

## G-TRAN Series

### Pirani Vacuum Gauge Sensor Unit

Analog Output Type

Model SW100-A

Serial Communication Type

Model SW100-R

### Specification



ULVAC, Inc.  
Components Division

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## 1. Specification

The Pirani vacuum gauge sensor unit SW100 is a vacuum gauge that can measure the low vacuum pressure by connecting a dedicated sensor (SWP series).

SW100 is the next model to the conventional model SW1. SW100-A is compatible with SW1-1, and SW100-R is compatible with SW1-2.

The following two types of interfaces are available. You can select the specification that best suits the communication type.

Analog output type : SW100-A (Next model of SW1-1)

Serial communication type : SW100-R (Next model of SW1-2)

(Hereinafter, SW100 refers to both SW100-A and SW100-R.)

The I/O connector of SW100 uses a D-sub 15pin and USB Type-C.

SW100 is set with the dedicated Windows/Android application "UL-MOBI".

※ "UL-MOBI" can be downloaded from our homepage or Google Play. For details, refer to the SW100 instruction manual.

※ USB Type-C can be connected to a Windows/Android device with UL-MOBI installed using the USB cable, and can be monitored and set by UL-MOBI.

※ UL-MOBI for Windows requires a Windows device with a USB device driver installed. For details, please refer to the SW100 instruction manual.

※ Settings that require UL-MOBI are SET POINT, OUTPUT, ADDRESS, BAUD RATE, and CHECKSUM. For details, please refer to the SW100 instruction manual.

※ Windows/Android devices and USB cable are not included.

### 1.1. Standard specifications

Name	Pirani vacuum gauge sensor unit	
Type	Analog output	Serial communication
Model	SW100-A	SW100-R
Compatible sensor ※Includes the selected one	Sensor for SW100: 1pc. SWP-16 (NW16), SWP-25 (NW25), SWP-R1/8 (R1/8), SWP-P18 (φ18mmtube), SWP-P15 (φ15mmtube), SWP-CF16 (ICF034), SWP-1S (ASME BPE sanitary1") ※See Section 6.2	
Measureable pressure range (N <sub>2</sub> )	5 × 10 <sup>-2</sup> Pa to 1 × 10 <sup>+5</sup> Pa	
Measurement accuracy※ <sup>1</sup> (N <sub>2</sub> )	1 × 10 <sup>-1</sup> Pa to 1 × 10 <sup>+4</sup> Pa : ±10%	
	5 × 10 <sup>-2</sup> Pa to 1 × 10 <sup>-1</sup> Pa : ±20% 1 × 10 <sup>+4</sup> Pa to 1 × 10 <sup>+5</sup> Pa	

Repeatability	$1 \times 10^{-1}$ Pa to $1 \times 10^{+4}$ Pa : $\pm 2\%$	
Measuring gas type	Indicate pressure as sensitivity to N <sub>2</sub> gas	
Sampling time	5times in 60msec moving average	
Measured value output	Output voltage : DC 0V to 10V Pressure indication: DC 1.7V to 8.0V log output DC 1.0V/digit	
	Update time	50msec
	Resolution	3mV
	Error	$\pm 3$ mV
	Output impedance	10 $\Omega$
Adjustment	Zero point/atmospheric pressure adjustment, adjustment clear	
Control input signal	Zero point/atmospheric pressure adjustment, adjustment reset Operates with open collector input, negative logic	
Control output signal	Sensor error signal, setpoint1/2 Open collector output, negative logic Rating: 30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW	
Communication	D-sub15pin USB Type-C ※USB Type-C can only be used for communication using UL-MOBI.	
	Serial communication	RS-232C/RS-485
	Communication speed	9600/19200/38400bps
	Memory function	Back up with EEPROM
LED display	POWER/ERROR: Power, Error LED	
	SET-1 : Setpoint1 LED	
	SET-2 : Setpoint2 LED	
Sensor material	Filament: Pt Others: SUS304 (SWP-1S: SUS316L/Ra<0.5), FeNiCo, Ni, Au, Glass, Ceramic	



CE standard		Low Voltage Directive EN61010-1:2010(Third Edition), A1:2019 2014/35/EU EMC Directive EN61326-2-3:2013 2014/30/EU Static electricity test IEC61000-4-2:2008 Radiation electromagnetic field test IEC61000-4-3:2006+A1:2007+A2:2010 Transient burst test IEC61000-4-4:2004+A1:2010 Lightening surge test IEC61000-4-5:2005 Conduction test IEC61000-4-6:2008 Commercial magnetic field test IEC61000-4-8:2009 Radiation field intensity measurement CISPR11:2009+A1:2010:Group 1 Class A RoHS EN IEC63000:2018 2011/65/EU						
UKCA standard		Conforms to British legislation equivalent to EU Directives for CE standards listed above.						
I/O connector		D-sub15pin connector (male), M2.6mm screw USB Type-C ※USB Type-C can only be used for communication using UL-MOBI.						
Weight		SW100 only: Approx.105g						
Dimensions		SW100 only: Approx. 48mm×30mm×74mm ※See Section 6.1						
Sensor	Model	SWP-16	SWP-25	SWP-R1/8	SWP-P18	SWP-P15	SWP-CF16	SWP-IS
※See Section 6.2	Inner volume	7.3cm <sup>3</sup>	7.8cm <sup>3</sup>	7.6cm <sup>3</sup>	13.9cm <sup>3</sup>	10.0cm <sup>3</sup>	11.3cm <sup>3</sup>	8.2cm <sup>3</sup>
	Weight	45g	48g	44g	43g	30g	60g	95g

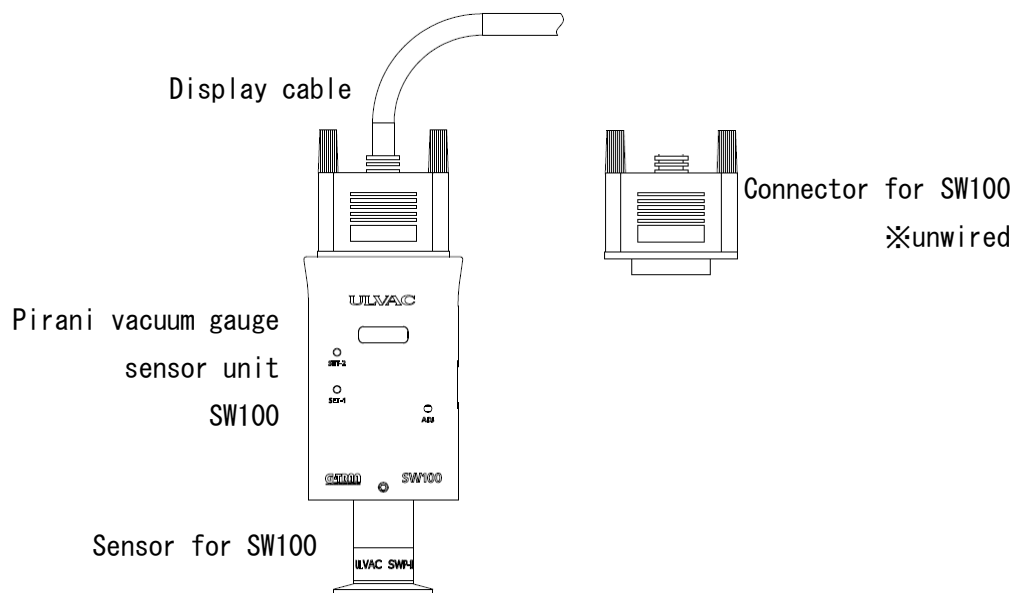
accuracy<sup>※1</sup>: The accuracy after atmospheric pressure and zero point adjustment.  
Please carry out atmospheric pressure and zero point adjustment before  
use especially. Moreover, since calibration gas is N<sub>2</sub>, when other gas  
is measured, be careful of an error of measurement.

## 1.2. Included items

Pirani vacuum gauge sensor unit SW100 (Main unit)	1pc.
Sensor for SW100	1pc. (attached to the main unit)
Quick manual (Regular paper)	1copy

## 1.3. Items that need to be ordered separately

I/O connector for SW100	D-sub15pin connector (female), M2.6mm screw ※unwired
Calibration certificate	Calibration certificate JCSS calibration certificate
Inspection certificate	
Traceability certificate	
Display unit	Model ISG1 (DC24V power supply)
Display cable	Between SW100 and display unit 2m, 5m, 10m
Sensor for SW100 ※See Section6.2	SWP-16 (NW16), SWP-25 (NW25), SWP-R1/8 (R1/8), SWP-P18 ( $\phi$ 18mmTube), SWP-P15 ( $\phi$ 15mmTube), SWP-CF16 (ICF034), SWP-1S (ASME BPE sanitary1" )



#### 1.4. OUTPUT (Measured output voltage compatibility) (SW100-A only)

The SW100-A maintains the compatibility (OUTPUT) shown in this chapter for the measured output voltage. By using this function, it can be replaced with SW100-A without changing the setting to convert the measured output voltage from SW100-A to the pressure value on the equipment side.

The setting of this function can be easily set with the dedicated application "UL-MOBI".

OUTPUT	Compatible models/conversion formula
SP1	ULVAC Pirani vacuum gauge sensor unit SP1
PSG	$P=10^{\wedge}((V-3.572)/1.286)$ (P : Pressure[Pa]、V : Measured output voltage[V])
APG	$P=10^{\wedge}(V-4)$ (P : Pressure[Pa]、V : Measured output voltage[V])

After purchase, please check the instruction manual of SW100 for both new installation and replacement, and set and connect. When used as a compatible unit, the performance of SW100-A may be limited, so please read the instruction manual.

- ※ "UL-MOBI" can be downloaded from our homepage or Google Play. For details, refer to the SW100 instruction manual.
- ※ To set SW100, a Windows/Android device with the application "UL-MOBI" installed and a USB cable (SW100 side: Type-C) are required.
- ※ UL-MOBI for Windows requires a Windows device with a USB device driver installed. For details, please refer to the SW100 instruction manual.
- ※ ULVAC display unit ISG1 does not support the measured value output voltage conversion formula of PSG and APG.
- ※ If the specifications of the I/O connector are different, you need to change the connector.
- ※ If you set the SW100 on the equipment side, you do not need to use the compatibility function in this section.

## 1.5. Pin layout

### 1.5.1. Analog output type SW100-A (D-sub15pin (male), M2.6mm screw)

Pin number	This unit	Function
1	Power supply	Power supply for driving this unit DC 14V to 30V
2	Sensor error	It outputs a signal when an error occurs, such as filament disconnection. Lo, DC 30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW
3	Setpoint1	It outputs a signal when setpoint1 is operating. Lo, DC 30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW
5	Adjustment input	Input a signal when adjusting zero point or atmospheric pressure. Operates when short with GND
8	Measure signal output	It outputs a measured value. DC 0V to 10V
9	Power supply GND	Ground for the power supply
11	Setpoint2	It outputs a signal when setpoint2 is operating. Lo, DC 30V <sub>MAX</sub> , 50mA <sub>MAX</sub> , 70mW
15	Signal GND	Ground for the output signal
Case	Frame ground	Ground of frame

※ When SP1, PSG, APG is selected as OUTPUT (see Section 1.4 of this manual), it is different from the above pin layout. For details, refer to the SW100 instruction manual.



## 1.5.2. Serial communication type SW100-R (D-sub15pin (male), M2.6mm screw)

Pin number	This unit	Function
1	Power supply	Power supply for driving this unit DC 14V to 30V
2	Sensor error	It outputs a signal when an error occurs, such as filament disconnection. Lo、DC 30V <sub>MAX</sub> 、50mA <sub>MAX</sub> 、70mW
3	Setpoint1	It outputs a signal when setpoint1 is operating. Lo、DC 30V <sub>MAX</sub> 、50mA <sub>MAX</sub> 、70mW
4	RS232C RxD	RxD of RS-232C
5	Terminating resistor for RS485	Terminating resistor for RS-485 Connect with pin13.
6	RS232C TxD	TxD of RS-232C
8	Measured value output	It outputs a measured value. DC 0V to 10V
9	Power Supply GND	Ground for the power supply
10	RS485-	Minus of RS-485
11	Setpoint1	It outputs a signal when setpoint2 is operating. Lo、DC 30V <sub>MAX</sub> 、50mA <sub>MAX</sub> 、70mW
12	RS485+	Plus of RS-485
13	RS485+ for connecting the terminating resistor	Terminating resistor for RS-485. Connect with pin5.
15	Signal GND	Ground for the output signal
Case	Frame ground	Ground of frame

## 2. Measurement value output

This unit outputs the measured value as a voltage signal of DC 0V to 10V.

I/O connector: 8pin[Measured value output+]-15pin[GND]

- ※ When SP1, PSG, APG is selected as OUTPUT (see Section 1.4 of this manual), the specifications are followed instead of the voltage output and pin sign in this section. For details, refer to the SW100 instruction manual.

### 2.1. Pressure conversion formula

Use the following formula to convert to pressure.

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

P: Pressure V: Measured output voltage[V] C: Conversion factor

Pressure unit	C: Conversion factor
Pa	3
Torr	5.1249
mbar	5

- ※ When SP1, PSG, APG is selected as OUTPUT (see Section 1.4 of this manual), follow the respective conversion formulas instead of the pressure conversion formulas in this section. For details, refer to the SW100 instruction manual.

### 2.2. Measurement value output

The table below shows the measurement value output under some conditions that can occur during measurement.

Operating state	Measurement value output voltage
Normal measurement	DC 1.7V to 8.0V
Higher than atmospheric pressure	DC 8.0V or more
Below measurable lower limit	DC 1.0V to 1.7V
Filament disconnection	DC 9.0V or more
4 seconds after startup	DC 8.1V

- ※ When SP1, PSG, APG is selected as OUTPUT (see Section 1.4 of this manual), the value will correspond to each conversion formula, not the output voltage in this section. For details, refer to the SW100 instruction manual.

### 3. Control input/output signal

#### 3.1. Control output signal (Lo output during operation)

Photocoupler ratings [ $30V_{MAX}$ ,  $50mA_{MAX}$ ,  $70mW$ ]

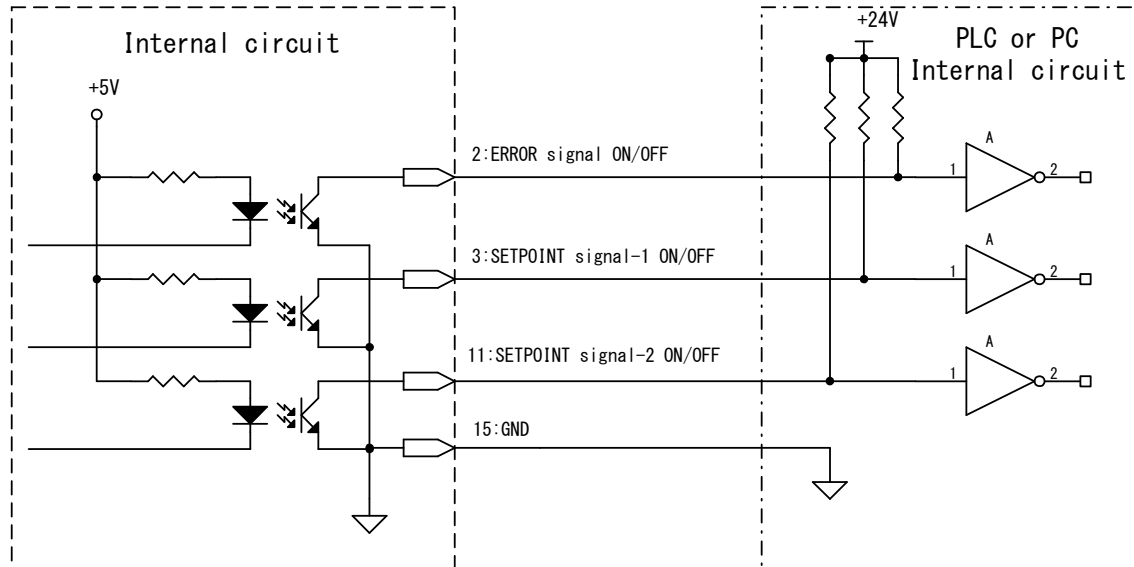


Fig. 3-1 SW100 output signal internal circuit diagram

#### 3.2. Control input signal (Analog output type SW100-A only)

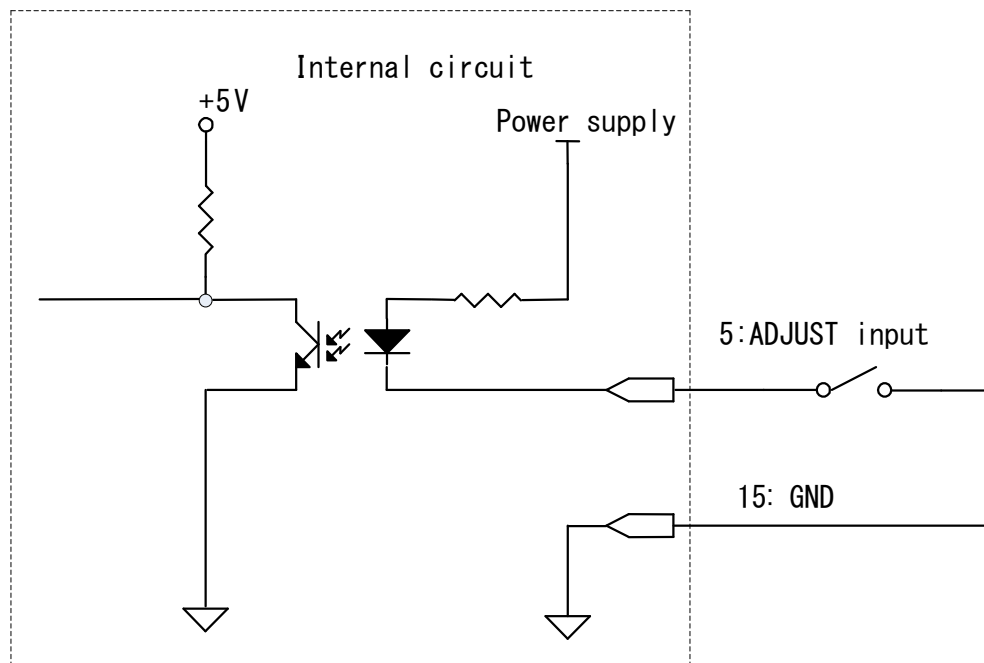


Fig. 3-2 SW100-A input signal internal circuit diagram

#### 4. How to use serial communication (Serial communication type SW100-R only)

##### 4.1. Communication specifications

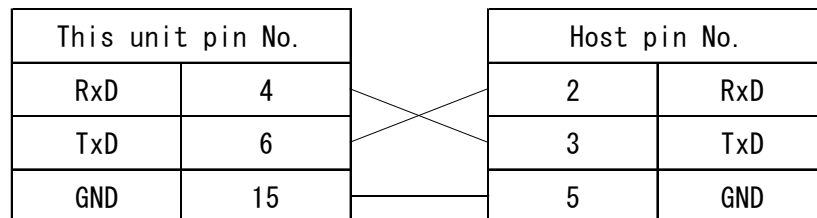
RS-232C	RS-485
Two-wire type	
Full duplex	Half duplex
Asynchronous	
ASC11 code	
Data bit length 8 bits	
Stop bit 1 bit	
No parity	
Maximum cable length 15 m	Maximum cable length 30 m
Maximum connection: 1	Maximum connections: 32 (including host)
9600/19200/38400 bps	9600/19200/38400 bps

##### 4.2. Settings

###### 4.2.1. Connection diagram

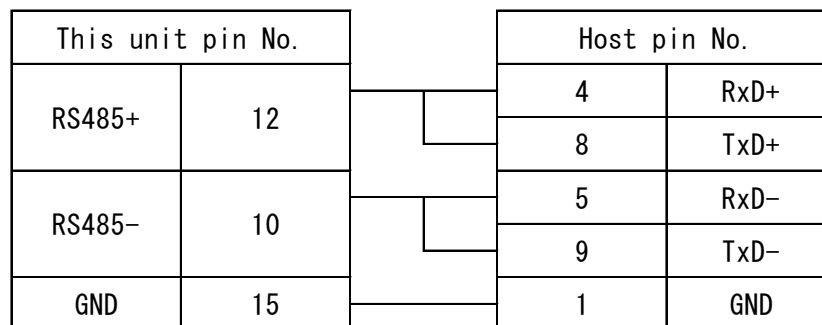
###### 4.2.1.1. RS-232C connection diagram

An example of RS-232C connection is shown below. The host side is a D-sub 9pin.



###### 4.2.1.2. RS-485 without terminating resistor (Example)

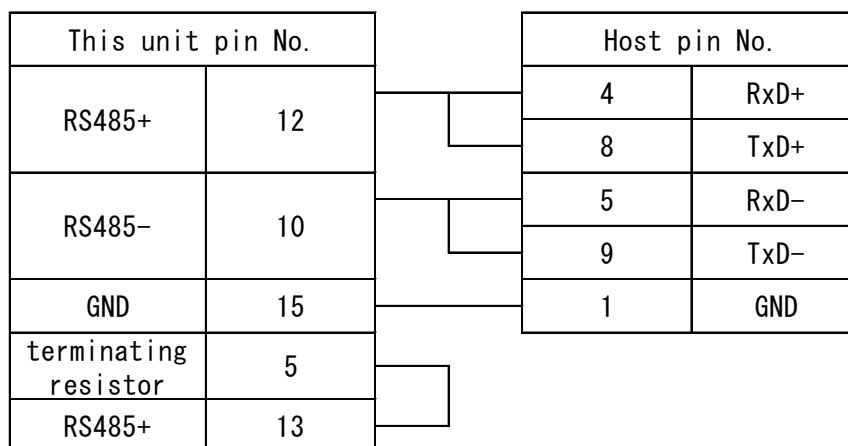
Example) USB serial interface USB-485 manufactured by NATIONAL INSTRUMENTS.



#### 4.2.1.3. RS-485 with terminating resistor (Example)

Example) USB serial interface USB-485 manufactured by NATIONAL INSTRUMENTS.

If the number of RS-485 connections is large, the total length of the connection cable is more than 15m, or communication errors frequently occur, install a terminating resistor in the terminating equipment.



#### 4.3. Standard data format

The following is the standard data format for sending and receiving.

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

:	Colon
AD0	Device address, higher 4bit (0~9)
AD1	Device address, lower 4bit (0~9)
CMD	Commands (upper/lower case-sensitive)
D0	Data 4bit (0~9, A~F)
Dn	Data 4bit (0~9, A~F)
SH	Higher bits of status (4bit)
SL	Lower bits of status (4bit)
CHKH	Higher bits of checksum (4bit) (0~9, A~F)
CHKL	Lower bits of checksum (4bit) (0~9, A~F)
CR	Carriage return

- Commands consist of alphanumeric uppercase and lowercase characters.
- The checksum is the exclusive OR sum (XOR) from AD0 to SL. Convert all in ASCII code hexadecimal.

## 4.3.1. Command list

Command	Description	Command	Description
D	Read measured value and status	T	Reading the model and software version
ZER	Zero point adjustment	1R	Read Setpoint1 value
ATM	Atmospheric pressure adjustment	2R	Read Setpoint2 value
CLR	Clear the zero point and atmospheric pressure adjustment	1W	Write Setpoint1 value
SR	Reading status	2W	Write Setpoint2 value
SW	Writing status		

## 4.4. Command (Excerpt): Reading measured value and status

Command

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

Return format from this unit to PC

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

- 「X.XXE±XX」 is the measured pressure value.  
e.g. 1)  $3.00\text{E}+03 \Rightarrow 3.00 \times 10^{+3}$   
e.g. 2)  $5.00\text{E}+00 \Rightarrow 5.00 \times 10^{+0}$   
e.g. 3)  $4.00\text{E}-01 \Rightarrow 4.00 \times 10^{-1}$
- When 「E.EEE+EE」 is returned.: Sensor error
- When 「F.FFE+FF」 is returned.: The measurement range is exceeded or filament is off.
- Please refer to Section4.3 for SH and SL.

## 5. Warranty

This unit is strictly inspected in-house before it is shipped out. However, should any failure that is our responsible occur, such as defects in manufacturing or accidents during transportation, please contact the Components division of ULVAC, Inc. or the nearest sales office or distributor. We will repair or replace it free of charge.

### Warranty covered items

- 1) Pirani vacuum gauge sensor unit SW100
- 2) Sensor immediately after delivery

### Warranty period

One year from the date of delivery

### Warranty scope

- 1) Domestic transaction: A product that is damaged due to the problem during transportation at the time of delivery.
- 2) Direct export transaction: A product that is damaged due to problem during transportation at the time of delivery. The warranty scope specified in the latest INCOTERMS shall be applied.
- 3) A product that does not meet the basic specifications of this unit even though it is used within the operating conditions of the basic specifications, such as the measurement pressure, the operating temperature limits, and the operating power supply.

### Warranty support

- 1) Domestic transaction: We will send you a replacement. Or we will ask you to send the unit to the nearest service center or us for repair. If you need local support, please contact the Components division of ULVAC, Inc. or your nearest sales office or distributor.
- 2) Direct export transaction: We will send you a replacement. Or we will ask you to send the unit to the nearest service center or us for repair. Please note that the customer is responsible for return shipping costs.

#### Disclaimer

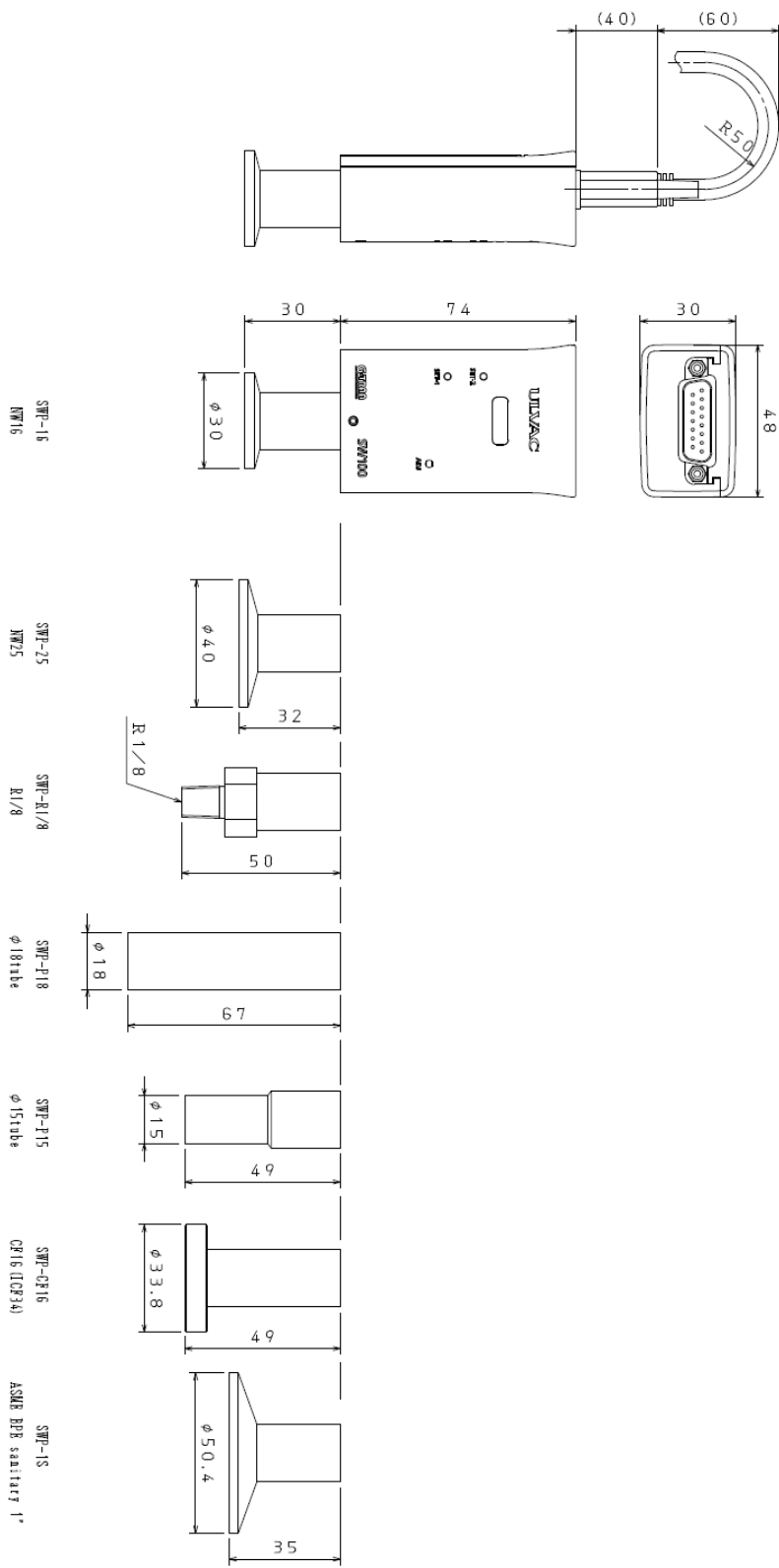
- 1) Products that are out of warranty period.
- 2) Failures and malfunctions caused by natural disasters such as fires, storms, floods, earthquakes, and lightning, and force majeure disasters such as wars.
- 3) Failure or malfunction caused by careless handling or improper use.
- 4) Products that are modified, disassembled, or repaired without our consent.
- 5) Defects and damages under an abnormal environment (Strong electromagnetic field, radiation environment, high temperature, high humidity, flammable gas atmosphere, corrosive gas atmosphere, dust).
- 6) Failures and malfunctions caused by noise.
- 7) Secondary damage caused to you by product defects or a third party's claim that we infringe a patent.
- 8) Sensor unit in use (Lifespan due to the use, measurement error due to contamination).
- 9) Sensor cable in use (Cable disconnection or poor contact due to improper installation).

#### Other

- 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) When exporting this product outside of Japan, please notify us and take necessary procedures according to Export Related Legislation such as the Foreign Exchange and Foreign Trade Act.
- 3) Should you have any questions or need consults about this product, please check the model and the serial number and contact the nearest sales office, distributor, or the components division of ULVAC, Inc.
- 4) Please note that the contents of this instruction manual are subject to change without notice.



6. Diagrams  
6.1. SW100 dimensions



## 6.2. SWP (Sensor for SW100) dimensions

