

**G-TRAN Series  
Pirani Vacuum Gauge Sensor Unit  
SW1-1 Standard Type  
SW1-2 Serial Communications Type  
Specifications**



**Components Division,  
ULVAC, Inc.**

## 1. Specifications

Name		Pirani vacuum gauge	
Type	Standard type	Serial communication type	
Model name	SW1-1	SW1-2	
Compatible sensor head	1 pc.		
Applicable sensor head	SWP-16, SWP-R1/8, SWP-P18, SWP-P15, SWP-25, SWP-CF16, SWP-1S		
Measurable pressure range	$5.0 \times 10^{-2}$ to $1.0 \times 10^{+5}$ Pa		
Measurement accuracy *1 (N <sub>2</sub> )	± 10% from $1 \times 10^{-1}$ Pa to $1 \times 10^{+4}$ Pa ± 20% from $1 \times 10^{+4}$ Pa to $1 \times 10^{+5}$ Pa, $5 \times 10^{-2}$ Pa to $1 \times 10^{-1}$ Pa		
Repeatability	± 2% from $1 \times 10^{-1}$ Pa to $1 \times 10^{+4}$ Pa		
Sampling time	50 ms 5 times of moving average processing		
Measurement value output	Output voltage 0 to 10 VDC Output indication 1.7 V to 8.0 V Log output 1 V/div		
	Update time	50 ms	
	Resolution	4 mV	
	Output error	±3 mV	
	Output impedance	10 Ω	
Adjustment	ADJ: one switch Zero point adjustment, atmospheric pressure adjustment, adjustment reset		
Control input signal	Zero point adjustment, atmospheric pressure adjustment, adjustment reset Actuated with open collector input, negative logic		
Control output signal	Sensor error signal, setpoint 1/2 Open collector output, negative logic Rating: 30 V <sub>MAX</sub> , 50 mA <sub>MAX</sub> , 70 mW		
Monitor for setpoint	Setpoint 1/2: 0 to 10 VDC LOG output		
	Output impedance	10 Ω	
Serial communication			RS-485/RS-232C
	Baud rate	9600/19200/38400 bps	
	Memory function	Backed up with EEPROM	
LED display	POWER/ERROR: Power error LED		
	SET1: Setpoint 1 LED		
	SET2: Setpoint 2 LED		
Sensor head material	Filament: Pt Others : SUS304(SWP-1S:SUS316L/Ra<0.5), FeNiCo, Ni, Au, glass, ceramic		
Sensor head pressure max	$2 \times 10^{+5}$ Pa (absolute) The breakdown pressure of the flange and clamp are to be considered otherwise.		
Operating temperature range	10°C to 40 °C		
Operating humidity range	15% to 80% (not condensing)		
Storage	-20 to 65 °C		
Bakeout	150°C (without electronics unit)		
Mounting position	Free		
IP protection class	IP30		
Line voltage	18 V to 30 VDC (ripple, noise <1%) 2 watts(4.8 watts when power is turned on)		

CE standard	Low voltage directive EN61010-1:2001(2nd Edition) Radiation field intensity measurement: EN55011:2007, A2:2007 group1 ClassA (Radiated) Radiation electromagnetic field test: EN61000-4-3:2006 Static electricity test: EN61000-4-2:1995, A1:1998,A2:2001 Transient burst test: EN61000-4-4:2004 Lightening surge test: EN61000-4-5:2006 Conduction test: EN61000-4-6:2007 Commercial magnetic field test: EN61000-4-8:1993, A1:2001							
Over-voltage category	Category I: Connected to a circuit that holds down transient over-voltage at a sufficiently low level							
Input/output connector	D-sub15-pin 2.6 mm screw							
Sensor head	model	SWP-16	SWP-R18	SWP-P18	SWP-P15	SWP-25	SWP-CF16	SWP-IS
	inner volume	7.3cm <sup>3</sup>	7.6cm <sup>3</sup>	13.9cm <sup>3</sup>	10cm <sup>3</sup>	7.8cm <sup>3</sup>	11.3cm <sup>3</sup>	8.2cm <sup>3</sup>
	weight	45g	44g	43g	30g	48g	60g	95g
Basic unit weight	Controller approx. 105 g							
Outside dimensions	70 × 46 × 28 (controller unit)							

\*1: The accuracy after atmospheric pressure and ZERO point adjustment. Please carry out atmospheric pressure and ZERO point adjustment before use especially. Moreover, since calibration gas is N<sub>2</sub>, when other gas is measured, be careful of an error of measurement.

### 1.1. Unpacking and quantity check

Quick manual	(Paper)	1
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### 1.2. Option

Display unit	1CH Digital	ISG1 (24VDC power supply type)
	4CH Digital	IM1R1(24VDC power supply type) 1M2R1 (100VAC power supply type)
	See Key Specifications "Compatible sensor head" .	
Sensor Head	See Key Specifications "Compatible sensor head" .	
Display cable	2 m, 5 m, and 10 m (between measuring unit and display unit)	
D-sub 15 Pin Connector (Socket, 2.6mm Screw)		
JCSS alibration certificate		
General proofreading test		
Inspection certificate		
Calibration certificate		

## 2. Input/Output Connector

### 2.1. Standard type SW1-1

Terminal	This instrument	Function
1	Power supply	Power supply for actuating this instrument (18 to 30 V DC)
2	Sensor error	Outputs a signal when the filament has burn out or at other times (Lo output, DC30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW)
3	Setpoint 1	Outputs a signal when setpoint 1 is actuated. (Lo output, DC30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW)
5	ADJ adjustment input	Input a signal when adjusting atmospheric pressure or zero point. (Lo output, DC30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW)
7	Setpoint 1 set value	Outputs the voltage for setting setpoint 1 (0 to 10 V DC)
8	Pressure signal output	Outputs a pressure signal (0 to 10 V DC).
9	Power supply GND	Ground of the power supply for actuating this instrument.
11	Setpoint 2	Outputs a signal when set point 2 is actuated (Lo output, DC30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW)
14	Setpoint 2 set value	Outputs the voltage for setting setpoint 2. (0 to 10 V DC)
15	Signal GND	Ground for output signal

### 2.2. Serial communication type SW1-2

Terminal	This instrument	Function
1	Power supply +24V	Power supply for actuating this instrument (18 to 30 V DC)
4	RS232C RxD	RxD of RS-232C
5	Terminal resistor for RS485	Terminator for RS485, connected to pin No. 13
6	RS232C TxD	TxD of RS232C
8	Pressure signal output	Outputs a pressure signal. (0 to 10 V DC)
9	Power supply GND	Ground of power supply for actuating this instrument
10	RS485-	Minus of RS485
12	RS-485+	Plus of RS485
13	RS485+ (for connecting terminator)	Connected to the terminator pin 5 for RS485
15	GND	Ground for output signal

3. Pressure Signal Output (SW1-1 and SW1-2)

$$P = 10^{(V - C)} \longleftrightarrow V = \text{Log } P + C$$

P: Pressure (Pressure)      V: Output voltage (V)    C: Conversion factor

Measurement Unit	C(Conversion factor)
Pa	3
Torr	5.1249
mbar	5

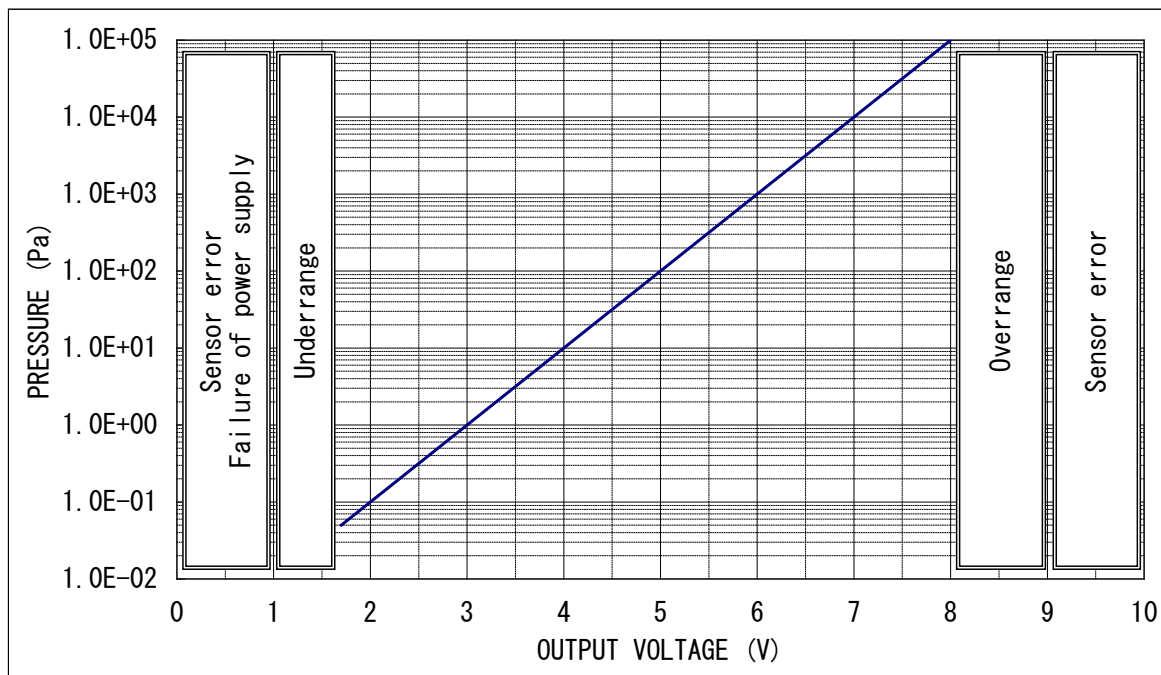


Fig. 5.1 Relationship between pressure signal output and pressure

Operating state	Measurement value output voltage
In normal measurement	DC1.7V to 8V corresponding to the measured pressure
In case of sensor error when filament has burnt	DC9V or more
Higher than atmospheric pressure	DC8V or more
Below measurable lower limit	DC1.7V to 1V
Sensor error, failure of power supply	DC1V or less

#### 4. I/O Signal Output (SW1-1 only)

##### 4.1. Signal Output

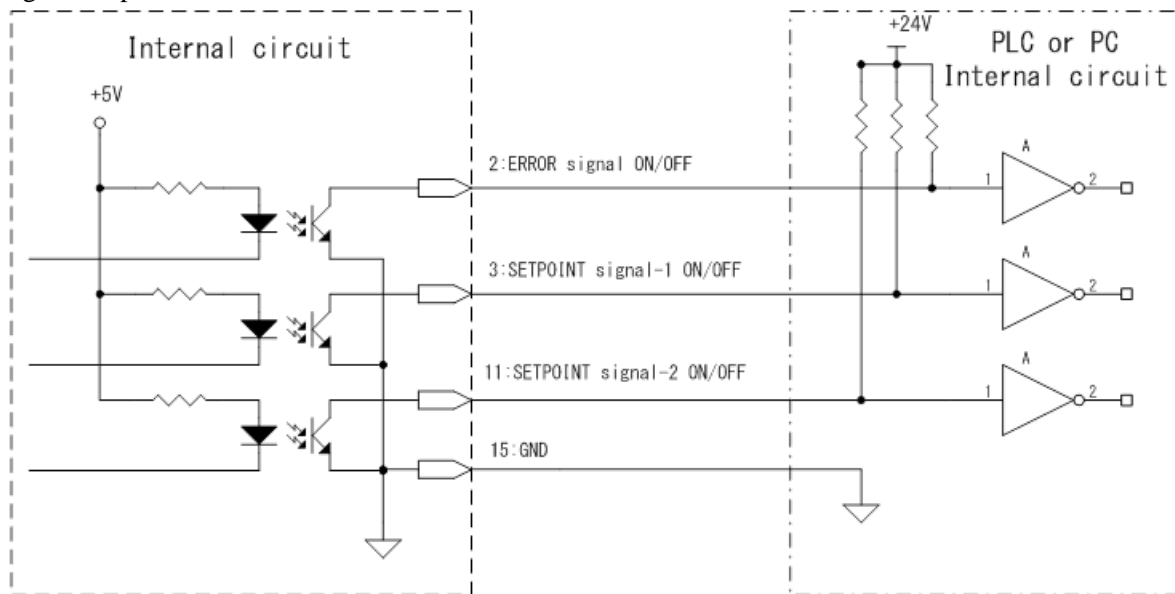


Figure Signal output internal circuit diagram

##### 4.2. Signal inputs

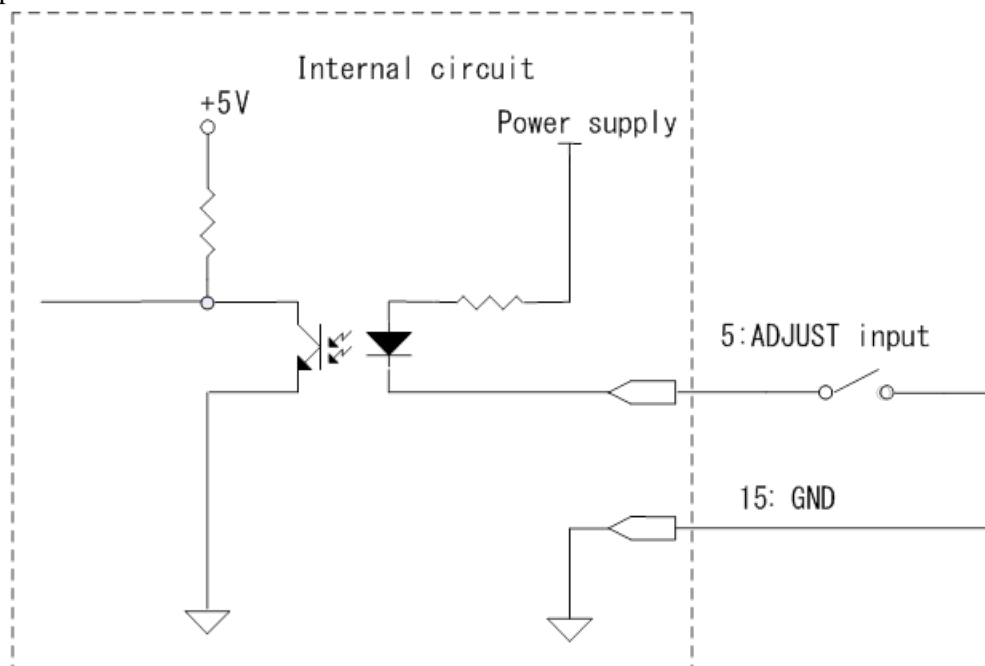


Fig signal input Internal circuit diagram

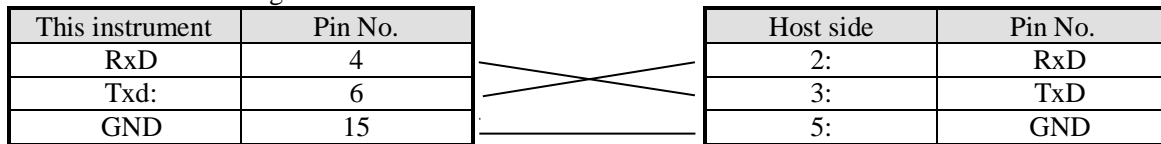
5. Serial Communication (SW1-2 only)

5.1. Communication Specifications

RS485	RS-232C
Two-wire type	
Half duplex	Full duplex
Asynchronous	
ASCII code	
Data bit length 8 bits	
Stop bit 1 bit	
No parity	
Maximum cable length 30 m	Maximum cable length 15 m
Maximum connections 32 (including host)	Maximum connection 1
9600/19200/38400 bps	9600/19200/38400 bps

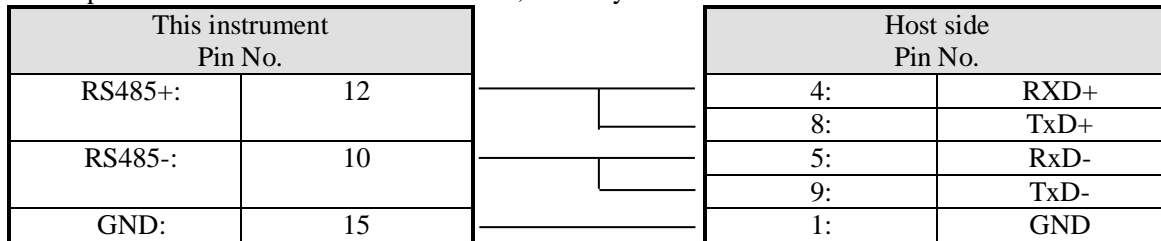
5.2. Connection diagram

5.3. RS-232C connection diagram



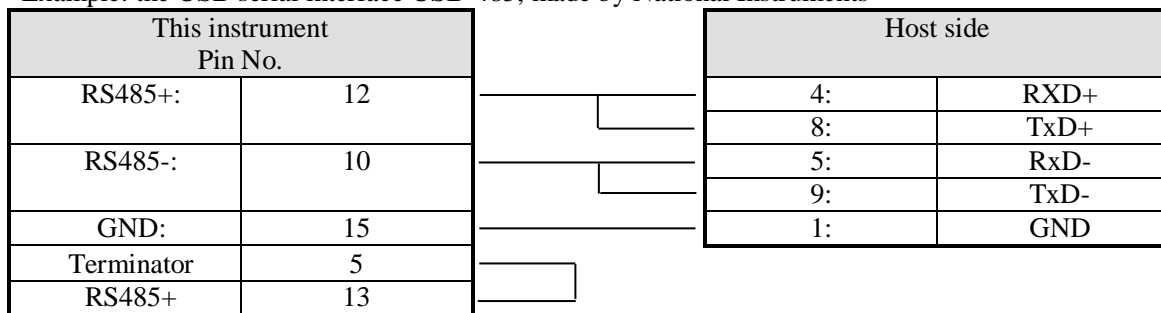
5.4. RS-485 connection diagram

Example: the USB serial interface USB-485, made by National Instruments



5.5. RS485 Install terminator

Example: the USB serial interface USB-485, made by National Instruments



5.6. Standard Data Format

The following shows the standard data format of receiving and sending.

:	AD0	AD1	CMD	D0	.....	Dn	SH	SL	CHKH	CHKL	CR
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- : Colon
- AD0 Device address/higher 4 bits (capital: 0 – 9)
- AD1 Device address lower case 4 bits (capital: 0 – 9)
- CMD Commands (Note the higher/lower case characters)
- D0 Data (4 bits) (upper case character: 0 – 9, A – F)
- Dn Data (4 bits) (upper case character: 0 – 9, A – F)
- SH Higher case 4 bits of status
- SL Lower case 4 bits of status
- CHKH Higher case 4 bits of check sum (upper case character: 0 - 9, A – F)
- CHKL Higher case 4 bits of check sum (upper case character: 0 - 9, A – F)
- CR Carriage return

- \* A command consists of higher and lower case alphanumeric characters. In the following description, notations bracketed with quotation marks are used to distinguish from other characters.
- \* Checksum is an exclusive sum (XOR) from AD0 to SL. Convert characters by the hexadecimal notation of the ASCII code.

5.7. List of commands

Command	Description	Command	Description
'D'	Reading measurement value and status	'T'	Reading the software version
'ZER'	Zero point adjustment	'AR'	Reading setpoint 1
'ATM'	Atmospheric pressure adjustment	'2R'	Reading setpoint 2
'CLR'	Resetting the zero point and atmospheric pressure adjustment	'1W'	Writing setpoint 1
'SR'	Reading status	'2W'	Writing setpoint 2
'SW'	Writing status		

5.8. Command (excerpt)

5.9. Reading the measurement value/status

Command	:	AD0	AD1	D	CHKH	CHKL	CR
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Format of returning from the basic unit to PC

:	AD0	AD1	D	X	.	X	X	E	±	X	X	SH	SL	CHKH	CHKL	CR
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- \* Measured pressure value is entered in “X. XXE ± XX”.

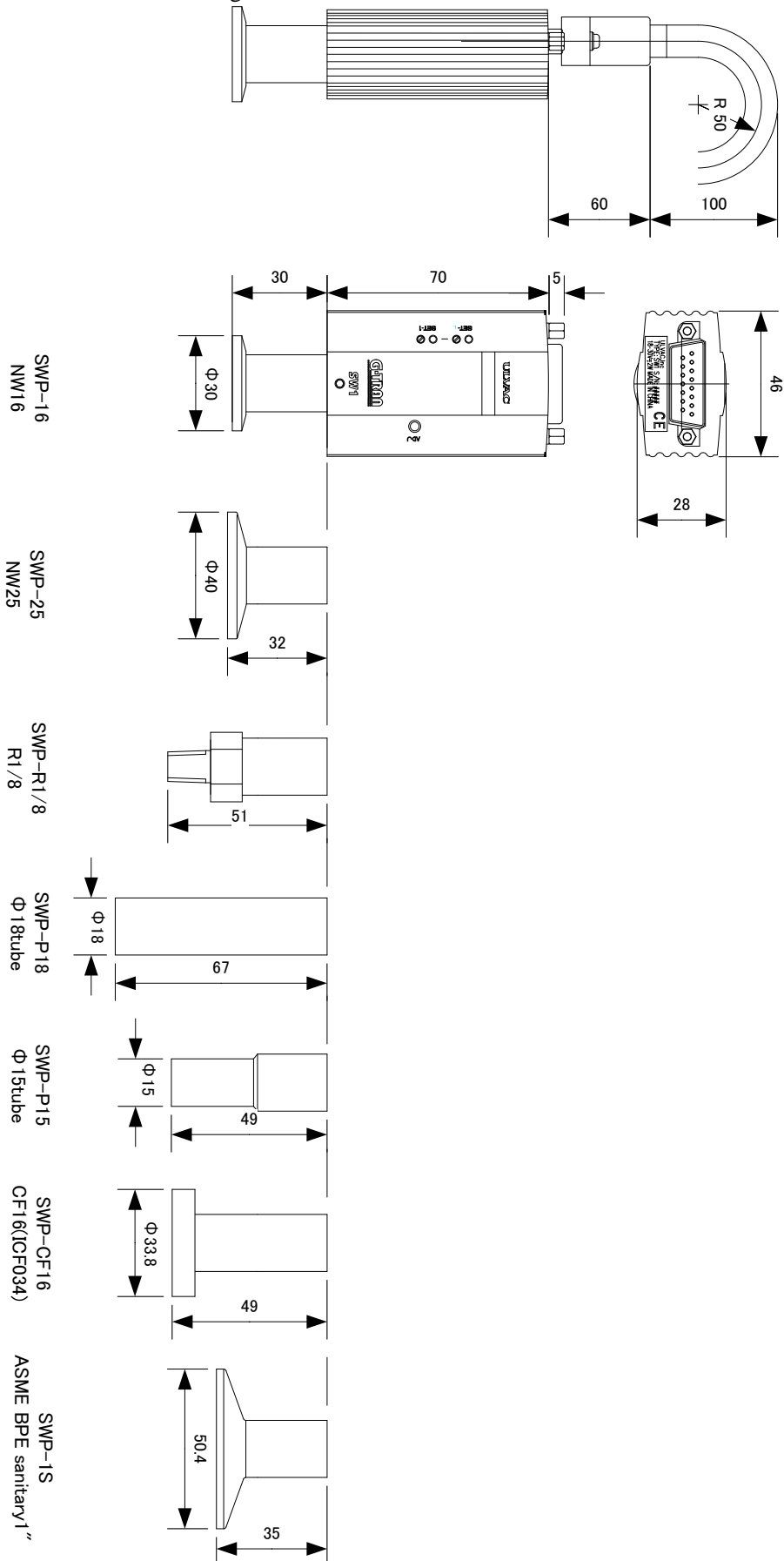
- Example 1) 3.00E+03 → 3.00 × 10<sup>+3</sup>
- Example 2) 5.00E+00 → 5.00 × 10<sup>+0</sup>
- Example 3) 4.00E-01 → 4.00 × 10<sup>-1</sup>

- \* Filament burnt out when “E. EED + EE” was returned
- \* For the status “SH” and “SL”, refer to instruction manual.

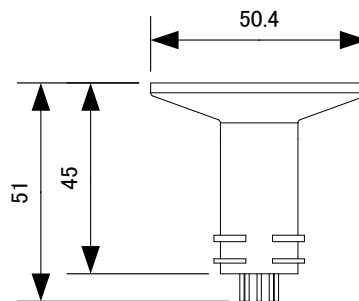
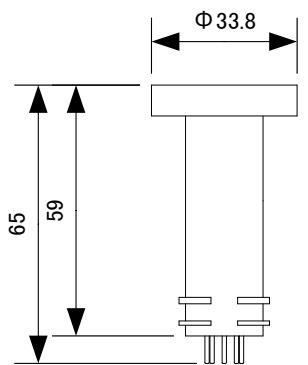
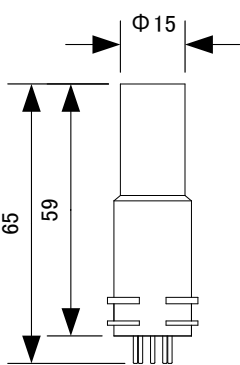
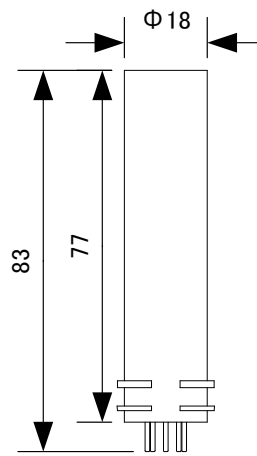
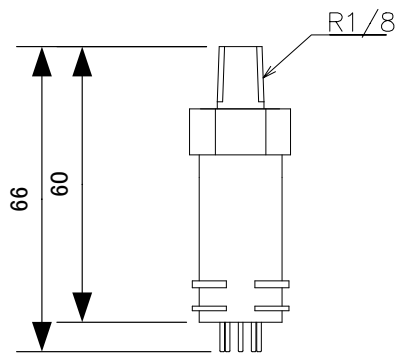
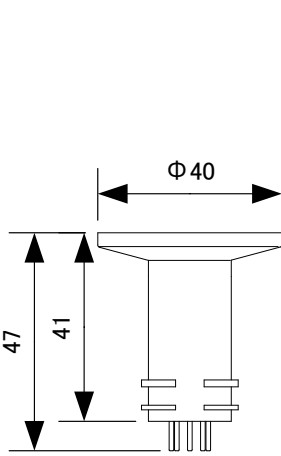
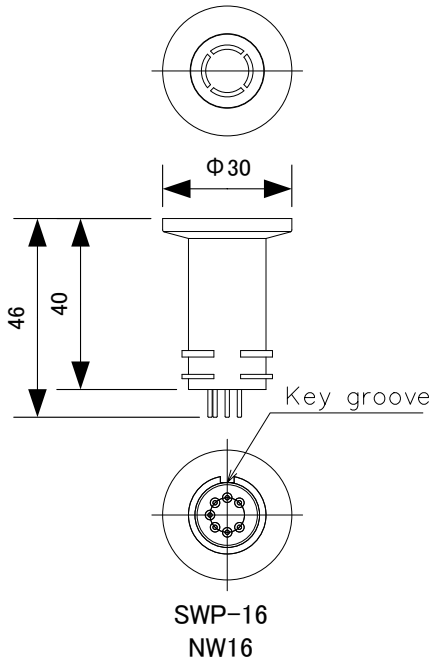


6. Dimensional Drawings

6.1. SW1-1/SW1-2 Dimensional Drawings



6.2. SWP Dimensional Drawings



## 7.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

One (1) year after shipping date from ULVAC

### 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 warranty scope shall confirm to the new INCOTERMS.
- 3) Products not satisfying meet the standard specifications although the product is used under the normal service conditions such as temperature range and power etc.

### Response procedure

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

### Disclaimer

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

### Others

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