YO00-0931-EQ-003-05

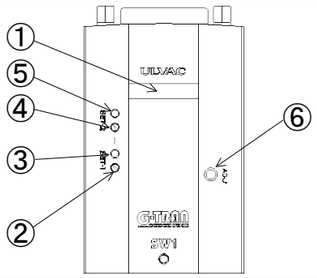
ULVAC

G-TRAN Series
Pirani Vacuum Gauge SW1
Quick Manual

Introduction
This quick manual is for quick check of operation and display of the product. Please refer to instruction manual in advance for detailed information about operation, precautions and safety for proper use. Available for download from ULVAC website. https://showcase.ulvac.co.jp/ja
This manual is for the following gauges. Serial Nos. 00001 and higher.

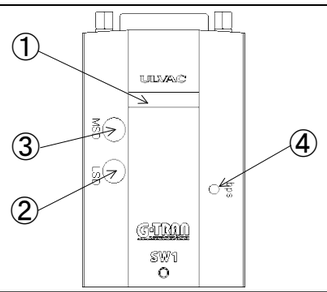
1. Nomenclature and Functions

1.1.SW1-1



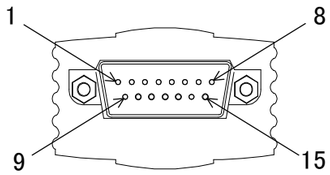
Component		Function
①	POWER/ERROR lamp	Lit blue when this unit is operating normally. If the sensor head filament burns out, the red light comes on. If ZERO point adjustment or atmospheric pressure adjustment is made, the blue light blinks.
②	SET-1 setting trimmer	Adjust the setpoint 1 set voltage with a trimmer.
③	SET-1 lamp	Lit when setpoint 1 is actuated.
④	SET-2 setting trimmer	Adjust the setpoint 1 set voltage with a trimmer.
⑤	SET-2 lamp	Lit when setpoint 2 is actuated.
⑥	ADJ switch	Switch for adjusting atmospheric pressure and zero point.

1.2.SW1-2



Component		Function
①	POWER/ERROR lamp	Lit blue when this unit is operating normally. If the sensor head filament burns out, the red light comes on. If ZERO point adjustment or atmospheric pressure adjustment is made, the blue light blinks.
②	Address setting MSD (higher order 4 bits)	Sets the address of the RS-485 in the figure 10.
③	Address setting LSD (lower order 4 bits)	Sets the address of the RS485 in the figure 11.
④	Baud rate	Sets baud rate.

1.3. Input/Output Connector（D-sub15 pin connector male M2.6mm screw）



SW1-1		
Terminal No.*	Sensor unit	Function
1	Power supply	Power supply for actuating this unit(18 to 30 V DC)
2	Sensor error	Outputs a signal when the filament has burn out or at other times(Lo output)
3	Setpoint 1	Outputs a signal when setpoint 1 is actuated. (Lo output)
5	ADJ adjustment input	Input a signal when adjusting atmospheric pressure or zero point(Lo input)
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 unit.
11	Setpoint 2	Outputs a signal when set point 2 is actuated (Lo output).
14	Setpoint 2 set value	Outputs the voltage for setting setpoint 2. (0 to 10 V DC)
15	Signal GND	Ground for output signal
Case	FG	Frame ground
SW1-2		
Terminal No.*	Sensor unit	Function
1	Power supply	Power supply for actuating this unit(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 unit
10	RS485-	Minus of RS485
12	RS485+	Plus of RS485
13	RS485+ (for connecting terminator)	Connected to the terminator pin 5 for RS485
15	GND	Ground for output signal
Case	FG	Frame ground

*Terminals other than those denoted here are not used. Do not wire these terminals, which are used in the internal circuit.

2. Installation

2.1. Unpacking and Quantity Check

Upon receipt of the instrument, unpack it and check it to see that it is not damaged in transit and that accessories are supplied as specified.

SW1 Pirani gauge basic unit (with sensor head)	1pc
Quick manual(This paper)	1copy

2.2. Installing the sensor unit

1) Sensor installing environment

This unit measures the static pressure in the position where the sensor head is connected. If the instrument is installed in an environment where there is a flow in the vacuum system or where there is a source of outgas or high intensity electrons or ions or magnetic field in the vacuum system, select the measuring position carefully and install the instrument in a position where measurement is least affected.

2) Installing the sensor head

Install the sensor head in such a way that the plane of the sensor head mounting port is parallel to the gas flow. See to it that gas does not enter the sensor head in a beam.

Do not use the instrument in a place where vibration is at a high level because the Pirani gauge sensor head filament is as small as 25 □m in diameter. Also be careful in selecting the installation place and in handling the instrument because, in most cases, mechanical impact is responsible for filament breakdown.

O-rings to be used in installing the sensor head should be as free from outgas as possible. Use of a rubber pipe or grease which releases much outgas can be a cause of outgas or short service life.

2.3.Electrical connection

•Signal GND [15-pin] is the ground for the signal of pressure signal output, setpoint, setpoint set value, and sensor error signal, serial communication, etc.

•Power GND [9 pin] and signal GND [15 pin] are common after being passed through the filter.

Use power [1 pin] and power GND [9 pin] in connecting to the power line. If power GND [9 pin] is used as signal GND, the power may be susceptible to noise.

2.4.Cautions in Operation

- Fix the cable so that undue force is not applied to cable connections.
- Tighten the connector fixing screws securely.
- Start measurement more than 20 minutes after turning on power.

3.Extarnal input and output signals

This section describes the signals that are output from, and input to, this unit.

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

This unit outputs measured pressure with a signal 0 to 10 VDC.
I/O connector: Pin 8 [pressure signal output +] – pin 15 [GND]

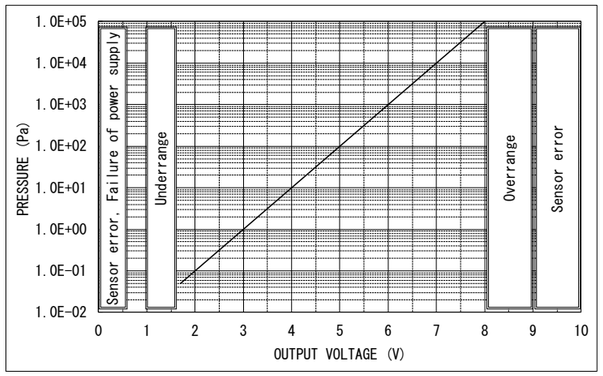
3.1.1. Pressure converting equation

P=10^(V-3) ⇔ V=Log P +3

P: Pressure (Pa) V: Output voltage (V)

3.1.2.Output of measurement value in each state

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 1Vor less
Sensor error, failure of power supply	DC0.5V or less



3.2. I/O Output Signal (Standard Type SW1-1 only)

The sensor error and setpoint signal are output from the I/O connector of this unit in the open collector format. The rating of the photocoupler is [30 V max, 50 mA max, 70 mW].

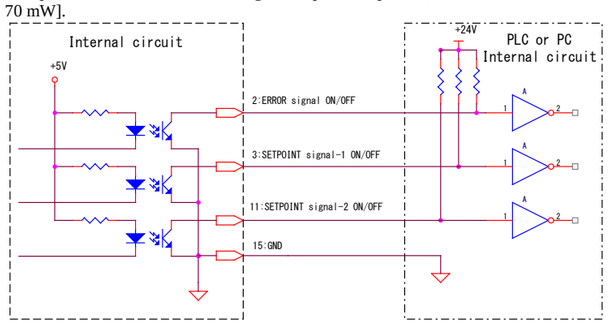


Fig.3-2. Signal output internal circuit diagram

3.2.1. Sensor error signal (Standard Type SW1-1 only)

The sensor error signal outputs sensor head filament burnout.

If a sensor error occurs, the signal will be Lo output.I/O connector: pin 2 (sensor error) – pin 15 (GND)

If the sensor error occurs, the POWER/ERROR LED will light red, and the pressure signal output will be 9 V or more.

3.2.2. Setpoint actuating signal (Standard Type SW1-1 only)

Setpoint is a function of outputting a signal to outside or lighting the LED when the pressure has lowered to below a set level. The set pressure value is called “Setpoint”. If a pressure being measured has come down to below the setpoint, the signal will be Lo output.Refer to Section 6 for how to set the setpoint.

3.3. I/O Input Signal (Standard Type SW1-1 only)

Zero point adjustment and atmospheric pressure adjustment are input through the I/O connector of this unit.

The photocoupler is connected to the line voltage (18 V to 30 V DC) that is input to this unit. Use a one with a contact capacity of 30 VDC or more or more than the line voltage. When using it, short the pin of the signal to use and the GND terminal.

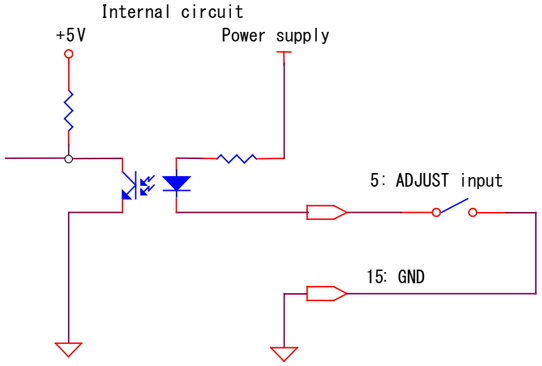


Fig.3-3. Internal circuit diagram

4. Setting the Setpoint (Standard Type SW1-1 only)

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

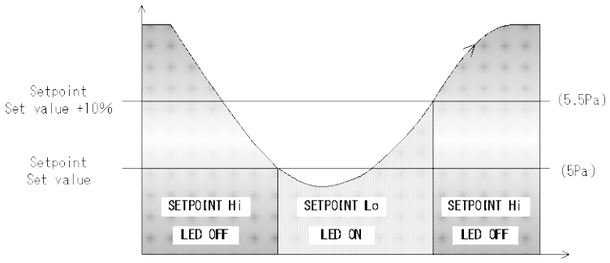
To use the setpoint function, make necessary settings according to the instructions. Both setpoints 1 and 2 have been set at about 0.4Pa (approx. 2.5 V) before shipment from the factory.

4.1. Set point ON/OFF pressure

Set point has hysteresis for ON pressure and OFF pressure

ON Pressure : set value

OFF Pressure : set value+10%



4.2.Wiring in setting Setpoint

Make wiring arrangement between pin 1 [+24 V power] and pin 9 [power ground] of the I/O connector of this unit and connect a voltmeter between the setpoint set value and ground.

Setpoint 1 set value: Between pin 7 [setpoint 1 set value] – pin 15 [GND]

Setpoint 2 set value: Between pin 14 [setpoint 2 set value] – pin 15 [GND]

4.3. Setting of Setpoint

The voltage of the setpoint set value can be changed by turning the trimmer for setting setpoint. This voltage in converted by the same method as the output voltage of the measured pressure. Calculate a voltage from a pressure point to set and turn the trimmer to obtain the voltage for adjustment.

V=Log P +3 ⇔ P=10^(V-3)

P: Pressure (Pa) V: Output voltage (V)

5. Zero Point Adjustment and Atmospheric Pressure Adjustment

More accurate measurement can be made by adjusting the zero point and atmospheric pressure.

If there is any deviation in the indicated value on the atmospheric pressure side or zero point side, make adjustment according to the following procedure.

5.1. Checking the Completion of Adjustment

If zero point or atmospheric pressure adjustment is made, the POWER/ERROR LED action will change as follows.

Action of POWER/ERROR LED	Condition
Turned off for 0.3 second	Adjustment has been completed normally.
"0.3-second off" continues 3 times consecutively	Adjustment was not made. → Check pressure. → Check filament for burnout.
Off for 0.3 second, and off for 0.3 second again 3 seconds later, or "0.3-second off" 3 times consecutively, followed by off again 3 seconds later	Atmospheric pressure adjustment and zero point adjustment have been reset.
Stays lit	No signal is input. →In manual operation, press the switch again. → In the case of I/O, check the wiring and others. → Check the communication command.

5.2. Adjusting Method

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

Model	Adjusting method	Operating procedure
SW1-1	Manual adjustment	Hold down the "ADJ" switch on this unit for 1 second or more.
	External I/O adjustment	Turn on (short) "ADJ adjustment input" from I/O for 1 second or more.
	Adjustment reset	Hold down the "ADJ" switch for 5 seconds or more or turn on (short) "ADJ adjustment input" from I/O for 5 seconds or more.
SW1-2	Communication	Input each command by serial communication.

5.3. Zero Point, ATM Adjustment, adjustment resetting

ZERO point and ATM pressure adjustment configures for every adjustment signal input, therefore there is no need to reset the configurations.

Configuration reset sets both ZERO point and ATM pressure back to default. This function is only recommended for sensor head lifetime check or at exchange.

5.4. Zero Point Adjustment

If zero point adjustment is made immediately after the pressure has come down to below $1x10^{-2}$ Pa, the temperature in the sensor head will not yet be in equilibrium, making the error high. Do not turn off the power to this unit until adjustment is completed.

The adjustment range is about ±1 Pa as default. If zero adjustment cannot be made, expiration of the sensor head life due to contamination of the filament is suspected.

(1)Evacuate the vacuum chamber.

(2)Make sure that the pressure in the vacuum chamber is 1×10^{-2} Pa or less using an ionization vacuum gauge or other.

(3)Wait for 5 minutes or more under a pressure of 1×10^{-2} Pa or less.

(4)Make adjustment.

5.5. Atmospheric Pressure Adjustment

If atmospheric pressure adjustment is made immediately after the vacuum chamber is evacuated to $1x\ 10^{+5}$ Pa, the temperature in the sensor head will not yet be in equilibrium and an error may result. Do not turn off the power of this unit until adjustment is completed.

The adjustment range is about $1x10^{-4}$ Pa to $2\ x10^{+5}$ Pa as default. If adjustment cannot be made, expiration of the filament life due to filament contamination is suspected.

(1)Feed nitrogen gas to the vacuum chamber.

(2)Make sure that the pressure in the vacuum chamber is $1x10^{-2}$Pa using a diaphragm vacuum gauge or other.

(3)Wait for 5 minutes or more with the vacuum chamber under a pressure of $1x10^{+5}$ Pa.

(4)Make adjustment.

5.6. Resetting

Both atmospheric pressure and zero point adjustment can be reset to the initial value by resetting atmospheric pressure and zero point adjustments to the initial values

5.7. Memory Function

The atmospheric pressure adjustment value and zero point adjustment value are stored in memory even if the power of this unit is turned off.

If the instrument has not be used for a long time, however, make adjustment before using it.

6. Checking the Filament and Temperature Sensor for Burnout

The diagram below shows the connection of the Pirani sensor head filament. Check continuity referring to this diagram. The resistance of the filament is about 5Ω under atmospheric pressure and that of the temperature sensor is about 1.1 kΩunder atmospheric pressure.

Note)Beware of over-current

If the filament or temperature sensor is energized with an over-current of 2 mA or more, it may burn out. Be alert to the current value on the measuring instrument. Also measure the resistance value under atmospheric pressure because in vacuum, the filament and other components are heated and an accurate resistance value cannot be measured.

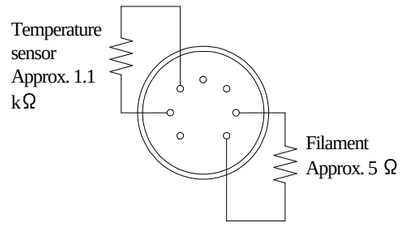


Fig. 6-1. Sensor head filament and temperature sensor connection diagram

7. Specifications

7.1. Key Specifications		
Name	Pirani vacuum gauge	
Type	Standard type	Serial communication type
Model name	SW-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	5.0×10^{-2} to $1.0 \times 1^{+5}$ Pa	
Output pressure tange	1.0×10^{-2} to $1.2 \times 1^{+5}$ Pa	
Measurement accuracy *1(N_2)	1×10^{-1}Pa～$1\times10^{+4}$Pa : ±10% 5×10^{-2}Pa～1×10^{-1}Pa $1\times10^{+4}$Pa～$1\times10^{+5}$Pa : ±20%	
Repeatability	1×10^{-1}Pa～$1\times10^{+4}$Pa : ± 2%	
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	50ms	
Resolution	4mV	
Output error	±3mV	
Output impedance	10Ω	
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_{MAX}, 50 mA_{MAX}, 70 mW	
Monitor for setpoint	Setpoint 1/2: 0 to 10 VDC LOG output	
Output impedance	10Ω	
Serial communication		RS-485/RS-232C
Baud rate		9600/19200/38400bps
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, 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)	
Standard	CE standard	
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 inner volume	Approx. 7.3 cm^3 (SWP-16)	
Basic unit weight	Controller approx. 105 g, sensor head (SWP-16) approx. 45 kg	
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 N2, when other gas is measured, be careful of an error of measurement.

7.2 Standard Accessories		
Quick manual	(This papaer)	1copy

7.3. Options		
Display unit		
	1CH Digital	ISG1(24VDC power supply type)
	4CH Digital	IM1R1(24VDC power supply type) IM2R1(100VAC power supply type)
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 calibration certificate		
General proofreading test		
Inspection certificate		
Calibration certificate		

8. 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

Warrantee scope

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

Response procedure

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

Disclaimer

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

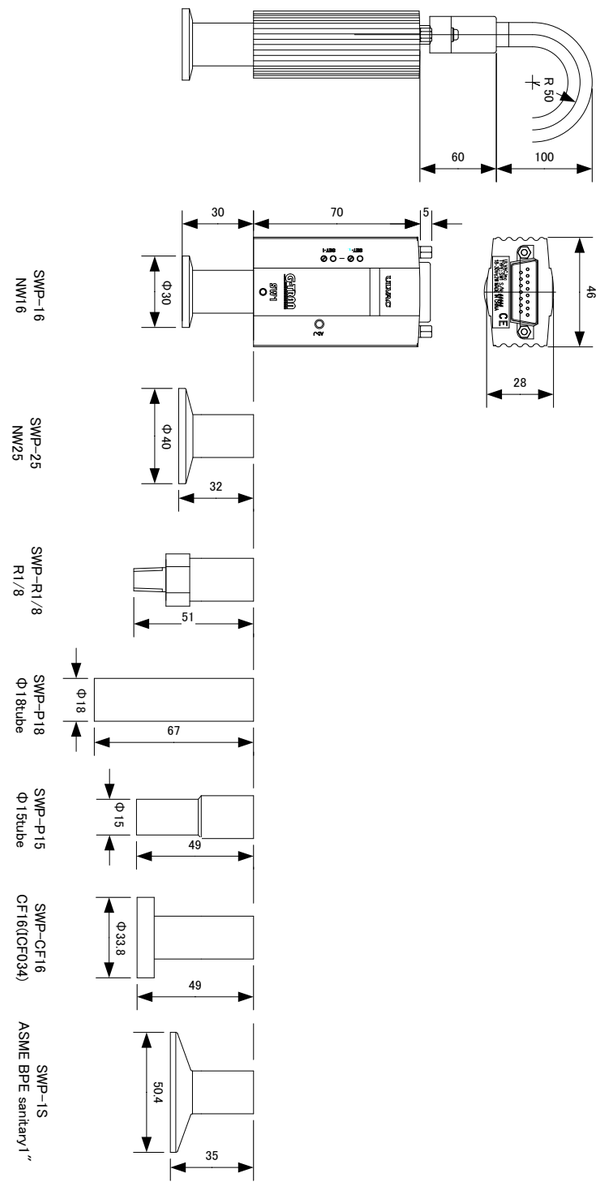
9. Certificate of Decontamination

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. The form is available for download from ULVAC website.

10. Network

ULVAC,Inc: http://www.ulvac.co.jp/eng/index.html
Service Centers: http://www.ulvac.co.jp/eng/support/service/index.html
Sales Offices: http://www.ulvac.co.jp/eng/support/sales_office/index.html

11.Drawing



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Components Division,
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