number of ions produced (ion current: Ii) and density of gas molecules (pressure: P).

$$Ii = S \cdot Ie \cdot P \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (1)$$

Ii : Ion current [A]
S : Sensitivity [Pa^{-1}]
Ie : Emission current [A]
P : Pressure [Pa]

In the equation above, sensitivity S depends on various conditions, such as the structure and size of the sensor head, voltage applied to each electrode, type of gas, and others.
This gauge indicates Ii in the above equation on the meter after electrically amplifying it.
Here, it will be understood that a change in sensitivity S will make a difference in the indicated value of the vacuum gauge even if emission current Ie or pressure P is the same.
Typical factors that change sensitivity S include:

(1) Type of sensor head
(2) Type of gas
(3) Deterioration of sensor head

The sensitivity in nitrogen gas atmosphere of the sensor head that can be used with this vacuum gauge is as follows.

	GI-M2	GI-D7	GI-N8
Measurement sensor head sensitivity factor Srj(N2)	0.06 Pa^{-1}	0.0827 Pa^{-1}	0.153 Pa^{-1}

13.2. Type of Measurable Gas and Specific Sensitivity Factor

This gauge has been adjusted so that a correct pressure is indicated for nitrogen gas. Therefore, if a gas other than nitrogen gas is measured, there will be an error in the indicated value.

The following describes the correction of the difference in the indicated values by type of gas.

Given that sensitivity S (N_2) for nitrogen gas is the reference, sensitivity S can be expressed by the following equation.

$$S = S(N_2) \cdot r \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (2)$$

S : Sensitivity Pa^{-1}

S (N_2) : Sensitivity of nitrogen gas [Pa^{-1}]

r : Specific sensitivity factor

Substituting this equation in Eq. (1), we obtain the following equation:

$$Ii = S(N_2) \cdot r \cdot Ie \cdot P \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (3)$$

Here, given that Ii (N_2) is the ion current for nitrogen gas.

$$Ii = r \cdot Ii(N_2) \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (4)$$

Thus, the gauge indicates the correct value multiplied by r (specific sensitivity factor). Eq. (4) shows that the indicated value on the gauge must be corrected for the type of gas by dividing it by its specific sensitivity factor (relative sensitivity for nitrogen gas).

(Example) Argon gas is measured by an ionization vacuum gauge.

True pressure P (Torr) is as follows when the indicated value P (Ar) at this time is 5×10^{-6} [Pa].

$$P = \frac{P\,(Ar)}{\text{Specific sensitivity factor for Ar}}$$

$$= \frac{5 \times 10^{-6}}{1.34}$$

$$= 3.7 \times 10^{-6}\ [Pa]$$

Table. 13-1 Relative Sensitivity Factor of Ion Gauge for Each Gas with Respect to Nitrogen and Relative Ionization Cross-Sectional Area

m/e	N	Molecule	Srj	Xj
4	2	He	0.221*	0.13±0.02
20	10	Ne	0.358*	0.25±0.05
40	18	Ar	1.34*	1.23±0.07
84	36	Kr	1.88*	1.84±0.06
132	54	Xe	2.50*	2.64±0.08
2	2	H_2	0.491*	0.38±0.04
4	2	D_2	0.40	0.41
15	10	NH_3	0.645*	1.23
18	10	H_2O	1.25±0.44	1.03
28	14	CO	0.95*	1.06±0.03
28	14	N_2	1.00	1.00
30	15	NO	1.17±0.11	1.24
32	16	O_2	0.879	0.96±0.07
		Air	0.97±0.1	0.75
34	18	H_2S	2.20±0.02	2.03±0.20
36	18	HCl	1.65±0.21	1.61±0.02
44	22	CO_2	1.35*	1.39±0.08
44	22	N_2O	1.66±0.27	1.30±0.17
146	70	Sfe	2.50	2.41
200	80	Hg	3.30±1.04	2.07±0.04
16	10	CH_4	1.58*	1.63±0.30
30	18	C_2H_6	2.58*	2.74±0.45
44	26	C_3H_8	3.44*	3.64±0.37
58	34	C_4H_{10}	4.04*	4.57±0.47
72	42	C_5H_{12}		5.60±0.76
86	50	C_6H_{14}	6.60	6.77±1.44
100	58	C_7H_{16}	7.60	7.72
114	62	C_8H_{18}		8.18
128	70	C_9H_{20}		8.86
26	14	C_2H_2	0.614*	2.06±0.27
28	16	C_2H_4	1.29*	2.27±0.28
42	24	C_3H_6	1.77*	3.25±0.22
56	32	C_4H_8	2.07*	3.82±0.59
70	40	C_5H_{10}		4.81±0.99
84	48	C_6H_{12}	6.37±0.86	6.49
112	64	C_8H_{16}		7.22
126	72	C_9H_{18}		8.72
140	80	$C_{10}H_{20}$		10.37
78	42	C_6H_6	5.18±0.42	5.19±0.50
42	24	Cyclo-C_3H_6		3.75
70	40	Cyclo-C_5H_{10}		6.01
84	48	Cyclo-C_6H_{12}	6.40	6.60±1.59
92	50	C_6H_5-CH_3	6.81	
40	22	CH_2-C-CH_2	1.31*	CH2=C=CH 2
40	22	CH_3-C-CH	1.41*	CH3-C≡CH

Srj:
Relatibe sensitibity of ionization gauge
Srj(N_2)=1(actual measurment value

Xj:
Relative ionization cross-sectional area
Xj(N_2)=1
Calculated value when ion electron energy is75 eV

N:
No. of electrons per molecule

Linear relationship holds between Sr and Xj and, when Srj of the gas is unknown, it can be predicted from Xj

Values marked with [*] are cited from Reference 2.

Unfortunately, data on other types of gas are not available at ULVAC

1) F.Nakao.Vacuum25(1975)201,431
2) K.NakayamaandH.Hojo:Jpn.J.Appl.Phys.Suppl.2Pt.1.(1974)113

14. WARRANTY

This product was shipped after rigid company inspection. However, in case any failure occurs under ULVAC's responsibility, such as defect in manufacturing and damage during transportation, Buyer shall inform ULVAC, Inc. or the local ULVAC representatives. ULVAC will repair or exchange it at free of charge.

Warrantable Items: This unit

Duration of guarantee: One (1) year after shipping date from ULVAC

Warrantee scope

1) Domestic business in Japan: Product, which has damage, caused by a failure on delivery.
2) Direct export transaction: Product, which has damage, caused by a failure on delivery. The warrantee scope shall confirm to the new INCOTERMS.
3) Products not satisfying meet the standard specifications although the product is used under the normal service conditions such as temperature range and power etc.

Response procedure

1) Domestic business in Japan: ULVAC send a replacement or Buyer return the defective items to ULVAC, Inc. or to the local ULVAC representatives for repair. If field service is required, Buyer shall ask ULVAC, Inc. or the local ULVAC representatives.
2) Direct export transaction: ULVAC send a replacement or Buyer return the defective items to ULVAC, Inc. or to the local ULVAC representatives for repair. Return charge shall be paid by Buyer.

Disclaimer

1) Failure occurred after expiration of warranty period
2) Failure caused by force majeure, such as fire, storm and flood damage, earthquake, lightning strike, war etc
3) Failure occurred due to carelessness handling or faulty usage
4) Products remodeled, disassembled or repaired without ULVAC's acceptance
5) Failure occurred under abnormal environment, such as intense electromagnetic field, radiation, high-temperature, high-humidity, flammable gases, corrosive gases, dust etc.
6) Failure occurred by noise
7) Product deficiency or secondary damnification occurred to Buyer, from law suit to ULVAC by third party for patent infringement.
8) Sensor head being used (expiration of life, measurement error, etc.)
9) Sensor head cable being used (cable burnout due to improper installation, poor contact, etc.)

Others

1) In case, special agreement or memorandum for specifications is made individually, the descriptions are prior to this article "13 Product Warranty".
2) Buyer shall inform ULVAC when this product is exported out of Japan. In the meantime, Buyer shall take necessary procedures according to Foreign Exchange and Foreign Trade Law.
3) As for the question and consultation, Buyer shall check the model and serial number and ask the local representative or ULVAC, Inc.
4) The content of this document is subject to change without notice in future.

15.Certificate of Contamination

This is a certificate of decontamination for repair and inspection request of ULVAC Components. All material must be certified as decontaminated and this certificate must be submitted to your closest local ULVAC service center or sales office prior to shipment.
Please consult with your closest local ULVAC service center or sales office if our components are used with toxic gases or contaminated with reactive products or substances produced by reaction.

Product model:

Model:

Serial No.:

Application:

Remarks: _____

_____

_____

Contaminant (Check an applicable box.)

☐ I guarantee that above returned item(s) is not contaminated with harmful substances.

☐ Above returned item(s) is contaminated with the following harmful substances.

	Name of contaminant (molecular formula)	Characteristics
1		
2		
3		
4		
5		

To: ULVAC, Inc

Attn:_____

Date: / / (YYYY/MM/DD)

Your company _____

Division _____

Contact _____

Phone _____

Fax _____

E-mail _____

Please pack returned item(s) carefully before shipment. Any accident occurred during transportation to us caused by contaminant is under your responsibility. It is also to be understood that ULVAC may decline to repair returned item(s) depending on the type of contaminant and degree of contamination, and return it to you.

To be filled in by ULVAC Request for MSDS: Yes/No	Received by	
ULVAC job No.		

16.China RoHS Declaration

Management Methods for Controlling Pollution by Electronic Information Products

This mark is applied to the electronic information product sold in the People's Republic of China. The figure at the center of the mark is the validity date of environmental protection. This product does not influence the environment, the human body and the property during the period reckoning the manufacturing date as long as the cautions for safe use regarding the products are observed.

*The environmental protection validity date is not the product warranty period.

Table. Making format for names and contents of hazardous substances or elements

Name of parts	Hazardous substances or elements					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
Printed Circuit Board	×	○	○	○	○	○
Chassis	○	○	○	○	○	○
Connector	×	○	○	○	○	○
Controller,Transformer	×	○	○	○	○	○
Label	○	○	○	○	○	○
Gauge Head	○	○	○	○	○	○
Cable	×	○	○	○	○	○

○: indicating that content of the hazardous substance or element in all homogeneous materials of the part does not exceed the requirements for concentration limits specified by SJ/T11363-2006.

×: indicating that content of the hazardous substance or element in, at least one kind of, homogeneous materials of the part exceeds the requirements for concentration limits specified by SJ/T11363-2006. Producer may further explain the technical excuse to the items marked with “X” perspecific conditions here.

17. RELATED DRAWINGS

17.1.Ion gauge

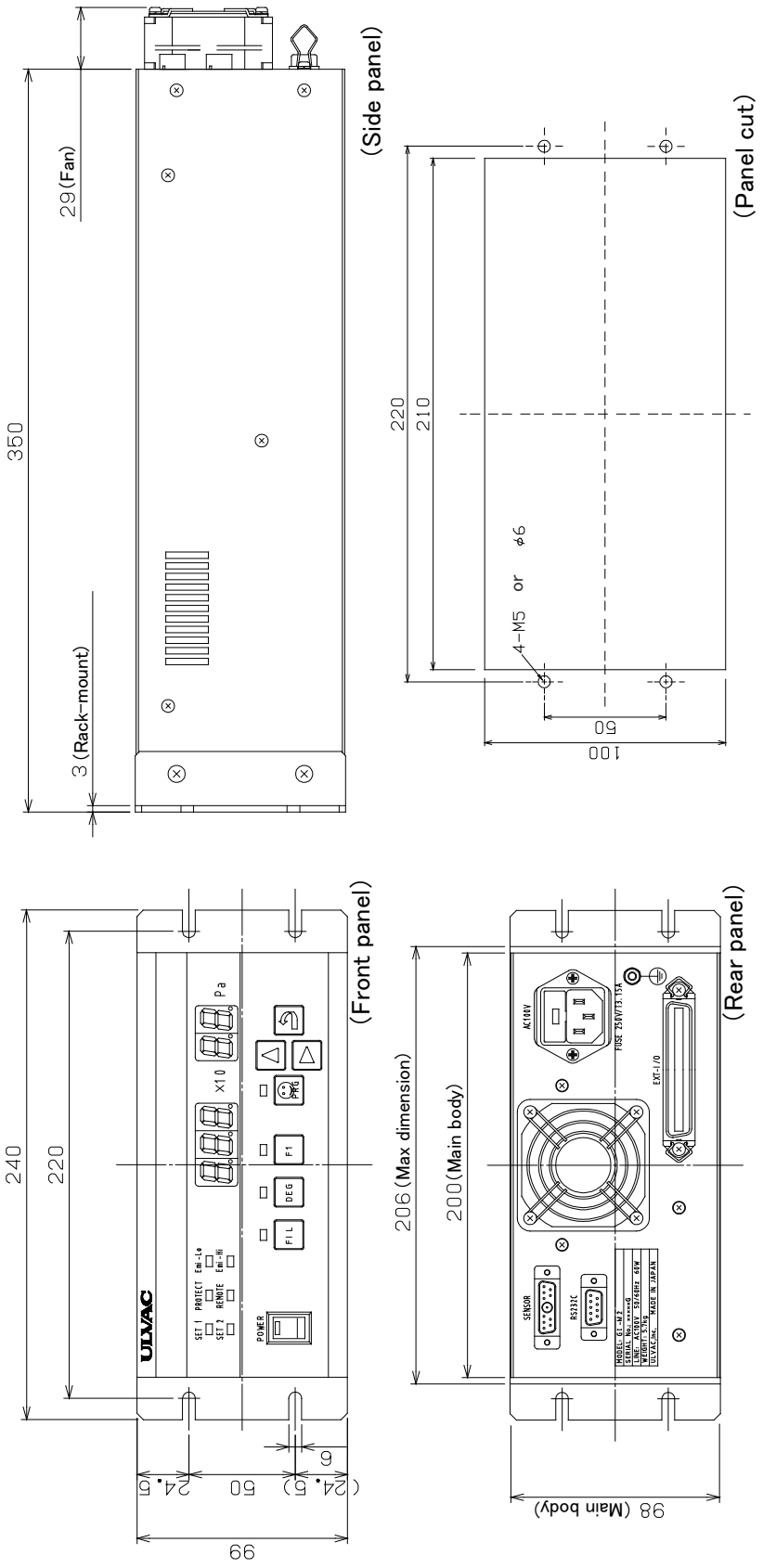
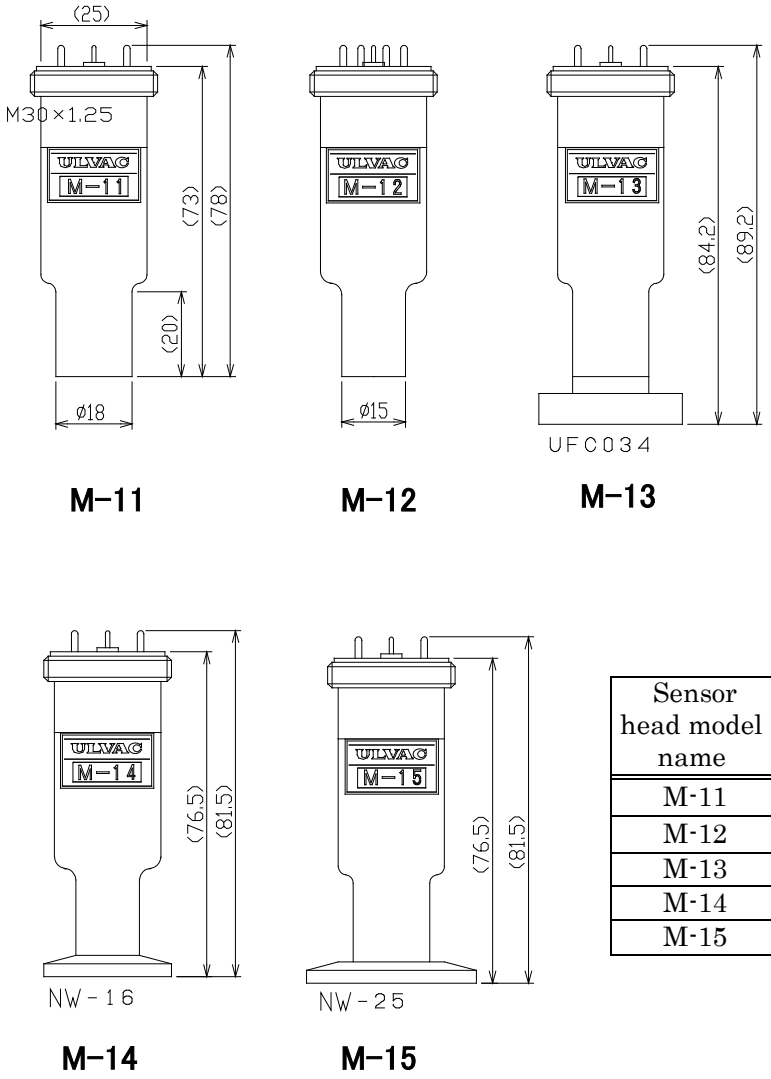


Fig. 17-1 Dimensional drawing・panel cut drawing

17.2. Sensor head

17.2.1.Sensor head GI-M2



Sensor head model name	Tie-in with vacuum	
M-11	ϕ 18	Pipe end
M-12	ϕ 15	Pipe end
M-13	UFC034	flange
M-14	NW-16	flange
M-15	NW-25	flange

Fig. 17-2 Sensor heas GI-M2

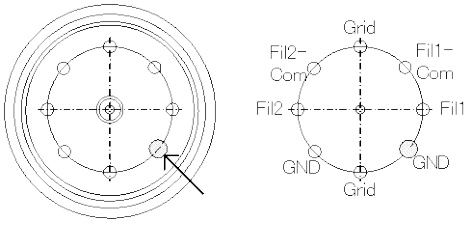
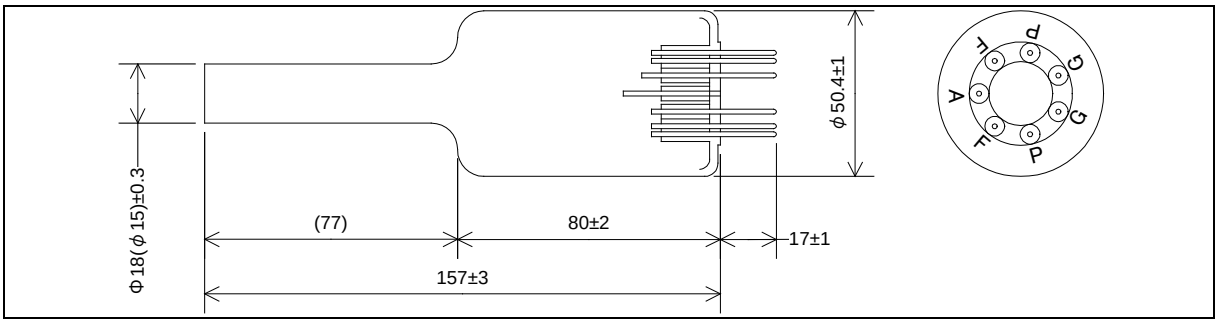


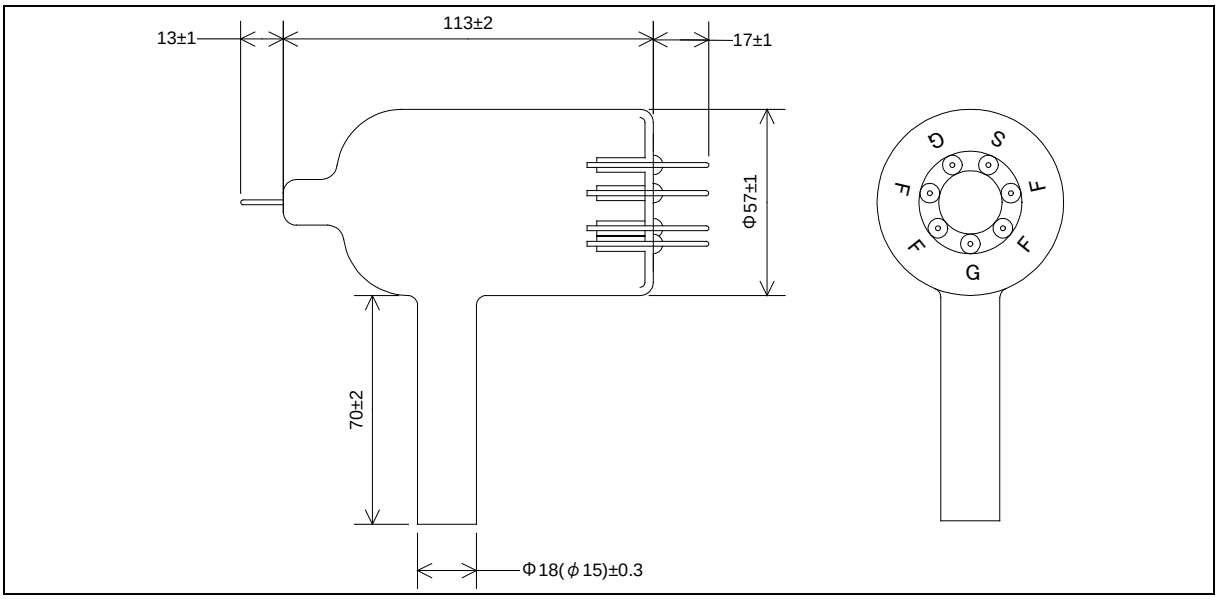
Fig. 17-3 Sensor head electrode and pin assignment

17.2.2. Sensor head GI-D7

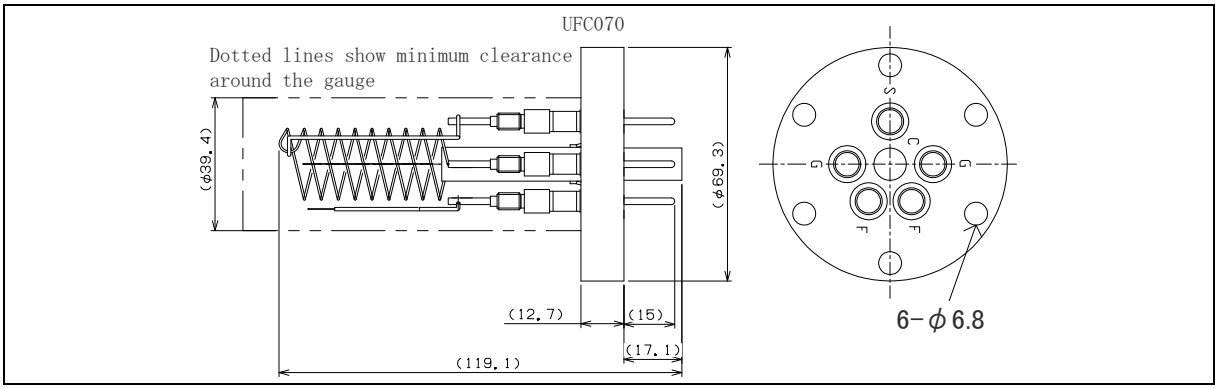
WIT-G1



WIB-G5



WIB-N3

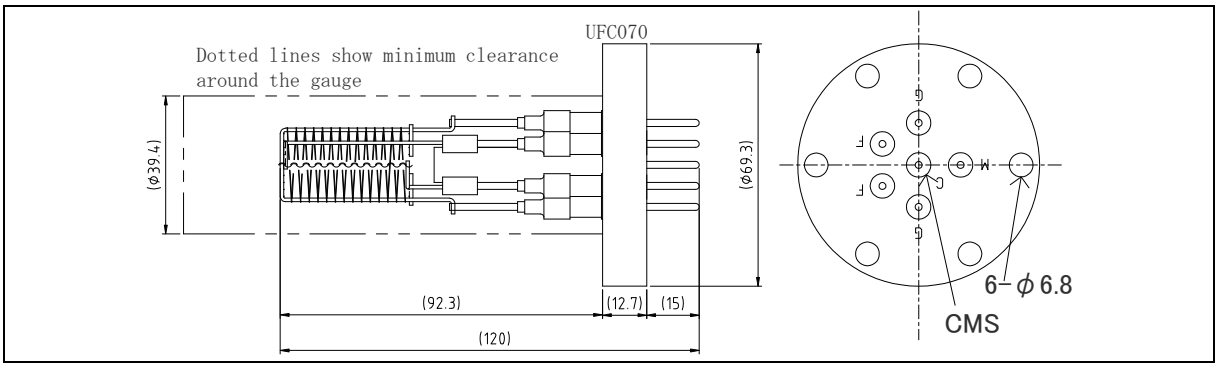


Sensor head model name	Tie-in with vacuum
WIT－G1	φ18 Pipe end φ15 Pipe end
WIB－G5	φ18 Pipe end φ15 Pipe end
WIB－N3	UFC070 Flange

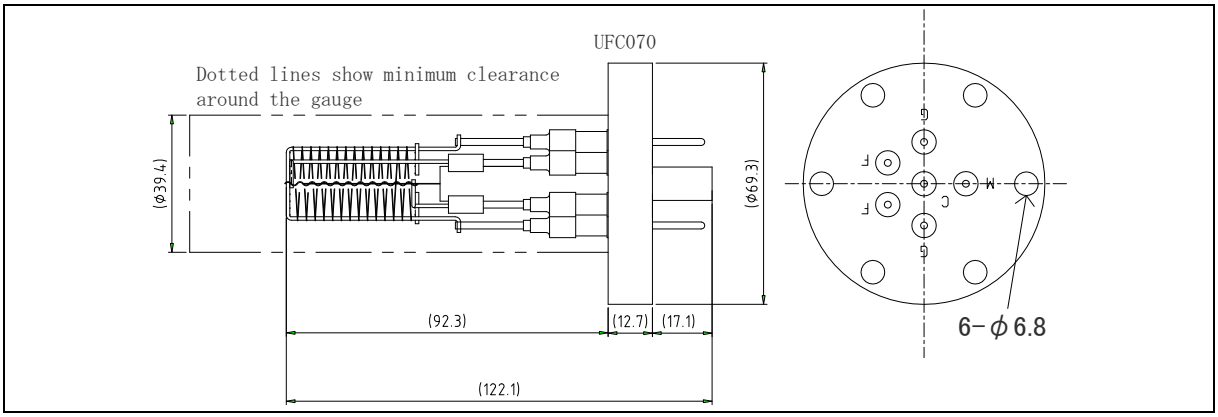
Fig. 17-4 Sensor head GI-D7

17.2.3. Sensor head GI-N8

WIN-N2



WIN-N3

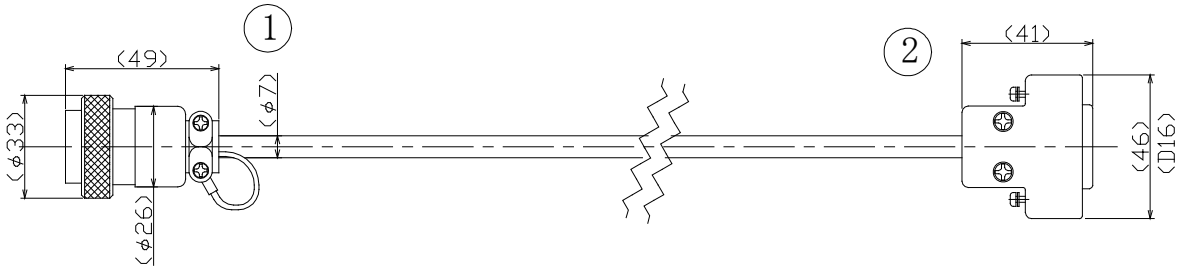


Sensor head model name	Tie-in with vacuum	
WIN－N3	UFC070	Flange
WIN－N2	UFC070	Flange

Fig. 17-5 Sensor head GI-N8

17.3. Sensor head cable (GI-M2)

17.3.1. Sensor head cable (GI-M2) 2,5,10,15m



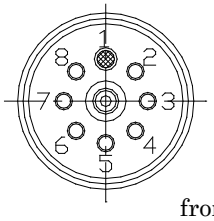
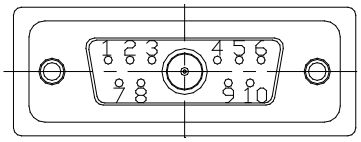
①Sensor head side		②Control side	
 The figure from connector fit side		 The figure from connector fit side	
Pin	Uses	Pin	Uses
1	Shield(GND)	1	GRID(150V)
2	FIL-1a	2	
3	FIL-1com	3	GRID(DEGAS)
4	GRID(DEGAS)	4	Shield(GND)
5	FIL-2com	5	
6	FIL-2a	6	
7	Shield(GND)	7	FIL-1a
8	GRID(150V)	8	FIL-1com
		9	FIL-2com
		10	FIL-2a

Fig. 17-6 Sensor head cable connection diagram (GI-M2)

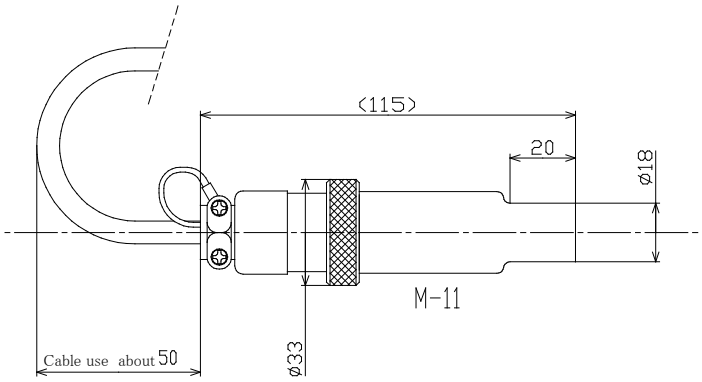


Fig. 17-7 Sensor head cable mouting reference drawing

17.3.2. Sensor head cable (GI-M2) long cable side

A junction box and interconnecting cable are added for cables 20 m or longer.

①	Sensor-side cable (2m)
②	Controller-side cable (2m)
③	Long cable （2x2m）
④	Junction （70x70x95mm）

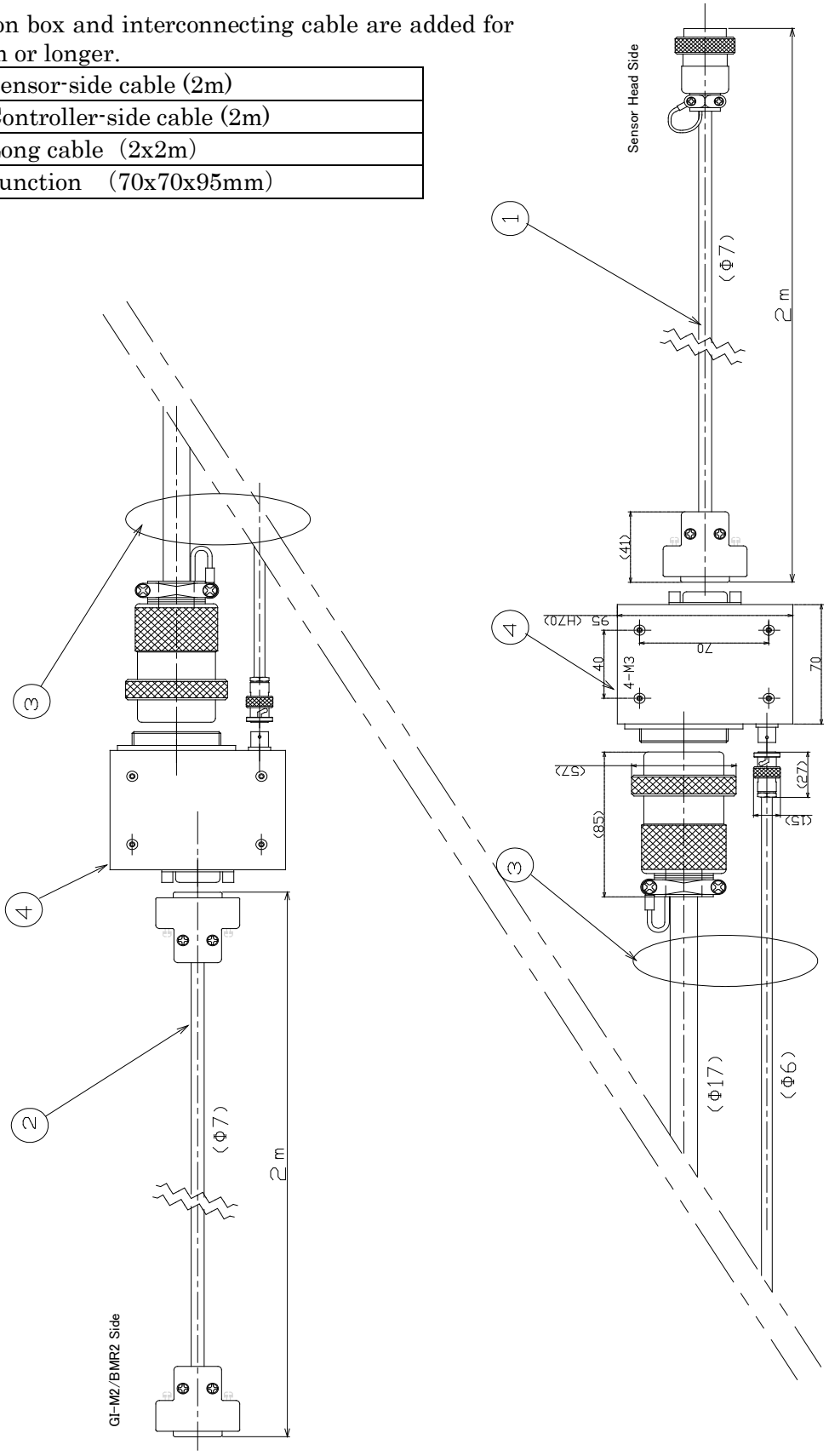
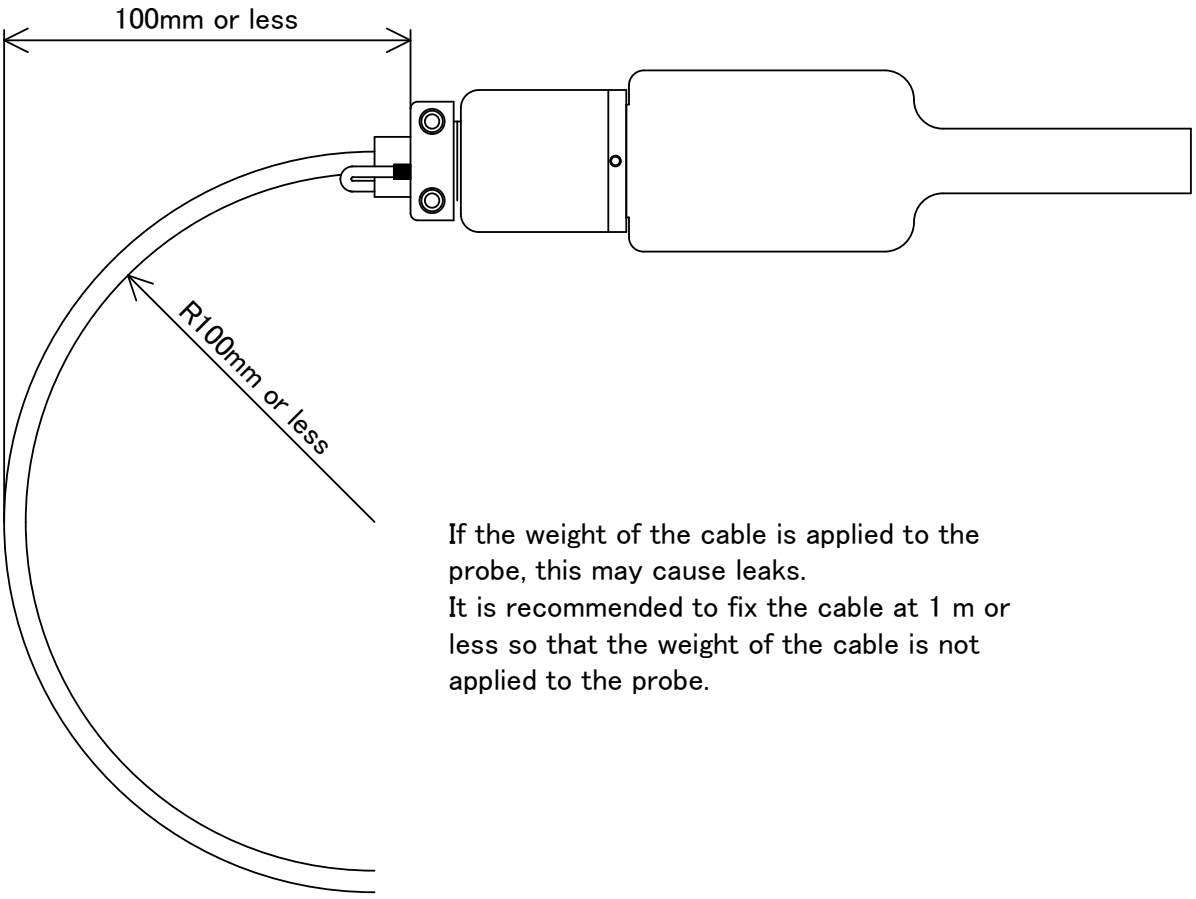


Fig. 17-8 Long cable (GI-M2)

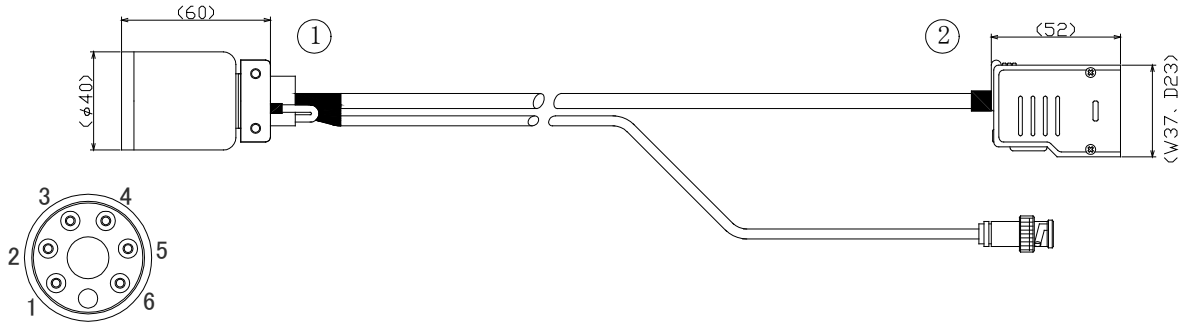
17.3.3. Reference diagram of sensor cable installation



If the weight of the cable is applied to the probe, this may cause leaks.
It is recommended to fix the cable at 1 m or less so that the weight of the cable is not applied to the probe.

17.4.Sensor head cable (GI-D7/GI-N8)

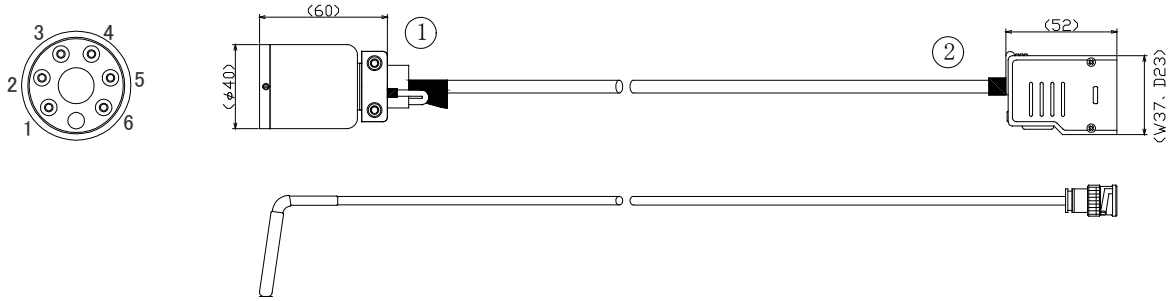
17.4.1.WIT socket type (GI-D7) 4,10,15,20,25m



①Sensor head side Pin	②Control side Pin	Uses
1	5,6	Fil Com
2	BNC	Ion collector
3	18,19	GRID(DEGAS)
4	14,15	GRID(150V)
5	BNC	Ion collector
6	1,2	Fil 1
(Shell)	16,17	Shield

Fig. 17-9 Sensor head cable connection diagram GI-D7 WIT socket)

17.4.2.WIB socket type (GI-D7) 4,10,15,20,25m



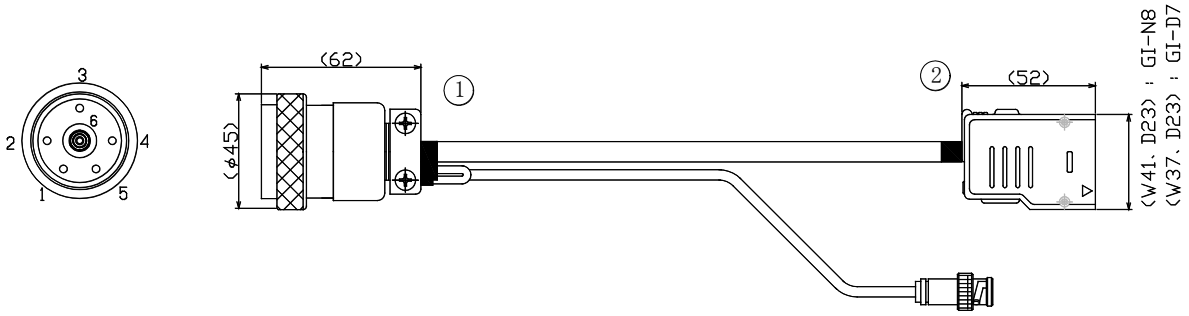
①Sensor head side Pin	②Control side Pin	Uses
1	14,15	GRID(150V)
2	1,2	Fil 1
3	5,6	Fil 1,2 Com
4	18,19	GRID(DEGAS)
5	3,4	Fil 2
6	5,6	Fil 1,2 Com
(Shell)	16,17	Shield

Fig. 17-10 Sensor head cable connection diagram(GI-D7 WIB socket type)

17.4.3.WIB-N3 socket type (GI-D7)　4,10,15,20,25m

17.4.4.WIN-N2 socket type (GI-N8)　4,10m

17.4.5.WIN-N3 socket type (GI-N8)　4,10m



①Sensor head side Pin	②Control side Pin	Uses
1	1,2	Fil 1
2	18,19	GRID(DEGAS)
3	(NC)	
4	14,15	GRID(150V)
5	5,6	Fil Com
6	BNC	Ion collector
(Shell)	16,17	Shield

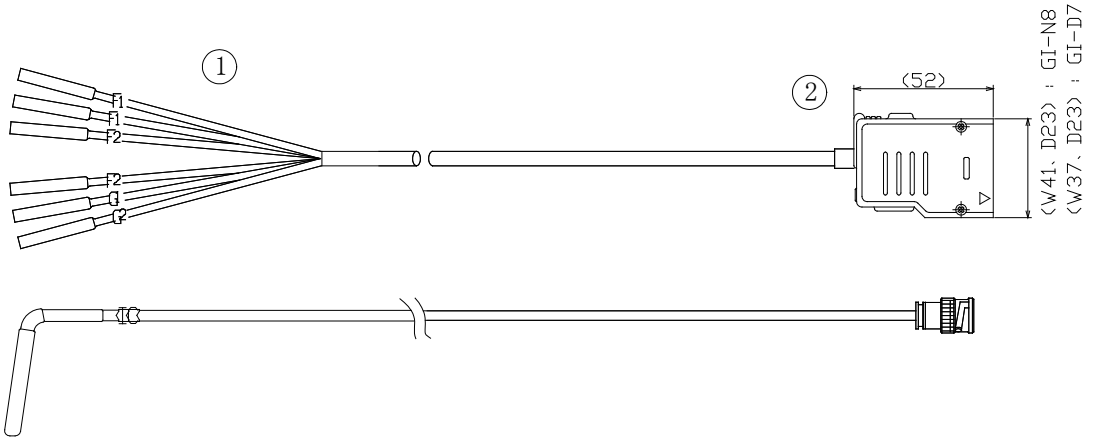
Fig. 17-11 Sensor head cable connection diagram (GI-D7 WIB-N3 socket type)

①Sensor head side Pin	②Control side Pin	Uses
1	1,2	Fil 1
2	16,17	GRID(150V)
3	16,17	
4	(NC)	
5	5,6	Fil Com
6	BNC	Iou collector
(Shell)	18,19	Shield

Fig. 17-12 Sensor head cable connection diagram (GI-N8 WIN socket type)

17.4.6.WIB Pin socket type (GI-D7)　4,10,15,20,25m

17.4.7.WIN-G Pin socket type (GI-N8)　4,10m



①Sensor head side Pin	②Contorl side Pin	Wiring color	Uses
F1	1,2	Black	Fil 1
F1	5,6	White	Fil Com
F2	3,4	Brown	Fil 2
F2	5,6	Blue	Fil Com
G1	14,15	Red	GRID(150V)
G2	18,19	Yellow	GRID(DEGAS)
IC	BNC		Ion collector

It is available with both WIT and WIB.

Fig. 17-13 Sensor head cable connection diagram (GI-D7 Pin socket type)

①Sensor head side Pin	②Contorl side Pin	Wiring color	Uses
F1	1,2	Black	Fil 1
F1	5,6	Black	Fil Com
F2	3,4	Red	Fil 2
F2	5,6	Red	Fil Com
G	16,17	Yellow	GRID(150V)
S	18,19	Yellow	Shield
IC	BNC		Ion collector

Fig. 17-14 Sensor head cable connection diagram (GI-N8 Pin socket type)

17.4.8.Sensor head cable （GI-D7/GI-N8） Long cable

A junction box and interconnecting cable are added for cables 30m(15m) or longer.

GI-D7: **30,35,40,50m**

GI-N8: **15,20,25,30m**

①	Sensor side cable (2m)
②	Long cable(2x2m)
③	Control side cable (2m)

The figure is a constitution example of WIB-N3 socket-type (GI-D7).

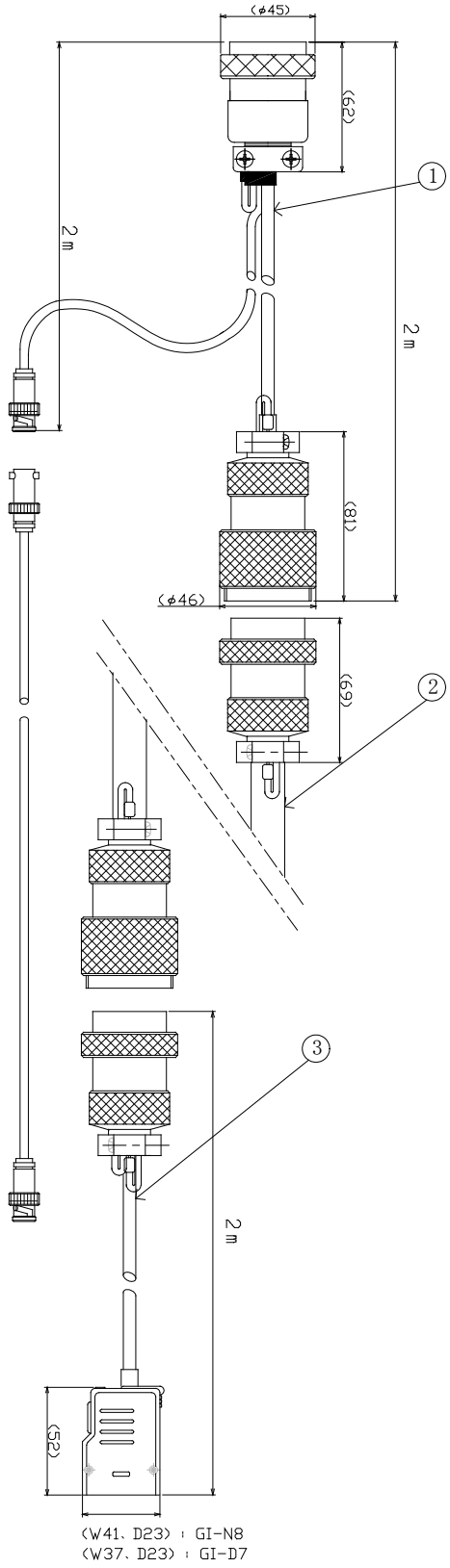


Fig. 17-15 Long cabel (GI-D7/GI-N8)