No.SK00-9656-EQ-003-08

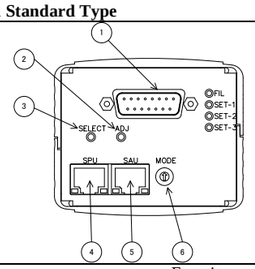
ULVAC

G-TRAN SERIES
Multi-Ionization gauge Sensor Unit
SH2-1,SH2-2
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://www.ulvac.co.jp/download/en/instruction-manual/
This manual is for the following gauges. SH2-1: Serial Nos. 06001 and higher. SH2-2: Serial Nos. 03001 and higher.

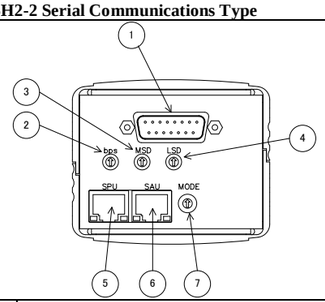
1. Part Names and Functions

1.1. Panel - SH2-1 Standard Type



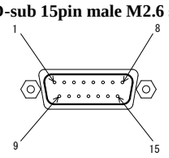
	Name (symbol)	Function
1	I/O connector	I/O connector for signals including the power supply and data
2	ADJ switch	Adjustment switch when adjusting pressure for the SAU
3	SELECT switch	Selection switch for pressure measurements, setpoint configuration, and SAU atmospheric pressure adjustments
4	SPU connector	Connector (RJ-45) to connect the SPU/SWU Pirani vacuum gauge measuring unit
5	SAU connector	Connector (RJ-45) to connect the SAU pressure sensor unit
6	MODE switch	Mode configuration switch for SH2 independent mode, SPU/SWU combination mode, and SAU combination mode.

1.2. Panel - SH2-2 Serial Communications Type



	Name (symbol)	Function
1	I/O connector	I/O connector for signals including the power supply and data
2	bps switch	Baud rate (communication speed) configuration switch
3	MSD switch	Communication address configuration switch, 10s place
4	LSD switch	Communication address configuration switch, 1s place
5	SPU connector	Connector (RJ-45) to connect the SWU/SPU Pirani vacuum gauge measuring unit
6	SAU connector	Connector (RJ-45) to connect the SAU pressure sensor unit
7	MODE switch	Mode configuration switch for SH2 independent mode, SWU/SPU combination mode, and SAU combination mode.

1.3. I/O connector D-sub 15pin male M2.6 screws



1.4. SH2-1 Standard Type

No	Sensor	Function
1	Power supply	Power supply to drive this unit
2	Sensor error	Outputs the pressure protection signal or a signal during an error such as when there is a filament break
3	Setpoint 1	Outputs a signal during setpoint 1 operation
4	Emission valid Connection signal	Outputs a signal when emission current is normal SWU/SPU and SAU connection check signal
5	FIL ON/OFF	Input a signal to turn the filament on or off * FIL ON signal in SH2 independent mode * FIL OFF signal in combination mode
6	FIL 1/2	Input a signal when selecting FIL 2
7	FIL power monitor	Outputs a signal when the FIL power exceeds the threshold
8	Pressure signal/setpoint setting output	Outputs the pressure signal and the setpoint setting output
9	Power supply GND	Ground for the power supply that drives this unit
10	Signal GND	Output signal ground
11	Setpoint 2	Outputs a signal during setpoint 2 operation
13	DEGAS ON/OFF	Input a signal during DEGAS ON
14	Setpoint 3	Outputs a signal during setpoint 3 operation
15	Signal GND	Output signal ground
Case	FG	Frame ground

1.5. SH2-2 Serial Communications Type

No	Sensor	Function
1	Power supply	Power supply to drive this unit
4	RS-232C RxD	RS-232C RxD
5	Terminal resistance for RS-485	Terminal resistance for RS-485, connect with pin 13
6	RS-232C TxD	RS-232C TxD
8	Analog output	Outputs the pressure signal
9	Power supply GND	Ground for the power supply that drives this unit
10	RS-485-	RS-485-
12	RS-485+	RS-485+
13	RS-485 (for terminal resistance connection)	Terminal resistance for RS-485, connect with pin 5
14	RS-232C GND	RS-232C ground
15	GND	Output signal ground
Case	FG	Frame ground

2. Attaching this unit

The pressure measurement measures the static pressure at the location where the gauge head is connected. When installed in environments with a flow in the vacuum system or environments with emitted gas sources or strong generation sources of electrons or ions, use caution in selecting the measurement location and attach this unit in a relatively unaffected location.

2.1. Attaching the gauge head

- Attach this unit so that the gauge head attachment opening surface is parallel to the gas flow. In particular, ensure that gases do not enter the gauge head interior like a beam.
- The Pirani vacuum gauge head filament is thin at φ25 μm, so avoid use as much as possible in locations with large amounts of vibrations. The biggest cause of filament breaks is from mechanical shock, so use caution regarding the installation location and handling.
- Use an O-ring to attach the gauge head that releases little gas. There is a risk of measurement errors or the gauge head operating life will decrease if materials that release a large quantity of gas, such as rubber tubing or grease, are used in the gauge head connection.

3. Mode Configurations : PLEASE CHECK

Configure the mode prior to use. The default is SPU combination mode. Please refer to a manual for the details.

No	Mode	Comments
0	SH2 independent mode	Ionization gauge only
1	SH2+SWU/SPU combination mode	Pirani vacuum gauge and ionization gauge ISG1 S/N: 04050～
2	SH2+SWU/SPU+SAU combination mode	Pressure sensor, Pirani vacuum gauge, ionization gauge ISG1 S/N: 04050～
3	SH2+SWU/SPU combination mode	Pirani vacuum gauge and ionization gauge ISG1 S/N: 00001～04049
4	SH2+SWU/SPU+SAU combination mode	Pressure sensor, Pirani vacuum gauge, ionization gauge ISG1 S/N: 00001～04049

※SWU and SPU cannot be used at the same time

4. Analog Output

4.1. Pressure conversion equation

$P = 10^{(V - 7.25) / 0.75 + C}$ ⇔ $V = 7.25 + 0.75 \times (\log P - C)$

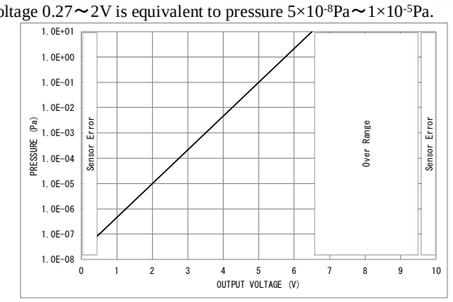
P: Pressure V: Output voltage (V)

Puressure Unit	C (Pressure unit dependent)
Pa	2
Torr	-0.1249
mbar	0

4.2. SH2 independent mode analog output

Operating state	Analog output voltage
Filament off	9.9 V or higher
During normal measurements	Voltage corresponding to the measured pressure 0.27 to 6.5 V
SH2 error (Errors such as a filament break)	9.9 V or higher
Power supply voltage abnormality, sensor unit fault, etc.	0.1 V or less

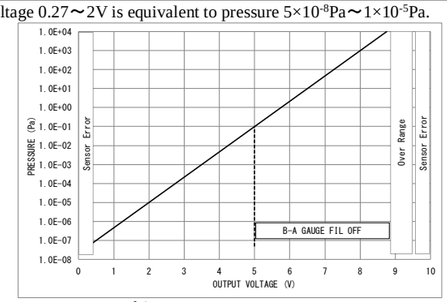
*1: Voltage 0.27～2V is equivalent to pressure 5×10^{-8}Pa～1×10^{-5}Pa.



4.3. SPU combination mode analog output

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

*1: Voltage 0.27～2V is equivalent to pressure 5×10^{-8}Pa～1×10^{-5}Pa.

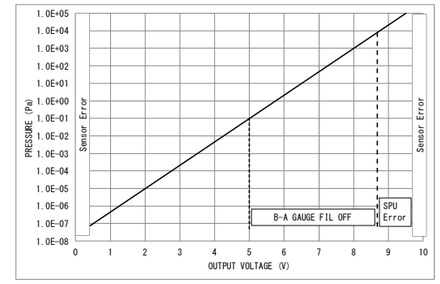


* Error is output even if SPU error.
However, the ionization gauge error is cleared by turning FIL off.

4.4. SAU combination mode analog output

Operating state	Analog output voltage
During normal measurements	Voltage corresponding to the measured pressure0.27 to 9.5 V
Atmospheric pressure or higher	9.5 V or higher
SH2 error (Errors such as a filament break)	Voltage corresponding to the measured by SAU and SPU 5 V to 9.5 V SWU and SPU 4.25 V to 9.5 V
Ionization gauge FIL OFF	Voltage corresponding to the measured by SAU and SPU 5 V to 9.5 V SWU and SPU 4.25 V to 9.5 V
SPU error (Errors such as a filament break)	Voltage corresponding to the measured by SAU 8.677 V to 9.5V
SAU error	9.9 V or higher
Power supply voltage abnormality, sensor unit fault, etc.	0.1 V or less

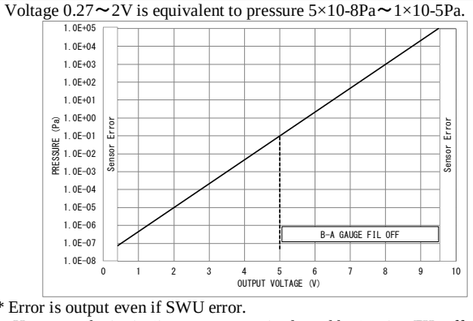
*1: Voltage 0.27～2V is equivalent to pressure 5×10^{-8}Pa～1×10^{-5}Pa.



4.5. SWU combination mode analog output

Operating state	Analog output voltage
During normal measurements	Voltage corresponding to the measured pressure 0.27 to 9.5 V
1x10^+5 Pa or higher	9.5 V
SH2 error (Errors such as a filament break)	Voltage corresponding to the measured by SWU 4.25 V to 9.5V
Ionization gauge FIL OFF	Voltage corresponding to the measured by SWU 4.25 V to 9.5V
SWU error (Errors such as a filament break)	9.9 V or higher
Power supply voltage abnormality, sensor unit fault, etc.	0.1 V or less

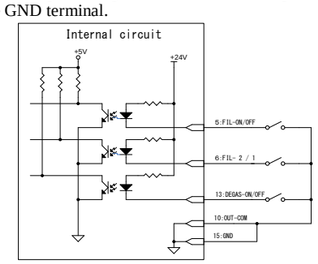
*1: Voltage 0.27～2V is equivalent to pressure 5×10-8Pa～1×10-5Pa.



* Error is output even if SWU error.
However, the ionization gauge error is cleared by turning FIL off.

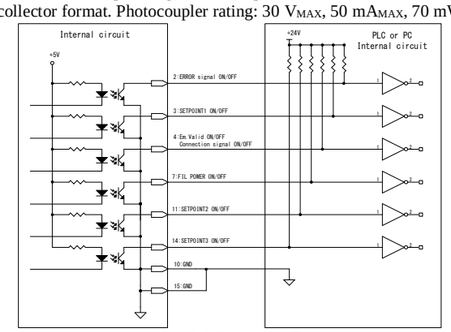
5. Control Input Signals (SH2-1 only)

FIL ON/OFF, FIL 1/2, and DEGAS ON/OFF are input with this unit's I/O connector. When using these signals, short between the pin of the signal to operate and the GND terminal.



6. Control Output Signals (SH2-1 only)

Sensor error and setpoint signals are output from this unit's I/O connector in open collector format. Photocoupler rating: 30 V_{MAX}, 50 mA_{MAX}, 70 mW



6.1. Sensor error signal (SH2-1 Standard Type only)

Sensor errors are signals that are output when an error occurs on this units.
When a sensor error occurs, the signal becomes low output.
When a sensor error occurs, the POWER/ERROR LED turns red and the pressure signal output becomes 9.9 V or higher.

6.1.1. **SH2 independent mode**

Error details	POWER LED	LED states	I/O	Comments
SH2-1/2 internal voltage abnormality	Red on	All LEDs off	No.2: Lo	Output 9.9 V or higher
Grid voltage abnormality	Red on	FIL LED 1 sec. flashing	No.2: Lo No.4: Hi	Error reset with FIL OFF
Filament break error				
Pressure protection	Red on	FIL LED 3 sec. flashing	No.2: Lo No.4: Hi	

6.1.2. **SWU/SPU combination mode**

Error details	POWER LED	LED states	I/O	Comments
SH2-1/2 internal voltage abnormality	Red on	All LEDs off	No.2: Lo	Output 9.9 V or higher
Grid voltage abnormality	Red on	FIL LED 1 sec. flashing	No.2: Lo No.4: Hi	Error reset with FIL OFF
Filament break error				
SWU/SPU power supply abnormality Unit cable abnormality	Red on	SPU LED Flashing	No.2: Lo No.4: Hi	Output 9.9 V or higher
Pirani vacuum gauge filament break				

6.1.3. **SAU combination mode**

Error details	POWER LED	LED states	I/O	Comments
SH2-1/2 internal voltage abnormality	Red on	All LEDs off	No.2: Lo	Output 9.9 V or higher
Grid voltage abnormality	Red on	FIL LED 1 sec. flashing	No.2: Lo No.4: Hi	Error reset with FIL OFF
FIL break error				
SPU power supply abnormality Unit cable abnormality	Red on	SPU LED Flashing	No.2: Lo No.4: Hi	Outputs SAU pressure
Pirani vacuum gauge Filament break				
SAU power supply fault Unit cable abnormality	Red on	SAU LED Flashing	No.2: Lo No.4: Hi	Output 9.9 V or higher

7. Configuring the Setpoints

The setpoint is a function that outputs an external signal and illuminates LEDs when the pressure falls below the configured pressure. The configured pressure value is called the setpoint.

To use a setpoint, follow this explanation and configure the necessary items. On the SH2-1, setpoint 1, 2, and 3 are all set to around 5x10-5 Pa (approx. 2.5 V) as the factory default.

7.1. Setpoint setting pressure

Pressure range which setpoint operate for pressure sensor, pirani gauge and ionization gauge is described in the following table.

Type name	Setpoint setting pressure	remarks column
SAU	$1\times10^{+4}$Pa〜$1\times10^{+5}$Pa	
SPU※1	$1\times10^{+1}$Pa〜$1\times10^{+4}$Pa	automatic switch
SPU※2	4×10^{-1}Pa〜$1\times10^{+4}$Pa	the condition filament of ionization gauge is forcibly OFF
SH2	5×10^{-8}Pa〜$1\times10^{+1}$Pa	
SWU※1	$1\times10^{+1}$Pa〜$1\times10^{+5}$Pa	automatic switch
SWU※2	1×10^{-2}Pa〜$1\times10^{+5}$Pa	the condition filament of ionization gauge is forcibly OFF

※1: When automatic switch is used, filament of ionization gauge gets ON at 2 Pa, and OFF at 3 Pa. Please be cautious, for instance when setpoint is configured 9 Pa, it gets OFF even tried to turn ON by pirani gauge after "emission current abnormity" of ionization gauge occurs.

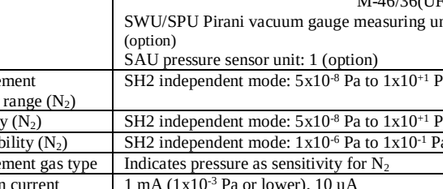
※2: Even when it is used under the condition filament of ionization gauge is forcibly OFF, setpoint can be operated down to 0.4 Pa by SPU, 0.01pa by SWU. If emission current abnormity is occurred when filament of ionization gauge is ON, sepoint configured under 10 Pa gets OFF. Also, when the filament gets OFF forcibly, setpoint for SPU can be ON.

7.2. Setpoint on/off pressure

The pressure to turn on the setpoint and the pressure to turn it off possess hysteresis.

On pressure value: setting

Off pressure value: setting + 10%



7.3. Configuring the setpoints

Analog output becomes the setpoint adjustment voltage mode by pressing the "SELECT" button. The setpoint adjustment voltage changes between 0.27 and 9.5 V.

Coarse adjustment: Push the <ADJ> button and keep it depressed, the setpoint value sweeps.

Fine adjustment: Push the <ADJ> button at short time, the setpoint value changes by one unit.

When the voltage reaches the voltage you wish to set, press the " SELECT " button to set it.

8. Adjusting SAU/SWU Pressure

You can take even more accurate measurements by adjusting the pressure for the SAU/SWU.

Before using a new SAU/SWU, or when you see a deviation in the reading, adjust this unit following procedure below.

Adjustment	Adjustment range	
	SAU	SWU
atmospheric	$7.1\times10^{+4}$Pa to $1.2\times10^{+5}$Pa	$1.0\times10^{+3}$Pa to $1.0\times10^{+5}$Pa
zero	SPU pressure display is less than 1,000Pa.	Adjusted automatically. (less than 1.0×10^{-3}Pa)

(1) Press the "ADJ" button.

(2) Check that the SAU LED is flashing.

(3) Press the "ADJ" button.

You can cancel the adjustments by pressing the "SELECT" button when the SAU LED is flashing.

(4) When POWER LED is off, the flashing LED of SAU will light up.

When SAU LED flash means that pressure rate is out of atmospheric adjustment area.

9. Specifications

Type name	Standard Type：SH2-1 Serial Communications Type：SH2-2
Connectable sensors	SH2 gauge head M-44/34 (NW16), M-45/35 (NW25), M-46/36(UFC070): 1 SWU/SPU Pirani vacuum gauge measuring unit: 1 (option) SAU pressure sensor unit: 1 (option)
Measurement pressure range (N_2)	SH2 independent mode: 5×10^{-8} Pa to $1\times10^{+1}$ Pa
Accuracy (N_2)	SH2 independent mode: 5×10^{-8} Pa to $1\times10^{+1}$ Pa: ±15%
Repeatability (N_2)	SH2 independent mode: 1×10^{-6} Pa to 1×10^{-1} Pa: ±2%
Measurement gas type	Indicates pressure as sensitivity for N_2
Emission current	1 mA (1×10^{-3} Pa or lower), 10 uA
DEGAS	Electron bombardment - Emission current 1 mA, grid voltage approx. 330 V, 1×10^{-3} Pa or lower
Sampling time	50 ms, 5x moving average
Analog output	Output voltage: 0 to 10 VDC log output: 0.75 V/1 decade Pressure conversion equation: P=10^{(V-7.25)/0.75+2}
Update time	50msec
Resolution	Approx.2.5mV
Output error	±20mV
Output impedance	1kΩ
Control input signals	FIL ON/OFF、FIL 1/2、DEGAS ON/OFF Operates with open collector input, negative logic
Control output signals	Sensor error, setpoint 1/2/3, emission valid, filament power monitor Rating: 24 V_{MAX}, 50 mA_{MAX}, saturation voltage 1 V
Serial communications	RS232C、RS-485　　9600/19200/38400bps
Gauge head material	Filament M-44/45/46　1: Ir/Y_2O_3-coated,　2: Ir/Y_2O_3-coated M-34/35/36　1: Ir/Y_2O_3-coated,　2: Tungsten Others　: PtC-Mo, SUS304, W, Kovar glass, Kovar/Ni plating
Gauge head withstand pressure	$2\times10^{+5}$ Pa (absolute pressure) * Take the withstand pressure for flanges, clamps, and other components into account separately.
Gauge head internal volume	M-44/34: 17 cm^3, M-45/35: 19 cm^3, M-46/36: 17 cm^3
Operating temperature range	10〜50°C
Operating humidity range	15% to 80% RH (no condensation)
Storage temperature	-20 to 65°C (when unpowered, no condensation)
IP code	IP30
Power supply voltage	20 to 28 VDC (ripple, noise 1% or lower) Steady state: 8W　Degas: 19W Inrush current: 6A or lower, 4ms or lower
Corresponding standard	CE standard, UKCA standard Validated with SPU, SAU connected The external Display cable 40m The SH2-SWU/SPU,-SAU cable 0.5m* *When using a unit cable of 0.5m or longer, please consider noise separately.
Overvoltage category	Category I: Connected to a circuit that implements measures to limit excessive overvoltage to a sufficiently low level
I/O connector	D-sub 15 pin connector (male, 2.6 mm screws)
Sensor weight	Controller: Approx. 530 g, Sensor M-34: 80 g, M-35: 80g, M-36: 300g
External dimensions	144 x 75 x 62 mm (approximate, controller section)

9.1. SPU combination mode key specifications

Measurement pressure range	5×10^{-8} Pa to $1\times10^{+4}$ Pa When pressure falling: Automatically switches from Pirani vacuum gauge to ionization gauge at $2\times10^{+0}$ Pa(SPU) When pressure rising: Automatically switches from ionization gauge to Pirani vacuum gauge at $3\times10^{+0}$ Pa(SPU) * Ionization gauge measurements can be forced off with the control signal
Accuracy	Refer to the accuracy for each sensor.
POWER/ERROR LED state	Blue on: Operating normally Red on : SH2-1/2, SPU power supply abnormality, etc.
Control input signals	FIL ON/OFF, FIL 1/2, DEGAS ON/OFF Operates with open collector input, negative logic * When the FIL ON/OFF signal is low input, the ionization gauge is FIL OFF

9.2. SAU combination mode key specifications

Measurement pressure range	5×10^{-8} Pa to $1\times10^{+5}$ Pa When pressure falling: Automatically switches from the pressure sensor to Pirani vacuum gauge at $1\times10^{+4}$ Pa(SAU) When pressure falling: Automatically switches from Pirani vacuum gauge to ionization gauge at $2\times10^{+0}$ Pa(SWU/SPU) When pressure rising: Automatically switches from ionization gauge to Pirani vacuum gauge at $3\times10^{+0}$ Pa(SWU/SPU) When pressure rising: Automatically switches from Pirani vacuum gauge to pressure sensor at $1\times10^{+4}$ Pa(SAU) * Ionization gauge measurements can be forced off with the control signal
Accuracy	Refer to the accuracy for each sensor.
POWER/ERROR LED state	Blue on: Operating normally Red on : SH2-1/2, SWU/SPU, or SAU power supply abnormality, etc.
Control input signals	FIL ON/OFF, FIL 1/2, DEGAS ON/OFF Operates with open collector input, negative logic * When the FIL ON/OFF signal is low input, the ionization gauge is FIL OFF

9.3. SWU combination mode key specifications

Measurement pressure range	5×10^{-8} Pa to $1\times10^{+5}$ Pa When pressure falling: Automatically switches from Pirani vacuum gauge to ionization gauge at $2\times10^{+0}$ Pa(SWU) When pressure rising: Automatically switches from ionization gauge to Pirani vacuum gauge at $3\times10^{+0}$ Pa(SWU) * Ionization gauge measurements can be forced off with the control signal
Accuracy	Refer to the accuracy for each sensor.
POWER/ERROR LED state	Blue on: Operating normally Red on : SH2-1/2, SWU power supply abnormality, etc.
Control input signals	FIL ON/OFF, FIL 1/2, DEGAS ON/OFF Operates with open collector input, negative logic * When the FIL ON/OFF signal is low input, the ionization gauge is FIL OFF

9.4. Standard Accessories

Multi-ionization gauge SH2-1/2 unit	1 pc.
M series sensor for SH2*	1 pc
Quick manual(this manual)	1 copy

*Only when you order at the same time as SH2, it will be attached to SH2 and delivered.

*The sensor model is the one specified when ordering.

9.5. Options

Sensor for SH2	M-44/34, M-45/35, M-46/36	
Connector for SH2	D-sub 15-pin connector (socket, 2.6 mm screws)	
Calibration certificate	General calibration certificate JCSS Calibration certificate	
Test results certificate		
Traceability certificate		
Display unit	1CH	ISG1 (24 VDC power supply)
	4CH	IM1R1 (24 VDC power supply) IM2R1 (100 VAC power supply)
Display cable	Cable connecting SH2 and display unit 2m, 5m, 10m, 15m, 20m, 25m, 30m, 35m, 40m	
Pirani vacuum gauge measuring unit	SWU/SPU	
Sensor for Pirani vacuum gauge measuring unit	SWP/WP	
Unit cable GUC-P	Cable connecting SH2 and SWU/SPU 0.5m, 1m, 2m	
Pressure sensor	SAU	
Unit cable GUC-A	Cable connecting SH2 and SAU 0.5m, 1m, 2m * The connector that connects this unit cable and SAU are connected by a cable of about 0.5m.	

10. Warranty

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

Warrantable Items: This unit

Duration of guarantee: Within 1 year from the date of delivery

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.

11. 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 at the end of instruction manual.

12. 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

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