YK06-0044-EI-003-19

ULVAC

# G-TRAN Series
# 1-Channel Display Unit
# Model ISG1
# Instruction Manual


This manual is for the display units of the following serial numbers:
Serial No. 09501 and higher.

Read this manual before operation and keep it at hand for immediate reference.

| Model | Serial numbers |
|---|---|
| Multi Ionization Gauge ST200-A | 00001～ |
| Multi Ionization Gauge SH200-A | 00001～ |
| Multi Ionization Gauge ST2-1 | 00901～ |
| Multi Ionization Gauge SH2-1 | 06001～ |
| Cold-Cathode Ion Gauge SC1 | 02300G～ |
| Pirani Vacuum Gauge SW100-A | 00001～ |
| Pirani Vacuum Gauge SW1-1 | 00001～ |
| Pirani Vacuum Gauge SP1 | 00001～ |
| Ceramic Capacitance Manometer CCMT-D series | 00001～ |

**Components Division,**
**ULVAC, Inc.**
http://www.ulvac.co.jp/en

# Prior to Operation

Upon receipt of this detector, make sure that it is the correct model you ordered and that it is not damaged 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.<br>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 Notations

| | |
|---|---|
| ⚠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<br>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.<br>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.<br>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 Precautions

For safe operation of this unit, read this manual and the following safety precautions.

| | |
|---|---|
| WARNING | **Servicing**<br>For repair and servicing, contact your local ULVAC representative or Components Division, ULVAC, Inc., Japan. |
| WARNING | **Turn OFF power.**<br>If the unit fails, immediately turn off the power.<br>Use of a failed unit may cause a fire or electric shock. |
| WARNING | **Turn off power.**<br>If the unit gets unusually hot or gives off smoke or unusual smell, immediately turn off the power. Otherwise, fire can result. |
| WARNING | **Power supply**<br>Before turning on the power to this instrument, make sure that the operating voltage and supply power are in agreement. If incorrect power is connected, this instrument and devices connected to this instrument may fail or fire may result. The over-voltage comes under Category 1. |
| WARNING | **Protective grounding**<br>Ground the sensor with class D (class 3) grounding. If the sensor is not correctly connected, it will not only show the wrong pressure, there is a risk of damage to the sensor and the equipment connected to the sensor and a risk of fire. |
| CAUTION | **Power supply**<br>The unit may only be connected to supply and measurement units that conform to the requirements of a grounded protective extra-low voltage (SELV-E according to EN 61010). The connection to the gauge has to be fused. |
| CAUTION | **Power cable**<br>The power cable is not packed in the same case. Use a cable having a sufficient current capacity. |
| CAUTION | **Installing an external switch in the power line**<br>This unit has no power switch. Install an external switch, breaker and over-current protector. |
| CAUTION | **Check connection**<br>See to it that the connection cables do not come into contact with other conducting parts. |
| CAUTION | **Do not disassemble**<br>Do not disassemble this unit. |
| CAUTION | **Do not modify**<br>Do not modify this unit. If modified, its actions are not warranted. Also fire or electric shock can result. |
| CAUTION | **Be careful of operating environment.**<br>Do not use the unit in a place where it may be splashed with water. If it is wetted, trouble, electric leak or fire can result. |
| CAUTION | **Laying cables**<br>Before turning on power, install the display cable, sensor unit, sensor, and others. |
| CAUTION | **Keep out foreign objects**<br>If any foreign objects, such as metals or combustibles, are admitted into the unit through an opening, remove them. Also keep foreign objects away from the terminals on the rear panel of the unit. Otherwise, the unit may be damaged. |
| CAUTION | **Discarding**<br>If this unit is discarded, follow the regulations of your local government. Incidentally, expenses for disposing of this unit are on the user's account. |

| | |
|---|---|
| CAUTION | **Operating conditions**<br>Use this unit within the scope of the environment set forth in the specification. |
| CAUTION | **Maintenance**<br>The electric circuit in this instrument uses aluminum electrolytic capacitors. Generally speaking, the life of the aluminum electrolytic capacitor becomes short as the ambient temperature rises. To prevent components from damage, it is recommended to conduct maintenance at ULVAC about once every 3 years. |
| CAUTION | **Cautions in shipping the unit**<br>If the unit is to be shipped back to ULVAC, pack it in the original condition. If it is shipped bare, it may be damaged. |

# Revision History

| DATE | No. | Reason |
|---|---|---|
| Apr. 4, 2008 | 03 | S/N:00001～ first version |
| Aug. 25, 2009 | 04 | ・Added CCMT-1000D/100D/10D/1D<br>・Section 2.1, added output impedance to specifications.<br>・Chapter 22, added EC DECLARATION OF CONFORMITY.<br>・Chapter 18, added Interlock function. |
| July 27, 2011 | 05 | ・Changed A5 version to B6 version.<br>・Added multi-ionization gauge SH2 |
| Mar. 1, 2012 | 06 | S/N:01482～<br>Added SH2 (SPU combination mode), SH2 (SAU triple combination mode) |
| June 1, 2012 | 07 | Corrected an error. |
| June 12, 2012 | 08 | Corrected an error. |
| Sept. 10, 2013 | 09 | ・BMR2 and BPR2 were discontinued.<br>・Chapter 10, added that in SC1 when it is lower than the measuring lower limit, “HuF” is displayed and the output voltage is 10V. |
| Jun. 7, 2014 | 10 | S/N:04050～<br>・Added connection check in combination mode of SH2.<br>Notice: SH2 before S/N:01000 does not output a set point.<br>・Chapter 5, displayed the sensor which is set in the program mode<br>・Chapter 6, added 『nc』 which means that the sensor is not set and the setting is factory default to the sensor unit selection. |
| July 7, 2014 | 11 | Corrected an error. |
| Oct. 9, 2015 | 12 | Added multi-ionization gauge ST2. |
| Nov. 21, 2017 | 13 | Added the explanation of CALCULATION function to the pressure conversion expression of each sensor. |
| Apr.20, 2018 | 14 | Added the Measurement units function. |
| Jul.3, 2018 | 15 | Added the Measurement display range function. |
| Oct.10, 2019 | 16 | Added Pirani Vacuum gauge Measuring Unit SWU<br>Corrected an error. |
| Dec.25, 2020 | 17 | Section 2.2, Delete the instruction manual CD from the standard accessories.<br>Section 2.1, Revised CE standard.<br>Section 26, Revised EC Declaration of Conformity.<br>Section 27, Revised certificate of Decontamination. |
| Mar.15, 2021 | 18 | Added multi ionization gauge SH200,ST200<br>Corrected an error |
| Oct.19, 2022 | 19 | Added Pirani gauge SW100<br>Corrected CE reference number of the standard<br>Correction of EU Declaration of Conformity<br>UKCA Declaration of Conformity added<br>Corrected an error |

# Contents

# 1. GETTING STARTED

## 1.1. Overview of G-TRAN Series

Units of the G-TRAN series vacuum gauges are varied in type and include the following types. "Sensor Unit" indicates all models and types of box units and sensor units throughout this manual.

as of Oct. 2022

| Unit Major classification | Unit Minor classification | Specification | Type | Model |
|---|---|---|---|---|
| Measurement unit | Box unit | Analog/communication | Pirani | BPR2* |
| | | | Ionization | BMR2* |
| | Sensor unit | Analog | Pirani | SP1 |
| | | Analog | CCG | SC1 |
| | | Analog/communication | Pirani (atmospheric pressure) | SW100/SW1 |
| | | Analog/communication | Ionization, multi ionization | SH200 SH2* |
| | | | | ST200 ST2* |
| | | SH200/ST200/ SH2*/ST2* dedicated | Pirani | SPU |
| | | SH200/ST200/ SH2*/ST2* dedicated | Pirani | SWU10-R |
| | | SH200/ST200/ SH2*/ST2* dedicated | Pressure sensor | SAU |
| | | Analog | Diaphragm | CCMT-D |
| Display unit | 1CH Digital | DC24V | Pirani/ionization/ CCG/diaphragm/ multi ionization | ISG1 |
| | 4CH Digital | DC24V | Pirani/ionization/ CCG/multi ionization | IM1R1* |
| | | AC100V | | IM2R1* |

*: End of sale

## 1.2. Terminology

The following terms have the same meanings throughout this manual.

| | | |
|---|---|---|
| Program | PROGRAM | PROG |
| Filament | FILAMENT | FIL |
| High voltage | HIGH VOLTAGE | HV |
| Degas | DEGAS | DEG |
| Zero | ZERO | ZERO |
| Setpoint | SETPOINT | ST |
| Error signal | ERROR | Err |
| Protection (pressure) | PROTECT | PRT |
| Emission valid | Emission Valid, Em.Valid | E.V. |
| Communication mode | Remote mode | RS-MODE |
| CAL function | CALCULATING FUNCTION | CAL |

| | | |
|---|---|---|
| Pirani vacuum gauge | Pirani gauge | PG |
| Hot cathode ionization vacuum gauge | Hot cathode gauge | IG |
| Cold cathode ionization vacuum gauge | Cold cathode gauge | CCG |
| Diaphragm vacuum gauge | Ceramic capacitance manometer | CCM |

## 1.3. Features of This Unit

- This display unit is for exclusive use with G-TRAN series:

| | |
|---|---|
| Pirani gauge | Sensor unit SP1 |
| | Sensor unit SW100-A<br>Sensor unit SW1-1 |
| | Box unit BPR2 |
| Cold cathode gauge | SC1 |
| Hot cathode gauge | Box unit BMR2 |
| Multi ionization gauge | SH200-A<br>SH2-1 |
| | SH200-A: SWU Combination mode<br>(SH200-A+SWU10-R)<br>SH2-1: SWU Combination mode |
| | SH200-A: SPU Combination mode<br>(SH200-A+SPU)<br>SH2-1: SPU Combination mode |
| | SH200-A: SAU Combination mode<br>(SH200-A+SWU10-R/SPU+SAU)<br>SH2-1: SAU Combination mode |
| | ST200-A<br>ST2-1 |
| | ST200-A: SWU Combination mode<br>(ST200-A+SWU10-R)<br>ST2-1 |
| | ST200-A: SPU Combination mode<br>(ST200-A+ SWU10-R/SPU)<br>ST2-1 |
| | ST200-A: SAU Combination mode<br>(ST200-A+SPU+SAU)<br>ST2-1 |
| Ceramic capacitance manometer | CCM series |

- By connecting the sensor unit, measured pressure can be easily displayed, setpoint and other operations can be performed easily, and the operating state can be checked at a glance.
- Measurement can be made by remote operation via a display unit.
- Two independent pressure setpoints are available
- Compact size compatible with DIN standards (48mm × 96mm)
- Serial communication RS-485 is included.
- CE marking
- Environment-friendly display compatible with RoHS directives.

# 2. SPECIFICATIONS AND COMPONENTS

## 2.1. Specifications

| | | | |
|---|---|---|---|
| Name | 1-channel digital display unit ISG1 | | |
| Number of sensor units connected | 1 pc. | | |
| Sensor unit | G-TRAN series | Pirani sensor unit SP1 | $4.0\times10^{-1}$ to $3.0\times10^{+3}$ Pa |
| | | Pirani box unit BPR2 | |
| | | Pirani sensor unit SW100-A*2 | $5.0\times10^{-2}$ to $1.0\times10^{+5}$ Pa |
| | | Pirani sensor unit SW1-1 | $5.0\times10^{-2}$ to $1.2\times10^{+5}$ Pa |
| | | Cold cathode ionization gauge SC1 | $1.0\times10^{-5}$ to $1.0\times10^{+0}$ Pa |
| | | Hot cathode ionization gauge BMR2 | $5.0\times10^{-8}$ to $9.9\times10^{+0}$ Pa |
| | | Multi ionization gauge SH200-A/SH2-1 | $5.0\times10^{-8}$ to $1.0\times10^{+1}$ Pa |
| | | Multi ionization gauge SH200-A/SH2-1 (SWU combination mode) | $5.0\times10^{-8}$ to $1.0\times10^{+5}$ Pa |
| | | Multi ionization gauge SH200-A/SH2-1 (SPU combination mode) | $5.0\times10^{-8}$ to $1.0\times10^{+4}$ Pa |
| | | Multi ionization gauge SH200-A/SH2-1 (SAU combination mode) | $5.0\times10^{-8}$ to $1.0\times10^{+5}$ Pa |
| | | Multi ionization gauge ST200-A/ST2-1 | $1.0\times10^{-5}$ to $1.0\times10^{+1}$ Pa |
| | | Multi ionization gauge ST200-A/ST2-1 (SWU combination mode) | $1.0\times10^{-5}$ to $1.0\times10^{+5}$ Pa |
| | | Multi ionization gauge ST200-A/ST2-1 (SPU combination mode) | $1.0\times10^{-5}$ to $1.0\times10^{+4}$ Pa |
| | | Multi ionization gauge ST200-A/ST2-1 (SAU combination mode) | $1.0\times10^{-5}$ to $1.0\times10^{+5}$ Pa |
| | Ceramic capacitance manometer | CCMT-1000A/1000D | $0.0\times10^{+1}$ to $1.3\times10^{+5}$ Pa *1 |
| | | CCMH-1000A | |
| | | CCMT-100A/100D | $0.0\times10^{+0}$ to $1.3\times10^{+4}$ Pa *1 |
| | | CCMH-100A | |
| | | CCMT-10A/10D | $0.0\times10^{-1}$ to $1.3\times10^{+3}$ Pa *1 |
| | | CCMH-10A | |
| | | CCMH-1A | $0.0\times10^{-2}$ to $1.3\times10^{+2}$ Pa *1 |
| | | CCMT-1D | |
| Analog input | | Reading the analog signal (voltage) from the sensor | |
| | Update time | 70msec | |
| | Internal processing | 5 times moving average | |
| | Resolution | 0.2mV | |
| Display | | Digital display of mantissa part 2 digits, exponential part 1 digit<br>$\square.\square \times 10^{\square}$ | |
| | Unit | Pa, Torr, mbar | |
| | Pressure range | Pressure range of each sensor unit | |
| | Update time | 200msec | |
| | Accuracy | ± 2% ± 1 digit against the pressure value from the measurement unit<br>* CCM series: 1/10 or less of the full scale ± 4 digits | |

| | | |
|---|---|---|
| Analog output | | DC0V to 10V pseudo-log. output, log, linear output<br>* The output differs depending on the unit to be connected. |
| | Update time | 70msec |
| | Resolution | 1mV |
| | Output error | ±10mV |
| | Impedance | 100Ω |
| | Accuracy | ±10mV against the voltage converted value of pressure display |
| Control input signal | | Actuated by open collector input, negative logic.<br>Filament, etc. ON/OFF signal, zero point adjustment signal, etc. |
| Control output signal | | Open collector output, negative logic.<br>[Rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW]<br>Signal of error, filament and other on signal and others<br>Setpoints1, 2, 3 |
| LED display | | SET-1, SET-2, SET-3<br>ERROR, DEG, ZERO |
| Communication | | RS-485 |
| | Baud rate | 9600/19200/38400 bps |
| | Number of nodes | 32 (including host) |
| | Distance | 1200m<br>*Please check a specification of remote host and an environmental noise if you use the cable of 30m or more. |
| | Memory function | Set value by communication is backed up by EEPROM. |
| CAL function | | Arbitrary value [$1.0\times10^{-3}$ to $1.0\times10^{+3}$] is multiplied by the measurement value and displayed. |
| Line voltage | | DC24V±1V Ripple and noise below 1% |
| Current consumption | | 2W (display unit alone)<br>*Power consumption by other interfaced units is to be added.<br>Maximum 30W (when BRM2 is used) |
| Corresponding standard | | CE standard, UKCA standard |
| Over-voltage category | | Category I: Connected to a circuit that holds down transient over-voltage at a sufficiently low level. |
| I/O connector | | |
| | Sensor unit side | D-sub 15pin connector socket, M2.6mm screw |
| | Control host side | D-sub 15pin connector pin, M2.6mm screw |
| | Power supply | Phoenix model MSTB 2.5/3-GF-5.08 |
| Connected cable length | | Length of cable from this unit to the sensor unit, calculated with 24AWG. |
| | | Pirani sensor unit SP1 up to 50m |
| | | Pirani box unit BPR2 up to 100m |
| | | Pirani gauge SW100-A/SW1-1 up to 100m |
| | | Cold cathode ion gauge SC1 up to 100m |
| | | Hot cathode ion gauge BMR2 up to 10m |
| | | Multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1 up to 40m |
| | | Multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1 (SWU/SPU combination) up to 40m |
| | | Multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1 (SAU combination) up to 40m |
| | | Ceramic capacitance manometer CCMT series up to 100m |
| | | Ceramic capacitance manometer CCMH series up to 15m |
| Operating temperature range | | 10℃ to 40℃ |
| Operating humidity range | | 15% to 80% (not condensing) |
| Storage | | -20℃ to 65℃ (non-operating, not condensing) |
| Weight | | 250g |
| Outside dimensions | | DIN 48mm × 96 mm, basic unit 70mm deep<br>JIS rack size 50mm × 100mm is also available as option. |

*1: In the pressure display of the CCM series, the lowest digit is 1.0, 2.0 ... 9.0, and the decimal point is not displayed.
*2: When SW100-A is connected, if the OUTPUT setting of SW100-A is PSG or APG, ISG1 is not supported. The pressure value is displayed, but it is not displayed correctly.

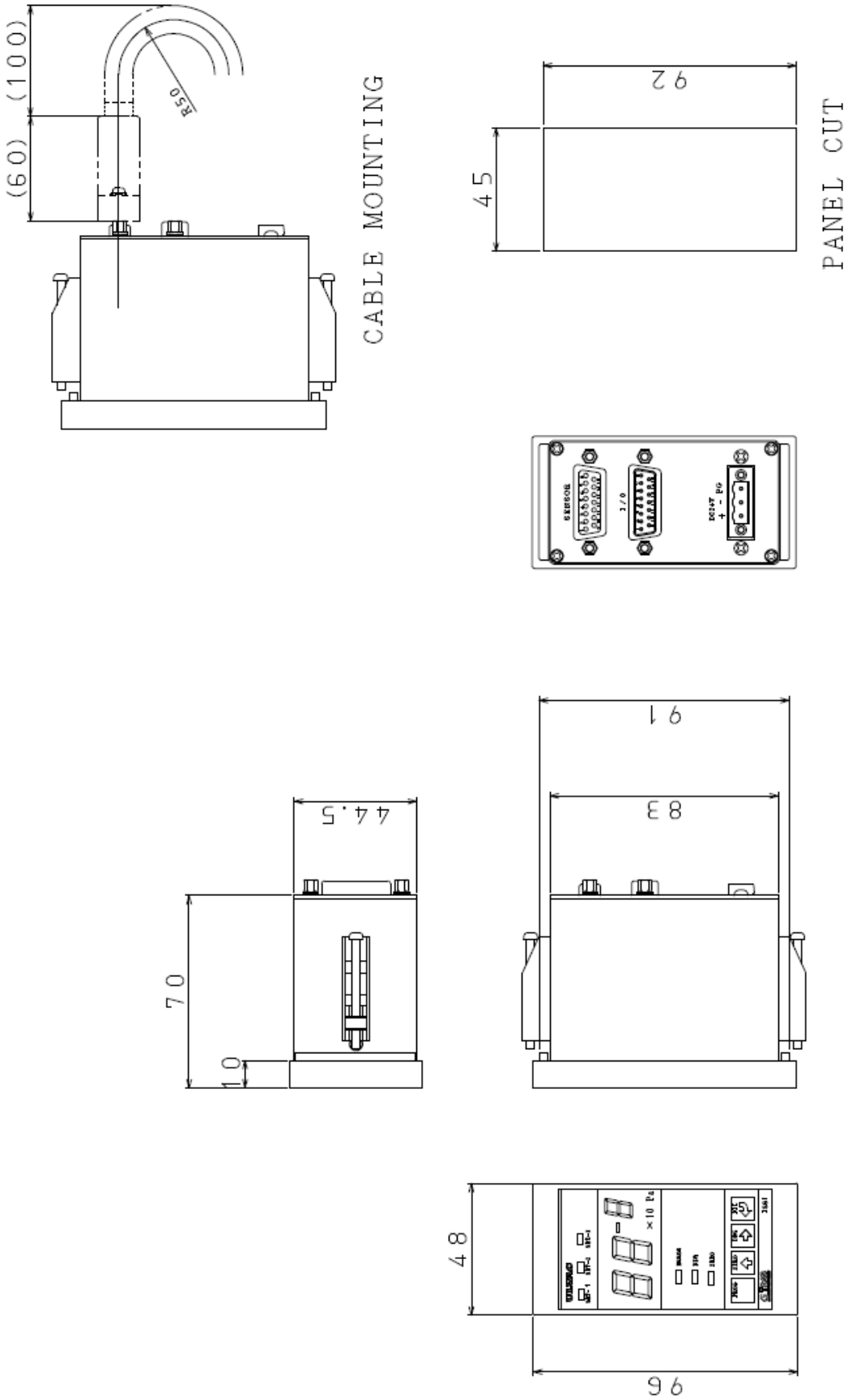
## 2.2. Standard Accessories

| | | |
|---|---|---|
| Power connector | MSTB 2.5/3-STF-5.08 made by PHOENIX | 1 pc. |
| DIN panel fixing tools | fitting | 1 set |
| Quick manual | | 1 pc. |

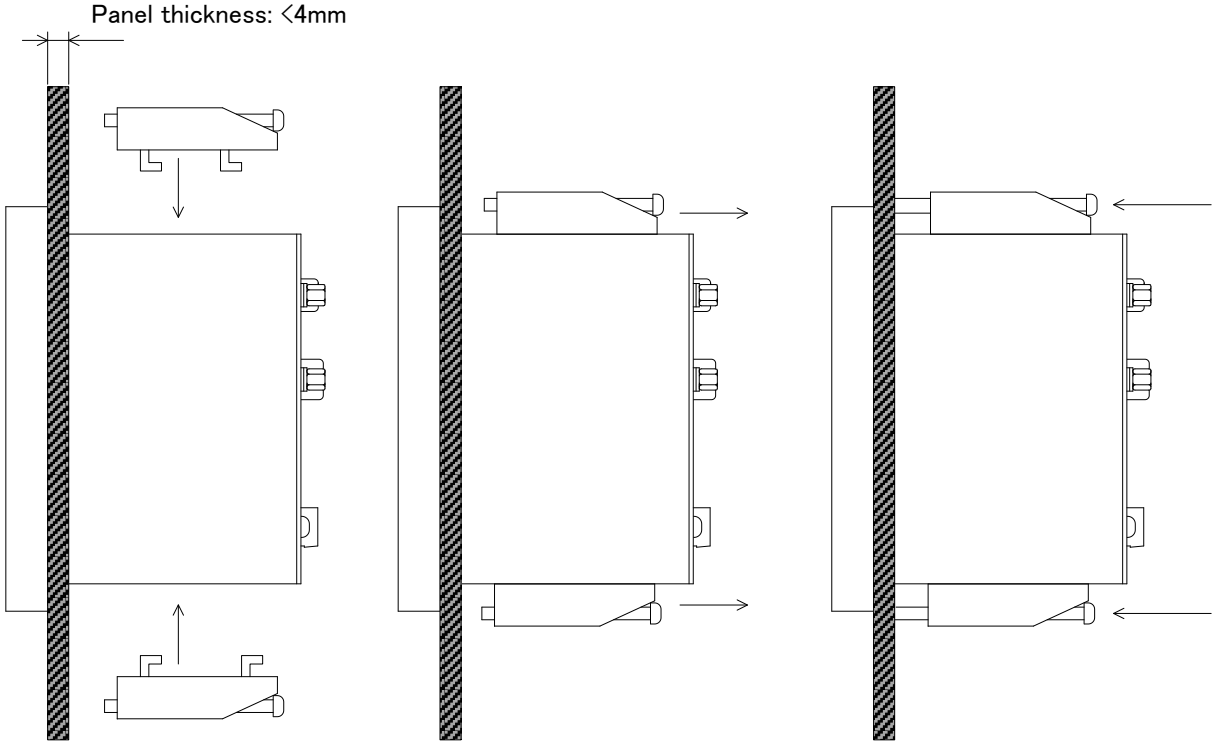
## 2.3. Options

| | |
|---|---|
| AC Adapter | OUTPUT: DC24V, INPUT: AC90 to 264V |
| JIS rack size type | |
| Display unit cable | 2, 5, 10, 15, 20, 25, 30, 35, 40m long<br>(between ISG1 and sensor unit) |
| Sensor unit | See section 1.3 |
| Sensor | Refer to the instruction manual of each sensor unit. |
| D-sub 15pin connector female | M2.6mm screw, for sensor connector |
| D-sub 15pin connector male | M2.6mm screw, for I/O connector |
| JCSS calibration certificate | Only combination with sensor unit |
| Calibration certificate | Only combination with sensor unit |
| Inspection certificate | |
| Traceability certificate | |

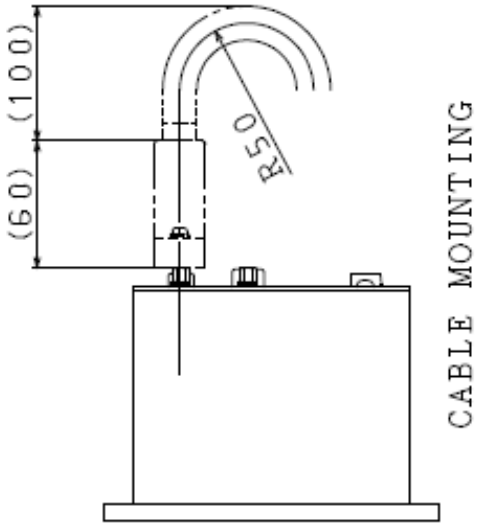
2.4. Dimensional Drawings DIN Panel Size

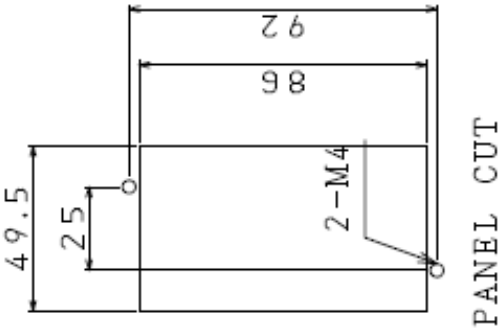


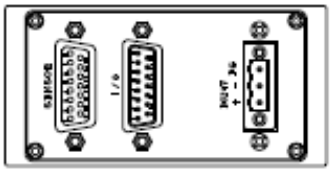
## 2.5. Installation DIN Panel

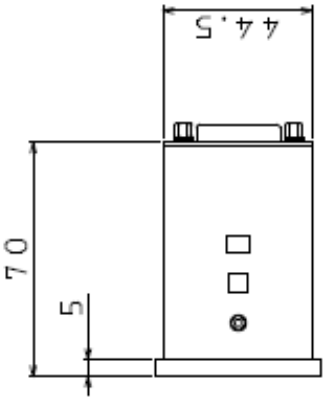


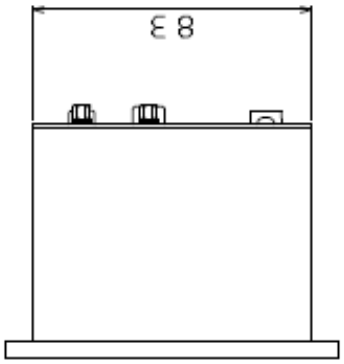
2.6. Dimensional Drawings JIS panel size

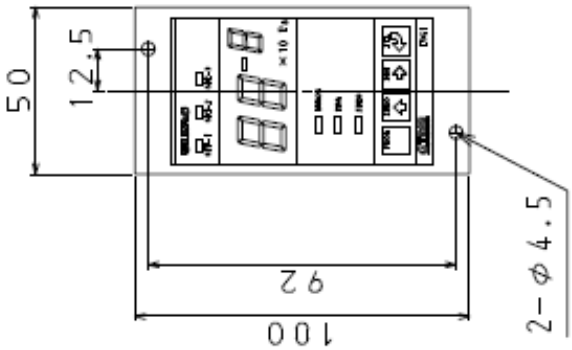




# 3. NAMES OF COMPONENTS AND DESCRIPTION OF FUNCTIONS

## 3.1. Front Panel Lights

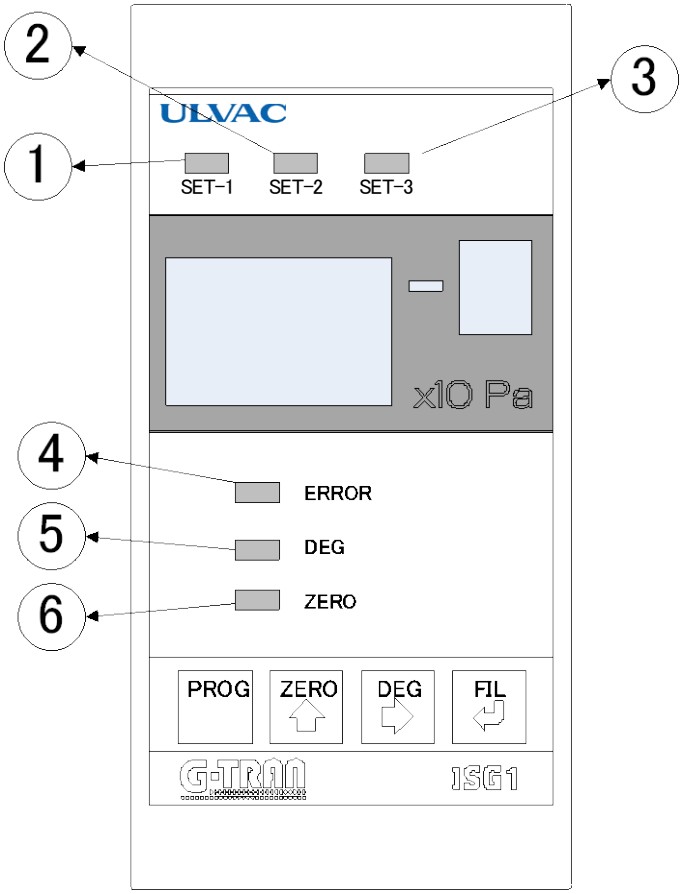



Fig. 3.1 Front Panel Lights

| Name (inscription) | | Function |
|---|---|---|
| ① | SET-1 | Lit when setpoint1 is actuated.<br>Blinks when a setpoint value is being set. |
| ② | SET-2 | Lit when setpoint2 is actuated.<br>Blinks when a setpoint value is being set. |
| ③ | SET-3 | Lit when setpoint3 is actuated.<br>Blinks when a setpoint value is being set. |
| ④ | ERROR | Lit or blinks when the sensor head filament has disconnect or in other errors. |
| ④ | DEG | Lit when DEGAS is on.<br>(only when SH200-A/ST200-A/SH2-1/ST2-1/BMR2 is selected.) |
| ⑥ | ZERO | Lit when the zero point is being adjusted.<br>(only when the ceramic capacitance manometer is selected.)<br>Lit when turns off the filament.<br>(only when SWU combination mode/SPU combination mode/SAU combination mode of SH200-A/ST200-A/SH2-1/ST2-1 is selected.) |

## 3.2. Front Panel Switch Program Mode

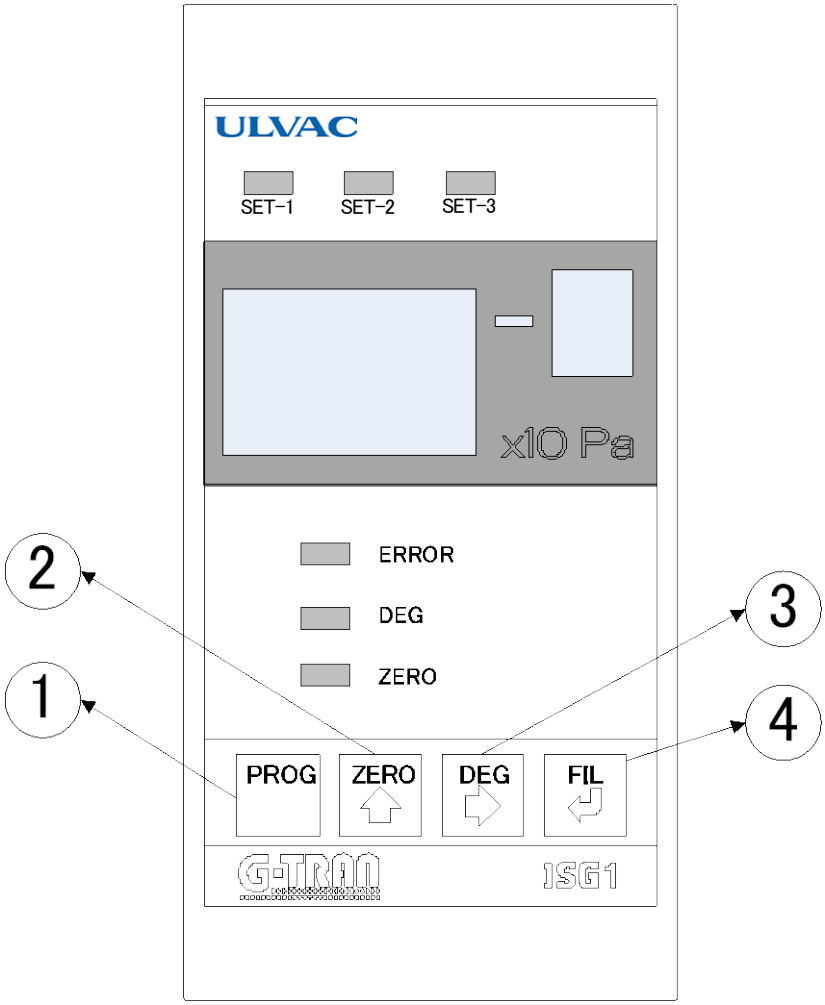



Fig. 3.2 Front Panel Switches

| Name (inscription) | | Functions of menu | Operating functions |
|---|---|---|---|
| ① | PROG | Program key | Enters into the program mode. |
| ② | ⇧ | Upward arrow key | Changes a value. |
| ③ | ⇨ | Rightward arrow key | Changes a numeric value. |
| ④ | ⏎ | Enter key | Enter key<br>Stores set values in memory. |

## 3.3. Front Panel Switch Measurement Mode

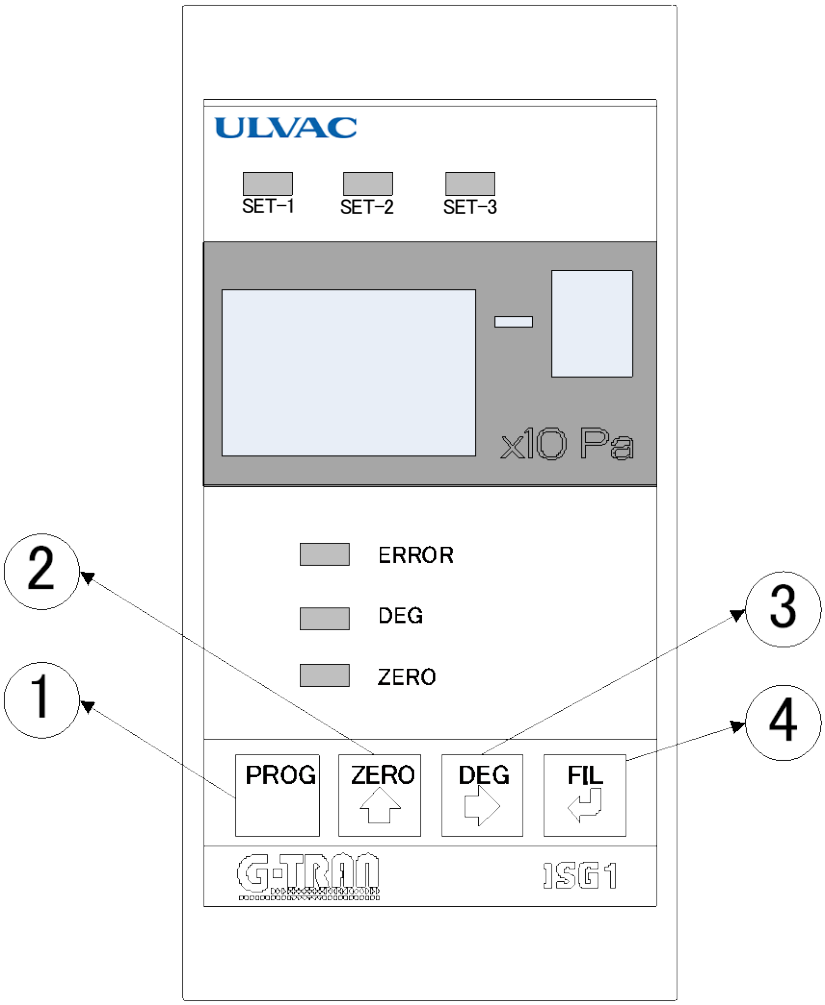



Fig. 3.3 Front Panel Switches

| Name (notation) | | Functions of menu | Operating functions |
|---|---|---|---|
| ① | PROG | Program key | Not used in measurement. |
| ② | ZERO | Zero key | Zero point adjustment ON/OFF switch for CCM series |
| ③ | DEG | Degassing key | ON/OFF switch for degas, etc. |
| ④ | FIL | Filament key | ON/OFF switch for filament, etc. SW100-A/SW1-1 zero point/atmospheric pressure adjustment switch. |

## 3.4. Rear Panel

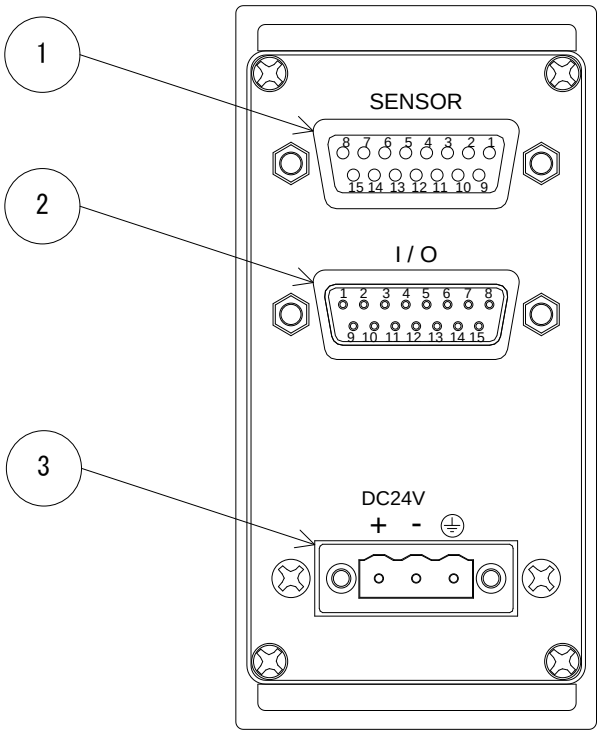



Fig. 3.4 Rear Panel

| Name (notation) | | Functions of menu |
|---|---|---|
| ① | SENSOR | Connector to connect to the sensor unit<br>(D-sub 15pin connector socket, M2.6mm screw) |
| ② | I/O | I/O connector for data and signals<br>(D-sub 15pin connector pin, M2.6mm screw) |
| ③ | DC24V | Connector for supplying DC24V power<br>(Phoenix model MSTB 2.5/3-GF-5.08) |

3.5. Sensor Connector (D-sub 15pin connector socket, M2.6mm screw)

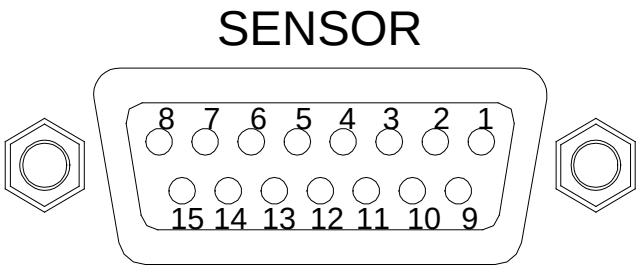



Fig. 3.5 Sensor Connector Pin Assignment
(D-sub 15pin connector socket, M2.6mm screw)

| Terminal No. * | Description | Signal direction | Connected to |
|---|---|---|---|
| 1 | +24V power output | OUT | Sensor unit |
| 2 | Sensor error input | IN | |
| 3 | Not used | | |
| 4 | FIL/HV input,<br>Unit connection check signal | IN | |
| 5 | FIL/HV ON, adjustment output | OUT | |
| 6 | FIL 1/2 output | OUT | |
| 7 | Not used | | |
| 8 | Pressure signal input + | IN | |
| 9 | Power supply GND | OUT | |
| 10 | Not used | | |
| 11 | Not used | | |
| 12 | Not used | | |
| 13 | DEGAS ON output | OUT | |
| 14 | Not used | | |
| 15 | Pressure signal input - | IN | |
| Case | FG | | |

* Do not wire the ‘Not used” part, which is used for the internal circuit.

3.6. I/O Connector (D-sub 15pin connector pin, M2.6mm screw)

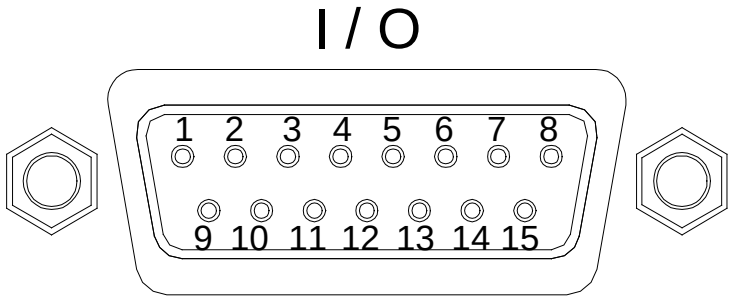



Fig. 3.6 I/O Connector Pin Assignment
(D-sub 15pin connector pin, M2.6mm screw)

| Terminal No. * | Description | Signal direction | Connected to |
|---|---|---|---|
| 1 | Not used | - | Remote host |
| 2 | Error signal output | OUT | |
| 3 | Setpoint1 actuating signal | OUT | |
| 4 | FIL/HV output signal | OUT | |
| 5 | FIL/HV on, adjustment input signal | IN | |
| 6 | FIL1/2 input signal | IN | |
| 7 | Setpoint3 actuating signal | OUT | |
| 8 | Recorder output + | OUT | Remote host/recorder |
| 9 | Signal GND | OUT | Remote host/recorder |
| 10 | RS485- | IN/OUT | Remote host/PC |
| 11 | Setpoint2 actuating signal | OUT | Remote host |
| 12 | RS485+ | IN/OUT | Remote host/PC |
| 13 | DEGAS ON input signal | IN | Remote host |
| 14 | Not used | - | |
| 15 | Signal GND | OUT | Remote host/recorder |
| Case | FG | | |

* Do not wire the ‘Not used” part, which is used for the internal circuit.

3.7. Power Supply Connector (Phoenix model MSTB 2.5/3-GF-5.08)

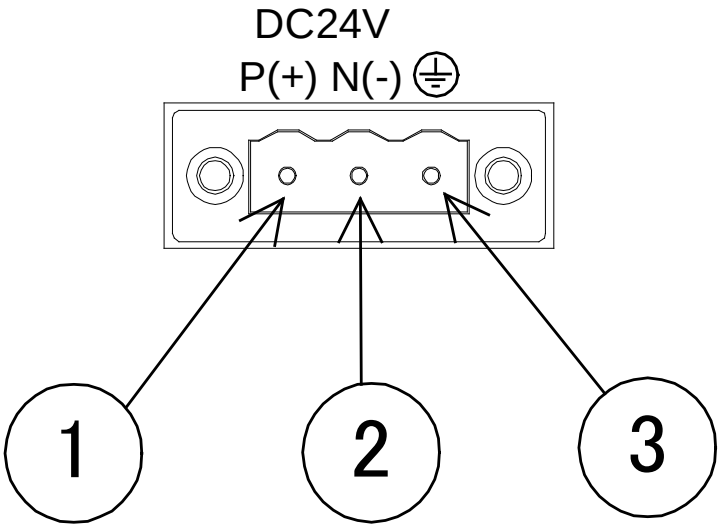



Fig. 3.7 Power Supply Connector Pin Assignment
(Phoenix model MSTB 2.5/3-GF-5.08)

| Description (notation) | | Function |
|---|---|---|
| ① | DC24V P(+) | Pin that supplies DC+24V power |
| ② | DC24V N(-) | GND in supplying DC+24V power |
| ③ | DC24V ⏚ | Frame ground. |

# 4. INSTALLATION

| | |
|---|---|
| CAUTION | **Operating environment**<br>Use this instrument within the scope of the environment set forth in the specifications. |
| CAUTION | **Keep out foreign objects**<br>If any foreign objects, such as metals or combustibles, are admitted into the unit through an opening, remove them. Also keep foreign objects away from the terminals on the rear panel of the unit. Otherwise, the unit may be damaged. |

## 4.1. Preparations

(1) Unpack the case and check quantities. (Refer to section 2.2 for the accessories.)
(2) Check components to see if any of them is damaged in transit.

## 4.2. Installation

### 4.2.1. Installing the display unit

| | |
|---|---|
| CAUTION | **Ensure ventilation**<br>When two or more sets are attached, please leave space of 20mm or more each in the direction of a side. When you put into a power supply rack etc., please take heat dissipation into consideration. |

Refer to section 2.4, 2.5 and 2.6 for the installation.

### 4.2.2. Circuit in the power supply

| | |
|---|---|
| WARNING | **Power supply**<br>Before turning on the power to this instrument, make sure that the operating voltage and supply power are in agreement. If incorrect power is connected, this instrument and devices connected to this instrument may fail or fire may result. The over-voltage comes under Category 1. |
| WARNING | **Laying cables**<br>When laying transmission lines for communication, see to it that they are not in the proximity of, or parallel to, power lines, high voltage lines, high frequency lines, etc. Otherwise, malfunction can result. |
| WARNING | **Protective grounding**<br>Ground the sensor with class D (class 3) grounding. If the sensor is not correctly connected, it will not only show the wrong pressure, there is a risk of damage to the sensor and the equipment connected to the sensor and a risk of fire. |
| CAUTION | **Power source**<br>The unit may only be connected to supply and measurement units that confirm to the requirement to the requirements of a grounded protective extra-low voltage (SELV-E according to EN 61010). The connection to the unit has to be fused. |
| CAUTION | **Laying cables**<br>Before turning on power, install the display cable, sensor unit, sensor, and others. |

- Fix the cable in such a way that undue force is not exerted to cable connections, such as power cable, display cable, external I/O cable, sensor head cable and others.
- Securely tighten the screws for fixing connectors.
- Do not mistake the pin No. in supplying power to this instrument. (See section 3)
- For the connection of the sensor unit and the sensor, refer to the manual for the sensor unit.

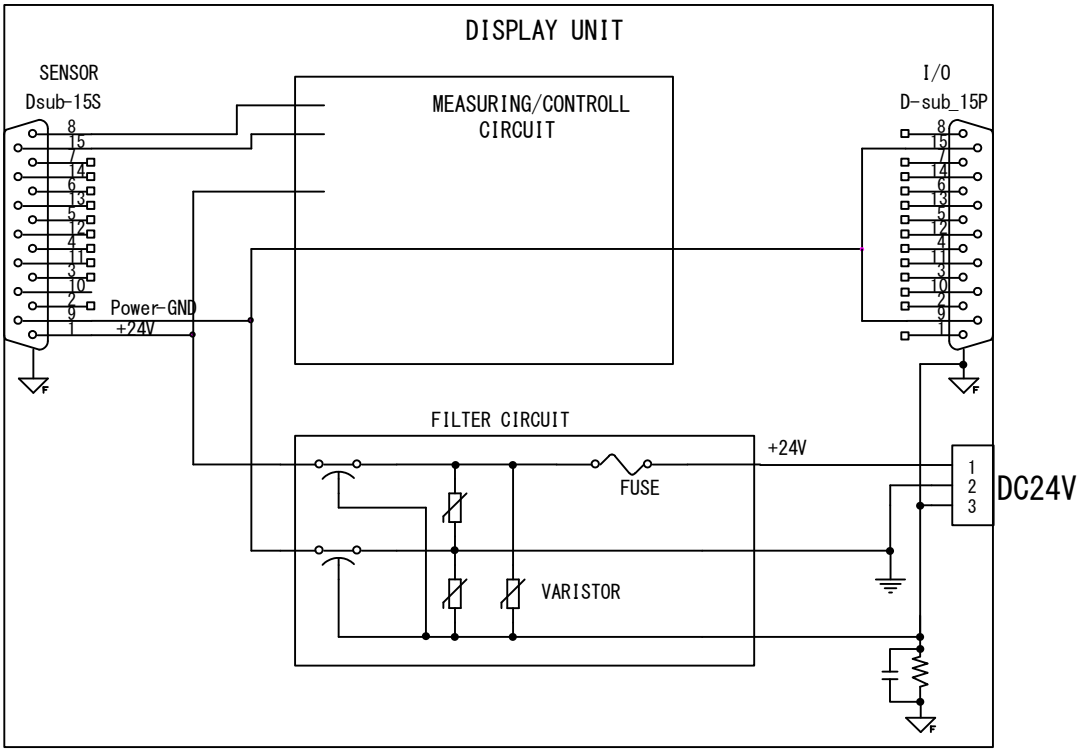
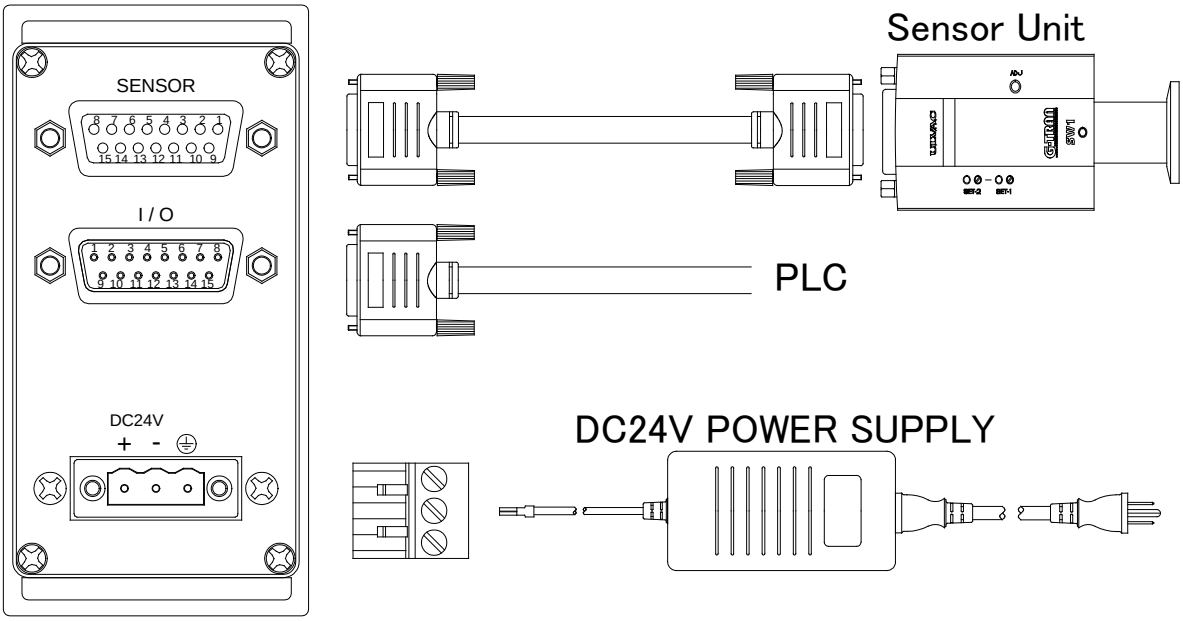



Fig. 4.1 Equivalent Circuit in the Power Supply

### 4.2.3. Installation



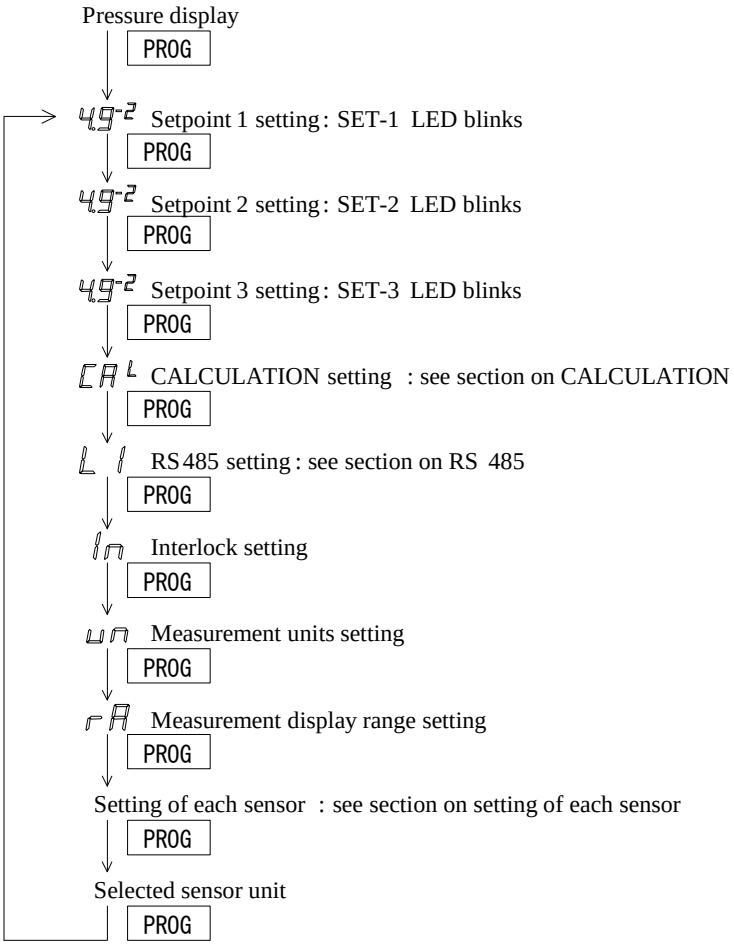
# 5. PROGRAM MODE OPERATION

This section describes the operating procedure on the front panel.

## 5.1. Description of Program mode

The table below gives the operating procedure in the program mode.

| Notation | Name | Function |
|---|---|---|
| PROG | Program key | Enters into the program mode.<br>Also a key for shifting to each setting. |
| ⇧ | Upper arrow key | Key that changes a numeric value. |
| ⇨ | Right arrow key | Used when changing settings. |
| ⏎ | Enter key | Press at the end of an input. |



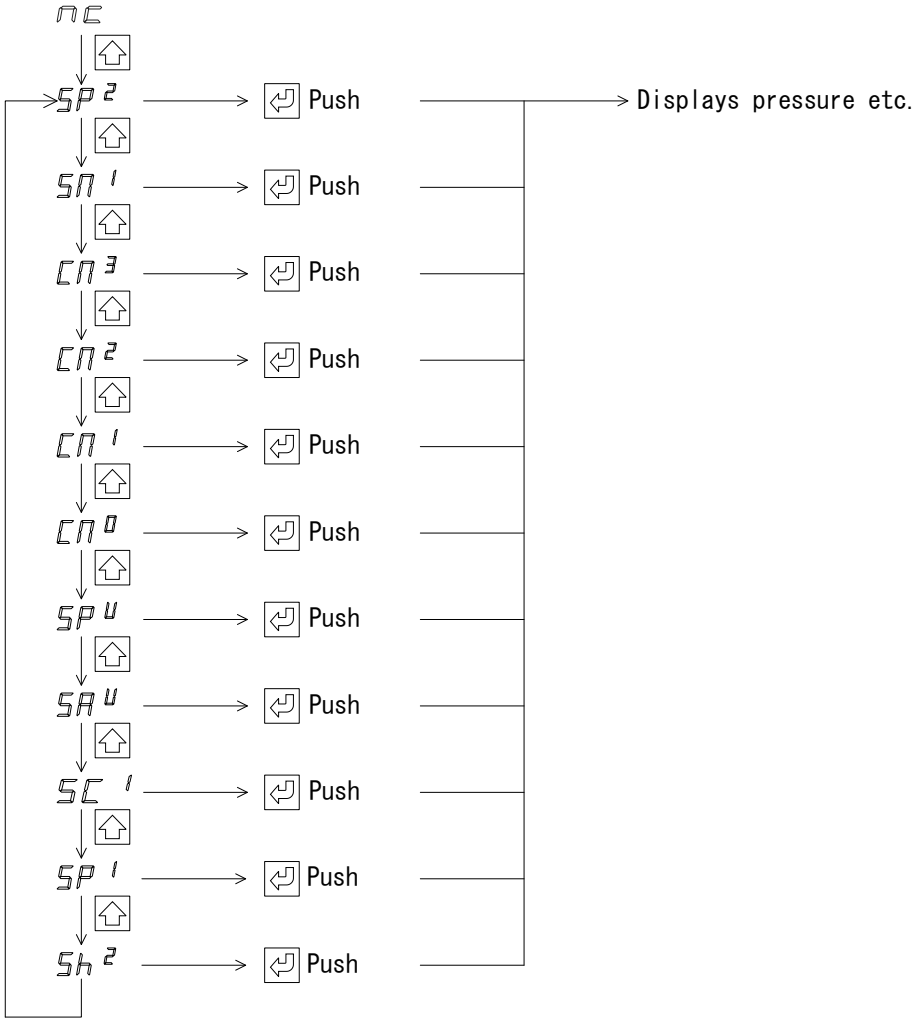
# 6. SELECTION OF SENSOR UNIT

Before using this unit, select a sensor unit to connect to this unit.

## 6.1. Selection of Sensor Unit

The currently selected sensor unit blinks for 3sec after power is applied to this unit.

Press the ⇧(up arrow) key while the sensor unit is blinking and, when the sensor unit is displayed, press the ⏎ (enter) key. Each press on the up arrow key changes the sensor unit name as shown below.




| Display of ISG1 | Sensor unit to connect |
|---|---|
| nc | Non-selection |
| SP 2 | Pirani vacuum gauge SW100-A/SW1-1 |
| SN 1 | Hot cathode gauge BMR2 |
| CN 3 | Ceramic capacitance manometer CCMT-1000A/1000D/CCMH-1000A |
| CN 2 | Ceramic capacitance manometer CCMT-100A/100D/CCMH-100A |
| CN 1 | Ceramic capacitance manometer CCMT-10A/10D/CCMH-10A |
| CN 0 | Ceramic capacitance manometer CCMT-1D/CCMH-1A |
| SP U | Multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1<br>(SPU combination mode) |
| SA U | Multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1<br>(SAU combination mode/SWU combination mode) |
| SC 1 | Cold cathode gauge SC1 |
| SP 1 | Pirani vacuum gauge BPR2, SP1 |
| Sh 2 | Multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1 |

## 6.2. Key operation in measurement

| Notation | Name | Sensor unit name | | | | | |
|---|---|---|---|---|---|---|---|
| | | BPR2 /SP1 | SW100-A /SW1-1 | SC1 | SH200-A/ST200-A /SH2-1/ST2-1 /BMR2 | SWU/SPU /SAU Combination | CCM series |
| PROG | Program key | | | | | | |
| ZERO | Zero point adjustment key | - | - | - | - | - | Zero point adjustment |
| DEG | Degas key | - | - | - | Degas | Degas | - |
| FIL | Filament key | - | Zero point adjustment, ATM pressure adjustment | HV ON | FIL ON | FIL OFF | - |

*This is the operation when the operation is selected from the front panel. For details, refer to the operation setting section of each unit in this manual.

## 6.3. Reset the Unit to the Factory Default Settings

The factory parameter setting is activated by keeping the “ZERO” key (⇧(up arrow) key) depressed for at least 3sec after power on. So display is “nc”.

Select a sensor unit, check the setpoint value and calculation value.

### 6.3.1. Factory Set Values

| Setting | | Set values |
|---|---|---|
| Sensor unit | | nc |
| ST1 | | 4.9E-2 |
| ST2 | | 4.9E-2 |
| ST3 | | 4.9E-2 |
| CAL | | 1.0E+0 |
| L1/L2 | | L1 (Operation of front panel and external I/O) |
| In | | F (interlock OFF) |
| rA | uP | 1.4E+8 |
| | Lo | 4.9E-b |
| Filament on ,etc. | | F (Front panel operation mode) |

# 7. SETPOINT

| | |
|---|---|
| CAUTION | **Display of $10^{-10}$, $10^{-11}$**<br>$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”.<br>Please note “b (B of small letter)” to make a mistake as '6' of the figure. |
| CAUTION | **Fast blinking of the setpoint value**<br>If the setpoint value blinks at high speed when you try to change the setpoint, it is set to RS-485 or interlock, so please check the setting. |

This section describes the settings of setpoint.

Before reading this section, read the standard operating procedure described in the preceding sections.

## 7.1. What is Setpoint?

Setpoint is a function of outputting a signal to outside or lighting an LED when pressure has lowered to below a certain set level. The set pressure value is called “setpoint”.

If a pressure being measured has lowered to below the setpoint,

Front panel : SET-1/SET-2/SET-3 LED light up.
External I/O : Each setpoint output becomes Lo.
RS-485 : 1 is set at each setpoint value of the status.

## 7.2. Setpoint Setting Range

The setpoint setting range of all sensors is the same. The setpoint range assumes the CALCULATION function.

Setpoint setting range: $4.9\times10^{-11}$ to $1.4\times10^{+8}$ Pa

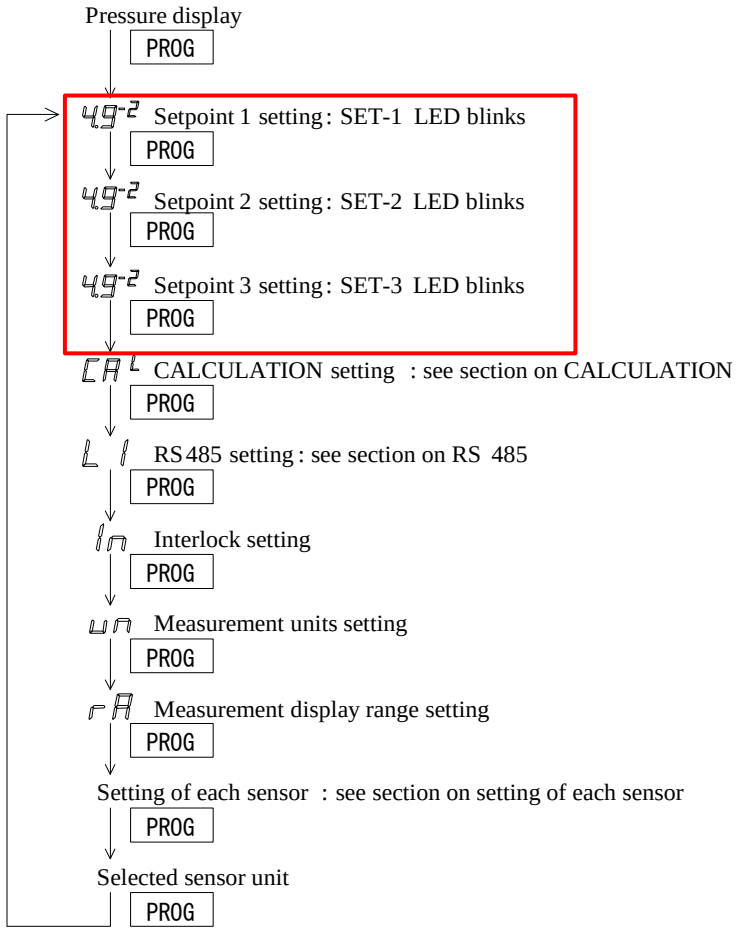
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”.Please note “b (B of small letter)” to make a mistake as '6' of the figure.

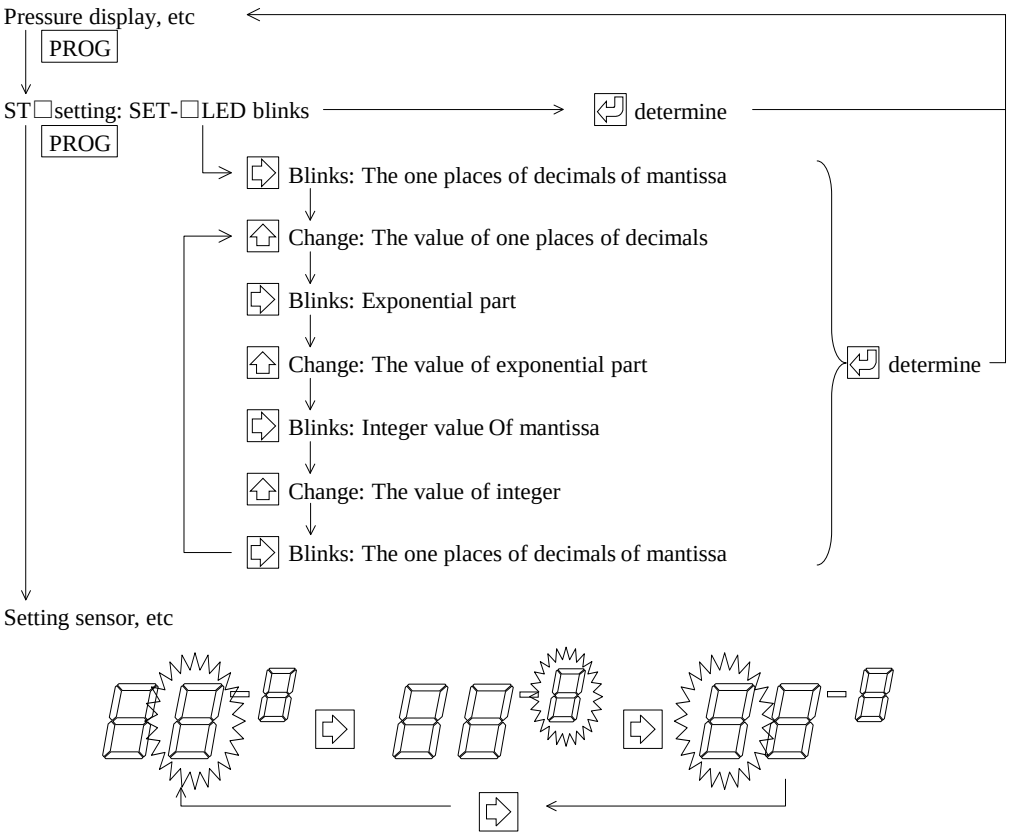
## 7.3. How to Set Setpoint

Setpoint can be set on the front panel or through RS-485.

For the setting through RS-485, refer to section 22.

### 7.3.1. How to Set Setpoint from Front Panel



### 7.3.2. How to set setpoint from RS-485

Refer to section 22 for how to set through RS-485.

In the RS-485 mode, the setpoint value can be checked with the PROG key, but it cannot be changed.

# 8. CONNECTION WITH EXTERNAL DEVICES

The table below gives the pin assignment in the connection with external devices.

*Connector for connection “I/O”: D-sub 15pin socket (M2.6mm screw)

| 『I/O』pin | Description | Remarks |
|---|---|---|
| 2 | Output signal | Output signals such as error.<br>Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Output a signal when setpoint 1 actuates.<br>Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 4 | Output signal | Outputs FIL, E.V., and HV signals.<br>Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | Input signal | Input signals such as FIL, HV, and adjust.<br>Actuated when shorted with GND |
| 6 | Input signal | Input switching signal such as FIL 1/2.<br>Actuated when shorted with GND |
| 7 | Setpoint3 actuating signal | Output a signal when setpoint 3 actuates.<br>Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | Output pressure signal<br>DC0V to 10V |
| 9 | Signal GND | GND of pressure signal, filament disconnect signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS485- output |
| 11 | Setpoint2 actuating signal | Output a signal when setpoint 2 actuates.<br>Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS485+ output |
| 13 | Input signal | Input a DEGAS signal.<br>Actuated when shorted to GND |
| 15 | Signal GND | GND of pressure signal, filament disconnection signal, setpoint, etc. |
| Case | FG | Frame ground |

## 8.1. Output Signal

For the output of signals such as setpoint, the photocoupler operates and become a Lo signal.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

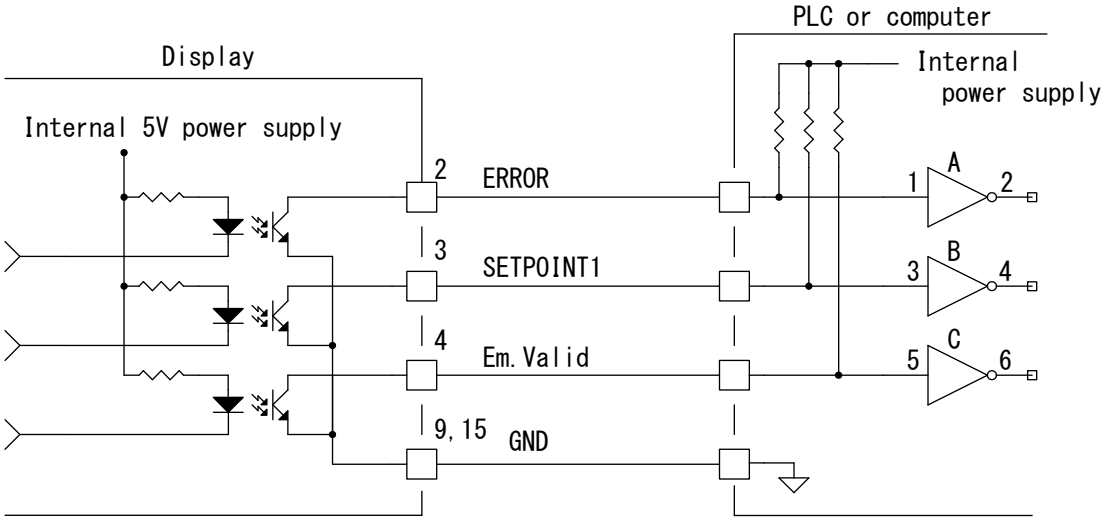



Fig.8-1 Output Signal

## 8.2. Input Signal

| | |
|---|---|
| CAUTION | **Contact capacity**<br>Use a capacity for externally installed contacts greater than the input power supply voltage and DC30V or higher. |
| CAUTION | **Contact leak current**<br>Be aware of contact leak current. If a current of 0.08mA or higher flows between the input signal pin to the GND terminal, that may be treated as signal input. |

When input each signal, set each terminal to GND.

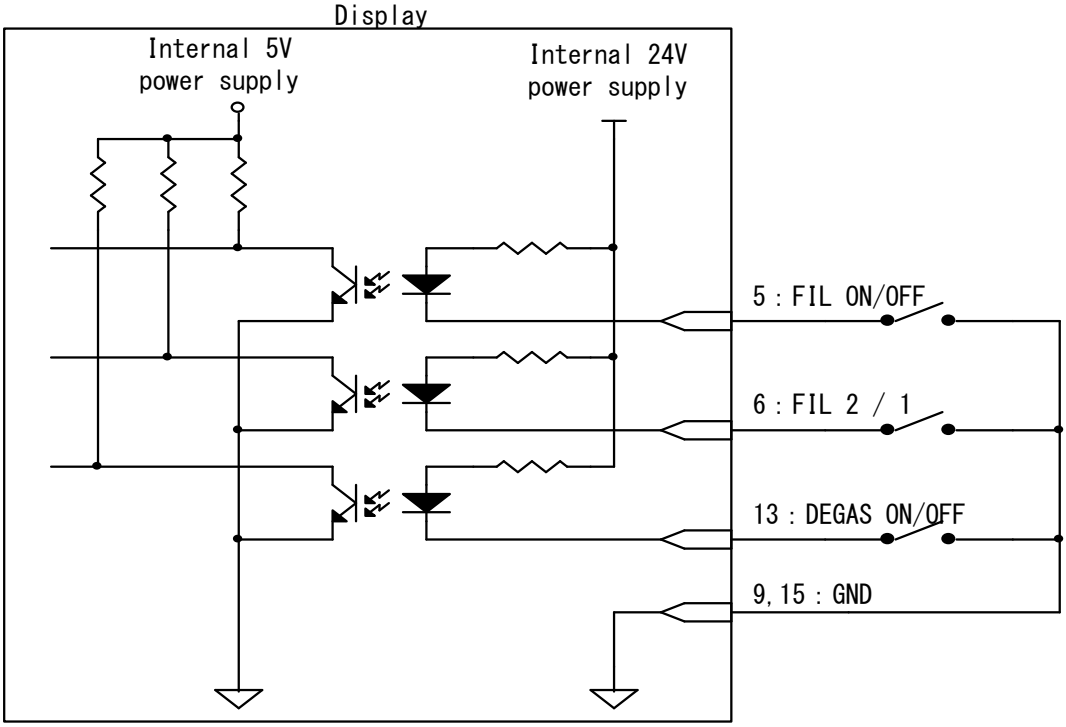



Fig.8-2 Input Signal

### 8.2.1. RS-485 communication

Refer to section 22 for RS-485 communication.

# 9. PIRANI GAUGE SW100-A/SW1-1

| | |
|---|---|
| CAUTION | **Connection with an analog output type SW100-A and a standard type SW1-1 is recommended.**<br>Zero point and atmosphere adjustment will be impossible if it connects with a serial communication type SW100-R/SW1-2. Moreover, Filament error signal may not be outputted. |
| CAUTION | **Please use the OUTPUT setting of SW100-A with SW100-A/SW1-1.**<br>If the OUTPUT setting of SW100-A is used with PSG and APG, the pressure will be displayed, but it will not be converted to the correct pressure value.<br>If the SW100-A OUTPUT settings are used with the SP1, follow the settings in Chapter 11.<br>For OUTPUT setting, please refer to the SW100 instruction manual. |

This section describes the operation of the sensor unit of the Pirani gauge SW100-A/SW1-1.
Before reading this section, read the standard operating procedure in the preceding sections.

## 9.1. Sensor Unit Setting: “SP2”

Turn on the power to this unit and make sure that “SP2” lights for several seconds.

To display others, press the ⇧ key several times within 3sec after turning on power to change over the display to “SP2” and make it definite with the ⏎ key.

Refer to section 6 for more information about the sensor unit setting.

## 9.2. Front Panel

### 9.2.1. Pressure display state

| | |
|---|---|
| CAUTION | **Filament disconnection detection**<br>If the main component of the measurement gas is hydrogen ($H_2$) or helium (He), this output signal may be output even if the filament is broken. |

| Condition | Pressure indicator | LED |
|---|---|---|
| In normal measurement | SW100-A: $5.0\times10^{-2}$Pa to $1.0\times10^{+5}$Pa<br>SW1-1 : $5.0\times10^{-2}$Pa to $1.2\times10^{+5}$Pa | |
| Below measurement pressure range | $0.0\times10^{-2}$Pa | |
| Above measurement pressure range | $F.F\times10^{+F}$Pa | |
| When filament has burnt out.<br>(When filament disconnection signal is input.) | Err | ERROR LED lights |
| When filament has burnt out.<br>(When filament disconnection signal is not input.) | Err | |
| When sensor unit is not connected. | - - - | ERROR LED lights |

### 9.2.2. Description of front panel keys

| Name (notation) | Function | Remarks |
|---|---|---|
| PROG | Enters into the program mode | Refer to section 5. |
| ZERO | Not used | |
| DEG | Not used | |
| FIL | Makes zero point and ATM adjustment | Cannot be operated<br>when RS-485 and I / O are set |

## 9.3. Setting Operation

The following settings are available for zero point and atmospheric pressure adjustment.

| Setting | Overview |
|---|---|
| Front panel operation mode | Can be operated on the front panel only. |
| External I/O operation mode | Only external I/O can be operated. |
| RS-485 communication mode | Only RS-485 communication can be operated. |

### 9.3.1. RS-485 communication operation setting “L1”, “L2”

Select whether zero point adjustment and atmospheric pressure adjustment are to be made through RS-485 communication or not.

Refer to section 22 for the detailed settings of RS-485.

| Display | Detail | Remarks |
|---|---|---|
| “L1” | Operation of front panel and external I/O | RS-485: Pressure reading only |
| “L2” | Operation of only RS-485 communication | |

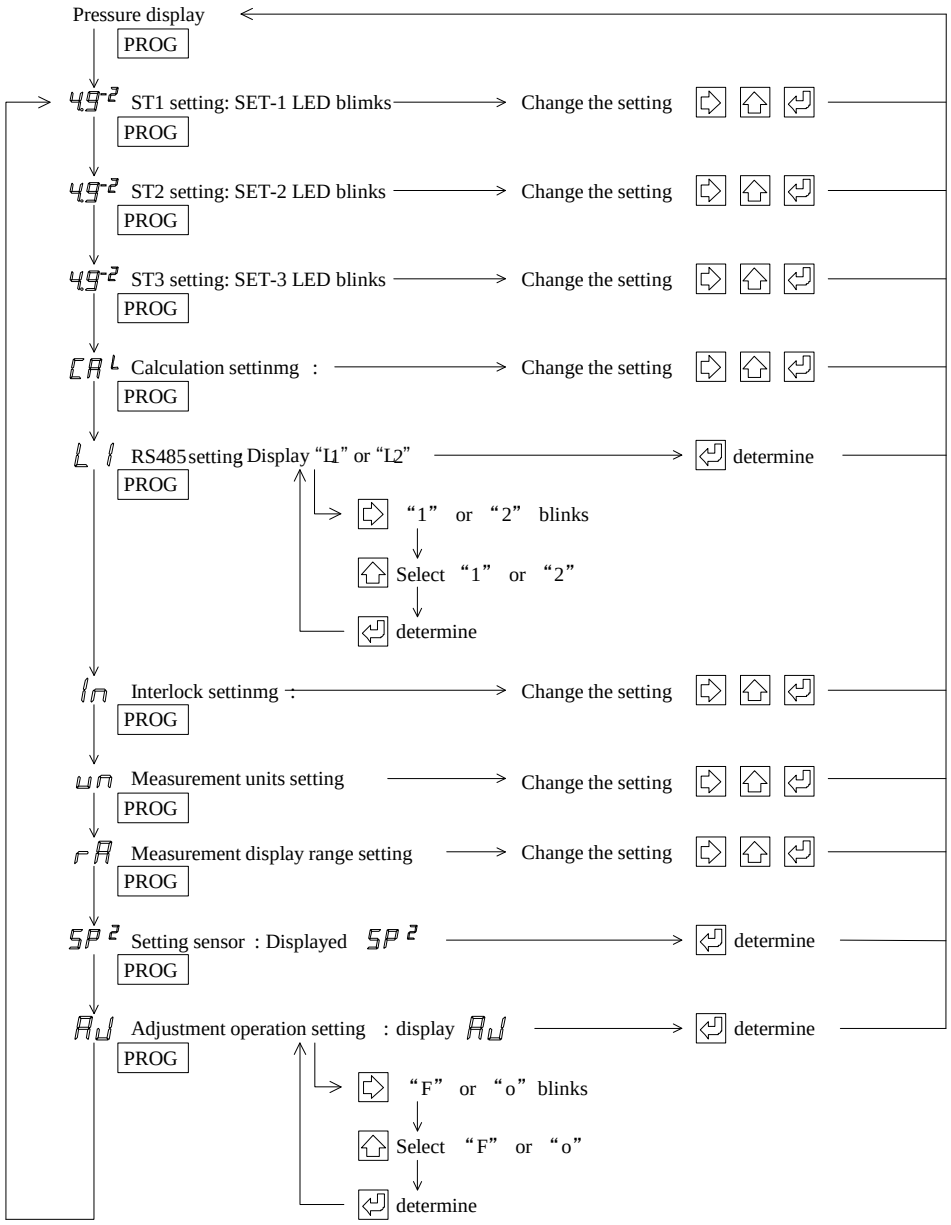
### 9.3.2. Front panel, external I/O operation setting: “AJ”

Selects whether the zero point and atmospheric pressure adjustment are not be made on the front panel or with external I/O.

| Display | Detail |
|---|---|
| “F” | Operation on the front panel only |
| “o” | Only I/O is operated. |

### 9.3.3. Method of setting

Press the “PROG” key to change over the mode. Each press on the “PROG” key changes the mode as follows.



## 9.4. Connection with Sensor Unit

The table below gives the pin assignment in connecting with the sensor unit SW100-A or SW1-1. In connecting with the sensor unit, it is recommended to connect all of the following pins.

* Connector for connection "SENSOR": D-sub 15pin connector pin, M2.6mm screw
* Connector for connection SW100-A/SW1-1: D-sub 15pin connector socket, M2.6mm screw

| "SENSOR" | Description | Remarks | Sensor unit |
|---|---|---|---|
| 1 | DC24V power | DC24V power to the sensor unit | 1 |
| 2 | Filament disconnection signal | Error signal is input when filament has disconnect. | 2 |
| 5 | ADJ adjustment | Makes zero point and ATM adjustment | 5 |
| 8 | Pressure signal input + | Pressure signal is input | 8 |
| 9 | Power GND | Power GND to the sensor unit | 9 |
| 15 | Pressure signal input - | Pressure signal is input | 15 |
| Case | FG | Frame ground | Case |

## 9.5. Connection to External Device

The table below gives the pin assignment in connecting with external devices.

* Connector for connection "I/O": D-sub 15pin connector socket, M2.6mm screw

| "I/O" | Description | Remarks |
|---|---|---|
| 2 | Filament disconnection signal output | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | Adjustment | Actuated when shorted to GND |
| 7 | Setpoint3 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 8 | Pressure signal output + | DC0V to 10V |
| 9 | Signal GND | GND of pressure signal, filament disconnection signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS-485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 15 | Signal GND | GND of pressure signal, filament disconnection signal, setpoint, etc. |
| Case | FG | Frame ground |

## 9.6. Various Signals

### 9.6.1. Output voltage

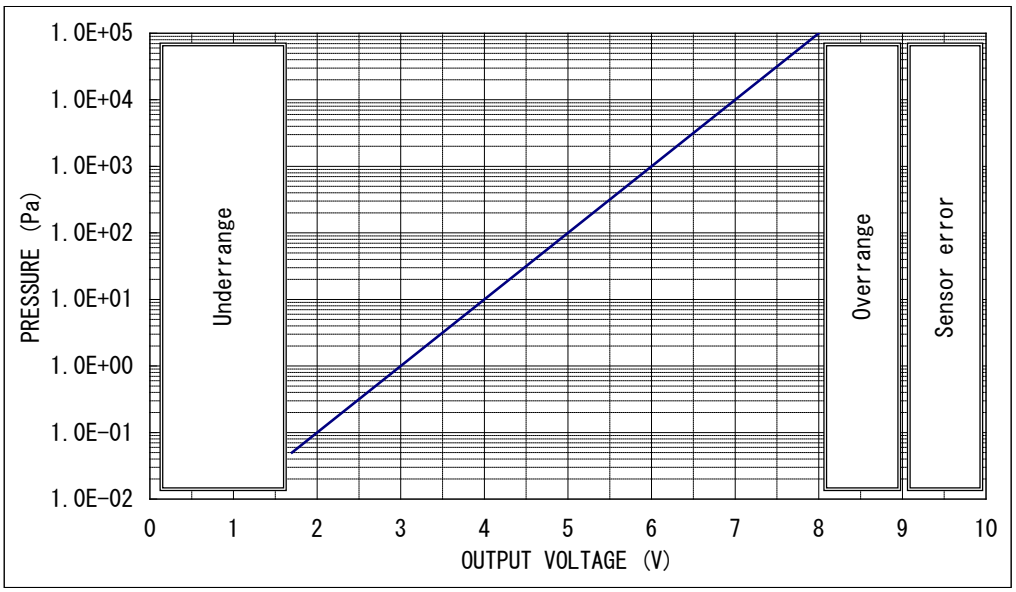
Output voltage is outputted with +[8pin]→GND [15pin] of the I/O connector.

$$P=10^{(V-k)\times C} \longleftrightarrow V=\log(P/C)+k$$

P: Pressure value
V: Measurement value output voltage (V)
C: Calculation value (Refer to below table or section 18)
k: Conversion factor (Refer to the table below)

| Measurement Unit | k | C |
|---|---|---|
| Pa | 3 | $1.0\times10^{+0}$ |
| Torr | 5.1249 | $7.5\times10^{-3}$ |
| mbar | 5 | $1.0\times10^{-2}$ |

| Status | Measurement value output voltage |
|---|---|
| In normal measurement | Voltage corresponding to the measured pressure |
| Above the measurable higher limit | 8.1V or higher |
| Below the measurable lower limit | 1.7V or less |
| In case of filament disconnection | 9V or higher |




9.6.2. Filament disconnection signal

The filament disconnection signal is output when the sensor head filament has disconnect. If the filament disconnect, Lo is output in the open collector format.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

In case of filament disconnection, "Err" is displayed on the front panel, but also it can be confirmed by reading the status from the I/O connector through RS-485 communication.

Refer to the manual for sensor unit for the check method when the filament is disconnect.

9.6.3. Zero point adjustment and atmospheric pressure adjustment

Makes zero point adjustment and atmospheric pressure adjustment of SW100-A/SW1-1.

+ [5pin] of the I/O connector → output with GND [15pin]

9.6.4. Setpoint

Refer to Section 7 for how to adjust and use the setpoint.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

9.6.5. RS-485 communication

Refer to section 22 for RS-485 communication.

9.7. Zero Point Adjustment and Atmospheric Pressure Adjustment

| | |
|---|---|
| ⚠ CAUTION | **Refer to the instructions manual of a sensor**<br>Please read the instructions manual of sensor unit, when zero point adjusted and atmospheric pressure adjusted. |

9.7.1. Adjusting method

Zero point adjustment and atmospheric pressure adjustment can be made by the following method.

| Adjusting Method | Operating procedure | |
|---|---|---|
| Front panel | Adjustment | Hold down the "FIL" switch for 1sec or more. |
| | Adjustment reset | Hold down the "FIL" switch for 5sec or more. |
| External I/O | Adjustment | Turn on (short) "adjustment input" from I/O for 1sec or more. |
| | Adjustment reset | Turn on (short) "adjustment input" from I/O for 5sec or more. |
| RS-485 | Input each command through serial communication | |

# 10. COLD CATHODE GAUGE SC1

This section describes the operation of the cold cathode gauge SC1.

Before reading this section, go through the standard operating procedure described in the preceding sections and the manual for the sensor unit.

## 10.1. Setting the Sensor Unit

Turn on the power to this unit and make sure that "Sc1" blinks for about 3sec.

In any other display appears, press the ⇧ key within 3sec after turning on power and, after changing the display to "Sc1", make it definite with the ⏎ key.

Refer to section 6 for more information about the sensor unit setting.

## 10.2. Front Panel

### 10.2.1. Pressure display

| Condition | Pressure display | LED |
|---|---|---|
| In normal measurement | $1.0\times10^{-5}$ Pa to $1.0\times10^{+0}$ Pa | |
| Below measurement pressure range | $0.0\times10^{-5}$ Pa | |
| Below measurable greatly lower limit*1 | HuO | |
| Above measurement pressure range | HuO | |
| When HV is off when power is turned on | HuF | |
| Immediately after HV is turned on | HuO | |
| When discharge check signal is not yet connected*2 | Pressure indication | Err blinks |
| When sensor unit is not connected | - - - | Err lights |

*1: Below measurable greatly lower limit. Refer to the manual of SC1.

*2: The discharge check signal indicates that discharge current is flowing normally.
The setpoint of this unit is not actuated unless this signal is input.

### 10.2.2. Front panel key description

| Name (notation) | Function | Remarks |
|---|---|---|
| PROG | Enters into the program mode | Refer to section 5 and this section |
| ZERO | Not used | |
| DEG | Not used | |
| FIL | HV ON/OFF operation | Cannot be operated when RS-485 and external I/O are set |

## 10.3. Settings Operation

The following settings are available for turning ON/OFF high voltage.

| Setting | Overview |
|---|---|
| Front panel operation mode | Only the front panel can be operated |
| External I/O operation mode | Only external I/O can be operated |
| RS-485 communication mode | Only RS-485 communication can be operated |

### 10.3.1. RS-485 communication operation setting "L1", "L2"

Select whether HV ON/OFF is to be operated by RS-485 communication or not.

Refer to section 22 for detailed setting of RS-485, commands and others.

| Display | Detail | Remark |
|---|---|---|
| "L1" | Operation of front panel and external I/O | RS-485: Pressure reading only |
| "L2" | Only RS-485 communication operation | |

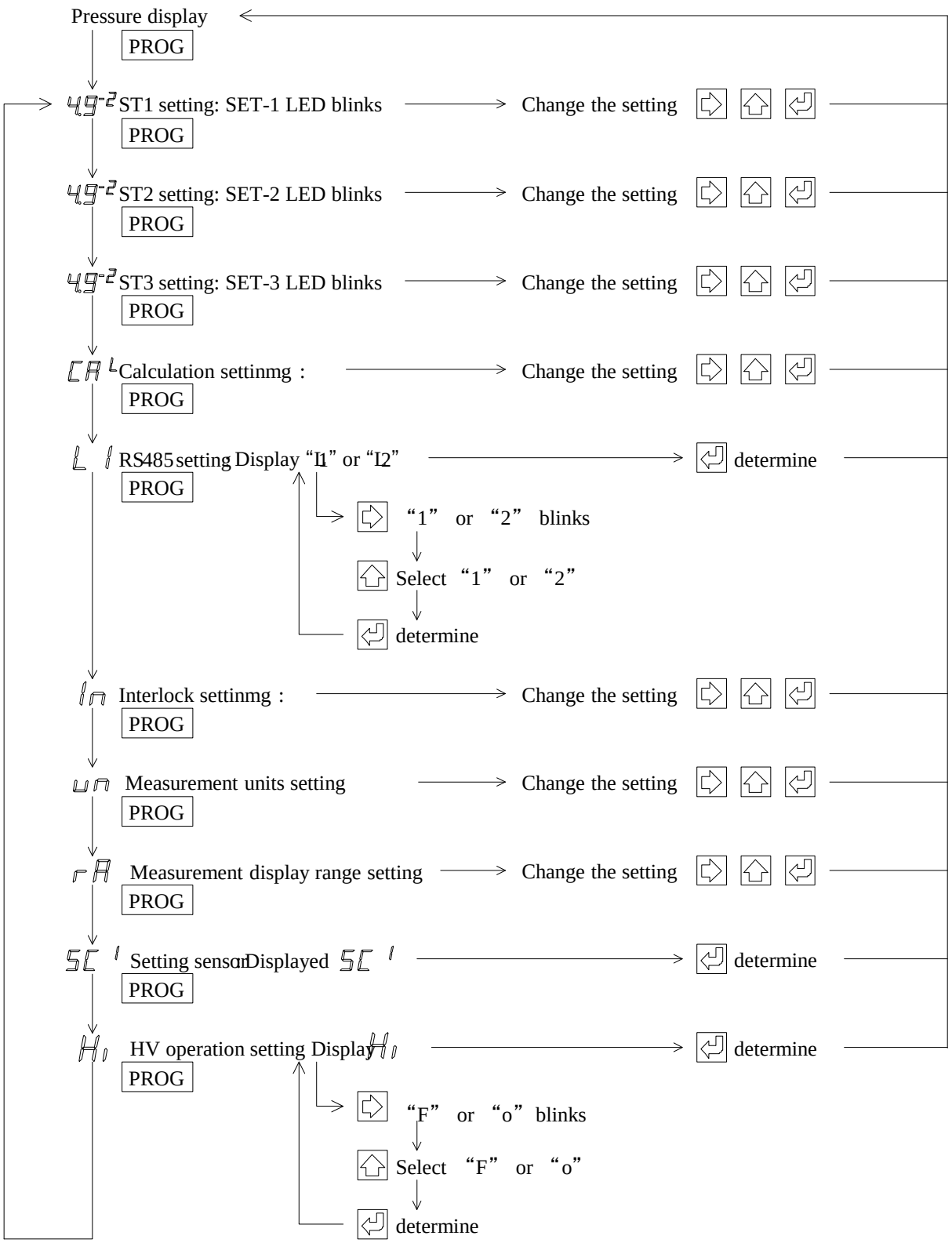
### 10.3.2. Front panel, external I/O operation setting: "Hi"

Selects whether HV ON/OFF is to be operated on the front panel or with external I/O.

| Display | Detail |
|---|---|
| "HiF" | Only operation on front panel |
| "Hio" | Only operation of I/O |

### 10.3.3. Operation setting method

Press the PROG key to change over the mode. Each press on the PROG key changes the display as follows. If HV is on (local or remote), this unit cannot do HV settings operation.



## 10.4. Connection to the Sensor Unit: “SENSOR” Connector

The table below gives the pin assignment in the connection with the sensor unit. In the connection with the sensor unit, it is recommended to connect all of the following pins.

* Connector for connection “SENSOR”: D-sub 15pin connector male, M2.6mm screw
* Connector for connection “SC1”: D-sub 15pin connector female, M2.6mm screw

| “SENSOR” | Description | Details | Sensor unit |
|---|---|---|---|
| 1 | DC24V power | DC24V power supply to the sensor unit | 1 |
| 4 | Discharge check signal*1 | Signal showing that discharge: input | 4 |
| 5 | HV ON/OFF | HV ON/OFF signal: output | 5 |
| 8 | Pressure signal input+ | Pressure signal: input. | 8 |
| 9 | Power GND | Power GND to the sensor unit | 9 |
| 15 | Pressure signal input- | Pressure signal: input. | 15 |
| Case | FG | Frame ground | Case |

*1 The discharge check signal indicates that discharge current is flowing normally.
The setpoint of this instrument is not actuated unless this signal is input.

## 10.5. Connection with External Devices: “I/O” Connector

The table below gives the pin assignment in the connection with external devices.

* Connector for connection “I/O”: D-sub 15pin connector female, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 3 | Setpoint1 actuating signal output | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 4 | Discharge check signal output | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | HV ON/OFF signal input | Actuated when shorted to GND |
| 7 | Setpoint3 actuating signal output | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | DC0V to 10V |
| 9 | Signal GND | Signal GND |
| 10 | RS485- | Serial communication RS-485- output |
| 11 | Setpoint2 actuating signal output | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 15 | Signal GND | Signal GND |
| Case | FG | Frame ground |

## 10.6. Signals

### 10.6.1. Output voltage

Output voltage is outputted with the I/O connector +[8pin]→GND [15pin].

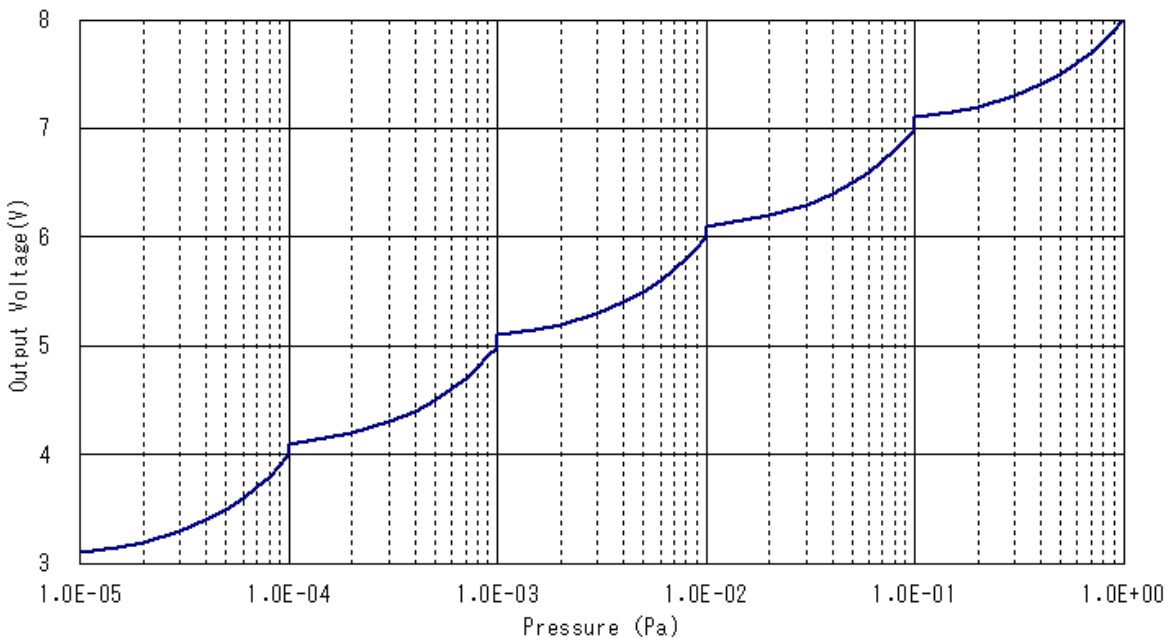
$$P=10\times(V-E)\times10^{(E-8+C)}$$

P : Pressure value
V : Measurement value output voltage (V)
E : Measurement value output voltage V from which fractions are rounded off
C : Exponent value of calculation value
(The value of C in $A.B\times10^{C}$, refer to section 18)

The (V-E) calculated value may become 0.1 or lower due to errors in the sensor's output voltage and errors with the measuring instrument. If it falls below 0.1 in this manner, we recommend rounding up to 0.1 and calculating.

| Status | Measurement value output voltage |
|---|---|
| In normal measurement | Voltage corresponding to the measured pressure |
| Above the measurable higher limit | 8.1V or higher |
| Below the measurable lower limit*1 | 3V |
| When HV is off | 10V |
| No discharge | 10V |

*1: Refer to the manual of SC1.




10.6.2. HV ON signal: Pin 5

Before turning on HV, short pin 5 to GND with the external switch.

When front panel operation or RS-485 communication is set, input of this signal will be invalid.

10.6.3. Discharge check signal: Pin 4

Start of discharge is output as a signal. If discharge occurs, the open collector will be Lo output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

For more information about the discharge check signal and corrective actions against the discharge signal not being turned on, refer to the manual for the sensor unit.

10.6.4. Setpoint: Pins 3, 7, 11

Refer to section 7 for how to adjust and use the setpoint.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

10.6.5. RS485 communication: Pins 10, 12

Refer to section 22 for communication through RS-485.

# 11. PIRANI GAUGE BPR2/SP1

| | |
|---|---|
| CAUTION | **Power supply to the BPR2**<br>If 24VDC is supplied to the BPR2, the display when the sensor unit is unconnected is shown. |

This section describes how to use the Pirani gauge BPR2 or SP1 sensor unit.
Before reading this section, refer to the standard operating procedure in the foregoing sections.

## 11.1. Sensor Unit Setting: "SP1"

Turn on the power to this unit and make sure that "SP1" is lit for several seconds.
To display others, press the ⇧ key several times within 3sec after turning on power to change over the display to "SP1" and then make it definite with the ⏎ key.
Refer to section 6 for more information about the settings of the sensor unit.

## 11.2. Front Panel

### 11.2.1. Pressure display

| | |
|---|---|
| ✔ Note | If the main component of the measurement gas is hydrogen ($H_2$) or helium (He), this output signal may be output even if the filament is broken. |

| Condition | Pressure indication | LED |
|---|---|---|
| In normal measurement | $4.0 \times 10^{-1}$ Pa to $3.0 \times 10^{+3}$ Pa | |
| Below measurement pressure range | $0.0 \times 10^{-1}$ Pa | |
| Above measurement pressure range | FFF | |
| When filament has burnt out<br>(When filament burnout signal is input) | Err | Err LED lights |
| When filament has burnt out<br>(When filament burntout signal is not input) | Err | |
| When the sensor unit is not connected | - - - | Err LED lights. |

### 11.2.2. Description of front panel keys

| Description (notation) | Function | Remarks |
|---|---|---|
| PROG | Enters into the program mode | Refer to section 5 |
| ZERO | Not used | |
| DEG | Not used | |
| FIL | Not used | |

## 11.3. Setting Operation

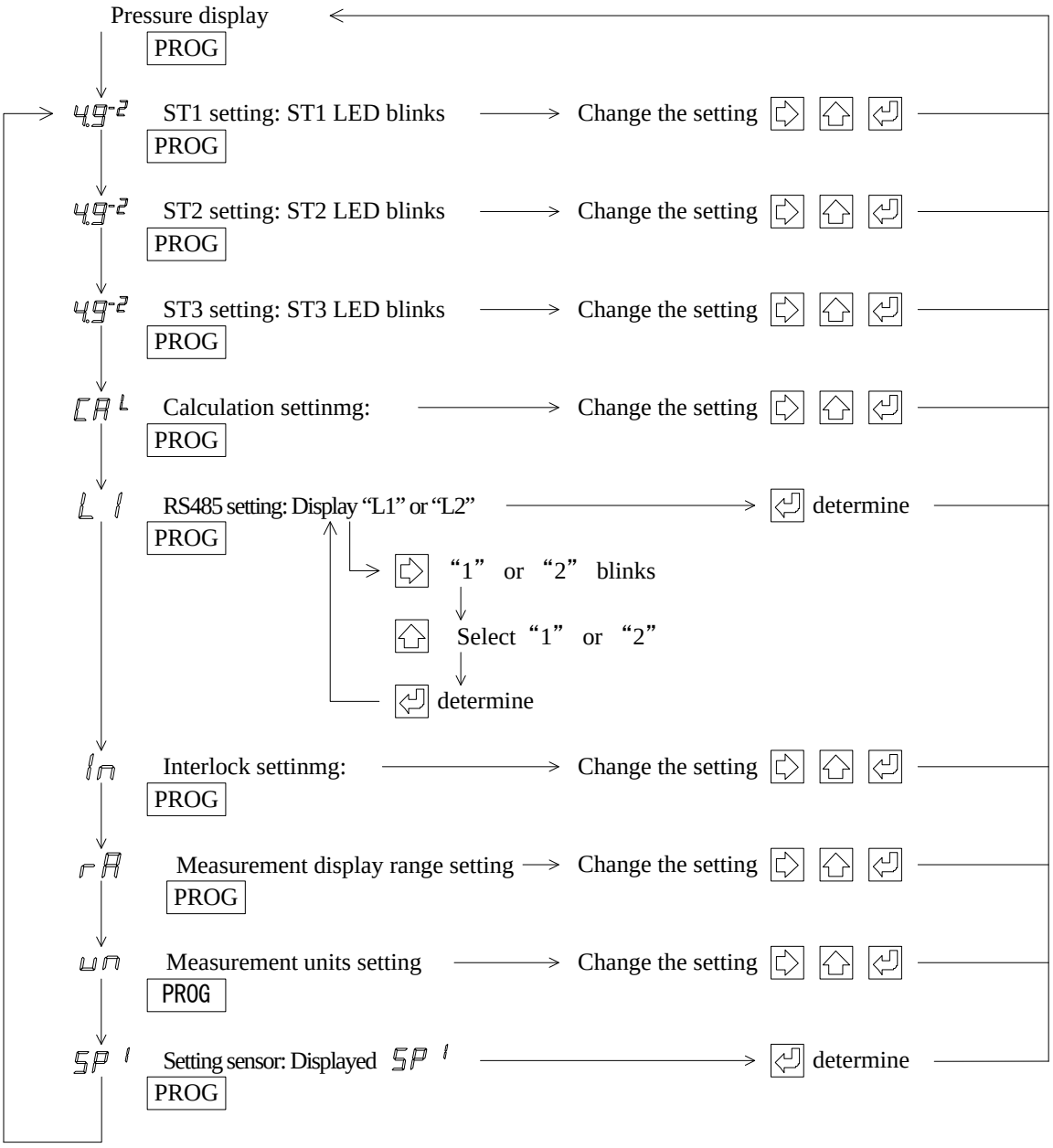
### 11.3.1. RS-485 communication operation setting "L1", "L2"

Select whether HV ON/OFF is to be operated by RS-485 communication or not.
Refer to Section 22 for detailed setting of RS-485, commands and others.

| Display | Detail | Remarks |
|---|---|---|
| "L1" | Operation of front panel and external I/O | RS-485: Pressure reading only |
| "L2" | Only RS-485 communication operation | |

### 11.3.2. Operation setting method

Press the PROG key to change over the mode. Each press on the PROG key changes the display as follows.




### 11.4. Connecting to the Sensor Unit

The table below gives the pin assignment in connecting to the sensor unit. In connecting to the sensor unit, it is recommended to connect all the following pins.

* Connector for connection "SENSOR": D-sub 15pin connector male, M2.6mm screw
* Connector for connection "BPR2/SP1": D-sub 15pin connector female, M2.6mm screw

| "SENSOR" | Description | Remarks | Sensor unit |
|---|---|---|---|
| 1 | 24VDC power supply | 24VDC power supply to the sensor unit | 1 |
| 2 | Burnout signal | Error signal of filament burnout is input. | 2 |
| 4 | Measuring unit connection check signal | Measuring unit connection check signal is input. | 4 |
| 8 | Pressure signal input+ | Pressure signal is input. | 8 |
| 9 | Power GND | Power GND to the sensor unit | 9 |
| 15 | Pressure signal input- | Pressure signal is input. | 15 |
| Case | FG | Frame ground | Case |

## 11.5. Connection with External Devices

The table below gives the pin assignment in connecting to an external device.

* Connector for connection "I/O": D-sub 15pin connector female, M2.6mm screw

| "I/O" pin | Description | Remarks |
|---|---|---|
| 2 | Burnout signal output | Lo when error, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 7 | Setpoint3 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | 0V to 10VDC |
| 9 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS-485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 15 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| Case | FG | Frame ground |

## 11.6. External Input/Output Signal

### 11.6.1. Output voltage

Output voltage output: I/O connector 4 [8pin] → GND [15pin]

$$P=10 \times ( V - E ) \times 10 \wedge ( E - 1 + C )$$

P: Pressure value

V: Measured value output voltage (V)

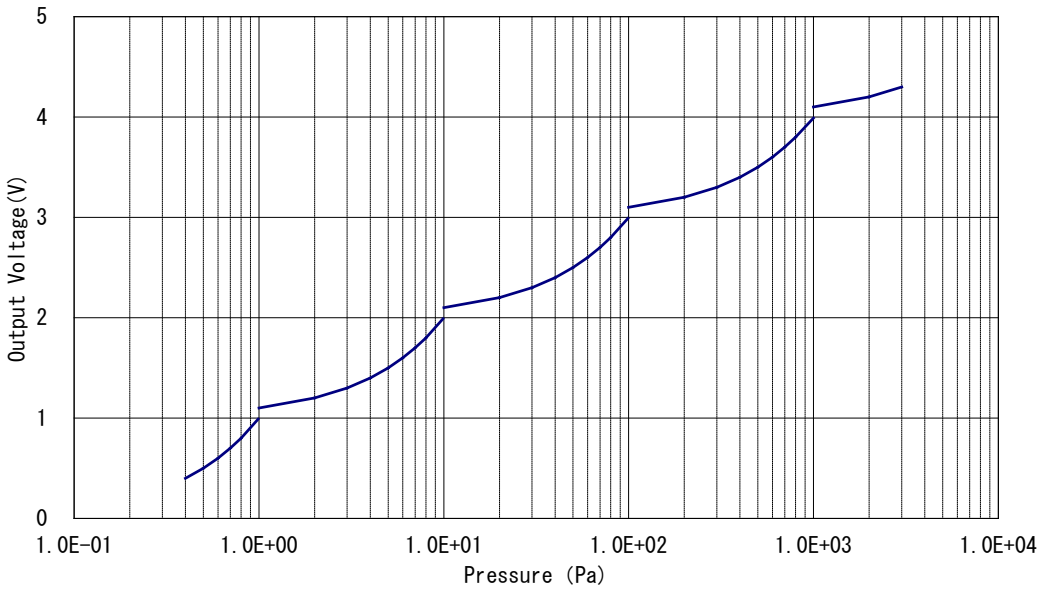
E: Measured value output voltage from which decimal point is omitted

C: Exponent value of calculation value

(The value of C in $A.B\times10^{C}$ , refer to section 18)

The (V-E) calculated value may become 0.1 or lower due to errors in the sensor's output voltage and errors with the measuring instrument. If it falls below 0.1 in this manner, we recommend rounding up to 0.1 and calculating.

| Condition | Measured output voltage |
|---|---|
| In normal measurement | Voltage corresponding to the measured pressure |
| When measurable higher limit is exceeded | 5.1V |
| When lower than measurable lower limit | 0V |
| When filament has burnt out | 9V or higher |



### 11.6.2. Burnout signal

| | |
|---|---|
| ✔ Note | **Burnout detection**<br>If the main component of the measurement gas is hydrogen ($H_2$) or helium (He), this output signal may be output even if the filament is broken. |

The burnout signal is a signal that is output when the sensor head filament has burnt out. If the filament burns out, Lo output is given in the open collector format.

Photocoupler rating: $30V_{MAX}$, $50mA_{MAX}$, 70mW

In case of filament burnout, “Err” is displayed on the front panel and the Err LED lights, but also it can be confirmed by reading status through RS-485 communication.

For how to check the filament for burnout, refer to the manual for the sensor unit.

### 11.6.3. Setpoint

For how to adjust and use the setpoint, refer to section 7.

Photocoupler rating: $30V_{MAX}$, $50mA_{MAX}$, 70mW

### 11.6.4. RS-485 communication

Refer to section 22 for RS-485 communication.

# 12. HOT CATHODE GAUGE BMR2

| | |
|---|---|
| CAUTION | Cable connecting the basic unit and BMR2<br>The cable (24AWG) connecting the basic unit and BMR2 is 10m long maximum. If a longer cable is necessary, connect the power source directly to the BMR2 or use a cable with a larger diameter. |

This section describes the operation of the BMR2 ionization vacuum gauge.
Before reading this section, read the standard operating procedure in the foregoing sections.

## 12.1. Sensor Unit Setting: “Sn1”

Turn on the power to this unit and make sure that “Sn1” lights for several seconds.
To display others, press the ⇧ key several times within 3sec after turning on power, change the display to “Sn1” and make it definite with the ⏎ key.
For more information about the sensor unit setting, refer to Section 6.

## 12.2. Front Panel

### 12.2.1. Pressure display

| Status | Pressure indicator | LED |
|---|---|---|
| In normal measurement | $5.0 \times 10^{-8}$ Pa to $9.9 \times 10^{+0}$ Pa | |
| Below measurement pressure range | $0.0 \times 10^{-8}$ Pa | |
| Above measurement pressure range and when pressure protection signal is input | Prt | |
| Above measurement pressure range and when pressure protection signal is not input | FiO | |
| When power is turned on | FiF | |
| Immediately after filament is turned on | FiO | |
| When degassing is on | Pressure indication | DEG is lit |
| When emission valid is off | Pressure indication | Err blinks |
| When sensor unit is not connected | - - - | Err lights |

*1: When a CALCULATION function is used, it displays to $10^{-11}$ at the minimum.
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”. Please note “b (B of small letter)” to make a mistake as '6' of the figure.

### 12.2.2. Description of front panel keys

| Inscription | Function | Remarks |
|---|---|---|
| PROG | Enters into program mode | Refer to section 5 |
| ZERO | Not used | |
| DEG | Degassing ON/OFF operation | Cannot be operated when RS-485 and external I/O are set |
| FIL | Filament ON/OFF operation | Cannot be operated when RS-485 and external I/O are set |

## 12.3. Setting Operation

### 12.3.1. Setting overview

The following settings are available for turning on the filament or degassing and for changing over the filament1/2.

| Setting | Overview |
|---|---|
| RS-485 communication mode | Only RS-485 communication is available |
| Front panel operation mode | Only front panel operation is available |
| External I/O operation mode | Only external I/O operation is available |

12.3.2. RS-485 communication operation setting “L1”, “L2”

Selects if filament ON/OFF, degassing ON/OFF or filament1/2 changeover is to be operated through RS-485 communication. Refer to section 22 for more information about the detailed setting of RS-485.

| Display | Details | Remarks |
|---|---|---|
| “L1” | Operation on the front panel and external I/O | RS-485: Pressure reading only |
| “L2” | Only operation through RS-485 communication | |

12.3.3. Front panel, external I/O operation setting

12.3.3.1. Filament operation setting “F1”

Selects whether filament ON/OFF is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.

| Display | Detail |
|---|---|
| “F” | Operation on the front panel only |
| “o” | Operation of external I/O only |

12.3.3.2. Degas operation setting “dE”

Selects whether degassing ON/OFF is to be operated on the front panel or with external I/O.
This function will be invalidated if RS-485 communication is set.

| Display | Detail |
|---|---|
| “F” | Operation on front panel only |
| “o” | Operation of external I/O only |

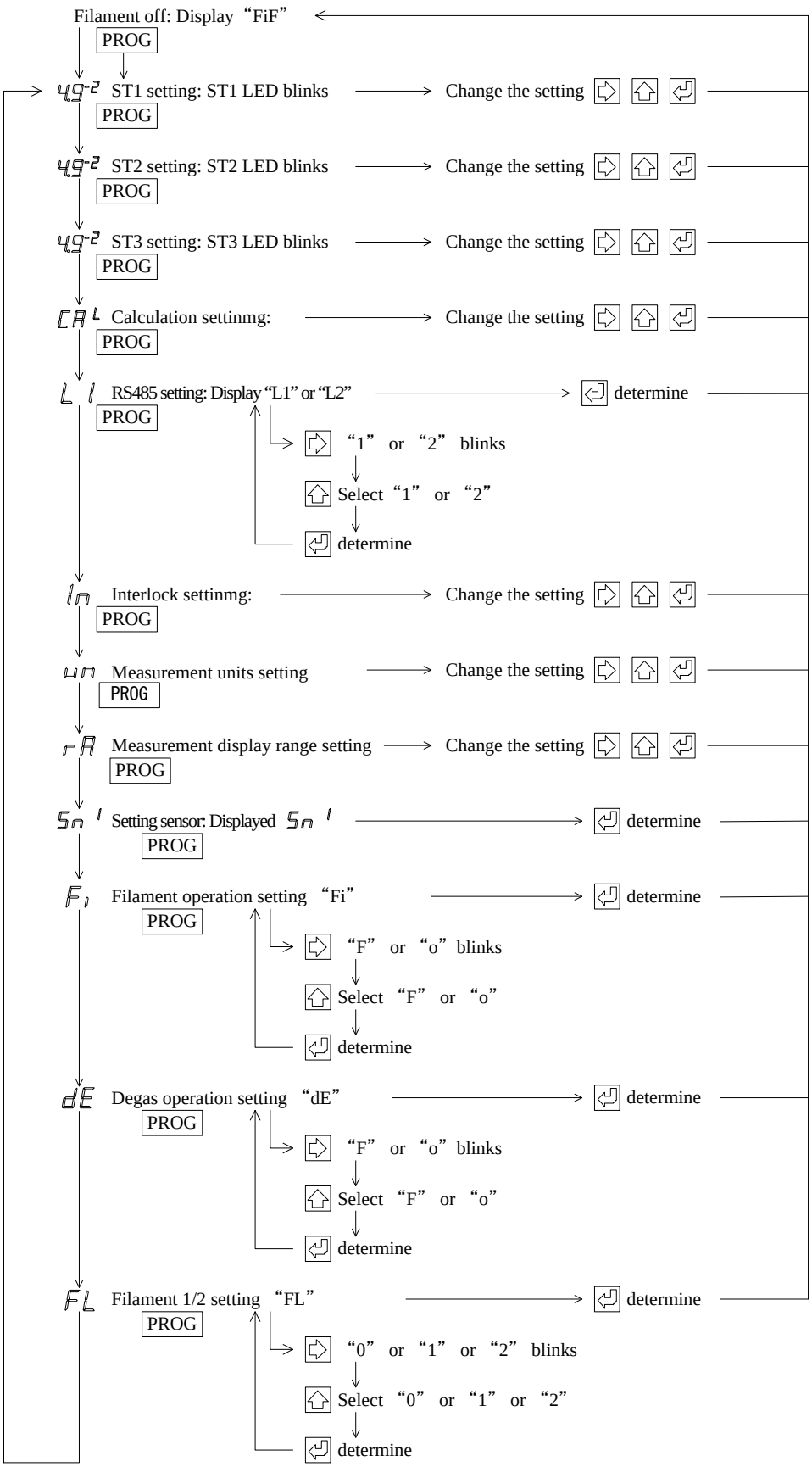
12.3.3.3. Filament changeover setting “FL”

Selects whether selection of filament 1/2 is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.
Also the filament set on the front panel will be invalidated when operation is changed over to external I/O.

| Display | Detail |
|---|---|
| “0” | Operation of external I/O only |
| “1” | Setting of filament1 |
| “2” | Setting of filament2 |

12.3.3.4. Operation setting method

Press the program key to change over the set mode. Each press on the program key changes over the display as follows. If filament is on (local or remote), this unit cannot do filament setting, degas setting, and filament1/2 setting.



## 12.4. Connection with the Sensor Unit

The table below gives the pin assignment in connecting to the sensor unit.
In connecting to the sensor unit, it is recommended to connect all pins below.

* Connector for connection “SENSOR”: D-sub15 pin connector male, M2.6mm screw
* Connector for connection “BMR2”: D-sub15 pin connector female, M2.6mm screw

| “SENSOR” | Description | Detail | Sensor unit |
|---|---|---|---|
| 1 | 24VDC power supply | 24VDC power supply to the sensor unit | 1 |
| 2 | Pressure protection signal | Protection signal in excess of the higher limit of measurement is input | 2 |
| 4 | Emission valid*[1] | Emission valid signal is input | 4 |
| 5 | Filament on | Filament on signal is output | 5 |
| 6 | Filament1/2 changeover | Outputs filament1/2 changeover signal | 6 |
| 8 | Pressure signal input+ | Pressure signal is input | 8 |
| 9 | Power supply GND | Power supply GND to the sensor unit | 9 |
| 13 | Degas on | Degas on signal is output | 13 |
| 15 | Pressure signal input- | Pressure signal is input | 15 |
| Case | FG | Frame ground | Case |

*1: The emission valid signal is a signal indicating that emission current is flowing normally. The setpoint of this instrument is not actuated unless this signal is input.

## 12.5. Connection with External Devices

The table below gives the pin assignment in the connection to external devices.

* Connector for connection “I/O”: D-sub 15pin connector female, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 2 | Pressure protection signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 4 | Emission valid | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 5 | Filament on | Actuated when shorted to GND |
| 7 | Setpoint3 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | 0V to 10VDC |
| 9 | Signal GND | GND of pressure, burnout, setpoint, etc. |
| 10 | RS485- | Serial communication RS-485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 13 | Degas on | Actuated when shorted to GND |
| 15 | Signal GND | GND of pressure, burnout, setpoint, etc. |
| Case | FG | Frame ground |

## 12.6. Various Signals

### 12.6.1. Output voltage

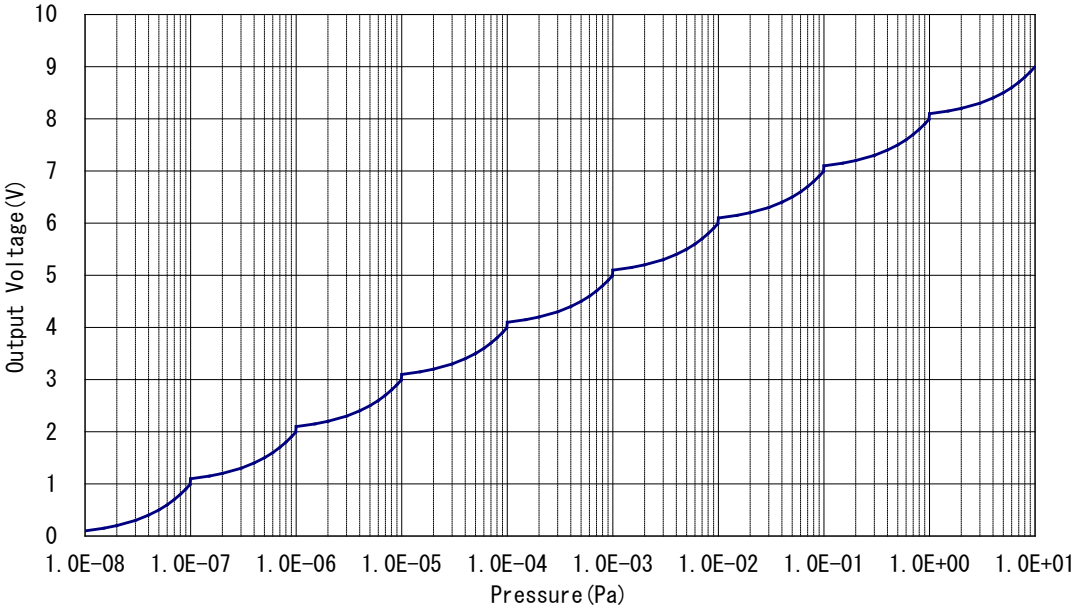
The output voltage is output with + [8pin] of the I/O connector → GND [15pin]
In case CAL function is enabled, the conversion formula is different from the above
The equation for converting pressure:

$$P = 10 \times ( V - E ) \times 10 \wedge ( E - 8 + C )$$

P: Pressure value
V: Measurement value output voltage (V)
E: Measured value output voltage from which decimal point is omitted
C: Exponent value of calculation value
(The value of C in $A.B \times 10^{C}$ , refer to section 18)

The (V-E) calculated value may become 0.1 or lower due to errors in the sensor's output voltage and errors with the measuring instrument. If it falls below 0.1 in this manner, we recommend rounding up to 0.1 and calculating.

| State | Measurement value output voltage |
|---|---|
| In normal measurement | Voltage corresponding to measured pressure |
| At above measurement higher limit | 9.9V or higher |
| At below measurement lower limit | 0.5V or less |
| When filament is off | 9.9V or higher |




### 12.6.2. Filament on signal

Signal that turns on the filament. To turn on the filament, connect it to GND with the external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

### 12.6.3. Degas on signal

Signal that turns on degassing. To turn it on, connect it to GND with the external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

### 12.6.4. Filament1/2 changeover signal

Signal that changes over filament1/2. To change it over to filament2, connect it to GND. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

12.6.5. Pressure protection signal

If the sensor unit exceeds the higher limit of measurement pressure, pressure protection will be actuated. If it is actuated, the open collector will be Lo output.

Photocoupler rating: $30V_{MAX}$, $50mA_{MAX}$, 70mW

For more information about pressure protection and actions in case of pressure protection signal being turned on, refer to the sensor unit manual.

12.6.6. Emission valid signal

When the emission current is flowing normally or not is output as a signal. If emission current is flowing normally, the open collector will be Lo output.

Photocoupler rating: $30V_{MAX}$, $50mA_{MAX}$, 70mW

For more information about the emission valid signal and corrective actions in case when the emission valid signal is turned off, refer to the sensor unit manual.

12.6.7. Setpoint

For how to adjust and use the setpoint, refer to section 7

Photocoupler rating: $30V_{MAX}$, $50mA_{MAX}$, 70mW

12.6.8. RS485 communication

For RS-485 communication, refer to section 22

# 13. MULTI IONIZATION GAUGE SH200-A/ST200-A/SH2-1/ST2-1

| | |
|---|---|
| ⚠CAUTION | **The support model of SH2-1 becomes manufacturing numbers after 06001**<br>If manufacturing number of SH2-1 is before **06001**, this unit may not output setpoints. |
| ⚠CAUTION | **The support model of ST2-1 becomes manufacturing numbers after 00901**<br>If manufacturing number of ST2-1 is before 00901, this unit may not output setpoints. |
| ⚠CAUTION | **We recommended a connection with the analog output type**<br>When connecting to the serial communication type SH200-R/ST200-R /SH2-2/ST2-2, FIL ON, etc., cannot be performed with the sensor. Depending on the cable connection, there is a risk of damage to the SH200-R/ST200-R /SH2-2/ST2-2. |
| ⚠CAUTION | **Sensor and SH200-A/ST200-A/SH2-1/ST2-1 connection cable**<br>The cable to connect the sensor and the SH200-A/ST200-A/SH2-1/ST2-1 has a maximum length of 40m for the 24AWG. To use the sensor with a cable longer than 40m, directly connect the SH200-A/ST200-A/SH2-1/ST2-1 to a power supply or increase the cable diameter. |

This section describes the operation of the multi ionization gauge SH200-A/ST200-A/SH2-1/ST2-1.

Before reading this section, read the standard operating procedure in the foregoing sections.

## 13.1. Sensor Unit Setting: “Sh2”

Turn on the power to this unit and make sure that “Sh2” lights for several seconds.

To display others, press the ⇧ key several times within 3sec after turning on power, change the display to “Sh2” and make it definite with the ⏎ key.

For more information about the sensor unit setting, refer to Section 6

## 13.2. Front Panel

### 13.2.1. Pressure display

| Status | Pressure indicator | LED |
|---|---|---|
| In normal measurement | $5.0\times10^{-8}$Pa to $1.0\times10^{+1}$Pa | |
| Below measurement pressure range | $0.0\times10^{-8}$Pa | |
| Above measurement pressure range and when pressure protection signal is input | Prt | |
| Above measurement pressure range and when pressure protection signal is not input | FiO | |
| When power is turned on | FiF | |
| Immediately after filament is turned on | FiO | |
| When degassing is on | Pressure indication | DEG is lit |
| When emission valid is off | Pressure indication | Err blinks |
| When sensor unit is not connected | - - - | Err lights |

*1: When a CALCULATION function is used, it displays to $10^{-11}$ at the minimum.
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”. Please note “b (B of small letter)” to make a mistake as '6' of the figure.

### 13.2.2. Description of front panel keys

| Inscription | Function | Remarks |
|---|---|---|
| PROG | Enters into program mode | Refer to Section 5 and this section |
| ZERO | Not used | |
| DEG | Degassing ON/OFF operation | Cannot be operated when RS-485 and external I/O are set |
| FIL | Filament ON/OFF operation | Cannot be operated when RS-485 and external I/O are set |

## 13.3. Setting Operation

### 13.3.1. Setting overview

The following settings are available for turning on the filament or degassing and for changing over the filament1/2.

| Setting | Overview |
|---|---|
| RS-485 communication mode | Only RS-485 communication is available |
| Front panel operation mode | Only front panel operation is available |
| External I/O operation mode | Only external I/O operation is available |

### 13.3.2. RS-485 communication operation setting “L1”, “L2”

Selects if filament ON/OFF, degassing ON/OFF or filament1/2 changeover is to be operated through RS-485 communication. Refer to Section 22 for more information about the detailed setting of RS-485.

| Display | Details | Remarks |
|---|---|---|
| “L1” | Operation on the front panel and external I/O | RS-485: Pressure reading only |
| “L2” | Only operation through RS-485 communication | |

### 13.3.3. Front panel, external I/O operation setting

#### 13.3.3.1. Filament operation setting “Fi”

Selects whether filament ON/OFF is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.

| Display | Detail |
|---|---|
| “F” | Operation on the front panel only |
| “o” | Operation of external I/O only |

#### 13.3.3.2. Degas operation setting “dE”

Selects whether degassing ON/OFF is to be operated on the front panel or with external I/O. This function will be invalidated if RS-485 communication is set.

| Display | Detail |
|---|---|
| “F” | Operation on front panel only |
| “o” | Operation of external I/O only |

#### 13.3.3.3. Filament changeover setting “FL”

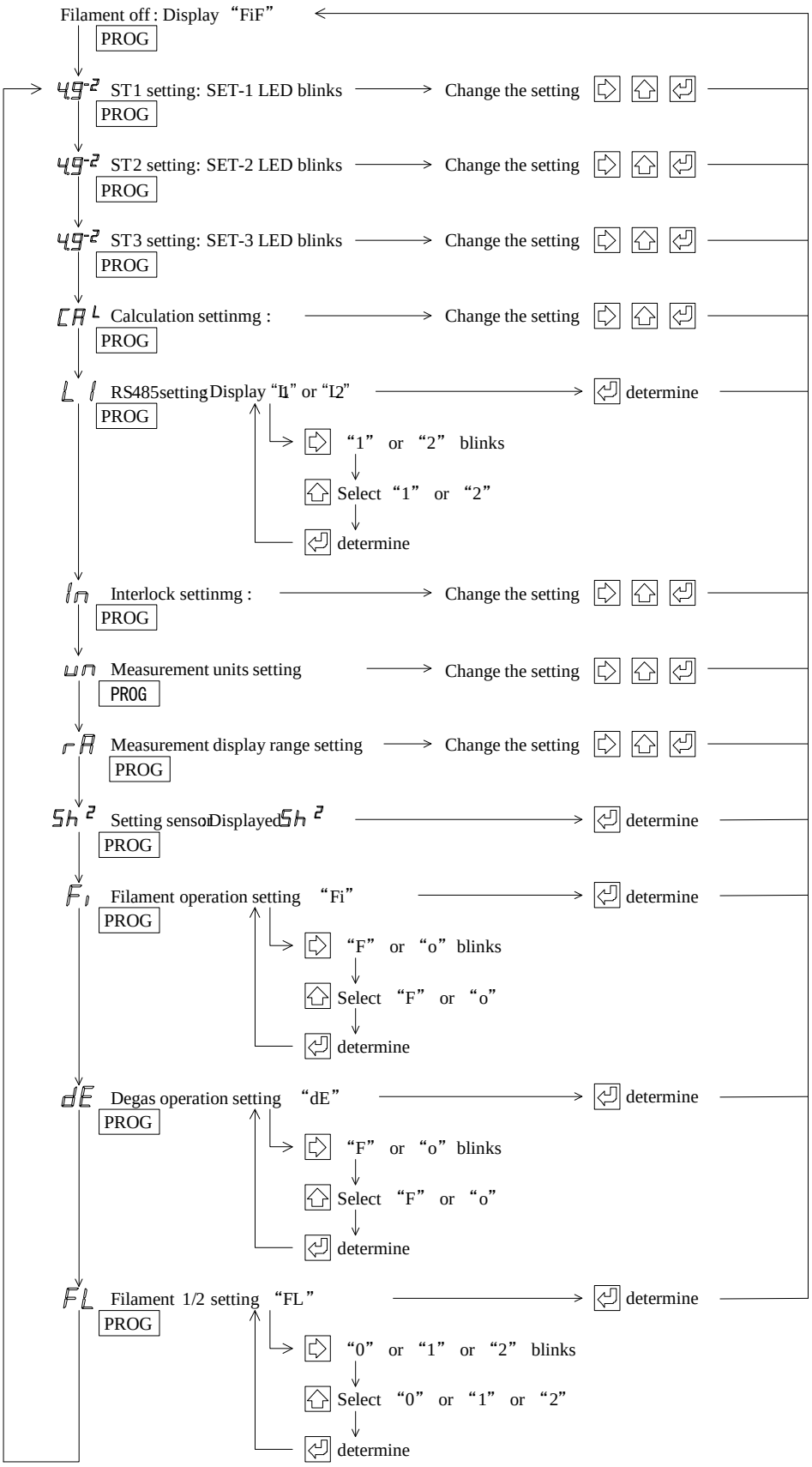
| | |
|---|---|
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Selects whether selection of filament1/2 is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.
Also the filament set on the front panel will be invalidated when operation is changed over to external I/O.

| Display | Detail |
|---|---|
| “0” | Operation of external I/O only |
| “1” | Setting of filament1 |
| “2” | Setting of filament2 |

13.3.3.4. Operation setting method

Press the program key to change over the set mode. Each press on the program key changes over the display as follows. If filament is on (local or remote), this unit cannot do filament setting, degas Setting, and filament1/2 setting.



## 13.4. Connection with the Sensor Unit

The table below gives the pin assignment in connecting to the sensor unit.
In connecting to the sensor unit, it is recommended to connect all pins below.

* Connector for connection “SENSOR”: D-sub 15pin connector pin, M2.6mm screw
* Connector for connection “SH200-A/ST200-A/SH2-1/ST2-1”: D-sub 15pin connector socket, M2.6mm screw

| “SENSOR” | Description | Detail | Sensor unit |
|---|---|---|---|
| 1 | DC24V power supply | DC24V power supply to the sensor unit | 1 |
| 2 | Pressure protect signal | Pressure protect signal is input | 2 |
| 4 | Emission valid[*1] | Emission valid is input | 4 |
| 5 | Filament off | Filament off signal is output | 5 |
| 6 | Filament1/2 changeover[*2] | Outputs filament1/2 changeover signal | 6 |
| - | FIL power monitor[*3] | Not used | 7 |
| 8 | Pressure signal input+ | Pressure signal is input | 8 |
| 9 | Power supply GND | Power supply GND to the sensor unit | 9 |
| 13 | Degas on | Degas on signal is output | 13 |
| 15 | Pressure signal input- | Pressure signal is input | 15 |
| Case | FG | Frame ground | Case |

*1: The emission valid signal is a signal indicating that the emission current is flowing normally. If this signal is not input, the set point of the instrument will not operate.
*2: Not use in ST200-A/ST2-1.
*3: This unit cannot use. The filament power monitor signal is a function that outputs a signal as on (low) when the power supplied to the filament of SH200-A/ST200-A/SH2-1/ST2-1 has exceed the specified value range.

## 13.5. Connection with External Devices

The table below gives the pin assignment in the connection to external devices.

* Connector for connection “I/O”: D-sub 15pin connector socket, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 2 | Pressure protection signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 4 | Emission valid | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | Filament on | Actuated when shorted to GND |
| 7 | Setpoint3 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 6 | Filament 1/2 changeover[*1] | Setting of Filament2 when shorted to GND |
| 8 | Pressure signal output+ | DC0V to 10V |
| 9 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS485+ output |
| 13 | Degas on | Actuated when shorted to GND |
| 15 | Signal GND | GND of pressure signal, filament disconnection signal, setpoint, etc. |
| Case | FG | Frame ground |

*1: Setting only firament1, if you used ST200-A/ST2-1.

## 13.6. Various Signals

### 13.6.1. Output voltage

The output voltage is output with + [8pin] of the I/O connector → GND [15pin]

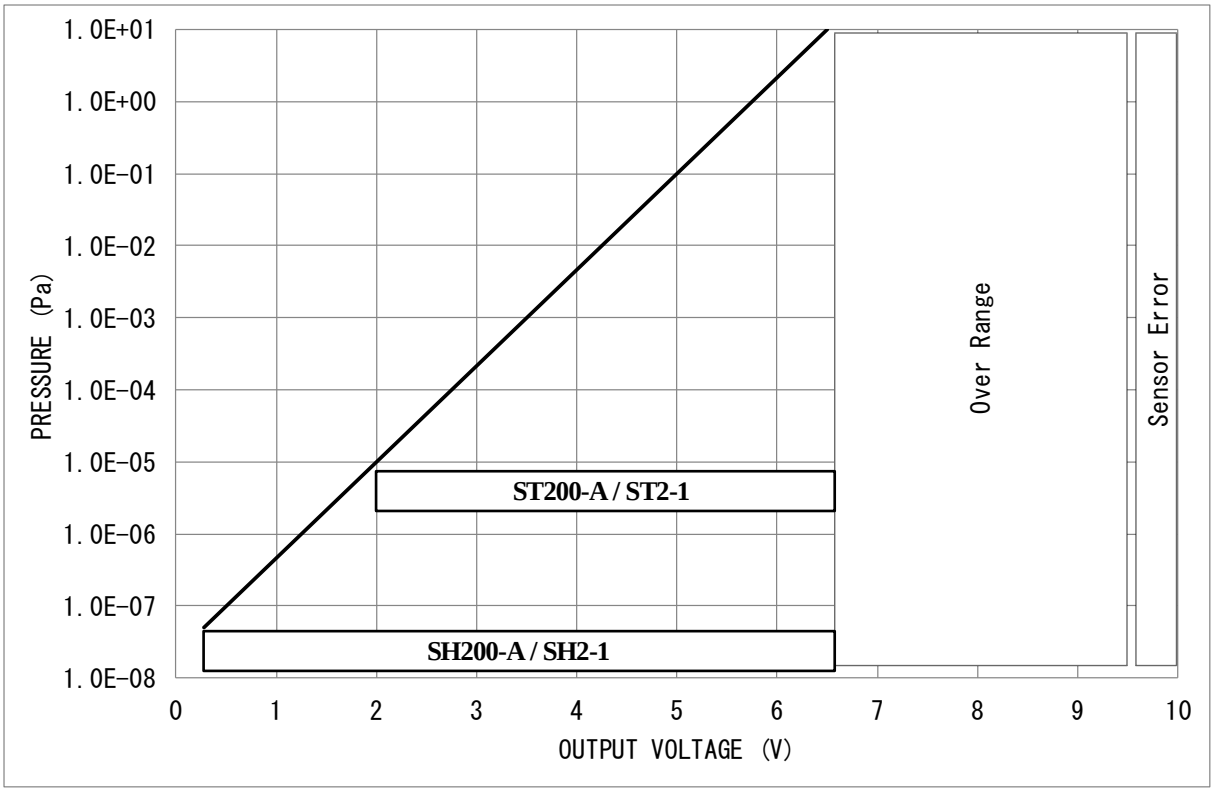
$$P = 10 \wedge \{ ( V - 7.25 ) / 0.75 + k \} \times C$$

$$\longleftrightarrow V = 7.25 + 0.75 \times \{ \log ( P / C ) - k \}$$

P: Pressure value
V: Measurement value output voltage (V)
C: Calculation value (Refer to below table or section 18)
k: Conversion factor (Refer to the table below)

| Measurement Unit | k | C |
|---|---|---|
| Pa | 2 | $1.0\times10^{+0}$ |
| Torr | -0.1249 | $7.5\times10^{-3}$ |
| mbar | 0 | $1.0\times10^{-2}$ |

| State | Measurement value output voltage |
|---|---|
| In normal measurement | Voltage corresponding to measured pressure 0.27V to 6.5V |
| At above measurement higher limit | 9.9V or higher |
| At below measurement lower limit | 0.25V or less |
| When filament is off | 9.9V or higher |




### 13.6.2. Filament on signal

Signal that turns on the filament. When turning on the filament by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

### 13.6.3. Degas on signal

Signal that turns on degassing. When turning on the degas by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

13.6.4. Filament1/2 changeover signal

| | |
|---|---|
| CAUTION | **Filament1/2 materials**<br>M-44/M-45/M-46: Both filament1 and filament2 are yttria-coated iridium wire.<br>M-34/M-35/M-36: Filament1 is a yttria-coated iridium wire.<br>Filament2 is a tungsten wire. |
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A /ST2-1 has only one filament. Setting only filament1. |

Signal that changes over filament1/2. To change it over to filament2, connect it to GND. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

13.6.5. Pressure protection signal

If the sensor unit exceeds the higher limit of measurement pressure, pressure protection will be actuated. If it is actuated, the open collector will be Lo output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

For more information about pressure protection and actions in case of pressure protection signal being turned on, refer to the sensor unit manual.

13.6.6. Emission valid signal

When the emission current is flowing normally or not is output as a signal. If emission current is flowing normally, the open collector will be Lo output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

If an emission error occurs during SH200-A/ST200-A/SH2-1/ST2-1 measurement, it can be released by turning off the SH200-A/ST200-A/SH2-1/ST2-1 filament.

For more information about the emission valid signal and corrective actions in case when the emission valid signal is turned off, refer to the sensor unit manual.

13.6.7. Setpoint

For how to adjust and use the setpoint, refer to section 7

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

13.6.8. RS-485 communication

For RS-485 communication, refer to section 22

# 14. MULTI-IONIZATION GAUGE SH200-A/ST200-A/SH2-1/ST2-1 (SPU combination mode)

| | |
|---|---|
| CAUTION | **The support model of SH2-1 becomes manufacturing numbers after 06001**<br>If manufacturing number of SH2-1 is before **06001**, this unit may not output setpoints. |
| CAUTION | **The support model of ST2-1 becomes manufacturing numbers after 00901**<br>If manufacturing number of ST2-1 is before 00901, this unit may not output setpoints. |
| CAUTION | **We recommended a connection with the standard type**<br>When connecting to the serial communication type SH200-R/ST200-R/SH2-2/ST2-2, FIL ON, etc., cannot be performed with the sensor. Depending on the cable connection, there is a risk of damage to the SH200-R/ST200-R/SH2-2/ST2-2. |
| CAUTION | **Sensor and SH200-A/ST200-A/SH2-1/ST2-1 connection cable**<br>The cable to connect the sensor and the SH200-A/ST200-A/SH2-1/ST2-1 has a maximum length of 40m for the 24AWG. To use the sensor with a cable longer than 40m, directly connect the SH200-A/ST200-A/SH2-1/ST2-1 to a power supply or increase the cable diameter. |

This section describes the operation of the multi ionization vacuum gauge SH200-A/ST200-A/SH2-1/ST2-1 (SPU combination mode). Before reading this section, read the standard operating procedure in the foregoing sections.

## 14.1. Sensor Unit Setting: “SPU”

Turn on the power to this unit and make sure that “SPU” lights for several seconds.

To display others, press the ⇧ key several times within 3sec after turning on power, change the display to “SPU” and make it definite with the ⏎ key.

For more information about the sensor unit setting, refer to section 6

## 14.2. Front Panel

### 14.2.1. Pressure display

| Status | Pressure indicator | LED |
|---|---|---|
| In normal measurement | $5.0 \times 10^{-8}$ Pa to $1.0\times 10^{+4}$ Pa | |
| Below measurement pressure range | $0.0 \times 10^{-8}$ Pa | |
| Above measurement pressure range | $F.F\times10^{+F}$Pa | |
| When error of SH200-A/ST200-A/SH2-1/ST2-1 (When error signal is input) | Pressure indication more than $1.0 \times 10^{-1}$ Pa | Err LED lights |
| When error of Pirani gauge (When error signal is input) | Err (Setpoints off) | Err LED lights |
| When error of Pirani gauge (When error signal is not input) | Err (Setpoints off) | |
| SH200-A/ST200-A/SH2-1/ST2-1 Emission valid off*1 | Display is pressure (Setpoints off) | Err LED blinks |
| When SH200-A/ST200-A/SH2-1/ST2-1 degassing is on | Pressure indication | DEG is lit |
| SH200-A/ST200-A/SH2-1/ST2-1 FIL OFF | Pressure indication more than $1.0 \times 10^{-1}$ Pa | |

*1: However, the error of SH200-A/ST200-A/SH2-1/ST2-1 is cleared by turning FIL off (Forced FIL OFF).

*: When a CALCULATION function is used, it displays to $10^{-11}$ at the minimum.
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”. Please note “b (B of small letter)” to make a mistake as '6' of the figure.

14.2.2. Description of front panel keys

| Inscription | Function | Remarks |
|---|---|---|
| PROG | Enters into program mode | Refer to Section 5 and this section |
| ZERO | Not used | |
| DEG | Degassing ON/OFF operation | Cannot be operated when RS-485 and external I/O are set |
| FIL | Filament forced off operation | Cannot be operated when RS-485 and external I/O are set |

## 14.3. Setting Operation

### 14.3.1. Setting Overview

The following settings are available for turning on the filament or degassing and for changing over the filament1/2.

| Setting | Overview |
|---|---|
| RS-485 communication mode | Only RS-485 communication is available. |
| Front panel operation mode | Only front panel operation is available. |
| External I/O operation mode | Only external I/O operation is available |

### 14.3.2. RS-485 communication operation setting “L1”, “L2”

Selects if filament off, degassing ON/OFF or filament1/2 changeover is to be operated through RS-485 communication. Refer to section 22 for more information about the detailed setting of RS-485.

| Display | Details | Remarks |
|---|---|---|
| “L1” | Operation on the front panel and external I/O | RS-485: Pressure reading only |
| “L2” | Only operation through RS-485 communication | |

### 14.3.3. Front panel, external I/O operation setting

#### 14.3.3.1. Filament operation setting “Fi”

Selects whether filament OFF is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.

| Display | Detail |
|---|---|
| “F” | Operation on the front panel only |
| “o” | Operation of external I/O only |

#### 14.3.3.2. Degas operation setting “dE”

Selects whether degassing ON/OFF is to be operated on the front panel or with external I/O. This function will be invalidated if RS-485 communication is set.

| Display | Detail |
|---|---|
| “F” | Operation on front panel only |
| “o” | Operation of external I/O only |

#### 14.3.3.3. Filament changeover setting “FL”

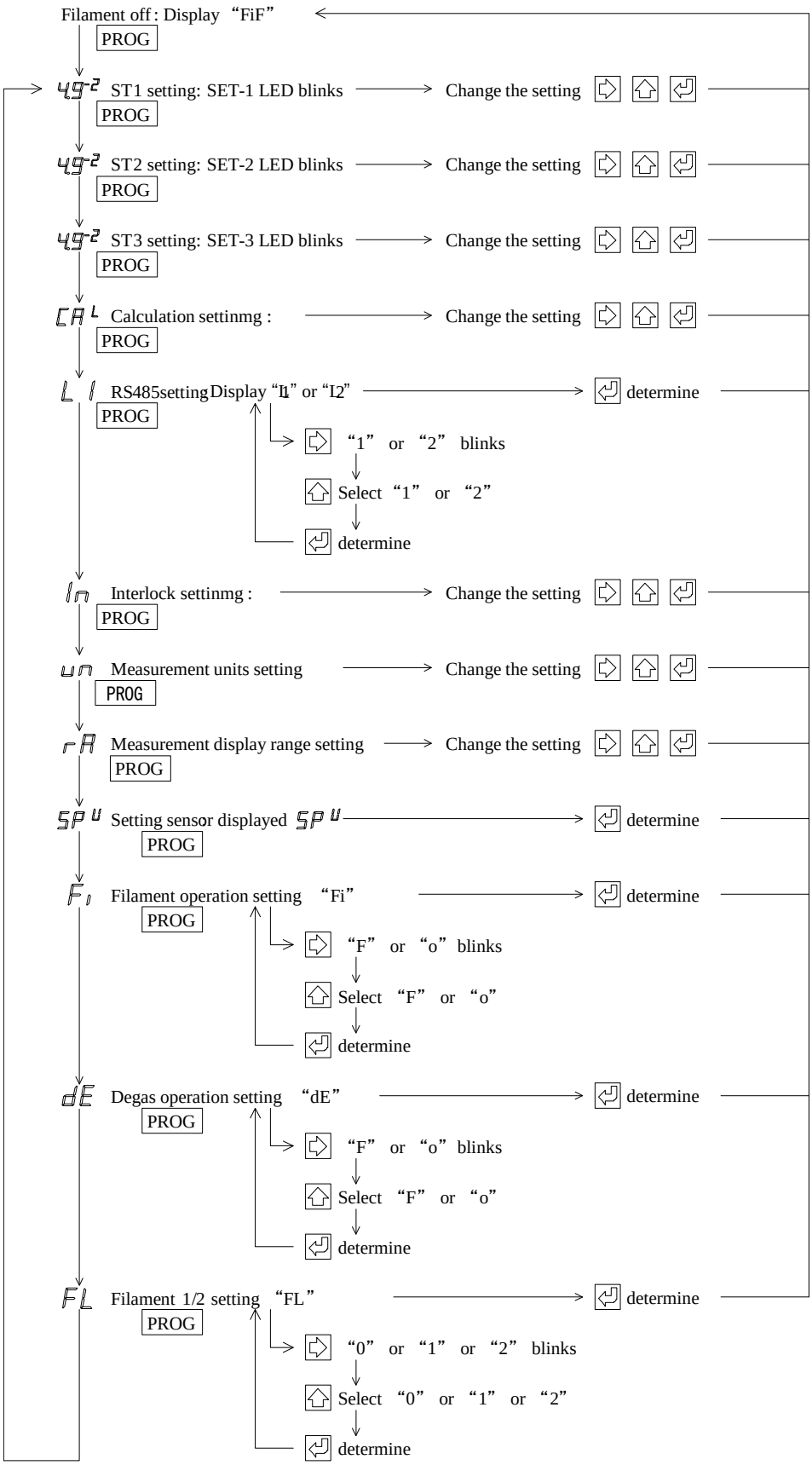
| | |
|---|---|
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Selects whether selection of filament 1/2 is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.
Also the filament set on the front panel will be invalidated when operation is changed over to external I/O.

| Display | Detail |
|---|---|
| “0” | Operation of external I/O only |
| “1” | Setting of filament 1 |
| “2” | Setting of filament 2 |

14.3.3.4. Operation setting method

Press the program key to change over the set mode. Each press on the program key changes over the display as follows. If filament is on (local or remote), this unit cannot do filament setting, degas setting, and filament1/2 setting.



## 14.4. Connection with the Sensor Unit

The table below gives the pin assignment in connecting to the sensor unit.
In connecting to the sensor unit, it is recommended to connect all pins below.

* Connector for connection “SENSOR”: D-sub 15pin connector pin, M2.6mm screw
* Connector for connection “SH200-A/ST200-A/SH2-1/ST2-1”: D-sub15 pin connector socket, M2.6mm screw

| “SENSOR” | Description | Detail | Sensor unit |
|---|---|---|---|
| 1 | DC24V power supply | DC24V power supply to the sensor unit | 1 |
| 2 | Error signal | Error signal is input. | 2 |
| 4 | Emission valid*1 | Emission valid is input | 4 |
| 5 | Filament off | Filament off signal is output. | 5 |
| 6 | Filament1/2 changeover*3 | Outputs filament1/2 changeover signal. | 6 |
| - | FIL power monitor*3 | Not used | 7 |
| 8 | Pressure signal input+ | Pressure signal is input. | 8 |
| 9 | Power supply GND | Power supply GND to the sensor unit | 9 |
| 13 | Degas on | Degas on signal is output. | 13 |
| 15 | Pressure signal input- | Pressure signal is input. | 15 |
| Case | FG | Frame ground | Case |

*1: The emission valid signal is a signal indicating that the emission current is flowing normally. If this signal is not input, the set point of the instrument will not operate.
*2: Not use in ST200-A/ST2-1.
*3: This unit cannot use. The filament power monitor signal is a function that outputs a signal as on (low) when the power supplied to the filament of SH200-A/ST200-A/SH2-1/ST2-1 has exceed the specified value range.

## 14.5. Connection with External Devices

The table below gives the pin assignment in the connection to external devices.

* Connector for connection “I/O”: D-sub 15pin connector socket, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 2 | Error signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 4 | Emission valid | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | Filament on | Actuated when shorted to GND |
| 6 | Filament1/2 changeover*1 | Input a signal when selecting FIL2 |
| 7 | Setpoint3 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | DC0V to 10V |
| 9 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS485+ output |
| 13 | Degas on | Actuated when shorted to GND |
| 15 | Signal GND | GND of pressure signal, filament disconnect signal, setpoint, etc. |
| Case | FG | Frame ground |

*1: Setting only firament1, if you used ST200-A/ST2-1.

## 14.6. Various Signals

### 14.6.1. Output voltage

The output voltage is output with + [8pin] of the I/O connector → GND [15pin]

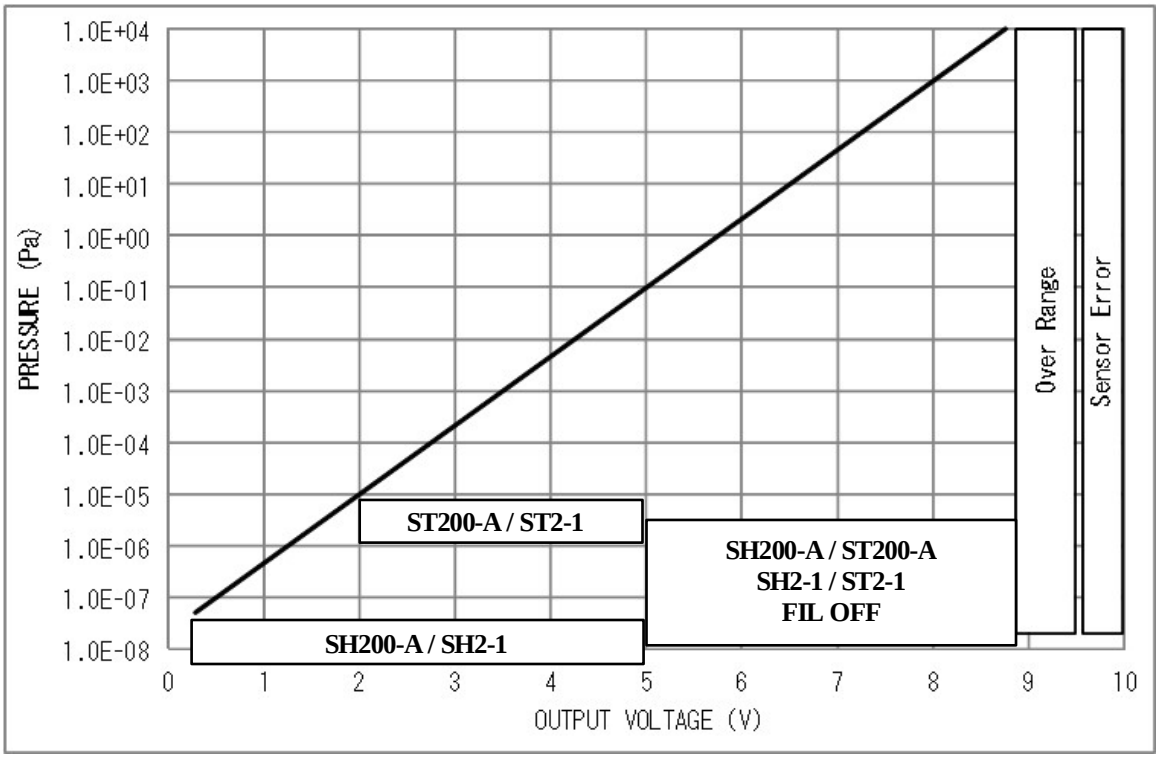
$$P = 10 \wedge \{ ( V - 7.25 ) / 0.75 + k \} \times C$$

$$\longleftrightarrow \quad V = 7.25 + 0.75 \times \{ \log ( P / C ) - k \}$$

P: Pressure value
V: Measurement value output voltage (V)
C: Calculation value (Refer to below table or section 18)
k: Conversion factor (Refer to the table below)

| Measurement Unit | k | C |
|---|---|---|
| Pa | 2 | $1.0\times10^{+0}$ |
| Torr | -0.1249 | $7.5\times10^{-3}$ |
| mbar | 0 | $1.0\times10^{-2}$ |

| Operating state | Analog output voltage |
|---|---|
| During normal measurements | Voltage corresponding to the measured pressure 0.27V to 8.75V |
| $1x10^{+4}$ Pa or higher | 8.75V |
| SH200-A/ST200-A/SH2-1/ST2-1 gauge FIL OFF | Voltage corresponding to the measured by SPU 5V to 8.75V |
| SH200-A/ST200-A/SH2-1/ST2-1 error (Errors such as a filament disconnection) | Voltage corresponding to the measured by SPU 5V to 8.75V |
| SPU error (Errors such as a filament disconnection) | 9.9V or higher |
| Power supply voltage abnormality, sensor unit fault, etc. | 0.1V or less |




### 14.6.2. Filament off signal

Signal that turns off the filament. When turning on the filament by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

14.6.3. Degas on signal

Signal that turns on degassing. When turning on the degas by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

14.6.4. Filament1/2 changeover signal

| | |
|---|---|
| CAUTION | **Filament1/2 materials**<br>M-44/M-45/M-46: Both filament1 and filament2 are yttria-coated iridium wire.<br>M-34/M-35/M-36: Filament1 is a yttria-coated iridium wire.<br>Filament2 is a tungsten wire. |
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Signal that changes over filament1/2. To change it over to filament2, connect it to GND. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

14.6.5. Sensor error signal

Sensor errors are signals that are output when an error occurs on sensor units.

When SH200-A/ST200-A/SH2-1/ST2-1 is error, this unit displays pressure of Pirani gauge. When Pirani gauge is error, this unit displays “Err”.

When a sensor error occurs, the signal becomes low output

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

For more information about sensor error and actions in case of sensor error signal being turned on, refer to the sensor unit manual.

14.6.6. Emission valid signal

When the emission current is flowing normally or not is output as a signal. If emission current is flowing normally, the open collector will be Lo output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

If an emission error occurs during SH200-A/ST200-A/SH2-1/ST2-1measurement, it can be released by forcibly turning off the SH200-A/ST200-A/SH2-1/ST2-1 filament.

For details of this signal and what to do when this signal is turned off, refer to the instruction manual of the sensor unit.

14.6.7. Setpoint

For how to adjust and use the setpoint, refer to section 7.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

14.6.8. RS-485 communication

For RS-485 communication, refer to section 22

# 15. Multi Ionization Gauge SH200-A/ST200-A/SH2-1/ST2-1 (SAU combination mode)

| | |
|---|---|
| ⚠CAUTION | **<u>The support model of SH2-1 becomes manufacturing numbers after 06001</u>**<br>If manufacturing number of SH2-1 is before **06001**, this unit may not output setpoints. |
| ⚠CAUTION | **<u>The support model of ST2-1 becomes manufacturing numbers after 00901</u>**<br>If manufacturing number of ST2-1 is before 00901, this unit may not output setpoints. |
| ⚠CAUTION | **<u>We recommended a connection with the analog output type</u>**<br>When connecting to the serial communication type SH200-R/ST200-R/SH2-2/ST2-2, FIL ON, etc. cannot be performed with the sensor. Depending on the cable connection, there is a risk of damage to the multi ionization gauge SH200-R/ST200-R/SH2-2/ST2-2. |
| ⚠CAUTION | **<u>ISG1 and SH200-A/ST200-A/SH2-1/ST2-1 connection cable</u>**<br>The cable to connect the sensor and the SH200-A/ST200-A/SH2-1/ST2-1 has a maximum length of 40m for the 24AWG. To use the sensor with a cable longer than 40m, directly connect the SH200-A/ST200-A/SH2-1/ST2-1 to a power supply or increase the cable diameter. |

This section describes the operation of the SH200-A/ST200-A/SH2-1/ST2-1 (SAU combination mode). Before reading this section, read the standard operating procedure in the foregoing sections.

## 15.1. Sensor Unit Setting: “SAU”

Turn on the power to this unit and make sure that “SAU” lights for several seconds.

To display others, press the ⇧ key several times within 3sec after turning on power, change the display to “SAU” and make it definite with the ⏎ key.

For more information about the sensor unit setting, refer to section 6.

## 15.2. Front Panel

### 15.2.1. Pressure display

| Status | Pressure indicator | LED |
|---|---|---|
| In normal measurement | $5.0\times10^{-8}$ Pa to $1.0\times10^{+5}$ Pa | |
| Below measurement pressure range | $0.0\times10^{-8}$ Pa | |
| Above measurement pressure range | $F.F\times10^{+F}$ Pa | |
| When error of SH200-A/ST200-A/SH2-1/ST2-1 (When error signal is input) | Pressure indication more than $1.0\times10^{-1}$ Pa | Err LED lights |
| When error of SWU10-R/SPU (When error signal is input) | Pressure indication more than $1.0\times10^{+4}$ Pa | Err LED lights |
| When error of SWU10-R/SPU (When error signal is input) | Err (Setpoints off) | Err LED lights |
| When error of SAU (When error signal is not input) | Err (Setpoints off) | Err LED off |
| SH200-A/ST200-A/SH2-1/ST2-1 emission valid off *1 | Display is pressure (Setpoints off) | Err LED blinking |
| When SH200-A/ST200-A/SH2-1/ST2-1 degassing is on | Pressure indication | DEG LED lights |
| SH200-A/ST200-A/SH2-1/ST2-1 FIL OFF | Pressure indication more than $1.0\times10^{-1}$ Pa | ZERO LED lights |

*1: However, the error of SH200-A/ST200-A/SH2-1/ST2-1 is cleared by turning FIL off (Forced FIL OFF).

*: When a CALCULATION function is used, it displays to $10^{-11}$ at the minimum.
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”. Please note “b (B of small letter)” to make a mistake as '6' of the figure.

15.2.2. Description of front panel keys

| Inscription | Function | Remarks |
|---|---|---|
| PROG | Enters into program mode | Refer to section 5 and this section |
| ZERO | Not used | |
| DEG | Degassing ON/OFF operation | Cannot be operated when RS485 and external I/O are set |
| FIL | Filament off operation | Cannot be operated when RS485 and external I/O are set |

15.3. Setting Operation

15.3.1. Setting overview

The following settings are available for turning on the filament or degassing and for changing over the filament1/2.

| Setting | Overview |
|---|---|
| RS-485 communication mode | Only RS-485 communication is available. |
| Front panel operation mode | Only front panel operation is available. |
| External I/O operation mode | Only external I/O operation is available |

15.3.2. RS-485 communication operation setting “L1”, “L2”

Selects if filament OFF, degassing ON/OFF or filament1/2 changeover is to be operated through RS-485 communication. Refer to section 22 for more information about the detailed setting of RS-485.

| Display | Details | Remarks |
|---|---|---|
| “L1” | Operation on the front panel and external I/O | RS-485: Pressure reading only |
| “L2” | Only operation through RS-485 communication | |

15.3.3. Front panel, external I/O operation setting

15.3.3.1. Filament operation setting “Fi”

Selects whether filament off is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.

| Display | Detail |
|---|---|
| “F” | Operation on the front panel only |
| “o” | Operation of external I/O only |

15.3.3.2. Degas operation setting “dE”

Selects whether degassing ON/OFF is to be operated on the front panel or with external I/O. This function will be invalidated if RS-485 communication is set.

| Display | Detail |
|---|---|
| “F” | Operation on front panel only |
| “o” | Operation of external I/O only |

15.3.3.3. Filament changeover setting “FL”

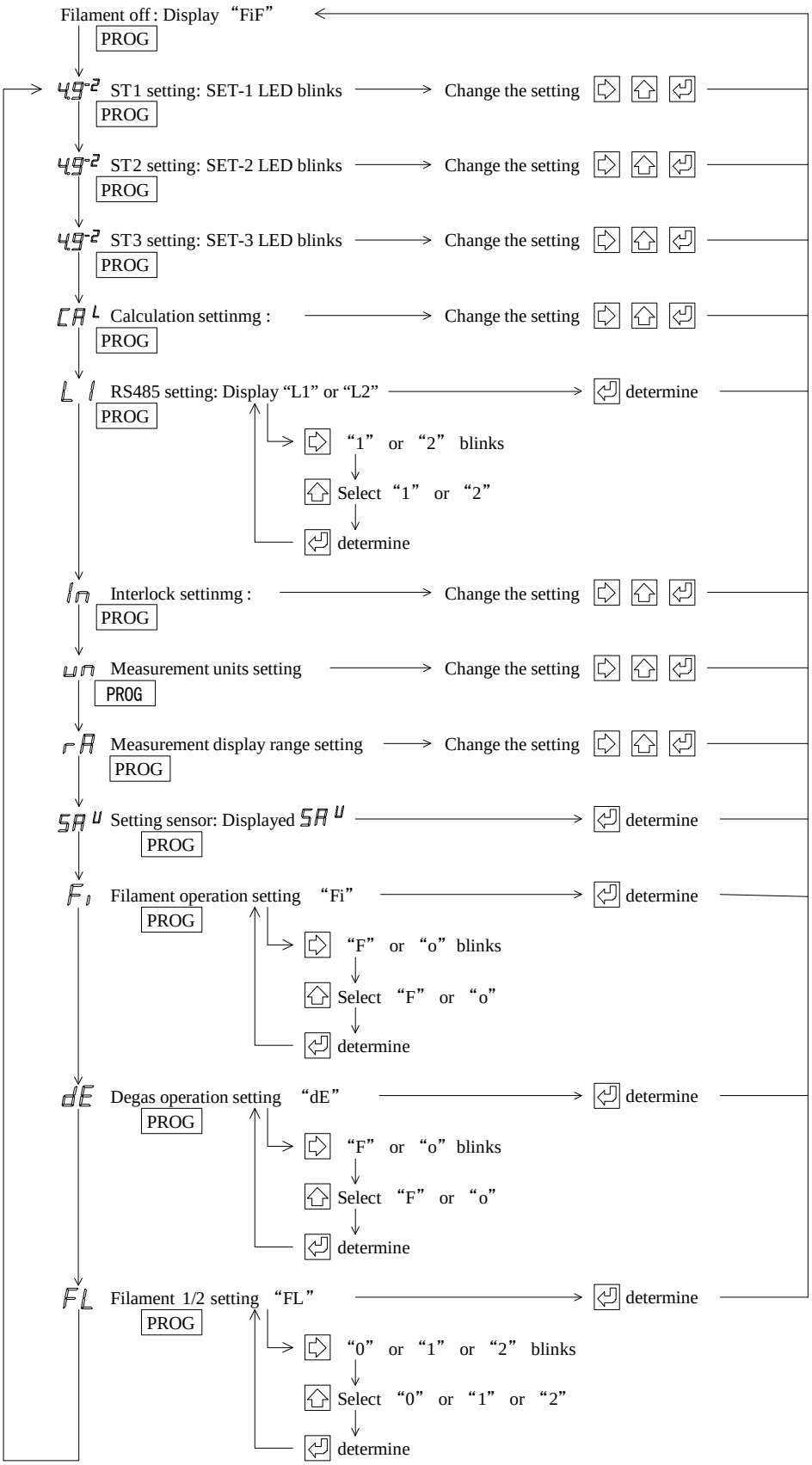
| | |
|---|---|
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Selects whether selection of filament1/2 is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.
Also the filament set on the front panel will be invalidated when operation is changed over to external I/O.

| Display | Detail |
|---|---|
| “0” | Operation of external I/O only |
| “1” | Setting of filament1 |
| “2” | Setting of filament2 |

15.3.3.4. Operation setting method

Press the program key to change over the set mode. Each press on the program key changes over the display as follows. If filament is on (local or remote), this unit cannot do filament setting, degas Setting, and filament1/2 setting.



## 15.4. Connection with the Sensor Unit

The table below gives the pin assignment in connecting to the sensor unit.
In connecting to the sensor unit, it is recommended to connect all pins below.

* Connector for connection “SENSOR”: D-sub 15pin connector pin, M2.6mm screw
* Connector for connection “SH200-A/ST200-A/SH2-1/ST2-1”: D-sub 15pin connector socket, M2.6mm screw

| “SENSOR” | Description | Detail | Sensor unit |
|---|---|---|---|
| 1 | DC24V power supply | DC24V power supply to the sensor unit | 1 |
| 2 | Error signal | Error signal is input. | 2 |
| 4 | Emission valid*1 | Emission valid is input | 4 |
| 5 | Filament on | Filament on signal is output. | 5 |
| 6 | Filament1/2 changeover*2 | Outputs filament1/2 changeover signal. | 6 |
| - | FIL power monitor*3 | Not use | 7 |
| 8 | Pressure signal input | Pressure signal is input. | 8 |
| 9 | Power supply GND | Power supply GND to the sensor unit | 9 |
| 13 | Degas on | Degas on signal is output. | 13 |
| 15 | GND | GND of pressure signal and each signal | 15 |
| Case | FG | Frame ground | Case |

*1: The emission valid signal is a signal indicating that the emission current is flowing normally. If this signal is not input, the set point of the instrument will not operate.
*2: Not use in ST200-A/ST2-1.
*3: This unit cannot use. The filament power monitor signal is a function that outputs a signal as on (low) when the power supplied to the filament of SH200-A/ST200-A/SH2-1/ST2-1 has exceed the specified value range.

## 15.5. Connection with External Devices

The table below gives the pin assignment in the connection to external devices.

* Connector for connection “I/O”: D-sub 15pin connector socket, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 2 | Error signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 4 | Emission valid | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | Filament on | Actuated when shorted to GND |
| 6 | Filament1/2 changeover*1 | Input a signal when selecting FIL2 |
| 7 | Setpoint3 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | DC0V to 10 V |
| 9 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS-485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 13 | Degas ON | Actuated when shorted to GND |
| 15 | GND | GND of pressure signal, burnout signal, setpoint, etc. |
| Case | FG | Frame ground |

*1: Setting only firament1, if you used ST200-A/ST2-1.

## 15.6. Various Signals

### 15.6.1. Output voltage

The output voltage is output with + [8pin] of the I/O connector → GND [15pin]

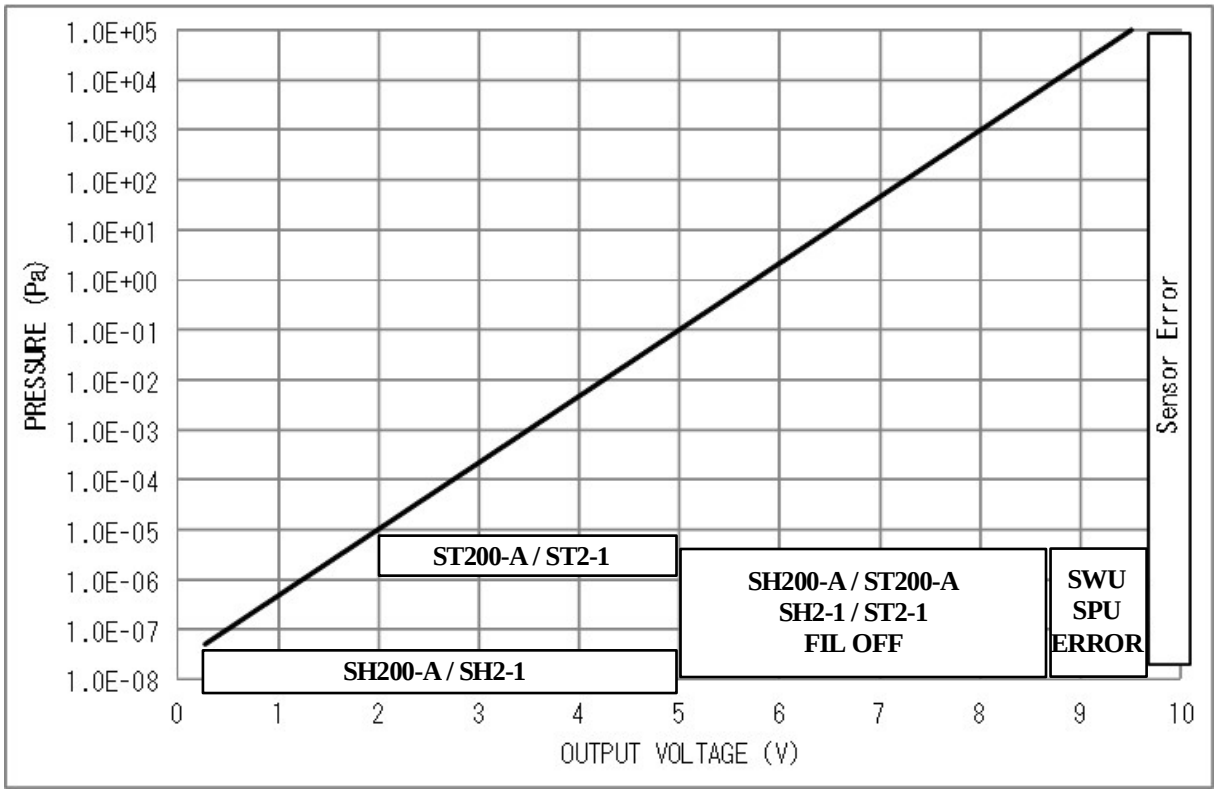
$$P = 10 \wedge \{ ( V - 7.25 ) / 0.75 + k \} \times C$$

$$\longleftrightarrow \quad V = 7.25 + 0.75 \times \{ \log ( P / C ) - k \}$$

P: Pressure value
V: Measurement value output voltage (V)
C: Calculation value (Refer to section18)
k: Conversion factor (Refer to the table below)

| Measurement Unit | k |
|---|---|
| Pa | 2 |
| Torr | -0.1249 |
| mbar | 0 |

| Operating state | Analog output voltage |
|---|---|
| During normal measurements | Voltage corresponding to the measured pressure<br>0.27V to 9.5V |
| Atmospheric pressure or higher | 9.5V |
| SH200-A/ST200-A/SH2-1/ST2-1 FIL OFF | Voltage corresponding to the measured by SWU/SPU and SAU<br>5V to 9.5V |
| SH200-A/ST200-A/SH2-1/ST2-1 error<br>(Errors such as a filament break) | Voltage corresponding to the measured by SWU/SPU and SAU<br>5V to 9.5V |
| SWU/ SPU error<br>(Errors such as a filament break) | Voltage corresponding to the measured by SAU<br>8.677V to 9.5V |
| SAU error<br>(Errors such as a filament break) | 9.9V or higher |
| Power supply voltage abnormality, sensor unit fault, etc. | 0.1V or less |



15.6.2. ilament off signal

Signal that turns off the filament. When turning on the filament by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

15.6.3. Degas on signal

Signal that turns on degassing. When turning on the degas by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

15.6.4. Filament1/2 changeover signal

| | |
|---|---|
| CAUTION | **Filament1/2 materials**<br>M-44/M-45/M-46: Both filament1 and filament2 are yttria-coated iridium wire.<br>M-34/M-35/M-36: Filament1 is a yttria-coated iridium wire.<br>Filament2 is a tungsten wire. |
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Signal that changes over filament1/2. To change it over to filament2, connect it to GND. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

15.6.5. Sensor error signal

Sensor errors are signals that are output when an error occurs on sensor units.

When SH200-A/ST200-A/SH2-1/ST2-1 is error, this unit displays pressure of Pirani gauge. When Pirani gauge is error, this unit displays “Err”

When a sensor error occurs, the signal becomes low output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

For more information about sensor error and actions in case of sensor error signal being turned on, refer to the sensor unit manual.

15.6.6. Emission valid signal

When the emission current is flowing normally or not is output as a signal. If emission current is flowing normally, the open collector will be Lo output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

If an emission error occurs during SH200-A/ST200-A/SH2-1/ST2-1measurement, it can be released by forcibly turning off the SH200-A/ST200-A/SH2-1/ST2-1 filament.

For details of this signal and what to do when this signal is turned off, refer to the instruction manual of the sensor unit.

15.6.7. Setpoint

For how to adjust and use the setpoint, refer to section 7.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

15.6.8. RS-485 communication

For RS-485 communication, refer to section 22.

# 16. MULTI IONIZATION GAUGE SH200-A/ST200-A/SH2-1/ST2-1 (SWU combination mode)

| | |
|---|---|
| CAUTION | **The support model of SH2-1 becomes manufacturing numbers after 06001**<br>If manufacturing number of SH2-1 is before 06001, this unit may not output setpoints. |
| CAUTION | **The support model of ST2-1 becomes manufacturing numbers after 00901**<br>If manufacturing number of ST2-1 is before 00901, this unit may not output setpoints. |
| CAUTION | **We recommended a connection with the analog output type**<br>When connecting to the serial communication type SH200-R/ST200-R/SH2-2/ST2-2, FIL ON, etc. cannot be performed with the sensor. Depending on the cable connection, there is a risk of damage to the multi ionization gauge SH200-R/ST200-R/SH2-2/ST2-2. |
| CAUTION | **Sensor and SH200-A/ST200-A/SH2-1/ST2-1 connection cable**<br>The cable to connect the sensor and the SH200-A/ST200-A/SH2-1/ST2-1 has a maximum length of 40m for the 24AWG. To use the sensor with a cable longer than 40m, directly connect the SH200-A/ST200-A/SH2-1/ST2-1 to a power supply or increase the cable diameter. |

This section describes the operation of the SH200-A/ST200-A/SH2-1/ST2-1 (SWU combination mode). Before reading this section, read the standard operating procedure in the foregoing sections.

## 16.1. Sensor Unit Setting: “SAU”

Turn on the power to this unit and make sure that “SAU” lights for several seconds.

To display others, press the ⇧ key several times within 3sec after turning on power, change the display to “SAU” and make it definite with the ⏎ key.

For more information about the sensor unit setting, refer to Section 6.

## 16.2. Front Panel

### 16.2.1. Pressure display

| Status | Pressure indicator | LED |
|---|---|---|
| In normal measurement | $5.0\times10^{-8}$ Pa to $1.0\times10^{+5}$ Pa | |
| Below measurement pressure range | $0.0\times10^{-8}$ Pa | |
| Above measurement pressure range | $F.F\times10^{+F}$Pa | |
| When error of SH200-A/ST200-A/SH2-1/ST2-1<br>(When error signal is input) | Pressure indication more than $1.0\times10^{-1}$ Pa | Err LED lights |
| When error of SWU<br>(When error signal is input) | Err<br>(Setpoints off) | Err LED lights |
| When error of SWU<br>(When error signal is not input) | Err<br>(Setpoints off) | |
| SH200-A/ST200-A/SH2-1/ST2-1 emission valid OFF *1 | Display is pressure<br>(Setpoints off) | Err LED blinking |
| When SH200-A/ST200-A/SH2-1/ST2-1 degassing is on | Pressure indication | DEG is lit |
| SH200-A/ST200-A/SH2-1/ST2-1 FIL off | Pressure indication more than $1.0\times10^{-1}$ Pa | |

*1: However, the error of SH200-A/ST200-A/SH2-1/ST2-1 is cleared by turning FIL off (Forced FIL OFF).

*: When a CALCULATION function is used, it displays to $10^{-11}$ at the minimum.
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”. Please note “b (B of small letter)” to make a mistake as '6' of the figure.

16.2.2. Description of front panel keys

| Inscription | Function | Remarks |
|---|---|---|
| PROG | Enters into program mode | Refer to section 5 and this section |
| ZERO | Not used | |
| DEG | Degassing ON/OFF operation | Cannot be operated when RS485 and external I/O are set |
| FIL | Filament off operation | Cannot be operated when RS485 and external I/O are set |

16.3. Setting Operation

16.3.1. Setting overview

The following settings are available for turning on the filament or degassing and for changing over the filament1/2.

| Setting | Overview |
|---|---|
| RS-485 communication mode | Only RS-485 communication is available |
| Front panel operation mode | Only front panel operation is available |
| External I/O operation mode | Only external I/O operation is available |

16.3.2. RS-485 communication operation setting “L1”, “L2”

Selects if filament off, degassing ON/OFF or filament1/2 changeover is to be operated through RS-485 communication. Refer to section 22 for more information about the detailed setting of RS-485.

| Display | Details | Remarks |
|---|---|---|
| “L1” | Operation on the front panel and external I/O | RS-485: Pressure reading only |
| “L2” | Only operation through RS-485 communication | |

16.3.3. Front panel, external I/O operation setting

16.3.3.1. Filament operation setting “Fi”

Selects whether filament OFF is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.

| Display | Detail |
|---|---|
| “F” | Operation on the front panel only |
| “o” | Operation of external I/O only |

16.3.3.2. Degas operation setting “dE”

Selects whether degassing ON/OFF is to be operated on the front panel or with external I/O. This function will be invalidated if RS-485 communication is set.

| Display | Detail |
|---|---|
| “F” | Operation on front panel only |
| “o” | Operation of external I/O only |

16.3.3.3. Filament changeover setting “FL”

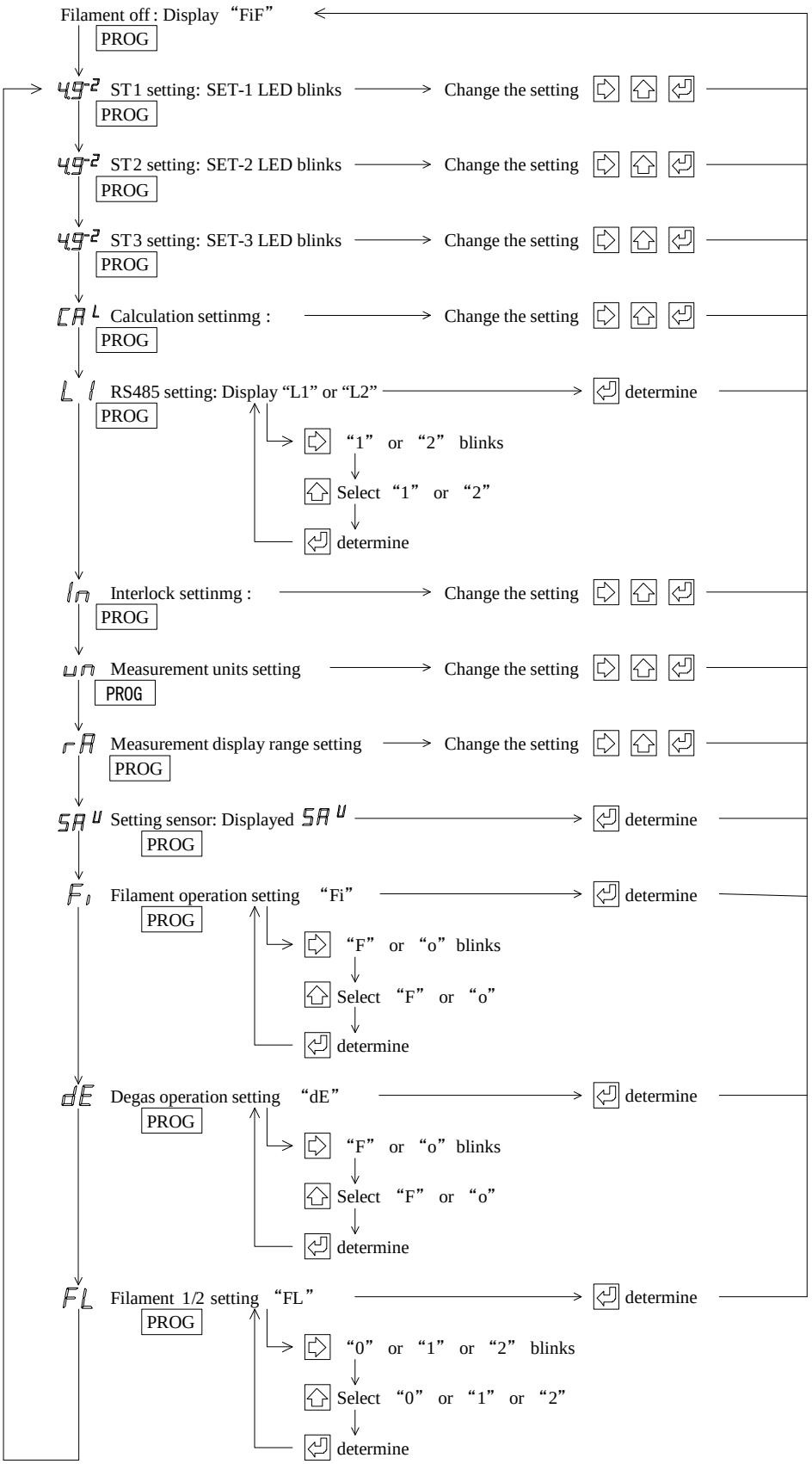
| | |
|---|---|
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Selects whether selection of filament1/2 is to be operated on the front panel or with external I/O.
This function will be invalidated if it is set at RS-485 communication.
Also the filament set on the front panel will be invalidated when operation is changed over to external I/O.

| Display | Detail |
|---|---|
| “0” | Operation of external I/O only |
| “1” | Setting of filament1 |
| “2” | Setting of filament2 |

16.3.3.4. Operation setting method

Press the program key to change over the set mode. Each press on the program key changes over the display as follows. If filament is on (local or remote), this unit cannot do filament setting, degas setting, and filament1/2 setting.



16.4. Connection with the Sensor Unit

The table below gives the pin assignment in connecting to the sensor unit.
In connecting to the sensor unit, it is recommended to connect all pins below.

* Connector for connection “SENSOR”: D-sub 15pin connector pin, M2.6mm screw
* Connector for connection “SH200-A/ST200-A/SH2-1/ST2-1”: D-sub15pin connector socket, M2.6mm screw

| “SENSOR” | Description | Detail | Sensor unit |
|---|---|---|---|
| 1 | DC24V power supply | DC24V power supply to the sensor unit | 1 |
| 2 | Error signal | Error signal is input. | 2 |
| 4 | Emission valid*1 | Emission valid is input | 4 |
| 5 | Filament off | Filament off signal is output. | 5 |
| 6 | Filament1/2 changeover*2 | Outputs filament1/2 changeover signal. | 6 |
| - | FIL power monitor*3 | Not used | 7 |
| 8 | Pressure signal input+ | Pressure signal is input. | 8 |
| 9 | Power supply GND | Power supply GND to the sensor unit | 9 |
| 13 | Degas on | Degas on signal is output. | 13 |
| 15 | Pressure signal input- | Pressure signal is input. | 15 |
| Case | FG | Frame ground | Case |

*1: The emission valid signal is a signal indicating that the emission current is flowing normally. If this signal is not input, the set point of the instrument will not operate.
*2: Not use in ST200-A/ST2-1.
*3: This unit cannot use. The filament power monitor signal is a function that outputs a signal as on (low) when the power supplied to the filament of SH200-A/ST200-A/SH2-1/ST2-1 has exceed the specified value range.

16.5. Connection with External Devices

The table below gives the pin assignment in the connection to external devices.

* Connector for connection “I/O”: D-sub 15pin connector socket, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 2 | Error signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 3 | Setpoint1 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 4 | Emission valid | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 5 | Filament on | Actuated when shorted to GND |
| 6 | Filament1/2 changeover*1 | Input a signal when selecting FIL2 |
| 7 | Setpoint3 actuating signal | Lo when actuated, DC 30$VDC_{MAX}$, 50$mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | DC0V to 10V |
| 9 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| 10 | RS485- | Serial communication R-S485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 13 | Degas on | Actuated when shorted to GND |
| 15 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| Case | FG | Frame ground |

*1: Setting only firament1, if you used ST200-A/ST2-1.

## 16.6. Various Signals

### 16.6.1. Output voltage

The output voltage is output with + [8pin] of the I/O connector → GND [15pin]

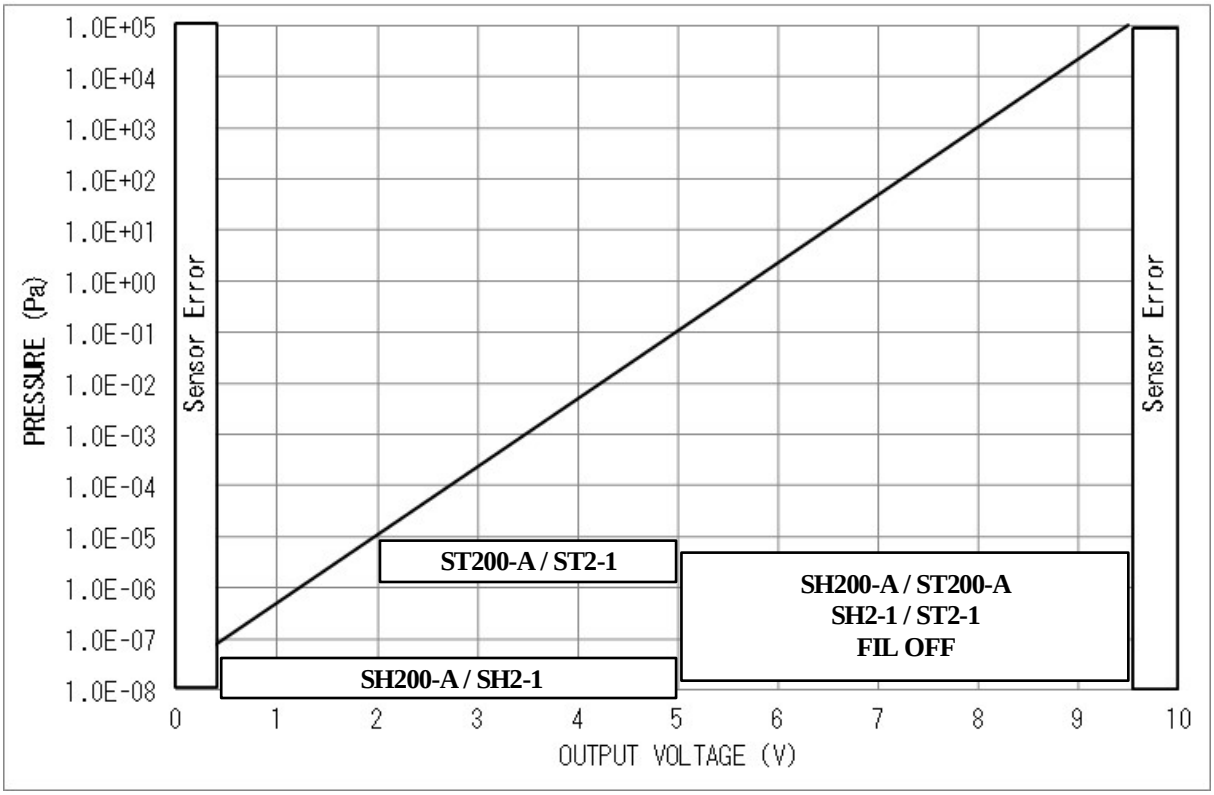
$$P = 10 \wedge \{ ( V - 7.25 ) / 0.75 + k \} \times C$$

$$\longleftrightarrow \quad V = 7.25 + 0.75 \times \{ \log ( P / C ) - k \}$$

P: Pressure value
V: Measurement value output voltage (V)
C: Calculation value (Refer to blow table or section 18)
k: Conversion factor (Refer to the table below)

| Measurement Unit | k | C |
|---|---|---|
| Pa | 2 | $1.0 \times 10^{+0}$ |
| Torr | -0.1249 | $7.5 \times 10^{-3}$ |
| mbar | 0 | $1.0 \times 10^{-2}$ |

| Operating state | Analog output voltage |
|---|---|
| During normal measurements | Voltage corresponding to the measured pressure 0.27V to 9.5V |
| Atmospheric pressure or higher | 9.5V or higher |
| SH200-A/ST200-A/SH2-1/ST2-1 FIL OFF | Voltage corresponding to the measured by SWU 5V to 9.5V |
| SH200-A/ST200-A/SH2-1/ST2-1 error (Errors such as a filament break) | Voltage corresponding to the measured by SWU 5V to 9.5V |
| SWU error (Errors such as a filament break) | 9.9V or higher |
| Power supply voltage abnormality, sensor unit fault, etc. | 0.1V or less |



16.6.2. Filament off signal

Signal that turns off the filament. When turning on the filament by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

16.6.3. Degas on signal

Signal that turns on degassing. When turning on the degas by operating with external I/O, connect to GND with an external switch. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

16.6.4. Filament 1/2 changeover signal

| | |
|---|---|
| CAUTION | **Filament1/2 materials**<br>M-44/M-45/M-46: Both filament1 and filament2 are yttria-coated iridium wire.<br>M-34/M-35/M-36: Filament1 is a yttria-coated iridium wire.<br>Filament2 is a tungsten wire. |
| CAUTION | **Setting only filament1, if you used ST200-A/ST2-1**<br>ST200-A/ST2-1 has only one filament. Setting only filament1. |

Signal that changes over filament1/2. To change it over to filament2, connect it to GND. In the case of front panel operation or RS-485 communication setting, input of this signal will be invalid.

16.6.5. Sensor error signal

Sensor errors are signals that are output when an error occurs on sensor units.

When SH200-A/ST200-A/SH2-1/ST2-1 is error, this unit displays pressure of Pirani gauge. When Pirani gauge is error, this unit displays “Err”

When a sensor error occurs, the signal becomes low output

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

For more information about sensor error and actions in case of sensor error signal being turned on, refer to the sensor unit manual.

16.6.6. Emission valid signal

When the emission current is flowing normally or not is output as a signal. If emission current is flowing normally, the open collector will be Lo output.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

If an emission error occurs during SH200-A/ST200-A/SH2-1/ST2-1measurement, it can be released by forcibly turning off the SH200-A/ST200-A/SH2-1/ST2-1 filament.

For details of this signal and what to do when this signal is turned off, refer to the instruction manual of the sensor unit.

16.6.7. Setpoint

For how to adjust and use the setpoint, refer to section 7.

Photocoupler rating: DC30$V_{MAX}$, 50$mA_{MAX}$, 70mW

16.6.8. RS-485 communication

For RS-485 communication, refer to Section 22.

# 17. CCM SERIES CERAMIC CAPASITANCE MANOMETER

This section describes the operation of the CCMT-A series, CCMT-D series and CCMH-A series ceramic capacitance manometers.

Before reading this section, read the standard operating procedure in the preceding sections.

## 17.1. Sensor Unit Setting

Turn on the power to this unit and make sure that the following display lights for several seconds. For display of others, change the setting as shown below, referring to section 6.

| Display | Sensor unit | | |
|---|---|---|---|
| Cn3 | CCMT-1000A | CCMT-1000D | CCMH-1000A |
| Cn2 | CCMT-100A | CCMT-100D | CCMH-100A |
| Cn1 | CCMT-10A | CCMT-10D | CCMH-10A |
| Cn0 | - | CCMT-1D | CCMH-1A |

## 17.2. Front Panel Display

### 17.2.1. Pressure display

| State | Pressure indicator | LED |
|---|---|---|
| In normal measurement | $0.0 \times 10^{+N-4}$ Pa to $1.3 \times 10^{+N}$ Pa | ZERO LED lights/off |
| Below measurement pressure range | Display by blinking | ZERO LED lights/off |
| Above measurement pressure range | FFF | ZERO LED lights/off |
| When zero point adjustment is completed | $0.0 \times 10^{+N-4}$ Pa | ZERO LED lights |
| When zero point adjustment is reset | Pressure indication | ZERO LED lights |
| When sensor unit is not connected | - - - | Err LED lights |

| Sensor Unit | N |
|---|---|
| CCMT-1000A/1000D、CCMH-1000A | 5 |
| CCMT-100A/100D、CCMH-100A | 4 |
| CCMT-10A/10D、CCMH-10A | 3 |
| CCMT-1D、CCMH-1A | 2 |

### 17.2.2. Front panel operation

| Inscription | Function | Remarks |
|---|---|---|
| PROG | Enters into the program mode | Refer to Section 5 and this section. |
| ZERO | Makes zero point adjustment | Cannot be operated when RS-485 and I/O are set |
| DEG | Not used | |
| FIL | Not used | |

## 17.3. Operation setting

For adjustment of the zero point, the following settings are available.

| Setting | Overview |
|---|---|
| Front panel operation mode | Only operation on front panel is possible |
| External I/O operation mode | Only external I/O can be operated |
| RS-485 communication mode | Only RS-485 communication can be operated |

### 17.3.1. RS-485 communication operation setting “L1”, “L2”

Selects whether RS-485 communication is to be used or not.

Refer to section 22 for the detailed setting of RS-485.

| Display | Detail | Remarks |
|---|---|---|
| “L1” | Operation on the front panel or external I/O | RS-485:Pressure reading only |
| “L2” | Only RS-485 communication can be operated | |

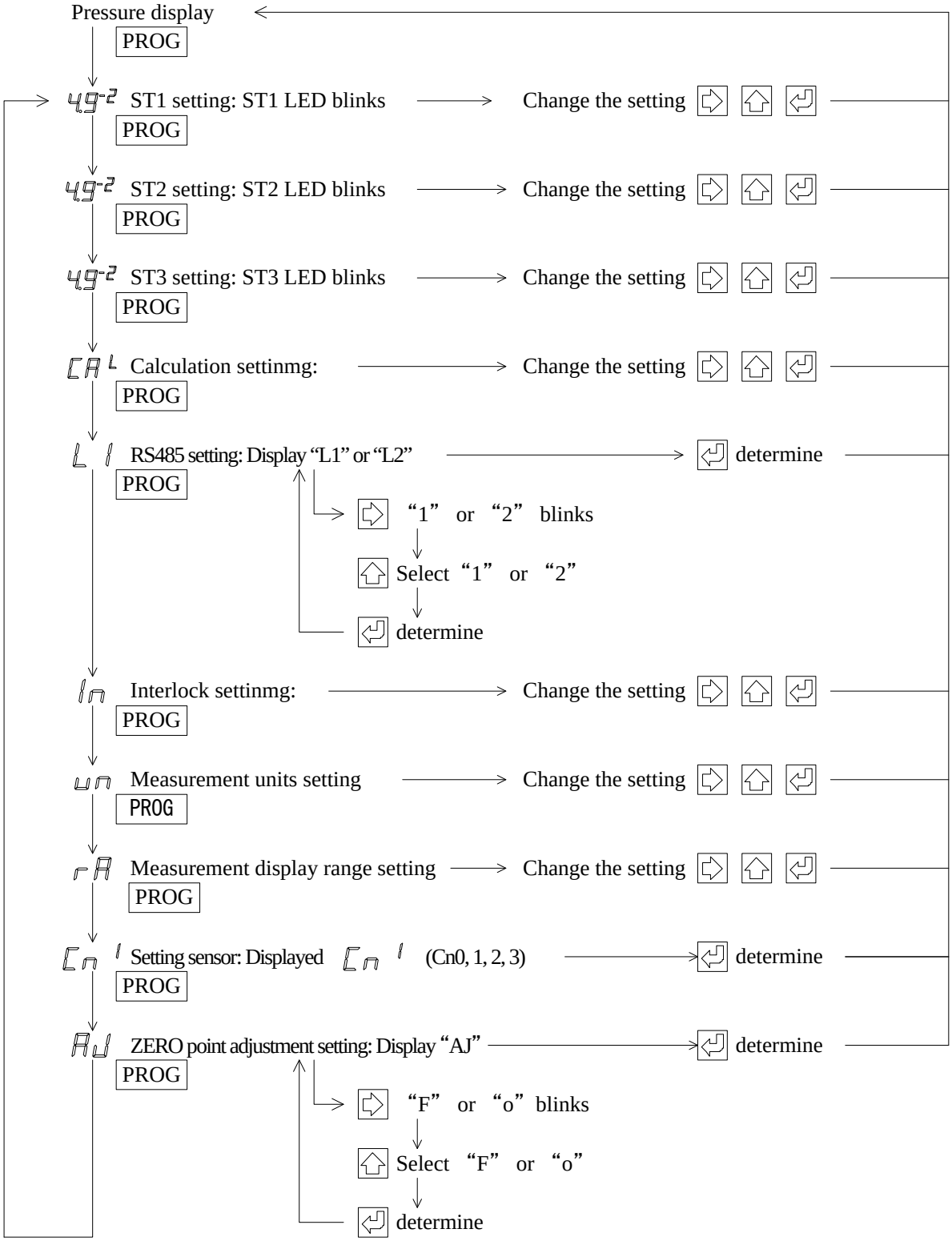
17.3.2. Front panel and external I/O operation setting “AJ”

Selects whether execution of zero point adjustment is to be made on the front panel or by external I/O.

| Display | Detail |
|---|---|
| “F” | Operation on front panel only |
| “O” | Operation of I/O only |

17.3.3. Setting method

Press the PROG key to change over the setting mode. Each press on the program key changes the display as follows.



## 17.4. Connection to Sensor Unit

The table below gives pin assignment in the connection with the sensor unit. It is recommended to connect all of the following pins in connecting to the sensor unit.

* Connector for connection “SENSOR”: D-sub 15pin connector male, M2.6mm screw
* Connector for connection “CCM”: D-sub 15pin connector female, M2.6mm screw

| “SENSOR” | Description | Remarks | Sensor unit |
|---|---|---|---|
| 1 | 24VDC power supply | 24VDC power supply to sensor unit | 11 |
| 8 | Pressure signal input+ | Pressure signal is input | 2 |
| 9 | Power supply GND | Power GND to the sensor unit | 5 |
| 15 | Pressure signal input- | Pressure signal is input | 12 |
| Case | FG | Frame ground | Case |

## 17.5. Connection to external device

The table below gives the pin assignment in connecting to external device.

* Connector for connection “I/O”: D-sub 15pin connector female, M2.6mm screw

| “I/O” | Description | Remarks |
|---|---|---|
| 3 | Setpoint1 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 7 | Setpoint3 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 8 | Pressure signal output+ | 0V to 10VDC |
| 9 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| 10 | RS485- | Serial communication RS-485- output |
| 11 | Setpoint2 actuating signal | Lo when actuated, $30VDC_{MAX}$, $50mA_{MAX}$, 70mW |
| 12 | RS485+ | Serial communication RS-485+ output |
| 15 | Signal GND | GND of pressure signal, burnout signal, setpoint, etc. |
| Case | FG | Frame ground |

## 17.6. Signals

### 17.6.1. Output voltage

Output voltage is output from +[pin8] of the I/O connector to GND [pin15].

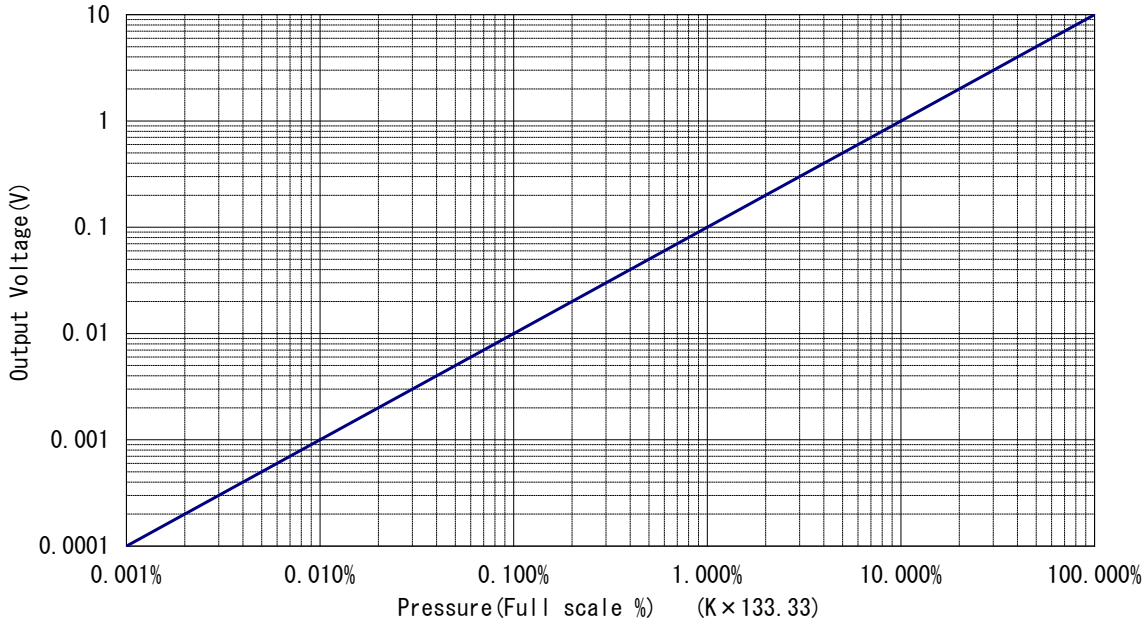
$$P = V \times k \times C \times m \quad \longleftrightarrow \quad V = P / k / C / m$$

P: Pressure value
V: Measurement value output voltage (V)
C: Calculation value (Refer to below table or section 18)
k: Conversion factor (Refer to the table below)
m: Factor of sensor type (Refer to the table below)

| m | Type of sensor | | |
|---|---|---|---|
| 1000 | CCMT-1000A | CCMT-1000D | CCMH-1000A |
| 100 | CCMT-100A | CCMT-100D | CCMH-100A |
| 10 | CCMT-10A | CCMT-10D | CCMH-10A |
| 1 | | CCMT-1D | CCMH-1A |

| Measurement unit | k | C |
|---|---|---|
| Pa | 13.33 | $1.0\times10^{+0}$ |
| Torr | 0.1 | $7.5\times10^{-3}$ |
| mbar | 0.1333 | $1.0\times10^{-2}$ |

| State | Measurement value output voltage | Remarks |
|---|---|---|
| In normal measurement | Voltage corresponding to measured pressure | |
| Above measurable higher limit | 10 V | The display is “FFF”. |
| Below measurable lower limit | 0 V | The display blinks. |




17.6.2. Setpoint

Refer to section 7 for how to adjust and use the setpoint.

Photocoupler rating: $30V_{MAX}$, $50mA_{MAX}$, 70mW

17.6.3. RS-485 communication

Refer to section 22 for RS-485 communication.

17.7. ZERO Point Adjustment

Zero point can be adjusted by the unit for ceramic capacitance manometer setting. It can be done from the front panel, external I/O, or RS485.

ZERO point adjustment range: Voltage from sensor unit = within ±20mV

Pressure value = within $\pm 2.6\times10^{+N-3}$Pa

*An error will occur if adjustment cannot be made within the above adjustment range. In that case, execute "zero point reset" and then perform zero point adjustment on the sensor unit. Refer to Sections 17.7.1, 17.7.2, and 17.7.3 for how to execute "zero point reset", and to the instruction manual for the sensor unit for how to perform zero point adjustment on the sensor unit.

17.7.1. Operation front panel

ZERO point adjustment: Hold down the “ZERO” switch for 1sec or more.

ZERO point reset : Hold down the “ZERO” switch for 3sec or more.

17.7.2. Operation external I/O

ZERO point adjustment: Turn on (short) “ZERO” from I/O for 1sec or more

ZERO point reset : Turn on (short) “ZERO” from I/O for 3sec or more

17.7.3. RS-485 communication

Refer to section 22 for RS-485 communication.

# 18. CALCULATING FUNCTION

| | |
|---|---|
| CAUTION | **Display of $10^{-10}$, $10^{-11}$**<br>$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”.<br>Please note “b (B of small letter)” to make a mistake as '6' of the figure. |

CALCULATION function (Hereafter, it abbreviates to CAL) powers desired value (from $1.0\times10^{-3}$～$1.0\times10^{+3}$) to the measured pressure value, and reflect to the display unit.

This function is used to set the specific sensitivity of the gas in the hot cathode ionization vacuum gauge and to switch the pressure unit for display.

## 18.1. Display Pressure Value in CAL Function

Displayed pressure value = Actual measured pressure × CAL set value

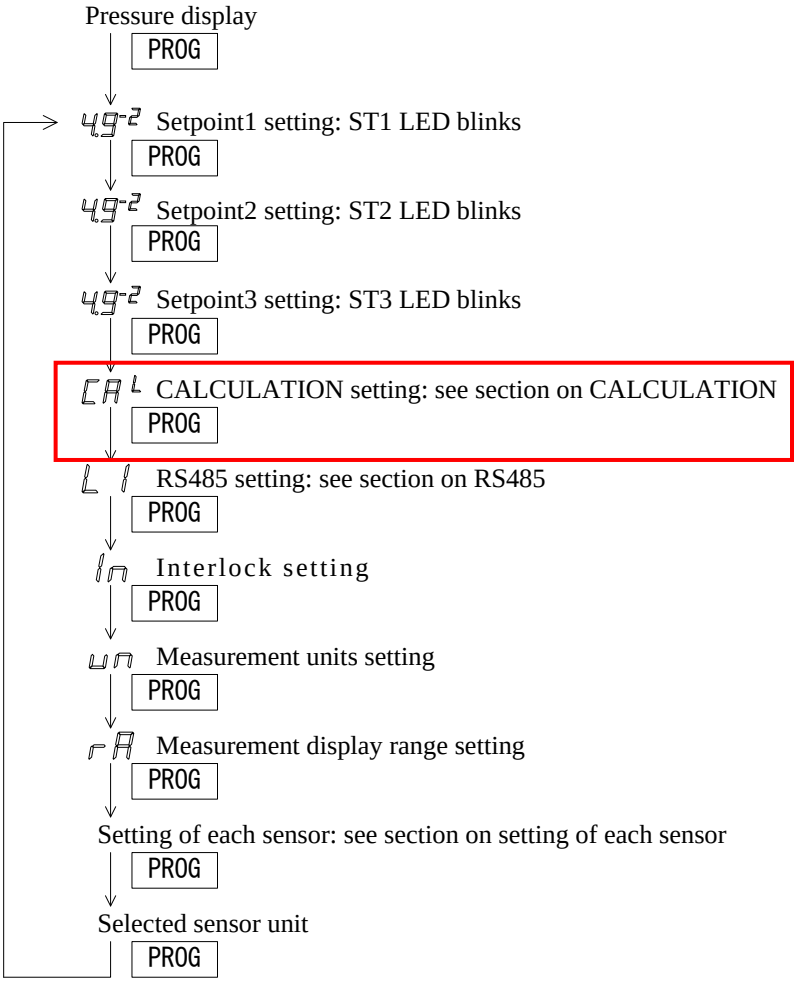
Please be aware that not only the displayed pressure value, but also the output voltage changes.

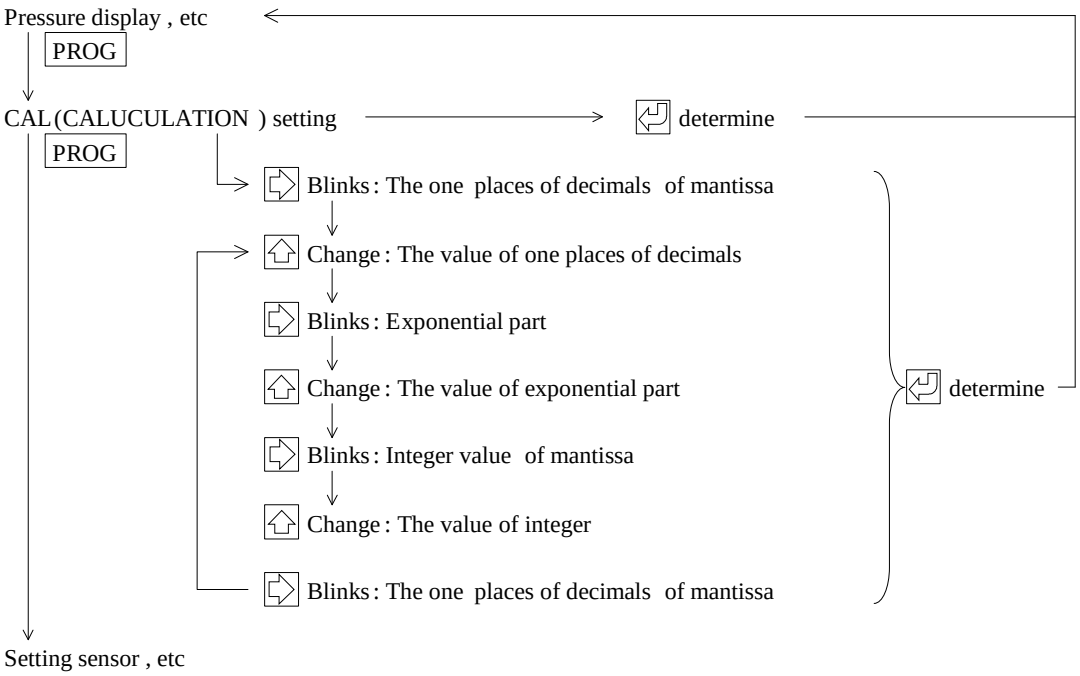
$10^{-10}$ is “A (A of capital letter)”, $10^{-11}$ is “b (B of small letter)”. Please note “b (B of small letter)” to make a mistake as '6' of the figure.

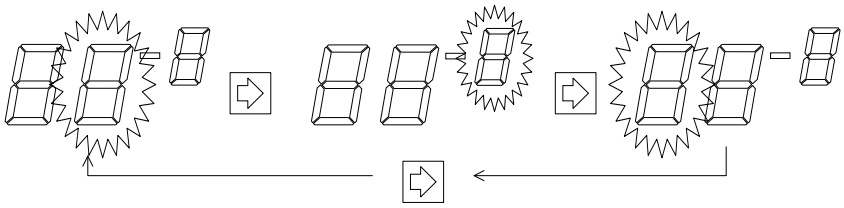
## 18.2. Output voltage in CAL function mode

Please refer to each chapter.

## 18.3. Setting CAL value





18.4. Specific Sensitivity Value of Gas in Hot Cathode Ionization Gauge
Please refer to each manual.

18.5. CAL Value of Measurement Unit

| measurement unit | CAL value |
|---|---|
| Pa | $1.0\times10^{+0}$ |
| Torr | $7.5\times10^{-3}$ |
| mbar | $1.0\times10^{-2}$ |

# 19. INTERLOCK FUNCTION

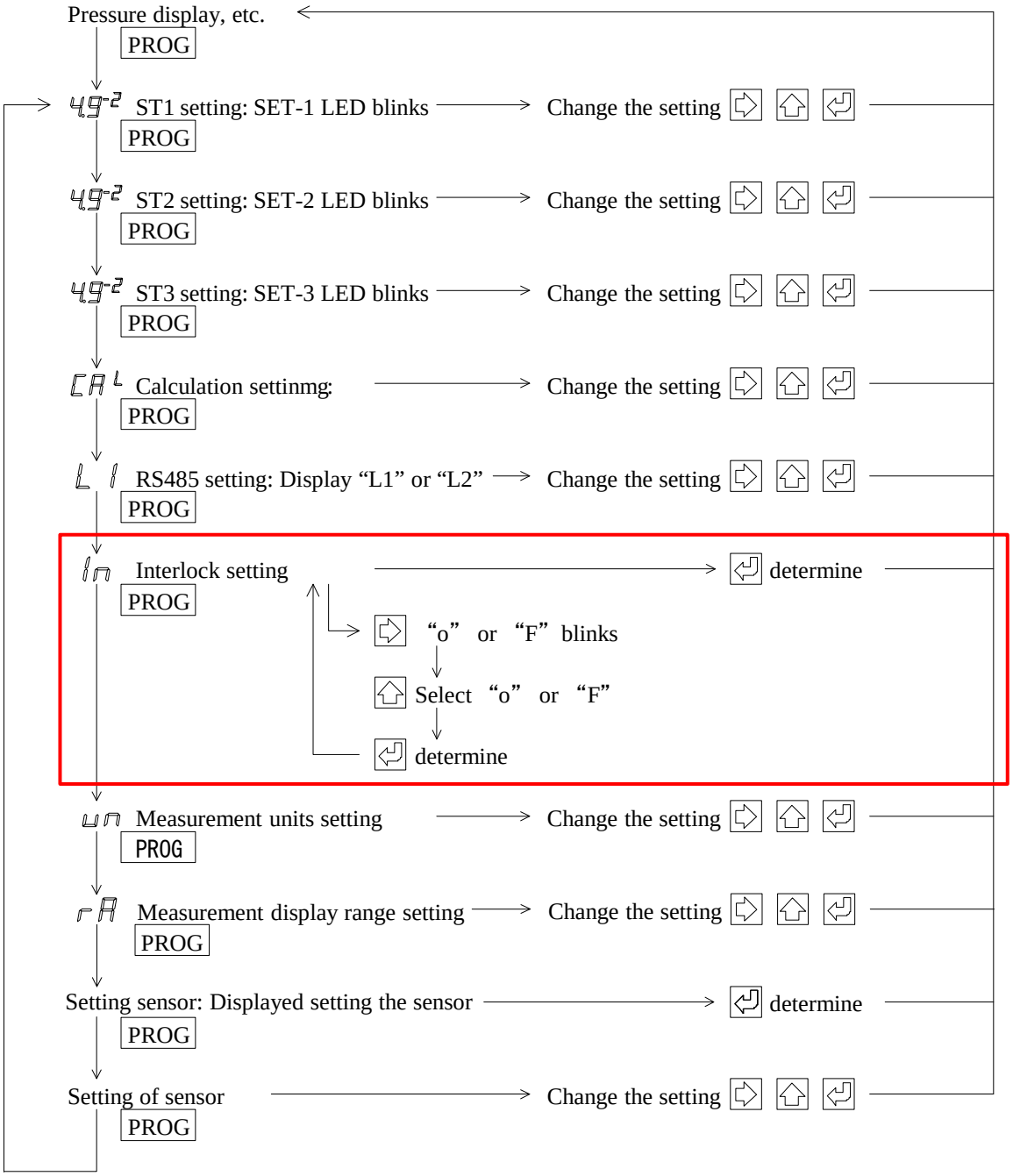
This function locks the front panel button controls, under certain condition.

## 19.1. Interlock Setting

Interlock setting can only be changed from the front panel control.

| Method | Operation |
|---|---|
| Setting | PROG, set the interlock “In” to “o” |
| Unlocking | Hit any key on the front panel while displaying the pressure value so that the numbers start blinking. Hold PROG more than 5sec after the blink, in order to reset the interlock. |

| Display | Detail |
|---|---|
| “F” | Off interlock state |
| “o” | Interlock is on |



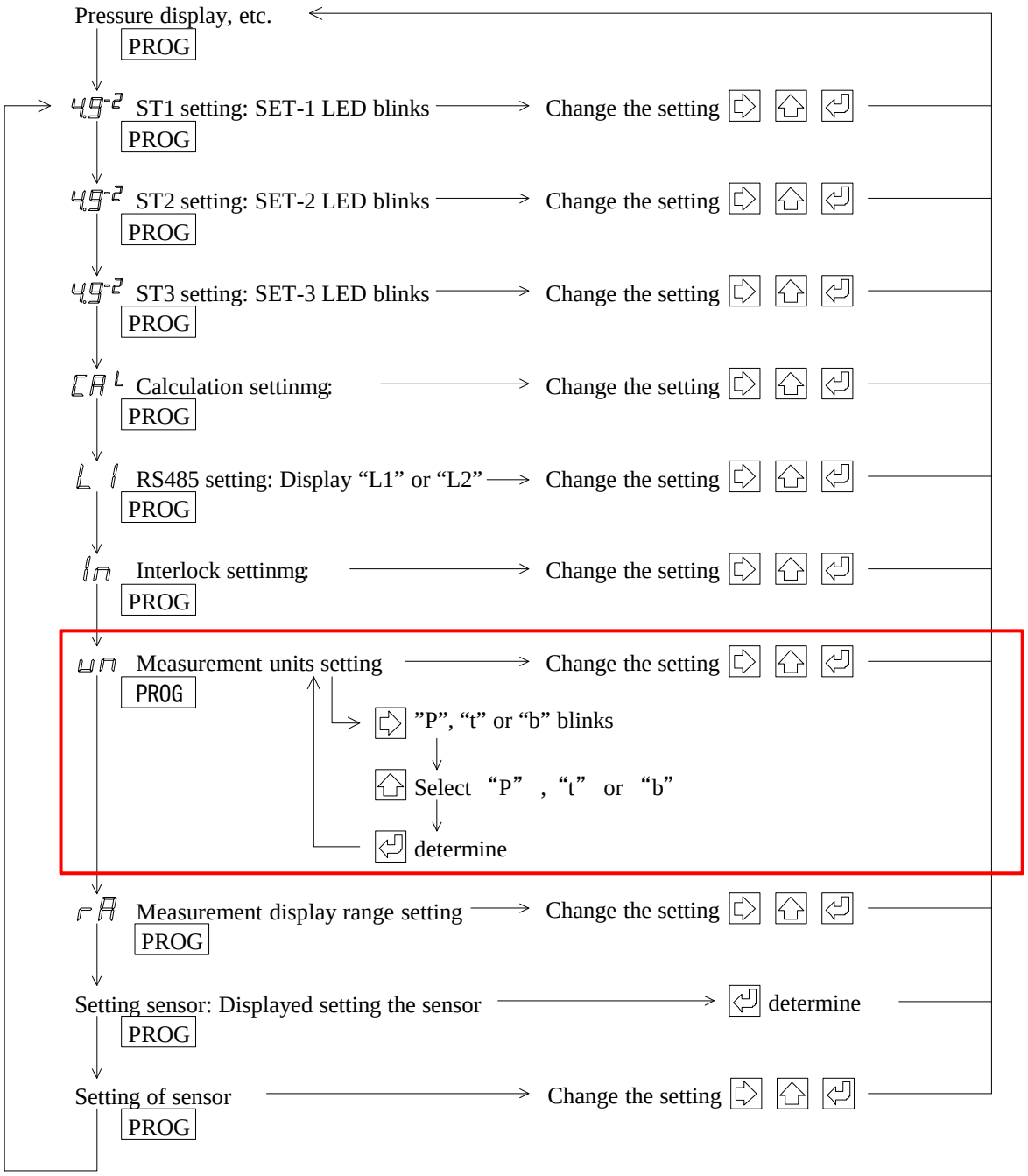
# 20. MEASUREMENT UNITS FUNCTION

## 20.1. Measurement Units Setting

Measurement unis setting can only be changed from the front panel control.

| method | Operation |
|---|---|
| Setting | PROG, set the measurement units “un” to “P”, “t” or “b” |

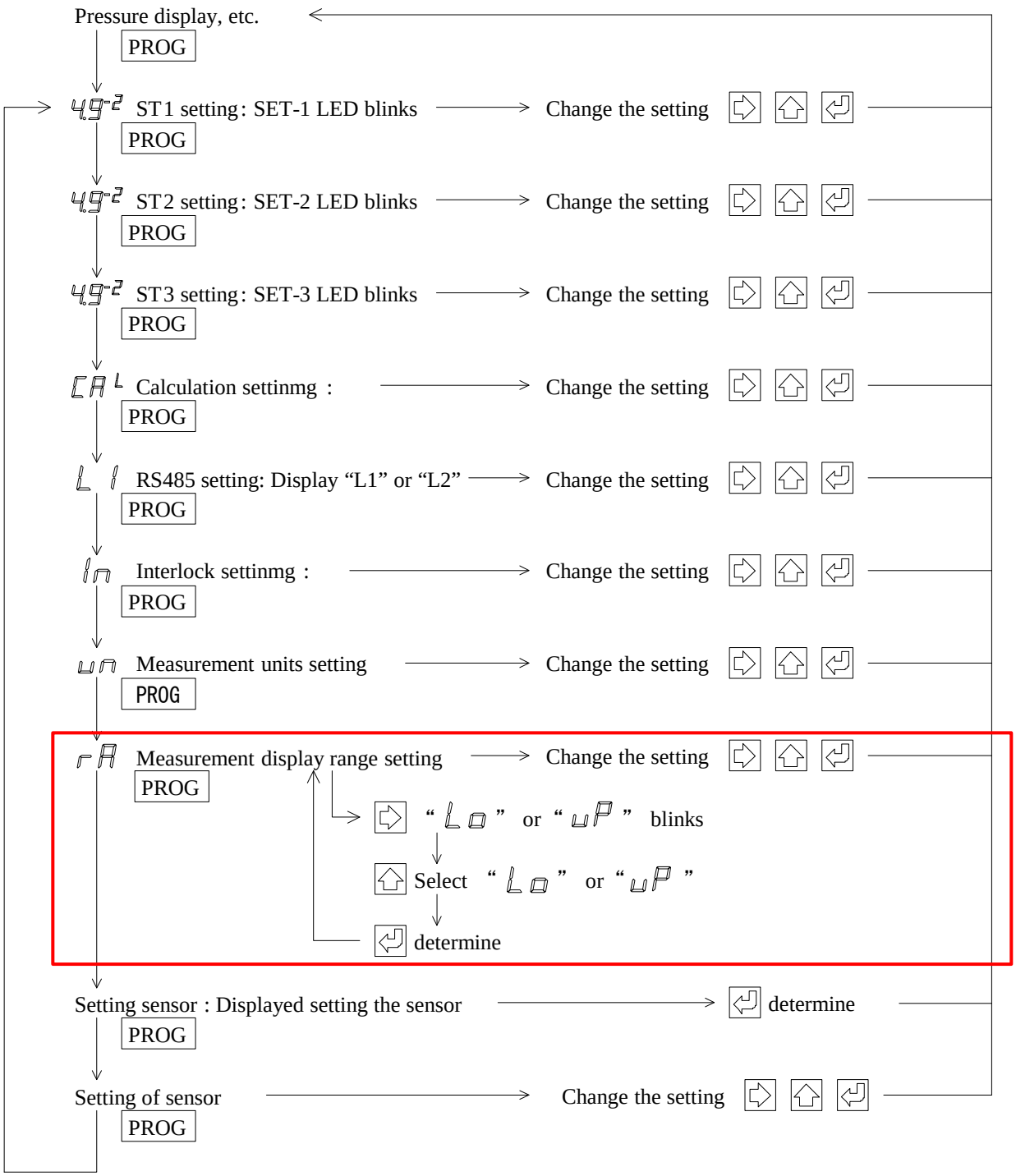
| Display | Detail |
|---|---|
| “P” | Pa |
| “t” | Torr |
| “b” | mbar |

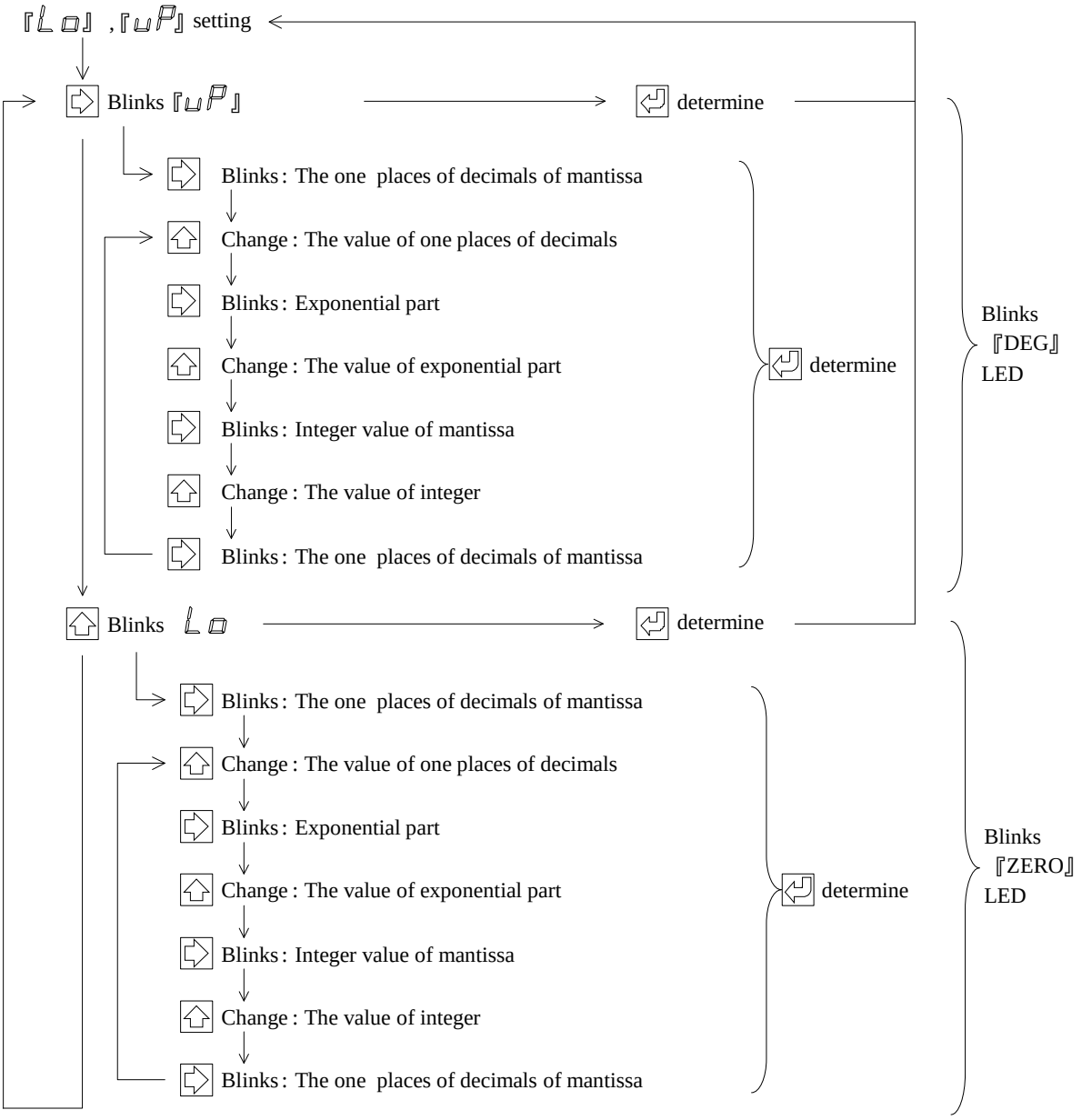


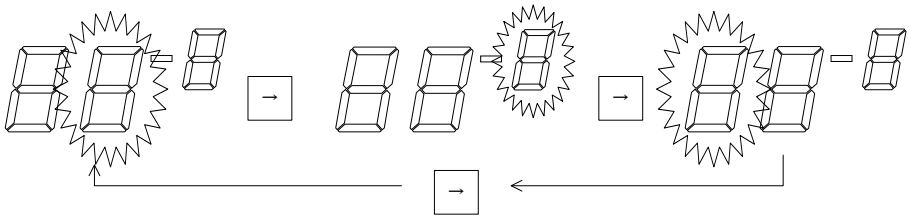
# 21. MEASUREMENT DISPLAY RANGE SETTING

The pressure measurement display setting is the function which sets the range which measurement of the pressure. Indication lower than the lower limit which isn't indicated beyond the upper limit value isn't done.

## 21.1. Measurement display Range rA Setting




『Lo』,『uP』setting
Blinks『uP』
determine
Blinks : The one places of decimals of mantissa
Change : The value of one places of decimals
Blinks : Exponential part
Change : The value of exponential part
Blinks : Integer value of mantissa
Change : The value of integer
Blinks : The one places of decimals of mantissa
determine
Blinks 『DEG』 LED
Blinks Lo
determine
Blinks : The one places of decimals of mantissa
Change : The value of one places of decimals
Blinks : Exponential part
Change : The value of exponential part
Blinks : Integer value of mantissa
Change : The value of integer
Blinks : The one places of decimals of mantissa
determine
Blinks 『ZERO』 LED



# 22. RS-485

| | |
|---|---|
| CAUTION | Caution in laying cables<br>When laying transmission lines for communication in the unit, see to it that they are not in the proximity of, or parallel to, the power line, high voltage line, high frequency line, etc. Failure to comply with this caution can cause malfunction. |
| CAUTION | Remote host<br>Use a noise-immune isolation for the remote host like PC, sequencer, etc. Otherwise, malfunction or failure can result. |

This section describes how to set and use RS-485.

## 22.1. Communication Specifications

### 22.1.1. Standard specifications

| | |
|---|---|
| Two-wire system | |
| Half duplex | |
| Start-stop synchronization system | |
| ASCII code | |
| Transmission distance | 1200m* |
| Maximum number of connections | 32 (including host) |
| Baud rate | 9600/19200/38400 bps |

*: Maximum cable length is 1200m in the RS-485 standard.
Please check a specification of remote host and an environmental noise if you use the cable of 30m or more.

### 22.1.2. Communication setting

| | | |
|---|---|---|
| DATA | | 8 bits |
| Parity | | None |
| Stopbit | | 1 bit |

* Change over the mode to the receiving state within 20msec after sending data.
* Set the time-out before receiving data at 150msec or more.
* After receiving data, send the next data with an interval of 50msec or more.

## 22.2. Setting

### 22.2.1. RS-485 communication setting “L2”

To use RS-485, it is necessary to set communication at “L2”.

| Display | Detail |
|---|---|
| “L1” | Operation on front panel external I/O. |
| “L2” | Only RS-485 is operated. |

### 22.2.2. Baud rate setting

The table below gives the baud rate settings.

| Display | Detail |
|---|---|
| 960 | 9600 bps |
| 192 | 19200 bps |
| 384 | 38400 bps |

### 22.2.3. Address setting

Address can be set from 01 to 32.

* Note that remote host may be allocated to 00.
* The maximum number of nodes is 32 per line, including the host.
* Settings are validated as and when necessary.

### 22.2.4. Setting the checksum collating function

Checksum collating function checks if all the data sent and received have been acquired.

| Display | Detail |
|---|---|
| “o” | Checksum is collated. |
| “F” | Checksum is not collated. |

[Checksum off]

This instrument receives the checksum value of the data on the host side, but does not collate it with command data. Whatever the checksum data is, it is returned according to it if only the command is correct. (The checksum value of the data on the host side can be communicated as fixed to “00” or other.)

[Checksum on]

This instrument receives the checksum value of the data on the host side and collates it with command data. If any error occurs in sending/receiving data as a result of collation, it is returned as “n” and no action is taken against the command. If the result of collation agrees with the command data, it is returned accordingly.

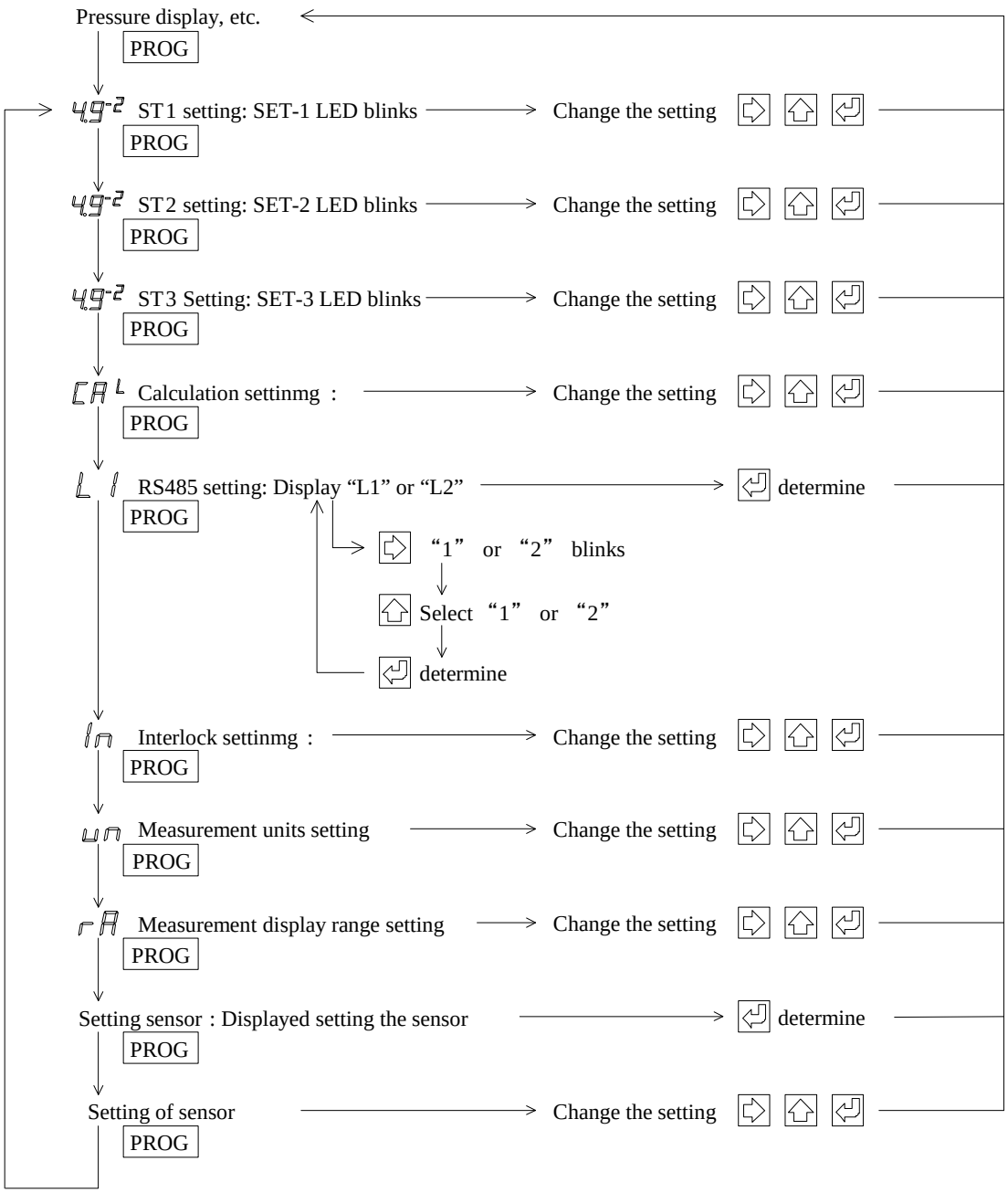
### 22.2.5. Setting the terminator

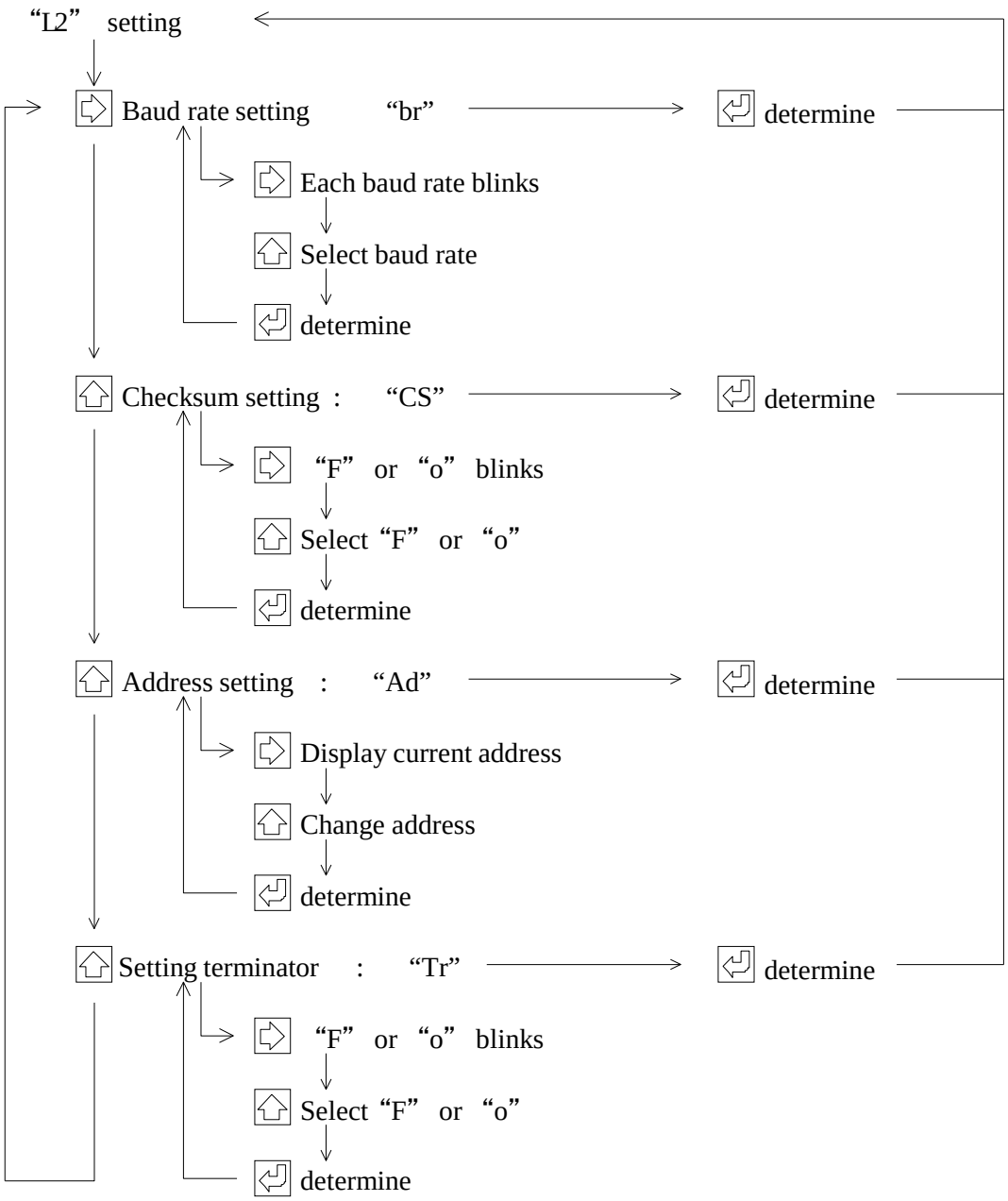
If the total length of the connected cable is 15m or more or if the frequency of communication errors is high, it is recommended to install a terminator in the terminating device. Turn it on on the terminating device of the transmission line.

| Display | Detail |
|---|---|
| “o” | Termination resistance |
| “F” | No termination resistance |

### 22.2.6. Setting method

Press the PROG key to change over the setting mode. Each press on the program key changes the display as follows.




“L2” setting
Baud rate setting
“br”
determine
Each baud rate blinks
Select baud rate
determine
Checksum setting : “CS”
determine
“F” or “o” blinks
Select “F” or “o”
determine
Address setting : “Ad”
determine
Display current address
Change address
determine
Setting terminator : “Tr”
determine
“F” or “o” blinks
Select “F” or “o”
determine

## 22.3. Standard Data Format

The table below gives the standard data sending/receiving format.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | CMD | D0 | ・・・・・・ | Dn | SH | SL | CHKH | CHKL | CR |

| | |
|---|---|
| : | Colon |
| AD0 | Device address high order (0 - 9) |
| AD1 | Device address low order (0 - 9) |
| CMD | Various commands (note uppercase character/lowercase character) |
| D0 | Data |
| Dn | Data |
| SH | High order of status |
| SL | Low order of status |
| CHKH | High order of checksum (0 - 9, A - F) |
| CHKL | Low order of checksum (0 - 9, A - F) |
| CR | Carriage return |

* A command consists of uppercase characters and lowercase characters of alphanumeric characters.
* Checksum is an exclusive logic sum (XOR) from AD0 to SL.
* Convert all with the ASCII code.

### 22.3.1. Command list

| Command | Description | Command | Description |
|---|---|---|---|
| D | Reads measurement value and status | 1W | Writes setpoint1 |
| SR | Reads status | 2W | Writes setpoint2 |
| SW | Writes status | 3W | Writes setpoint3 |
| T | Reads software | ZER | Adjusts SW1 zero point |
| 1R | Reads setpoint1 | ATM | Adjusts SW1 atmospheric pressure |
| 2R | Reads setpoint2 | CLR | Resets adjustment of SW1 zero point, atmospheric pressure adjustment |
| 3R | Reads setpoint3 | CZR | CCM zero point adjustment |
| | | CCR | Resets CCM zero point adjustment |

### 22.3.2. When received normally

The following is returned when data is normally received.

When a pressure value is returned

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | D | X | . | X | X | E | ± | X | X | SH | SL | CHKH | CHKL | CR |

When writing setpoint or adjusting

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | o | CHKH | CHKL | CR |

* ‘o’ is a lowercase character.

### 22.3.3. When receiving is faulty

The following is returned when not normally received or when there is no command.

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | n | CHKH | CHKL | CR |

* ‘o’ is a lowercase character.

## 22.4. Command

### 22.4.1. Reading the measurement value/status

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | D | CHKH | CHKL | CR |

Format of returning from this instrument to PC

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | D | X | . | X | X | E | ± | X | X | SH | SL | CHKH | CHKL | CR |

* The measured pressure value is entered in the "X.XXE±XX" section.
  Example 1: 3.00E+03 ⇒ $3.00\times10^{+3}$
  Example 2: 5.00E+00 ⇒ $5.00\times10^{+0}$
  Example 3: 4.00E-01 ⇒ $4.00\times10^{-1}$
* Measurement range is exceeded when "F.FFE+FF" is returned
* Filament has burnt out when "E.EEE+EE" is returned.
* Refer to the relevant section for the status "SH" and "SL".

### 22.4.2. Writing status

Command that instructs filament ON/OFF, DEGAS ON/OFF and others.

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | SW | CHKH | CHKL | CR |

* Refer to the relevant section for statuses "SH" and "SL".
* If a command is normally received, normal receipt 'o' is returned.
  If a command is correct, normal receipt 'o' will be returned even when a status that cannot be functionally possible is written.

### 22.4.3. Reading a status

Filament state and setpoint operational state can be confirmed.

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | SR | CHKH | CHKL | CR |

Format of return from this instrument to PC

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | S | SH | SL | CHKH | CHKL | CR |

* Refer to the relevant section for the status "SH" and "SL".

### 22.4.4. Reading the software version

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | T | CHKH | CHKL | CR |

Format of return from this instrument to PC

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | T | I | S | G | 3 | 1 | 1 | CHKH | CHKL | CR |

* "ISG" denotes model name and "211" denotes software version Ver2.11.
* Version is subject to change without notice.

### 22.4.5. Reading setpoint1 value

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 1R | CHKH | CHKL | CR |

Format of returning from this instrument to PC

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 1 | X | . | X | X | E | ± | X | X | CHKH | CHKL | CR |

* "±" denotes "+" or "-".

### 22.4.6. Reading the setpoint2 value

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 2R | CHKH | CHKL | CR |

Format of returning from this instrument to PC

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 2 | X | . | X | X | E | ± | X | X | CHKH | CHKL | CR |

* "±" denotes "+" or "-".

### 22.4.7. Reading the setpoint3 value

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 3R | CHKH | CHKL | CR |

Format of returning from this instrument to PC

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 3 | X | . | X | X | E | ± | X | X | CHKH | CHKL | CR |

* "±" denotes "+" or "-".

### 22.4.8. Writing the setpoint1 set value

Command

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 1W | X | . | X | X | E | ± | X | X | CHKH | CHKL | CR |

* A numeric value that can be set varies with each sensor. If a value lower than the lower limit set value of each sensor is set, it will be set at the lower limit value of setting or, if a value higher than the higher limit set value, it will be set at the higher limit value of setting.
* Internal mantissa part comparison processing is done at 2 digits below decimal point [□.□□ × $10^{-□□}$].
* If a command is normally received, 'o' of normal receipt will be returned.

### 22.4.9. Writing the setpoint2 set value

Command

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 2W | X | . | X | X | E | ± | X | X | CHKH | CHKL | CR |

* A numeric value that can be set varies with each sensor. If a value lower than the lower limit set value of each sensor is set, it will be set at the lower limit value of setting or, if a value higher than the higher limit set value, it will be set at the higher limit value of setting.
* Internal mantissa part comparison processing is done at 2 digits below decimal point [□.□□ × $10^{-□□}$].
* If the command is normally received, 'o' of normal receipt will be returned.

### 22.4.10. Writing the setpoint3 set value

Command

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| : | AD0 | AD1 | 3W | X | . | X | X | E | ± | X | X | CHKH | CHKL | CR |

* A numeric value that can be set varies with each sensor. If a value lower than the lower limit set value of each sensor is set, it will be set at the lower limit value of setting or, if a value higher than the higher limit set value, it will be set at the higher limit value of setting.
* Internal mantissa part comparison processing is done at 2 digits below decimal point [□.□□ × $10^{-□□}$].
* If the command is normally received, 'o' of normal receipt will be returned.

### 22.4.11. SW1 ZERO point adjustment command

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | ZER | CHKH | CHKL | CR |

* Adjustable pressure range: Approx. ±1Pa
* Signal for zero point adjustment is output from the I/O connector.
* If a command is normally received, normal receipt 'o' will be returned though adjustment is not made. Read the measurement value and others after adjustment and check them.

### 22.4.12. SW1 atmospheric pressure adjustment command

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | ATM | CHKH | CHKL | CR |

* The adjustable pressure range is $1 \times 10^{-4}$ to $2 \times 10^{-5}$Pa
* Signal for atmospheric pressure adjustment is output from the I/O connector.
* If a command is normally received, normal receipt 'o' will be returned though adjustment is not made. Read the measurement value and others after adjustment and check them.

### 22.4.13. SW1 zero point, atmospheric pressure adjustment correction reset command

Command

| | | | | | | |
|---|---|---|---|---|---|---|
| : | AD0 | AD1 | CLR | CHKH | CHKL | CR |

* Reset signal is output from the I/O connector.
* If the command is normally received, normal receipt 'o' will be returned.

### 22.4.14. CCM zero point adjustment command

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Command | : | AD0 | AD1 | CZR | CHKH | CHKL | CR |

* The adjustable pressure range is about ±20mV.
* Arithmetically processed in this instrument.
* If a command is normally received, normal receipt ‘o’ will be returned though adjustment is not made. Read the measurement value and others after adjustment and check them.

### 22.4.15. Zero point, atmospheric pressure adjustment correction reset command

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Command | : | AD0 | AD1 | CCR | CHKH | CHKL | CR |

* Arithmetic processing in this instrument is reset.
* If the command is received normally, normal receipt ‘o’ will be returned.

## 22.5. Checksum

Checksum is for checking if data sent has been received correctly. Without checksum, this instrument cannot send/receive data.

Checksum calculates from address to Xor of the character preceding the check sum.

Checksum can be calculated more conveniently by using “calculator” in the windows. Select the alpha calculator from the types of calculators and calculate by hexadecimal notation.

### 22.5.1. Example: when reading the measurement value of address 11 and status

The following tables give the commands and ASCII coder when reading the measurement value and status of address 11.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Command(ASII) | : | 1 | 1 | D | CHKH | CHKL | CR |
| | | ↓ | ↓ | ↓ | | | |
| Hex | | 31 | 31 | 44 | CHKH | CHKL | CR |

**「31」 Xor 「31」 Xor 「44」 = 44**

Here, calculate from the address to the character before the checksum with Xor, equal 44.

Don’t calculate [:(3A)]

Accordingly, the accurate command is as follows.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Command(ASII) | : | 1 | 1 | D | 4 | 4 | CR |

Given that the measurement value at this time is the following string,

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command (ASII) | : | 1 | 1 | D | 1 | . | 0 | 0 | E | + | 0 | 5 | F | 6 | 4 | 0 | CR |
| | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | | ↓ | ↓ | ↓ | ↓ | | | |
| Hex | | 31 | 31 | 44 | 31 | 2E | 30 | 30 | 45 | 2B | 30 | 35 | 46 | 36 | CHKH | CHKL | CR |

**「31」 Xor 「31」 Xor 「44」 Xor 「31」 Xor 「2E」 Xor**
**「30」 Xor 「30」 Xor 「45」 Xor 「2B」 Xor 「30」 Xor**
**「35」 Xor 「46」 Xor 「36」**
**= 「40」**

Thus, calculating from the address to the character preceding the checksum, we obtain “40” and can judge that the data has been received correctly.

Don’t calculate [:(3A)]

## 22.6. Status Setting List

### 22.6.1. When writing

Only BMR2, SC1, SH2, ST2, SH200, ST200

SH (high order Status)

| | | 0〔30H〕 | 8〔38H〕 | C〔43H〕 | 4〔34H〕 | D〔44H〕 | 5〔35H〕 |
|---|---|---|---|---|---|---|---|
| B7 | FIL-2/1 | 0 | 1 | 1 | 0 | 1 | 0 |
| B6 | FIL-ON/OFF | 0 | 0 | 1 | 1 | 1 | 1 |
| B5 | N･C | 0 | 0 | 0 | 0 | 0 | 0 |
| B4 | DEGAS-ON/OFF | 0 | 0 | 0 | 0 | 1 | 1 |

| | | |
|---|---|---|
| FIL-2/1 | 1: FIL1 | 0: FIL2 |
| 「Sn1」「SC1」：FIL(HV) ON/OFF | 1: ON | 0: OFF |
| 「Sh2」「SPU」「SAU」：FIL OFF/ON | 1: OFF | 0: ON |
| DEGAS-ON/OFF | 1: ON | 0: OFF |

SL (low order 4 Status)

| | | 0〔30H〕 | F〔46H〕 |
|---|---|---|---|
| B3 | N･C | 0(X) | 1(X) |
| B2 | N･C | 0(X) | 1(X) |
| B1 | N･C | 0(X) | 1(X) |
| B0 | N･C | 0(X) | 1(X) |

* The N.C portion can also be actuated with [1] or [0].
* SC1 does not have FIL 1/2 or DEGAS, so this part works with either [1] or [0].

The data configuration of the reading status and that of the writing status are similar, but they differs from the those of reading/writing values to the same register.

Therefore, the low order of the reading status will not be [F] even if [F] is written in the low order when writing.

22.6.2. When reading

SH (high order Status)

* CCM: This SH is all “0” = plus
This SH is all “F”:= minus (display by blinking)

| | | 0〔30H〕 | 4〔34H〕 | 6〔36H〕 | 5〔35H〕 | 7〔37H〕 |
|---|---|---|---|---|---|---|
| B7 | FIL-2/1 | 0 | 0 | 0 | 0 | 0 |
| B6 | FIL-ON/OFF | 0 | 1 | 1 | 1 | 1 |
| B5 | Em.Valid | 0 | 0 | 1 | 0 | 1 |
| B4 | DEGAS-ON/OFF | 0 | 0 | 0 | 1 | 1 |

| | | 8〔38H〕 | C〔43H〕 | E〔45H〕 | D〔44H〕 | F〔46H〕 |
|---|---|---|---|---|---|---|
| B7 | FIL-2/1 | 1 | 1 | 1 | 1 | 1 |
| B6 | FIL-ON/OFF | 0 | 1 | 1 | 1 | 1 |
| B5 | Em.Valid | 0 | 0 | 1 | 0 | 1 |
| B4 | DEGAS-ON/OFF | 0 | 0 | 0 | 1 | 1 |

| | | |
|---|---|---|
| FIL-2/1 | 1: FIL-1 | 0: FIL-2 |
| 「Sn1」「SC1」：FIL(HV) ON/OFF | 1: ON | 0: OFF |
| 「Sh2」「SPU」「SAU」：FIL OFF/ON | 1: OFF | 0: ON |
| Em.Valid | 1: OK | 0: NG |
| DEGAS-ON/OFF | 1: ON | 0: OFF |

SL (low order Status)

| | | 0〔30H〕 | 1〔31H〕 | 2〔32H〕 | 3〔33H〕 | 4〔34H〕 |
|---|---|---|---|---|---|---|
| B3 | PROTECT | 0 | 0 | 0 | 0 | 0 |
| B2 | SETPOINT3 | 0 | 0 | 0 | 0 | 1 |
| B1 | SETPOINT2 | 0 | 0 | 1 | 1 | 0 |
| B0 | SETPOINT1 | 0 | 1 | 0 | 1 | 0 |

| | | 5〔35H〕 | 6〔36H〕 | 7〔37H〕 | 8〔38H〕 |
|---|---|---|---|---|---|
| B3 | PROTECT | 0 | 0 | 0 | 1 |
| B2 | SETPOINT3 | 1 | 1 | 1 | 0 |
| B1 | SETPOINT2 | 0 | 1 | 1 | 0 |
| B0 | SETPOINT1 | 1 | 0 | 1 | 0 |

| | | |
|---|---|---|
| PROTECT | 1: ON | 0: OFF |
| SETPOINT3 | 1: ON | 0: OFF |
| SETPOINT2 | 1: ON | 0: OFF |
| SETPOINT1 | 1: ON | 0: OFF |

22.7. ASCII Code Table

| ASII | Hex | ASII | Hex | ASII | Hex | ASII | Hex |
|---|---|---|---|---|---|---|---|
| (nul) | 00 | (sp) | 20 | @ | 40 | ‘ | 60 |
| (soh) | 01 | ! | 21 | A | 41 | a | 61 |
| (stx) | 02 | “ | 22 | B | 42 | b | 62 |
| (etx) | 03 | # | 23 | C | 43 | c | 63 |
| (eot) | 04 | $ | 24 | D | 44 | d | 64 |
| (enq) | 05 | % | 25 | E | 45 | e | 65 |
| (ack) | 06 | & | 26 | F | 46 | f | 66 |
| (bel) | 07 | ‘ | 27 | G | 47 | g | 67 |
| (bs) | 08 | ( | 28 | H | 48 | h | 68 |
| (tab) | 09 | ) | 29 | I | 49 | i | 69 |
| (lf) | 0A | * | 2A | J | 4A | j | 6A |
| (vt) | 0B | + | 2B | K | 4B | k | 6B |
| (ff) | 0C | , | 2C | L | 4C | l | 6C |
| (cr) | 0D | - | 2D | M | 4D | m | 6D |
| (so) | 0E | . | 2E | N | 4E | n | 6E |
| (si) | 0F | / | 2F | O | 4F | o | 6F |
| (dle) | 10 | 0 | 30 | P | 50 | p | 70 |
| (dc1) | 11 | 1 | 31 | Q | 51 | q | 71 |
| (dc2) | 12 | 2 | 32 | R | 52 | r | 72 |
| (dc3) | 13 | 3 | 33 | S | 53 | s | 73 |
| (dc4) | 14 | 4 | 34 | T | 54 | t | 74 |
| (nak) | 15 | 5 | 35 | U | 55 | u | 75 |
| (syn) | 16 | 6 | 36 | V | 56 | v | 76 |
| (etb) | 17 | 7 | 37 | W | 57 | w | 77 |
| (can) | 18 | 8 | 38 | X | 58 | x | 78 |
| (em) | 19 | 9 | 39 | Y | 59 | y | 79 |
| (sub) | 1A | : | 3A | Z | 5A | z | 7A |
| (esc) | 1B | ; | 3B | [ | 5B | { | 7B |
| (fs) | 1C | < | 3C | ¥ | 5C | \| | 7C |
| (gs) | 1D | = | 3D | ] | 5D | } | 7D |
| (rs) | 1E | > | 3E | ^ | 5E | ~ | 7E |
| (us) | 1F | ? | 3F | _ | 5F | (del) | 7F |

## 23. TROUBLESHOOTING

Possible causes of malfunction of this unit include erroneous electric wiring. If any trouble is suspected, check the following.

(1) Wiring between the display unit and sensor unit
(2) Wiring between the display unit and remote host
(3) Short/open signal

Refer to the troubleshooting chart below after checking these. The arrow mark [→] in the corrective action column represents the reference page.

Turn off the power before making these checks.

① No display appears when power is turned on.

| Possible cause | Corrective action |
|---|---|
| Erroneous wiring or disconnection of the power supply cable | Correct the wiring and check continuity using a circuit tester. |
| Line voltage is below the specified range. | Check the line voltage using a voltmeter. Line voltage is to be within 24V±1V. |
| CPU has run out of control because of external noise. | Turn on the power again to start up CPU again. |
| | Corrective measures against noise should be taken otherwise. |
| Internal fuse has blown out. | Check and/or repair at ULVAC are necessary. |
| Failure of display unit indicating circuit. | Check and/or repair at ULVAC are necessary. |
| Failure in the display unit circuit. | Check and/or repair at ULVAC are necessary. |

② Pressure has changed, but the indication remains constant.

| Possible cause | Corrective action |
|---|---|
| Pressure is below the measurement range. | Normal |
| Erroneous wiring between sensor unit and display unit (pressure signal is not input to the display unit) or wiring is broken. | Correct the wiring and check continuity using a circuit tester or other. |
| Cable connecting the sensor unit and the sensor head is disconnected (when the box unit is used). | Reconnect the cable and fix it securely. |
| Line voltage is too low. | Check the line voltage using a circuit tester.<br>Line voltage: 24V±1V |

③ [*FU LL*] is not displayed under atmospheric pressure

| Possible cause | Corrective action |
|---|---|
| The sensor head or cable length differs from the specified one. | Change it with a specified one or recalibrate it with the current one.<br>→ Refer to the sensor unit manual |
| Gas under measurement is not air. | Normal<br>→ Refer to the sensor unit manual |
| Gas under measurement is air, but it contains much water and/or oil. | Normal<br>→ Refer to the sensor unit manual |

④ Pressure display does not indicate a constant value.

| Possible cause | Corrective action |
|---|---|
| Pressure is changing. | Normal |
| The type of sensor unit differs from the specified one. | Change it with the specified one. Or readjust and recalibrate the sensor being used. |
| The sensor head is contaminated or the sensor head filament has worn out. | Replace the sensor.<br>→ Refer to the sensor unit manual. |
| There is a leak in the sensor head or in the vicinity of the portion where the sensor head is installed. | Leak in the sensor.<br>→ Replace the sensor. |
| | Other leak<br>→ Stop the leak. |
| Poor contact of the sensor head cable or increased resistance of the wire rod due to corrosion. | Check cable connection. |
| The cable is subject to electromagnetic induction (by external noise). | Change the cable laying position. Or turn off a component that can be a source of noise. |
| | Recheck the method of laying cables. |
| | Examine measures against noise otherwise. |

⑤ The indicated pressure value differs largely from expected value.

| Possible cause | Corrective action |
|---|---|
| The sensor head is contaminated and sensitivity has lowered noticeably. | Change the sensor with another one and check symptom. If ok with another sensor, there is a problem in the sensor.<br>→ Refer to the sensor unit manual. |
| Failure of the internal circuit in the display unit.<br>(The sensor unit itself operates normally.) | Check and/or repair at ULVAC is necessary. |
| The actual pressure differs from the expected pressure. | Check pressure using another vacuum gauge. |

## 24. 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

1) This unit

Duration of guarantee

Within 1 year from the date of delivery.

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

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 in use (cable burnout due to improper installation, poor contact, etc.)

Others

1) If there is a separate contract or memorandum regarding specifications besides this instruction manual, the contents of the contract or memorandum will be followed.
2) Customer shall inform ULVAC when this product is exported out of Japan. In the meantime, customer shall take necessary procedures according to Foreign Exchange and Foreign Trade Law.
3) As for the question and consultation, customer 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.

## 25. China RoHS Declaration

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.

Table1. 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 | × | ○ | ○ | ○ | ○ | ○ |
| AC-DC Converter | × | ○ | ○ | ○ | ○ | ○ |
| Label | ○ | ○ | ○ | ○ | ○ | ○ |

○: 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.

## 26. EC DECLARATION OF CONFORMITY

ULVAC

CE **Declaration of Conformity** CE

We, Company:ULVAC ,Inc.

of Address:2500 HAGISONO, CHIGASAKI, KANAGAWA, 253-8543 Japan.

This declaration is issued under the sole responsibility of the manufacturer.
In accordance with the following Directive:

| | |
|---|---|
| EN IEC63000:2018 | RoHS Directive (2011/65/EU) |

declare under our sole responsibility that the product,

| | | |
|---|---|---|
| **Type of Product** | : | **1CH Display Unit** |
| **Model Name** | : | **ISG1** |

to which this declaration related is in conformity with the following standards:

**EN61326-2-3:2013**
EMC Directive (2014/30/EU)
**EN IEC61000-4-2:2008**
Electrostatic Test
**EN IEC61000-4-3:2006+A1:2007+A2:2010**
Radiated Electromagnetic Field Test
**EN IEC61000-4-4:2004+A1:2010**
Transient Burst Test
**EN IEC61000-4-5:2005**
Surge Test
**EN IEC61000-4-6:2008**
Conduction Test
**EN IEC61000-4-8:2009**
Commercial Magnetic Field Test
**CISPR11:2009+A1:2010 Group 1 Class A**
Radiation Field Intensity Measurement

following the provisions of

The person stated below will keep the following technical documentation:

- operating and maintenance instructions
- technical drawings
- description of measures designed to ensure conformity
- other technical documentation, e.g. quality assurance measures for design and production

**Person authorized to compile the technical file:**
( Name and address) Julian Weck
ULVAC GmbH, Klausnerring 4, 85551 Kirchheim b. München, Germany

| | |
|---|---|
| 19 Oct, 2022<br>Kanagawa , Japan | Toyoaki Nakajima<br>Senior Manager of Components Division T. Nakajima |
| (date & place) | (name, function, signature) |

Form:A00315287-01-01

## 27. UKCA DECLARATION OF CONFORMITY

ULVAC

UK CA **Declaration of Conformity** UK CA

We, Company:ULVAC ,Inc.

of Address:2500 HAGISONO, CHIGASAKI, KANAGAWA, 253-8543 Japan.

This declaration is issued under the sole responsibility of the manufacturer.
In accordance with the following Directive:

| | |
|---|---|
| BS EN IEC63000:2018 | RoHS Directive (2011/65/EU) |

declare under our sole responsibility that the product,

| | | |
|---|---|---|
| **Type of Product** | : | **1CH Display Unit** |
| **Model Name** | : | **ISG1** |

to which this declaration related is in conformity with the following standards:

**BS EN61326-2-3:2013**
EMC Directive (2014/30/EU)
**BS EN IEC61000-4-2:2008**
Electrostatic Test
**BS EN IEC61000-4-3:2006+A1:2007+A2:2010**
Radiated Electromagnetic Field Test
**BS EN IEC61000-4-4:2004+A1:2010**
Transient Burst Test
**BS EN IEC61000-4-5:2005**
Surge Test
**BS EN IEC61000-4-6:2008**
Conduction Test
**BS EN IEC61000-4-8:2009**
Commercial Magnetic Field Test
**BS CISPR11:2009+A1:2010 Group 1 Class A**
Radiation Field Intensity Measurement

following the provisions of

The person stated below will keep the following technical documentation:

- operating and maintenance instructions
- technical drawings
- description of measures designed to ensure conformity
- other technical documentation, e.g. quality assurance measures for design and production

**Person authorized to compile the technical file:**
( Name and address) Julian Weck
ULVAC GmbH, Klausnerring 4, 85551 Kirchheim b. München, Germany

| | |
|---|---|
| **19 Oct, 2022**<br>**Kanagawa , Japan** | **Toyoaki Nakajima**<br>**Senior Manager of Components Division** T. Nakajima |
| **(date & place)** | **(name, function, signature)** |

Form:A00315287-02-00

## 28. Certificate of Decontamination

ULVAC

Form: A00315268-02-00

**ULVAC Components / Certificate of Decontamination**

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
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 and during disassembly 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<br>Request for SDS: Yes/No | Received by | |
| ULVAC job No. | | |